

3rd International Conference on  
Functional (Psychogenic)  
Neurological Disorders  
September 6–8, 2017 Edinburgh, Scotland



ABSTRACTS

## Phenomenology

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### Baseline characteristics and outcome of pediatric onset psychogenic non-epileptic seizures

*Anne Sofie Hansen, Charlotte Rask, Jakob Christensen, René Nielsen (Aalborg, Denmark)*

**Objective:** This present study is the first study conducted on a nationwide cohort of children and adolescents with incident PNES. The aim is to investigate baseline characteristics and outcomes of pediatric PNES, i. e. psychiatric and somatic comorbidity and all-cause mortality, by utilizing the Danish healthcare registries and medical records.

**Background:** Five to fifteen percent of children and adolescents referred to epilepsy centers are diagnosed with psychogenic non-epileptic seizures (PNES). PNES are mainly understood as manifestations of psychological distress. PNES resemble epileptic seizures, and the diagnosis is based on an exclusion of epilepsy. A misdiagnosis of epilepsy can result in potentially harmful treatment, whereas a misdiagnosis of PNES can result in lack of treatment and risk of multiple epileptic seizures. In spite of the potential consequences of a misdiagnosis, little is known about baseline characteristics and outcomes of pediatric-onset PNES as existing research primarily focuses on PNES in adults(1).

**Methods:** Firstly, we will identify which ICD-10 diagnoses cover pediatric PNES in the Danish healthcare registers. We will examine a nationwide sample of medical records from patients (age 5-17 years, both included) registered with one of four most commonly used ICD-10 diagnoses combined with a procedure code for electroencephalography(2). Data describing demographic and clinical characteristics at onset will be retrieved from the medical records. Secondly, based on these findings, we will define an epidemiological cohort of children and adolescents with childhood-onset of PNES. They will be followed by use of the Danish healthcare registers to investigate comorbidity and all-cause mortality, and occurrence will be compared to age and gender matched controls diagnosed with epilepsy, and to a group of age and gender matched controls from the background population.

**Results:** The detailed study design and preliminary results will be presented at the conference.

**Conclusions:** This study contributes with unique new results describing characteristic features at the onset of childhood PNES, as well as the course of this disorder. This knowledge will be useful in future strategies for the prevention and treatment of PNES.

**References:** (1) Reilly C, Menlove L, Fenton V et al. Psychogenic non-epileptic seizures in children: a review. *Epilepsia* 2013; 54(10):1715-24. (2) Wichaidit BT, Østergaard JR, Rask CU. Diagnostic practice of psychogenic nonepileptic seizures (PNES) in the pediatric setting. *Epilepsia* 2015; 56(1):58-65.

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### Experience of 32 patient with functional movement disorders at the Department of Neurology, Ege University Medical Faculty, Izmir Turkey

*Ahmet Acarer, Zafer Colakoglu (Bornova Izmir, Turkey)*

**Objective:** In this retrospective study, we aimed to analyse outcome and phenomenologies of the 32 patients with functional movement disorders (FMD) admitted to our Movement Disorders outpatient clinic (Department of Neurology, Ege University Medical Faculty, Izmir, Turkey) between years 2011 – 2017.

**Background:** Phenomenological analysis can guide the diagnosis, treatment and prognosis of the FMD.

**Methods:** In this retrospective study, 32 adult patients were recruited with the inclusion of FMD diagnosis criteria. Age, sex, duration of disease, phenomenological types, predisposing factors, medication, response to medication and wrong treatment applied were evaluated.

**Results:** There were 22 female patients (% 68) and 10 male patients (% 32). Four phenomenological types were in this study. These was 16 dystonia (5 male, 11 female), 8 tremor (3 male, 5 female), 8 gait disorder (8 female), 3 myoclonus (2 male, 1 female). Three patients have more than one phenomenological types. Mean duration of illness were 2. 2 years in male and 3. 8 years in female. 11 female patients have predisposing factors (7 marital, 1 pregnancy, 1 violence, 1 mourning, 1 elbow fracture). 4 male patients have predisposing factors (1 pain, 1 marital, 1 head trauma, 1 lomber disc operation). Seven patients were treated incorrectly (3 botulinum toxin Injections, 3 antiparkinsonian drug, 1 deep brain stimulation). We treated patients with antidepressant drug and sixteen patients were followed without medication. Three patients had complete recovery (3 male 0 female). Twelve patients had partial improvement (4 male, 8 female). Ten patient didn't accepted diagnosis and treatment (3 male, 7 female).

**Conclusions:** FMD has a special precaution in movement disorders. Misinterpretation of phenomenologies can be lead to wrong diagnosis and treatments (deep brain stimulation, antiparkinsonian drugs and botulinum toxin Injections etc).

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### Emotion regulation and post-traumatic stress in patients with psychogenic non-epileptic seizures

*Ruifan Zeng, Lorna Myers, Marcelo Lancman (New York, NY, USA)*

**Objective:** To investigate if differences in emotion regulation (alexithymia, coping strategy) differentiated between 3 groups of patients with PNESs: 1) those with comorbid PTSD, 2) those with a history of trauma and no PTSD, and 3) those with no past trauma.

**Background:** There is increasing evidence that patients with PNESs can form subgroups distinguished by emotion dysregulation and psychological symptoms. Specifically, patients with PNESs and comorbid PTSD diagnosis appear to be distinct from other PNES patients.

**Methods:** 156 adult patients with a diagnosis of PNESs confirmed with inpatient video-EEG monitoring (and IQ > 70) completed a comprehensive neuropsychological battery between 2008 and 2016. The 3 groups consisted of 48 patients with PTSD, 62 patients who had experienced trauma and did not have PTSD, and 46 patients who denied experiencing trauma. All patients were assessed with the Trauma Symptom Inventory-2 (TSI-2) and diagnostic clinical interview, the Toronto Alexithymia Scale (TAS-20), and the Coping Inventory for Stressful Situations (CISS). One-way ANCOVA and post-hoc analyses were used to compare differences between the PTSD group, trauma and no PTSD group, and no trauma group on alexithymia and use of coping strategies.

**Results:** One-way ANCOVA revealed that there was a significant difference between groups on reported levels of alexithymia [ $F(2, 154) = 18.33, p < .001$ ] and use of emotion-focused coping [ $F(2, 156) = 11.12, p < .001$ ]. Post-hoc comparisons using the Tukey HSD test indicated that the PNESS/PTSD group had significantly higher mean alexithymia scores ( $M = 59.54, SD = 12.89$ ) compared to both the no trauma ( $M = 49.51, SD = 14.92$ ) and the trauma with no PTSD groups ( $M = 49.98, SD = 13.27$ ), which did not differ from each other. The PNESS/PTSD group was also significantly more likely ( $M = 62.82, SD = 11.44$ ) than the no trauma group ( $M = 49.51, SD = 13.17$ ) and the trauma with no PTSD groups ( $M = 52.01, SD = 12.86$ ) to utilize emotion-focused coping strategies.

**Conclusions:** The study revealed elevated alexithymia and use of emotion-focused coping strategies (linked to higher neuroticism and somatization) among patients with PNESSs and a comorbid PTSD diagnosis, a significant discrepancy from other patients with PNESSs who did not have PTSD. These findings underscore that PNESSs, which is often regarded as a homogeneous entity, appear to encompass distinct subgroups. Moreover, the pronounced difficulties with emotion regulation observed are akin to the emotional numbing and avoidance observed in PTSD. Overall, these factors represent discrete areas to target in treatment and highlights the importance of taking into account the heterogeneity of this population when tailoring psychotherapeutic treatment approaches.

**References:** Brown, R. J., Bouska, J. F., Frow, A., Kirkby, A., Baker, Gus A., Kemp, S., Reuber, M. (2013). Emotional dysregulation, alexithymia, and attachment in psychogenic nonepileptic seizures. *Epilepsy & Behavior*, 29, 178-183. Myers, L, Perrine, K., Lancman, M., Fleming, M., & Lancman, M. (2013). Psychological trauma in patients with psychogenic nonepileptic seizures: trauma characteristics and those who develop PTSD. *Epilepsy and Behavior*, 28, 121-126.

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### **Functional dystonia: Experience in a US specialised dystonia clinic**

*Christopher Stephen, David Perez, Nutan Sharma (Boston, MA, USA)*

**Objective:** Retrospective cohort study to investigate clinical characteristics associated with functional dystonia (FD) within a US specialised dystonia clinic.

**Background:** FD is a poorly understood, under-recognised and debilitating subtype of functional movement disorder (FMD) that is particularly difficult to diagnose and treat.

**Methods:** Medical records were reviewed for all new patient visits at a mixed adult/paediatric tertiary referral dystonia clinic from 2005-2017. 1475 consecutive new consultations were identified; 143 (9.7%) met criteria for a clinically-established Functional Neurological Disorder; 99 met criteria for clinically-established FD. FD was second only to cervical dystonia ( $N=249$ ) as the most common condition evaluated. Functional status was assessed by the modified Rankin scale (mRS). Descriptive statistics are provided for the cohort with future plans to perform univariate and multivariate statistics aimed at investigating predictors of symptom severity. 86 adult and 13 paediatric FD cases, age  $34 \pm 16$  yrs (range 5-66) were identified. 87% were female.

**Results:** FD phenotypes included: mobile dystonia (78%), cranial dystonia (40%), fixed dystonia (14%). 32% had multiple forms of dystonia. 26 had paroxysmal symptoms. 57% had a prior diagnosis of "organic" dystonia by a neurologist. One individual had a sister with FD. There were high levels of disability: 85% of adults and 77% of paediatric cases had mRS scores =2 (some disability); 19% and 31% respectively had mRS =3 (disability requiring help); 8 were wheelchair-bound. 51% of adults were on or pursuing disability. Complications of misdiagnosis included one individual undergoing deep brain stimulation at another institution. Another patient required orthopaedic surgery for contractures due to delay in treatment of bilateral fixed foot dystonia.

**Conclusions:** This cohort study describes the characteristics of a large US FD population. FD is a frequently misdiagnosed FMD with significant morbidity. Misdiagnosis and delay in treatment can result in unnecessary interventions and complications.

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### **Sudden Unexpected Death in Opera**

*Michael Trimble, Dale Hesdorffer (New York, NY, USA)*

**Objective:** To show how 19th century findings relevant to functional neurological disorders (FND) are reflected in the phenomenology of 19th century operatic characters.

**Background:** Sudden unexpected death is well-recognized in epilepsy, but can also occur in functional neurological disorders (FND). In this presentation, we reveal another cause of sudden unexpected death in opera (SUDOP) associated with an autonomic dysfunction.

**Methods:** We have explored operas and operatic characters in which death on the stage happens suddenly and unexpectedly. These deaths are not due to suicide, murder, poisoning, self-injury, recognized medical illness or starvation. We have analyzed these deaths by gender, composer, era and year of the composition. We have also analyzed the librettos to examine the phenomenology of medical indicators of autonomic dysfunction preceding the sudden death.

**Results:** We studied 22 sudden deaths. Significant findings included an increase in SUDOP for: females ( $N=16$ ) compared to males ( $N=6$ ). There were more deaths in females in 19th century operas, and in males of those in the 20th century. We also show that sudden deaths are more common in the narratives of particular composers. Two examples of autonomic dysfunction preceding sudden deaths in opera will be presented in opera clips and from the librettos. Our results will be compared to another study of death in opera (1), which covered all methods of death.

### Sudden Death In Opera by Gender, Composer and Year

Opera	Character	Composer	Year
<b>Females</b>			
Manon de Lescaut	Manon	Auber/Puccini/Massenet	1856/1896/1884
Bluebeard's castle	Judith	Bartok	1918
I Capuleti e i Montecchi	Guiletta	Belinni	1830
Mefistofele (Act 3)	Margaretta	Bioto	1868
Pelleas et Melisande	Melisande	Debussy	1902
Lucia di Lammermoor	Lucia	Donizetti	1835
Faust	Marguerite	Gounod	1859
Undine	Undine	Hoffmann	1816
Thais	Thais	Massenet	1903
Tales of Hoffmann	Olympia	Offenbach	1851
Queen of Spades	Countess	Tchaikovsky	1890
Tristan and Isolde	Isolde	Wagner	1865
Götterdämmerung	Gertrune	Wagner	1876
Tannhäuser	Elizabeth	Wagner	1845
Lohengrin	Elsa	Wagner	1850
Parsifal	Kundry	Wagner	1882
<b>Males</b>			
Lulu	Dr. Goll	Berg	1937
Death in Venice	Aschenbach	Britten	1973
Undine	Huldbrand	Hoffmann	1816
Boris Gudunov	Boris	Mussorgsky	1869/1874
Der Ferne Klang	Fritz	Schreker	1912
Tannhäuser	Tannhäuser	Wagner	1845

**Conclusions:** It is an old adage that opera is about love and death. In our study, we discuss representations of death in the arts in the 19th century Romantic era, focusing on opera. Such drama was associated not only with the arts, but also in 19th century neuropsychiatry, reflected in the rise of hysteria and the flowering of FND. These ideas were represented in philosophy, literature, and as we demonstrate on the stage in opera.

**References:** 1. Michel Poizat. *The Angels Cry: beyond the Pleasure Principle in Opera*. Cornell University Press, 1992.

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### Referrals to acute neurology and stroke teams in Leeds with functional neurological symptoms: characterising current service use.

*Stefan Williams, Melissa Maguire, Jane Alty, Christopher Graham (Ilkley, United Kingdom)*

**Objective:** To help refine the services offered to people with functional neurological symptoms (FNS), we sought to characterise the healthcare usage of a cohort of patients with FNS who were referred to acute neurology services in a UK regional neuroscience centre.

**Background:** Patients with FNS may present acutely to hospital, but a lack of clear patient pathways can lead to inappropriate management. This problem is not well characterised in existing literature, making service improvement harder to justify or plan [1,2].

**Methods:** We are collecting data by a daily phone call to each of the following staff at Leeds Teaching Hospitals NHS Trust: on-call neurology registrar and consultant doctors, stroke nurse specialist, and neurology ward nurse. They are recording referrals for any patient with a possible element of FNS in the preceding 24 hours. The hospital number is securely recorded, with an initial diagnostic category: (1) functional; (2) functional overlay; or (3) functional differential. We plan to then undertake an electronic record search for: type of symptom, inpatient bed days, outpatient appointments, investigations, appropriate psychological / psychiatric referral, and

stability of diagnosis over time (including cost calculation).

**Results:** The average number of patients with functional symptoms referred to acute neurology or stroke services was greater than one per day. Around half involved an inpatient hospital stay. More than half had a purely functional diagnosis. The most common symptom was weakness or sensorimotor impairment. Many patients had a history of multiple emergency attendances, admissions and investigations for FNS.

**Conclusions:** Our data support evidence that patients with functional neurological symptoms represent a significant proportion of acute, unplanned hospital attendances among referrals to neurology or stroke, with considerable service usage. This is likely to be an underestimate though as patients presenting to acute medical teams with spontaneously resolving symptoms may not have been recognised or referred on to the neurology teams before discharge. Our findings help provide rationale and justification for new services designed to create better pathways of care for patients with functional neurological symptoms who present acutely to hospital.

**References:** (1) Stone J. The Bare Essentials: Functional Symptoms in Neurology. *Practical Neurology*. 2009; 9: 179-189(2) Healthcare Improvement Scotland. Stepped Care for Functional Neurological Symptoms – A new approach to improving outcomes for a common neurological problem in Scotland. Edinburgh: NHS Scotland; 2012.

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### **Functional neurological features in Parkinson disease: a multicenter case-control study**

*Benjamin Wissel, Alok Dwivedi, Danielle Chin, Aristide Merola, Cara Jacob, Andrew Duker, Jennifer Vaughan, Lilia Lovera, Kathrin LaFaver, Ariel Lev, Anthony Lang, Francesca Morgante, Melissa Nirenberg, Christopher Stephen, Nutan Sharma, Alberto Romagnolo, Leonardo Lopiano, Bettina Balint, Kailash Bhatia, Alberto Espay (Cincinnati, OH, USA)*

**Objective:** To ascertain demographic and clinical features of Parkinson disease (PD) associated with the development of functional neurological features.

**Background:** Functional neurological disorders have been reported to co-occur with PD to a greater extent than patients with other neurodegenerative conditions.

**Methods:** A standardized form was used to extract data from electronic medical records of PD patients with additional functional neurological disorders (PD-FND) across eight movement disorders centers in the USA, Canada, and Europe. These subjects were matched for age, gender, and disease duration to PD patients without functional features (PD-only). After adjusting for clustering effect, logistic regression analysis was used to compare clinical and demographic characteristics between groups.

**Results:** A total of 53 PD-FND patients met inclusion criteria (68% female;  $62 \pm 10$  years; PD disease duration,  $9 \pm 5$  years). Compared to PD-only, the PD-FND cohort had a higher prevalence of dyskinesia (42% vs. 18%;  $p = 0.023$ ), higher depression and anxiety scores ( $p = 0.033$  and  $0.025$ , respectively), higher levodopa equivalent daily dose ( $972 \pm 701$  vs.  $741 \pm 559$  mg;  $p = 0.029$ ), and lower motor severity (MDS-UPDRS-III  $25 \pm 14$  vs.  $30 \pm 11$ ;  $p = 0.019$ ). PD-FND patients had greater health care resource utilization and were more likely to have had a preexisting psychiatric disorder ( $p = 0.008$ ) and a family history of PD ( $p = 0.036$ ) than PD-only patients.

Functional symptoms preceded or co-occurred with PD diagnosis in 30% and nearly always manifested in the body side most affected by PD.

**Conclusions:** PD-FND was associated with milder motor impairment, higher dopaminergic medication dosage, more dyskinesia, higher depression and anxiety symptoms, and more frequent family history of PD than PD-only controls. Functional manifestations antedate or co-occur with PD onset in nearly one third of patients with these problems.

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### **The impact of non-motor symptoms on health-related quality of life in patients with functional movement disorders**

*Gabriela Vechetova, Matej Slovak, Pavel Dušek, Tomáš Nikolaj, Eva Bolceková, Zuzana Hanzlíková, Evžen Ružicka, Tereza Serranová (Prague, Czech Republic)*

**Objective:** To assess the severity of motor and non-motor symptoms including depression, anxiety, fatigue, pain and cognitive complaints and their impact on quality of life (QoL) in patients with functional movement disorders (FMD) and in healthy controls.

**Background:** Pain, fatigue and cognitive complaints are common in patients with FMD and may affect their QoL. However, except for comorbid affective and personality disorders, non-motor symptoms have not been studied systematically in FMD [1, 2].

**Methods:** Thirty-eight patients with clinically established FMD (mean age  $45.5 \pm 11.9$  years, 7 males, mean disease duration  $6.6 \pm 6$  years) and 36 age and sex matched healthy controls (HC) completed the Beck Depression Inventory (BDI), the State-Trait Anxiety Inventory (STAI); the Fatigue Severity Scale; the PainDetect and the Subjective Memory Complaints Questionnaire. Personality characteristics were assessed using the 44-Item Big Five Inventory (BFI-44), motor disorder severity using the Psychogenic Movement Disorders Rating Scale. Quality of life was assessed using the 12-Item Short Form Health Survey (SF-12). A statistical comparison was performed using the Mann-Whitney U-test and Pearson's correlation coefficient ( $p < 0.05$ , Bonferroni corrected).

**Results:** Compared to HC, patients reported higher levels of depression, anxiety, fatigue, pain and cognitive complaints ( $p < 0.001$ ), but no differences were found in personality characteristics. In the FMD group, health related QoL was decreased ( $p < 0.001$ ). QoL scores negatively correlated with depression ( $r = -0.84$ ,  $p < 0.001$ ), anxiety (state  $r = -0.76$ ,  $p < 0.001$ ; trait  $r = -0.80$ ,  $p < 0.001$ ), cognitive complaints ( $r = -0.76$ ,  $p < 0.001$ ) and neuroticism ( $r = -0.71$ ,  $p < 0.001$ ) according to BFI but not with the severity of motor symptoms, pain and fatigue. Subjective cognitive complaints correlated with depression ( $r = 0.66$ ,  $p < 0.001$ ), trait anxiety ( $r = 0.62$ ,  $p < 0.001$ ) and neuroticism level ( $r = 0.61$ ,  $p < 0.001$ ).

**Conclusions:** We confirmed a high level of self-reported non-motor symptoms and impaired QoL in FMD patients. Decreased QoL was associated with anxiety, depression and cognitive complaints but not with motor symptoms severity, pain or fatigue in FMD. We found no differences in personality characteristics between FMD and controls, nevertheless neuroticism, along with anxiety and depression, was related to higher cognitive complaint scores and impaired QoL in FMD. The impact of mood disorder on QoL is well established. Further studies should address the role of cognitive complaints, which may either represent a comorbid functional symptom or result from abnormally focused attention and working memory deficits or from an associated mood disorder.

**References:** 1 Gelauff J, Stone J, Edwards M, Carson A. The prognosis of functional (psychogenic) motor symptoms: a systematic

review. *J Neurol Neurosurg Psychiatry* 2014;85(2):220-226. 2 Psychologic/functional forms of memory disorder. Griem J, Stone J, Carson A, Kopelman MD. *Handb Clin Neurol.* 2016;139:407-417.

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### **Attitudes and Knowledge of Local GPs to Patients with Functional Seizures**

*Ruth Child, Marco Mula, Mark Edwards, Mahinda Yogarajah (London, United Kingdom)*

**Objective:** As part of a service evaluation, we sought to assess the attitudes, perception and knowledge of GPs to patients with functional seizures (FS).

**Background:** FS are a common and often chronic disorder, in which GPs play a key role. Understanding of GP knowledge of, and attitudes to, patients with FS is crucial. Differences in illness perceptions between patients and GPs have a negative impact on treatment outcome, and are associated with increased demands on healthcare systems.

**Methods:** All GPs local to a tertiary neuroscience centre were emailed a link to a 5-minute online survey exploring their knowledge of, and attitudes to, patients with FS, and the terms they commonly use to describe FS.

**Results:** 120/974 invitations to the survey were completed. 65.5% of respondents were female, and 75.7% were aged below 55 years. 89.2% of respondents reported having seen between 1 and 10 patients with FS. Overall, the most popular terms used by 75% of GPs to describe FS were "pseudoseizure" and/or "non-epileptic attacks/events/seizure". The term "non-organic seizure" was more popular amongst younger GPs. 30% of GPs had not heard of the term "dissociative seizure", which may explain why 53% of GPs thought that patients have voluntary control of their bodies during a FS. This perception was more common amongst GPs in richer areas. Older GPs were more likely to believe that FS only occur when patients are stressed. 48% and 83% of GPs felt neurology and psychiatry respectively should be involved in the management of patients. While 50% of GPs expressed an interest in managing these patients, 48% also reported a lack of confidence in dealing with their queries. While 97% of GPs reported feeling comfortable referring patients to neurology, only 50% felt comfortable referring to psychiatry. Furthermore, 72% and 40% reported feeling supported by neurology and psychiatry respectively in managing these patients.

**Conclusions:** Most GPs think that patients have voluntary control during a FS, and favour descriptive terms that may offend patients. While most feel that psychiatric services should play a key role in managing patients, they also feel uncomfortable referring patients to, and feel unsupported by, psychiatric services. For this reason amongst others, neurology services should also play a key role in the management of these patients.

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### **Utilization of Anion gap to differentiate between psychogenic non-epileptic seizures and epileptic seizures in the emergency setting**

*Yi Li, Liesl Matzka, Louise Maranda, Daniel Weber (Worcester, MA, USA)*

**Objective:** We investigated whether Anion gap (AG), bicarbonate, and Denver seizure score (DSS), could differentiate between psychogenic non-epileptic seizures (PNES) and generalized convulsive epileptic seizures (ES) in the emergency setting.

**Background:** Evaluation of shaking spells are frequently encountered questions by neurologists. Differentiation between PNES and ES is important for appropriate triaging in the emergency department (ED), however it can be difficult especially if not witnessed.

**Methods:** Total 1354 subjects who were admitted to ED due to shaking spells in a tertiary care medical center from 1/2014- 6/2016 were screened. Patients were excluded from the study if they had other documented active medical problems which could cause acidosis and confound the analysis, such as sepsis, alcohol or medicine toxicity; or did not have lab studies within 24 hours after the spells. 27 PNES and 27 ES patients were identified based on clinical description and subsequent EEG. Multivariable logistic regression analysis and receiver operating characteristic curves were used to determine whether there was an association between AG, bicarbonate, or DSS ( $[24\text{-Bicarbonate} + 2 \times (\text{AG}-12)]$ ) drawn within 24 hours of the concerning event.

**Results:** AG greater than 10, bicarbonate less than 20, and DSS greater than or equal to 0 had a 100% specificity and positive predictive value for ES. Sensitivity and negative predictive value dropped markedly for all measures if drawn more than two hours after the event. With specificity set at 100%, sensitivity was similar for AG and DSS and higher than for bicarbonate. Part of the prelim study results presented in American Epilepsy Society annual meeting in 12/2016.

**Conclusions:** AG and DSS were more sensitive than bicarbonate for ES. We propose AG greater than 10 (sensitivity of 81.8%, specificity of 100%) in the first two hours after the event, could be used as a potential tool in the ED to help differentiate between PNES and ES.

**References:** 1. Bakes KM, Faragher J, Markovchick VJ, Donahoe K, Haukoos JS. The Denver Seizure Score: anion gap metabolic acidosis predicts generalized seizure. *Am J Emerg Med* 2011;29:1097-1102. 2. Kisaka T, Cox TA, Dumitrescu D, Wasserman K. CO2 pulse and acid-base status during increasing work rate exercise in health and disease. *Respir Physiol Neurobiol* 2015;218:46-56.

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### **Functional Sensory Symptoms Progressing Into Cenesthopathy --- Was It Preventable? A Case Report**

*Hidehiro Shibayama (Chiba, Japan)*

**Objective:** To speculate the cause of progression of sensory symptoms and to look for preventive measures if possible.

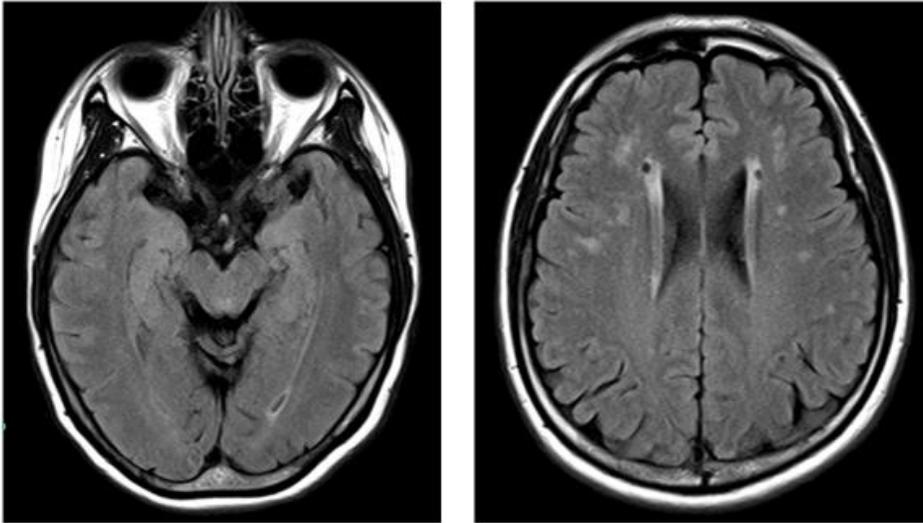
**Background:** Cenesthopathy has been reported mainly in association with schizophrenia as disturbance of body image or from dentistry as delusions of oral area, but it has been discussed only briefly in the field of functional neurological disorders. [Methods] Medical charts of a patient was retrospectively reviewed.

**Methods:** Medical charts of a patient was retrospectively reviewed.

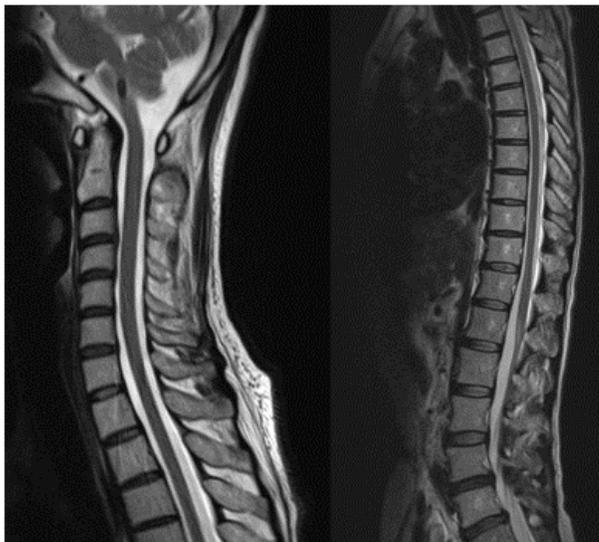
**Results:** A 45 years-old woman was admitted with complaints of abnormal bodily sensation and difficulty in movement. Her neurological symptoms started at 32 with extremity dysesthesia 3 years after delivery of first son who was diagnosed as broad

developmental disorder at 2. She was suspected of multiple sclerosis at a neurology department of university hospital but definite diagnosis was not obtained. Her symptoms were stable with some fluctuation for succeeding 12 years during which time she had visited the same hospital intermittently. She retired from her clerical job at 34. At 44 she subjectively deteriorated with difficulty in leg movement, dysphagia, hypesthetic legs, systemic weakness, facial pain, and decreased oral-gingival sensation spreading systemically. No triggering events have been identified. Cenesthopathic schizophrenia was suspected at psychiatry but treatment with oral olanzapine 5mg/day was stopped due to ineffectiveness. Neurological examination disclosed rotation of tongue to left at protrusion and hip sunken, knee bent gait. Her notable complaints were decreased sensation of various body parts necessitating identification of their location on mirror and misunderstanding that her son had the same symptoms as hers. In response to her view for her own disease as "physical", we performed several laboratory examinations including imaging, electrophysiological, and CSF studies, all of which turned out not pathognomonic. After consultation with a psychiatrist who suggested conversion disorder or cenesthopathy, an explanation as probable functional neurological disorder (FND) was done to her and her family. She was discharged under planned follow-up at a local psychiatrist, but information reached us that she was seeking another medical facility a year later.

**Conclusions:** Cenesthopathic complaints do appear in symptomatic course of FND and to cooperate for prevention of its appearance, neurologists should not be contented with exclusion of organic etiology. He should positively diagnose FND as early as possible and pave the way for effective intervention.



brain MRI at admission



Apr 4 '13

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**References:** 1. Umezaki Y, Uezato A, Torihara A, et al. Clin Neuropharm 2017;40: 97-992. Rajender G, Kanwal K, Rathore DM, et al. Ind J Psychiatry 2009;51(3): 195-198

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**Self-assessed depression, anxiety, fatigue and depersonalisation in functional and organic dystonia**

*Rachel Newby, Jane Alty, D. R. Jamieson, Stephen Smith, Peter Kempster (Melbourne, VIC, Australia)*

**Objective:** To compare depressive, anxiety, fatigue and depersonalisation symptoms between patients with functional dystonia, organic dystonia, and healthy controls.

**Background:** Published evidence of physiological and psychological overlap between functional and organic dystonia challenges

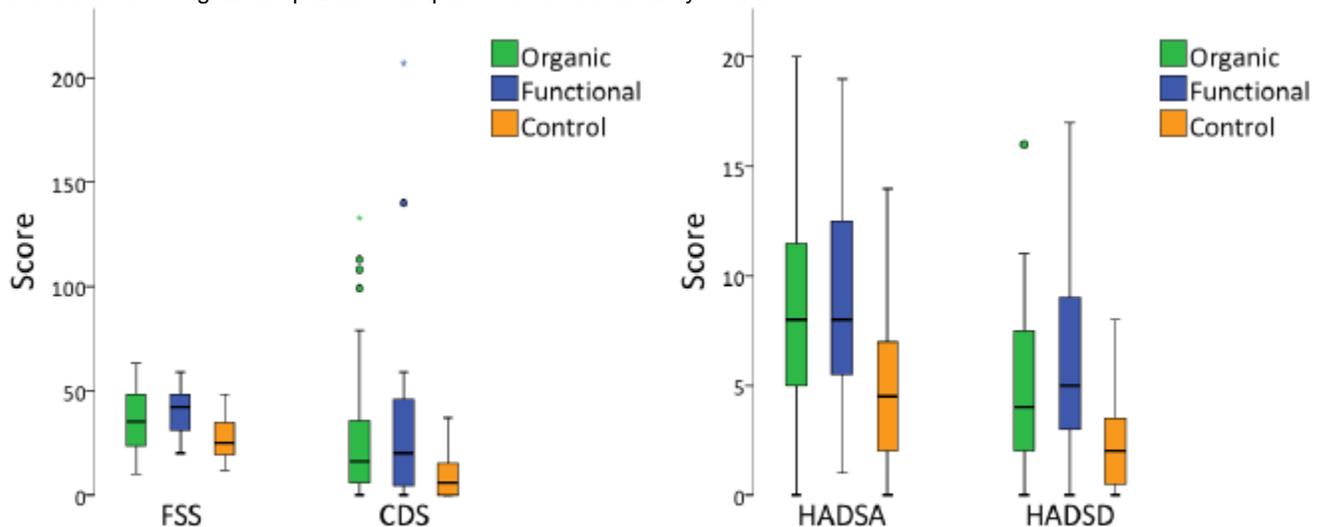
rigidly dualistic models of these disorders. They may possess a common pathophysiological substrate with complex environmental interactions influencing the expression of both the movement disorder and associated psychological symptoms.

**Methods:** 33 patients with organic dystonia, 11 with functional dystonia and 27 age- and sex-matched control subjects [Table1] were asked to complete a Hospital Anxiety and Depression Scale (HADS), Fatigue Severity Scale (FSS) and the Cambridge Depersonalisation Scale (CDS). Data was analysed for statistical significance, using SPSS software, by Kruskal-Wallis test followed by post hoc pairwise comparisons using the Dunn-Bonferroni approach.

Table 1: Demographic Details	Organic dystonia		Functional dystonia		Healthy controls
Number of cases	33	23 IFD (17 CD and 6 FHD)	11	5 Limb	27
		5 Genetic (generalized)		4 Cranial/cervical/craniocervical	
		5 Secondary		2 Truncal/generalised	
Gender (F:M)	21:12		9:2		18:9
Age: mean (s.d.)	57 (16)		44 (17)		50 (20)

**Key:** CD = cervical dystonia; F = female; FHD = focal hand dystonia; M = male; s.d. = standard deviation.

**Results:** Scores for HADS-anxiety (HADS-A,  $p = 0.019$ ), HADS-depression (HADS-D,  $p = 0.008$ ), the Fatigue Severity Scale ( $p = 0.011$ ) and the Cambridge Depersonalisation Scale ( $p = 0.036$ ) differed significantly across the groups [Figure1]. Post hoc pairwise comparisons, after adjusting for multiple comparisons using the Bonferroni correction, revealed no significant differences between the groups for HADS-A. For HADS-D and FSS both organic and functional dystonia groups had significantly higher scores than healthy controls, but scores did not differ between the patient groups. For CDS, scores in organic dystonia were higher than those of controls, but there were no significant pairwise comparisons for functional dystonia.



**Figure 1:** Boxplots of self-assessment scores for HADS-A and HADS-D (anxiety and depression subscales of HADS), FSS and CDS.

**Conclusions:** There were no significant differences between functional and organic dystonia in any of the domains measured. Both scored significantly higher than healthy controls for depression and fatigue, with a trend towards significance for anxiety. Organic but not functional dystonia patients had significantly higher levels of self-rated depersonalisation than control subjects. These findings build on existing evidence of phenomenological overlap between functional and organic dystonia. Altered cortico-striatal connectivity may explain the increased incidence of psych morbidity and dissociation in dystonic disorders. More flexible biopsychosocial frameworks are required to meet the demand for new diagnostic and therapeutic rationales in these conditions.

**References:** 1. Kranick S, Ekanayake V, Martinez V, Ameli R, Hallett M, Voon V. Psychopathology and psychogenic movement disorders. *Mov Disord* 2011;26:1844–1850. 2. Newby R, Alty J, Kempster P. Functional Dystonia and the Borderland Between Neurology and Psychiatry: New Concepts. *Mov Disord* 2016;31:1777–1784.

**Minimum voluntary EMG burst duration: Implications for electrodiagnostic investigation of movement disorders***Alexis Collins, Steven Brown, Ghaith Tarawneh, Mark Baker (Newcastle Upon Tyne, United Kingdom)*

**Objective:** To define the normal physiological limits of the minimum voluntary EMG burst duration in cranial, axial and appendicular muscles in healthy controls imitating myoclonic movements and investigate the effect of age on the duration of these bursts.

**Background:** Paroxysmal/rhythmic muscle activities (i. e. myoclonus/tremor) are common to a range of functional movement disorders. The diagnosis of myoclonus is frequently justified based on EMG burst duration; EMG burst duration in myoclonus is said to be less than 50 ms (for review see Kamble & Pal, 2016). When EMG burst duration is >50 ms in a patient with an apparent myoclonic movement disorder alternative diagnoses are considered, including, most commonly, psychogenic movement disorder. However, the published evidence for this electrodiagnostic criterion is sparse, and it is not known whether burst duration varies across different muscles (because of physiological/biomechanical differences) or as a consequence of the aging process. By defining the physiological limits of EMG burst duration in rapid voluntary ballistic/rhythmic movements recorded from health controls of all ages we hope to address this.

**Methods:** This study involved recording muscle contractions using surface EMG in 74 healthy participants (35 females; age range 20-85). Subjects were asked to imitate myoclonic jerks or produce rapid alternating movements in a total of 29 separate/individual muscles in the face, neck, back, trunk, arm and leg. EMG bursts were measured automatically using MATLAB.

**Results:** Average minimum EMG burst duration across 29 major muscles of the body in healthy individuals was 70 ms. However, there was a large range of minimum burst durations and paired t-tests revealed significant differences between muscles associated with the face, forearm and foot. Ballistic movements gave significantly longer burst durations than rhythmic flexion-extension movements. Our results did not show any statistically significant differences of burst duration between the age groups.

**Conclusions:** We have tabulates data on the minimum physiological EMG burst duration for a range of muscles. These data will prove invaluable for the electrodiagnostic evaluation of movement disorders.

**References:** Kamble NL & Pal PK (2016) Electrophysiological evaluation of psychogenic movement disorders. *Parkinsonism and Related Disorders* 22:S153-158.

**The risk of perceived stigma in psychogenic nonepileptic seizures vs. epilepsy***Gregg Rawlings, Ian Brown, Markus Reuber (Sheffield, United Kingdom)*

**Objective:** This study aimed to investigate the prevalence, risk and nature of perceived stigma in individuals with psychogenic nonepileptic seizures (PNES) by comparing their self-reported responses to those living with epilepsy.

**Background:** PNES superficially resemble epilepsy, but are conceptualised as a mental disorder. Although individuals with seizures or mental illness experience stigma, there is a lack of research investigating PNES-related stigma [1].

**Methods:** Participants were recruited from the Royal Hallamshire Hospital (Sheffield, UK) and from membership-led organisation for individuals with seizures. Participants with epilepsy (n=78) and PNES (n=47) were asked to complete a series of questionnaires investigating: health-related quality of life components (NEWQOL-6D), anxiety (GAD-7), depression (NDDI-E), seizure frequency and severity (LSSS-3), and illness perception (B-IPQ). To investigate perceived stigma, individuals were asked in the context of their seizures: How much do you feel people treat you as an inferior person? This is a validated question investigating perceived stigma taken from the NEWQOL-6D [2].

**Results:** All individuals were living in a Western Culture. Participants with PNES and epilepsy were matched on age, years of education and seizure severity. A Mann-Whitney U test revealed that the level of perceived stigma was higher in PNES compared to epilepsy (p=0.04). Stigma was associated with diagnoses (p=0.002). The odds of individuals with epilepsy to report stigma was 1.6, compared to 6.83 in PNES, suggesting a four-fold greater odds of perceived stigma in PNES. A risk ratio demonstrated that there was 1.42 times as much probability of perceived stigma in PNES than in epilepsy. A correlational analysis revealed that in epilepsy, stigma was associated with seizure frequency, anxiety and depression, but this was not the case in PNES.

**Conclusions:** This is the first study to date that quantitatively supports the notion that individuals with PNES experience stigma related to their condition, the degree of which, is greater than that reported in epilepsy. Differences were found between the relationship of stigma and the outcome measures investigated (such as, seizure frequency and psychopathology) suggesting that the nature of stigma is different between the two conditions. Overall, 87.2% of individuals with PNES, compared to 61.5% in epilepsy, reported experiencing some degree of stigma. Given these findings, we hope to have motivated future investigations into the cause, impact and management of stigma that is reported in PNES.

**References:** [1] G. H. Rawlings, I. Brown, B. Stone, and M. Reuber, "Written accounts of living with psychogenic nonepileptic seizure: A thematic analysis," Manuscript submitted. [2] B. Mulhern et al., "The development of a QALY measure for epilepsy: NEWQOL-6D," *Epilepsy Behav*, vol. 24, no. 1, pp. 36-43, 2012.

