

Recognising and managing functional neurological disorder in the acute healthcare setting

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ABSTRACT

Functional neurological disorder (FND) is a complex and heterogenous condition characterised by abnormal neurological symptoms that are linked to structural and functional alterations in widely distributed brain networks. For many patients with FND, the emergency department (ED) is the first point of contact with the healthcare system. This review seeks to provide up-to-date FND diagnostic criteria to ED providers, with a focus on common FND subtypes. Furthermore, we summarise the appropriate management course for these patients. Proper recognition and management of FND at the time of initial presentation in the acute care setting has the potential to improve patient prognosis and reduce overall costs to the healthcare system.

INTRODUCTION

Functional neurological disorder (FND) can present with a wide spectrum of symptoms, ranging from abnormalities in speech/swallowing to sensory disturbances to seizure-like spells. FND may closely resemble other neurological disorders, making it challenging to diagnose.¹ Compared with patients with other neurological disorders such as multiple sclerosis, epilepsy and Alzheimer's disease, patients with FND have a higher rate of hospital admissions after an emergency department (ED) evaluation.² Recent criteria, however, make it possible to come to an accurate diagnosis using diagnostic criteria that rely on the presence of positive signs on neurological examination. Although previously considered a diagnosis of exclusion, FND is now well-recognised as a diagnosis of inclusion based on specific positive findings on physical examination. The criteria for FND, as per the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), are listed below³:

1. One or more symptoms of altered voluntary motor or sensory function.
2. Clinical findings provide evidence of incompatibility between the symptom and recognised neurological or medical conditions.
3. The symptom or deficit is not better explained by another medical or mental disorder.
4. The symptom or deficit causes clinically significant distress or impairment in social, occupational or other important areas of functioning or warrants medical evaluation.

Importantly, this updated DSM-5 criteria for FND no longer requires the presence of psychological factors to make the diagnosis of FND. While FND often coexists with underlying depression and

anxiety, these comorbidities are neither necessary nor sufficient to make a diagnosis.

Neuroimaging studies point to aberrations in brain circuitry in individuals with FND. Individuals with FND lack a sense of self-agency for their abnormal movements, and multiple resting-state and task-based functional MRI (fMRI) studies have demonstrated abnormal activation of the right temporoparietal junction, an important brain region in the self-agency network.^{4–6} Increased limbic activity and abnormal limbic-motor circuitry have been seen in numerous task-based fMRI studies^{7–10} and point to altered emotional regulation in these patients. In addition, electrophysiological experiments are consistent with abnormal attention allocation and processing of sensory information in FND.¹¹

FND can cause considerable physical and mental distress for affected patients and family members and often places a significant economic burden on the healthcare system.

Based on US Healthcare Cost & Utilization Project data, in 2017 alone, overall charges for adult and paediatric ED visits for FND were US\$163 million in 2017, comparable to those for refractory epilepsy. The rate of these charges has increased significantly since 2008 compared with other neurological disorders, notably in the ED setting.² Expanding beyond the USA, a systematic review analysing 2021 data from eight countries found that annual costs for FND were calculated to be up to US\$86 000 per patient. These costs included hospital and outpatient visits, diagnostic investigations and medications, underscoring the significant economic impact associated with this condition.¹²

Although there are a number of reviews describing the diagnosis and management of FND, there are a limited number of reviews that focus specifically on the ED setting. This article will discuss the salient features, diagnostic criteria and the appropriate management of FND, with a focus on the ED setting. In the ED, clinicians appropriately have a low threshold for high morbidity conditions that require urgent treatment. While essential, this approach can also lead to diagnostic delay and inappropriate healthcare utilisation for patients ultimately diagnosed with FND. Proper management and early diagnosis may help improve the long-term prognosis of patients with FND.¹³

METHODS

This practice review was coauthored by an emergency medicine physician (DC), a neurologist with subspecialty training in movement disorders and



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expertise in FND (CWM) and two medical students (AG-C and TR). The information provided is guided by relevant literature and expert opinion to deliver insight into the management of FND in the ED setting. To gather the relevant data for this study, a literature search was conducted using the PubMed database. Our search strategy was formulated to encompass various terms related to FND in the ED setting. The following search terms were used: “conversion disorder”, “functional neurological disorder”, “non-epileptic seizure”, “seizure mimic”, “psychogenic neurological disorder”, “psychogenic movement disorder”, “functional movement disorder”, “emergency service”, “emergency department” and “emergency room”.

