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FUNCTIONAL MOVEMENT DISORDERS: UNDERSTANDING, APPROACH AND DIAGNOSIS

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ABSTRACT

This commentary offers a comprehensive examination of Functional Movement Disorders (FMD) and explores recent advancements in our understanding and treatment of these intricate syndromes. FMDs challenge clinicians due to their variable nature and diverse clinical presentations, often intertwined with psychological factors. Impairments in motor intention and agency must be considered when providing care. Recognizing that non-motor symptoms can have a major impact on a patient's quality of life is equally important. Recognizing FMDs as multi-faceted conditions requiring multidisciplinary care allows consideration of cognitive, social, and demographic aspects.

Keywords: Functional neurological disorder, Functional movement disorder, Movement disorders

INTRODUCTION

Functional Movement Disorders (FMDs) represent a multifaceted spectrum of conditions characterized by movements that defy organic disease explanations.[1]

Here we focus on exploring their diagnostic challenges, mysterious pathophysiology, therapeutic strategies, and recognize the profound impact these disorders have on individual lives.

DIAGNOSIS AND CLINICAL FEATURES

FMDs present a diagnostic conundrum, relying on clinical observations during neurological examinations. These may have complex characteristics, like variability, inconsistency, suggestibility, distraction, and suppression. Although associations with psychological and physical stress are usually made, the exact pathophysiological basis is still unclear. A multidisciplinary approach involving neurology, psychiatry, and therapy can address the emotional burden that conditions place on patients, especially in children with chronic FMDs.[2]

ADVANCES IN UNDERSTANDING

Recent research has brought about a shift in terminology from "psychogenic" to "functional" due to better patient acceptance.[3] Studies have revealed this condition may involve over activity in the limbic system, disruptions in self-agency networks, and disrupted feedforward signaling pathways. While a combination of physical therapy and psychological support displays promise, we emphasize the pressing need for further investigation to enhance our therapeutic arsenal.[4] In the field of FMD clinical management, there's a positive shift happening. Most clinicians now recognize the importance of coordinating patient care and are more hopeful about treatment outcomes than a decade ago. However, there are still challenges to overcome, including the need to educate neurologists about diagnosing FMD based on positive signs rather than exclusion. Additionally, limited access to treatment resources remains a significant barrier to effectively caring for FMD patients and reducing their disabilities.[5]

PATHOPHYSIOLOGY

Childhood trauma and psychiatric symptoms may contribute to Functional Movement Disorders, with heightened stress responses and biological factors playing a role in the condition's pathogenesis. Physical trauma, particularly in fixed dystonia cases, frequently precedes Functional Movement Disorders, with studies showing that traumatic events, often from accidents, play a role alongside psychological stressors in triggering these disorders. This suggests a "double hit" pathogenic mechanism involving multiple traumatic events throughout a patient's life.

Social influence, exemplified by "mass psychogenic illness," can play a role in FMDs where a group of individuals develop similar psychogenic symptoms after observing others. This may involve a "modeling" mechanism, and FMDs have been associated with exposure to similar movement disorders. Secondary gain may occur alongside neurological disorders such as Parkinson's. Adequate knowledge of these mechanisms will help healthcare professionals better address the emotional burden that patients may experience, especially children with chronic FMDs.

Genetics, environmental factors, and epigenetic mechanisms may contribute to the development of FMDs. Childhood abuse and stress have been linked to DNA methylation and brain changes, possibly starting in utero. Limited evidence suggests increased methylation of the oxytocin receptor gene in FMD patients, and there is potential relevance to stress-related disorders and autoimmune diseases, although FMD-specific studies are lacking.[6]

NEUROANATOMICAL INSIGHTS

The patients showed increased gray matter volume in certain brain regions like the left amygdala, left striatum, left cerebellum, left fusiform gyrus, and bilateral thalamus, but decreased volume in the left sensorimotor cortex in a study. Interestingly, these volumetric differences were not linked to disease duration or severity, but they were found in brain regions associated with limbic and sensorimotor circuits. These structural changes could be a trait vulnerability, related to the disease itself, or a compensatory response, and they were not explained by comorbid depression, anxiety, or childhood trauma. The study also conducted thorough neuropsychological evaluations using scales like Hamilton Anxiety Rating Scale (HAM-A), Hamilton Depression Rating Scale (HAM-D), and Childhood Trauma Questionnaire (CTQ) to explore potential psychiatric factors.[7]

