
DISORDERS

**SICKNESS OF
DISEMBARQUEMENT**

The continuous illusion of motion, normally after disembarking from a moving vehicle.

ARTICLE

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Mal de Débarquement Syndrome (MdDS)

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WHAT IS MAL DE DEBARQUEMENT SYNDROME?

Mal de Debarquement Syndrome is a rare central vestibular disorder that typically arises after exposure to passive motion (e.g., a boat, airplane, automobile, or train). 'Mal de Debarquement' is French for 'sickness of dis-embarkment'¹. This term originally referred to a short-lived sensation of movement felt as an aftereffect of travel on water by ship or boat². For some individuals, these sensations do not improve, and after one month of experiencing these symptoms, a patient is considered to have Mal de Debarquement Syndrome (MdDS).

The hallmark symptom of MdDS is a persistent sensation of rocking, swaying, and/or bobbing that typically begins shortly after disembarking from a vehicle. While most people experience a fleeting version of this feeling for minutes to hours after travel, in patients with MdDS, it becomes constant and unrelenting. Beyond



this defining characteristic, the condition presents with a broad range of associated symptoms common to vestibular disorders, including migraine, vestibular migraine, unsteadiness, brain fog, visual-motion sensitivity, cognitive difficulties, and mood disorders such as depression and anxiety³.

The most common onset for MdDS is exposure to passive motion⁴. Patients with this type of onset are referred to as Motion-Triggered (MT) MdDS patients. There is a subset within this clinical population that cannot attribute the onset of their symptoms to a motion event but rather to a non-motion event or to a spontaneous onset. It is still debatable whether the latter is a true form of MdDS. Non-motion events that have been associated with the onset of MdDS symptoms include surgery, childbirth, medication changes, traumatic experiences, and minor head injuries^{5,4}. These patients are referred to as non-motion-triggered (NMT) or spontaneous-onset (SO) MdDS patients, or NMT/SO MdDS patients



collectively^{4,6}.

Although the NMT/SO MdDS subtype reports symptoms identical to those of the MT MdDS subtype, the Barany Society has recently suggested that NMT/SO patients should perhaps be classified as a separate vestibular entity (Persistent Postural-Perceptual Dizziness), given the vastly different causes of onset and potential differences in underlying mechanisms. Research into both subtypes is ongoing in the hope of identifying similarities and differences between them and to clarify a potential classification.

Regardless of onset type, MdDS generally affects more women than men, with onset starting between 40 and 50 years of age⁴. Male subjects can also be affected, although they represent only 10 - 15% of the MdDS clinical population^{5,7,8}.

PROPOSED UNDERLYING CAUSES

The research into MdDS is still in its infancy, though there are three main theories regarding the underlying cause of MdDS:

- VOR (vestibular ocular reflex) Maladaptation (Dr. Mingjia Dai)
- Functional Connectivity Issues (Dr. Yoon-Hee Cha)
- Hormonal Dysfunction with a Noxious Oscillator (Dr. Viviana Mucci)

WHO IS MOST AFFECTED?

As mentioned above, MdDS mostly affects women (roughly 85% of the clinical population), with onset around the age of perimenopausal transition^{9,10,8,5,11}. The reason for this female predominance remains unclear, yet some hypotheses have been formulated (Mucci et al., 2018/2020).

WHAT CAUSES IT?

MdDS is normally caused by exposure to an unfamiliar movement and then the removal of that movement (e.g., pitch, roll, sway). Sea travel is the most common precipitating event^{13,14,2}. Today, it is known that MdDS is not an issue with the inner ear but rather with the brain's ability to integrate its afferent signals from the inner ear, the eyes and the proprioceptors (built-in sensors in muscles, tendons, and joints)².

Peripheral vestibular tests in patients with MdDS are usually unremarkable, and structural MRI

results are also normal. Only specific brain imaging studies (e.g., fMRI) have demonstrated changes in the MdDS patient's brain metabolism and functional brain connectivity among different brain regions. From such observations, the theory of neuroplastic changes in MdDS patients has been developed¹⁵.