The search was not limited by publication date, allowing for the inclusion of all available studies on the topic. All titles and abstracts were screened for relevance to the practice review. Case reports and studies not available in English were excluded. Full-text articles were then evaluated, and cited studies that were relevant to the topic and not previously found were additionally included. Original articles were prioritised, but information was also included from noteworthy systematic reviews and expert opinions. This methodology enabled a thorough understanding of the topic and a well-rounded perspective on the existing literature.

PREVALENCE AND EPIDEMIOLOGY

FND is common, as highlighted by a cross-sectional study of 3781 newly referred neurology patients in Scotland, UK, which found that 15%–20% of the neurology referrals were for FND.¹⁴ A 2025 systematic review estimated its incidence at 10–22 cases per 100 000 people annually, with a prevalence of 80–140 instances per 100 000 people. In the ED, the overall prevalence of FND is estimated to be 0.4%–4%.¹⁵ A retrospective observational study from a hospital in New Zealand found that FND accounted for 9% of neurological admissions from 2016 to 2018.¹⁶ FND affects women more than men in a roughly 3:1 ratio.¹⁷ The disorder typically affects young to middle-aged individuals, although any age group can be affected. Subtypes of FND have distinct age patterns, with functional seizures having a median age of onset in the late 20s compared with functional movement disorder (FMD) which presents with a median age of onset in the late 30s. A 2022 systematic review and individual patient meta-analysis of 4905 patients with FMD found that 72.6% were women, with a mean age of onset of 39.1 years in women and 41.0 years in men.¹⁸

MISDIAGNOSIS: –FREQUENCY AND POTENTIAL CONSEQUENCES

Failure to diagnose FND in a timely manner can result in increased hospital reattendance, increased costs and unnecessary and even sometimes harmful treatment. A 2021 meta-analysis found that up to 13.5% of patients enrolled for status epilepticus trials had functional rather than epileptic seizures.¹⁹ Half the studies included patients diagnosed by hospital-based physicians, highlighting the potential for misdiagnosis in the inpatient setting. A 2021 retrospective observational study from an Australian hospital found that among patients coming in with a seizure-like episode, 26.5% of those initially diagnosed with epileptic seizure were misdiagnosed.²⁰ Misdiagnosis was even higher for patients presenting with prolonged or multiple seizure-like episodes, as 49.5% of the 196 cases treated as epileptic seizures were ultimately diagnosed with functional seizures.

Misdiagnosis of FND can result in inappropriate treatment. Two large status epilepticus trials from 2011 were analysed

retrospectively, discovering that out of 980 trial participants, 8.1% were discharged with a diagnosis of functional seizure with the highest incidence in individuals aged 15–29 (20.1%). About 26% of these misdiagnosed individuals experienced respiratory depression and intubation.¹⁹ The intensive care unit (ICU) experience can be highly distressing, leading to a significant rate of ICU-related post-traumatic stress disorder among patients with FND. A 2019 observational study discovered that among 80 patients with functional seizures, the 12 who were intubated experienced longer seizure-like activity and a higher rate of rehospitalisation due to recurrent non-epileptic attacks compared with those who were not intubated.²¹

In addition to unnecessary treatments, patients with FND can also receive unnecessary diagnostic testing. A 2020 retrospective observational study that evaluated more than 40 000 ED visits using an US healthcare database demonstrated that although now recognised as a diagnosis of inclusion, FND often continues to be treated as a diagnosis of exclusion, frequently leading to extensive unnecessary medical evaluations including neuroimaging, laboratory testing, lumbar puncture and electrophysiological testing.² Aims to exclude other diagnoses may overshadow the prompt diagnosis of FND made based on a careful evaluation and clinical examination. A 2022 retrospective study of 212 patients with FND referred to a city hospital in the UK found the mean time from initial presentation with neurological symptoms to a documented diagnosis of FND to be 19.2 months, with some patients waiting up to 11 years for a formal diagnosis.¹