**Electrophysiological Characteristics of Voluntary Orthostatic Leg Tremor***Alexis Collins, Marisa Brum, Georgja Collins, Ghaith Tarawneh, Mark Baker (Newcastle upon Tyne, United Kingdom)*

**Objective:** To refine electrodiagnostic criteria for orthostatic tremor

**Background:** Orthostatic tremor (OT) is a rare disorder characterised by symptomatic unsteadiness and tremor when standing unsupported. Electromyography (EMG), in particular the frequency of EMG bursts and the frequency and magnitude of EMG-EMG coherence calculated between lower limb muscles, helps to confirm the diagnosis. High frequency (13-18 Hz) EMG bursts were a defining feature in the original description of primary OT. More recently, 'slow' OT with EMG bursts at frequencies of 3-12 Hz has been described (Leu-Semnescu et al, 2007). At this 'slow' frequency, it is possible to imitate orthostatic tremor. We therefore recorded EMG from healthy controls whilst imitating OT with the purpose of defining electrophysiological features of voluntary OT, refining diagnostic

criteria for 'slow' OT and identifying patients with psychogenic OT.

**Methods:** Thirty-six participants were involved in the study (18 males; age-range 20-85). Surface EMG was recorded simultaneously from tibialis anterior, medial gastrocnemius, vastus lateralis and biceps femoris bilaterally (total 8 channels). Participants were asked to mimic OT tremor by shaking their legs synchronously and as rapidly as possible. In some participants we measured the time to fatigue and cessation of movements (n=18). Data from healthy controls was compared with data recorded from a sample of patients with primary OT (n=6). EMG data was analysed using Spike2 (Cambridge Electronic Design) and MATLAB software.

**Results:** EMG burst duration in voluntary OT was 50-90ms and statistically significantly different from mean EMG burst duration (<50 ms) in patients with primary OT (t-test;p<0.05). There was also a statistically significant difference between peak tremor frequencies and the magnitude of EMG-EMG coherence in healthy controls and patients with primary OT (t-test;p<0.05). Finally, older participants and those with higher voluntary tremor frequency could not sustain voluntary OT movements for as long as younger participants, illustrating a significant negative correlation coefficient (R<sup>2</sup>= 0.058).

**Conclusions:** By incorporating additional electrophysiological parameters to diagnostic criteria for OT, this disorder, particularly the newer entity of 'slow' OT, can be diagnosed with greater confidence.

**References:** Leu-Semenescu S et al. (2007) Myoclonus or tremor in orthostatism: an under-recognised cause of unsteadiness in Parkinson's disease. *Movement disorders*; 22(14):2063-9.

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### **Speech, language and swallowing impairments in functional neurological symptom disorder: A scoping review**

*Caroline Barnett, Christina Smith, Jean Armes (Birmingham, United Kingdom)*

**Objective:** To address the question: "What is known about speech, language and swallowing impairments in patients with functional neurological symptom disorder (FNSD)?" with a view to identifying gaps for further research.

**Background:** The DSM-V has a code to categorise FNSD with speech symptoms and with swallowing symptoms (American Psychiatric Association, 2013). Despite this, no clinical guidelines exist in the United Kingdom for speech and language therapists on the diagnosis or management of these patients, other than for functional dysphonia and psychogenic dysfluency.

**Methods:** A scoping review was conducted based on the framework outlined by Arksey and O'Malley (2005). Four healthcare databases were searched for published and unpublished literature. Only studies written in English language and focussing on adults were included. Studies on the following topics were excluded: dysphonia, foreign accent syndrome, dysfluency and globus pharyngeus. Two authors independently reviewed citations for inclusion of articles. Data were charted onto a data extraction form for analysis.

**Results:** A total of 50 publications were included in the final analysis ranging from 1967 to 2017. Eleven different terms were used to describe FNSD with conversion being used most frequently (36%). Case reports were the commonest research method used (44%). Speech symptoms were reported most frequently (60%), followed by language symptoms (32%) then swallowing symptoms (18%). Despite these publications reporting on the presence of these symptoms, only 18% of citations reported the involvement of speech and language therapy (SLT). None of the publications examined the effectiveness of direct SLT involvement.

**Conclusions:** SLT involvement in the diagnosis and management of patients with FNSD is limited, despite relevant symptoms being reported in the literature. A limitation of this scoping review is that the focus of many of the papers was not speech, language or swallowing symptoms and as such SLT involvement may have been underreported as opposed to underutilised. This highlights, however, the need for further research to determine current SLT approaches to the management of this client group. There is emerging evidence on the effectiveness of physiotherapy for patients with FNSD. Given this, there is potential for further research on the effectiveness of SLT in FNSD.

**References:** Arksey, H. & O'Malley, L., 2005. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), pp. 19–32. Available at: <http://www.scopus.com/inward/record.url?eid=2-s2.0-14644388070&partnerID=tZOtx3y1>. American Psychiatric Association, 2013. *Diagnostic and statistical manual of mental disorders 5th ed.*, Arlington, VA: American Psychiatric Publishing.

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### **Presence of multiple comorbid functional symptoms impacts Psychogenic Nonepileptic Seizures (PNES) outcomes**

*Gaston Baslet, Benjamin Tolchin, Mary O'Neal, John Sullivan, Carolyn Lee, Molly O'Reilly, Barbara Dworetzky (Boston, MA, USA)*

**Objective:** To compare baseline clinical and psychological characteristics as well as outcome measures in PNES patients with multiple comorbid functional symptoms to PNES patients with a limited number of comorbid functional symptoms.

**Background:** The presence of multiple comorbid functional symptoms in PNES argues for a common approach that addresses all functional symptoms. Few studies have examined how functional comorbidities impact clinical presentation and functional outcomes in PNES.

**Methods:** 173 subjects with video-EEG confirmed PNES were prospectively recruited to provide baseline data: additional functional symptoms (headaches, chronic pain, and cognitive, motor, sensory and other functional symptoms), psychiatric diagnoses based on a semi-structured interview, trauma history, functional status and self-rated psychopathology, affective management and quality of life (QOL) measures. Functional status and QOL from 93 subjects were obtained 12 to 24 months after baseline. Subjects were classified (as multiple functional symptoms) based on the presence of 3 or more functional symptoms. Linear and logistic regression was used to compare PNES subjects with multiple functional symptoms to those with 2 or less functional symptoms.

**Results:** 47% of patients had multiple comorbid functional symptoms. At baseline, this subgroup had increased likelihood of disability status and comorbid major depression, as well as more severe depressive symptoms, more somatic complaints, a more negative perception of their illness and a lower QOL. At a 12-24 month follow-up, those with multiple functional symptoms were still significantly more likely to be unemployed on disability and to have lower QOL. The affective style of patients with PNES and multiple functional symptoms was characterized by a lower ability to conceal emotions and to adjust to distressing situations. Likelihood of trauma history and other psychiatric comorbidities at baseline and seizure outcome were not different between the groups.

**Conclusions:** In addition to addressing psychiatric comorbidities such as depression, it is imperative to identify comorbid functional

symptoms in PNES patients, as their presence can negatively impact functional outcomes. A more significant impairment in emotion regulation may underlie a more florid functional symptomatic presentation in PNES. An integrated approach to the care of PNES patients should account for and address other comorbid functional symptoms and their underlying psychopathological mechanisms. **References:** 1. McKenzie PS, Oto M, Graham CD, Duncan R. Do patients whose psychogenic non-epileptic seizures resolve, 'replace' them with other medically unexplained symptoms? *Medically unexplained symptoms arising after a diagnosis of psychogenic non-epileptic seizures*, *J Neurol Neurosurg Psychiatry* 2011; 82:967-969. 2. Tatum WO, Langston ME, Acton EK. Fibromyalgia and seizures. *Epileptic Disord.* 2016;18:148-54.

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### **An Exploration of the Long-term Outcome for Patients with Functional Memory Disorder and Depressive Pseudodementia**

*Josef Mahdi, Kirsty Harkness, Laura Kelly, Jessica Collins, Evaldina Incopte, Markus Reuber, Daniel Blackburn (Sheffield, United Kingdom)*

**Objective:** To determine the memory profiles, quality of life and natural progression of Functional Memory Disorder (FMD) and Depressive Pseudodementia (DPD) via neuropsychological assessments, subjective memory questionnaires and patient focus groups. **Background:** FMD and DPD are two distinct causes of memory impairment that are routinely observed in memory clinic. Little is known about the prognosis of FMD. By increasing our understanding of these disorders, better treatments could be developed. **Methods:** Fifteen adult patients with FMD and five with DPD were recruited from a neurology outpatient clinic and were asked to complete nine self-administered cognitive questionnaires. Mean scores were calculated for both cohorts and differences between baseline and one year follow-up results from the Addenbrooke's Cognitive Examination-Revised (ACE-R), Generalised Anxiety Disorder (GAD-7) and Patient Health Questionnaire (PHQ-9) were examined. The data was compared with results from 31 healthy controls and 11 patients with Non-Epileptic Attack Disorder (NEAD), all extracted from a prior study by the research team. In addition, two focus groups will be conducted in order to explore themes surrounding quality of life and treatment. **Results:** There were no significant differences in mean ACE-R scores between baseline and follow-up results in FMD (83.3 vs 85.5;  $p=0.43$ ) and DPD patients (79.6 vs 82.2;  $p=0.21$ ). There were also no significant differences between baseline and follow-up mean PHQ-9 and GAD-7 scores in either cohort. Mean scores in very long-term, verbal, visuospatial and retrospective memory were not significantly different between FMD, DPD and NEAD patients. All three patient cohorts scored higher for depression and anxiety compared to healthy controls. **Conclusions:** FMD and DPD appear to be non-progressive memory disorders and the lack of improvement in memory might reflect an absence of effective treatments. Effective therapies for NEAD such as cognitive behavioural therapy might prove useful for FMD and DPD due to their similar memory profile and co-morbidities. However, as the preliminary results are constrained by the limited sample size, additional participants are currently being recruited into the study. The added qualitative data from the on-going focus groups may provide further insight into potential treatments for these patients. **References:** 1. Blackburn D, Wakefield S, Bell S, Harkness K, Venneri A and Reuber M. Functional memory disorder; review from a memory clinic. *Journal of Neurology, Neurosurgery & Psychiatry.* 2014; 85(10): e4.

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### **Can Free Association Narrative Interviews help to extend understandings of Psychogenic Non-Epileptic Seizures (PNES)?**

*Marian Peacock, Jon Dickson, Markus Reuber, Richard Grunewald, Paul Bissell, Steph Howlett (Sheffield, United Kingdom)*

**Objective:** To establish, via a small pilot study, if the use of an innovative biographical-narrative method, Free Association Narrative Interviews (FANI), can extend current understandings of the subjective experience of PNES and indicate whether the method is an effective tool for future research. **Background:** There has been limited qualitative research into PNES and none using biographical-narrative methods. The subjective experience of PNES, the meanings attributed to seizures and the narratives drawn upon to understand illness are salient to outcomes following diagnosis. **Methods:** The FANI method is particularly valuable in areas that are emotionally troubling or likely to engender shame or embarrassment, and where there is a need to "account" for the self. FANI arose in response to the limitations of conventional qualitative research; it is a psycho-social, biographical-narrative approach embracing unconscious conflicts and defences to go "beneath the surface". FANI assumes a defended research subject and a defended researcher in the research encounter. It is characterised by multiple interviews with small numbers of participants and a reflexive approach to data analysis. This study aimed to conduct three interviews with each of six participants. Interviews were audio recorded and transcribed. Detailed portraits of the participants were developed and preliminary themes were explored further in a data analysis group. **Results:** Study findings were in three areas; trauma denied, the journey through services and the FANI interview as a "third space". PNES are associated with high rates of trauma in some but not all subjects. The eliciting of unforced biographical narratives during the interviews resulted in description of some traumatic events not identified as trauma by participants. Attaining the diagnosis was difficult for most and associated with a strong sense of not being heard, fear of undiagnosed illness and a struggle to make sense of their experiences. Participants' subjective illness experience and the evoked narratives exposed a disparity with biomedical explanations. Using FANI resulted in a "third space", neither medicine nor psychiatry, where it was possible to explore the meanings of the diagnosis with less investment in the defences likely to be evoked in the medical encounter. **Conclusions:** In line with Benjamin's conception of "thirdness", we propose that the use of FANI opened up a "third space" that was a little freer than the space of the medical or psychiatric encounter and allowed the emergence of new ways of thinking and speaking of the experience of PNES. Thirdness is contingent on recognition and the appreciation of being understood by another. The use of FANI can result in an encounter which induces recognition, making this third space less likely to evoke conscious and unconscious defences that can make thinking and reflection problematic and block access to reflection. This was particularly salient when participants were speaking of their journey through services and understandings of PNES. FANI emerged as a promising tool for researchers and as a method allowing patients to gain a potentially therapeutic understanding of their disorder.

**References:** Hollway, W and Jefferson, T. (2013) Doing qualitative research differently. London, Sage. Benjamin, J (2004) Beyond doer and done to: an intersubjective view of thirdness. *Psychoanalytic Quarterly* 73: 5-46.

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### **Attitudes and nature of diagnostic disputes made by patients with Functional Neurological Disorders in secondary care**

*Piriyankan Ananthavarathan, Shanika Samarasekera (Barnet, Hertfordshire, United Kingdom)*

**Objective:** Conveying a functional disorder diagnosis may lead to patient dissatisfaction due to lack of an organic basis (1). Patients often present with multiple physical symptoms in several clinic visits (2), with adverse clinical and financial implications.

**Background:** We reviewed the nature of complaints made by those diagnosed with functional neurological disorders (FND) in the outpatient neurology setting. We assessed the proportion of those who disputed their functional diagnosis and sought a further opinion.

**Methods:** Complaints logged on the DATIX database were obtained from the Neurology Department at Queen Elizabeth Hospital (Birmingham). The nature of the complaint (administrative vs clinical), underlying diagnosis and whether the diagnosis was disputed were recorded. The clinic letters of those who disputed their diagnosis were reviewed in further detail to establish the way in which a diagnosis of functional symptoms was conveyed and perceived by the patient, whether they eventually accepted their diagnoses, and the range of other specialties a patient was seen by or referred on to.

**Results:** 137 complaints were recorded under Neurology (2015-2017): 10 complainants disputed their neurological diagnosis. 60% (n=6) were given a diagnosis of FND (n=4 with chronic fatigue, n=1 functional paraparesis, n=1 conversion syndrome). A third of these (n=2) sought a second neurological opinion (1 diagnosis changed from non-specific functional disorder to fibromyalgia). Half (n=3) had documented evidence suggesting acceptance of the diagnosis of FND. A third (n=2) of patients disputing the diagnosis of FND also initially presented to rheumatology. Half (n=3) were referred to another specialty by neurology (n=3 neuropsychiatry, n=2 neurorehabilitation, n=2 pain clinic).

**Conclusions:** While diagnostic disputes form a relatively small proportion of overall complaints in neurology, a significant proportion stem from those given a diagnosis of FND. Dissatisfaction with the diagnostic process is reflected in the proportion of patients who seek further specialist opinions. Co-working between clinicians across specialties is a potential way in which to unify diagnostic and treatment pathways. This reduces the potential for misinterpretation between patients and clinicians and encourages consistency of approach.

**References:** (1) Rosendal M, Carlsen A, Rask M. Symptoms as the main problem: a cross-sectional study of patient experience in primary care. *BMC Family Practice*. 2016;17(1). (2) Reid S. Medically unexplained symptoms in frequent attenders of secondary health care: retrospective cohort study. *BMJ*. 2001;322(7289):767-767.

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### **Predictors of Quality of Life in Children with PNES: The Impact of PNES Frequency**

*Lindsey Elliott, Lauren Bolden, Aaron Fobian (Birmingham, AL, USA)*

**Objective:** The aim of this study was to examine the relationship between PNES frequency, age, gender and health related quality of life (HRQOL) in a pediatric population.

**Background:** PNES patients report lower HRQOL than epilepsy patients. Seizure frequency has been associated with lower HRQOL in children with epilepsy; however, little is known about the relationship between PNES frequency and HRQOL in children.

**Methods:** Fourteen participants (mean age=16.64, SD=3.30; 42.9% African American, 57.1% Caucasian, 50% female) with PNES were recruited. Participants completed the Pediatric Quality of Life Inventory (PedsQL), a self-report questionnaire which measures HRQOL on four domains (physical, emotional, social, and school/work functioning), and gives total HRQOL, physical health summary, and psychosocial health summary scores. Participants completed demographic questionnaires and recorded the number of PNES occurring in one week.

**Results:** A linear regression was performed with HRQOL, as measured by the PedsQL total score, as the dependent variable and PNES frequency, gender, and age as independent variables. Age ( $t = -3.17, p < 0.05$ ) and PNES frequency ( $t = -2.50, p < 0.05$ ) were independent significant predictors of HRQOL. Together, PNES frequency, gender, and age accounted for 88.5% of the variance in HRQOL, Adj.  $R^2 = 0.885, F(3, 8) = 29.20, p < 0.05$ .

**Conclusions:** Results demonstrate a significant relationship between PNES frequency, gender, age, and HRQOL. Increased PNES frequency, female gender, and older age predicted lower HRQOL. This is consistent with previous literature which has found that condition related factors in adults with PNES are associated with lower HRQOL. (1) This may be due, in part, to illness perceptions; one study found that negative illness perceptions (e.g., personal control, concern, and consequences) accounted for as much variance as psychological distress in HRQOL. (2) PNES frequency and illness perception may represent important avenues of intervention. Research previously presented as an oral presentation at the 2017 Alabama Psychological Association Annual Convention.

**References:** 1. Lawton G, Mayor RJ, Howlett S, Reuber M. Psychogenic nonepileptic seizures and health-related quality of life: The relationship with psychological distress and other physical symptoms. *Epilepsy & Behavior* 2009;14:167-171. 2. Rawlings GH, Brown I, Reuber M. Predictors of health-related quality of life in patients with epilepsy and psychogenic nonepileptic seizures. *Epilepsy & Behavior*;68:153-158.

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### **Pitfalls of Diagnosing Functional Neurological Disorders in the Emergency Ward**

*Carlo Dallochio, Carla Arbasino, Federica Bombieri, Angela Marotta, Michele Tinazzi (Voghera, Italy)*

**Objective:** To focus on how failure to diagnose Functional Neurological Disorders (FND) in an emergency setting can lead to incorrect therapeutic choices.

**Background:** When patients with FND are assessed in an emergency, their symptoms may be mistaken for those of other serious

physical disorders, such as stroke, epileptic seizures or multiple sclerosis. Since FND are relatively common, this issue constitutes a significant diagnostic challenge.

**Methods:** We report three cases of patients with FND who were evaluated in an emergency setting by emergency physicians and neurologists who ran a series of laboratory investigations with an outcome of an incorrect diagnosis and treatments. Two of the patients presented with functional limb paralysis and one with psychogenic nonepileptic seizures. All subjects had an abrupt onset of symptoms. There was no clear history of prior medical disorders that include FND.

**Results:** Case 1: a 29 year old male presented with abrupt onset of weakness in his left arm about 2 hours before arrival in the emergency room. The only relevant information given by the patient was that he failed to pass his job advancement test one month prior to onset of symptoms. Blood studies, carotid doppler ultrasound and brain CT were normal and he was diagnosed as having acute ischemic stroke, and alteplase infusion was given. After being monitored for 12 hours, a mild improvement of the paresis was observed, but a brain MR with angiography of the cerebral vessels did not showed any lesion. Symptoms remitted dramatically after the first physical therapy session. Case 2: a 49 year old female with known hypertension arrived at the emergency room with mild right hemiparesis and hemisensory symptoms which appeared suddenly 4 hours prior to her arrival. Brain CT showed no evidence of focal lesions and she was unsuccessfully treated with intravenous thrombolysis using alteplase. After 6 hours, brain MR and EEG were normal. The patient reported a history of sporadic falls. She was initially treated with physical rehabilitation, but only cognitive-behavioral therapy resulted in a complete improvement. Case 3: a 21 year old female presented with ictal generalized tonic-clonic seizure-like movement as well as unresponsiveness continuing for over 30 minutes. She received intensive care treatments for presumed status epilepticus. The day after the symptomatology reappeared, but video-electroencephalography revealed no abnormal brain electrical activity. She had no history of seizures, but she did report a family history of seizures. After 5 months of observation alone she had another episode of psychogenic nonepileptic seizure.

**Conclusions:** Diagnosing FND is often challenging, particularly in the context of an emergency situation. A specific set of investigations may be necessary in many patients with disabling conditions. There will not always be characteristic features or distinct comorbidities in the patient's medical history. Sometimes emergency physicians and even neurologists may not have much confidence when diagnosing these patients. Therefore, the diagnosis of FND should be made primarily on the basis of the physical examination. Furthermore, positive signs are just as relevant as the absence of signs of disease and, in the overall context of the presentation, some specific diagnostic tools might aid the clinical diagnosis of FND.

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#### **Demographic and clinical characteristics of patients with functional motor disorders: the prospective Salpêtrière cohort**

*Nicolas Villain, Francine Mesrati, Lionel Naccache, Marie Vidailhet, Emmanuel Flamand-Roze, Bertrand Degos, Béatrice Garcin (PARIS, France)*

**Objective:** This study aimed at describing demographic and clinical characteristics of patients with functional motor disorders (FMD).

**Background:** Diagnosis and management of FMD is challenging. Moreover, demographic and clinical characteristics of these patients are still poorly known and rely on data from small cohorts.

**Methods:** We prospectively collected clinical and demographic data from patients with FMD that were referred to the Neurophysiology Department of the Pitié-Salpêtrière Academic Hospital between 2008 and 2016. Every patient had large etiologic investigations in the Neurology Department of the Pitié-Salpêtrière Academic Hospital and was then referred for treatment with repeated transcranial magnetic stimulation (TMS) [1].

**Results:** 482 patients were included (73% women). Mean age was 40 years at inclusion, ranging from 8 to 77 y. o. 55% had a low level of education (<12 years, i. e. baccalauréat), and only 25% were still active workers. Half of the patients had movement disorders, and the other half had motor deficit. Mean symptoms duration was 52 months (median: 24 months / range: 2days – 65years). A traumatic event was found for 80% of the patients, in the 3 months period before symptom onset (50% psychological trauma, 20% physical trauma, 10% surgical procedure). Regarding psychiatric history, 53% had mood disorders, 8% anxiety disorders and 5% eating disorders.

**Conclusions:** We report a large cohort of patients with FMD. Our data show a clear predominance of women and a long duration of symptoms before medical care. It should be noted that a substantial proportion of these patients had no psychiatric or traumatic events history. This observation is in agreement with the exclusion of psychological factors in the latest diagnostic criteria of FND [2]. Finally, only a little proportion of patients were still working. This underlines the socio-economical costs of FMD and stresses out the urge for a better diagnostic procedure and management.

**References:** [1] Garcin et al. , 2013, JNNP;84(9):1043-6[2] American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed. ). Washington, DC: Author.

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#### **Functional movement disorders and associated psychiatric comorbidity in US veterans**

*Joel Mack, Joseph Quinn, Brenna Lobb, Susan O'Connor (Portland, OR, USA)*

**Objective:** To examine the frequency and phenomenology of functional movement disorders (FMD) in a US Veterans Administration Medical Center (VAMC) movement disorders clinic and compare psychiatric comorbidity in veterans with FMD versus those diagnosed with organic movement disorder (OMD).

**Background:** Studies of FMD in tertiary movement disorders centers have shown a prevalence of 3-4% with FMD presenting across the spectrum of movement disorder phenomena, however the clinical characteristics of FMD have not been examined in US veterans, specifically. Functional neurological disorders have historically been thought to be associated with psychological trauma ("psychogenic"), and studies have found a diagnosis of PTSD to be predictive of psychogenic non-epileptic seizures (PNES) in US veterans. A better understanding of the relationship between trauma, psychiatric disorders and FMD may aid in earlier and more valid FMD diagnosis, resulting in improved treatments and outcomes for veterans with these disorders.

**Methods:** We reviewed records of all veterans seen as new consultations in the Portland VAMC Movement Disorders Clinic over a two-

year period (January 2013 through December 2014). For those deemed to have FMD at the time of initial evaluation, further record review was performed and data collected on movement disorder clinical characteristics and past psychiatric history including DSM-IV Axis I diagnoses. Those with FMD were compared to a group of randomly selected veterans diagnosed with an OMD at initial movement disorders clinic evaluation over the same time-period. Predictive models of movement disorder type (FMD vs OMD) were evaluated by logistic regression.

**Results:** Of the 693 veterans evaluated, 3.6% (n=25) had FMD. The most frequently observed movement type in FMD was tremor (n=10, 40%). Both groups were 90% male, which is typical of VA samples. Veterans in the FMD group were significantly younger than those in the comparison group (56.0 years versus 69.6 years,  $p=0.001$ ). Significantly more patients in FMD were formally diagnosed with a psychiatric disorder compared to OMD (76% versus 40%,  $p=0.01$ ), and FMD had a greater total number of psychiatric diagnoses on average (1.5 versus 0.6,  $p=0.006$ ). PTSD was diagnosed in 32% of FMD and 12% of OMD ( $\chi^2$ Fisher  $p=0.085$ ). Using forward stepwise entry into a logistic regression model, age and presence of a psychiatric diagnosis were the final predictors of FMD, explaining 26% of the variance. No Axis I psychiatric diagnosis significantly differentiated the two groups, although PTSD and depressive disorders diagnoses were more common in FMD.

**Conclusions:** The prevalence of FMD in veteran movement disorders clinics approximates that seen in civilian movement disorder clinic samples. Veterans with FMD present at a younger age and have higher rates of psychiatric comorbidity than those with OMD, although it is not clear that specific psychiatric diagnoses may be associated with FMD in US veterans. Further studies are needed to examine psychiatric correlates of FMD in veteran populations and how psychiatric factors are related to service utilization and prognosis, with a goal of developing more effective FMD treatments.

**References:** Factor SA et al. Psychogenic movement disorders: frequency, clinical profile and characteristics. *J Neurol Neurosurg Psychiatry*. 1995;59:406-412 Salinsky M et al. Psychiatric comorbidity in veterans with psychogenic seizures. *Epilepsy & Behavior*. 2012;25:345-349

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### **Systematic Review: Electrophysiology in Movement Disorders**

*Steven Brown, Mark Baker (Milton Keynes, United Kingdom)*

**Objective:** To perform a systematic review of the clinical utility of electrophysiology (including EMG and EEG) in the diagnosis of movement disorders. To further highlight the advantages and limitations of electrophysiology in distinguishing organic movement disorders from psychogenic.

**Background:** Electromyography (EMG) and electroencephalography (EEG) have historically been invaluable in evaluating movement disorders (MD) and diagnosing functional movement disorders (FMD). The clinical utility of surface EMG was reviewed in 2000 for the American Academy of Neurology (Pullman et al., 2000)

**Methods:** Search terms used were as follows: "(Electrophysiology OR electromyography OR electroencephalography OR neurophysiology OR evoked potentials OR magnetoencephalography) AND (movement disorders OR psychophysiological disorders OR somatoform disorders OR dissociative disorders OR psychosomatic medicine OR gait disorders OR ataxia OR chorea OR dystonia OR dyskinesia OR myoclonus OR ataxia OR tics OR tremor OR stereotypy OR spasm OR rigidity OR stiff person)". Inclusion criteria were human studies, English language, publication date 2000-present and original journal articles, with movement disorders the primary condition in study populations. Results were rejected if classified as case report, comment, editorial, conference proceedings or reviews.

**Results:** In a preliminary search using Medline, 3197 results were obtained using search criteria and current inclusion and exclusion criteria. On an initial review of results, we took 588 articles to be examined in more detail. Prior to controlling for predominantly epileptiform disorders as opposed to movement disorders, 83 of these results involved psychogenic disorders explicitly. The data generated is currently being analysed and synthesized.

**Conclusions:** Our results will provide a better understanding of the evidence for the utility of electrophysiological techniques in the investigation of movement disorders. We also hope to highlight where electrophysiology may be of greater utility clinically and where evidence is not as strong future work might establish utility more definitively. A key element of this review will be to assess the role of electrodiagnostic investigation in functional movement disorders.

**References:** Pullman SL, et al. Clinical utility of surface EMG: report of the therapeutics and technology assessment subcommittee of the American Academy of Neurology. *Neurology*. 2000 Jul 25;55(2):171-7.

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### **Semiological Classification Of Psychogenic Nonepileptic Seizures With The Video-Eeg Study In A Reference Epilepsy Surgery Center In Venezuela**

*Anilu Daza Restrepo, Rosaly Gonzalez Zerpa, Arnoldo Soto Reyes, Guilca Contreras, Angelica Aroni Paytan, Valentin Sainz, Herman Scholtz (Caracas, Venezuela)*

**Objective:** To identify the semiological characteristics of patients with psychogenic nonepileptic seizures with Video-EEG using a new classification system.

**Background:** Thirty percent of patients who first go to a general neurology clinic have symptoms that are not physically explainable. In particular, psychogenic non-epileptic seizures (PNESs) attract the attention of many specialists because of the diagnostic and therapeutic problems they pose, and their important repercussions not only on health but also on socio-family and economic issues (1, 2). In a study conducted by Magaouda et al (2016) the objective of this study was to validate a new classification for the diagnosis of PNESs (3), which is used by other authors as Asadi-Pooya et al (2016), they classified patients with psychogenic nonepileptic seizures (PNESs) according to a newly proposed classification system. Then, we investigated the demographic and clinical differences between various classes of the patients. Sixty-three patients were studied. Thirty-five (55.6%) patients had generalized motor seizures, 14 (22.2%) had seizures with subjective symptoms, 12 (19%) had akinetic seizures, and two (3.2%) patients had focal motor seizures. Patients with generalized motor seizures (35 patients) demonstrated a trend for later age at onset ( $p=0.06$ ), more frequently had a

history of substance abuse ( $p = 0.001$ ), and more often had loss of responsiveness with their seizures ( $p=0.04$ ) compared with patients who had nonmotor seizures (26 patients) (4). The International League Against Epilepsy (ILAE) has identified psychogenic nonepileptic seizures (PNES) as one of the key neuropsychiatric issues associated with epilepsy. The management of patients with PNES begins with an accurate diagnosis. The misdiagnosis of PNES leads to inappropriate treatment of presumed epilepsy, with significant risk of iatrogenic injury, morbidity, and cost to patients and to the health care system. Several studies have documented that misdiagnoses resulting from misinterpretations of the patients' history or of misreading electroencephalography (EEG) studies are common (5, 6).

**Methods:** A retrospective analytical observational study was carried out, in which the patients admitted to the La Trinidad Pedagogical Medical Center were evaluated, who performed at least one non-psychotic non-epileptic seizure during the Video-EEG in the period between 2011-2017. Patients were classified into 4 groups, according to the semiologic presentation of the crises: generalized motor (hypermotor), akinetic, focal motor and those with crisis with subjective symptoms. Inclusion criteria: 1. Patients older than 14 years with diagnosis of PNES. 2. Patients diagnosed with PNES admitted to the Epilepsy Unit of the Teaching Hospital of Trinidad, for Video-EEG, during the period 2013-2017. Exclusion criteria: 1. Patients with concomitant diagnosis of epilepsy. 2. Patients with specific paroxysmal alteration in the ictal or interictal EEG registry.

**Results:** In our study, 365 Video-EEG were performed between 2013 and 2017, of which only 38 met the inclusion criteria (10.41%); 76.32% were women and 23.68% were men. The mean age was 32 years with a range between 17 to 63 years. The working population represents 57.89% of the cases; the average number of years of schooling was 13.9 years. The age of onset of PNES was at 27.58 years. The time with PNES until diagnosis was 7.01 years. The sensitivity of the Video-EEG in the diagnosis of PNES was observed in 94% of the cases, since only 2 patients were diagnosed with PNES at the time of admission, corroborating the diagnosis through the Video-EEG tool. The average time of registration was 2 days. It was identified that 97.7% of patients received AEDs, 65.79% received 3 or more, and two of the patients were treated with 8 antiepileptic drugs. 18.42% of the patients had a history of status epilepticus, and had been admitted to intensive care units. There is no relation between encephalocranial trauma and family history with the frequency and semiological characterization of PNES. 21.4% of the PNES were spontaneous, requiring induction in 78.6%, which was positive in all cases. According to the semiological characterization we had 57.89% hypermotor, being more frequent in the lesser of 32 years ( $p = 0.046$ ). Pelvic movement was the most prevalent (36.84%), followed by akinetic crises (52.63%); 62.07% were observed in women ( $p = 0.03$ ); subjective symptoms (39.47%) and motor focal (36.84%). It is noteworthy that the pedal subtype was very common in young men (33%) ( $p = 0.05$ ). In women, 82.66% ( $p = 0.03$ ) identified depression, fear and frustration, work dysfunction and student dysfunction as triggers and perpetuators factors. Family dysfunction, love rupture, and student dysfunction were only identified in women. Sexual identity disorder was identified in one man and physical abuse in 2 women.

**Conclusions:** This is the first study in an Epilepsy Surgery Center of Venezuela, in which was used the recently proposed PNESs classification system and we proved the useful and practical utility of this one, above to get the better clinical view to our patients. This may also potentially shed light on the etiologic understanding and management of various classes of patients affected with PNESs in our country. Instead of, is important to looking for the predisposing, precipitating and perpetuating risk factors, and correlates these with the entire clinical history as to offer a correct management and redirection, if necessary, to Psychiatry and psychology department. Thus, the account of PNESs is bigger enough and the bad practice is also too, there are a lot of people with antiepileptic drugs unnecessary treated, and we want to Highlight about the importance of Video-EEG evaluation needs to be performed by an experienced clinician, which will provide guidance for differential and correct diagnosis. We hope of this report may serve to provide greater clarity about the process and certainty of the diagnosis of PNES, with the intent to improve the care for people with nonepileptic seizures, above all in our country.

**References:** 1. Frances PL, Baker GA, Appleton PL. Stress and avoidance in Pseudoseizures: Testing the assumptions. *Epilepsy Research*. 1999;34:241-9. 3. 2. Devinsky O, Gazzola D, LaFrance Jr WC. Differentiating between nonepileptic and epileptic seizures. *Nat Rev Neurol*. 2011;7:210-20. 3. Magaúdda A, Laganà A, Calamuneri A, Brizzi T, Scalera C, and Beghi M. et al. Validation of a novel classification model of psychogenic nonepileptic seizures by video-EEG analysis and a machine learning approach. *Epilepsy & Behavior*. 2016; 60:97–201. 4. Asadi-Pooya A, Tinker J, and Fletman J. Semiological classification of psychogenic nonepileptic seizures. *Epilepsy & Behavior*. 2016;64:1-3. 5. Curt LaFrance W, Baker GA, Duncan R, Goldstein LH, and Reuber M. Minimum requirements for the diagnosis of psychogenic nonepileptic seizures: A staged approach A report from the International League Against Epilepsy Nonepileptic Seizures Task Force. *Epilepsia*. 2013;54(11):2005-2013. 6. Reuber M. The Etiology of Psychogenic Non-Epileptic Seizures: Toward a Biopsychosocial Model *Neurol Clin*. 2009;27:909–924

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### Current projects of the Functional Neurological Disorders Research Group (FRG) University of Edinburgh

*J Stone and A Carson on behalf of the FRG including J Gelauff, I Hoeritzauer, L McWhirter, P Gardiner, L McGregor, H Callaghan (Edinburgh, Scotland)*

**Objective:** To provide an overview of current research projects being undertaken by Functional Neurological Disorders Research Group, University of Edinburgh

**Background:** Jon Stone and Alan Carson have been researching functional neurological disorders at the University of Edinburgh since 1998. They lead a multidisciplinary research group focusing on clinical trials and observational studies.

**Methods:** An overview of research projects undertaken by participants within the Functional Neurological Disorders Research Group.

**Results:** CODES Trial: CODES is a multicentre randomised controlled trial led by Laura Goldstein at the Institute of Psychiatry comparing cognitive behavioural therapy to standardised medical care. Edinburgh has been a key partner in the trial which will finish data collection in 2018. SHIFT: A randomised controlled trial investigating the added benefit of high quality internet information about functional disorders in the treatment of motor disorders. BLB study: An observational case control study of all patients presenting with possible cauda equina syndrome. Aiming to establish how many patients with normal MRI scans have a functional disorder and the outcome of patients with bladder and motor dysfunction. FAS: The largest study of patients with foreign accent syndrome investigating aetiology, comorbidity and what proportion of patients have a functional neurological disorder.

**Conclusions:** These are exciting times for research into functional neurological disorders. The Functional Neurological Disorders Research Group at the University of Edinburgh is investigating a wide range of research questions all informed by patient care.

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### **Cryptogenic Drop Attacks revisited – evidence of overlap with Functional Neurological Disorder**

*Ingrid Hoeritzauer, Alan Carson, Jon Stone (Edinburgh, Scotland)*

**Objective:** To determine clinical features, comorbidity and outcome of younger patients with drop attacks.

**Background:** No consecutive study of cryptogenic drop attacks in a predominantly middle age cohort has been undertaken since 1973.

**Methods:** We carried out a retrospective review of consecutive cases of cryptogenic drop attacks between 2006 and 2017.

Demographics, duration and frequency of attacks, and attack description were recorded. Comorbid diagnoses at onset were reviewed and patients were followed up with a notes review until July 2016.

**Results:** 83 patients with drop attacks were predominantly female (89%) mean age 44yrs. The majority (93%) could not remember the fall itself, and almost half (43%) experienced prodromal dissociative symptoms. There were initial historical mechanical trips or syncope in 24% of cases. Patients had high levels of comorbid functional disorders: 31% had functional limb weakness and 27% had dissociative (non-epileptic) attacks. Disease comorbidity that may have acted as a predisposing but not causative factor was found in 12 patients at baseline and in 5 patients at follow up (mean 38 months). 28% had resolution of their drop attacks at follow up.

**Conclusions:** Drop attacks in some younger patients may be best seen as brief episodes of dissociation, often triggered by an initial mechanical fall or faint, perpetuated by fear of falling and becoming habitual via a conditioned response.

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### **Are Functional Neurological Disorder Symptoms Dependent Upon the Patient's Understanding of the Symptom?**

*E Cox, I Hoeritzauer, L McWhirter, J Tiefenbach, M Paterson, A Crawford, K Ahmed, L Delaney, A Southgate, J Stone (Edinburgh, Scotland)*

**Objective:** To investigate whether the signs and symptoms of Functional Neurological Disorders (FND) are dependent on the individual's ideas and preconceptions of the symptoms, rather than based on an anatomical or physiological basis.

**Background:** The relationship between the symptoms that patients exhibit and individuals' preconceptions could provide a valuable insight into the underlying pathological mechanism. This idea was inspired by an experiment undertaken with medical students by Arthur Hurst in 1919<sup>1</sup>.

**Methods:** A scripted neurological examination and Montreal Cognitive Assessment (MoCA) was conducted on 42 healthy non-medical volunteers pretending to have weakness, tremor and dementia. Neurological examination was focused on validated signs of FND such as Hoover's sign of functional leg weakness, tremor entrainment test and ballistic movements for functional tremor. Examinations were videoed, simultaneously rated by two assessors and anonymised. A subset of volunteers were asked about where their ideas of weakness and epileptic seizures originated.

**Results:**

**Weakness:** Hoover's sign was positive in 23 people feigning weakness. 12 people went from positive to negative Hoover's sign with initial strength on hip extension in the weak limb followed by a sudden weakness. **Sensation:** Sensation was widely variable with 13 volunteers showing no sensory symptoms. 69% (n=29) had sensory loss, most commonly either a sharp circumferential limit or a gradual increase of sensation moving up or down the limb. **Tremor:** All 37 people feigning a tremor had positive signs of a functional tremor. **Cognitive:** Average MoCA score was 18/30 (median=19, range = 6 - 29). **Ideas:** Ideas about neurological symptoms were from multiple sources including imagination, TV, family and friends or working with people affected by neurological disorders.

**Conclusions:** The clinical tests for functional weakness show different outcomes for those pretending compared to patients with FND. A proportion of people feigning weakness were able to change from a positive to negative Hoover's test result during testing. Tests for functional tremor seem more robust with all people pretending to have tremor demonstrating entrainment or stopping during testing for functional tremor. The majority of people feigning weakness did associate sensory problems with weakness, despite a script which sought to prevent any suggestion by the examiner. This supports Hurst's theory that sensory loss is associated with weakness in the lay public. Ideas about neurological symptoms come from many different cultural references.

**References** 1. Hurst A. *The psychology of the special senses and their functional disorders*. London: Henry Frowde, Hodder & Stoughton, Oxford University Press 1919.

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**Cauda Equina Syndrome (CES): What happens to the patients who have CES symptoms but negative scans?**

*Ingrid Hoeritzauer, Savva Pronin, Alan Carson, Patrick Statham, Andreas K. Demetriades, Jon Stone*

**Objective:** To characterise patients who present with suspected CES and have normal or negative MRI scans.

**Background:** At least half of all patients who present with CES symptoms are 'scan negative' with non-explanatory MRI scans.

Clinical and radiological features of 'scan negative' CES remain unclear, as is their relation to comorbid functional somatic disorders and outcome.

**Methods:** Retrospective e-record review of referrals to our regional service with suspected CES requiring urgent MRI. We assessed clinical and radiological features, functional disorder comorbidity (fibromyalgia/chronic fatigue syndrome/non-cardiac chest pain/functional neurological disorders) at baseline and follow-up.