BIOPSYCHOSOCIAL MODEL

FMDs appear to have a complex etiology with biological, psychological, and social factors that may interact with one another. Early life stress, including prenatal stress, can contribute to FMD development through cortisol-related changes in the brain. Current stress, though common, may not always correlate with FMD, suggesting a more subjective response to stress. Deficient vagal tone indicates difficulty adapting to environmental demands in FMD patients. Secondary gain, where improvement could lead to worse social situations, can affect patient motivation for recovery. FMD patients are often found to have comorbid anxiety and depression, with some neuroimaging studies showing abnormalities in brain function, including decreased activation in the Temporo-Parietal Junction (TPJ) related to a sense of self-agency for movement. Over activity in the limbic system and its connection to the motor system may also contribute to FMD symptoms, suggesting a complex interplay of factors in FMD pathogenesis.[8]

CLINICAL FEATURES DIFFERENTIATING FMDS

A major breakthrough emerged from a large cohort study that identified ten clinical features capable of distinguishing FMDs from non-FMDs. These features are age of onset, gender, psychiatric history, family history, presence of more than one motor phenotype, pain, fatigue, abrupt onset, long-term waxing/waning, and daily fluctuations. Furthermore, a predictive model exhibited remarkable accuracy, promising substantial aid to clinicians in identifying suspected FMD cases.[9]

Functional stomatognathic movement disorders often manifest as involuntary jaw and lip movements and high-speed tongue and jaw oscillations. These findings could assist in distinguishing functional from organic disorders affecting speech, swallowing, and jaw function.[10]

LIVED EXPERIENCE

A study conducted on individuals living with Functional Movement Disorders (FMDs), explored their experiences from symptom onset to diagnosis and ongoing challenges. Participants commonly faced fear and disbelief, with some enduring extended periods of misunderstanding before finding the right neurologist. Diagnosis provided relief but often led to disappointment due to the absence of a cure. Three participants adapted positively to living with FMD, while five continued to struggle, reflecting the emotional and identity impact. This aligns with prior studies showing reduced quality of life, social isolation, self-doubt, and loss of identity in FMD patients. Some found it difficult to maintain their old roles, but a few embraced new, albeit limited, ones. Overall, coping strategies varied among participants, emphasizing the importance of finding purpose for well-being. Additionally, the study introduced the unique perspective of some FMD patients perceiving their affected body parts as separate entities, adding depth to our understanding of FMD experiences.[12]

EMOTION REGULATION

An insightful Functional MRI (fMRI) study navigates the intricacies of voluntary emotion regulation in FMD patients. It uncovers altered patterns of brain activation during the observation of negative stimuli which include increased activation in specific brain regions (postcentral gyrus, precuneus, posterior cingulate cortex, and cerebellar vermis) and attempts at emotion regulation. In patients, alexithymia was negatively correlated with left insula activation during negative picture viewing. These findings suggest the involvement of self-processing regions in patients voluntary emotional regulation and a diminished emotional awareness within this population, deepening our understanding of the psychosocial dimensions of FMDs.[13]

FMDs GENDER DIFFERENCES

It was found in a study that females are the majority in FMD cases, potentially due to their higher utilization of

healthcare services, cultural and biological factors. In addition, the study revealed variations in FMD prevalence across age groups, with females predominantly affected in middle-aged patients but equal representation in patients aged 60 years or older.[14]

FMDs IN CHILDREN

A dedicated examination of FMDs in pediatric patients illuminated distinctions in frequency, clinical presentations, and treatment responses when compared to their adult counterparts. FMDs account for 4.3-23% of acute pediatric movement disorder cases, with common manifestations like tremors, dystonia, gait issues, and functional tics. Precipitating factors include social, physical, and familial factors. Remarkably, pediatric patients tend to respond better to FMD treatment compared to adults.[15]

CHRONIC FMDs

A compelling long-term follow-up study reinforced the notion of FMDs as chronic and debilitating conditions. Functional weakness was the most common presentation, with all patients experiencing ongoing disability despite interventions. Key observations included persistent but non-progressive symptoms, mood disturbances, changing symptom patterns, and the absence of pituitary tumors linked to FMD. Patient narratives highlighted long-term struggles with disability, disrupted social and occupational lives, acceptance of diagnosis, and self-identity impacts.[16]