Another hypothesis proposes that MdDS originates from maladaptation of the Vestibular Ocular Reflex (the connection between the eyes and the inner ear) and velocity storage (internal gyroscope and short-term memory bank for motion), both caused by exposure to passive motion. In simple terms, certain movements (such as those experienced on a ship or boat) expose an individual to unique movement patterns in all planes of motion¹⁶. During this time, the brain is normally fine-tuning its responses to the body and the eyes to keep our vision stable and help us stay upright. This adaptation is often referred to as developing "sea legs." Once a person returns to a stable environment (such as land), such adaptation is no longer needed.

However, in people with MdDS, the brain doesn't get the memo^{17, 18}. It has been proposed that after a while, the brain becomes accustomed to these novel movements and, in some cases, does not readapt to the old patterns once the movement has stopped¹⁹. Therefore, some people are unable to redevelop their "land legs"²⁰.

Based on this theory, a treatment using optokinetic stimuli ("moving light" therapy) has been developed. Optokinetic therapy for MdDS uses a moving visual pattern, such as rotating stripes or a moving light field, while the patient performs gentle side-to-side head movements under the guidance of a trained clinician. The treatment is designed to help recalibrate the brain's processing of motion and spatial orientation, which may reduce the persistent sensations of rocking, bobbing, or swaying experienced by people with MdDS.^{21,22} Another hypothesis was recently formulated by Mucci et al. Mucci and colleagues investigated the interaction of hormonal fluctuations in MdDS, given the high female predominance, as a potential underlying predisposing factor for patients who are unable to adapt to the novel movement patterns⁵. Recent studies have also investigated the role of reproductive hormones^{5,11} in triggering MdDS, highlighting that hormonal changes appear to be associated with MdDS onset, with most patients developing the condition during the menopausal transition⁵. In patients of reproductive age, hormonal fluctuations associated with the menstrual cycle or pregnancy have been



reported to affect MdDS symptoms similarly to migraine, with higher symptoms during menses when estrogen is lower and a reduction in symptoms during the first two trimesters of pregnancy, when estrogen and progesterone are higher^{5,12}. In a small pilot study, women during pregnancy reported significant changes in their symptoms (reduction or complete resolution during the first two trimesters of pregnancy), 5. These studies have generated the hypothesis outlining that MdDS pathophysiology might be driven or partially influenced by specific hormonal fluctuations and phases^{11,12}.



What are the Symptoms?

The most common symptoms associated with MdDS are rocking, swaying, bobbing and disequilibrium^{17,23}. High visual motion sensitivity is also related to MdDS^{4,22}. Visually busy environments, screens, scrolling, grocery aisles, and patterned spaces may worsen symptoms, and some patients may benefit from evaluation by clinicians familiar with visual-vestibular disorders. As secondary symptoms, many MdDS patients develop anxiety and depression^{4,24}. Stress and/or fatigue can make symptoms more noticeable in some people⁴. One characteristic of MdDS is that symptoms often improve or even disappear when re-exposed to continuous movement, such as that experienced while driving in a vehicle^{4,25}.

Overall, MdDS is considered a debilitating condition with a strong negative impact not only on a patient's physical health and psychology but also on their quality of life²⁶.

Because the symptoms of MdDS overlap with other vestibular disorders, it is important to be evaluated by a healthcare professional familiar with dizziness and balance disorders.

HOW IS IT DIAGNOSED?

Obtaining a diagnosis has proven challenging for MdDS patients around the world due to the lack of clear biomarkers (i.e., objective measurable data) and the lack of awareness of the condition²⁷. Neurologists and otolaryngologists (ENTs) are the most common healthcare professionals diagnosing

the condition, though research shows that primary care physicians/general practitioners are also diagnosing patients. MdDS patients are usually diagnosed by taking a thorough patient history, performing objective testing, meeting diagnostic criteria^{7,4}, and ruling out other potential causes. Testing procedures may include vestibular testing (VNG, VHIT, etc.), radiological or laboratory diagnostic examinations, and magnetic resonance imaging (MRI)^{27,23}. If these test results are normal, then MdDS can be considered a diagnosis through exclusion²⁸. Personal or family history of migraine is a potential contributing factor and should always be inquired in patients presenting these symptoms²⁹.