**Results:** Between August 2013 and November 2014, we received 287 referrals with possible CES warranting an MRI scan. Mean follow up was 15 months. Three groups were apparent:

Group 1: **Scan positive CES** (n=90, 31%); 72 patients had clinicoradiological evidence of CES due to degenerative disc disease (80%), 8% (n=7) had a functional disorder and 24% had a psychiatric diagnosis. Group 2: **Scan negative CES with L3-S1 foraminal compromise** (n=102, 35%). 27% (n=28) had a co-existing functional disorder and 40% had a psychiatric disorder diagnosed at diagnosis/during follow-up. Group 3: **Scan negative patients without neurocompromise** (n=95; 33%): 36% (n=34) had a functional disorder and 54% had a psychiatric diagnosis. In both groups 2 and 3 only one patient out of the 197 was given an explanatory diagnosis on follow up and 53% had chronic pain.

**Conclusions:** Almost 70% of patients who have clinical CES have normal or non-explanatory scans. Only 0.005% of the scan negative group had an explanation for their CES symptoms. Patients with 'scan negative' CES have high rates of functional disorders and psychiatric comorbidity

**Aetiology and Mechanism**

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**Gray matter differences in patients with functional movement disorders**

*Carine Maurer, Kathrin LaFaver, Gaurang Limachia, Geanna Capitan, Rezvan Ameli, Stephen Sinclair, Steve Epstein, Silvina Horovitz, Mark Hallett (Bethesda, MD, USA)*

**Objective:** To assess whether patients with functional movement disorders (FMD) exhibit alterations in gray matter volume as compared to matched healthy controls (HC).

**Background:** Functional neuroimaging studies have demonstrated numerous alterations in limbic and sensorimotor networks in patients with FMD. Little is known about structural brain differences in this population.

**Methods:** We recruited 48 patients with clinically definite FMD and 55 age- and sex-matched healthy controls. T1-weighted MP-RAGE images were obtained using a 3T Skyra Siemens scanner. Between-group differences in gray matter volume were assessed using voxel-based morphometry (VBM) across the entire brain. All participants additionally underwent a thorough neuropsychological battery, including the Hamilton Anxiety and Depression scales and the Childhood Trauma Questionnaire. Post-hoc analysis was performed using Spearman's rank correlation coefficient to determine whether differences in GM volume correlate with comorbid anxiety and depressive symptoms, exposure to childhood trauma, or disease characteristics including duration and severity.

**Results:** Patients with FMD exhibited increased volume of the left amygdala, left striatum, and bilateral thalamus, and decreased volume of the left sensorimotor cortex. Volumetric differences did not correlate with anxiety or depression scores on post-hoc analysis. Among patients, degree of volumetric difference did not correlate with measures of disease duration or patient-rated disease severity.

**Conclusions:** Patients with FMD exhibit volumetric abnormalities in critical components of the limbic and sensorimotor circuitry. It remains unclear whether these abnormalities represent a premorbid trait rendering patients more susceptible to disease, the disease itself, or a compensatory response to disease.

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**Emotion processing in patients with Functional Neurological Disorders: comparing Nonepileptic Attacks with other Functional Neurological Symptoms**

*Isobel Williams, Liat Levita, Markus Reuber (Sheffield, United Kingdom)*

**Objective:** To compare emotion processing (EP) and psychopathology in FND patients with nonepileptic attacks (FND+) against those with FND but no nonepileptic attacks (FND-).

**Background:** FND are heterogeneous in symptomatology and deficits in EP are assumed to cause and / or maintain these disorders. We have previously demonstrated impaired EP in patients with nonepileptic attacks [1], but EP has yet to be studied in patients with other FND.

**Methods:** Nonepileptic attacks have been conceptualised as a dissociative response to overwhelming emotion [2]. We therefore

hypothesised that FND+ patients would exhibit greater EP deficits and levels of psychopathology than FND-. 38 FND+ patients and 17 FND patients were recruited from neurology wards and clinics at the Royal Hallamshire Hospital. Patients completed questionnaires measuring emotion processing (EPS-25), anxiety (GAD-7), depression (PHQ-9), somatic symptoms (PHQ-15), and post-traumatic symptoms (PCL-5). Group differences between FND+ and FND- patients were explored with inferential statistics. A Benjamini-Hochberg correction was applied to control for False Discovery Rate.

**Results:** Overall, patients' scores exceeded clinical thresholds and healthy norms on EP and all psychopathology measures. Contrary to our prediction, EPS-25 scores did not significantly differ between FND+ and FND- patients ( $p=.880$ ). Likewise, PHQ-9 ( $p=.377$ ) and PHQ-15 ( $p=.483$ ) scores did not differ between groups. However, FND+ patients scored significantly higher than FND- patients on the GAD-7 ( $p=.035$ ) and PCL-5 ( $p=.014$ ).

**Conclusions:** Our preliminary findings suggest that FND+ and FND- patients report similarly elevated levels of EP deficits, depression, and somatic symptoms. However, significantly greater GAD-7 and PCL-5 scores in the FND+ group suggest that nonepileptic attacks may be linked more closely with anxiety and previous trauma than other FND. This may have important implications for psychological treatment.

**References:** 1. Novakova, B., et al., Emotion processing and psychogenic non-epileptic seizures: A cross-sectional comparison of patients and healthy controls. *Seizure*, 2015. 29: p. 4-10. 2. Roberts, N. A. and M. Reuber, Alterations of consciousness in psychogenic nonepileptic seizures: emotion, emotion regulation and dissociation. *Epilepsy Behav*, 2013. 30: p. 43-9.

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### Severity and Correlates of Illness Anxiety in Three Functional Neurologic Disorders

Mary Widmeyer, Jeffrey Staab (Rochester, MN, USA)

**Objective:** We investigated severity and correlates of illness anxiety in patients with persistent postural-perceptual dizziness (PPPD), non-epileptic seizures (NES), and functional movement disorders (FMD).

**Background:** Illness anxiety presents with increased vigilance for physical symptoms, fear of illness, and excessive need for reassurance about health. Severity of illness anxiety has not previously been compared among different functional neurologic disorders.

**Methods:** We retrospectively reviewed records of 200 patients with functional neurologic symptoms evaluated in 2016 by collaborative teams of neurologists, psychiatrists or psychologists, and vestibular specialists. We included patients with primary diagnoses of PPPD ( $n=68$ ), NES ( $n=38$ ), or FMD ( $n=30$ ) and excluded those with indeterminate symptoms or multiple functional syndromes. We abstracted data on demographics, presence of comorbid structural, cellular, metabolic, or psychiatric diagnoses, and scores on the short Health Anxiety Inventory (SHAI). We compared mean SHAI scores across groups and between those with and without comorbid diagnoses.

**Results:** Patients ranged in age from 18-82 years. 65% were female. Mean SHAI scores did not differ by diagnosis: PPPD 14.8, NES 15.4, FMD 12.9 ( $p<0.36$ ). 62% of patients had low scores, 29% moderate, and 9% high, with no differences across groups ( $p<0.35$ ). 74% of patients had comorbid psychiatric diagnoses, which were associated with higher mean SHAI scores, collectively 16.3 vs 9.6 ( $p<0.0001$ ) and in all diagnostic groups. 74% had structural, cellular or metabolic diagnoses, but these did not affect SHAI scores. Headache was more common in patients with PPPD (57%) and NES (61%) than FMD (20%) ( $p<0.001$ ) and was associated with higher mean SHAI scores 16.3 vs 12.8 ( $p<0.005$ ).

**Conclusions:** The results indicate that illness anxiety is not particularly prominent among patients with functional neurologic disorders. Mean illness anxiety scores were comparable to patients with uncomplicated anxiety disorders (14.9), but much lower than patients with hypochondriasis (30.1). Only 9% of patients had illness anxiety in the hypochondriacal range, though 29% had moderate illness-related worries. Psychiatric diagnoses and complaints of headache were related to higher illness anxiety, but comorbid structural, cellular, or metabolic diagnoses were not. Severity of illness anxiety did not differ across the three functional neurologic syndromes.

**References:** Salkovskis PM, Rimes KA, Warwick HMC, Clark DM. The Health Anxiety Inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological Medicine*, 2002, 32, 843–853.

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### Abnormal beta power is a hallmark of explicit movement control in functional movement disorders

Tiago Teodoro, Anne Marthe Meppelink, Simon Little, Robert Grant, Glenn Nielsen, Antonella Macerollo, Isabel Parees (London, United Kingdom)

**Background:** Excessive attention towards the “mechanics” of movement and away from its goal is considered a key pathophysiological feature of functional movement disorders (FMD). This is thought to explain why patients with FMD are unable to take advantage from cueing to improve motor performance. Sensorimotor beta-frequency oscillations normally decrease and lateralize prior to movement, and might provide an index of motor attention. We investigated whether beta power remains abnormally raised during motor preparation in FMD patients, thus constituting a marker of excessive “body focused” attention.

**Methods:** We analyzed motor performance and beta-frequency cortical oscillations during a pre-cued choice reaction time (RT) task with varying cue validity (50% or 95% congruence between preparation and go cues). We compared 21 FMD patients with 13 healthy controls (HC).

**Results:** In HC, highly predictive cues were associated with faster RT and beta desynchronization in the contralateral hemisphere [contralateral slope:  $-0.045$  (95CI  $-0.057$   $-0.033$ ) vs ipsilateral  $-0.033$  (95CI  $-0.046$   $-0.021$ ),  $p < 0.001$ ] as well as a trend for reaching lower contralateral end-of-preparation beta power [contralateral  $-0.482$  (95CI  $-0.827$   $-0.137$ ) vs ipsilateral  $-0.328$  (95CI  $-0.673$   $0.016$ ),  $p=0.069$ ]. In contrast, FMD patients had no improvement in RTs with highly predictive cues, and showed an impairment of beta desynchronization and lateralization prior to movement.

**Conclusions:** Persistent beta synchronization during motor preparation might be a signature of abnormal explicit movement control in FMD. We propose that excessive attention towards movement mechanics and away from its goal might sustain beta synchronization and impair motor performance.

**A case control study of 322 functional motor disorder patients utilising a psychiatric case register**

Nicola O'Connell, Anthony David (London, United Kingdom)

**Objective:** This study assesses the demographic, social, health variables and life events linked to the presentation of functional motor disorder (FMD). This is a case control study utilising a large psychiatric case register and a general psychiatric control group.

**Background:** Functional motor disorders are movement disorders which cannot be attributed to underlying organic disease. Symptoms vary from gait disorders to weakness, numbness and tremor and are common, debilitating, costly and often chronic.

**Methods:** Data from this study were collected from the Clinical Record Interactive Search (CRIS) (Stewart et al. , 2009). CRIS provides de-identified information from electronic clinical records from secondary and tertiary mental health services provided by South London and the Maudsley NHS Trust. In 2016, it held records for over 250,000 patients. Participants were included if they received a confirmed diagnosis of FMD. Control patients were included if they had received any psychiatric diagnosis the day proceeding the FMD patient's diagnosis date. Data was collected on a range of socio-demographic, health and life event variables and analysed using Student's t-tests and odds ratios with SPSS.

**Results:** 966 patients were included, 322 with FMD and 644 control patients. There were more women in the FMD than control group (74% v 53%, OR = 2. 52, 95% CI 1. 9 - 3. 4, p = 0. 001). British ethnicity was more common in FMD patients (64. 6% v 53. 3%, OR = 1. 6, 95% CI 1. 2 - 2. 1, p = 0. 001). FMD patients were more likely to work in health/social care. Control patients were more likely to smoke with no difference in BMI. FMD patients had more physical conditions, specifically diseases of the nervous system but were less likely to be admitted to psychiatric inpatient settings. The most common comorbid functional disorder was psychogenic seizures. There were no differences in the rate of childhood physical or sexual abuse between groups.

**Table 1** The gender, ethnicity and marital status of functional motor disorder patients versus the general psychiatric control group

	Functional Motor Disorder n (%)	Control Group n (%)	OR	95% CI	p value
<b>Gender</b>					
Female	238 (74)	341 (53)	2.52	1.9 – 3.4	<b>0.001</b>
Male	84 (26)	303 (47)			
<b>Ethnic Group</b>					
British <sup>1</sup>	195 (64.6)	328 (53.3)	1.6	1.2 – 2.1	<b>0.001</b>
Irish <sup>2</sup>	2 (0.7)	22 (3.6)	0.15	0.04 – 0.7	<b>0.01</b>
Any other white background <sup>2</sup>	16 (5.3)	46 (7.5)	0.6	0.3 – 1.06	> 0.05
Any other mixed background <sup>2</sup>	0 (0)	3 (0.9)	0.2	0.01 – 4.7	> 0.05
African/Caribbean/Black <sup>2</sup>	43 (14.2)	152 (24.7)	0.5	0.3 – 0.7	<b>0.001</b>
African	15 (37.2)	63 (41.4)			
Caribbean	13 (30.2)	38 (25)			
Any other black background	14 (32.6)	51 (33.6)			
Asian <sup>2</sup>	14 (4.6)	24 (3.9)	0.5	0.25 – 0.9	<b>0.02</b>
Indian	3 (21.4)	2 (8.3)			
Pakistani	3 (21.4)	5 (20.8)			
Bangladeshi	1 (7.1)	4 (16.7)			
Chinese	1 (7.1)	2 (8.3)			
Any other Asian background	6 (42.9)	11 (45.8)			
Any other ethnic group <sup>2</sup>	32 (10.6)	40 (6.5)	1.3	0.8 – 2.2	> 0.05
Not known	20 (6.2)	29 (4.5)			
<b>Marital Status</b>					
Married/Civil Partner <sup>3</sup>	130 (41.5)	95 (15.2)	4	2.9 – 5.4	<b>0.001</b>
Not married	183 (58.5)	531 (84.8)			
Single	125 (68.3)	399 (75.1)			
Divorced/Civil Partnership					
Dissolved	34 (18.6)	54 (10.2)			
Cohabiting	11 (6)	16 (3)			
Widowed/Surviving Civil Partner	9 (4.9)	27 (5)			
Separated	4 (2.2)	35 (6.6)			
Not known	9 (2.8)	18 (2.8)			

<sup>1</sup> Reference group: all other ethnicities

<sup>2</sup> Reference group: British

<sup>3</sup> Reference group: Not married

**Table 1** Table displaying the rate of employment in health and social care and the carer status of functional motor disorder patients and psychiatric control group

	Functional Motor Disorder n (%)	Control Group n (%)	OR	95% CIs	p value
<b>If the patient works or worked, did they/do they work in social or health care?</b>					
Yes	54 (19)	46 (8.2)	2.63	1.73 – 4	<b>0.001</b>
No	230 (81)	515 (91.8)			
Not known	38 (11.8)	83 (12.8)			
Female social/health worker* n (%)	48 (22.7)	37 (12.6)	2.04	1.3 – 3.2	<b>0.003</b>
Male social/health worker** n (%)	6 (8.2)	9 (3.4)	2.6	0.9 – 7.5	> 0.05
<b>Is the patient a carer for a family member or friend?</b>					
Yes	28 (9.8)	16 (2.8)	3.77	2 – 7.1	<b>0.001</b>
No	257 (90.2)	553 (97.2)			
Not known	37 (11.5)	75 (11.6)			
Female carer*** n (%)	22 (10.4)	10 (3.3)	3.4	1.5 – 7	<b>0.002</b>
Male carer**** n (%)	68 (8.1)	264 (2.2)	3.8	1.2 – 12.4	<b>0.02</b>

\*Comparison between female conversion and control patients who are social workers versus not social workers

\*\*Comparison between male conversion and control patients who are social workers versus not social workers

\*\*\* Comparison between female conversion and control patients who are carers versus not carers

\*\*\*\* Comparison between male conversion and control patients who are carers versus not carers

	Functional Motor Disorder n (%)	Control group n (%)	OR	95% CI	p value
<b>Comorbid functional disorder?</b>					
Yes <sup>1</sup>	91* (28.3)	12** (1.9)	20.8	11.2 – 38.7	<b>0.001</b>
No	223 (72.3)	612 (98.2)			
Not known	8 (2.5)	20 (3.1)			
Females with comorbid functional disorder <sup>2</sup> n (%)	72 (30.8)	10 (3)	14.3	7.2 – 28.5	<b>0.001</b>
Males with comorbid functional disorder <sup>3</sup> n (%)	19 (23.8)	2 (0.7)	45.2	10.3 – 199	<b>0.001</b>
<b>If comorbid functional disorder, what?</b>					
Chronic fatigue syndrome	11 (10.5)	2 (14.3)			
Irritable bowel syndrome	24 (22.9)	7 (50)			
Fibromyalgia	11 (10.5)	3 (21.4)			
Psychogenic non-epileptic seizure	48 (45.7)	1 (7.1)			
POTs	1 (0.95)	0 (0)			
Foreign accent syndrome	2 (1.9)	0 (0)			
Dissociative amnesia	1 (0.95)	0 (0)			
Dissociative pain disorder	4 (3.8)	0 (0)			
Dissociative Identity Disorder	1 (0.95)	0 (0)			
Psychogenic polydipsia	1 (0.95)	1 (7.1)			
Depersonalisation disorder	1 (0.95)	0 (0)			
<b>Total</b>	<b>105 (100)</b>	<b>14 (100)</b>			

\* 14 participants had more than one comorbid functional disorder

\*\* 2 participants had more than one comorbid functional disorder

<sup>1</sup> Comorbid functional disorder versus no comorbid functional disorder

<sup>2</sup> Females with comorbid functional disorder versus females without comorbid functional disorder

<sup>3</sup> Males with comorbid functional disorder versus males without comorbid functional disorder

	Functional Motor Disorder n (%)	Control Group n (%)	OR	95% CI	p value
<b>History of child sexual abuse</b>	50 (20)	85 (21.9)	0.9	0.6 – 1.3	> 0.05
Female <sup>1</sup>	43 (22.8)	66 (30.3)	0.7	0.4 – 1.1	> 0.05
Male <sup>2</sup>	7 (11.3)	19 (11.2)	1	0.4 – 2.5	> 0.05
Family mental health history <sup>3</sup>	29 (69)	39 (83)	0.46	0.17 – 1.2	> 0.05
<b>History of child physical abuse</b>	57 (22.7)	84 (21.8)	1.05	0.72 – 1.5	> 0.05
Female <sup>1</sup>	46 (24.3)	58 (27.1)	0.9	0.6 – 1.4	> 0.05
Male <sup>2</sup>	11 (17.7)	27 (15.8)	1.2	0.5 – 2.5	> 0.05
Family mental health history <sup>3</sup>	32 (71.1)	39 (79.6)	0.6	0.24 – 1.6	> 0.05
<b>History of adult physical or sexual abuse</b>	70 (27.2)	84 (21)	1.4	0.9 – 2	> 0.05
Female <sup>1</sup>	65 (33.9)	75 (32.8)	1.1	0.7 – 1.6	> 0.05
Male <sup>2</sup>	5 (7.7)	9 (5.3)	1.5	0.5 – 4.7	> 0.05
Family mental health history <sup>3</sup>	26 (50)	33 (75)	0.3	0.14 – 0.8	<b>0.014</b>

<sup>1</sup> Females abused in conversion group versus females abused in control group

<sup>2</sup> Males in abused in conversion group versus males abused in control group

<sup>3</sup> Family mental health history in conversion group versus family mental health history in control group

**Conclusions:** Functional motor disorder is more prominent in women and linked to poorer physical health. The study doesn't support the thesis that abuse is a prevalent precipitant. Patients commonly work in health care settings, indicative of a behavioural view of learned illness behaviour. Limitations include the study's retrospective nature. The anonymous case register means clinical data entry mistakes will be repeated. The extent of generalisability may be limited given the idiosyncratic urban region involved and its well-developed psychiatric services. Future research may test the generalisability of these results for other functional symptoms and assess which life events or care pathways help predict recovery, severity and chronicity.

**References:** Stewart, R. , Soremekun, M. , Perera, G. , Broadbent, M. , Callard, F. , Denis, M. , Hotopf, M. , Thornicroft, G. & Lovestone, S. (2009). The South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLAM BRC) case register: development and descriptive data. *BMC Psychiatry* 12; 9: 51.

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### Structural MRI changes in cerebral psycho-motor networks in functional tremor

Sebastian Franthal, Stephan Sailer, Nina Homayoon, Mariella Koegl, Petra Katschnig-Winter, Karoline Wenzel, Reinhold Schmidt, Petra Schwingenschuh (Graz, Austria)

**Objective:** To investigate structural changes of cerebral psycho-motor networks in functional tremor (FT) compared to essential tremor (ET) and healthy controls (HC) and thereby increase the pathophysiological understanding of functional movement disorders.

**Background:** The pathophysiology of functional tremor is still poorly understood. Functional-MRI studies are rare and studies investigating structural changes in psycho-motor networks are lacking.

**Methods:** We included 10 patients with clinically diagnosed FT (5 M/ 5 F; age 55. 35±13. 95; disease duration 5. 25±5. 82) and 10 age- and sex-matched ET patients as well as 10 HC. All subjects underwent a 3T cerebral MRI protocol (including T1 MPRAGE) as well as detailed clinical examinations. We defined cortical as well as sub-cortical regions of interest that are known to be evolved in psycho-motor networks. Volumes and cortical thickness were calculated automatically using Freesurfer software. Volumes were normalised on estimated total intracranial volume, group difference were calculated by one way anovas and results corrected with Bonferroni

correction for multiple comparisons.

**Results:** Insular volume in FT showed significant hypotrophy compared to ET (right  $p=0,046$ , left  $p=0,008$ ) and HC (right  $p=0,009$ , left  $p=0,002$ ) in both hemispheres. Insular Cortical thickness was significantly lower in FT compared to ET on the right side ( $p= 0,033$ ). There were no significant group-differences in other regions, namely primary motor area (BA 4), premotor area (BA6), cingulate cortex, amygdala, hippocampus and orbitofrontal cortex. Insular volumes and insular cortical thickness in FT did not correlate with clinical parameters (disease duration, FTM-tremor rating scale, Geriatric Depression Scale).

**Conclusions:** The insular cortex is involved in the processing of attention, pain, emotion, motor as well as sensory input. Altered insular structure and function has been described in schizophrenia, mood, panic, anxiety and other psychiatric disorders. (1) Our analysis suggests that insular hypotrophy might be an important factor in the pathogenesis of FT. To investigate whether it is a cause or consequence, further longitudinal studies are needed.

**References:** (1) Nagai M, Kishi K, Kato S. Insular cortex and neuropsychiatric disorders: a review of recent literature. *Eur Psychiatry* 2007 Sep;22(6):387-394.

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### **Saliency Network Structural Alterations Linked to Health-Related Quality of Life in Functional Neurological Disorder**

*David Perez, Benjamin Williams, Nassim Matin, W. Curt LaFrance, Victor Costumero-Ramos, Gregory Fricchione, Jorge Sepulcre, Matcheri Keshavan, Bradford Dickerson (Boston, MA, USA)*

**Objective:** This structural MRI study investigated saliency network alterations associated with health-related quality of life (HR-QoL) in patients with Functional Neurological Disorder (FND) using complementary within-group and between-group approaches.

**Background:** Affective symptoms influence HR-QoL in FND, and the saliency network is linked to the neurobiology of FND and mood/anxiety disorders. We hypothesized that HR-QoL and affective symptoms would map onto overlapping saliency network regions in FND.

**Methods:** This voxel-based morphometry study examined gray matter volumetric associations with self-reported HR-QoL (Short Form Health Survey-36), trait anxiety, and depression in 26 FND patients (21 women, 5 men; mean age=40. 3±11. 5) using a within-group dimensional approach. Comparative analyses were also performed with 27 matched healthy controls (22 women, 5 men; mean age=40. 5±10. 8). Post-hoc comparisons stratified FND patients by HR-QoL scores to further study group-level differences. Whole-brain corrected and region-of-interest analyses were performed, with the bilateral amygdala, insula, anterior cingulate cortex, and periaqueductal gray identified as a priori regions-of-interest.

**Results:** Impaired mental HR-QoL and trait anxiety were positively associated with right amygdalar volumes in FND patients. The relationship between amygdalar volume and mental HR-QoL was independent of sensory-motor functional neurological symptom severity and motor FND subtype. In secondary analyses, periaqueductal gray volume positively correlated with role limitations due to emotional problems. Impaired physical functioning inversely correlated with left anterior insular volumes. There were no volumetric differences between FND and controls. In stratified post-hoc analyses, FND patients reporting the most severe HR-QoL impairments showed reduced left anterior insular and increased right posterolateral cerebellar volumes compared to controls.

**Conclusions:** This neuroimaging study links structural cortical-limbic-cerebellar components of the saliency network to HR-QoL in FND and highlights the utility of investigating brain-QoL relationships in a neuropsychiatric population. These findings add support to involvement of the saliency network in the pathophysiology of FND.

**References:** 1. LaFrance WC, Jr. , Syc S. Depression and symptoms affect quality of life in psychogenic nonepileptic seizures. *Neurology* 2009; 73(5): 366-71. 2. Aybek S, Vuilleumier P. Imaging studies of functional neurological disorders. *Handb Clin Neurol*. 2016;139:73-84.

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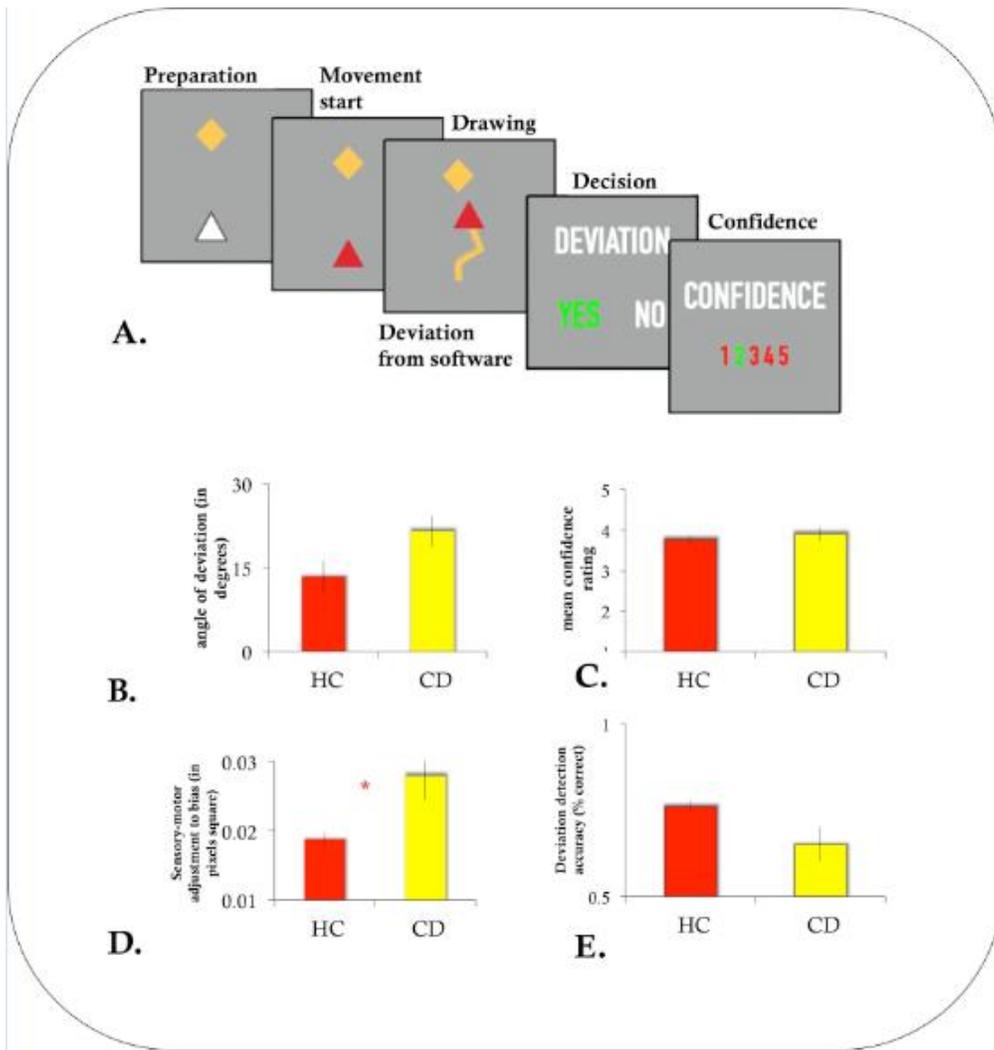
### **Metacognition of Visuomotor Performance In Conversion Disorder**

*Indrit Sinanaj, Rebekah Blakemore, Julian Klug, Silvio Galli, Yann Cojan, Alexandre Berney, Selma Aybek, Patrik Vuilleumier (Geneva, Switzerland)*

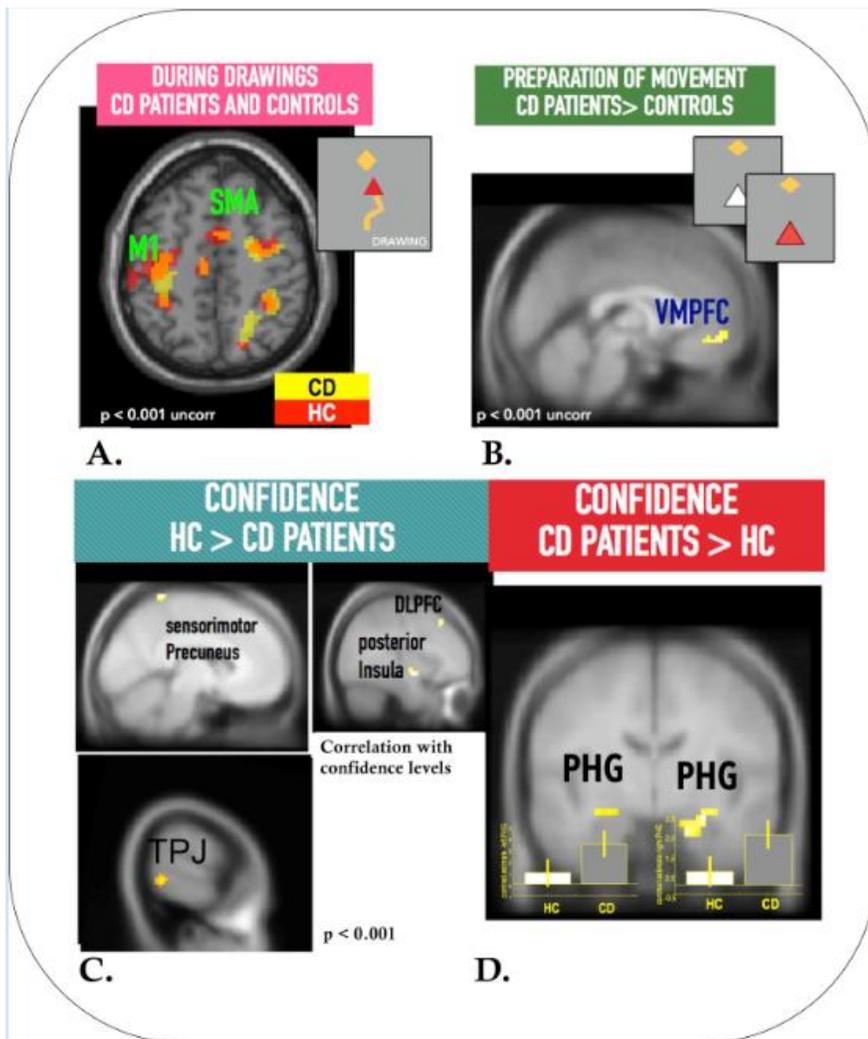
**Objective:** Examine the behavioural and neural correlates of metacognition of visuomotor performance in motor conversion disorder (CD).

**Background:** CD entails disturbances in the subjective experience of motor function. Abilities by which individuals assess their own performance are called metacognitive. Impairment of such abilities has been described in disorders of self-awareness; however, metacognition in CD has not been studied.

**Methods:** We tested ten CD patients and ten controls during a visually guided motor paradigm that introduced a perceptual conflict between the visual and proprioceptive feedback of voluntary movements (Fourmeret & Jeannerod, 1998; Sinanaj et al. 2015). Participants had to draw straight trajectories towards a visual target while, unbeknownst to them, deviations were occasionally introduced in the reaching trajectory seen on the screen. Participants reported both awareness of deviations and confidence in their response (Figure 1, A). We calculated the sensorimotor adjustment to the bias (SMAB), mean confidence ratings, and percentage of correct responses. We employed a staircase procedure to obtain a balanced proportion of detected and undetected deviations overall between patients and controls. Functional MRI measures were acquired and analyzed using SPM8.



**Results:** At the behavioral level, while patients produced less precise reaching movements overall and required larger perturbations to detect deviations (Figure 1, B and D), their ability to detect these deviations during the task and their confidence in their own responses' accuracy and their detection accuracy were similar to controls (Figure 1, C and E). At the brain imaging level, patients but not controls engaged the ventromedial prefrontal cortex during the preparation of movement phase (Figure 2, B). During movement, controls and controls both engaged similar motor networks (Figure 2, A). During confidence assessment, controls engaged the left superior precuneus and temporo-parietal junction (Figure 2, C), whereas CD patients recruited bilateral parahippocampal regions and left amygdala (Figure 2, D).



**Conclusions:** Our results reveal that distinct brain regions subserve metacognitive confidence in HC and CD, and provide novel evidence for a recruitment of systems involved in affective and memory associative processing during the subjective evaluation of visuomotor performance in CD. In healthy controls, confidence judgments activated the precuneus and the TPJ suggesting reliance on areas integrating multimodal sensorimotor information with agency representations. By contrast, confidence judgements in CD patients engaged bilateral parahippocampal regions and amygdala, pointing to differential reliance on internally generated information and memory systems mediating the retrieval of affective autobiographical associations. Overall, these results point to fundamental mechanistic differences for subjective evaluation of motor performance in health and disease.

**References:** Fournieret, P., & Jeannerod, M. (1998). Limited conscious monitoring of motor performance in normal subjects. *Neuropsychologia*, 36(11), 1133-1140. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9842759> Sinanaj, I., Cojan, Y., & Vuilleumier, P. (2015). Inter-individual variability in metacognitive ability for visuomotor performance and underlying brain structures. *Consciousness and Cognition*, 36, 327-337. doi:10.1016/j.concog.2015.07.012

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### Response inhibition and conflict in functional weakness

Graeme Hammond-Tooke, Karleigh O'Connor (Dunedin, New Zealand)

**Objective:** To investigate event-related potentials in a Go/No-go cued reaction time task in patients with unilateral upper limb functional (conversion) weakness to determine if their responses are different to those of healthy controls.

**Background:** Patients with functional motor disorders have abnormal motor response inhibition (1). The N2 and P3 event related potentials following a Go/No-go stimulus may reflect response inhibition or possibly response conflict (2).

**Methods:** Eight patients with functional upper limb weakness (mean age 43. 9± 20. 3) were compared to eight age and gender-matched healthy participants (mean age 46. 8±19. 4). They performed a Go/No-go task where a precue indicated which hand to use (Figure 1). Electroencephalography was performed simultaneously, and epochs time-locked to the imperative Go/No-go stimulus were extracted from the electroencephalogram using EEGLAB software. Amplitudes and latencies of the N2 and P3 components of the averaged event related potentials following the imperative stimulus were analysed using a linear mixed model with factors: Group (healthy control or patient), Condition (Go or No-go) and Electrode (Fz, Cz or Pz). [figure1]

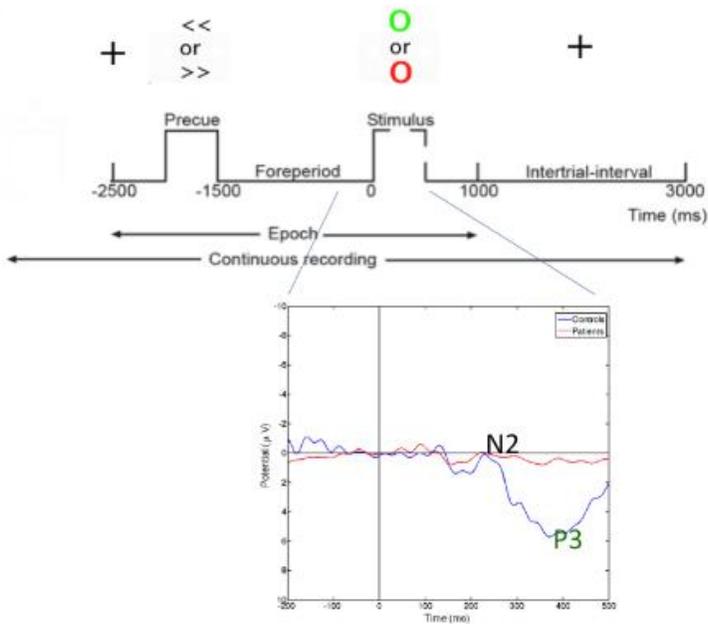


Figure 1. (A) Time course of each trial. (B) Grand mean waveforms for patients (red) and healthy controls (blue).

**Results:** The Go signal hit rate and the discriminability index were lower in patients than controls,  $p < 0.05$ . P3 amplitudes were higher for No-go conditions than Go conditions,  $p = 0.001$ . Patients had lower P3 amplitudes when compared with controls ( $p < 0.05$ ) and there was a significant Group X Condition interaction with lower P3 amplitude in the Nogo condition in patients compared to controls,  $p < 0.05$  (Figure 2). N2 amplitudes did not differ significantly between the two groups. [figure2]

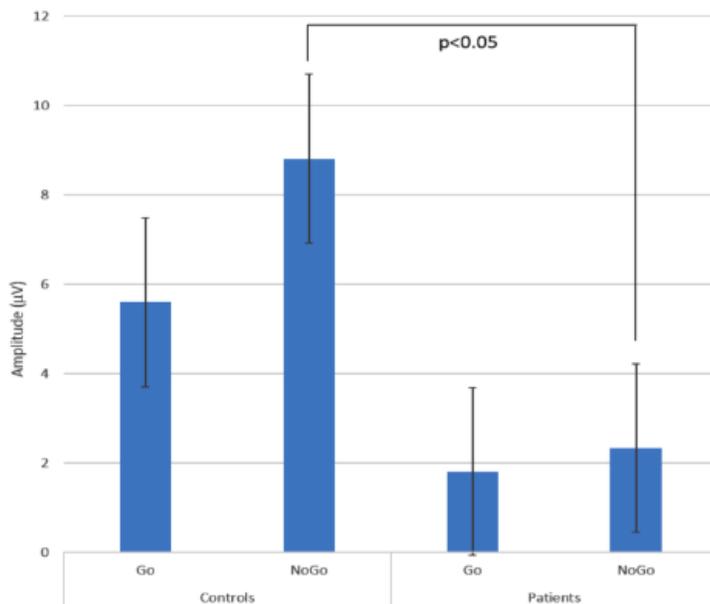


Figure 2. P3 Amplitude Group by Condition Interaction.  $\mu V$  = microvolts

**Conclusions:** The lower Go signal hit rate in patients suggests they are more likely to make errors of omission than commission, in contrast to previous findings in psychogenic movement disorders. Impaired response inhibition would be paradoxical in patients who display weakness, rather than involuntary movements. The reduced P3 amplitudes in conversion weakness patients might suggest dysfunctional inhibition, but it is possible that N3 and P3 rather reflect conflict resolution and evaluative processes. Irrespective of the exact significance of P3, the findings provide evidence of dysfunctional movement preparation in patients with functional weakness.

**References:** 1. Voon V, Ekanayake V, Wiggs E, Kranick S, et al. Response inhibition in motor conversion disorder. *Mov Disord*

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### **Is functional weakness associated with neural correlates in imaging studies? A systematic review of the evidence**

*Lori Black (Cardiff, United Kingdom)*

**Objective:** The purpose of this systematic review is to evaluate all literature regarding functional imaging of functional weakness during movement or attempted movement to see if functional weakness has any clear neural correlates.

**Background:** Functional neurological disorders (FNDs) are common disorders that are defined by the presence of neurological symptoms which have no organic cause. There are a range of positive symptoms to be found on examination which support a diagnosis. Functional weakness is an FND in which patients develop paralysis or paresis of a part of the body which is not attributable to a structural abnormality. By definition, patients with functional weakness will have no signs on structural imaging that could form a reasonable explanation for their deficits. However, it would be reasonable to suggest that there may be neural correlates to be found using SPECT and PET imaging and fMRI.

**Methods:** I followed the PRISMA guidelines to conduct a systematic review. To do this, I searched MedLine, Embase and PsychInfo. I searched for “functional”, “psychogenic”, “somatoform”, “somatization”, “somatisation”, “FND”, “conversion” OR “non-organic” and Medical Subject Headings (MeSH) for somatoform disorder and conversion disorder. I then made another search for “neuroimag\*” OR “fMRI” OR “MRI” OR “SPECT” OR “PET” OR “positron emission tomography” OR “single photon emission computed tomography” as well as MeSH for neuroimaging and functional neuroimaging. I combined this search with the other searches using the word OR. This gave 42237 search results, which was refined to 39651 by only looking at articles with abstracts in the English language. Using a highly time consuming strategy of reading the titles and abstracts of the papers this was reduced to 29 and a further 2 papers were found by searching the grey literature for articles. Most articles were easily rejected because they contained no information regarding imaging or functional neurological disorders (often being related to rheumatological conditions and other neurological problems). I read all of these papers in full, excluding articles not specific to functional imaging in functional weakness. This left 7 articles to be included in this systematic review.

**Results:** 7 studies were included in my systematic review. The majority of these studies used fMRI. All of the articles looked at patients with unilateral weakness. 4 of the studies reviewed purely researched patients with unilateral upper limb weakness. Most studies found that there were some neural correlates to be found in patients with functional weakness. These findings were often different to those seen in subjects feigning weakness. Studies found that specific areas of the motor cortex corresponding to the affected limb were poorly activated and that the frontal lobe and prefrontal cortex were also often subject to diminished activity or hypoperfusion. Other areas implicated were the basal ganglia, precuneus and ventrolateral prefrontal gyrus.