IMPAIRED AWARENESS OF MOTOR INTENTION

Groundbreaking fMRI research utilizing Libet's clock task uncovered a fundamental impairment in the awareness of motor intention among FMD patients. When focusing on intention versus movement, FMD patients had reduced activity in the right inferior parietal cortex. The interval between W and M judgements correlated with activity in motor areas, suggesting that impaired motor intention processing may underlie clinical features in FMD, such as slowed voluntary movement and functional symptoms. This finding underscores a fundamental deficiency in motor intention processing as a key element of FMD symptomatology.[17]

IMPAIRED SENSE OF AGENCY

With the aid of fMRI and a sophisticated virtual reality task, research discerns an impaired sense of agency in FMD patients. This neural evidence offers validation for the involuntary nature of movements experienced by these individuals.[18] Resting-state fMRI investigations revealed decreased connectivity within key brain regions central to the processing of a sense of agency among FMD patients. Decreased connectivity between the right Temporo-Parietal Junction (rTPJ) and right sensorimotor cortex, cerebellar vermis, bilateral SMA and right insula was observed.

This diminished connectivity suggests that impaired motor predictions and altered sensory feedback play pivotal roles in the deficits in agency perception.[19]

OVERFLOW SYMPTOMS

Intriguing findings from an fMRI and finger tapping task study examining motor overflow symptoms in FMD patients unveil the neural intricacies underlying this phenomenon. FMD patients showed reduced activation in posterior parietal and premotor regions. The posterior parietal cortex is involved in internally representing intended movements, while reduced premotor cortex activation suggests impaired motor control. Additionally, functional connectivity between these regions and the striatum was weaker in FMD patients. Abnormal neural interactions between parietal and premotor regions shed light on the mechanisms behind overflow symptoms, opening avenues for more targeted interventions.[20]

IMPACT ON QUALITY OF LIFE

A thorough evaluation of FMD patients' quality of life, as conducted in a study, highlighted the significant impact of non-motor symptoms such as depression, anxiety, pain, and cognitive issues. Instead of motor severity, these non-motor aspects significantly affect patients' overall well-being.[21]

ABNORMALITIES IN AWARENESS OF ACTION

Intriguing research uncovered specific abnormalities related to sensory attenuation, temporal binding, and intention awareness that impact the sense of agency in FMD patients. These findings offer potential explanations for the perceived involuntary nature of their movements.[22]

EXECUTIVE CONTROL OF ATTENTION

A fascinating exploration of FMD patients' cognitive functioning unveils impaired executive control of attention, particularly in conflict situations. These insights shed light on cognitive processes contributing to FMD symptoms, such as concentration difficulties and fatigue.[23]

CLINICAL CHARACTERISTICS

An in-depth analysis of clinical and sociodemographic features within the FMD patient population underscores the prevalence of non-motor symptoms, notably pain and fatigue. These observations emphasize the imperative need for multidisciplinary care approaches to comprehensively address the diverse facets of FMDs.[24]

CORTICO-MUSCULAR COHERENCE

CMC, which indicates the coupling between motor cortical oscillations and muscle activity, was found to be significantly increased in psychogenic tremor patients, especially over the ipsilateral motor cortex. Within the psychogenic tremor group, CMC correlated positively with tremor amplitude and was also increased in a static postural task without tremor. These findings suggest enhanced coupling between motor cortical activity and tremor-related muscles in psychogenic tremor, differing from patterns seen in essential tremor. Increased CMC may serve as a neural biomarker associated with abnormal sensorimotor integration and impaired voluntary motor control, shedding light on potential pathophysiological mechanisms of psychogenic tremor.[25]

KEY INSIGHTS

In a concise summation, an article highlighted five pivotal insights gleaned from recent research. These encompass the importance of meticulous exclusion of neurological diseases, enlightening volumetric MRI findings, elucidation of impaired self-agency mechanisms, recognition of executive dysfunction, and the effectiveness of specialized multidisciplinary clinics.[26]

CONCLUSION

Recent strides in research have significantly enriched our comprehension of FMDs, demystifying their complex nature, neuroanatomical insights, and the crucial role of emotion regulation.

These diseases are influenced by both genetic and environmental factors and have a significant impact on patients' lives, with non-motor symptoms playing an important role in determining a patient's overall health status. Embracing a multidisciplinary approach is pivotal for improved understanding and tailored management of FMDs.

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Hudaibiya Ayub; Concept, design, data collection, data interpretation, manuscript writing
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Rasheed Azhar; Data interpretation, manuscript writing, manuscript review

The authors have approved the final version of the article, and agree to be accountable for all aspects of the work.