Even after a correct diagnosis of FND is made, there are still challenges in the management of the disease. Many FND patients are left uninformed about their condition, with a 2023 prospective observational multisite inpatient study in Australia reporting that out of 113 patients with FND, 54% were not provided with a diagnosis and 20% had no mention of their diagnosis in their medical records.²² Even after diagnosis, many patients end up returning to the ED postdischarge, with up to 31% returning at least once and 8% returning more than once in one study.^{18 22}

COMMON FND PRESENTATIONS

FND can present with a wide range of neurological symptoms. The most common ED presentations include functional seizures and FMD, which can include tremors, gait abnormalities and weakness. Visual impairments and speech disorders may also be seen. Each of these phenotypes can present with distinct physical signs on neurological examination that allow a physician to arrive at the correct diagnosis.^{17 23} The following sections will outline the key clinical signs that can be employed to help recognise some of the more common presentations of FND.

Functional weakness

Functional weakness may be detected by specific findings on physical examination (table 1), including a positive Hoover sign, a positive hip abductor sign, as well as give-way weakness. The specificity and sensitivity of these signs have been well characterised, with many of these signs having high specificity for FND.^{24 25} Hoover's sign relies on the principle of synergistic contraction, which refers to the coordinated effort between muscle groups to initiate a movement. Testing for Hoover's sign should occur with the patient in the seated or supine position. First, the examiner asks the patient to extend the hip of the weak leg while providing resistance. Little movement will occur. Afterwards, the examiner asks the patient to flex their healthy hip against resistance. If the patient's weakness is functional, the examiner will appreciate involuntary hip extension of the weak

Table 1 Clinical signs in functional weakness

Clinical feature	Brief description	Sensitivity (%)	Specificity (%)
Positive Hoover sign	Involuntary hip extension of the weak leg during contralateral hip flexion, but unable to extend weak leg voluntarily	63–100	86–100
Positive hip abductor sign	Involuntary hip adduction of the weak leg during contralateral hip abduction, but unable to adduct weak leg voluntarily	100	100
Give-way weakness	Sudden loss of muscle strength during strength testing	20–90	95–100
Motor inconsistency	Degree of weakness can vary significantly when attention is directed elsewhere (including the execution of other movements)	98	13
Dragging monoplegic gait	Weak leg is dragged, rather than circumducted	8–100	11–100
Drift without pronation	During assessment of pronator drift, downward drift of arm without pronation	11–93	100
This table summarises the diagnostic features of functional weakness and their respective sensitivity and specificity. ²³			

leg when the healthy contralateral hip is flexed. This represents a positive Hoover's sign (see references for schematic).^{26 27}

The hip abductor sign, like the Hoover's sign, also relies on the principle of synergistic contraction. To test for the hip abductor sign, the examiner first asks the patient to lie supine with legs relaxed. The examiner will then place their hands on the lateral aspect of the patient's leg and apply resistance as the patient abducts their weak leg. Little to no movement should occur. The examiner will then repeat the same step on the healthy leg. A hip abductor sign is positive when involuntary adduction of the leg with functional weakness is observed, demonstrating that motor signals are still intact (see reference for schematic).²⁸

Patients with functional weakness may also exhibit give-way weakness on strength testing. In comparison to a consistent reduction in resistance, patients with functional weakness may initially exhibit normal resistance and then 'give-way' and abruptly lose strength. Weakness can also vary significantly in patients with functional weakness, improving with distraction or performing inconsistently throughout the physical examination, which is referred to as motor inconsistency. Patients with functional gait may present with a dragging monoplegic gait, in which the affected leg is dragged with their foot sliding on the floor. This is distinct from a hemiparetic gait as seen after stroke, for example, where a patient circumducts the weak leg. For patients with functional weakness of the arm, evaluation for pronator drift may present with a downward drift of the arm but without the pronation that frequently accompanies weakness secondary to other aetiologies. It is important to note that the sensitivity of these signs is not 100% (see [table 1](#)), and additional testing should be pursued if other diagnoses such as stroke are on the differential.