**Conclusions:** The findings of this systematic review suggest that there may well be some neural correlates to be seen on functional imaging of patients with functional weakness. In the majority of studies, there was reduced activation or hypoperfusion (which may infer reduced activity) in the areas of the motor cortex that corresponded to the affected limb. However, the few studies looked at are small, pilot studies and, therefore, work in this area remains inconclusive.

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### **Attention and functional movement disorders: Its role in symptom generation and sense of agency**

*Anne-Catherine Huys, Mark Edwards, Patrick Haggard, Kailash Bhatia (London, United Kingdom)*

**Objective:** We aim to investigate whether misdirected attention onto the movement itself rather than its goal, its desired outcome, contributes to symptom generation in functional movement disorders. If so, it would offer an effective treatment strategy.

**Background:** Functional movement disorders are common, disabling and carry a poor prognosis. Their most characteristic, yet intriguing feature is that they typically manifest with attention to the affected limb and improve or even disappear with distraction.

**Methods:** Patients with functional tremor and healthy and organic tremor controls move their finger on a touchscreen from a starting point to a target. Their arm is hidden underneath a horizontal screen, onto which the target and their current hand position are projected. Attentional manipulation onto the target: the task is to detect a very slight target jump occurring randomly during their reaching movement. Attentional manipulation onto their movement: detect when the visual feedback they receive deviates to one side in relation to their actual movement. The effects of these two attentional foci on movement performance and sense of agency are analysed. We also test the subjects’ perception of their own movements, both online and in retrospect.

**Results:** The study is ongoing, but results will be available by September. Preliminary results indicate that attentional manipulation onto the target as opposed to the movement does not seem to decrease tremor severity. Further analysis is required. The trajectory to the start (“just to get ready”) versus the target (“this counts”) is less shaky in functional tremor patients and shakier in healthy controls. Perception of one’s tremor: Retrospectively, all groups, especially the organic tremor group, perceive their trajectories as being shakier than they were in reality. Online adjustment of their tremor severity: there is a trend for functional tremor patients to be more objective about their own tremor compared to organic tremor controls.

**Conclusions:** The preliminary conclusions are that functional tremor patients seem to be more realistic about the severity of their tremor than patients with an organic tremor. Contrary to healthy controls, trying to do well seems to lead to increased tremor in functional tremor patients. This parallels the well-known clinical observation of impaired movement when actively trying and near normal performance in the absence of attention. Sometimes, doing less is more.

**References:** Edwards, M. J., Fotopoulou, A. & Pareés, I. Neurobiology of functional (psychogenic) movement disorders. *Curr. Opin. Neurol.* 26, 442–7 (2013). Slachevsky, a et al. Preserved adjustment but impaired awareness in a sensory-motor conflict following prefrontal lesions. *J. Cogn. Neurosci.* 13, 332–340 (2001).

### The nocebo effect: how headache pain is generated by biological, psychogenic and social factors

*Diletta Barbiani, Eleonora Camerone, Fabrizio Benedetti (Turin, Italy)*

**Objective:** The aim of the present study is to manipulate biological, psychological and social factors, which are key elements of placebo and nocebo effects, in order to understand their contribution to the generation of headache pain.

**Background:** Hypoxia headache has been shown to be related to an increase in cyclooxygenase (COX) activity. Nocebos can modulate both COX activity and headache, whereby negative expectations lead to an increase of COX products and headache pain.

**Methods:** 27 healthy subjects were subdivided into 3 groups and brought to our high-altitude labs (3500 m) for the assessment of hypoxia-induced headache, blood oxygen saturation (SO<sub>2</sub>), salivary prostaglandins (PG) D<sub>2</sub>, E<sub>2</sub>, F<sub>2</sub>, I<sub>2</sub>, thromboxane (TX) A<sub>2</sub>, and cortisol during the first 24 h from arrival. The first group did not undergo any manipulation. The second group (negative expectation) was told that severe headache would occur if SO<sub>2</sub> dropped to less than 80% and their oximeters were set to display a saturation of 75%, even though real SO<sub>2</sub> was much higher. The third group (negative expectation + negative social contact) underwent the same manipulation as the second group but, in addition, these subjects spent the night together with people experiencing severe headache and insomnia.

**Results:** None of the three groups differed significantly for SO<sub>2</sub>. However, compared to the first group, the second group (negative expectation) experienced more severe headache and showed an increase of PGE<sub>2</sub>, TXA<sub>2</sub>, and cortisol. The third group (negative expectation + negative social contact), compared to the first and second group, showed a significant increase of headache as well as of PGE<sub>2</sub> and cortisol. Overall, compared to hypoxia alone, negative expectation further increased headache by 37%, PGE<sub>2</sub> by 19% and cortisol by 26%. Likewise, compared to expectation, negative social contact further increased headache by 18%, PGE<sub>2</sub> by 11% and cortisol by 13%.

**Conclusions:** These findings indicate that biological factors alone, i. e. hypoxia, cannot account for the generation of headache pain, psychological and social factors playing a crucial role. More specifically, we found that biological, psychological and social factors were somehow additive in the generation of headache pain. Therefore, the present study highlights how negative expectations and psychosocial interactions are fundamental elements not only for the perception of pain but also for the biochemical changes related to hypoxia.

**References:** Barbiani D, Benedetti F (2017) Placebo Effect. Wiley Encyclopedia of Health Psychology, Volume IV. Lee M. Cohen (Ed). John Wiley and Sons, New York, NY; Barbiani D, Benedetti F (2017) Critical life functions: can placebo replace oxygen? *Int Rev Neurobiol*, in press

### Are there gender differences in psychogenic non-epileptic seizures: demographically, clinically and psychologically

*Lorna Myers, Robert Trobinger, Kirsty Bortnik, Marcelo Lancman (New York, NY, USA)*

**Objective:** To determine whether male and female populations of patients with psychogenic non-epileptic seizures (PNES) are similar, in terms of demographic, social/clinical and etiological factors as well as psychological measures.

**Background:** PNES is over-represented by females; therefore, information about PNES in male PNES is limited. Only a handful of studies have examined PNES and gender finding differences in abuse type, psychiatric diagnoses and psychometric results.

**Methods:** This is a retrospective study of 51 consecutive males (2007 to 2016) and 97 consecutive females (2014 to 2016) with video EEG-confirmed diagnosis of PNES. Patients were examined on demographics (age, education, working status), clinical (trauma type: sexual, non-sexual), age of first trauma, psychiatric hospitalizations, suicide attempts, and psychometric measures. The latter included the State Trait Expression Inventory-2 (anger expression out/in, anger control out/in), Toronto Alexithymia Scale, Trauma Symptom Inventory-2 (anxious arousal, defensive avoidance, intrusive experiences, and dissociation), the Coping with Stress Inventory (task-oriented, avoidance, emotion) and the Quality of Life Inventory in Epilepsy-31.

**Results:** Women reported more traumatic histories ( $\chi^2(2, N=8.79, p<.0003)$ ) and sexual traumas ( $\chi^2(2, N=11.67, p<.0006)$ ) than men, and more trauma symptomatology: anxious-avoidance ( $p=.049, 59.28 \pm 9.96; 55.46 \pm 11.87$ ), dissociation ( $p=.005, 60.65 \pm 13.36; 53.39 \pm 9.67$ ), somatization ( $p=.012, 61.19 \pm 12.00; 55.37 \pm 9.68$ ), sexual disturbance ( $p=.020, 51.59 \pm 9.64; 46.67 \pm 13.31$ ), and TRAUMA factor ( $p=.043, 59.77 \pm 11.05; 55.46 \pm 10.88$ ). Women also reported more medication side effects ( $p=.045, 47.91 \pm 11.39; 51.93 \pm 13.26$ ) and low energy ( $p=.049, 41.00 \pm 10.25; 44.49 \pm 11.52$ ). In contrast, men were higher on avoidance ( $p=.001, 56.17 \pm 11.58; 49.58 \pm 10.59$ ) and emotion ( $p=.037, 57.44 \pm 12.61; 53.15 \pm 11.91$ ) stress coping.

**Conclusions:** Women with PNES exhibited significantly higher rates of trauma in total and specifically, sexual trauma compared to male counterparts. Women also had higher rates of trauma symptomatology (anxious-avoidance, dissociation, somatization, sexual disturbance, trauma factor) and quality of life concerns. In contrast, sexual trauma and trauma symptoms were less prominent in men. Instead the main difficulties for the male gender seemed to involve a higher use of ineffective stress coping approaches. These clinical differences between genders can be useful in treatment planning, with trauma-based therapies potentially as a first-line choice for a number of female patients while effective problem-solving techniques might be useful for men.

**References:** M. Oto, P. Conway, A. McGonigal, A. J. Russell, R. Duncan (2005) Gender differences in psychogenic non-epileptic seizures. *Seizure*, 14, 33-39. Holmes M, Dodrill C, Bachtler S, Wilensky A, Ojemann L, Miller J (2001). Evidence That Emotional Maladjustment Is Worse in Men Than in Women with Psychogenic Nonepileptic Seizures. *Epil & Behav.* 2, 568-573.

### The truth about cognitive impairment in functional motor disorders: an experimental deception study with the Guilty Knowledge Task

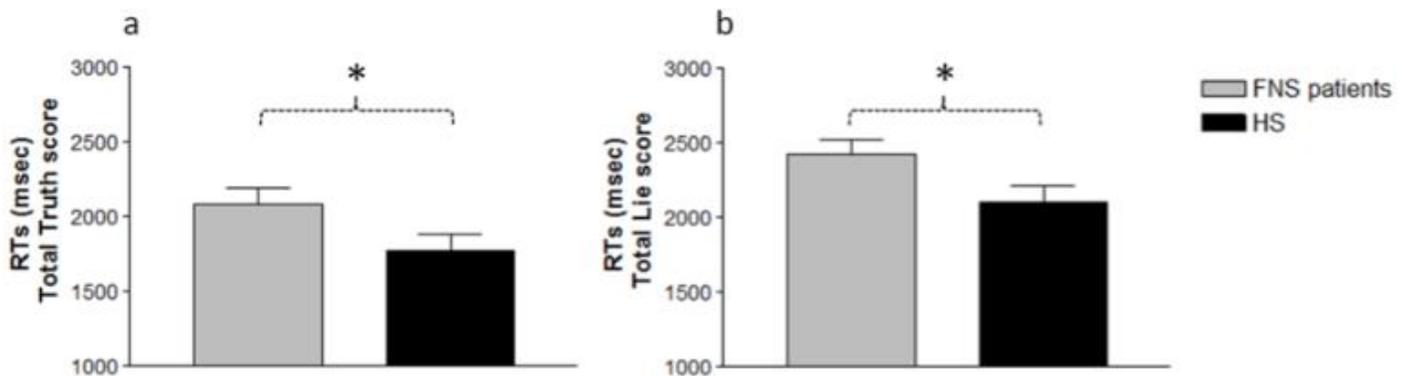
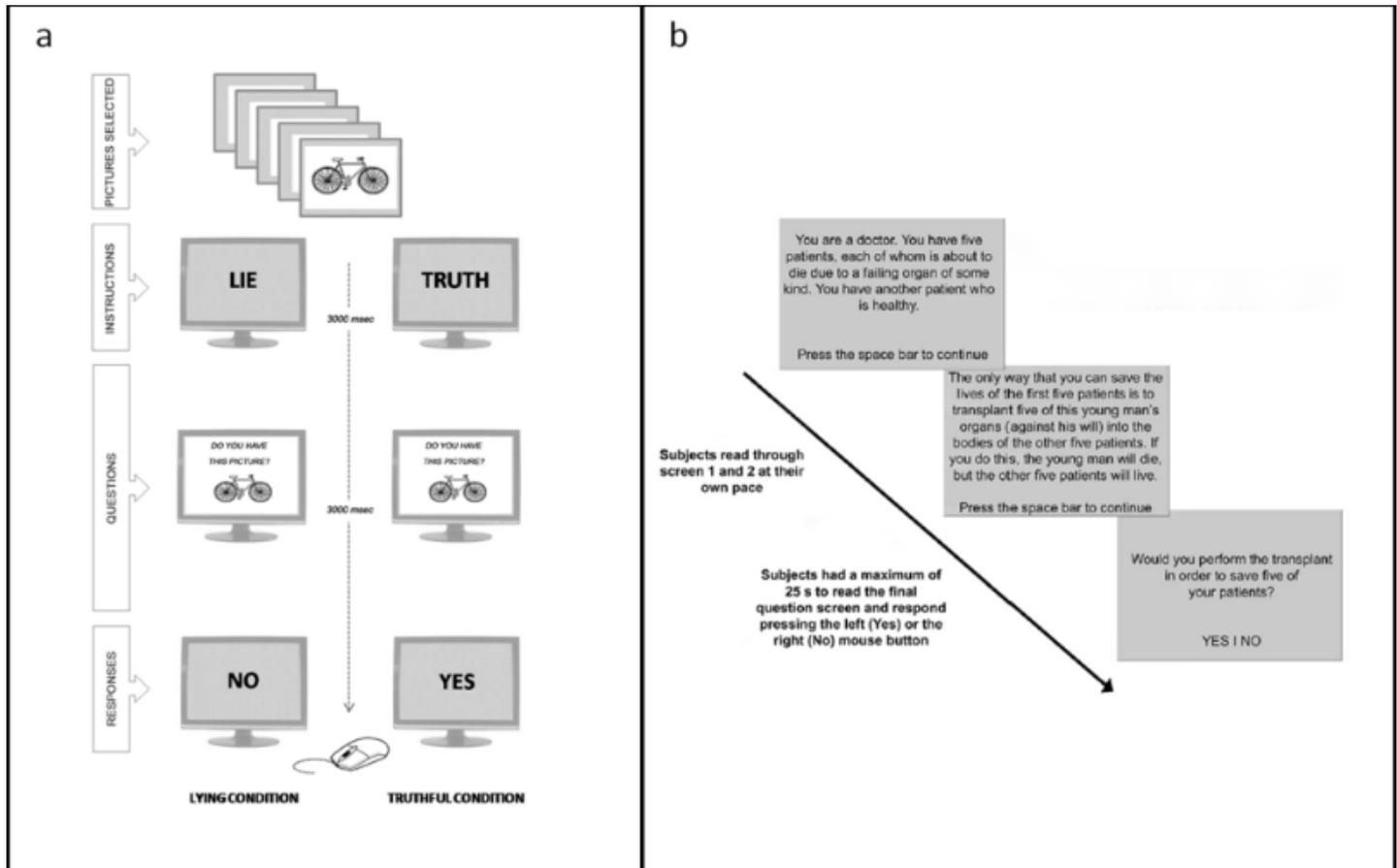
*Benedetta Demartini, Roberta Ferrucci, Diana Goeta, Fabiana Ruggiero, Alberto Priori, Orsola Gambini (Milan, Italy)*

**Objective:** To examine the cognitive functions regulating deception in patients with functional motor disorders (FMD), we used a computerised task, the Guilty Knowledge Task (GKT). We also tested a group of patients with healthy subjects (HS) as a control group.

**Background:** A century ago, Janet was the first to conceptualize conversion reactions as having a neurocognitive component – in particular, as disorders of memory processing that arise in the wake of trauma. The available evidence suggests that this impairment might arise from dysfunction in the fronto-subcortical circuits.

**Methods:** Thirteen patients affected by FMD and 14 HS, matched for age and gender, underwent a modified version of the GKT, a computer-controlled procedure used to detect truthful and deceptive responses. All participants were also screened for depression [Hamilton Rating Scale for Depression (HAM-D)], anxiety [Hamilton Rating Scale for Anxiety (HAM-A)], alexithymia [Toronto Alexithymia Scale 20 item (TAS-20)] and for moral sense (moral judgment task).

**Results:** The reaction times (RTs) were significantly longer for lie responses than for true responses ( $F(1,26)=50.47$ ;  $p<0.001$ ) in the two groups. ANOVA showed that total RTs were significantly longer for patients with FMD than for HS, in true responses ( $F(1,25)=4.36$ ;  $p=0.047$ , post hoc:  $p=0.047$ ) and lie responses ( $F(1,25)=4.26$ ;  $p=0.05$ , post hoc:  $p=0.05$ ). No differences were found between the two groups for accuracy in producing true responses ( $F(1,25)=0.09$ ,  $p=0.77$ ), and lying responses ( $F(1,25)=0.12$ ,  $p=0.73$ ). No significant correlation was found either between deception ability and demographic variables or between deception ability and psychological scales' score/moral task responses.



**Conclusions:** The main finding of our study is that when tested with the GKT, a procedure assessing the ability to lie, patients with FMD were slower than HS in producing both truthful and lying responses. Current knowledge along with our new findings in patients

with FND - possibly arising from individually unrecognised extremely mild, cognitive difficulties -should help in designing specific rehabilitative programmes to improve cognitive and behavioural disturbances in these patients.

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## 215

### **Anorexia Nervosa and Functional Motor Symptoms: two faces of the same coin?**

*Benedetta Demartini, Diana Goeta, Luigi Romito, Simona Anselmetti, Sara Bertelli, Orsola Gambini (Milan, Italy)*

**Objective:** To compare patients affected by Anorexia Nervosa (AN) and patients affected by Functional Motor Symptoms (FMS) by assessing their variability in demographics, clinical characteristics, symptomatology, risk factors, precipitating stressors, psychopathology and psychiatric family history.

**Background:** Although apparently quite different, clinical experience leads neurologists and psychiatrists to observe some similarities between patients affected by AN and patients affected by FMS, in terms of environmental stressors, psychological profiles, emotional styles and sensitivity to physiological states.

**Methods:** Twenty patients affected by AN were included in the study, and they were compared to 20 patients with a diagnosis of FMS. We also recruited 20 healthy subjects (HS) as a control group for the psychometric assessment and for interoception. A semi structured interview was coined to assess the following aspects: history of abuse, type of abuse, precipitating stressor, presence of chronic pain, subjective fatigue and cognitive complaints, sleep disorders, alcohol and drug abuse. Psychiatric diagnoses were determined with the Structured Clinical Interview (SCID) for DSM-IV. All patients and controls were screened for depression (HAM-D), anxiety (HAM-A), alexithymia (TAS-20), self-objectification (SOQ), body awareness (BAQ), dissociation (DES), trauma (TEC) and interoceptive awareness (heart beat detection task).

**Results:** Unexpectedly, no differences for the three groups were seen for the measures related to awareness of physical state, including body awareness, self-objectification, and interoceptive ability via the heartbeat task. However, both the AN and FMS group were not different from each other but were different from HC for anxiety, depression, alexithymia and dissociation.

**Conclusions:** In the light of the similarities we found, our data support the hypothesis of a common aetiology involving emotional dysfunction for both the disorders. These findings suggest that AN and FMS patients may be disorders belonging to the same spectrum (where emotional dysregulation is a key point) and suggest potential opportunities for collaborative, integrated investigations of aetiology, diagnosis, and management of these disorders.

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### **The Emotional Component of Pain Is Impaired In Functional Dystonia**

*Francesca Morgante, Angela Matinella, Elisa Andrenelli, Cosimo Allegra, Carmen Terranova, Paolo Girlanda, Michele Tinazzi (Messina, Italy)*

**Objective:** We tested the sensory-discriminative and cognitive-emotional component of pain in patients with functional and idiopathic dystonia.

**Background:** Pain is often experienced by patients with functional dystonia (F-dys) and might occur in body segments not affected by involuntary movements. We hypothesized that patients with F-dys have higher pain tolerance thresholds in all body districts, regardless of the presence of pain and abnormal movements.

**Methods:** We enrolled 10 patients with idiopathic cervical dystonia (CD), 12 patients with F-dys and 16 age- and gender matched healthy controls (HC). All patients with F-Dys had symptoms restricted to one body side, except for 2 patients with predominant right side involvement. F-Dys and CD underwent clinical evaluation by means of the Burke-Fahn-Marsden Rating Scale (BFMRS), the pain score of the TWTRS, Hamilton's depression and anxiety rating scales (HDRS, HARS). We assessed tactile threshold (TT), pain threshold (P-Th) (intensity at which sensation changed from unpainful to faintly painful) and pain tolerance (P-Tol) (intensity at which painful sensation was intolerable) by delivering electrical pulses of increasing intensity to the index finger of each hand and the halluces of each foot.

**Results:** No differences were found between HC, CD and F-Dys for TT and P-Th assessed in both hands and feet. P-Tol was significantly increased in the affected and unaffected side of F-Dys compared to CD. P-Tol was also significantly increased in the affected and unaffected side of patients with persistent F-Dys compared to those with paroxysmal F-Dys; a higher increase of P-Tol was also found in F-Dys with limb/neck involvement compared to F-Dys with facial involvement. No difference was found between idiopathic CD and HC in pain thresholds, regardless of the presence of pain in CD. Spearman Rank Correlation did not demonstrate any correlation between P-Tol and pain scores, HDRS, HARS, BFMRS (movement and disability scores), disease duration, age at onset.

**Conclusions:** Patients with F-Dys have a higher P-Tol in all body parts, regardless of the presence of pain and abnormal movements. This is consistent with an impairment of the cognitive-emotional component of pain. We hypothesize that an abnormal connectivity between the motor and the limbic system might account for abnormal pain processing in F-Dys.

## Attention Bias in Adults with Non Epileptic Seizures

Clive Bellis, Jason Price (Durham, United Kingdom)

**Objective:** The current study aims to: 1) Assess whether there is a difference in patients with NES and epilepsy on their perception of social threat stimuli (anger and fearful facial expressions) using an objective assessment, Bristol Emotional Recognition Task (BERT; Penton-Voak, Bate, Lewis, & Munafò, 2012), which includes a measure of accuracy which accounts for both error and correct responses. 2) Confirm that patients with NES and epilepsy do not differ on perception of non social threat stimuli using an objective assessment which includes a measure of accuracy which accounts for both error and correct responses. 3) Explore if patients with NES and epilepsy differ in the intensity required to recognise threat stimuli.

**Background:** Non epileptic seizures (NES) are isolated paroxysmal episodes of altered movement, sensation, behaviour, or consciousness which resemble epileptic seizures however lack ictal epileptiform activity in the brain. NES are difficult to diagnosis and initially many patients are thought to have epilepsy, with an average diagnostic delay of 7 years. The inability to consciously experience and tolerate emotions, correctly identify emotions, and accurately link these to bodily sensations have frequently been linked to somatoform disorders such as NES. Previous research has consistently found an attentional bias for emotions in patients with NES when compared against healthy controls but research is lacking in comparison against those with epilepsy.

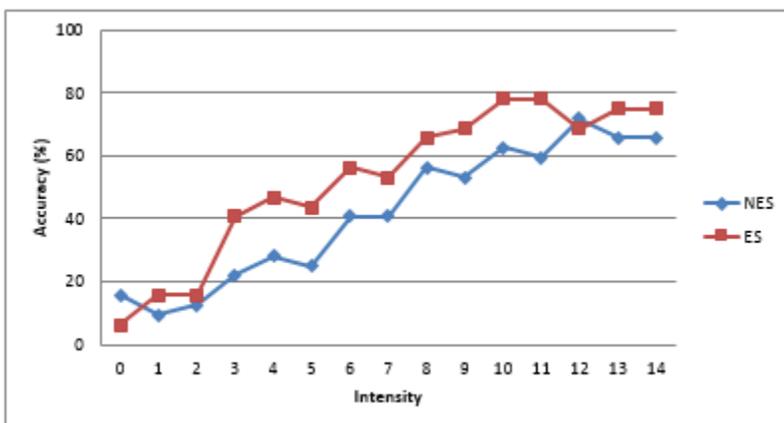
**Methods:** The study employed an experimental independent groups design. The independent variable for the study was the diagnosis of the participant (NES / Epilepsy). The dependent variables were generated from an objective attentional bias task, the BERT. This assessed participant bias towards sensitivity to emotional facial expressions. Inclusion/Exclusion Criteria Before consent was obtained all participants were required to meet four criteria. In addition, depending upon their experimental group further criteria were required. All participants should: • Be fluent in English. • Have the ability to complete the study measures independently. • Be aged over 18 years. • Not engage in illicit drug use. NES group should have: • A diagnosis based upon ictal V-EEG recording of a typical seizure or confirmation by a Neurologist. • NES characterised by complete or partial loss of consciousness. • At least two NES in the previous 12 months. • No co-morbid epilepsy or neurological disease. Epilepsy group should have: • A diagnosis of epilepsy. • No photosensitive epilepsy. • No co-morbid neurological disease. Sample Overall 87 potential participants were contacted, 60 for the NES group and 27 for the epileptic group. Of this total, 34 agreed to participate in the study, 16 for the NES group and 18 for the epileptic group. Following the inclusion criteria mentioned previously this number was further reduced to 32, 16 for the NES group and 16 for the epileptic group. Attentional Bias Computer Program The main data collection tool used in the study was a computer program known as the BERT. This measures attentional bias by displaying both male and female faces, taken from the Karolinska Directed Emotional Faces (Lundqvist et al., 1998), portraying different emotional expressions for brief periods and requiring a forced choice decision on the emotion displayed. Unlike traditional tasks employing emotional facial expressions the BERT program uses composites from 12-15 individuals of the same age and gender to enable prototypical characteristics to be isolated thereby allowing individual variations to be controlled and removed using the program Psychomorph. In addition, the program uses a unique method of morphing sequences of emotional expression. The product of this composite is a face that is emotionally ambiguous rather than neutral. Procedure Once recruitment had been achieved, participants were invited to attend testing sessions. Participants were seated in one of several quiet, well lit offices. Inclusion and exclusion criteria were checked by the researcher and informed consent completed. Participants were initially asked to complete the brief demographic questionnaire. Participants were then required to complete the BERT attentional bias program. This was presented on a 15 inch screen laptop, running at a resolution of 1024 x 768 pixels, with an external mouse attached. Participants were seated with the screen at eye level at a distance of approximately 50cm. The BERT entailed participants focussing upon a fixation cross displayed upon the screen for between 1500 and 2500 ms, before being shown a facial expression for 150 ms, followed by a masking screen of visual noise for 150 ms, and finally six labels of emotions in a circular formation. The labels remained on screen until one had been selected by the participant. Once a label had been selected the next trial commenced. The program randomly presented the order of the facial expressions used in the trials in order to reduce any bias developing through the sequence of stimuli. In total, fifteen different photographs with differing levels of intensity for each of the six emotions are used from both sexes resulting in 180 facial images. Once completed participants were fully debriefed, asked if they wished to be notified of the results of the study, and finally thanked for their participation. Participants were signposted to the website <http://www.nonepilepticattacks.info/> which provides information and support to those with NES. The whole procedure took approximately 40 minutes at a relaxed pace. Strategy for the Analysis of Data Descriptive statistics were used to summarise the data from the demographic questionnaire. In relation to the BERT, group means for hit rate, number of false hits, and the unbiased hit rate were analysed. For further analysis the unbiased hit rate needs to be arc sine transformed. The arc sine transformation converts the data from a binomial distribution to a normal distribution thereby avoiding violation of the basic parametric assumptions. Once completed this data can then analysed using an independent samples t-test. All statistical analysis was carried out using IBM SPSS Statistics version 23.

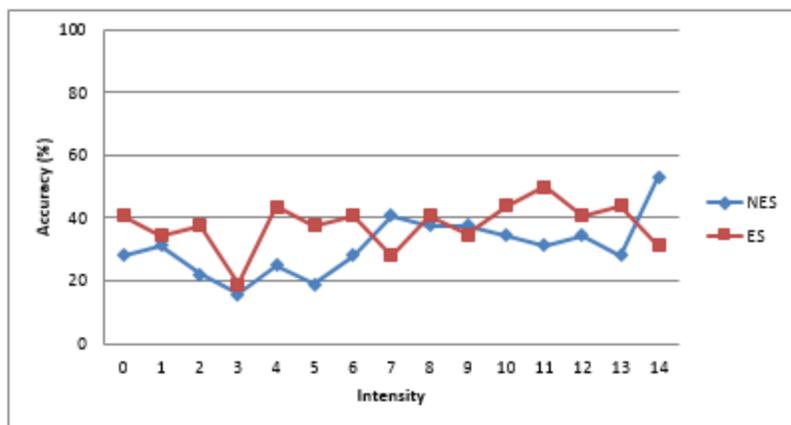
**Results:** Participant Characteristics Participants in the NES sample ranged in age from 27 to 57 years (Mdn = 48. 5, IQR = 15. 75). Participants from the epilepsy sample ranged in age from 18 to 67 years (Mdn = 32. 0, IQR = 22. 25). Statistical tests showed that both groups were normally distributed, epilepsy:  $W(16) = 0. 869$ ,  $p = 0. 069$  and NES:  $W(16) = 0. 909$ ,  $p = 0. 112$ . The variances were also found to be equal,  $F(1,30) = 2. 782$ ,  $p = 0. 106$ . The NES sample (M = 45. 19, SD = 9. 85) were found to be significantly older than the epilepsy sample (M = 34. 19, SD = 13. 86),  $t(30) = -2. 588$ ,  $p = 0. 015$ . Chi square comparisons showed that there was no significant difference evident between the two samples in terms of sex,  $\chi^2(1, N = 32) = 2. 133$ ,  $p = 0. 144$ . Age of seizure onset Participants in the NES sample ranged in age of onset from 3 to 52 years (Mdn = 32. 0, IQR = 29. 25). Participants from the epilepsy sample ranged in age from 1 to 60 years (Mdn = 16. 5, IQR = 7. 75). Statistical tests showed that, whilst the NES was normally distributed, the epilepsy group was not, epilepsy:  $W(16) = 0. 766$ ,  $p = 0. 001$  and NES:  $W(14) = 0. 944$ ,  $p = 0. 465$ . The variances of both groups was found to be equal,  $F(1,28) = 2. 231$ ,  $p = 0. 146$ . The NES sample (M = 30. 93, SD = 15. 23) were found to have a significantly later onset of seizures than the epilepsy sample (M = 18. 69, SD = 13. 11),  $t(28) = -2. 366$ ,  $p = 0. 025$ . Due to the violation of normality in the epilepsy group this was confirmed with a Mann-Whitney U-test (U = 59. 00,  $z = -2. 21$ ,  $p = 0. 027$ ,  $r = -0. 40$ ). Frequency Participants in the NES sample ranged in frequency of seizures from 0. 5 to 100 seizures per month (Mdn = 3. 0, IQR = 19. 25). Participants from the epilepsy sample ranged in age from 1 to 30 seizures per month (Mdn = 4, IQR = 8. 88). Statistical tests showed that neither sample was normally distributed, epilepsy:  $W(16) = 0. 671$ ,  $p < 0. 001$  and NES:  $W(14) = 0. 605$ ,  $p < 0. 001$ . Due to this violation of normality data was analysed using a Mann-Whitney U-test. There was no significant difference in the number of seizures experienced on average per month between the NES and epilepsy sample, (U = 102. 50,  $z = -0.$

398,  $p = 0.691$ ,  $r = -0.07$ ). Emotional Recognition Comparisons of the data from the BERT measure for each of the emotional facial expressions were made between patients with NES and epilepsy. Prior analysis of the groups with the Shapiro-Wilk test showed that the sample did not violate the assumption of normality, with the exception of the happy category. Therefore a Mann-Whitney U-test was employed which confirmed the parametric findings reported in table 1. Prior analysis of the variance within each group using Levene's Test of Equality showed that, with the exception of elements of the Surprise category, all fell within acceptable limits. Where equality violations were detected, appropriate corrections were made to the degrees of freedom. Table 1. Breakdown of BERT Scores. [table1]Intensity Levels

The effect of the emotional intensity of each image within the BERT was also calculated. Figures 1 and 2 portray the recognition accuracy for the NES and epilepsy samples across the levels of intensity for anger and fear. It is evident that both NES and epilepsy samples consistently require similar levels of emotional intensity to achieve recognition. In regards to anger, as the emotional intensity of each image increases both samples find it easier to recognise the emotion, corresponding to an increase in the sample accuracy percentage. However, the performance of both groups within the fearful condition appears to remain consistently low as the intensity of emotional expression increases. [figure1]Figure 1. Accuracy of NES and epilepsy sample responses in identifying the anger emotional facial images as intensity of expression increases. [figure2]Figure 2. Accuracy of NES and epilepsy sample responses in identifying the fearful emotional facial images as intensity of expression increases.

Variable	NES M (SD)	Epilepsy M (SD)	Test Statistic
<b>Anger</b>			
Correct Hit Rate	12.56 (5.51)	15.75 (7.81)	$t(30) = 1.334, p = 0.192$
False Hit Rate	11.50 (7.83)	8.81 (6.00)	$t(30) = -1.089, p = 0.285$
Unbiased Hit Rate	1.059 (0.40)	1.238 (0.61)	$t(30) = 0.981, p = 0.334,$
<b>Disgust</b>			
Correct Hit Rate	14.38 (6.86)	16.06 (6.62)	$t(30) = 0.708, p = 0.484$
False Hit Rate	10.44 (7.15)	9.44 (6.87)	$t(30) = -0.404, p = 0.689$
Unbiased Hit Rate	1.199 (0.50)	1.286 (0.47)	$t(30) = 0.510, p = 0.614$
<b>Fear</b>			
Correct Hit Rate	9.31 (6.75)	11.31 (7.65)	$t(30) = 0.784, p = 0.439$
False Hit Rate	13.06 (8.73)	13.44 (10.21)	$t(30) = 0.112, p = 0.912$
Unbiased Hit Rate	0.704 (0.63)	0.909 (0.63)	$t(30) = 1.020, p = 0.316$
<b>Happy</b>			
Correct Hit Rate	21.00 (7.09)	23.25 (5.00)	$t(30) = 1.037, p = 0.308$
False Hit Rate	15.19 (17.12)	16.81 (9.99)	$t(30) = 0.328, p = 0.745$
Unbiased Hit Rate	1.442 (0.32)	1.519 (0.34)	$t(30) = 0.658, p = 0.515$
<b>Sad</b>			
Correct Hit Rate	18.75 (5.16)	18.81 (4.56)	$t(30) = 0.036, p = 0.971$
False Hit Rate	14.44 (8.45)	9.63 (7.46)	$t(30) = -1.707, p = 0.098$
Unbiased Hit Rate	1.317 (0.33)	1.456 (0.41)	$t(30) = 1.054, p = 0.300$
<b>Surprise</b>			
Correct Hit Rate	21.06 (1.84)	19.19 (4.29)	$t(20.346) = -1.605, p = 0.124$
False Hit Rate	18.31 (7.63)	17.50 (9.23)	$t(30) = -0.271, p = 0.778$
Unbiased Hit Rate	1.346 (0.18)	1.285 (0.37)	$t(21.602) = -0.596, p = 0.558$
<b>Total Correct</b>	<b>97.06 (19.18)</b>	<b>104.38 (28.44)</b>	$t(30) = 0.853, p = 0.401$





**Conclusions:** Aim 1: Social threat stimuli was hypothesised that patients with NES would achieve a lower score on their recognition of social threat stimuli compared to those with epilepsy. The results suggest that these two clinical samples do not differ. The first explanation is that patients with NES and epilepsy experience similar difficulties with social threat stimuli compared to healthy controls, although for differing mediating reasons. The amygdala has been reported to be responsible for the processing of appropriate cognitive, autonomic, and behavioural responses to emotional stimuli. In epilepsy studies, participants with damage to these areas in particular have been shown to produce deficits in emotional recognition compared to healthy controls. Individuals experiencing NES would not have physical damage to the amygdala, due to the difference in aetiology. Instead theories suggest that the increased experience of anxiety, consistently reported, can result in those with NES relying upon an avoidant defense. This coping strategy functions as a protective strategy from what is perceived as threats in the environment. It could also be argued that potentially both the NES and epilepsy sample shared pertinent histories resulting in a lack of difference in the recognition of social threat stimuli. Research has shown that victims of trauma are more alexithymic than those who have not experienced trauma. Trauma has also been consistently associated with experiencing NES. However, it is not unreasonable to consider the unpredictable and debilitating effects of epilepsy as a type of trauma. This could account for the similar psychiatric histories reported in the current sample. Aim 2: Non social threat stimuli was hypothesised that patients with NES and epilepsy would achieve comparable scores on their ability to recognise non social threat stimuli. The results suggest that on average patients with NES do not differ on their ability to recognise non threat stimuli compared to those with epilepsy. This finding is consistent with previous research in that both NES and epilepsy studies have failed to find any consistent deficits in facial recognition of happiness. Furthermore, no current theories of NES aetiology, although admittedly not fully developed, would be suggestive of any deficits in this domain. Aim 3: Intensity required to accurately recognise emotion. It was hypothesised that both the social threat facial expressions, fearful and anger, would require a greater average intensity to be accurately recognised by patients with NES as opposed to those with epilepsy. The results suggest that on average both clinical samples recognised anger and fearful facial expressions at a lower intensity than the other emotions. Although inferential statistics were not appropriate to be used on the current data, the initial exploratory investigation, looking at simple averages of the modest available sample, suggest that both NES and epileptic samples were comparable across all six basic emotions. Limitations and Strengths of the Current Study Due to difficulties in recruitment the target sample size to achieve adequate power was not achieved. Although the sample size was lower than hoped, given the timescale to complete the study, a sample in line with the majority of previous research in the area, ranging between 12 and 23 NES participants was achieved. In addition, the study assumed patients within the NES and epilepsy samples were homogeneous and equally affected. Research suggests that this assumption may be false. Those with temporal lobe epilepsy have been shown to experience greater deficits within social cognition than other focal epilepsies not originating in the temporal and frontal lobes. Two distinct clusters in those experiencing NES have also been found. Cluster one reporting greater emotional regulation difficulties and higher psychopathology whilst cluster two reporting lower emotional regulation difficulties and low psychopathology. However cluster two may have been presenting as more emotionally avoidant. Conclusion The primary purpose of the current study was to assess whether there was a difference in patients with NES and epilepsy on their perception of social threat stimuli. NES are difficult to diagnosis and initially many patients are thought to have epilepsy. It was hoped that the BERT would be able to distinguish between NES and epilepsy to aid in this differentiation process, speeding up accurate diagnosis which would bring both benefit to the patient and NHS. Previous research had consistently found emotional recognition deficits in social threat stimuli between those with NES and healthy controls using objective tasks, however no research had been published looking at differences between those with NES and epilepsy using objective tasks. Unfortunately, the BERT was unable to distinguish between patients with NES and epilepsy, finding both samples displayed similar difficulties.

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Lundqvist, D., Flykt, A., & Ohman, A. (1998). The Karolinska Directed Emotional Faces-KDEF [CD ROM]. Stockholm, SE: Department of Clinical Neuroscience, Psychology Section.

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### How do Patients with epilepsy differ from patients with PNES: initial formulation of a paradigm shift

David Anderson, Maria Damianova, Skye Hanekom, Marilyn Lucas (Johannesburg, South Africa)

**Objective:** The present study compared a broad range of neurological and psychological characteristics in both groups, with specific reference to seizure severity, traumatic experiences, somatoform dissociations, somatic symptoms and quality of life.

**Background:** Various studies attempting to identify the differentiating features of patients with psychogenic non-epileptic seizures (PNES) and epilepsy have yielded equivocal results suggesting more definitive research is still required.

**Methods:** The participants were patients referred for v-EEG monitoring at the Epilepsy Monitoring Unit (EMU), Donald Gordon Medical Centre in South Africa. A total of 30 patients were recruited of which 23 (76.7%) were female participants and 7 (23.3%) male participants. Average age was 37 years (M = 36.5, SD = 14.7) ranging from 18 to 69 years of age. Following a neurological examination and a clinical interview, the participants completed the Traumatic Experiences Checklist, the Seizure Severity Questionnaire, the Somatoform Dissociation Questionnaire, the LEVEL 2—Somatic Symptom—Adult Patient Questionnaire, and the Quality of Life in Epilepsy Questionnaire.

**Results:** Twelve patients were diagnosed with epilepsy and 18 patients received a PNES diagnosis, despite 12 patients from this latter group having a previous EEG reading, (from sources unrelated to the EMU) considered indicative of epilepsy. Although the two groups were surprisingly similar on a range of variables measured, the patients with PNES had lower overall quality of life rating as measured by the Quality of Life in Epilepsy Questionnaire and more traumatic experiences than the patients with epilepsy supporting the view that the roots of PNES are in a psychological rather than neurological disorder.

**Conclusions:** The similarity of both groups in relation to seizure severity, somatoform dissociations and somatic symptoms poses diagnostic challenges for a practitioner. Notwithstanding the different neurophysiological mechanisms of PNES and epilepsy, the patients' account of their experiences associated with these conditions indicates more similarities than differences. Without the benefits of v-EEG findings, diagnosis is challenging, particularly so when EEG readings have a low differentiating diagnostic value.

