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THE ROMBERG SIGN: HISTORICAL CONCEPTION

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Abstract

The Romberg sign is one of the classic and most helpful signs in neurological examination. It was proposed by the German Moritz Heinrich Romberg in 1851, describing the loss of postural control experienced by patients with tabes dorsalis after closing their eyes or in the dark.

Different descriptions of Romberg's sign are reported in the literature, and there is no consensus. In the first descriptions, this sign was related to damage to the proprioceptive pathway. Likewise, it is not only used in neurology but also in other medical areas, which makes it very useful.

keywords: *historical concepts, description, review, Romberg sign*

Introduction

The Romberg sign is a test that allows us to assess alterations in the proprioceptive sensitivity of patients when loss of postural control is observed in the absence of visual stimulus. In general, the Romberg test is performed by asking the patient to stand with his feet together, first with his eyes open and then asking him to close them. The sign is said to be present when loss of stability or even a fall is observed at the moment the patient closes his eyes.[1,2]

The Romberg sign is one of the oldest clinical findings ever described. It was initially described as a pathognomonic sign of tabes dorsalis in neurosyphilis; however, today this sign persists as an integral part of the neurological examination because it is a useful tool for assessing proprioception.[1,3]

Since its description in the mid-19th century by Moritz Heinrich Romberg, the Romberg sign has had several modifications and adaptations. Even today there is no consensus on the variants in execution and interpretation and, above all, its clinical translation. This has led to discrepancies about the validity and semiological importance of this test in neurological practice and in other related areas, such as otolaryngology.[4,5,6]

Historical development of the sign's description

Perhaps the first description of the Romberg sign as we know it today should be attributed to the English neurologist Marshal Hall, who in 1836, in his Lectures on the Nervous System and its Diseases, described the loss of postural control in the dark in patients with significant compromise of proprioception: "This day I have seen a patient with a slight degree of weakness. He walks safely and normally while his eyes are fixed on the ground, but staggers if he tries to walk in the dark (...) In is hi own words: "my legs feel numb, I couldn't tell you where my feet are in the dark, I can't keep my balance."[7]

By the late 19th century in Germany, Moritz Heinrich Romberg described in the second edition of his work Lehrbuch der Nervenkrankheiten des Menschen (1851) the loss of postural control experienced by patients with tabes dorsalis after closing their eyes or in the dark. Based on Marshall Hall's description, Romberg devised a test to demonstrate the phenomenon, which later gave rise to the neurological sign above mentioned. Romberg states in his text, "If the patient is told to close his eyes in a standing position, he immediately begins to move from side to side and sways even to the extent of falling."

In another section, Romberg describes how patients with loss of proprioception place the sole of the foot with great force, with their gaze fixed on their limbs while walking.[8]

Parallel to Romberg's work, the German physician Bernardus Brach described similar features in1850: "It is well known that persons with tabes dorsalis have an unusual gait (...) the patient with tabes dorsalis raises his legs with his knees extended and with difficulty. When he takes steps, he hits the floor with his feet with force (...) He does not feel the movement he makes with his legs, he has no sensation in his extremities. His gait is very prone to falling and he must use his body and arms to maintain balance. In tests for temperature, pressure, and pain sensitivity, the patient responds like any healthy person. So, we can't say he has no sensitivity."[5] Brach noted that these patients did not show weakness. In fact, as a curious anecdote, he reports that, in 1838, a 36-year-old patient walked for 4 hours to see him. Days earlier, the patient had described his symptoms to Brach in a letter: "I must use my eyes to guide me. In the dark, I have no balance, even in familiar places, and I certainly tend to fall. When I walk, I must concentrate fully on the task my feet are performing (...) I take such heavy steps that even the soles of my feet show lesions and become swollen after walking short distances."[5]