Functional tremor

Specific clinical findings on examination allow for a clinically definite diagnosis of functional tremor to be made. One notable characteristic is the potential for a functional tremor to be entrained, in which the frequency of the tremor adopts the rhythm of another stimulus. For example, if a patient taps their contralateral extremity to a specific tempo, the frequency of the functional tremor may match that same tempo. The tremor may also suppress completely during this contralateral tapping. The tremor may pause momentarily when the patient makes a contralateral ballistic manoeuvre (ie, a sudden large movement on the contralateral side of the body). Patients with functional tremor may exhibit tonic coactivation, in which agonist and antagonist activation of opposing muscle groups contribute to involuntary shaking. Lastly, a variable tremor—in its frequency, axis or distribution—is suggestive of a functional tremor. Collectively, these positive phenomena are diagnostic and help distinguish functional tremor from other aetiologies of tremor.²⁹

Functional seizure

Functional seizures, also commonly referred to as non-epileptic attacks, can differ from epileptic seizures in several distinctive ways (see [table 2](#)). Unlike epileptic seizures, which are typically brief and last for less than 2 min, functional seizures often have a longer duration, frequently lasting greater than 2 min. The movements seen in functional seizures tend to be asynchronous and non-stereotyped, with brief pauses or changes in tempo. Forced eye closure is a common observation, and the individual may cry and be able to recall items or events presented during the event. Side-to-side head movement and pelvic thrusting are also highly specific findings. There is generally a normal pupillary

Table 2 Comparison of functional and epileptic seizures

Clinical feature	Functional seizure	Epileptic seizure	Sensitivity (%)	Specificity (%)
Duration	Often longer duration (greater than 2 min)*	Usually brief (seconds to a few minutes)	N/A	N/A
Pattern	Often asynchronous and non-stereotyped (brief pauses or changes in tempo)†	Typically synchronous and stereotyped	9–56	93–100
Eyes	Forced eye closure during event, crying may occur	Open eyes, sometimes with deviation to one side, no crying	52–96	97
Pelvic thrusting†	Commonly observed	Rarely observed	7.4–44	92–100
Side to side movements	Commonly observed of head and body	Less commonly observed	15–36	92–100
Postictal	Able to recall items presented during ictus	Confusion and drowsiness	77–88	90

This table outlines the key clinical differences between functional and epileptic seizures, alongside their sensitivity and specificity percentages.³⁸

*Patients in status epilepticus will have seizures lasting longer than 5 min.

†Exception: frontal-lobe partial seizures.

light reflex during the spell, and when present, the visible tongue bite in patients with functional seizures tends to be on the front instead of the lateral aspect of the tongue. Capturing a functional seizure on electroencephalographic (EEG) can be diagnostic, as it facilitates the correlation between the clinical manifestation of the spell and its underlying cerebral electrical activity.³⁰

ED EVALUATION OF FND

For a patient presenting to the ED with symptoms suggestive of FND, the first priority is to assess for any conditions with high morbidity. A low threshold for investigation is warranted for patients with acute focal deficits or seizure-like activity, especially if this is a patient's first presentation. The initial workup may include a complete neurological examination, bloodwork and neuroimaging. Although FND is diagnosed through positive clinical signs, and not through exclusion, it is still important to use relevant diagnostic testing in the ED if serious pathologies are on the differential (ie, neuroimaging if stroke is suspected or, if available, EEG if seizure is suspected). However, repetitive testing should be avoided if a patient's presentation, history and examination all support a diagnosis of FND.

The signs outlined in the tables above provide an initial guide for ED providers to use when assessing a patient for FND. The history and collateral gathered can be helpful for differentiating key diagnostic patterns, as shown in [table 2](#) which illustrates historical features differing between a functional seizure and an epileptic seizure. A 2024 prospective cohort study of 465 newly referred patients in the Netherlands and Australia developed a predictive model using history to differentiate patients with FMD from non-FMD patients with 88% accuracy. For example, sudden symptom onset increased the likelihood of an FMD diagnosis by more than fivefold, while each additional year of age in a patient slightly decreased the odds of an FMD diagnosis. History of functional disorders and symptom fluctuations over an extended period of time were all also seen in greater proportion in patients with FMD.³¹ Nevertheless, even if a patient has a previously confirmed diagnosis of FND, any subsequent presentation to the ED should not be assumed to be a consequence of FND. Up to 20% of individuals with FND have comorbid neurological conditions that may account for their acute presentation.²⁷

As with other neurological disorders, confirmation of the diagnosis of FND should be attained through consultation with a neurologist. If a neurologist is not present on-site, telehealth services, when available, may provide a useful alternative. A neurologist can gather a comprehensive history virtually, speaking to the patient, family and on-site ED attending. A FND diagnosis should not be made on history alone, however. Through remote consultations, neurologists can also evaluate for positive features on physical examination that are critical for the diagnosis of FMD, as described above.