**References:** Anderson, D., Damianova, M., Hanekom, S., & Lucas, M. (2017). A comparative retrospective exploration of the profiles of patients in South Africa diagnosed with epileptic and psychogenic non-epileptic seizures. *Epilepsy and Behavior*, 69, 37-43

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### Higher volume of the supplementary motor area in patients with functional movement disorders: a VBM study

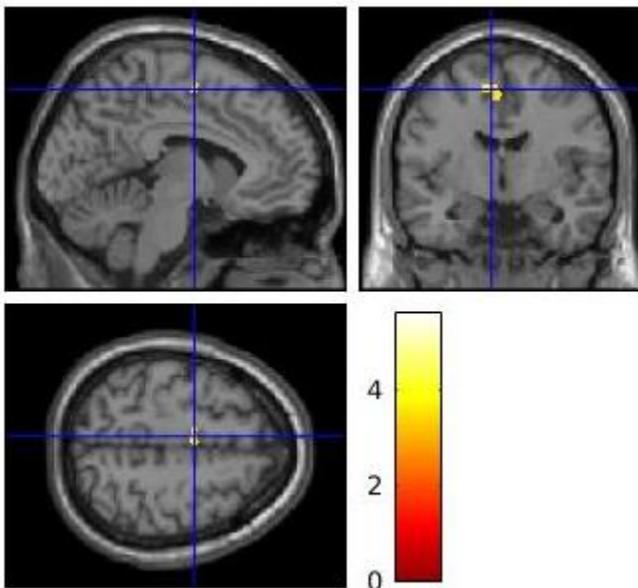
*Pavel Dusek, Robert Jech, Matej Slovak, Karsten Mueller, Jiri Keller, Filip Ruzicka, Tereza Serranová (Prague, Czech Republic)*

**Objective:** To identify structural changes of gray matter in functional movement disorder (FMD) patients compared to healthy control subjects investigated by magnetic resonance imaging (MRI) using voxel-based morphometry (VBM).

**Background:** Only a few imaging studies have analyzed grey matter changes in FMD using VBM and voxel-based cortical thickness. Changes in the basal ganglia, thalamus and premotor areas have been found in small groups of patients predominantly with functional weakness.

**Methods:** Twenty-nine patients with clinically established FMD (11 with weakness and 18 with abnormal movements or gait disorder, mean age 46.2±9 years±SD, 5 males, mean disease duration 6.8±5 years±SD) and 27 healthy control subjects (mean age 46.6±8 years±SD, 5 males) were included in the study. A T1-weighted MP-RAGE MRI (Siemens Skyra 3T) with a 1-mm isotropic voxel resolution was performed for both groups. For preprocessing and analysis, the imaging CAT12 toolbox and SPM12 in MATLAB were used. Statistics were performed on modulated and smoothed (8\*8\*8 mm filter) images using a T-test using total intracranial volume, gender and age as covariates.

**Results:** Gray matter analysis showed higher volume in the left supplementary motor area (SMA, MNI maximum coordinates x=0, y=9, z=50) in FMD patients compared to control subjects which was significant on the cluster level (FWE-corrected p<0.05).



**Conclusions:** In line with previous imaging studies suggesting functional and structural abnormalities in the motor network, we found a relative hypertrophy of the SMA in a heterogeneous group of FMD patients. This suggests an abnormality in motor processing at the level of motor act preparation, which is shared by all FMD patients regardless of motor dysfunction character and provides further evidence for an altered brain structure in this condition.

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### **Relationship between traumatic experiences and psychogenic non-epileptic seizures**

*Skye Hanekom, Maria Damianova, David Anderson (Johannesburg, South Africa)*

**Objective:** The present study explored the relationships of traumatic experiences with dissociation, somatization, depression, anxiety, attachment, identity, and personality characteristics in patients with PNES and epilepsy.

**Background:** Traumatic experiences play a significant role in the development of psychological dissociation, which in turn is considered the key dynamic underlying the occurrence of psychogenic non-epileptic seizures (PNES).

**Methods:** Eighteen PNES and 12 epileptic patients took part in the study. There were 23 male and seven female participants aged between 18 and 51 years ( $M = 36.6$ ,  $SD = 14.7$ ). Participants' traumatic and dissociative experiences, somatisation, attachment, identity and personality characteristics were assessed using self-report questionnaires.

**Results:** The PNES patients reported higher levels of traumatic and dissociative experiences, compared to epileptic patients. The two groups differed further in that in the PNES patient group traumatic experiences were positively correlated with dissociative experiences (derealisation and absorption), somatisation, depression and anxiety but had no association with any personality traits. In the epilepsy patient group traumatic experiences had no significant associations, except for Extroversion.

**Conclusions:** These results indicate that in PNES patients, compared to epileptic patients, traumatic experiences are exacerbated, and form a cluster of significant relationships with various indicators of psychological wellbeing.

**References:** Baslet, G., Roiko, A., & Prensky, E. (2010). Heterogeneity in psychogenic nonepileptic seizures: Understanding the role of psychiatric and neurological factors. *Epilepsy & Behavior*, 17(2), 236-241.

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### **Functional neuroimaging of functional movement disorders (FMD) before and after a rehabilitation program**

*Leonard Faul, Brendan Depue, Alexandra Jacob, Darryl Kaelin, Alberto Espay, Kathrin LaFaver (Louisville, USA)*

**Objective:** To examine emotional and motor responses during a Go/No-Go task in patients with functional movement disorders (FMD) before and after undergoing a comprehensive rehabilitation program.

**Background:** FMD are common, yet poorly understood disorders of abnormal motor control presenting with tremor, dystonia, gait or speech problems. Prior imaging studies have found greater connectivity between amygdala and motor planning regions in FMD patients.

**Methods:** Using fMRI, we studied 8 FMD patients performing an emotional Go/No-Go task before and after undergoing a one-week multidisciplinary rehabilitation program. Because of high levels of depression and anxiety in this population, BDI and STAI scores were used as co-variables for analysis. All analyses were thresholded at voxel-wise;  $t=3.5$ ,  $p < .01$ ,  $N=8$ . Standardized patient videos pre- and post-treatment were reviewed by a blinded rater using the psychogenic movement disorder rating scale (PMDRS) as clinical outcome measure.

**Results:** PMDRS scores improved from 29.25 ( $SD 11.4$ ) to 13 ( $SD 4.31$ ). Whole brain results from pre- to post-treatment indicated a significant shift of activation across emotional states (fear, happy, neutral > baseline) from ventral visual cortices, cerebellar vermis, and hippocampus (bottom-up processing regions) to caudate, putamen, premotor, pre-SMA (supplementary motor area), and SMA (top-down control of motor and motor regions). Subsequently, we regressed the changes in video score (post-pre) and examined regions that related to increased motor outcome in a whole brain regression analysis. Increased activation in pre-SMA and motor cortices at the pre-treatment scanning session predicted improved outcomes (pre-post; controlling for post). Increased activation in the SMA, premotor cortex, visual cortices, as well as the right anterior middle frontal gyrus predicted improved outcomes at the post-treatment (post-pre; controlling for pre) scanning session. Further, when using the above resultant regions as seeds for whole-brain functional connectivity analyses, improved outcome also related to increased functional connectivity post-treatment between the premotor cortex and the amygdala.

**Conclusions:** Our results demonstrate that a one-week treatment program for FMD may lead to changes from stimulus driven "bottom-up" activity to "top-down" control of motor regions. Furthermore, greater activation in the SMA and motor cortices and increased functional connectivity between motor and emotion regions at baseline may predict improved treatment outcomes.

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**Withdrawn by author**

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### **A comparison between the prevalence of alexithymia in patients with psychogenic non-epileptic seizures, epilepsy and the healthy population - a systematic review of the literature**

*Bruno Silva, Ana Sequeira (Lisbon, Portugal)*

**Objective:** To determine the prevalence of alexithymia in patients with psychogenic non-epileptic seizures (PNES) and to compare it with patients with epilepsy and healthy controls.

**Background:** The construct of alexithymia includes a deficit in identifying and describing feelings. It has been proposed that alexithymia plays a role in the etiology of PNES, but whether this is a specific association remains a matter of debate.

**Methods:** We performed a systematic review of the literature based on the PRISMA guidelines. We searched the MEDLINE, EMBASE and PsycINFO databases. Only studies using the TAS-20 to measure alexithymia in at least 20 patients with PNES, compared with a control group (epilepsy or healthy controls) were included.

**Results:** The initial search returned 146 papers of which 8 were included in this review. A total of 412 patients with PNES, 286 patients with epilepsy and 129 healthy controls participated in these studies. Prevalence of alexithymia in PNES varied between studies (30-90%). Prevalence is higher in PNES than in the healthy population (5-14%), but not significantly different from patients with Epilepsy

(26-76%). Cluster analysis revealed two groups of patients with PNES, one with alexithymia and more anxiety, depression, and somatization. Alexithymia appears to mediate perceived QoL in patients with NEAD and patients with Epilepsy.

**Conclusions:** The included studies had several limitations: small samples; lack of gold-standard diagnostic methods; incomplete history of traumatic events and psychiatric comorbidities; lack of control for malingering. Prevalence of alexithymia is higher in patients with PNES than in the healthy population but it doesn't seem to be different in patients with PNES compared to patients with epilepsy. This finding can be a false positive, or it can point to a shared history between these patients (namely of traumatic events). As alexithymia appears to mediate perceived QoL in these patients, therapies aimed at increasing emotional awareness can be of use.

## 224

### Identifying contributing factors in individual patients with a (functional) tremor

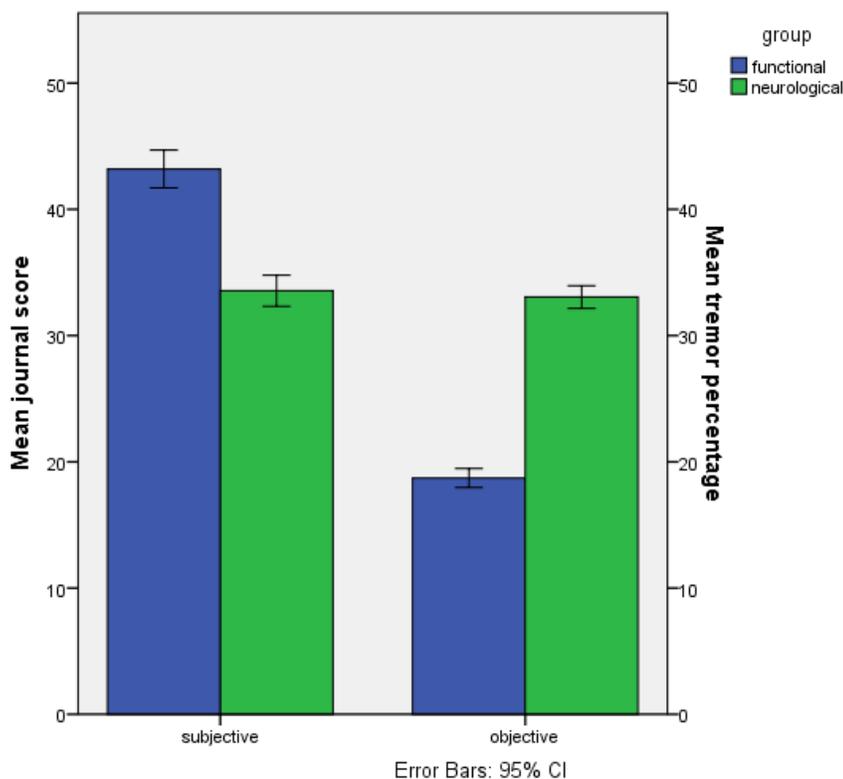
*Gerrit Kramer, Marina De Koning-Tijssen (Groningen, Netherlands)*

**Objective:** To determine whether factors like stress or exercise contribute to symptom fluctuations in individual patients with a functional or organic tremor.

**Background:** Functional movement disorders (FMDs) can resemble movement disorders like tremor or dystonia, but do not have a clear underlying neurological cause. FMDs are often regarded as being stress-related or a consequence of a psychiatric disease, however these causes are only present in a part of the FMD patients [1]

**Methods:** 15 tremor patients (3 functional and 12 organic) completed a web based diary 5 times a day for 30 days. During the FND congress, this number will be larger. Patients indicated on a 1-100 VAS scale items on subjective tremor complaints, exercise, stress and physical exercise (subjective score). Besides, patients wore an accelerometer to record the tremor duration (objective score). Granger causality was applied to determine whether subjective factors predicted objective symptom fluctuations or vice versa.

**Results:** Patients with a functional tremor had a lower percentage of the time with tremor than patients with an organic tremor (18.7% vs 33.6%), whilst FMDs patients reported more subjective complaints (average score 43.2 vs 33.6). Contributing factors for symptom fluctuation (especially physical exercise) were present in 3 functional tremor patients and in 5 organic tremor patients.



**Conclusions:** Patients with a functional tremor have more subjective tremor complaints in relation to their objective tremor duration. Contributing factors seem to be more prominent in patients with a functional tremor. In the future, this method may be used for personalized treatment.

**References:** [1] Van der Hoeven et al. Functional (psychogenic) movement disorders associated with normal scores in psychological questionnaires: A case control study. *Journal of Psychosomatic Research* 79 (2015) 190–194

## 225

### Illness attention and somatic interpretations in functional neurological disorder and chronic fatigue syndrome

*Roxanne Keynejad, Alicia Hughes, Susannah Pick, Colette Hirsch, Rona Moss-Morris, Trudie Chalder, Timothy Nicholson (London, United Kingdom)*

**Objective:** To examine attentional and interpretive biases in people diagnosed with functional neurological disorder (FND), relative to those with chronic fatigue syndrome (CFS) and healthy controls (HC).

**Background:** Cognitive biases towards illness and disability-related stimuli and interpretations may maintain medically unexplained syndromes (1). Such biases have been demonstrated in people with CFS (2), but have not been studied in FND.

**Methods:** People with FND of any symptom type were compared to individuals with CFS and HCs on three experimental tasks. These measure: 1. attentional bias to illness (somatic symptoms and disability)-related stimuli (visual dot-probe task), 2. somatic interpretations of ambiguous material (interpretive bias task), and 3. general attentional performance (attentional network task). Participants also completed self-report questionnaires assessing global functioning, cognitive and behavioural responses to illness, fatigue, and comorbid psychopathology.

**Results:** Preliminary analyses of data collected to date indicate bias towards somatic/illness-related interpretations of ambiguous stimuli in FND and CFS groups, relative to HCs. Both clinical groups also appear to show reduced attentional control relative to HCs. No attentional bias specific to illness-related stimuli was observed in the FND group, in initial analyses. Full results will be available at the conference, if selected.

**Conclusions:** Individuals with FND, like those with CFS (2), might exhibit a tendency towards somatic interpretations of ambiguous information, alongside reduced attentional control. This may result in heightened automatic attentional allocation to their bodily states. A bias towards somatic interpretations might elevate illness-related worry, rumination, and distress in FND. Furthermore, frequent somatic interpretations in daily life might exacerbate maladaptive beliefs regarding somatic symptoms. These biases represent important candidates for psychological intervention to treat this common, disabling disorder. Our study demonstrates the value of research collaborations to study FND and other medically unexplained syndromes.

**References:** 1. Deary, V. , Chalder, T. , & Sharpe, M. (2007). The cognitive behavioural model of medically unexplained symptoms: A theoretical and empirical review. *Clinical Psychology Review*, 27, 781-797. 2. Hughes, A. M. , et al. (2017). An attention and interpretation bias for illness-specific information in chronic fatigue syndrome. *Psychological Medicine*, 47, 853-865.

## 226

### **Altered brain metabolism associated with functional motor disorder**

*Ismael Conejero, Laurent Collombier, Emilie Olié, Philippe Courtet, Mocrane Abbar, Eric Thouvenot (Montpellier, France)*

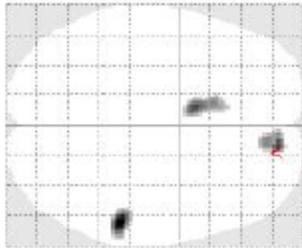
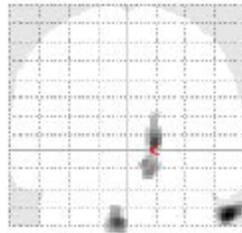
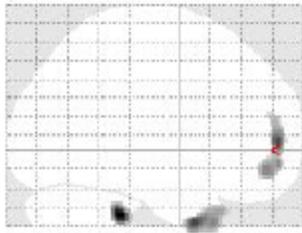
**Objective:** Pathophysiology of conversion disorder is not well understood. The HYCORE study (Hysterical conversion recovery) aims at evaluating alterations of brain metabolism during first episode in patients with functional movement disorders, and their association with persistent physical disability at 3 months and 6 months follow-up. We also assessed evolution of brain metabolism at 3 months follow-up for each patient.

**Background:** Conversion disorder (CD) also called "functional neurological disorder" (DSM-5) is a common psychiatric condition with poor prognosis. Symptoms persist for nearly half of patients within 8 months. Pathophysiology of conversion disorder is not well understood.

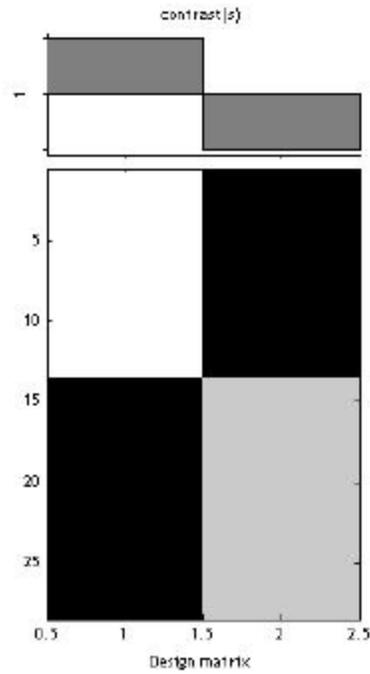
**Methods:** 22 patients with first episode of functional motor loss or abnormal movement disorder were recruited in university hospital of Nîmes. Motor impairment was evaluated using a neurologic scale: Expanded Disability Status Scale (EDSS score). For each patient, we assessed alteration of brain metabolism at rest using 18FDG-Positron emission tomography during two scan sessions: at symptoms onset and 3 months later, EDSS was scored at the same time. First scans were compared with those of 13 controls without neurological impairment or any motor disability. We performed statistical analysis using SPM 12.

**Results:** At that time, 22 patients performed initial scan session and 14 patients were evaluated with second scan at 3 months. Preliminary results (Fwe corrected) show hypoactivation of right frontopolar cortex (Peak voxel: 14, 56, 2) and right orbitofrontal cortex (Peak voxel: 12, 50, -12) at symptoms onset in patients compared with controls. Moreover, patients had greater activation of right primary motor cortex (Peak voxel: 10, -28,76) and right caudate (Peak voxel: 16, 2, 18) compared with controls (Figure 1,2 and 3). Patients with complete recovery within 3 months follow-up had increased activation of ventral anterior cingulate cortex (Peak voxel: 2, -10, 48), increased right fronto-polar cortex (2, 60, 4), increased left anterior cingulate cortex (Peak voxel: -2, 48,4) and increased right thalamus (6,-10, 2) between initial PET-scan and PET-scan at 3 months. Analysis of brain imaging at 3 months show that patients with persistent motor disability (EDSS>0) have greater Posterior cingulate cortex activation (Peak voxel : 16, -38, -2) compared with patients with complete recovery (EDSS=0).

**temoins -base**



SPM{T<sub>26</sub>}



Results: /Desktop/SPM base-temoins  
 at threshold T = 6.574603 (p<0.05 (FWE))  
 at threshold k = 100 voxels

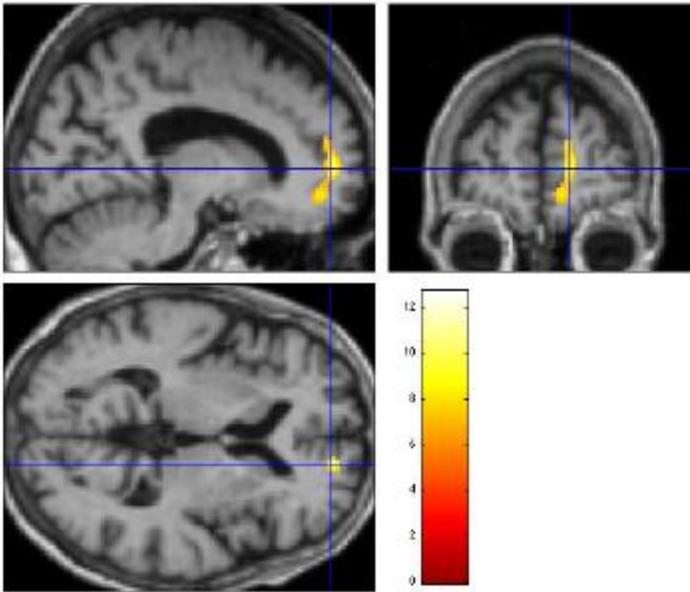
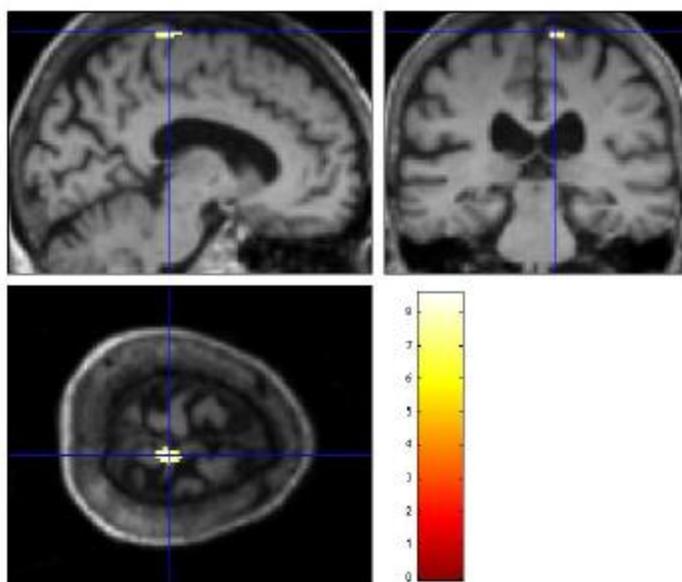
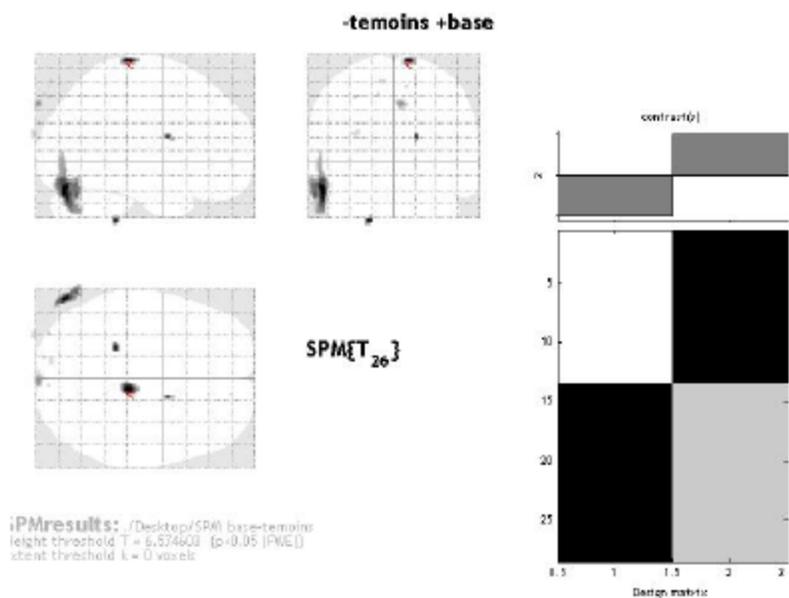
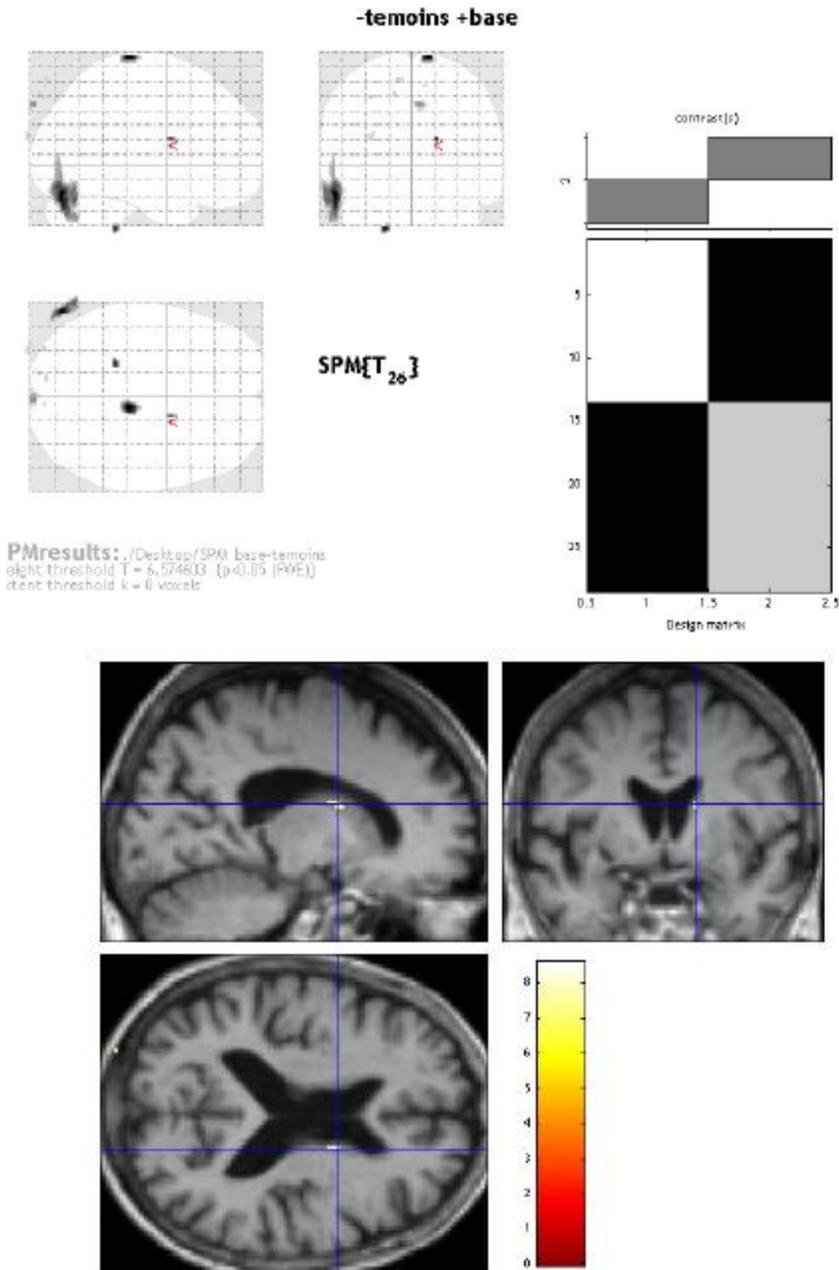


Figure 1: hypoactivation of frontopolar cortex and Orbitofrontal cortex in patients vs controls (Fwe corrected, Peak voxel: 14, 56, 2 and Peak voxel: 12, 50, -12)



**Figure 2: hyperactivation of right motor area (Fwe corrected, Peak voxel: 10, -28,76) in patients vs controls**



**Figure 3: hyperactivation of right caudate (Fwe corrected, Peak voxel: Peak voxel: 16, 2, 18) in patients vs controls**

**Conclusions:** Preliminary results of HYCORE study are in line with previous findings showing baseline altered activation of primary motor area, basal ganglia and orbitofrontal cortex in patients with motor conversion disorder. Our findings suggest that brain markers are associated with complete recovery and the existence of “trait markers” associated with motor disability.

**References:** Functional neuroanatomical correlates of hysterical sensorimotor loss (Vuilleumier et al, 2001); Discrete neurophysiological correlates in prefrontal cortex during hysterical and feigned disorder of movement (Spence et al, 2000)

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**Psychic causes of autobiographical amnesia: A study of 27 cases**

*Jessica Collins, Hans Markowitsch (Sheffield, United Kingdom)*

**Objective:** In the present study a big collection of patients (27) with psychogenically caused autobiographical amnesia will be described and documented in order to establish variables which are central for the occurrence of dissociative amnesia.

**Background:** Autobiographical amnesia is found in patients with focal as well as diffuse brain damage (“organic amnesia”), but also without overt brain damage (at least when measured with conventional brain imaging methods). This last condition is usually named dissociative amnesia at present, and was originally described as hysteria. Classically and traditionally, dissociative amnesia is seen as a condition that causes retrograde amnesia in the autobiographical domain due to incidents of major psychological stress or trauma.

**Methods:** Neuropsychological tests and brain imaging methods were applied.

**Results:** The described cases demonstrate that autobiographical amnesia without direct brain damage can have very mixed appearances, causes and consequences. Manifestations of these psychogenic forms include a reduced effort to perform cognitively at a normal level, a forensic background, anterograde (instead of retrograde) autobiographical amnesia, the fugue condition, its mixture with somatic diseases, and its appearance in childhood and youth.

**Conclusions:** It is concluded that autobiographical amnesia of a psychogenic origin may occur within a variety of symptom pictures. For all patients, it probably serves a function by protecting them from continuing to deal with their life situation which appears to them unmanageable or adverse.

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### **Preoperative Quantitative Evaluation of Dysfunctional Determinants in Abnormal Head Postures**

*Emily Sanrey (Montpellier, France)*

**Objective:** To design and test a dedicated questionnaire aiming at improving the diagnostic capability to discriminate the dysfunctional (psychogenic) part of the disorder. To provide one more quantitative criterion for patient's selection to surgical GPI- Continuous Electrical Neuromodulation (CEN).

**Background:** Abnormal head posture can be related to dystonia and/or dyskinesia but psychogenic participation and/or origin is often discussed.

**Methods:** We achieved a two part study: 1/ a retrospective study including 34 patients (01/2000-01/2015) treated by GPI-CEN for abnormal head posture due to dystonia-dyskinesia syndrome. 2/ a prospective one including 8 patients referred more recently for preoperative evaluation. With group 1, extensive clinical history was investigated allowing us to generate a spreadsheet of items dealing with several domains. The questionnaire is composed of 139 items scored in a dichotomous manner. Thirty-four items are scored directly by the physician. With group 2, we tested this questionnaire. Aside, three neurologists gave their conclusion on the "neurological pertinence of symptoms". A score was built from 0 to 5 from this observation.

**Results:** In group one, in only 18 patients surgery was anticipated. At one year evaluation, 5 failed to improve. These patients did not present any contraindication criteria for CEN (pertinence score). In group 2, the questionnaire was included in the selection process: 7/8 patients showed psychogenic clues. These patients did not present any contra-indication criteria of CEN referring to standard evaluation (pertinence score). Only one patient was finally selected and operated last year.

**Conclusions:** The need of precise and quantitative criteria for evaluating the risk of dysfunctional participation to a movement disorder is obvious in daily practice. It becomes crucial at the time of patient's selection for functional neurosurgery. So-called "cervical dystonia" is one of the most challenging syndrome in this domain corresponding in first analysis to an abnormal head posture which can be easily, voluntarily or not, mimicked. Only selected cases, with symptoms isolated to head and neck, appears to actually be of dystonia-dyskinesia origin.

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### **Cognitive Behavioral Therapy for Functional Tremor: Clinical and Functional Magnetic Resonance Study**

*Alberto Espay, Thomas Maloney, Jennifer Vannest, Erin Neefus, Jane Allendorfer, Anthony Lang, Jerzy Szaflarski (Cincinnati, OH, USA)*

**Objective:** We sought to evaluate abnormalities in emotional circuitry in patients with functional tremor (FT), the most common functional movement disorder, using functional magnetic resonance imaging (fMRI) before and after cognitive behavioral therapy (CBT).

**Background: Methods:** Fifteen consecutive consenting patients with FT were recruited into a 12-week CBT program. All participants underwent fMRI with a finger-tapping motor task, a basic-emotion task, and an intense-emotion task to probe motor and emotion networks at baseline and after end of CBT. The primary clinical endpoint for CBT was the tremor score (sum of severity, duration, and incapacitation sub-scores) adapted from the Rating Scale for Psychogenic Movement Disorders (RSPMD), through an off-line video-based rating by a blinded clinician. Anatomical and functional brain images were obtained using a 4T MRI/MRS system (Varian Inc.). Data pre-processing was carried out using a combination of FSL (FMRIB Software Library) and AFNI (Analysis of Functional Neuroimages). A GLM analysis and a region of interest (ROI) analysis were used to assess differences in activation between baseline and post-CBT. Regions of interest were identified from a previous study, using the same paradigms and protocol, which compared FT participants with healthy controls.

**Results:** CBT reduced tremor severity (RSPMD reduced from  $32.3 \pm 17.1$  to  $7.4 \pm 10.8$ ;  $p < 0.01$ ) with 9 patients reaching tremor freedom (Table 1). FT patients showed increase pre-to-post CBT activation in the anterior cingulate (Emotional Pictures > Neutral Pictures) and right parietal region (Emotional Pictures > Squares) at a Z threshold of 2.81 ( $p > 0.005$ , uncorrected). The anterior cingulate/paracingulate region of interest showed a significant decrease in activation post-CBT among CBT responders during the basic emotion task (Sad Faces > Neutral Faces) ( $p < 0.03$ ). Subjects with lower HAM-D scores were associated with greater decreases in activation in the anterior cingulate/paracingulate ( $r^2 = 0.652$ ,  $p < 0.005$ ).

**Conclusions:** CBT led to significant clinical improvements in FT patients. These improvements were associated with decreased activity in the anterior cingulate/paracingulate region, which may represent a biomarker of FT and serve to predict CBT response. A randomized controlled trial of CBT for FT is warranted.

## Treatment

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### Long Term Result and Safety of the Subthalamic Nuclei DBS of Advanced Parkinson's Disease: An Eight Year Follow Up Study

Qiyu Guo, Lulu Jiang, Shaohua Xu, Chen Wanru, Wenbiao Xian, Yanmei Liu, Jinglong Liu, Ling Chen (Guangzhou Shi, Peoples Republic of China)

**Objective:** To investigate the long term efficacy of STN DBS for PD in China with an eight year follow up of eight patients.

**Background:** Parkinson's disease (PD) is a neurodegenerative disease. With the progress of the disease, the symptoms gradually worse and levodopa-induced motor complication arise. Deep brain stimulation (DBS) is an effective treatment for advanced PD. There are some RCT researches for short term efficacy for DBS as well as some long term study in foreign. But its long term efficacy have been little formulated in China, although China occupies the largest proportion of PD.

**Methods:** Patients with PD who had received bilateral STN DBS, was assessed preoperatively (baseline) and 1, 3, 5 and 8 years postoperatively, using the Unified Parkinson's disease Rating Scale (UPDRS) and a series of neuropsychological assessment. At the same time, the levodopa equivalent daily dose (LEDD) and stimulating parameter were also recorded.

**Results:** As compare to the preoperative med-off state, motor symptom improved by 42.8% ( $P < 0.001$ ). Among these, rigidity showed the most prominent improvement, and then follow by bradykinesia, Axial symptom (speech, posture stability), tremor. As to the med-on state, motor symptom did not show significant change. The quality of life is improved by 64.39% ( $P < 0.001$ ) from baseline to 3 years and gradually sharpened afterward. Sleep, cognition, and emotion were mostly unchanged. Levodopa equivalent daily dose was reduced from 721.1 ± 188.7 mg at baseline to 328.1 ± 241.4 mg at 8 years (by 54.5%,  $P < 0.001$ ). The stimulating parameter gradually increased and its stimulating pattern has changed from single negative to double negative, bipolar and interleaving.

**Conclusions:** STN DBS shows a positive efficacy for advanced PD, appearing as improving motor symptom and reducing the almost half of the dosage of antiparkinsonism medication. Compared with other studies, patients in our study received diverse stimulating setting which can better control patients' symptom.

**References:** 1. Williams A, Gill S, Varma T, Jenkinson C, Quinn N, Mitchell R, et al. Deep brain stimulation plus best medical therapy versus best medical therapy alone for advanced Parkinson's disease (PD SURG trial): A randomised, open-label trial. *Lancet Neurol* 2010;9:581-91. 2. M. G. Rizzone a, A. Fasano b, A. Daniele b, M. Zibetti a, et al. Long-term outcome of subthalamic nucleus DBS in Parkinson's disease from the advanced phase towards the late stage of the disease. *Parkinsonism and Related Disorders* 2014; 376-381.

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### Characteristics and outcomes of children with conversion disorder admitted to inpatient rehabilitation unit, a retrospective study

Ashlee Bolger, Andrew Collins, Michelle Michels, David Pruitt (Loveland, OH, USA)

**Objective:** To identify characteristics and outcomes of children admitted to a pediatric inpatient rehabilitation program with conversion disorder (CD) symptoms.

**Background:** CD can lead to impaired functioning. Few studies present demographic data for pediatric patients and fewer evaluate outcomes after physical/occupational therapy. Many have had success with rehabilitation, however details related to functional outcomes are not known.

**Methods:** We conducted a retrospective chart review of all patients with diagnosis of CD or functional gait disorder (FGD) admitted to a pediatric inpatient rehabilitation unit. We reviewed characteristics of patients prior to rehabilitation admission including duration of symptoms prior to diagnosis and rehabilitation admission, physician visits and medical admissions for CD symptoms prior to rehabilitation admission, school absences, and symptom classification. Outcomes were reviewed including average length of stay, Functional Independence Measure for Children (WeeFIM) scores, WeeFIM change, WeeFIM efficiency, recommended therapies, the number of admissions for one year post discharge, and school reentry characteristics. Descriptive statistics and Wilcoxon signed rank tests were used to analyze data. A P value of  $< .05$  was considered statistically significant.

**Results:** 33 admissions were initially identified during the time period. Two were excluded due to no documented diagnosis of CD/FGD and one due to repeat admission. Duration of patient symptoms before diagnosis was 58 ± 145 days and 62 ± 95 days prior to rehab admission. Average physician visits were 1.9 ± 2.1, and average hospital admissions were 0.7 ± 0.9. Absence from school averaged 6 ± 12 weeks. 83% of patients presented with mixed symptoms. Average length of stay was 8.4 ± 4.2 days. Average change in WeeFIM score from admission to discharge was 30 ± 11.9 ( $p < .001$ ). WeeFIM efficiency was 4.8 ± 4.1. All ten patients with documented three month WeeFIM scores improved or maintained their WeeFIM scores. For the year following discharge, 80% of patients did not have a documented readmission for CD symptoms. 47% of patients returned to school within one week of discharge.

**Conclusions:** As expected, many pediatric CD patients had interactions with multiple medical providers prior to diagnosis in both the inpatient and outpatient settings. This not only can increase healthcare cost but often leads to distrust of a functional diagnosis by patients and caregivers. Overall, pediatric CD patients in this cohort showed improvement in WeeFIM scores that were maintained or improved at three months post discharge, and very few of them required repeat admissions for the year following admission. This suggests that an inpatient rehabilitation approach leads to sustained functional improvement for a subset of CD patients and has the potential to decrease overall cost to the healthcare system.

**References:** American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub. Kozłowska, K., English, M., Savage, B., Chudleigh, C., Davies, F., Paull, M., & Jenkins, A. (2013). Multimodal rehabilitation: a mind-body family-based intervention for children and adolescents impaired by medically unexplained symptoms. Part 2: case studies and outcomes. *The American Journal of Family Therapy*, 41(3), 212-231.

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### **Outcomes of a Five Week Intensive Multidisciplinary Rehabilitation Outpatient Programme for people with Functional Neurological Symptoms**

*Hannah Louissaint, Jasbir Ranu (London, United Kingdom)*

**Objective:** To observe the immediate effect of an intensive multidisciplinary team (MDT) outpatient rehabilitation programme on functional ability, beliefs around diagnosis, quality of life and psychological well-being in patients with Functional Neurological Symptoms (FNS).

**Background:** Studies suggest that a specialised MDT inpatient programme for FNS can provide long-lasting benefits in the majority of patients (ref Joyce and Steiff). A five week outpatient MDT rehabilitation programme has been set up to manage the high demand for this service.

**Methods:** Data was collected from patients who completed the programme over 6 months (February – July 2017). A battery of outcome measures was completed at the start and end of the programme to measure change at impairment, activity and participation levels of the WHO ICF framework as well as measuring beliefs around diagnosis, psychological well-being and quality of life. Outcome measures will be compared pre and post treatment and trends will be observed across the population.

**Results:** We are in the process of recording the data which will be analysed in August 2017. We are using a battery of outcome measures to record change, including the HoNoS, EQ5D5L, 10metre timed walk, Berg Balance Scale, COPM, FIM/FAM, and GAD7, PHQ9. Within this data we will report trends between pre and post treatment and present in a chart format.

**Conclusions:** If the results are in keeping with previous studies for inpatients, an intensive, five week multidisciplinary outpatient programme using specific therapeutic approaches should demonstrate significant improvements in functional ability, beliefs around diagnosis, psychological well-being and quality of life.

**References:** 1) Demartini, B., Batla, A., Petrochilos, P., Fisher, L., Edwards, M., Joyce, E. (2014) Multidisciplinary treatment for functional neurological symptoms: a prospective study. *Journal of Neurology*. 261:2370-23772 Saifee, T., Kassavetis, P., Parees, I., et al. (2012) Inpatient treatment of functional motor symptoms; a long-term follow-up study. *Journal of Neurology* 259:1958–1963

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### **Functional Outcomes of a Four Week Intensive Multidisciplinary Rehabilitation Programme for people with Functional Neurological Symptoms**

*Hannah Louissaint, Jasbir Ranu (London, United Kingdom)*

**Objective:** To observe the immediate effect of an intensive MDT rehabilitation programme on functional ability and quality of life in patients with FNS.