Adoption of the sign

During the 19th century, the identification of loss of postural control with eyes closed or in the dark was a contribution most often attributed to Moritz Romberg, although some authors credited both Romberg and Bernardus Brach, or even presented the description of the sign without authorship. There was notorious disagreement among leading neurologists about the attribution of this clinical finding. To cite a few examples, the American physician William Osler,[9] the noted neurologist Frances Jean Martin Charcot[8], and the prominent British neurologist Willam Gowers5 referred to the phenomenon described as Romberg's sign in various publications.[2,5,9,10] However, other important neurologists of the time, such as Charles K. Mills or Charles Loomis[9] referred to the finding as Brach-Romberg's sign. In contrast, authors such as Duchenne de Bologne, Alexander Hammond, and Charles Radcliffe[8,9] cited the phenomenon without crediting it to anyone.[5,10,11]

Despite the various descriptions and attributions throughout the 19th century, it was Romberg who first evaluated the phenomenon in the neurological examination, which remains an integral part of the physical examination in neurology.

In 1871, William Hammond presented his observations on patients with tabes dorsalis. He indicated that the sign was independent of some variable degree of paresis and established its usefulness in distinguishing tabes dorsalis from a cerebellar-type condition.[10] Afterwards, Jean-Martin Charcot, perhaps the most important neurologist of the time, referred to the sign in the classes he gave at La Salpêtrière, a hospital in Paris, where medical students from different parts of the world studied. This international audience contributed to the diffusion of the clinical phenomenon. Charcot, like Hammond, considered the sign to be characteristic of tabes dorsalis; however, he indicated that patients with Friedreich's disease, alcoholic neuropathy, and some patients with hysteria also presented this condition.[5]

Later, in 1888, William Gowers, in his *A Manual of Diseases Of the Nervous System*, clearly established the anatomic and physiological basis of the Romberg sign. Moreover, he added the instruction that the patient should assume a posture in which the base of support was reduced, i.e., standing with his feet together. Instead of asking the patient only to close his eyes, Gowers considered that in this position, the sensation of the feet was further tested, since demanding a higher grade of the patient's proprioception made possible to assess whether or not a disturbance existed.[3]

Anatomical account of proprioception

It is generally accepted that there are three modalities of sensitivity: (1) superficial or exteroceptive, which includes pain, touch, and temperature; (2) deep, also known as proprioception, which refers to the variants of vibration, joint position sense, and deep pain; and (3) associated or combined, which uses cortical association pathways to integrate sensation and recognition of the external environment.

The various axons of neurons of the same type of receptors form a bundle (tract) to create a sensory pathway. In the case of proprioceptive sensitivity, the information travels through the medial lemniscus pathway, also known as the posterior cords.[12,13,14]

The lemniscal system (posterior cord) conducts touch, joint sensations, discrimination between two points and vibration sense. The receptors Pacini and Golgi, especially the neuromuscular spindle, are located in muscles, tendons and joints. The impulse is transmitted through highly myelinated fibers from the dorsal ganglion of the posterior horn and

ascends through the posterior cords to the bulb, where a second synapse occurs in the nuclei gracilis and cuneatus, then crosses the midline to the contralateral side, and ascends through the medial lemniscus to the thalamus and then to the parietal cortex in Brodman's somatosensory area 3, 1 and 2.[12,13,14]

Proprioception is the type of sensation that informs the organism of the position of muscles and constitutes the ability to sense the relative position of adjacent body parts. Likewise, it regulates the direction and range of movement, allows automatic reactions and responses, intervenes in the development of the body schema, and in the relationship of this with space, and sustains planned motor action. Other functions in which it acts with more autonomy are the control of balance and coordination of both sides of the body. It should be noted that several of these functions, such as balance, position sense, and movement, are a construct made up not only of proprioception and neuroanatomical structures, since the cerebellum, the vestibular system, and vision, among others, are also involved.[12,13,14]