ED MANAGEMENT OF FND

Early proper management of FND is critical for optimal long-term prognosis. As first-line responders, ED providers can play an important role in setting patients up for success. Clear communication is critical for this process. Once a diagnosis of FND is reached, ED professionals should provide transparency on the disorder to alleviate anxiety, promote understanding and facilitate more effective management of the condition. This includes legitimising the patient's experience by emphasising that their symptoms are real and a result of a potentially reversible condition involving abnormal functioning of their nervous system.²⁰

Patients should understand that the diagnosis is made based on positive findings found on physical examination and not a result of ruling out other conditions. An ED physician can and should initiate a discussion with the patient about this diagnosis, even in the absence of a neurologist. Effective communication with the patient can help to foster a patient's acceptance of the diagnosis, which is a positive prognostic indicator.³² An international survey of movement disorders neurologists asserted that educating patients about FND was the most successful approach in improving a patient's prognosis, followed by avoiding iatrogenic harm.^{32,33} Below is an example of how the diagnosis may be communicated: 'You most likely have functional neurological disorder. This is a common condition seen in neurology. I am making this diagnosis based on specific features in your physical examination that I can demonstrate to you. With FND, there is an issue with the functioning of the nervous system, but there is no damage to the nervous system itself. This means that your symptoms are potentially reversible.' Additional resources on how to deliver the diagnoses may be found in Stone and Hoeritzauer.³⁴

Before the patient leaves the ED, providers should offer educational material including the FND websites such as www.neurosymbols.org; www.fndhope.org and www.nonepilepticattacks.info. FNDhope.org includes a list of FND specialists in specific countries including the USA (www.fndhope.org), the UK (www.fndhope.org.uk) and Canada (www.fndhope.org.ca). The patient's diagnosis should also be documented in the electronic medical record (EMR), as this has been associated with reduced risk of ED reattendance.¹ [Figure 1](#) demonstrates the initial steps that can be taken during management of an ED patient with suspected FND. Providing a clear diagnosis and appropriate referrals can help patients accept the diagnosis and avoid excessive testing and treatment.²⁰ Discharge planning should include a referral to an outpatient neurologist, given that a neurologist can subsequently confirm the diagnosis and assess for any comorbid neurological conditions.

Patients with FND experience lower rates of inpatient physical therapy and psychiatric consultation compared with other neurological disorders, despite the benefit this population can receive from such services. When these services are available, ED providers have a unique opportunity to serve as the initial link to these services. For example, treatment methods such as psychotherapy and occupational therapy have been shown to result in lower rates of hospital reattendance and improvement in overall quality of life. A 2022 retrospective study of 212 patients with FND referred to a city hospital in the UK found that patients who were given a psychology referral had a 65% reduced risk of ED reattendance.¹ Another study found that adherence to psychotherapy in patients with functional seizures resulted in improved scores on the QOLIE-10 quality of life scale (7.2 ± 8.6 for adherent vs 2.8 ± 9.0 for non-adherent ($p=0.044$)).³⁵ These forms of therapy provide patients with a deeper understanding of their symptoms, equipping them with strategies to better manage their conditions. Individuals with FND have higher rates of psychiatric comorbidities, which when addressed, can lead to more effective management and better outcomes.² ED providers can play an important role by referring the patient to mental health services and avoiding medications that may further complicate a patient's mental health status. Physical therapy can also be used for symptom management with positive outcomes. One historical cohort study demonstrated that 73.5% and 60.4% of patients with FMD improved in the short term and long term, respectively, following a physical therapy rehabilitation protocol.³⁶ A more recent randomised controlled trial