**Background:** People with a known diagnosis of Functional Neurological Symptoms (FNS) are admitted onto a four week intensive multidisciplinary (MDT) rehabilitation programme at The National Hospital for Neurology and Neurosurgery to aim to reduce and manage their symptoms, and improve their quality of life and functional ability. Subjective and Objective outcome measures are completed to measure change at impairment, activity and participation levels of the WHO ICF framework.

**Methods:** Data was collected from patients who completed the programme over 2 years (November 2014 – December 2016). A battery of outcome measures was completed at the start and end of the program (week one and week four). Week four outcome measures were compared to the baseline at week one and trends were observed across the population.

**Results:** We have recorded the data, which now requires analysis. We have continued to use outcome measures such as EQ5D5L, 10metre timed walk, BERG and COPM. Within this data we will report trends between week one and week four and present in a chart format. A 50% reduction in patient reported difficulty of main problem was demonstrated using a visual analogue scale. The Visual Analogue Scale showed 80% of patients saw an improvement across the 5 health dimensions.

**Conclusions:** An intensive, four week multidisciplinary programme using specific therapeutic approaches can lead to significant improvements in functional ability and quality of life.

**References:** 1. Nielsen G (2014) Physiotherapy for functional motor disorders: a consensus recommendation. *J Neurol Neurosurg Psychiatry*. 0: 1-7. 2. Demartini, B. , Batla, A. , Petrochilos, P. , Fisher, L. , Edwards, M. , Joyce, E. (2014) Multidisciplinary treatment for functional neurological symptoms: a prospective study. *Journal of Neurology*. 261:2370-2377

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### **A novel treatment protocol for Functional Neurological Symptom Disorder (FNSD): A retrospective consecutive case series**

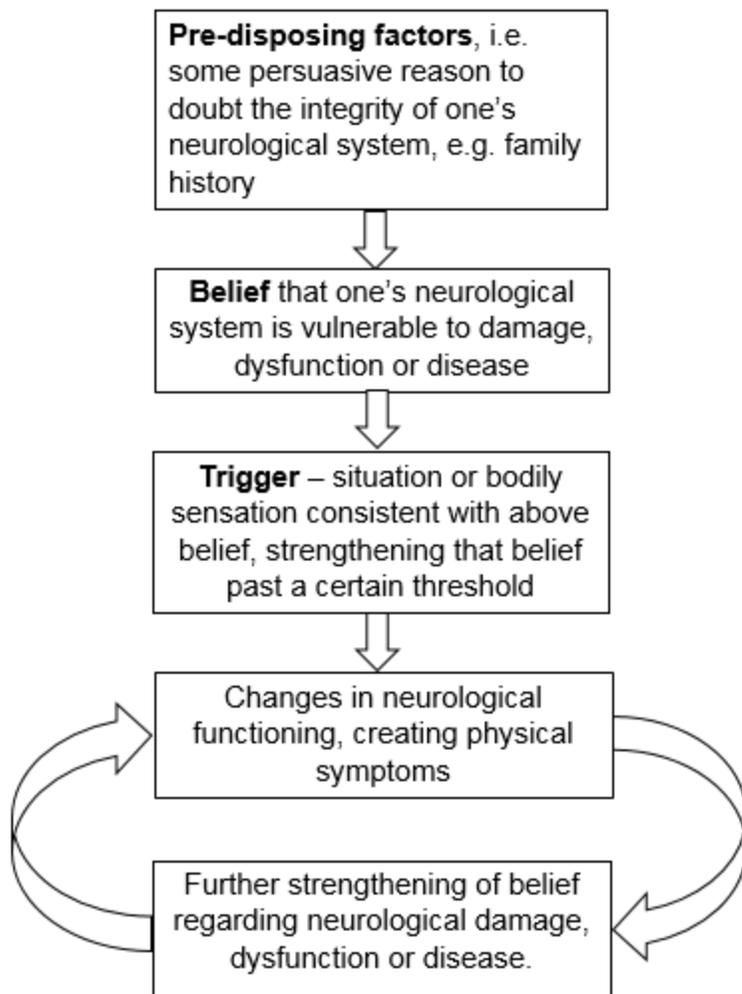
*Matt Richardson (Dunedin, New Zealand)*

**Objective:** It was hypothesized that FNSD arises from a belief of being neurologically damaged (via nocebo effect), and a treatment protocol consistent with this hypothesis could effectively reduce or eliminate functional symptoms.

**Background:** In our clinical practice, a substantial proportion of patients present without significant mental health difficulties or dissociative symptoms, but almost all have some reason to doubt the integrity of their neurological system.

**Methods:** A retrospective consecutive case series design was utilised, measuring functional independence and symptom remission in 13 episodes of care (involving 12 participants) with a range of functional symptoms (e. g. weakness, tremor and non-epileptic seizures). The treatment protocol involved transparently sharing the above hypothesis [figure1] with participants. They then engaged in behavioural activation or exposure aiming to contradict the idea of being neurologically damaged, often by varying attention (e. g. away from one's movement or tremor) and giving video feedback. The participants were followed up by telephone an average of 17 months later.

Fig 1: A simple hypothesized model for the creation and maintenance of functional neurological symptoms.



**Results:** Of the 13 episodes of care, 10 resulted in complete symptom remission, one participant was discharged with a slight limp that was probably linked to chronic pain following previous discectomy, and one self-discharged with a minor symptom, but achieved full symptom remission after a week at home. The other participant dropped out. Scores on measures of functional independence were much improved, and length of stay in rehabilitation was also greatly reduced, compared to previous treatment attempts at the rehabilitation centre. At telephone follow-up, the majority of participants had continued to be fully functionally independent.

**Conclusions:** A treatment protocol involving transparently hypothesizing with participants that their belief of neurological damage is causing their symptoms via a nocebo mechanism appears very effective, in that it reliably and quickly eliminates symptoms in the majority of participants. The improvements were well maintained for the majority of participants over a considerable period. Despite numerous methodological limitations, the clinical outcomes were substantial enough for a controlled study of the protocol to appear warranted.

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#### **Impact of transcranial magnetic stimulation in functional movement disorders: cortical modulation or behavioral effect?**

*Beatrice Garcin, Francine Mesrati, Iulia Iliescu, Cécile Hubsch, Lionel Naccache, Emmanuel Roze, Bertrand Degos (Paris, France)*

**Objective:** The objective was to determine whether the beneficial action of transcranial magnetic stimulation in patients with functional movement disorders is due to cortical neuromodulation or to a combination of suggestion and cognitive-behavioral effect.

**Background:** The outcome of functional movement disorders (FMD) is often poor. Recent studies suggest that repeated transcranial magnetic stimulation (TMS) improves FMD, but the underlying mechanisms are unclear [1].

**Methods:** Consecutive patients with FMD underwent repeated low-frequency (0.25 Hz) magnetic stimulation over the cortex contralateral to the symptoms or over the spinal roots (root magnetic stimulation, RMS) homolateral to the symptoms. The patients were randomized into two groups: group 1 received RMS on day 1 and TMS on day 2, while group 2 received the same treatments in reverse order. We blindly assessed the severity of movement disorders before and after each stimulation session.

**Results:** We included 33 patients with FMD (26 F/7M, mean age 43.1 ± 17.1). The main clinical presentation was dystonia (45%),

tremor (39%), myoclonus (6%), Parkinsonism (3%) or stereotypies (6%). The median symptom duration was 2.9 years (mean 7.4 years). The magnetic stimulation sessions led to a significant improvement (>50%) in 22 patients (66%), with a sustained benefit at one year follow-up. We found no difference between TMS and RMS (table 1).

Factors	% improvement	
	mean (median) ± SD	
<b>Day of treatment</b>	p=0.03*	
after day 1	40.7 (29.2) ± 36.9	
after day 2	19.9 (28.3) ± 37.8	
<b>Treatment modality</b>	p=0.26	
RMS	24.8 (20) ± 38.9	
TMS	35.8 (33) ± 37.8	
<b>Order of treatment (final improvement)</b>	p=0.8	
RMS first	58.3 (79.6) ± 45.8	
TMS first	62.8 (67) ± 40	

**Table 1. Multifactorial ANOVA.**

**Conclusions:** Our results suggest that the therapeutic benefit of TMS in patients with FMD is due more to a cognitive-behavioral and suggestion effect than to cortical neuromodulation.

**References:** [1] Nicholson, T. R. J., & Voon, V. (2017). Transcranial magnetic stimulation and sedation as treatment for functional neurologic disorders. *Handbook of Clinical Neurology*, 139, 619-629.

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#### **EMDR in the treatment of functional speech disorders**

*Miriam Lomas (Durham, United Kingdom)*

**Objective:** Various treatment models have been proposed for functional speech disorders including direct voice therapy and CBT as an indirect voice treatment. This paper presents a small case series using EMDR as a novel treatment method.

**Background:** Functional dysphonia is an umbrella term for voice problems without physiological cause. There are c. 40000 new cases each year in the UK and population prevalence of 3-4%. Treatments include direct voice therapy and indirect psychological therapy.

**Methods:** Our service operates alongside local Speech and Language Therapists to offer specialist indirect therapy to patients with functional speech problems. This includes psychoeducation, emotional skills training, assertiveness skills training and psychological work with underlying trauma. This paper is a case series focusing on Eye Movement Desensitisation and Reprocessing [EMDR] therapy as a treatment for trauma in three patients with functional dysphonia with the aim of improving the functional dysphonia and their general mental health. All EMDR sessions were carried out by a registered clinical psychologist with EMDR practitioner accreditation.

**Results:** Three patients with functional speech problems were identified as having trauma histories and treated using EMDR. All experienced improvements in their mental health as evidenced by improvements on the PHQ-9 (for depression), GAD-7 (for anxiety) and PHQ-15 (for somatisation); two experienced complete resolution of their functional voice symptoms.

**Conclusions:** EMDR has been used as an effective treatment for trauma symptoms in a population with functional speech disorders. In some circumstances this treatment has also resolved the voice symptoms. This treatment has potential to be useful component of a multi-factorial approach to treating functional speech disorders but further research is indicated.

**References:** Deary, V. & Miller, T. (2011) Reconsidering the role of psychosocial factors in functional dysphonia, *Current Opinion in Otolaryngology and Head and Neck Surgery* 19, 150-154. Ruotsalainen, J. , Sellman, J. , Lic, P. , Lehto, L. & Verbeek, J. (2008) Systematic review of the treatment of dysphonia and prevention of voice disorders. *Otolaryngology-Head and Neck Surgery* 138, 557-565.

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#### **Treatment of patients suffering from functional neurological motor dysfunction**

*Peter Arlien-Søborg, Hans Henrik Holmberg Olsen, Lis Albrechtsen (Copenhagen, Denmark)*

**Objective:** To show that a combination of physiotherapy and psychological intervention may improve the condition of these patients despite a traditionally poor prognosis

**Background:** For more than ten years we have been treating patients with functional neurological disorders , primarily with motor dysfunction. Often the symptoms are very disabling and long-lasting and still an excellent response to treatment can be seen.

**Methods:** The primary diagnosis was done by a neurologist. The physiotherapist initially analysed the motor function and the

rehabilitation started in a warm water pool with focus on relearning of normal movement patterns. A structured motor reprogramming contract was formed by the physiotherapist in agreement with the patient and the rehabilitation was integrated in daily activities in the department. Psychological intervention was based on the functional symptoms as a reaction to different burdens affecting cognition, emotions, behaviour and body function. An individual intensive course was planned with focus on possible stressful events experienced by the patient. Information of psychological reactions and neuroeducation was important, based on knowledge and experiences from psychotraumatology and stress science.

**Results:** Forty-two patients have been treated. The treatment duration was 8,5 weeks in average. 67% of the patients had an excellent effect and 26% moderately improvement while 2,4% only had a mild effect and 4,7% were unchanged. At follow-up 3-6 months later 79% of the patients still had an excellent effect while 14% showed a moderate good effect.

**Conclusions:** Our results are in agreement with those from other centers offering specialised physiotherapy in combination with psychological intervention to these often very disabled patients often with long-lasting symptoms. This means that patients dependent on wheel-chairs or sticks most often ended up independent of any kind of supports.

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### **A multidisciplinary clinic for functional movement disorders (FMD): One-year experience from a single center**

*Alexandra Jacob, Courtney Smith, Megan Jablonski, Abbey Roach, Kathy Paper, Darryl Kaelin, Diane Stretz-Thurmond, Kathrin LaFaver (Louisville, KY, USA)*

**Objective:** To describe a multidisciplinary, outpatient specialist clinic for patients with Functional Movement Disorders (FMD) and report experience from implementation at the University of Louisville.

**Background:** FMD is commonly seen in neurologic clinics, yet optimal management is ill defined. A multidisciplinary approach to patient evaluation and treatment has been postulated but is not widely available.

**Methods:** This is a retrospective chart review of patients seen between February 2016 and February 2017 in a newly established, multidisciplinary FMD clinic. Patients are referred with a suspected diagnosis of FMD and seen by a movement disorder specialist, a physical therapist, a psychologist and a social worker. Furthermore, patients are asked to complete standardized psychological screening instruments for depression and anxiety. The clinic is held once a month for half a day and accommodates three patients. The purpose of the clinic is to confirm the diagnosis, assess comorbidities, educate patients, develop a treatment plan, and determine candidacy for an inpatient rehabilitation program at our center.

**Results:** During its first year, 34 patients were evaluated in the clinic. 70.6% of patients were female and mean age was 47.9 ( $\pm 15.0$ ) years. Patients were referred from 12 different US states. The mean duration of FMD symptoms was 4.9 ( $\pm 6.8$ ) years and diagnosis of FMD was confirmed in all cases. 82.4% of patients had a history of depression and 70.6% had a history of anxiety. 30 patients were considered to be good candidates for our inpatient rehabilitation program and 25 patients have completed the program to date. Three patients had only mild symptoms and were recommended to engage in outpatient therapy. One patient with severe depression and suicidal ideation was referred for acute psychiatric treatment.

**Conclusions:** We demonstrate feasibility of establishing a multidisciplinary clinic for FMD patients. Such care models have been widely implemented for neurologic disorders including Huntington's disease and amyotrophic lateral sclerosis and offer several advantages in the coordination of care for complex illnesses. Multidisciplinary assessments may facilitate patient acceptance of diagnosis and treatment suggestions. Further research is needed to study long-term outcomes for patients receiving care at FMD specialist clinics.

**References:** 1. Ricciardi, L. and M. J. Edwards, Treatment of functional (psychogenic) movement disorders. *Neurotherapeutics*, 2014. 11(1): p. 201-72. Perez DL et al, Preliminary Predictors of Initial Attendance, Symptom Burden, and Motor Subtype in a US Functional Neurological Disorders Clinic Population. *Cogn Behav Neurol*, 2016. 29(4):197-205

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### **Documentation Bias in Functional Neurological Disorders: Comparing the Prevalence and Documentation of Suspected FND with Other Common Neurological Disorders**

*Katherine Werbaneth, Katie Emily Leaver, Kim Bullock (Palo Alto, CA, USA)*

**Objective:** 1) Evaluate the prevalence and presenting symptoms of patients with Functional Neurological Disorder (FND) in a general neurology clinic at a tertiary academic center. 2) Investigate documentation rates for FND as compared to other neurological disorders.

**Background:** Neurologists may suspect FND in their clinical assessment, but fail to document the diagnosis in the medical record.

Accurate documentation in the electronic medical record (EMR) is essential to guiding patient centered care and research.

**Methods:** The prevalence of suspected FND was assessed through retrospective chart review of all unique patients presenting to a general neurology clinic between July 2016 – March 2017 at Stanford University Hospitals and Clinics. Cases of suspected FND were identified using key search words in the history and exam. A diagnosis of FND was considered documented if it was associated with an ICD-10 code for FND. The same process was used to assess other common neurologic disorders, including Parkinson's disease, Primary Headache Disorder, Stroke, Dementia, Demyelinating disease, Epileptic Seizure, Neuropathy and Vertigo. The percentage of FND cases with a documented diagnosis in the medical record was compared to that of other neurological disorders.

**Results:** Out of the 213 patient charts reviewed, FND was suspected in 37 (17%). The most common FND symptom was sensory (N=14), followed by motor (N=7). Of the 37 suspected cases, FND was documented with an ICD-10 code in 4 (11%). The most common documented presenting symptom of FND was Non-Epileptic Seizures (50%) and Functional Movement Disorders (50%). Most other suspected cases of FND were documented for general neurological symptoms. Comparatively, a diagnosis of Dementia had the highest concordance between suspected and documented (100%), and Parkinson's disease had the lowest (63%). There was a statistically significant difference in rates of documentation in FND compared to other neurological disorders ( $p < 0.001$ ).

**Conclusions:** The diagnosis of FND is frequently suspected but rarely documented. In comparison, other common neurological diagnoses are more reliably documented when suspected. This under-documentation in FND most likely reflects reluctance on the part of neurologists to take ownership of the diagnosis of FND. This bias may lead to inappropriate or insufficient care for this large patient population. Additionally, the discrepancy of clinical suspicion and documentation holds significant negative implications regarding the

accuracy of EMR-based clinical research. From our findings, identification of these patients will likely need to stem from clinician referral with targeted clinician education, rather than relying on EMR search methods. We suggest a clinical protocol for appropriate triage and treatment of patients once FND is suspected.

**References:** 1. Stone J, Carson A, Sharpe M. Functional symptoms and signs in neurology: assessment and diagnosis. *Journal of Neurology, Neurosurgery & Psychiatry* 2005;76:i2-i12. 2. Ahern L, Stone J, Sharpe M. Attitudes of neuroscience nurses toward patients with conversion symptoms. *Psychosomatics* 2009;50(4):336-9.

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### **Virtual Reality Delivered Mirror Visual Feedback for Functional Neurological Disorder**

*Kim Bullock, Andrea Won -Stevenson, Jeremy Bailenson (Stanford, CA, USA)*

**Objective:** 1. Test feasibility and safety of virtual reality delivered Mirror Visual Feedback (VR-MVF) for Functional Neurological Disorder (FND). 2. Explore efficacy of VR-MVF to improve symptoms and functioning in FND in a randomized controlled pilot.

**Background:** Evidence suggests that lasting cortical and symptom changes occur after MVF in various motor and sensory disorders.

No previous use of MVF for FND has been reported. We have developed an in-office MVF system delivered by VR to be tested in FND.

**Methods:** Subjects meeting criteria for FND were randomized to receive 8 sessions of VR-MVF or control in a single-blind fashion.

Treatment group received 5-20 minutes of a body tracking VR experience delivered by HTC-VIVE headset. Subjects visually inhabited an avatar which laterally swapped affected and unaffected limb movements. The control group received a similar but unembodied commercially available VR experience that reinforced attention. The primary and secondary outcome measures were symptom frequency and Oxford Handicap Scale, respectively. Analysis of estimated change over time using standard linear mixed effects modeling utilizing of all available cases and intention to treat principals will be used at final analysis.



**Results:** Preliminary descriptive findings of 11/30 subjects are presented. Current observations include 91% retention rate with one adverse event. One drop-out occurred at session 6 due to study exclusion criteria of pregnancy. A single adverse event occurred on 3rd session in which a control subject experienced a one week episode of increased symptom severity which remitted by session 5 two weeks later. There were no episodes of cybersickness. Acceptability reports were high by subjects and provider. A descriptive data comparison of pre and post primary and secondary outcome measures will be presented on completed subjects and suggests treatment likely beneficial. Quantitative analysis will be postponed until all 30 subjects complete the study.

**Conclusions:** Imaging suggests cortical hypoactivity and disconnection as possible targets for engagement in treating FND. MVF increases visual and somatosensory areas to resolve incongruence and enhances monitoring, leading to increases in attention and cognitive control which may benefit FND patients. In addition, MVF has been documented to increase excitability of ipsilateral primary motor cortex (M1) that projects to affected body parts leading to increased action control. MVF delivered thru VR allows customization and specificity of treatment that may be helpful for the heterogeneous presentations in FND. This study shows that use of VR-MVF is safe and feasible and its efficacy worth exploring for this ubiquitous yet understudied diagnosis.

**References:** 1. Deconinck FJ, Smorenburg AR, Benham A, Ledebt A, Feltham MG, Savelsbergh GJ. Neurorehabil Neural Repair. Reflections on mirror therapy: a systematic review of the effect of mirror visual feedback on the brain. 2015 May;29(4):349-61. doi: 10.1177/1545968314546134. Review. PMID: 251605672. 2. Edwards M. J. (2016) Neurobiological theories of functional neurologic disorders. In *Handbook of Clinical Neurology: Functional Neurologic Disorder* (pp. 131-138). Oxford, UK: ELSEVIER.

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**Botulinum Neurotoxin (BoNT) for treatment of functional (psychogenic) jerky movement disorders: a randomized placebo-controlled clinical trial**

*Yasmine Dreissen, Joke Dijk, Jeannette Gelauff, Evelien Zoons, Maria Fiorella Contarino, Rodi Steenbergen-Zutt, Bart Post, Daniel Van Poppelen, Alexander Munts, Johannes Speelman, Rob De Haan, Johannes Koelman, Marina De Koning-Tijssen (Amsterdam, Netherlands)*

**Objective:** to assess the effectiveness of botulinum neurotoxin (BoNT) in patients with functional jerky movement disorders

**Background:** At least 2–9% of patients seen in movement disorder clinics suffer from functional movement disorders and a substantial part has jerks. Botulinum neurotoxin (BoNT) has emerged as a useful therapy for several hyperkinetic movement disorders. Previous research and our own clinical experience suggest that treatment with BoNT is an effective therapy for jerky movements as well.

**Methods:** Forty-eight patients with invalidating functional jerky movement disorders, present for at least one year were included in a double-blind randomized placebo controlled of 16 weeks. The primary endpoint was reached patients showed minimal to major improvement (score 1,2 or 3) on the Clinical Global Impression (CGI)-scale. This was based on videotaped sessions, assessed by two investigators blinded to the allocated treatment. Hereafter all patients received BoNT treatment during one year in order to evaluate the long-term effect. Blinded assessment was repeated at the end.

**Results:** In the treatment group 16 of 25 (64%) patients reached the primary endpoint, opposed to 13 of 23 patients (57%) in the placebo group. No significant difference was detected. In the open-label follow-up phase 35 of 44 (80%) of patients improved (4 patients were lost to follow-up). Secondary outcome measures including psychiatric co-morbidity, disability and quality of life failed to reach significance for the trial phase (botulinum vs. placebo) as well as the follow-up compared to baseline.

**Conclusions:** Results show no significant effect of BoNT on functional (jerky) movement disorders. However the open label follow-up phase showed that the majority of patients improved on motor symptoms. (Netherlands Trial Registry 2478).

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**Treatment of four 14- year old girls with non-epileptic seizures (NES) in the same school where successful treatment of the index case had a significant impact on the others**

*Maria Hadji-Michael, Eve McAllister, Tara Murphy, Isobel Heyman (London, United Kingdom)*

**Objective:** Four young teenage classmates in the same school developed NES and were referred to a specialist service in a children's hospital. We report the impact of treatment of the index case which incorporated psychological therapy and seizure management.

**Background:** A cluster of similar NES in a group of girls all in the same class, suggests 'contagion'. We present case examples of each of the four children, specify the treatment model that was adopted in one case and the impact on the group.

**Methods:** The 14 year old girl who first developed NES was the first child referred, and following assessment and formulation, underwent treatment. Treatment incorporated identification and alleviation of any predisposing/precipitating factors, followed by rehabilitation and behavioural management strategies. Detailed education about NES and management advice to the school was a key intervention. Treatment goals included reduction in the frequency of NES at home and at school, to return to enjoyable activities and to become more independent. Achievement of individual treatment goals was monitored via weekly Goal Based Outcome measures (GBO's) as well as monitoring of severity and impairment caused by the NES weekly on a Likert scale.

**Results:** Following 15 sessions of individual and systemic cognitive behaviour therapy, including 6 school contacts (one of which was a school visit), her NES were almost fully resolved. Outcome data for NES frequency, GBO's and quality of life will be presented. NES frequency also reduced significantly from 40 a day to 1 a month. Even before individual treatment was commenced in the other 3 children, there were marked reductions in the numbers of NES reported by school in the other children. It was clear however that the other girls affected by NES had a range of other presenting concerns and or/history of medically unexplained symptoms (e. g. ADHD; Intellectual Disability; systemic issues) which subsequently required assessment and intervention.

**Conclusions:** Groups of children presenting with medically unexplained physical symptoms have been described over centuries –often previously call 'mass hysteria', and we propose that these 4 cases represent a small example of a similar phenomenon. As in historic cases, before the school were given accurate information on NES, they were concerned that there might be a toxin in the school environment contributing to the girls' illness. Encouragingly, effective treatment and environmental behavioural modification (school management advice) of an index case was effective in significantly reducing the severity of the additional cases. We discuss possible mechanisms and areas for future research and clinical practice.

**References:** Reilly, C. (2013). Psychogenic Nonepileptic Seizures in Children: A review. *Epilepsia*, 54: 1715-24Yadav (2015). Outcome of PNES in Children. *Epilepsy & Behaviour* 53: 168 – 173.

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**Diagnosing psychogenic nonepileptic seizures: video-EEG monitoring, suggestive seizure induction and diagnostic certainty**

*Stoyan Popkirov, Johannes Jungilligens, Wenke Grönheit, Jörg Wellmer (Bochum, Germany)*

**Objective:** Psychogenic nonepileptic seizures (PNES) can remain undiagnosed for many years, leading to unnecessary medication and delayed treatment. A recent report by the International League Against Epilepsy Nonepileptic Seizures Task Force recommends a staged approach to the diagnosis of PNES (La France, et al., 2013). We aimed to investigate its practical utility, and to apply the proposed classification to evaluate the role of long-term video-EEG monitoring (VEEG) and suggestive seizure induction (SSI) in PNES workup.

**Background:** Recording a habitual event on video and EEG is the gold standard in terms of diagnostic certainty. In epilepsy centers this is usually achieved during long-term video-EEG monitoring (VEEG); additionally, or alternatively, suggestive seizure induction (SSI) during video-EEG recording can be utilized.

**Methods:** Using electronic medical records, 122 inpatients (mean age 36. 0±12. 9 years; 68% women) who received the diagnosis of PNES at our epilepsy center during a 4. 3-year time period were included and analyzed.

**Results:** There was an 82.8% agreement between diagnostic certainty documented at discharge and that assigned retroactively using the Task Force recommendations. Both VEEG and SSI were effective at supporting high level diagnostic certainty. Interestingly, about one in four patients (26.2%) had a non-diagnostic (“negative”) VEEG but a positive SSI. On average, this subgroup did not have significantly shorter mean VEEG recording times than VEEG-positive patients. However, VEEG-negative/SSI-positive patients had a significantly lower habitual seizure frequency than their counterparts.

**Conclusions:** In a minority of cases, having used the Task Force criteria could have encouraged the clinicians to give more certain diagnoses, exemplifying the Task Force report’s utility. Furthermore, our findings emphasize the utility of SSI in ascertaining the diagnosis of PNES in patients who do not have a spontaneous habitual event during VEEG due to, for example, low seizure frequency.

**References:** LaFrance WC Jr, Baker GA, Duncan R, Goldstein LH, Reuber M. Minimum requirements for the diagnosis of psychogenic nonepileptic seizures: a staged approach: a report from the International League Against Epilepsy Nonepileptic Seizures Task Force. *Epilepsia* 2013;54(11):2005-18.

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#### **Outcome data from a functional seizure psychology service**

*Tammy Walker (Nottingham, United Kingdom)*

**Objective:** Specialist treatment services for patients with functional seizures are rare. In the East Midlands, a clinical psychology service has been treating patients for three years. The clinical and financial outcome data for the service is reviewed.

**Background:** Functional seizures are difficult to treat and are associated with high healthcare utilisation (Reuber et al. , 2005). There are no recommended treatments although referral to a psychologist or psychiatrist is considered best practice (NICE, 2012).

**Methods:** This descriptive paper presents clinical and financial data from the first three years of operation. Clinical data is routinely collected in the service in the form of pre- to post-treatment questionnaires and a qualitative patient feedback form. Measures assess psychological distress, functional impairment, dissociative experiences, seizure frequency and severity, healthcare utilisation, and quality of life. As part of a business case to support the recurrent commissioning of the service, healthcare utilisation data was used to calculate the cost-savings from this service in the form of reduced A&E attendance, hospital admissions, ambulance call-outs, medication use and neurology follow-up pre- to post-treatment.

**Results:** The clinical outcome measures demonstrate a good outcome for patients. This is reflected in improvement across all measures and positive qualitative feedback provided by patients about their experience of the service. Cost savings to the NHS of commissioning the service were calculated to be £93,000 per annum. Over five years, with a conservative projected reduction in treatment efficacy (50%), there was a cumulative cost-saving of up to £750,000 to commissions. Factoring in the cost of providing the service, the net return to the commissioners was projected to be £415,000.

**Conclusions:** Psychological treatment services for patients diagnosed with functional seizures are clinically and financially effective. There is a clinical and financial case of need to commission more local psychological treatment services for patients with functional seizures.

**References:** NICE (2012). *Epilepsies: diagnosis and management*.

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#### **Multidisciplinary Treatment and Outcome Registry Collaboration for Dystonia and Functional Movement Disorders**

*Alyssa Elder, Julie Hershberg, Allie Southam, Sarah Patejak, Arik Johnson, Allan Wu (Los Angeles, CA, USA)*

**Objective:** To describe interdisciplinary longitudinal interventions for patients with dystonia and functional movement disorders (FMD). We highlight our physical therapy (PT) and neurology collaboration and describe an illustrative FMD case study.

**Background:** FMD and dystonia have variable phenotypes and treatment options. In both, interdisciplinary team-based care is often acknowledged, yet understudied. Detailed knowledge of combined longitudinal PT and neurologic interventions in FMD is limited.

**Methods:** An observational registry was developed with detailed interventions and functional outcomes for individuals with dystonia and FMD who are seen at a neurology-focused community PT practice (re+active) and an academic movement disorders clinic (UCLA). The registry uses REDCap to capture all neurologic and PT interventions with concurrent standardized outcomes. Our initial pilot required integration of our outcome measure, the Patient-Specific Functional Scale (PSFS) scale, into both clinic workflows and the development of a comprehensive classification of PT methods with an emphasis on the learning-based sensorimotor re-training approach.

**Results:** Our REDCap database is in pilot phase testing. Neurology clinic visits record medications, in-office procedures, referrals made, and education. PT visits record movement interventions, activity/functional training, sensorimotor re-training, modalities, manual therapy and education. Our primary outcome measure of interest, collected at all neurology and PT visits, is the Patient Specific Functional Scale (PSFS)(Stratford 1995). The PSFS is a self reported measure of disability for patient-chosen activities that are affected by their condition. While our current phase 1 is an observational registry, phase 2 will add research scales. We provide an illustrative example of a patient with FMD who was seen by both clinics with improvement.

**Conclusions:** We are establishing a longitudinal observational registry to collect uniform data about multidisciplinary therapies that patients with dystonia and FMDs receive along with concurrent functional outcome assessments. We plan to provide summary and descriptive statistics, related to therapies (medical, procedures, and physical therapy) in order to address questions such as what range or combination of therapies will be most beneficial for a patient with a particular presentation. We plan to illustrate our longitudinal registry with advantages of ease of use and integration into standard clinical practice without additional resources. Results will inform design of future multidisciplinary treatment combinations to maximize outcomes.

**References:** Stratford, P. (1995). "Assessing disability and change on individual patients: a report of a patient specific measure." *Physiotherapy Canada* 47(4): 258-263.

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**Neuropsychiatric Factors Linked to Adherence and Short-Term Prognosis in a US Functional Neurological Disorders Clinic: a Retrospective Cohort Study**

*Sean Glass, Nassim Matin, Benjamin Williams, Julie Mello, Christopher Stephen, Sigrid Young, Janet Callahan, W. Curt LaFrance, David Perez (Boston, USA)*

**Objective:** To retrospectively investigate neuropsychiatric and psychosocial factors associated with treatment adherence and prognosis in 100 patients with functional neurological disorder (FND) evaluated in a tertiary care specialized FND Clinic.

**Background:** Advancements in the clinical assessment and management of FND have established a new standard of care which includes delivery of a positive "rule-in" diagnosis and important therapeutic roles for physical therapy and cognitive behavioral therapy.

**Methods:** We reviewed the medical records for 100 consecutive patients (79 women, 21 men; age=39.6±12.4) evaluated in our FND clinic with suspected functional motor symptoms. Diagnoses included psychogenic nonepileptic seizures (N=51), functional weakness (N=41), and functional movement disorders (N=38); 28 out of 100 patients had mixed motor symptoms. Dichotomized outcome variables included missing at least one follow-up visit, improvement at 7 months, and treatment adherence. Prognostic classifications were based on the composite measure of clinician assessment and patient self-report at the 7-month follow-up visit in comparison to the initial visit. Analyses employed univariate screenings ( $p=0.05$ ) followed by multivariate logistic regression.

**Results:** 32 of 99 patients invited to follow-up had a no-show visit. In univariate analyses only, functional weakness correlated with having a no-show, while current generalized anxiety disorder or baseline antidepressant use inversely correlated with missing a visit. In 81 patients with follow-up visits, 33 (41%) reported improvement at 7 months; 36 patients (44%) were unchanged. Improvement positively correlated with white race (odds ratio (OR)=4.1,  $p=0.03$ ) and inversely correlated with having chronic pain (OR=0.2,  $p=0.02$ ). In the 50 patients newly referred for treatments, 18 (36%) were fully adherent. Adherence correlated with improvement (OR=13.7,  $p=0.003$ ) and inversely correlated with having a baseline abnormal brain scan (OR=0.3;  $p=0.04$ ).

**Conclusions:** This retrospective cohort study offers preliminary insights into neuropsychiatric and psychosocial factors linked to early treatment adherence and prognosis within a specialized FND clinic employing an optimized standard of care approach. Our findings suggest that socio-economic factors closely tied to race and the co-occurrence of chronic pain disorders are variables that may potentially influence prognosis in patients with FND. The findings of this study require replication and further clarification with prospective quantitative data collection. This study also supports the feasibility of integrating clinical and research efforts across the spectrum of motor functional neurological symptoms.

**References:** 1. Matin N, Young SS, Williams B, et al. (2017) Neuropsychiatric Associations With Gender, Illness Duration, Work Disability, and Motor Subtype in a U. S. Functional Neurological Disorders Clinic Population. *J Neuropsychiatry Clin Neurosci*. [Epub ahead of print]. 2. Perez DL, Young SS, King JN, et al. (2016) Preliminary Predictors of Initial Attendance, Symptom Burden, and Motor Subtype in a US Functional Neurological Disorders Clinic Population. *Cogn Behav Neurol* 29(4):197-205.

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**Outcomes of functional neurological disorder patients requiring physiotherapy and neuropsychology**

*Dharsha Navaratnam, Alexander Downie, Megan Broughton, Rian Dob, Alexander Lehn (Brisbane, QLD, Australia)*

**Objective:** To explore patient demographics and outcomes for a functional neurological disorder (FND) outpatient cohort requiring both physiotherapy and neuropsychology over a 1-year time period.

**Background:** Patients attended a multidisciplinary FND clinic in Australia. After initial diagnosis by the neurologist, they are referred to either physiotherapy, neuropsychology (CBT) or both based on symptom complexity.

**Methods:** FND outpatients who commenced both physiotherapy and neuropsychology treatment in 2016 were included (N=22, of which 8 males). All patients completed physiotherapy treatment, however 15 had ongoing psychology input in 2017. The mean age was 40.95 years (range: 20-67). Data were reviewed by means of a retrospective audit of physiotherapy and neuropsychology records. Reporting of patient outcomes and patient demographics were based on calculating chi square and descriptive statistics. Outcome, including symptom improvement, increased participation, and distress reduction, were measured with standardised physiotherapy tools and changes reported by patients.

**Results:** Patients received an average of 6.91 physiotherapy sessions. The average number of psychology sessions per patient who completed treatment ( $n=7$ ) was 5.43. Six patients had dissociative attacks, six had limb motor disturbances only, eight had a combination of symptoms (including fatigue and pain). Nine patients had childhood risk factors (n.s.), eight had histories of significant mental health diagnoses (n.s.), 16 had current comorbid mental health diagnoses ( $p < .05$ ). More patients accepted the diagnosis than not (77%;  $p < .05$ ). Similarly, more patients had both subject and objective symptom improvement and distress reduction than not (72%;  $p < .05$ ).

**Conclusions:** Complex FND patients receiving both physiotherapy and neuropsychology demonstrate improvements in distress reduction, subjective reporting of symptoms and objective physiotherapy outcome measures. Due to the incidence of psychological factors, neuropsychology require greater duration with some patients compared to physiotherapy. The small sample size of the current study limits its ability to comment on factors related to outcome or prognosis more specifically. However, this retrospective audit has identified that treatment of FND by a multidisciplinary team is effective and has informed future data collection.

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**Outcomes of a Time Limited Physiotherapy Service within a Dedicated Functional Neurological Disorder Clinic**

*Dharsha Navaratnam, Anthea Goslin, John Fitzgerald (Brisbane, QLD, Australia)*

**Objective:** The objective of this audit was to report on the outcomes of a three month time limited outpatient physiotherapy service provided within a dedicated functional neurological disorders (FND) clinic.

**Background:** A holistic approach is needed to manage the multifactorial nature of FND. A time limited outpatient physiotherapy service was established to manage patient throughput in a multidisciplinary team and facilitate long term self-management for patients.

**Methods:** Over an 18 month period, all 47 patients (51% of patients seen at the clinic) who had completed their outpatient physiotherapy were included in this audit. All referrals were made by the specialist neurologist. Patient outcomes were defined as positive, neutral and negative based on evaluating patients' progress with physiotherapy assessment tools. Physiotherapy outcome measures used included BERG balance scale, ten metre walk test and the timed up and go test. Using descriptive statistics, patient throughput and clinical audit results were analysed.

**Results:** 51. 2% of patients were seen within the proposed timeframe. Mean treatment duration was seven sessions over 14 weeks. The "did-not-attend" rate was 8%. Based on a summary of outcome measure results, 67% of patients audited were determined as achieving positive outcomes, 18% as neutral and 15% as having a negative outcome. Prognosticating factors leading to negative physiotherapy outcomes were poor patient understanding of their diagnosis and extensive psychiatric illness. Enablers for positive patient outcomes include collaboration between a skilled team of health professionals, access to neuropsychology and good patient understanding of their diagnosis.

**Conclusions:** Physiotherapy has a key role in the holistic management of functional neurological disorders. Positive physiotherapy outcomes can be achieved through a time limited outpatient physiotherapy program focused on promoting self-management of FND symptoms. Although not all patients were seen strictly within three months, the mean number of sessions and weeks of treatment provided reflected that the time limited model is both effective and feasible.

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### Survey of Perceptions of Health Practitioners regarding Functional Neurological Disorders (FND)

*Joanne Bullock-Saxton, Peter Newcombe, Jon Stone, Alan Carson, Alexander Lehn (South Brisbane, QLD, Australia)*

**Objective:** This survey seeks to clarify perceptions of Australian health carers who come in contact with FND clients. As a result, we hope to understand, then later develop, specific and appropriate educational resources for the management of patients with FND

**Background:** FND is common in neurological, general and allied health practice and the second most common reason for referral to neurology. Diagnosis and management are often poorly understood by clinicians<sup>1,2</sup>.

**Methods:** 2 FND experts created a questionnaire tapping into perceptions of FND which was then reviewed by our expert British Co-investigators to assure content and face validity. 538 professionals participated (Mage=43 yrs, SD = 12; 399 ? :74%) practicing in Neurology (n=79), Psychiatry (n=35), Psychology (n=81), General Practice (n=60), Physiotherapy (n=195) and Nursing (n=70). They were invited to participate via email, social media or professional association e-newsletter. The survey also included demographic and professional experience questions. The items relating to FND (eg "I enjoy working with patients who have functional neurological symptoms") were responded to on a 5-point Likert scale from 1="Strongly agree" to 5="Strongly disagree".

**Results:** Participants practiced a (x) ~ 3. 5 yrs & annually saw 2. 8 FND patients. Factor analyses revealed 4 factors with strong internal consistency (knowledge/training, negative attitude clinical interest, communication confidence) & 2 borderline (peer referral, negative experience). Gender differences were found; ? reporting less knowledge/training and confidence in communication but greater clinical interest and fewer negative experiences than ?. Neurologists reported greater knowledge/training than all others; Psychiatrists reported greater communication confidence than all others (except Neurologists); GPs and Neurologists reported less clinical interest than all others; and Nurses and GP's reported greater negative attitude than all others.

**Conclusions:** Several interesting cross professional differences were highlighted by this study. While Neurologists for example reported good knowledge regarding FND they are often not comfortable explaining the diagnosis to patients. Psychiatrists on the other hand are generally confident with communicating but might struggle with making the diagnosis. Most participants reported having received inadequate education about FND. The information provided by this study will inform the development of specific and appropriate educational resources for different professional groups according to their needs to assist the management of patients with FND, with a hope that across the country we can improve the comprehensive care and outcomes.

**References:** Edwards, M. J., Stone, J. , & Nielsen, G. (2012). Physiotherapists and patients with functional (psychogenic) motor symptoms: a survey of attitudes and interest. *Journal of Neurology, Neurosurgery, and Psychiatry*, 83(6), 655–658. <http://doi.org/10.1136/jnnp-2011-302147> Carson, A. J., Stone, J., Warlow, C., & Sharpe, M. (2004). Patients whom neurologists find difficult to help. *Journal of Neurology, Neurosurgery, and Psychiatry*, 75(12), 1776–1778. <http://doi.org/10.1136/jnnp.2003.032169>

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### Development of a novel method of "explanation as treatment" with neuropsychological assessment and debriefing (NAD) for functional movement disorders (FMD)

*Hiral Shah, Jason Krellman, Stephanie Assuras (New York, NY, USA)*

**Objective:** To develop a NAD method based on principles of motivational interviewing (emphasizing non-judgmental education, effective communication, and shared-decision making), in individuals with FMD, and determine the effect of this method on disability, distress and healthcare utilization.