BÁRÁNY SOCIETY DIAGNOSTIC CRITERIA FOR MDDS

In 2020, the Classification Committee of the Bárány Society, an international organization dedicated to vestibular disorders, published diagnostic criteria for MdDS. According to these criteria, a person must have:

- A persistent sensation of rocking, bobbing, or swaying when no movement is occurring.
- Symptoms that begin within 48 hours after exposure to passive motion, such as a cruise, boat trip, flight, train ride, or other prolonged travel.
- Symptoms that temporarily improve while riding in a moving vehicle or during other passive motion.
- Symptoms that last longer than 48 hours.

MdDS may be further classified based on



symptom duration:

- In evolution: Symptoms have been present for less than one month, and the long-term outcome is not yet known.
- Transient MdDS: Symptoms resolve within one month.
- Persistent MdDS: Symptoms continue for more than one month.

HOW IS IT TREATED?

Limited treatments are available to MdDS patients³⁰. Due to the poor understanding of MdDS pathophysiology, treatments are still experimental or address associated symptoms like anxiety and depression. The most successful treatment to date is the optokinetic rehabilitation protocol developed by Dr. Mingjia Dai (vale) from Mount Sinai Hospital in NYC²¹, which was also assessed by Dr. Mucci with a sham-placebo study in 2018. This treatment has a ~70% success rate at significantly reducing symptoms and occasionally helping patients achieve remission. Due to its specialized nature, this treatment is offered at only a limited number of clinics worldwide.

(There are online versions of this treatment which should not be used unless under the guidance of your healthcare professional. The treatment is powerful and has had detrimental effects on those who attempt to treat themselves without any guidance. OKS protocols are direction-, frequency-, and symptom-specific and can worsen symptoms if applied incorrectly.)

Recent research has helped standardize this treatment approach, making it easier for clinicians to reproduce. In a 2024 study of 131 patients with MdDS, researchers used a structured protocol consisting of optokinetic stimulation combined with side-to-side head movements over several consecutive days. Approximately 64% of patients experienced meaningful improvement in their symptoms. Notably, patients with both motion-triggered and spontaneous-onset forms of MdDS responded similarly. While additional research is needed to determine the long-term durability of treatment and identify which patients are most likely to benefit, these findings provide further support for optokinetic/VOR readaptation therapy as one of the most promising treatments currently available for MdDS.

Benzodiazepine/antidepressant medication is typically prescribed to MdDS patients and has been

shown to be beneficial in reducing the symptoms of MdDS or its associated anxiety³⁰. Other stress-reduction treatments and symptom management strategies also seem to have a positive effect³⁰. Other treatments, such as neuromodulation, seem promising, though they are still in the research phase^{31,32}. rTMS (repetitive transcranial magnetic stimulation) has pilot and small sham-controlled trial evidence suggesting possible short-term benefit, but it remains investigational and not a standard MdDS treatment.

Addressing the migraine component in MdDS patients presenting with migraine comorbidity is also essential²⁹. Migraine is common in MdDS cohorts and may influence spontaneous or recurrent episodes. Migraine assessment and management may be relevant even when MdDS is the primary diagnosis. Physiotherapy and chiropractic treatments have not been shown to be beneficial for MdDS patients unless they address balance deficits present before the onset of MdDS³⁰.

PROGNOSIS

Cha's clinical follow-up study found that many episodes resolve within a year, but the likelihood of resolution declines with duration. Multiple episodes can occur, and later episodes may last longer. If you have previously experienced MdDS and your symptoms have finally resolved, avoiding the same precipitating event may help prevent a recurrence.

EMERGING RESEARCH: VENOUS COMPRESSION AND PERSISTENT OSCILLATING VERTIGO

Researchers are continuing to investigate the biological mechanisms underlying MdDS. In a small 2025 case series, Dr. Yoon-Hee Cha and colleagues reported that some patients with persistent rocking, bobbing, or swaying symptoms had compression of the veins in the neck or thoracic outlet, which may have affected blood flow around the vestibular system. Several patients experienced symptom improvement after treatment directed at these vascular abnormalities.

Because this study involved a small number of patients and did not include a comparison group, more research is needed before routine vascular screening or treatment can be recommended for people with MdDS. At present, these findings are considered preliminary and may represent only a subset of patients with persistent oscillating vertigo.

IN SUMMARY

MdDS is a complex disorder that requires further research, yet in recent years, awareness of MdDS has increased, and with this, patient care and management can be improved.

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