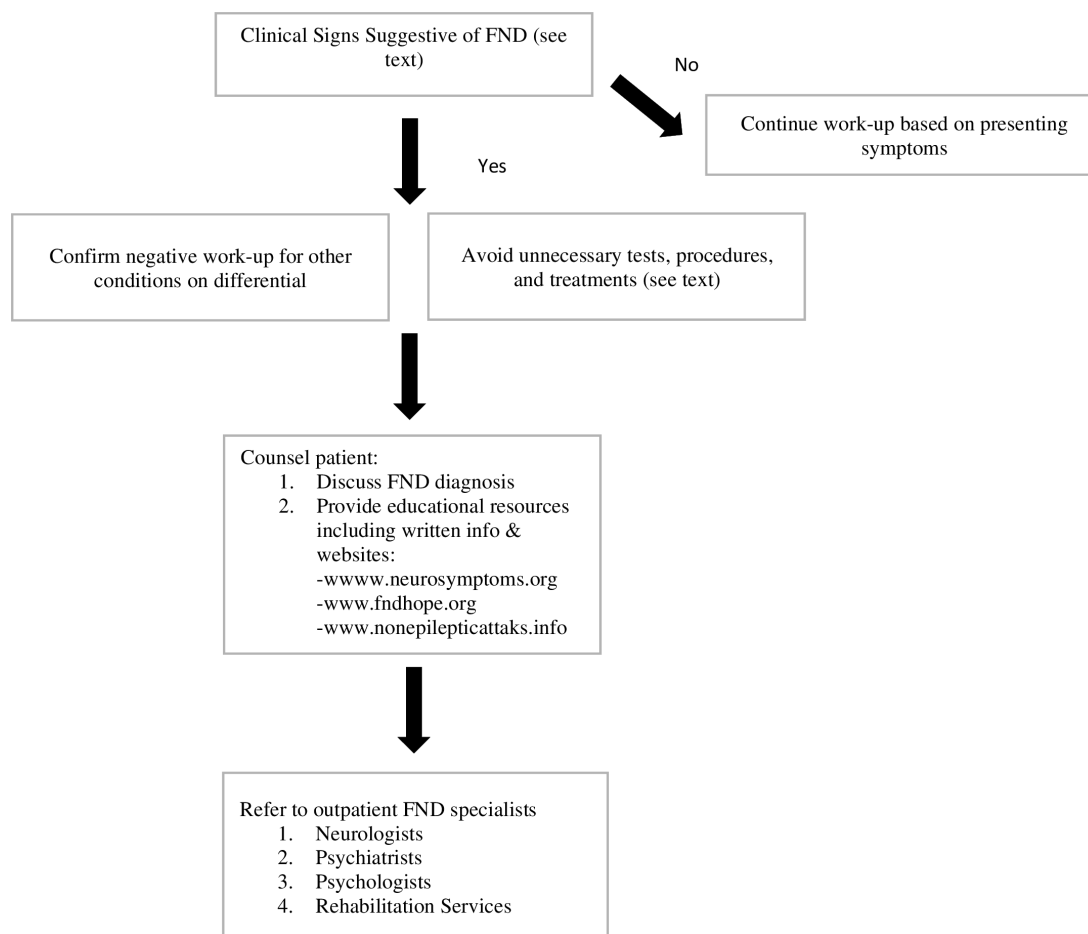


Figure 1 Management of emergency department patient with suspected FND. FND, functional neurological disorder.

demonstrated that 72% of the intervention group who underwent a physical therapy programme experienced an improvement in symptoms compared with 18% of the control group.³⁷ In EDs with access to physical therapists, short interventions or guidance may be provided before transitioning the patient to a more structured outpatient management plan.

All these modes of treatment emphasise the need for a multidisciplinary team, including neurologists, psychiatrists, physical therapists, occupational therapists and psychologists. Referral to these providers in the acute care setting helps to ensure that specialised interventions can be implemented in a timely manner. Professionals with expertise in FND may provide more attuned care. Through appropriate management, both direct and indirect costs can be lowered.

CONCLUSION

FND is a common and complex neuropsychiatric disorder that significantly impacts patients' lives. Early identification of FND in the ED setting can benefit patients by preventing unnecessary treatments, reducing hospital readmissions and mitigating associated costs. The multifactorial nature of FND requires a holistic multidisciplinary management approach, with evidence supporting the success of such treatment strategies in improving patient quality of life. The ED can serve as a crucial link to this multidisciplinary care. By equipping ED professionals with the knowledge and tools to identify and initiate the management of FND, patients can be placed on the right trajectory towards positive outcomes.

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