**Background:** Functional movement disorders are chronic, disabling, and associated with high rates of healthcare system utilization due to lack of diagnosis and treatment adherence. Patient acceptance and confidence in the diagnosis is integral to facilitate treatment compliance. Neuropsychologists evaluate both cognitive/neurological and psychological symptoms and are therefore uniquely positioned to assess FMD. Using cognitive assessment tools, performance and symptom validity tools, and mood and personality measures, they can provide additional data and comprehensive feedback about the findings to assist in diagnosis.

**Methods:** We plan to recruit 25 participants ages 18-65 with a diagnosis of FMD. The participants will be randomized to NAD group and neurological debriefing (standard neurological care). The NAD debriefing session will be conducted in accordance with the principles of motivational interviewing (MI) including a review of NA data and treatment recommendations (e. g. CBT). At the debriefing and a 3-month follow-up, questionnaires assessing perceived disability, diagnostic consensus, and healthcare utilization will be completed. Group comparisons will be made based on these outcome measures. Multivariate multiple regressions will be conducted to determine participant characteristics (e. g. , PAI scores) that predict outcomes (e. g. , degree of healthcare utilization) at 3 -month follow-up.

**Results: Conclusions:** We hypothesize that assessment and debriefing of individuals with FMD by a NAD, including appropriate explanation about diagnosis and treatment recommendations conveyed in a novel, structured feedback session with follow-up, will lead to improved acceptance of the diagnosis and engagement with treatment. We also offer that this will result in increased treatment compliance and decreases in functional disability, distress, and healthcare utilization.

**References:** Stone, J., A. Carson, and M. Hallett, Explanation as treatment for functional neurologic disorders. *Handb Clin Neurol*, 2017. 139: p. 543-553. Friedman, J. H. and W. C. LaFrance, Jr., Psychogenic disorders: the need to speak plainly. *Arch Neurol*, 2010. 67(6): p. 753-5.

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### **Risk Stratification for individuals with functional movement disorders (FMD)**

*Hiral Shah, Jason Krellman, Stephanie Assuras (New York, NY, USA)*

**Objective:** To identify participant characteristics assessed on neuropsychological evaluation that are predictive of outcomes (functional and psychological distress, compliance, healthcare utilization).

**Background:** FMD are disabling and associated with high rates of healthcare system utilization. The management of FMD typically includes the use of cognitive behavioral therapy and physiotherapy. However, little evidence exists to guide specific treatment recommendations regarding the intensity and duration of treatment. Comprehensive neuropsychological assessment conducted with principles of motivational interviewing (including cognitive assessment, performance and symptom validity tools, and mood and personality measures), offers an opportunity to identify patient specific characteristics that could predict patient acceptance of diagnosis and adherence to treatment plan.

**Methods:** We plan to recruit 25 participants ages 18-65 with a diagnosis of FMD. All participants will undergo a neuropsychological evaluation. At the assessment and a 3-month follow-up questionnaires assessing perceived disability, diagnostic consensus, and healthcare utilization will be completed. Multivariate multiple regressions will be conducted to determine participant characteristics (e. g. , PAI scores, number of systems involved, years of symptom report) that predict outcomes (e. g. , degree of healthcare utilization and adherence to treatment plan) at 3 -month follow-up.

**Conclusions:** We hypothesize that assessment of individuals with FMD by a comprehensive neuropsychological evaluation will allow for identification of patient-specific characteristics predictive of functional outcomes. Further, identification of patient characteristics on neuropsychological assessment that are predictive of outcomes will allow for risk-stratification of patients and tailoring appropriate duration and intensity of treatment.

**References:** (1) Stone, J., A. Carson, and M. Hallett, Explanation as treatment for functional neurologic disorders. *Handb Clin Neurol*, 2017. 139: p. 543-553. (2) Friedman, J. H. and W. C. LaFrance, Jr., Psychogenic disorders: the need to speak plainly. *Arch Neurol*, 2010. 67(6): p. 753-5.

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### **Eye Movement Desensitisation and Reprocessing (EMDR) as a clinical intervention in the treatment of dissociative seizures**

*Abrar Hussain (Bracknell, Berkshire, United Kingdom)*

**Objective:** Case report

**Background:** Dissociative seizures (non-epileptic attacks) can arise in the context of traumatic situations. EMDR is a trauma based intervention with good evidence in PTSD but there is little evidence for its use in dissociative seizures.

**Methods:** This case study portrays the effective use of EMDR in a young male patient with dissociative seizures. A complete resolution in the symptoms was achieved at the end of treatment and the reduction in symptom burden improved the patient's quality of life. The main outcome measures used in this case (PHQ9, GAD7, PHQ15 and IES-R) demonstrate the effectiveness of EMDR.

**Results:** At the end of EMDR treatment, the patient recovered fully and had no dissociative seizures.

**Conclusions:** EMDR is a clinical intervention that can be used to treat dissociative seizures. More research in the form of clinical trials is needed to establish its use.

**References:** Baslet G. Psychogenic nonepileptic seizures: a treatment review. What have we learned since the beginning of the millennium? *Neuropsychiatric Disease and Treatment*. 2012;8:585-598.

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### **Healthcare professionals' experiences of providing inpatient care for patients with functional neurological symptoms: Interdisciplinary focus group interviews**

*Guðbjörg Andrésdóttir, Aldís Hauksdóttir, Þórdís Hjartardóttir, Helga Jónsdóttir, Marianne Klinke (Reykjavík, Iceland)*

**Objective:** To explore how the interdisciplinary team of healthcare professionals experience facilitators and barriers in the rehabilitation of adult patients with functional neurological disorder.

**Background:** Functional neurological symptoms are present in approximately one out of 10-15 neurological inpatients at each time. Although teamwork has been identified as one of the core aspects for successful rehabilitation, no study has scrutinized the challenges that the interdisciplinary team are confronted with.

**Methods:** A total of 18 healthcare professionals who had clinical experience in caring for patients with functional disorders participated in qualitative focus group interviews. They represented the following professions; nursing, occupational therapy, physicians specialized in neurology, physiotherapy, and neuropsychology. A total of three focus group interviews were conducted. Data were analyzed using qualitative content analysis.

**Results:** Participants had experienced many challenges when organizing the care of patients with functional neurological symptoms. Knowledge and stigma were critical issues to address. Participants identified viable solutions that could be implemented to counterbalance challenges in clinical care. Three particularly important timepoints were identified (a) the time of diagnosis, (b) planning

of interventions, and (c) discharge and follow-up. Coherence in care was the main feature to enable connection of the critical timepoints in the process of care and rehabilitation.

**Conclusions:** Findings underscore existing interdisciplinary challenges and provide detailed examples of how these can be counterbalanced in a feasible way. Knowledge that has been gained provides new information on how to optimize care for patients with functional neurological disorders and how to better support interdisciplinary healthcare professionals in care and rehabilitation.

### 324 **Functional disorder in the Department of Neurology in the National University hospital of Iceland in 2014-2015 and Physiotherapists' knowledge of the disorder**

*Guðbjörg Andrésdóttir, Agnes Snorradóttir, Freyja Barkardóttir, Þjóðbjörg Guðjónsdóttir (Reykjavík, Iceland)*

**Objective:** 1) Explore the prevalence and symptoms of patients with FND in the Department of Neurology (ND), at the National University Hospital of Iceland in 2014-15, 2) examine the referral of patients to physiotherapy, and 3) evaluate PTs' perceived knowledge of FND.

**Background:** Physiotherapy is an important treatment option for patients with Functional Neurological Disorders (FND). In Iceland little knowledge exists with regard to the prevalence, symptoms, and treatment options for patients with FND. Also Physiotherapists' (PT) knowledge of FND remains unexplored.

**Methods:** Data on prevalence and characteristics of patients were collected retrospectively from electronic medical records. A 11 item questionnaire on perceived knowledge of FND was sent to members of the Icelandic Physiotherapy Association.

**Results:** 1) In 2014-15, the number of patients with symptoms of FND were 122. Less than half had an ICD-10 diagnosis of the disorder. Significantly more patients were diagnosed in 2015 than in 2014 ( $p=0.0038$ ). Average age was 43 years, 81.1% were women. Limb weakness and sensory symptoms were the most common manifestations, 37% had a neurological- and 9.0% a psychiatric comorbid condition. 2) More than half of the patients were referred to physiotherapy after hospitalization regardless of the nature of the symptoms. Out of those 68% were referred to a long-term rehabilitation. 3) The response rate of the questionnaire was 47% ( $n=270$ ). Approximately 80% of PTs' reported having little/medium knowledge of FND. It was more likely that PTs' believed they had good knowledge if they had treated more patients with FND ( $p<0.001$ ) and worked within the field of neurology ( $p<0.001$ ).

**Conclusions:** FND is a common disorder in the ND. Physiotherapy is the leading treatment option used. Results underscore the importance of improving education of PTs' and optimizing documentation of FND in the medical records.

### 325 **Lessons from Constraint-Induced Therapy (CI therapy) for Rehabilitating Behaviorally-Maintained Motor Deficits**

*Victor Mark, Edward Taub, David Morris, Gitendra Uswatte (Birmingham, AL, USA)*

**Objective:** 1) Provide a model for the origin and measurement of learned non-use (LNU) in paretic neurological disorders. 2) Detail how CI therapy can improve LNU. 3) Indicate how CI therapy techniques can benefit Functional Movement Disorders (FMD).

**Background:** Taub first observed LNU in experimental animals, then patients: inhibited paretic limb use despite movement capability. LNU is behaviorally conditioned, not improved by standard physical therapy. CI therapy has controlled evidence of overcoming LNU.

**Methods:** LNU develops from compensating actions by less-affected parts of the body or caregivers when patients experience inadequate movement with the more-affected body part for daily living activities. Persisting compensation, in turn, behaviorally inhibits recovery from LNU in customary care, despite retained movement capability. CI therapy prescribes 1) massed practice of more-affected limb (3 h/day, 10-15 consecutive weekdays), 2) training by shaping of movement with praise at each stage, 3) constraint of compensatory movements, and 4) behavioral techniques to transfer gains from clinic to the real world, including behavioral contracting, systematic daily problem-solving on answers to a validated structured interview, the Motor Activity Log.

**Results:** Over 30 years of trials at our lab at the University of Alabama at Birmingham (under direction of Edward Taub, PhD), CI therapy Effect Sizes ( $d'$ ) for stroke, multiple sclerosis, TBI, cerebral palsy, and spinal cord injury have ranged 1.5-3.3, based on Motor Activity Logs measuring spontaneous limb use in real world conditions. Results also indicate reduced depression symptoms. Other forms of treatment, including attenuated versions of CI therapy, were not as successful, despite patients' similar expectancy to benefit. Outcomes have been replicated internationally from numerous other labs. Treatment gains have been retained for years following initial treatment.

**Conclusions:** CI therapy is a carefully controlled rehabilitation that improves spontaneous real-world limb use, self-efficacy for activity, and depression following chronic behaviorally maintained LNU. Published physical rehabilitation trials for FMD have used similar techniques (behavioral contracting, shaping, problem-solving discussions), but without the full complement of CI therapy procedures or systematic measurement of real-world limb use on validated scales. With modest adaptation, CI therapy procedures could enduringly benefit FMD. We have moreover outlined adapting CI therapy for other neurological deficits (perceptual disorders, speech disorders), which may similarly apply to non-motor functional neurological disorders.

**References:** • Taub E, Uswatte G, Mark VW, Morris DM. The learned nonuse phenomenon: implications for rehabilitation. *Eura Medicophys* 2006;42:241-255. Taub E, Mark VW, Uswatte G. Implications of CI therapy for visual deficit training. *Front Integr Neurosci* 2014;8:78.

### 326 **Service Evaluation of a Functional Neurological Disorder Team in the Highlands of Scotland**

*Heather Ireland, Emma Burton (Inverness, United Kingdom)*

**Objective:** Evaluation of a Functional Neurological (FN) Team covering remote and rural areas in the North of Scotland, comparing team activity with Scottish recommendations for 'stepped' care for people with FN symptoms (Healthcare Improvement Scotland, 2012).

**Background:** Prompted by patient feedback, and staff recognition of challenges, a Multi-professional team of working with Functional

Neurological Disorder was formed in 2015, within NHS Highland. The team are keen to examine and reflect on their practice.

**Methods:** We used two data collection methods; an Audit form to collect information from electronically held correspondence, and staff feedback invited by email from members of the multi-professional team. Anonymised age, gender, area of referral, time to diagnosis, step of care, professionals involved, and interventions recommended were recorded for patients on the team caseload. Anonymised staff responses on profession, step of care delivered, interventions offered, average number of sessions, advantages and disadvantages of team working, impact on patient care and changes in practice were received. 36 patient records and 14 staff responses were examined. Results were shared with the team, and further work to develop action points is planned.

**Results:** The caseload was 30% male, 70% female, 52% were aged between 40 and 60 years of age, with urban and rural populations represented. 52% were diagnosed with FN symptoms within 6 months of contact, 30% at first contact. 5% were step 1, 47.5% step 2, 47.5% step 3. The number of professionals involved, including other specialities ranges from 1 to 14. The team includes Neurology, Rehabilitation Medicine, Physiotherapy, Occupational Therapy, Speech and Language Therapy, Psychiatry, and Psychology, offering physical, pharmacological and psychological interventions, over six or more sessions. Most staff work within steps 2 and 3. All saw advantages to this way of working, felt that patient care had been improved and described changes in practice.

**Conclusions:** The Scottish Neurological Symptoms Study (Carson & Sharpe, 2005) found FN patients to be younger and likely to be female. More of our patients were female, but in older age groups. Only 5% of our patients are seen as suitable for step one input. Feedback from staff identifies better 'in team' communication and use of resources, but some patients are also investigated in other specialities for symptoms which might also be functional, with impact on resource and patient experience. The Stepped Care approach (Healthcare Improvement Scotland, 2012) suggests structured psychological intervention at step 2, not currently available in Highland. Staff identify a desire to increase psychological skills across the team, but no new resource for developments.

**References:** Carson, A. & Sharpe, M., 2005. Scottish Neurological Symptoms Study, Edinburgh: Quality Improvement Scotland. Healthcare Improvement Scotland, 2012. Stepped care for Functional Neurological Symptoms, A new approach to improving outcomes for a common neurological problem in Scotland, Edinburgh/Glasgow: NHS Scotland.

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### **Functional neurological symptoms: Piloting a group protocol**

*Nicole Scheiner, Amanda Agyare (Watford, United Kingdom)*

**Objective:** To evaluate an innovative group intervention both to enhance functioning and quality of life, and to reduce symptomatology, inappropriate procedures and unscheduled out-patient appointment in adults with chronic functional somatoform presentations.

**Background:** Patients and consultants report incompatible aetiological understandings of symptoms, resulting in mutual frustration. In contrast, the group treatment, underpinned by biopsychosocialspiritual models, focused on alleviating symptom distress.

**Methods:** Referrals to the new Service were accepted from Acute General Hospital consultants. Impaired functioning in two or more body systems, (for example, neurological and gastroenterological or respiratory disturbances), favoured a treatment protocol based on 'lumping' (not 'splitting') principles. An extensive individual assessment determined eligibility for inclusion in the group. A tri-phase intervention was offered over sixteen weekly 90 minutes sessions. Psycho-education about stress, sleep, exercise, nutrition, and motivation, preceded behavioural interventions targeting attention switching, and goal identification and practice. Enhancing emotional regulation skills integrated all three phases. Between-session tasks consolidated learning.

**Results:** Pre-and post group self-report instruments yielded base-line and outcome measures; healthcare utilisation was provided both by consultants and GPs. Quality of life and mental well-being scales were completed each session. A cross-sectional retrospective analysis indicated a reduction in symptom severity, improved quality of life (independent of symptom reduction), and a decrease in emotional distress (anxiety and depression). Audit of medical appointments during the 12 months prior to referral showed statistically and clinically significant cost-savings; improvements were maintained at 3 month follow-up. Patients with moderate learning disabilities benefitted from the protocol; narcissistic presentations impeded progress.

**Conclusions:** The experience of offering the group intervention highlighted the complexity of chronic functional presentations, and the inadvisability of assigning causality to any specific process, including genetic heritability, childhood experiences, stress diathesis, life experiences, or environmental pressures. A multi-disciplinary approach addressing physiological, cognitive, affective and behavioural processes helped reduce stigma and foster recovery. Referrers and patients reported satisfaction with the intervention. Patients with moderate learning difficulties benefitted from the treatment; Narcissistic patients made few gains. Early results indicate that the pilot protocol is a low-cost intervention per quality-adjusted life year (QALY).

**References:** Bass C, & Pearce, S (2016) Severe and enduring somatoform disorders: recognition and management. *BJPsych Advances*, 22:87-96. Wessely S, Nimnuan C, Sharpe M, (1999) Functional somatic symptoms: one or many? *Lancet*, 354 (9182): 936-0.

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### **Two studies of inpatient rehabilitation outcomes for patients with functional neurological disorders (FND)**

*Philip Yates, Timothy Harrower, Elizabeth Parry, Jac Dendle (Devon, United Kingdom)*

**Objective:** To compare the differences in clinical outcomes of patients with functional neurological disorders and those who have organic neurological disorders in an inpatient neurological rehabilitation service.

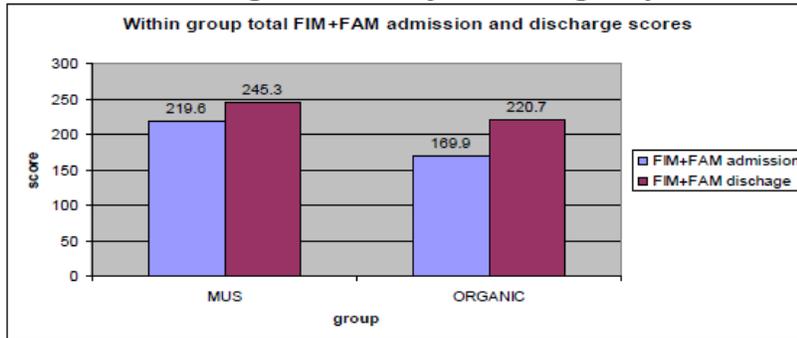
**Background:** The significant number of patients presenting with FND in outpatient clinics and the acute neurology ward led to a care pathway and service development involving an inpatient neuro-rehabilitation service and a community neuropsychology FND service.

**Methods:** Patients with FND are referred for a 4 week (average length of admission) inpatient assessment of rehabilitation potential with a multi-disciplinary team alongside those who receive standard inpatient rehabilitation over 12 weeks (average length of admission). Two studies were carried out over subsequent time points examining the outcomes in functional independence on admission and discharge scores for organic patient groups compared with a functional neurological disorder group. Measures: UK FIM-FAM (study one and two) and the Rehabilitation Complexity Scale (study two).

**Results:** Study One: The FND group (n=18) the organic brain injury group (n=29) both achieved significantly higher overall FIM+FAM

scores at discharge (Fig. 1). [Figure one]. The mobility and home management domains revealed the most measurable change. Study Two: All patient groups (FND, n=9; progressive neurological, n= 17 ; non-progressive neurological, n= 57) had significantly lower scores on the RCS at discharge compared to admission (Fig. 2). [Figure two]. The FND and non-progressive groups, but not those with progressive disorders, had significantly improved FIM-FAM scores at discharge compared to admission in mobility and psychological domains (Figs. 3-5). [Figures 3-5]

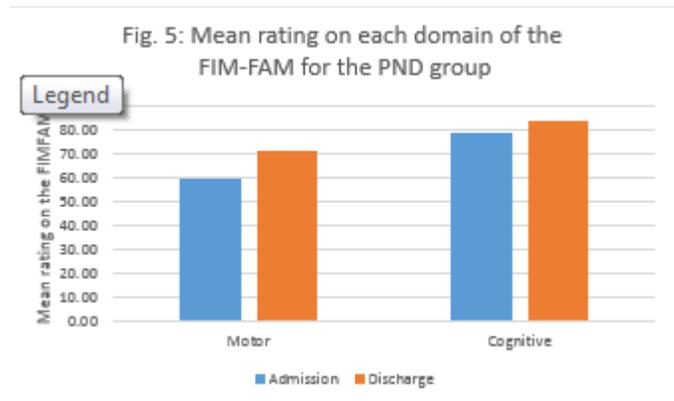
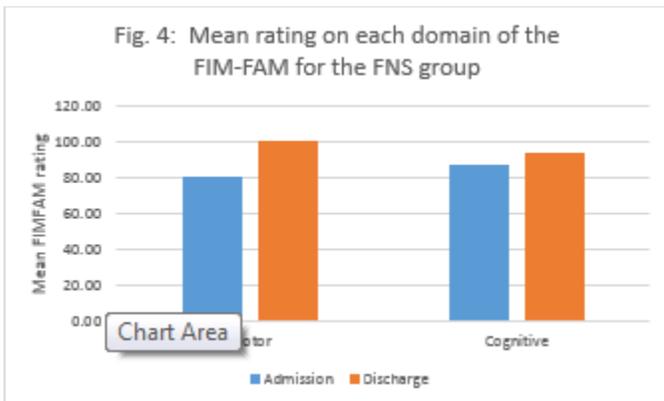
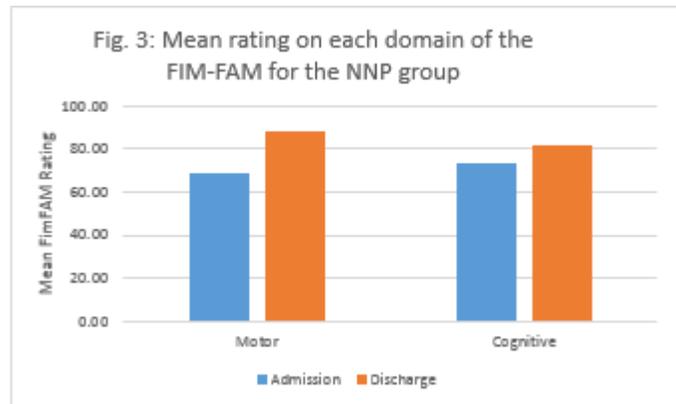
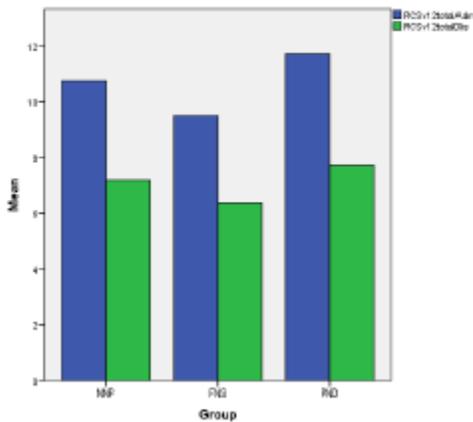
**Fig. 1 Within group FIM-FAM total admission and discharge scores by clinical group**



• MUS group and Organic brain injury group show significant admission-discharge improvement for total FIM+FAM scores.

Note: Sig. level is .05

**Figure 2: Mean total RCS scores at admission and discharge by clinical group**



**Conclusions:** Both studies indicated that the inpatient rehabilitation pathway significantly improves the overall functioning of service

users with FND, particularly in the FIM-FAM domain of mobility. However, areas of psychological function were improved but not significantly. Research and guidelines suggest that a greater length of time is needed to ensure psychological improvement (CSL Mental Health Project Team, 2010; NICE guidelines 90, 2009). The development of community psychological service pathways is recommended for meeting the longer-term needs of patients with FND.

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### **Functional Neurological Disorders and Patient Reported Experiences of the NHS**

*Mahinda Yogarajah, Ibrahim Chowdhury, Tiago Teodoro, Mark Edwards (London, United Kingdom)*

**Objective:** The aim of this study is to assess the health and social care experience of patients with functional neurological disorders within the NHS, compared to patients with 'organic' neurological disorders such as multiple sclerosis (MS).

**Background:** The 'National Service Framework for Long Term Conditions' (NSF) sets out the quality requirements for the care of patients with chronic neurological conditions in the UK. It aims to improve the quality of life of patients by supporting them to live as independently as possible. Key themes include prompt recognition, diagnosis and treatment, independent living, tailored care, increased access to services and joint working across all health professionals. Success in meeting these standards is best measured using patient related experience measures (PREMs) which elicit feedback on the process of care rather than its effects, focusing on issues such as communication with health professionals, information provision, involvement in decisions, physical comfort, emotional support, and care transitions.

**Methods:** Data was collected from functional and MS patients attending a tertiary neurology service using a validated PREM based on the NSF in order to assess patient experience of health and social care in the NHS.

**Results:** Surveys were completed by 20 functional and 10 MS patients. Both groups of patients had similar levels of anxiety/depression, but functional patients had greater levels of physical disability as measured by the EQ5D. Despite this, patients with functional disorders reported receiving poorer levels of health and social care compared to MS patients. Functional patients reported delays being referred to a specialist clinician by their GPs, a lack of respect and dignity in interactions with health professionals, and that their conditions were misunderstood leading to poorer care and difficulties gaining access to the services they required.

**Conclusions:** The study provides valuable information regarding the poor quality of care provided to functional patients by the NHS, highlighting areas of care not meeting the quality requirements set by the NSF.

**References:** Peters et al 2013 Patients' Experiences of Health and Social Care in Long-Term Neurological Conditions in England: A Cross-Sectional Survey

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### **The Archeology of treatment of functional neurological symptom (conversion) disorders in Castle Hornberg in Black Forrest: From torpillage and faradic current treatment to TENS (Transcutaneous electrical nerve stimulation)**

*Hans Markowitsch, Hans Markowitsch, Hans Markowitsch, Angelica Staniloiu, Angelica Staniloiu, Angelica Staniloiu, Monika Finke, Andreas Wahl-Kordon (Baden-Baden, Germany)*

**Objective:** We aim to increase understanding of combat-related functional neurological symptom disorders by comparative historical and cultural data about clinical features, explanatory paradigms and treatment evolution of these disorders in the course of time.

**Background:** TENS (transcutaneous electrical nerve stimulation) is a treatment for functional movement or sensory disorders. A precursor of it was developed and used in the sanatorium of Castle Hornberg to treat First World War German soldiers with functional neurological symptoms.

**Methods:** Literature review of original historical material and history of medicine articles.

**Results:** After reaching a gipfel in the 19th century, the popularity of electrical current treatment surged during the World War I (WWI), when clinicians treated many patients with functional neurological symptoms. Faradization or torpillage was criticized after the war; Wagner Jauregg—a controversial Nobel prize winner—was accused of a very radical administration of this therapy. A radical approach to electrotherapy also had Dr. Fritz Kaufmann from Ludwighafen, a proponent of a one flooding treatment session, blending suggestion and high intensity electrical current. A different approach was developed and used by Dr. Kehrer in the sanatorium in the Castle Hornberg in Black Forrest. Dr. Kehrer rejected the method of Dr. Kaufmann and used a mild intensity current method for functional neurological disorders, which can be conceived as a precursor of TENS.

**Conclusions:** Triberg and Hornberg sanatoria in Black Forrest were tertiary-like treatment settings for WWI soldiers with treatment-resistant functional neurological disorders. In the sanatorium in the Castle Hornberg in Black Forrest, Dr. Kehrer used a possible precursor of TENS. Although many electrical treatment methods fell into oblivion after the Armistice, they were unearthed in the 1980s due to case report studies. Most recently TENS has been increasingly used for patients with functional movement disorders. Other contemporary versions of electrotherapy including transcranial magnetic stimulation and transcranial direct current stimulation show preliminary promising roles for treating these frequent and potentially disabling conditions.

**References:** Linden SC, Hess V, Jones E. The neurological manifestations of trauma: lessons from World War I. *Eur Arch Psychiatry Clin Neurosci* 2012; 262: 253–64 Hitzfeld Karlleopold. Hornberg an der Schwarzwaldbahn. Vergangenheit und Gegenwart der Stadt des Hornbergerger Schiessens. Hornberg: Stadtverwaltung Hornberg. 1970 (pages 1-394)

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### **Evaluation of a multidisciplinary FND Workshop for patients and their family members**

*Sarah Cope, Mark Edwards, Kate Holt, Norman Poole, Shakiba Azizi, Niruj Agrawal (London, United Kingdom)*

**Objective:** To evaluate a multidisciplinary workshop for patients diagnosed with functional neurological disorder (FND) and their family members.

**Background:** FND is a common presentation seen in Neurology clinics, and it is known that explaining the diagnosis is an essential

part of the treatment pathway. This explanation may happen at multiple points along their treatment pathway, e. g. Neurology, Neuropsychiatry, and it is important that a consistent message is given. The Understanding FND Workshop was developed in order to: explain the diagnosis and introduce potential treatments of FND; give patients the opportunity to hear from multiple professional groups who may be involved in their care, as well as hear a patient's experience of treatment; allow patients to see that FND is common; and increase patients' carers' understanding of FND. The workshop is facilitated by a Consultant Neurologist, Consultant Neuropsychiatrist, Clinical Psychologist, Neuro-physiotherapist, and a patient who has been through treatment.

**Methods:** Data from six workshops was collected. A total of 110 patients and 87 family members (or friends or carers) attended. At the beginning and end of each workshop, patients and their guests were asked to rate, on numerical rating scales ranging from 0 to 100, how much they: understood the FND diagnosis; agreed with the diagnosis; were hopeful regarding recovery; and believed FND is treatable.

**Results:** Significant increases between pre and post workshop ratings of understanding of diagnosis, belief in treatability, hopefulness regarding recovery, and agreement with diagnosis were found.

**Conclusions:** A multidisciplinary workshop focused on explaining the diagnosis and treatment of FND can be a useful part of the FND treatment pathway.

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#### Functional Neurological Symptoms and Idiopathic Intracranial Hypertension

Jan Coebergh, Mark Edwards (Hinchley Wood, United Kingdom)

**Objective:** Idiopathic intracranial hypertension (IIH) is a treatable condition leading to headaches, tinnitus, visual and cognitive symptoms. Its main risk factors are female sex and obesity. Rates of obesity in patients with functional neurological symptoms (FNS) have not been studied. We present four cases that illustrate the complex relationship between IIH and FNS; two of IIH as possible trigger, one of immobility in FNS as a possible contributor to weight gain leading to IIH requiring a V-P shunt and one where IIH was the main cause of disability. Two cases had IIH without papilloedema which delayed diagnosis. We discuss shared risk factors and possible aetiology.

**Methods:** Case 1A 28 year old woman with a history of severe childhood sexual abuse had a 12 month history of significant weight gain (to 120kg) and during a routine outpatient visit became unresponsive and was admitted to ITU with suspected meningitis; lumbar puncture was normal but pressure not measured; after discharge she became quadriplegic and after normal MRI imaging and EMG was discharged to a rehabilitation centre with severe urinary incontinence despite a catheter and development of a fixed dystonia of all extremities. When seen for a second opinion nine months later she described a constant pressure in the head, double and blurred vision that had preceded her initial presentation. There was convergence spasm, but no papilloedema and normal OCT. There was functional visual field loss (see Figure 1 and 2). Lumbar puncture (pressure 55 cm H<sub>2</sub>O) led to a significant relief of headache and visual symptoms and therapeutic sedation, botulinum toxin and multidisciplinary rehabilitation led to her regaining mobility. Her IIH symptoms unfortunately return within weeks after an LP and pressures remained very elevated (routinely >40) despite more than 20 lumbar punctures, failed lumboperitoneal shunt and acetazolamide. She is currently slowly losing weight (108kg) and awaiting bariatric surgery. Figure 1 and 2  
Figure 4 Case 2A 32 old lady presented for a second opinion on her functional 6Hz postural wrist flexion/extension tremor of less than 0.5 cm amplitude with normal writing and spiral drawing with give-away weakness that was distractible. A history of chronic headache and brief episodes of total visual loss was elicited (not necessarily with positional change). Her BMI was (155kg) and examination by ophthalmologist showed no abnormalities. Her visual field tests were abnormal; most likely functional (Figure 3). Imaging was normal and her initial LP showed an elevated pressure of 38.5 cm H<sub>2</sub>O; which leads to brief headache improvement. Three subsequent LPs also showed elevated pressures (30-35). Further co-morbidity of OSAS was diagnosed (apnoea-hypopnea index 29.5/hour). She declined weight loss surgery and tried acetazolamide and bendroflumethiazide. The tremor has not interfered with function. Figure 3  
Case 3 A 29 year old lady with benign joint hypermobility syndrome and widespread musculoskeletal pain, intermittent catheterisation, history of sexual abuse in early childhood and anorexia (hospital admission age 13) and later diagnosis of emotionally unstable disorder with ongoing deliberate self-harm had dissociative attacks and functional weakness and was mostly in a wheelchair since several years; over several years she had weight gain and binge eating disorder (BMI 44.2); when she developed increase in headaches and reduced visual acuity she had an opening pressure of 52 cm H<sub>2</sub>O and had a VP shunt inserted with six revisions in three years since for dysfunction. Her vision improved but her overall quality of life remains poor (Figure 4). Case 4A 48 year old lady with a BMI of 41.4 presented in 2014 to an optician with a six month history of continuous headache and papilloedema was seen. After a normal MRI head an LP demonstrated an opening pressure of 39cm H<sub>2</sub>O and headache improved from unbearable to VAS 4/10. She had nasal visual field loss (Figure 5) and a functional 8 Hz postural arm tremor of less than 0.5cm amplitude, which disappeared with rapid ballistic movements. Despite best medical therapy with acetazolamide, furosemide and topiramate and six therapeutic LP with elevated pressures (range 25-39) she remained unable to work as result of tremor and visual symptoms. After bariatric surgery she lost more 55% (137? 62 kg) and all symptoms resolved fully and she was able to return to work.

**Results:** FNS are common in co-morbid neurological disease although the relationship with IIH has not been described. [1] IIH can occur without papilloedema in about five percent in case series. In the largest series 20% of patients had functional visual symptoms and signs; the response to treatment was not specified. [2] Whether BMI is raised in FNS has not been systematically studied, but it was raised compared to controls in one study. [3] Raised BMI is a very important, almost essential, contributor to IIH. One could see how FNS through immobility, fatigue and sleep problems could contribute to an increase in BMI. Childhood adverse events is a risk factor for both raised BMI [4] and FNS (although not an essential condition for either). IIH has been associated with neuropsychological dysfunction in multiple cognitive domains, including attention which has been implicated in the development of FNS. [5] Triggers are well recognised to play an important part in the development in FNS but treatable co-morbidity has not been studied in detail. [6]

**Conclusions:** IIH can occur with and without papilloedema and be associated with functional visual symptoms and signs. These cases illustrate IIH can be a trigger for FNS, possibly incidental co-morbidity, a likely complication and is amenable to treatment which can improve the FNS. IIH and FNS share risk factors and at risk individuals and their health professionals should have a low threshold for suspicion, and particularly in the absence of papilloedema is easily missed.

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### **Guided self-help treatment for Functional Neurological Symptoms: Internet-based Psychoeducation**

*Sue Humblestone, Michael Moutoussis (London, United Kingdom)*

**Objective:** An adequate understanding of functional neurological symptoms (FNS) by the patient is central to the recovery. To increase patients' understanding of Functional Neurological Symptoms (FNS) prior to multidisciplinary specialist treatment.

**Background:** Specialist treatment programmes for FNS can be beneficial, but for many patients, a lot of time is needed for preparatory psychoeducation. We aimed to provide this through a web-based guided self-help (GSH) programme to optimize treatment.

**Methods:** We adapted the previously successful outpatient group psychoeducation program for guided self-help use. We designed a 12 week programme for patients who were found suitable for specialist treatment. The programme led up to the start of the specialist, usually inpatient, treatment. Information was sent weekly by e-mail along with worksheets and exercises for the patients to complete. Guidance telephone appointments took place at 2-3 week intervals. Didactic information was provided in the form of 15min youtube videos. New material was sent on an approximately weekly basis subject to ongoing e-mail communication. At the end of preparation a handover was provided to the therapists about to provide specialist treatment.

**Results:** It was rare for patients to decline participating in GSH. For all patients, discussing the diagnosis and understanding their individual symptoms was prioritized. Those who engaged more were introduced to the principles of rehabilitation and started on putting them to practice. Avoidance of activity, including the treatment, was a common problem. Inpatient therapists evaluated the intervention after seeing patients that received (or not) GSH. They indicated that patients that participated in GSH were more aware of the specialist treatment approach and had a better understanding of their diagnosis. Patients particularly appreciated knowing what to expect from therapy sessions. A quantitative evaluation of the intervention has been initiated.

**Conclusions:** Patients reported that interacting with the facilitators allayed their fears about attitudes to FNS specialist treatment. They talked about their experiences of diagnosis, and unhelpful interactions in healthcare. Conversations with facilitators explored these very personal experiences and helped tailor treatment to the individual. Several patients found it difficult to use computers for GSH.

Therapists had to adapt the treatment to these individual needs. Overall, GSH provided a good foundation for therapeutic rapport. The improvement of collaborative therapy work is however only an interim outcome, and further investigation of outcomes at discharge from the service such goal attainment and improved self-management is under way.

**References:** Dr. Moutoussis is supported by the UCLH Biomedical Research Council. He is also funded by the Wellcome Trust (ref 095844/7/11/Z) Strategic Award wherein Prof. Ray Dolan is Principal Investigator.

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### **Multidisciplinary rehabilitation for patients with Functional Neurological Disorder (FND)**

*Monica Aasnes, Kerstin Wahman (Solna, Sweden)*

**Objective:** The aim of the FND rehabilitation program at Rehab Station is to support patients to: understand and accept the diagnosis, decrease dysfunctional symptoms, acquire tools to prevent relapses

**Background:** There is an ambiguity regarding who should treat these patients; neurologists or psychiatrists, and rehabilitation is therefore often delayed or absent. However, treating this condition is of great benefit for the patients and reduces social costs.

**Methods:** Treating FND in multiprofessional teams is a prerequisite for successful rehabilitation. At Rehab Station the team consists of; a neurologist, an occupational therapist, a physiotherapist, a psychologist, a rehab instructor, and a social worker. Patients are admitted to inpatient rehabilitation or outpatient rehabilitation. Key elements: • Establishing a collaborative relationship between patient and the team. • Confirming and explaining the diagnosis and cause of symptoms. • Focusing on recovery. • Encouraging normal patterns of movement. A common symptom for this group is a functional motor disorder, for example gait disturbance. Therefore gait ability is recorded at admission and discharge.

**Results:** The data has not yet been scientifically analyzed, but clinical evaluation of the gait shows that about 80% of the patients, over the course of rehabilitation, went from being in a manual wheelchair to being able to walk, with or without technical aids. Further, patients with tremors, seizures and other symptoms subjectively have fewer symptoms at discharge.

**Conclusions:** As other authors have stated, some of the keys for a successful rehabilitation for persons with FND, seems to be the understanding and acceptance of the diagnosis, the response and acknowledgement of the symptoms from others, and learning to use tools in a safe and supportive environment. The multiprofessional team at Rehab Station has many opportunities to work with the key elements during rehabilitation and the patient benefits from the knowledge from the diverse disciplines. Preliminary clinical data shows promising results. In the future the team will evaluate the FND rehabilitation program with a standardized protocol.

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### **A report on a new pilot day hospital treatment programme for Functional Neurological Disorders at the Maudsley / Bethlem Royal Hospital**

*Simon Harrison, Yvonne Hsieh, Vaida Gudeliunaite, Maria Avraam, Paul Davies (London, United Kingdom)*

**Objective:** We describe a new day programme and report on preliminary outcomes

**Background:** The Functional Neurological Disorders (FiND) programme has been set up. The FiND programme was set up to meet the needs of patients with (Functional Neurological Disorders (FND) who would benefit from an intensive evidence-based multidisciplinary treatment in an outpatient setting.

**Methods:** The programme has been developed within an established national neuropsychiatry service (South London and Maudsley National Health Service Foundation Trust) which provides outpatient and inpatient assessment and treatment for FND. Its principles are CBT-based, with group work, and functional rehabilitative approaches. It aims to empower the individual to become their own therapist and equip them with self-efficacy in their ongoing recovery from FND. It is an intensive, 3 days a week, 8 week, programme. It has been developed and delivered by a physiotherapist, rehabilitation assistant/OT, psychologist/CBT therapist, psychology assistant, with consultant neuropsychiatrist input.

**Results:** We report on a number of process and outcome measures. Of 49 people assessed, 20 met referral criteria and, 19 attended showing high rates of acceptability of the programme. The patients attend, in 3 cohorts and, 13 completed the 8 week programmes. All completers showed much or very much improvement compared to baseline; of the non-completers, 1 much, 3 minimally improved, 2 no change. Improvements included mobilising independently from wheelchair dependence, full recovery from fixed foot dystonia not responsive to outpatient physiotherapy, restoration of visual loss, as well significant reductions in motor and seizure symptoms. Qualitative feedback from completers has been positive.

**Conclusions:** The programme has shown evidence of efficacy, although numbers remain small. It continues to develop, collecting outcome and research data.

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#### **A striking case of a functional quadriplegia – what next when functional disorders are resistant to physiotherapy?**

*Alexandra Boogers, Ludo Vanopdenbosch (Aalst, Belgium)*

**Objective:** We present a striking case of a patient with recurrent functional quadriplegia. She initially responded well to physiotherapy. However, due to increasing number of relapses, we explored new strategies to treat this debilitating functional disorder.

**Background:** This 28 year old lady with a long history of nonepileptic seizures woke up being unable to move her legs in 2016. In 9 months, we had to admit the young lady 6 times with a relapse of functional paresis of her legs and subsequently also her arms.

**Methods:** In our hospital, we treat functional disorders with intensive physiotherapy. The physiotherapist starts by moving the affected limb passively. Step-by-step the exercise becomes a more active one. The patient is instructed to focus her attention on the movement. From early in the revalidation we include hydrotherapy. The warm water helps the patient to relax and engage in the therapy. After 2-3 days of therapy this lady was able to walk again normally. We explained her what a functional disorder is, i. e. an involuntary condition most likely the result of an impairment of the neural pathway of agency (1). She seemed to understand this, but relapses became more frequent nevertheless. That is why alternative treatment options were explored.

**Results:** Cognitive behavioral therapy was described to have value in functional movement disorders (FMD). Since rTMS is available in our centre and few small studies on rTMS for FMD have been executed, showing good (short-term) effects, we are considering this treatment. However, we did not find a consistent protocol of stimulus parameters: frequency, inhibitory or activation, cortical localisation to bring this into clinical practice (2). ECT might be another option, but we do not have any experience with ECT in psychogenic movement disorders and literature on this approach is scarce. We also considered DBS. To our knowledge, DBS has never been used before to treat a FMD. Nevertheless, DBS for OCD is widely used with good results.

**Conclusions:** Treating a refractive psychogenic movement disorders can be challenging. Physiotherapy has proven benefits, but is sometimes not enough. We started cognitive behavioral therapy for a young lady with refractive quadriplegia. In case of failure, we would consider rTMS as the next step. This should however be done in a research setting.

**References:** 1. Edwards MJ, Fotopoulou A, Pareés I. Neurobiology of functional (psychogenic) movement disorders. *Curr Opin Neurol* [Internet]. 2013;26(4):442–7. Available from: <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00019052-201308000-000172>. Parain D, Chastan N. Large-field repetitive transcranial magnetic stimulation with circular coil in the treatment of functional neurological symptoms. *Neurophysiol Clin* [Internet]. Elsevier Masson SAS; 2014;44(4):425–31. Available from: <http://dx.doi.org/10.1016/j.neucli.2014.04.004>

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#### **Visual-feedback in Psychogenic Movement Disorders & Its Management**

*Sunita Gudwani, S Kumaran, Rajesh Sagar, Gaurishankar Kaloiya, Madhuri Behari (New Delhi, India)*

**Objective:** Understanding psychosomatic overlay versus executive control in freezing of gait (FOG) in Parkinson's disease (PD) and planning management based on this neurobiological model

**Background:** Imaging and electrophysiological testing in psychosomatic disorders including movement disorders (PMD) provide insight & diagnostic confirmation [1] It suggest different (i) mechanism (ii) emotion & emotion-motor processing (iii) stressor reaction [2]

**Methods:** Pilot study compared PD+PMD with (i) healthy controls (ii) only PMD. Clinical assessments included EPQ-S, DASS-21, UPDRS, H&Y, PDQ39, MMSE, YBOC scale, visuospatial motor processing, with MRI & functional (fMRI). Acquisition of MRI & fMRI was done at 3T MR scanner using 32-channel headcoil, Invivo Corp (Ingenious Philips Healthcare) and MR compatible LCD monitor. fMRI (BOLD) paradigm was block design with 3 cycles AXAYAZ where XYZ were videos of the same subject with "FOG" "session+collective walk with therapist", postRx "walk with no freezing" respectively. In PMD paradigm XYZ videos were "tremor", (preRx), session (cognitive behavioural Rx) & postRx "no tremors" fMRI parameters were TR 2s, dynamics 360, acquisition time 12min

**Results:** In "drug-state-controlled" PD+PMD before cognitive restructuring had severe FOG and postRx session had minimal FOG, it was video-recorded and displayed during fMRI task. In PMD, preRx recruited lower positive BOLD activation volume and higher negative volume. In PD+PMD the video recording of FOG (preRx) visual processing recruited activation in areas BA 2, 6, 9, 10, 11, 40,

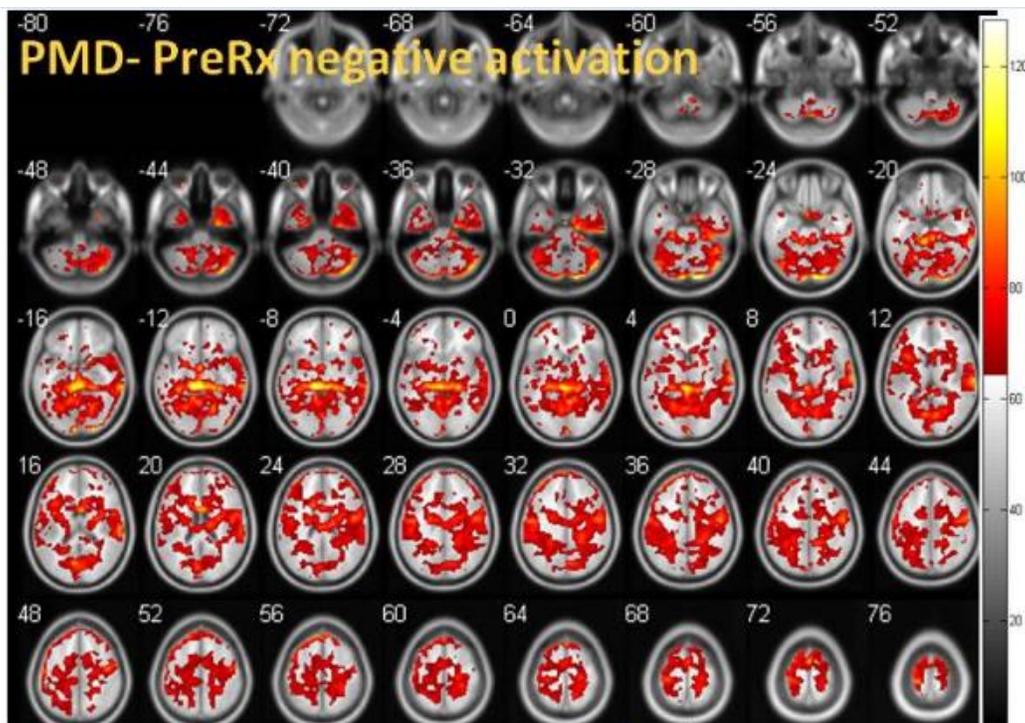
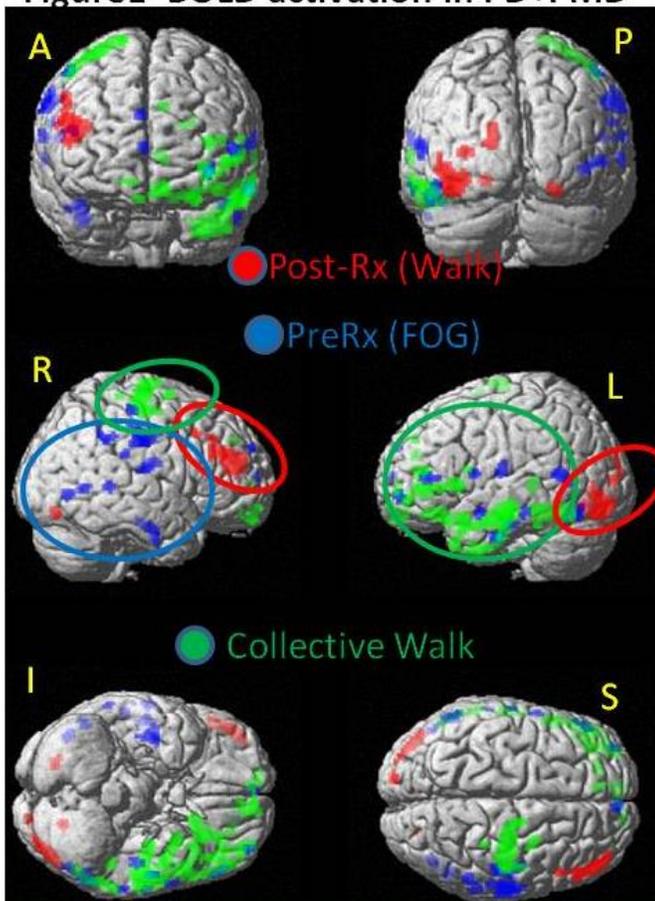
43, 46 and cerebellum. PMD visual processing of preRx signs recruited activity in BA 8, 9, 10, 40, 47, cerebellum and Left ACC (LACC). PostRx, video processing in PD+PMD showed confined activity in left hemispheric occipital, right frontal (BA 8, 9, 46) and cerebellum. PMD during postRx video processing positive activity was higher and lower negative activity in motor areas [Table1, Table2, Table3, Figure1, Figure2]

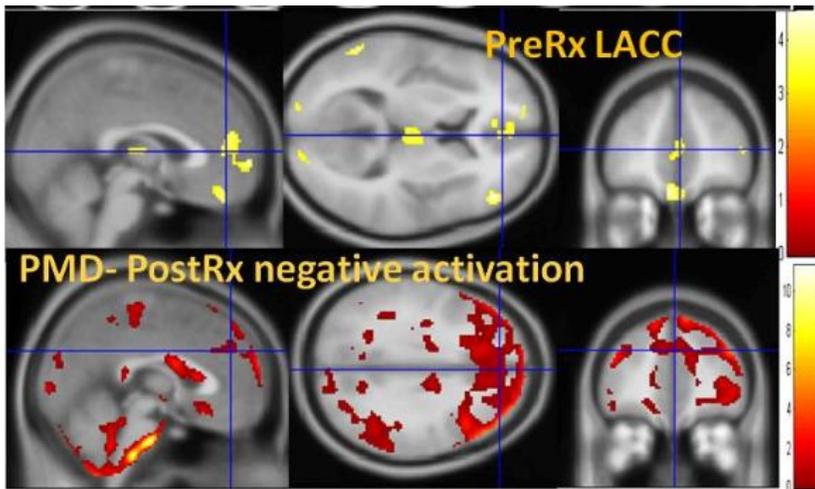
No of clusters	Z score	MNI Coordinates	Hemisphere	Area	Brodmann Area
123	6.01	62 -18 36 58 -28 46	Right	Postcentral Gyrus Inferior Parietal Lobule	BA 2 BA 40
24	5.32	-50 36 10	Left	Middle Frontal Gyrus	BA 46
55	4.96	-58 -56 12 -58 -60 4	Left	Superior Temporal Gyrus Middle Temporal Gyrus	BA 39 BA 37
18	4.93	-54 -10 -32	Left	Inferior Temporal Gyrus	BA 20
12	4.74	-60 4 12	Left	Precentral Gyrus	BA 6
17	4.63	-64 -16 20	Left	Postcentral Gyrus	BA 40
17	4.47	64 -42 4	Right	Middle Temporal Gyrus	BA 22
17	4.41	6 56 30	Right	Medial Frontal Gyrus	BA 6
99	4.41	40 -10 -28	Right	Fusiform Gyrus	BA 20
13	4.37	-60 -2 -14	Left	Middle Temporal Gyrus	BA 21
25	4.28	64 -12 18	Right	Postcentral Gyrus	BA 43
19	4.20	-36 56 -4	Left	Middle Frontal Gyrus	BA 10
27	4.14	-48 -68 -16	Left	Cerebellar Declive	
44	4.09	60 -38 38	Right	Supramarginal Gyrus	BA 40
22	4.05	50 -24 56	Right	Postcentral Gyrus	BA 2
10	4.04	-62 -30 -16	Left	Middle Temporal Gyrus	BA 21
14	4.02	4 60 10	Right	Medial Frontal Gyrus	BA 9
32	3.99	50 -58 2	Right	Middle Temporal Gyrus	BA 37
32	3.97	42 -70 -2	Right	Lingual Gyrus	BA 18
15	3.90	58 -30 26	Right	Inferior Parietal Lobule	BA 40
15	3.65	-46 -24 -22	Left	Parahippocampal Gyrus	BA 36
43	3.58	54 -16 16	Right	Insula	BA 13
12	3.44	-52 -56 -22	Left	Cerebellar Declive	

No of clusters	Z score	MNI Coordinates	Hemisphere	Area	Brodmann Area
162	4.26	-38 -84 -12 -44 -80 -4 -32 -90 -8	Left	Fusiform Gyrus Inferior Occipital Gyrus	BA 19 BA 18
35	4.21	24 -78 -16	Right	Cerebellar Declive	
27	4.13	-18 -72 -10	Left	Cerebellar Declive	
128	4.06	52 32 28 48 46 12	Right	Superior Frontal Gyrus Middle Frontal Gyrus	BA 9 BA 46
28	3.66	-14 -96 16	Left	Cuneus	BA 18
11	3.60	50 18 40	Right	Middle Frontal Gyrus	BA 8
13	3.47	-40 -82 8	Left	Middle Occipital Gyrus	BA 19

Table3- Visual processing of Pre-Rx signs in PMD					
No of clusters	Z score	MNI Coordinates	Hemisphere	Area	Brodmann Area
86	4.68	-40 36 -6	Left	Inferior Frontal Gyrus	BA 47
76	4.55	-40 -82 14	Left	Middle Occipital Gyrus	BA 19
162	4.47	46 40 8	Right	Middle Frontal Gyrus	BA 46
147	4.23	-4 46 -20 2 50 18 -6 34 -18	Left	Medial Frontal Gyrus Anterior Cingulate	BA 10, 9 BA 32
272	4.21	4 62 0	Right	Medial Frontal Gyrus	BA 10
111	3.98	10 -82 -8	Right	Cerebellar Declive	
32	3.96	-60 -56 8	Left	Middle Temporal Gyrus	BA 21
59	3.90	18 -96 4	Right	Lingual Gyrus	BA 17
36	3.88	48 36 -10	Right	Inferior Frontal Gyrus	BA 47
46	3.76	40 -74 0	Right	Inferior Occipital Gyrus	BA 19
22	3.76	24 -90 20	Right	Middle Occipital Gyrus	BA 18
92	3.75	6 -18 10	Right	Thalamus (Medial Dorsal Nucleus)	
29	3.75	-6 34 16	Left	Anterior Cingulate (ACC)	BA 32
149	3.66	-12 -86 -4 -20 -86 -12	Left	Lingual Gyrus Cerebellar Declive	BA 18
17	3.72	6 24 48	Right	Superior Frontal Gyrus	BA 8
17	3.70	50 -68 12	Right	Middle Temporal Gyrus	BA 37
17	3.56	-18 -98 8	Left	Cuneus	BA 17
19	3.53	-10 60 6	Left	Medial Frontal Gyrus	BA 10
15	3.33	42 -44 58	Right	Inferior Parietal Lobule	BA 40

Figure1- BOLD activation in PD+PMD





**Conclusions:** In PMD LACC & visual cortex was associated with go-no-go spatial constraint. No activity of ACC was observed in PD+PMD. BA6, 9 important for movement executive control, were observed in preRx indicating different mechanism in PD+PMD. PostRx gait improvement with BA8, 43, occipital, cerebellum activity associated with better motor planning and executive control. Cuneus with lingual play role in visuo-spatial planning for movement observed as hypoactive in FOG and increased activity with improvement. Similar activation pattern in PMD support functional overlay in PD+PMD, thus, differential diagnosis is important for optimal management before increasing drug dose.

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### **Embedded Neuropsychiatric services within a Comprehensive Epilepsy Program: Improving access to early assessment for PNES**

*Adith Mohan, Rebecca Koncz, Ernest Somerville, Christian Zentner, Hanka Laue-Gizzi, Perminder Sachdev (Randwick, NSW, Australia)*

**Objective:** To evaluate access to structured psychiatric assessment and input for patients diagnosed with psychogenic non-epileptic seizures (PNES), during admission to a tertiary epilepsy monitoring unit (EMU) with an embedded neuropsychiatric liaison service.

**Background:** Short-term efficacy of structured diagnostic communication for PNES patients is well documented. Engagement with psychological treatment predicts long term outcome<sup>1</sup> however, and requires an integrated model of care between psychiatry and neurology.

**Methods:** The study was a retrospective file audit of patients admitted to the EMU for video-EEG (VEEG) in a tertiary hospital in metropolitan Sydney over a 2-year period. Primary outcomes included frequency of contact between the psychiatry services and EMU patients diagnosed with PNES prior to discharge, as well as referral rates for further mental health intervention. Follow-up rates for a subset of patients seen in our local neuropsychiatry of epilepsy outpatient clinic were determined by cross referencing PNES patients with clinic attendance records.

**Results:** 100 VEEG cases were reviewed (45 male; age range 17-74y, mean 37. 2, SD 14. 5). 24% of patients were confirmed to have PNES with uncertain diagnosis in another 7 patients. Illness duration ranged from 14-60 months (mean 32. 3 months, SD 15. 3). 18 of the 24 (75%) had structured neuropsychiatric assessment during admission including diagnosis and initial treatment of comorbidity. Missed assessment was due to early discharge (2), patient refusal (3) and was uncertain in one. Of the patients assessed during VEEG 6 were followed up in our specialist clinic whilst 15 (62. 5%) were referred for local mental health input. The main barrier to follow up was the regional location of patients and inability to travel back to Sydney for neuropsychiatric care.

**Conclusions:** Among the three EMUs comprising the New South Wales Statewide Complex Epilepsy Service, our model of care is unique in providing embedded neuropsychiatric assessment to the majority of PNES patients admitted for VEEG. Early mental health input during VEEG admission has been shown to facilitate subsequent treatment engagement with local mental health care<sup>2</sup>. By integrating specialist neuropsychiatric assessment within the EMU team, our model of care ensures assessment by a mental health professional proficient in the clinical aspects of both epilepsy as well as PNES, and provides for a shared care approach consistent with recent ILAE consensus recommendations for PNES management.

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### **Motor retraining program by means of a smartphone for patients with functional neurological symptoms: Protocol for a feasibility study**

*Federica Bombieri, Lucia Ricciardi, Angela Marotta, Mirta Fiorio, Carlo Dallochio, Michele Tinazzi, Benedetta Demartini (Verona, Italy)*

**Objective:** we aim to evaluate the feasibility of a motor retraining program mediated by the use of a smartphone for patients affected by

functional motor symptoms and non epileptic seizures (NES).

**Background:** recent studies focusing on the neurobiological basis of functional neurological symptoms (FNS) have found abnormalities in attentional focus and altered sense of agency as two key components. Physiotherapy has been showed to be a feasible and effective treatment for FNS. One rationale for physiotherapy is that it is theoretically possible to “relearn” normal motor patterns by breaking down abnormal movements into individual components and gradually reconstructing normal patterns.

**Methods:** here we present the protocol of a feasibility study of motor retraining for patients affected by FNS and NES. Fifteen patients with FNS and NES will be included in the study. A neurologist or a psychiatrist expert in functional movement disorder will make the diagnosis according to validated criteria. Patients will undergo a first face-to face assessment by the therapist. Focus of this assessment will be to identify specific trigger factors for abnormal movement or non-epileptic attacks and their motor pattern. Therapist will instruct the patient on how to recognize the abnormal movement, how to distract it and will give a structured plan of exercises to the patient to do at home every day. The following contacts between the patient and the therapist will be through smartphone: patient will be asked to make videos while he is doing the exercises at home and he will then send the videos to the therapist who will review them and will give feedback to the patients through a chat. The duration of the programme will be three months. At the end of the programme a second face-to-face assessment will be done by the therapist. Outcome measures will include: 1. Patient self-assessment of outcome at the end of the programme; patients will judge his symptoms according to a five-point Clinical Global Impression scale (CGI) as “much worse”; “worse”; “not changed”; “better”; “much better”. 2. A neurologist expert in FNS will blindly assess a standardized video of patient’s symptoms performed by the therapist at baseline and at the end of the study. The Simplified Functional Movement Disorders Rating Scale score will be used for this purpose.

**Conclusions:** here we present the protocol of a study aiming to test the feasibility of a motor retraining program for FNS and NES using a smartphone as a supportive device.

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#### **Early Experience of the First Multidisciplinary Unit for Functional Movement Disorders in Spain**

*Isabel Parees, Leticia Martinez, Monica Kurtis, Marta Sanz, Blanca Borda, Carmen Vicente, Pilar Rada, Beatriz Martin, Javier Perez-Sanchez, Montserrat Garcia, Oriol Franch (Madrid, Spain)*

**Objective:** To describe the establishment and early experience of the first multidisciplinary unit for functional movement disorders (FMD) recently implemented in Madrid, Spain.

**Background:** FMD are common, may be disabling and are associated with substantial health and social care costs. Over the past decades, a burst of research has occurred and a more integrated view of these disorders has emerged. A multidisciplinary approach based on individual characteristics is recommended. Despite that, there is a lack of specific healthservice provision for these patients.

**Methods:** In January 2017 a FMD clinic was established as part of the Movement Disorder Program of the Neurology Service, Hospital Ruber Internacional. The clinic is run by a neurologist with experience in FMD and the team includes three physiotherapists, a psychiatrist, a clinical psychologist, a speech and language therapist (SLT) and an occupational therapist. Diagnosis explanation was given in the first consultation by the neurologist and treatment options were individualised to patients’ clinical characteristics.

**Results:** 11 patients (8 females/3 males, mean age at time of consultation 44. 3±17. 1 years, disease duration 4. 1± 7. 1 years) have been evaluated. FMD included: 3 functional gait disorders, 3 leg tremors, 2 paroxysmal FMD with retained consciousness, 1 functional camptocormia, 1 hemifacial spasm and 1 functional paraparesia. Two patients underwent a 5 day intensive physical rehabilitation program and reported significant improvement measured by the Global Clinical Impression Scale at 1 month follow-up. One more patient has successfully completed the program but there is no follow up data available. Four patients are on the waiting list for the physical rehabilitation program. One patient with paroxysmal FMD improved after diagnosis was explained, the other patient with paroxysmal FMD is currently undergoing cognitive behavioural therapy sessions. The patient with hemifacial spasm significantly improved with combined therapy (psychiatrist treating active depression and SLT guiding facial exercises weekly).

**Conclusions:** Based on our early clinical experience, a multidisciplinary clinic for FMD is feasible and may provide clinical improvement for this perplexing condition.

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#### **Informal caregiver (CG) behavior and the mutual impact on the functional patient: An analysis of a psychotherapeutic group offered to the CG**

*Eduardo Mutarelli, Ymara Lucia Camargo Vitolo, Bruna Bartorelli (Sao Paulo, SP, Brazil)*

**Objective:** An analysis of the informal CG behavior. These would be only formal aspects or signs to be taken into account in the elaboration of the diagnosis and treatment of both the patient and the CG.

**Background:** Throughout our work in the care of patients with functional disorders we have observed that most of them come to the clinic accompanied. We suspect of a co-dependence with possible pathological bias.

**Methods:** This is a prospective analysis of an open psychotherapeutic group that we offer to all informal CGs. The objectives of the psychotherapeutic work are: 1. Identifying the type of relationship established between the CG and the patient and their role in the clinical setting and treatment; 2. Increasing the perception and emotional understanding related to the bond with the patient. 3. Encouraging attitudes that give greater autonomy to the binomial patient/CG; 4. Establishing identifications among group members

regarding concerns and patient care; 5 Strategies to build greater confidence in the couple and enable relief of the CG's burden.

**Results:** Although the service has been offered to all the CGs, only 29 out of 76 participated. Sixteen were female with a mean age of 56.7, range 19-88 years old. We have noticed a great resistance to participate in the activities, showing a reluctant attitude and statements such as: "I am not the patient". It was possible to confirm the existence of a pathological link characterized by co-dependence, reduced autonomy, reinforcement of unhealthy behaviors, and daily life as a function of the disease. In these cases, throughout the care, we have observed a change in the dynamics between CG/patient, establishing a healthier relationship that results in better adherence to psychiatric treatment.

**Conclusions:** Throughout the care, we have observed a change in the dynamics between CG/patient. Even though no protocol has been followed, we have observed that providing care for CGs is required and vital for a more favorable prognosis. A systematic study may be conducted in order to collect more consistent data, to evidence the importance of attending CGs in the treatment outcome, and the further development a protocol.

**References:** Bidwell JT, Vellone E, Lyons KS, D'Agostino F, Riegel B, Paturzo M, Hiatt SO, Alvaro R, Lee CS. Caregiver determinants of patient clinical event risk in heart failure. *Eur J Cardiovasc Nurs*. 2017 May 1;1474515117711305. doi: 10.1177/1474515117711305.

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### **Treatment of Functional Movement Disorders in an Outpatient Rehab Setting: A Pilot Study**

*Daniel Schneider, Shaloo Choudhary, Mary Jo Bronson (New Brunswick, NJ, USA)*

**Objective:** To assess whether Functional Movement Disorders (FMD's) can be successfully treated in a traditional outpatient setting.

**Background:** Past reports describing the successful treatment of FMD's using a rehab model have, in the vast majority, used an inpatient or "intensive outpatient" setting. This pilot study assesses whether a more traditional outpatient rehabilitation model can be successful in symptom reduction.

**Methods:** This is a retrospective study of 14 patients sent from a FMD clinic to a specialized rehab program from 2015-2017. The program changed during that time as we experimented with different dose models. •9 subjects did 8 1hr sessions over two weeks (4/wk) with PT alternating with OT. •2 patients did 12 1hr sessions alternating between PT and OT. They did 8 sessions over two weeks (4/wk), followed by a week without treatment and then a final week of 4 sessions. •3 patients did 10 2hr sessions including both PT and OT over 2 weeks (5/wk). Outcome measures included the Patient Specific Functional Scale (PSFS) done before and after the treatment and a global QoL improvement score at the end of treatment.

**Results:** Across all patients we saw improvement. The average PT PTFS increased from 3.35 to 4.82, a 43% improvement and the OT PTFS score increased from 2.49 to 6.47, a 160% improvement. The average subjective QoL improvement estimated by the patient was 63%. When the first group (low treatment dose, n=9) was compared to the second and third groups (higher treatment dose, n=5) using a two-tailed t-test, there was a statistically significant improvement on the OT PTFS ( $p = 0.003$ ) and the QoL measure ( $p=0.05$ ), and a non-significant trend for the PT PTFS ( $p = 0.19$ ).

**Conclusions:** A more traditional outpatient approach to rehabilitation appears to be helpful in symptom reduction, particularly treatment schedules with a higher amount of sessions. A formal clinical trial should be done to better quantify this improvement compared to a placebo group.

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**Withdrawn by author**

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### **The rehabilitation of functional neurological (symptom) disorders and dissociative disorders after a mild TBI and mild TBI prognosis**

*Jessica Collins, Hans Markowitsch (Sheffield, United Kingdom)*

**Objective:** Patients with mild traumatic brain injury (TBI) constitute the majority of patients with TBI (the silent epidemic). Psychiatric disorders accompanying mild TBI contribute to mild TBI prognosis. Little research was devoted to the potential linkage between mild TBI and dissociative disorders and functional neurological symptom (conversion disorders). This may be due to the fact that for a long time, dissociative and conversion disorders were "dissociated" from the research arena. Similarly to the mild TBI, these disorders have been evolving diagnostic constructs, at times submitted to controversy. The current presentation aims to increase the awareness and understanding of the relationship between mild TBI and dissociative disorders and functional neurological symptom (conversion) disorders by summarizing diagnostic, epidemiological, pathophysiological, neuropsychological and neuroimaging information on these disorders, reviewing explanatory paradigms of the relationship between mild TBI and dissociative disorders and summarizing the status of art of treatment and rehabilitation of these disorders.

**Methods:** Literature review and own clinical data.

**Results:** Functional neurological (symptom) disorders and dissociative disorders often have their onset after a mild TBI; their development contributes to the delayed recovery from TBI related symptoms. Furthermore patients with mild TBI who score high on the Dissociative Experiences Scale (DES) have worse outcomes than patients who score low on DES.

**Conclusions:** At least 10-15 % of patients with mild TBI follow a chronic course. Preliminary data suggest that dissociative disorders and functional neurological symptom (conversion disorders) may be a risk factor for delayed recovery from mild TBI. This underlines a stringent need for timely (early) multidisciplinary treatment and rehabilitation to provide cure, prevent chronicity and reduce the substantial disability associated with both mild TBI and functional neurological (conversion) and dissociative disorders.

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**Treatment of chronic functional hemiplegia with time-limited inpatient multidisciplinary team (MDT) intervention – a case report**

*Anna Rutherford (Salford, United Kingdom)*

**Objective:** To describe a successful time-limited inpatient treatment pathway for functional neurological hemiplegia.

**Background:** Functional hemiplegia is a common presentation of Functional Neurological Disorder (FND). Patients are often admitted on a stroke pathway before being discharged without treatment, resulting in poor outcomes and repeated attendance at neurology clinics. Whilst pressure on NHS hospital beds make admissions for rehabilitation unpopular, this report was designed to identify if time-limited specialist MDT intervention could be beneficial. This is the initial report from a series which will be used to support a business case to commission such a service.

**Methods:** The report is focused on a 33 year old female presenting with chronic left sided functional weakness of the upper and lower limb. She was admitted for 2 weeks of MDT intervention encompassing explanation of diagnosis, neuropsychology and specialist neuro-physiotherapy. Evaluation was carried out on days 1, 7 and 14 using the Nine Hole Peg Test (9HPT) and 10m walk test (10MWT). Video footage of the 10MWT was used to assess gait qualitatively. Patient satisfaction questionnaires (PSQ) captured subjective feedback. Follow up was provided at an outpatient clinic at 3 months and by email at 9 months post discharge.

**Results:** Post intervention (day 14), time taken to complete the 9HPT decreased from 45 to 23 seconds (51% improvement) whilst the 10MWT decreased from 10 to 7 seconds (30% improvement). Gait quality improved with a reduction in abnormal posturing and asymmetry and the patient discarded her lycra sleeve and ankle-foot orthosis. Compliance with treatment was excellent with engagement in 100% of sessions. At 3 month follow up, the patient had returned to driving and full-time work. At 9 month follow up, the patient reported complete resolution of lower limb symptoms with return to regular exercise and mild upper limb symptoms on overhead activities only. The PSQ completed rated the FND service overall as 'outstanding'.

**Conclusions:** Results suggest a 2 week hospital admission with specialist multidisciplinary intervention can be a successful treatment for functional hemiplegia. Although follow up data is limited, ongoing progress post discharge and maintenance of benefit is a promising indicator for long term outcome. Whilst this is encouraging, further research with greater sample size is needed.

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**Expectation-based Functional Symptom Therapy for the Inpatient Management of FND**

*Lindsey MacGillivray, Sarah Lidstone, Mateusz Zurowski, Anthony Lang (Toronto, ON, Canada)*

**Objective:** To develop and implement a unique, proof-of-concept patient-specific collaborative inpatient management plan for patients newly diagnosed with functional neurological disorder (FND).

**Background:** Patients with FND commonly present to Neurology, including acutely in the ED. The philosophy of care for this population is prompt positive diagnosis and outpatient management; the inpatient management of functional symptoms is sometimes necessary but not yet operationalized.

**Methods:** Resident team leaders for the Neurology and Psychiatry Inpatient services co-developed a personalized expectation-based functional symptom therapy protocol for the inpatient management of FND. This protocol was trialed as a proof of concept intervention with a consenting patient and included expectation management, conceptual model groundwork (Stone et al 2005), demedicalization, pain control, physiotherapy (PT) and occupational therapy (OT). Psychiatric assessment was completed in a graded fashion. The protocol emphasized interprofessional collaboration and included daily team meetings attended by neurology, psychiatry, PT, OT and pharmacy to ensure consistency of approach. The patient returned at 2 weeks post-discharge for a debrief meeting with all team members.

**Results:** Here we present a proof of concept case study of a 51 year old patient with early-onset Parkinson disease and a 4 year history of recurrent dystonic attacks, who presented acutely to the ED in a generalized dystonic crisis. She was diagnosed promptly with Functional Dystonia by the Neurology service and underwent a 5-day inpatient admission to the Neurology service in a tertiary hospital with the prospective intent of stabilizing her functional symptoms through the personalized protocol described above. The frequency and intensity of her dystonic attacks decreased. She accepted her diagnosis and returned her supply of rescue medication (apomorphine). We established outpatient care for ongoing treatment of her FND. She has not returned to the ED in the 6 months since discharge.

**Conclusions:** Patients with FND can accrue significant morbidity iatrogenically through the use of unnecessary medications, medical procedures, and repeated admissions to hospital. Repeated diagnostic interventions, emergency visits and siloed care have a high economic burden. We have demonstrated the feasibility and effectiveness of a personalized expectation-based functional symptom therapy protocol in a N of 1 case study. This protocol may be particularly effective as a crisis intervention and may reduce morbidity and unnecessary burden on the health care system. The patient and provider team identified establishment of expectations, interprofessional collaboration and consistency of approach as key factors contributing to the positive outcome.

**References:** Stone J, Carson, A and Sharpe, M. Functional symptoms in neurology: management. 2005. *J Neurol Neurosurg Psychiatry*. 76 (Suppl 1): i13-i21.

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**Functional cervical dystonia: from the diagnosis to treatment, what we appraised from a clinical history**

*Martina Petracca, Delia Mulas, Maria Luana Cerbarano, Alessandro Specchia, Diego Ricciardi, Daniela Di Giuda, Anna Rita Bentivoglio (Rome, Italy)*

**Objective:** Aim of this report is to present the case a 25-years-old nun affected by functional cervical dystonia (CD) with abrupt onset and variable dystonic pattern, markedly improved by an intensive physiotherapy program.

**Background:** Functional movement disorders (FMD) are common in neurological practice, with functional dystonia representing the second most common presentation. Evidence of amelioration with specific physical therapy is rapidly growing.

**Methods:** During a religious celebration, the patient acutely presented CD, characterized by right torticollis, left laterocollis, anterocollis,

lateral shift of the head, left shoulder elevation, associated with intense cervical pain. The Toronto Spasmodic Torticollis Rating Scale (TWSTRS) at the first clinical evaluation was: Motor 23/33, Disability 9/29, Pain 20/20. Brain MRI, orthopedic and psychiatric evaluation, extensive lab workout showed no relevant alterations. We proposed a trial with repeated session of botulinum toxin A (BoNT-A) intramuscular injections for pain relief and an intensive rehabilitative program of fourteen sessions, consisted of specific exercises focused on relaxing muscles, correcting posture and reinforcing weak muscles.

**Results:** The hypothesis of a FMD was carefully communicated to the nun. During the first physiotherapy sessions, dystonic pattern considerably changed to retrocollis and further again to anterocollis. Five weeks later, the TWSTRS scores were: Motor 9/33, Disability 3/29, Pain 4/20. A week after the discontinuation of this program, the patient presented with resting and action tremor and mild parkinsonism. A DaT-SPECT didn't show anything of relevant. After the restart of physiotherapy, a rapid neurological amelioration was noticed. At follow-up visits, a slight lateral shift of the head remained, but some photographs taken before the onset of CD showed a similar pattern. The BoNT treatment is still repeated once a year for pain relief (VAS: 4/10).

**Conclusions:** Abrupt onset with a complex severe and painful CD are considered "red flags" for the diagnosis of FMD. Moreover, the marked variability of the motor pattern is an additional clue to a FMD. These patients typically present with fixed abnormal postures accompanied by severe pain and most of them are young women. The psychiatric interview in our case showed no psychopathological elements; this confirms the fact that the diagnosis of functional disorder should be based on specific and 'positive' symptoms and signs. Prospective studies and a randomized control trials have demonstrated the efficacy of specific physiotherapy treatment for FMD. This case confirms the effectiveness of physical therapy in FMD, especially in CD.

**References:** 1. Edwards MJ, Bhatia KP. Functional (psychogenic) movement disorders: merging mind and brain. *Lancet Neurol* 2012;11:250–260. 2. Ricciardi L, Edwards MJ. Treatment of functional (psychogenic) movement disorders. *Neurotherapeutics*. 2014 Jan;11(1):201-7. doi:10. 1007/s13311-013-0246-x.

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#### **Efficacy of Stimulus Control and Retraining Therapy (SCRT) for Pediatric Patients with PNES**

*Aaron Fobian, Lindsey Elliott, Christina Mueller, Lauren Bolden, Jerzy Szaflarski (Birmingham, AL, USA)*

**Objective:** Stimulus Control and Retraining Therapy (SCRT) teaches patients to gain control of functional symptoms by retraining their responses to stimuli which precipitate and maintain symptoms. This study assessed the efficacy of SCRT in treating pediatric PNES.

**Background:** After EEG, up to 13% of pediatric patients are diagnosed with PNES, and patients and their families are significantly affected by the condition. 1 To date, there are no randomized controlled trials for PNES treatment for pediatric patients.

**Methods:** Fourteen participants (M age=16. 64 SD=3. 30, 50% male, 57. 1% African American, 42. 9% Caucasian) with PNES were randomized to 8 weeks of one-hour outpatient therapy in either SCRT or supportive therapy (ST). ST aims to identify and discuss general life stressors and stress triggers for PNES. Patients completed daily PNES diaries to record occurrence of PNES 1 week before, during, 1 week post and at 2 months post therapy. If PNES were not decreased by >60% or continued to occur =2 times per week at 1 week follow-up, participants were offered the option to cross over to the other therapy.

**Results:** Eight participants were randomized to SCRT (M pre weekly PNES=7. 57, SD=1. 25) and six to ST (M pre weekly PNES=3. 00, SD=2. 92). For ST, one participant dropped out because they believed it was unsuccessful, and one crossed over to SCRT after four sessions because his PNES became violent. Three participants chose to complete SCRT early after PNES resolution, but they completed follow-up. At 1 week post, 100% of SCRT participants and 17% (1/6, M weekly PNES=1. 40, SD=2. 61) of ST participants were PNES-free. Three ST participants crossed over to SCRT, and 100% were PNES-free after SCRT. Six SCRT participants completed 2 month follow-up, and 100% remained PNES-free.

**Conclusions:** SCRT reduces PNES in pediatric patients compared to ST. Despite small sample size, the discrepancy in PNES resolution between treatments is compelling. In SCRT, PNES resolution occurred after 3. 71 (SD=2. 56) sessions on average, suggesting a short-term, outpatient treatment can be effective for treatment of pediatric PNES. Retraining responses in participants with PNES is consistent with success found in the use of physiotherapy for functional movement disorders. 2 Recruitment is ongoing; additional data will be available at time of presentation.

**References:** 1. Kim SH, Kim H, Lim BC, et al. Paroxysmal nonepileptic events in pediatric patients confirmed by long-term video-EEG monitoring—Single tertiary center review of 143 patients. *Epilepsy & Behavior*, 2012;24:336-340. 2. Nielsen G, Ricciardi L, Demartini B, Hunter R, Joyce E, Edwards MJ. Outcomes of a 5-day physiotherapy programme for functional (psychogenic) motor disorders. *Journal of Neurology*, 2015;262:674-681.

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#### **The Effects of Group Psychodynamic Therapy on Psychological Characteristics and Psychogenic Non-Epileptic Seizure Frequency in Patients with Functional Neurological Symptom Disorder**

*Juliana Lockman, Ariela Karasov, Craig Forte, John Barry, Kim Bullock, Sepideh Bajestan (Menlo Park, CA, United States)*

**Objective:** Measure affective characteristics and psychogenic non-epileptic seizure frequency in FND patients receiving group psychodynamic psychotherapy.

**Background:** Functional Neurological Symptom Disorder (FND) is commonly associated with characteristics such as alexithymia, impaired emotional regulation and maladaptive attachment style. Psychodynamic psychotherapy seeks to provide a corrective emotional experience in the context of fostering a meaningful therapeutic relationship. Prior studies of the psychodynamic modality for FND have shown promise. However, further work is needed to better define the specific psychological characteristics that change with treatment and how they relate to functional outcomes.

**Methods:** Hypothesis: Participants will improve with regards to indices of emotional regulation, alexithymia and somatic dissociation, as well as seizure frequency. Methods: 9 subjects were enrolled in a weekly psychodynamic psychotherapy group, with ongoing enrollment. Subject were required to complete at least 9 months of treatment but were not required to leave the study at the end of 9 months if they chose to remain in the group. Measures collected include symptom frequency, Toronto Alexithymia Scale, Dissociative Experiences Scale (DES), Difficulties in Emotional Regulation Scale, and questionnaires for somatoform symptoms (SDQ-20), attachment (ASQ), trauma (ACE), depression and anxiety.

**Results:** Preliminary sampling of seizures at baseline, 9 months and exit from therapy group in all subjects (including patients who completed the treatment and who are still enrolled) showed substantial decrease from average of 17/week/patient to 5/week/patient. There have been no dropouts and all of the subjects that exited the study completed at least 9 months of treatment. Among patients who completed treatment,  $\frac{3}{4}$  had complete remission of seizures and the remaining had significant reduction in frequency of seizures. Baseline measures of alexithymia and somatic dissociation revealed heterogeneous results. The majority of patients showed moderate levels of emotional dysregulation. Given the ongoing research, based on analysis of change in a mixed effect model, post-intervention results will be discussed with respect to psychological profiles.

**Conclusions:** This pilot study examines psychological characteristics and treatment outcomes in psychodynamic group therapy for FND. Further research on psychological characterization may inform psychotherapeutic interventions.