As already mentioned, the description of the Romberg sign was originally attributed exclusively to tabes dorsalis, a process observed in neurosyphilis, characterized by demyelinating lesions along the posterior cord pathway, resulting in alterations of the proprioceptive sensitivity modalities, including the appearance of the Romberg sign. However, once the neuroanatomical basis of the sign was documented, it was no longer a pathognomonic sign of tabes dorsalis. Any neurological condition affecting the posterior cord pathway as it travels from the receptor to the somatosensory cortex in the parietal lobe could show the Romberg sign, e.g., multiple sclerosis, trauma, Charcot-Marie-Tooth disease, or even vitamin B12 deficiency. It should also be noted that the presence of the Romberg sign has also been documented in conditions not directly related to the proprioceptive pathway, such as acute vestibular damage (acute vestibular neuritis) and in cerebellar conditions.[12,15,16]

Technique and variants of the sign

Since its original description, and until recent years, there have been variations in the way of performing and evaluating the Romberg sign, arising from the need to give greater sensitivity or specificity to the sign when evaluating proprioceptive function. The original description indicates: the patient when standing and closing the eyes begins to stagger, or when in darkness the gait becomes unsteady. As can be seen, this description does not point out characteristics regarding the base of support or the position of the hands, although over time specifications were added in this regard. For example, it has been recommended that the base of support should be a small area, i.e., the patient should be asked to keep the feet together and on a firm surface.[1,9]

Variations have also been proposed regarding the position of the hands; some authors state that the hands should be at the sides of the body, others that they should be extended to the front, or crossed over the thorax. However, there is no data indicating that the position of the hands affects the sensitivity of the test. Thus, at present, most descriptions of the test state: the patient, standing upright, with feet together and arms outstretched in front, is asked to close his eyes and maintain the standing upright position.[1,5]

The tandem Romberg sign is another variation; here the patient stands in the tandem position, that is, with one foot in front of the other so that the toe of one foot touches the heel of the front foot. The interpretation of the sign is like the one in the traditional Romberg test.[5]

The walking Romberg sign, another variant of the test, consists of the patient walking five meters with eyes open and subsequently with eyes closed; the sign is recorded as positive if the patient sways, falls or is unable to perform the test when the eyes are closed. In a study comparing this variant with the traditional Romberg, the former proved to be more useful in detecting proprioceptive abnormalities in patients with chronic myelopathy.[9]

Since the Romberg test, as discussed above, is not used exclusively to detect proprioceptive lesions, modified tests have also been described. For example, in one study the test was designed exclusively to assess vestibular function: the participant had to balance on a foam rubber base - used to confound proprioceptive information - with eyes closed.[4]

The following is a brief account of the authors' experience with the truncal Romberg sign. The test consisted of asking the patient, seated on the examination table, to extend his arms forward with his head backward, all this with his eyes open. Once the patient was in this position, he was asked to close his eyes. If the sign was positive, the patient began to present truncal instability with truncal swaying. This finding was documented in four patients with multiple sclerosis with spinal lesions at the level of the posterior cord pathway.

Test interpretation

The Romberg test is difficult to interpret since there are multiple variations in the criteria to consider the sign positive. In general, it is accepted that the sign is positive when the patient begins to sway, loses posture, or falls when closing the eyes. This would be an indicator of damage to the proprioceptive pathways, since, with the elimination of visual information, the patient relies solely on proprioceptive information to maintain position. However, factors such as the experience of the examiner and the degree of injury may generate false positives or negatives.[1,2] Similarly, there is variation in the degree of sway that must be present for the sign to be considered positive. Many physicians do not consider hip sway and insist on observing ankle sway before confirming the sign. Other specialists prefer to have the patient barefoot during the test and confirm the sign only if the patient takes a corrective step to the side, or if a fall almost occurs.[12] On the other hand, many elderly patients sway slightly with their eyes closed, so this may be of little significance. However, minimal swaying may disappear by asking the patient to remain completely still.[17] In sum, such lack of unification of criteria may alter the sensitivity of the test and detract from diagnostic confidence.

Other uses of the test

Since the Romberg sign appears not only in the case of proprioceptive pathway lesions, but also in cerebellar and vestibular lesions, its use is not restricted to the field of neurology, and it has even been used as a test of postural control to investigate the relationship between secondary postural defects and ankle sprains.[15]

Likewise, the sign has been used as an indicator of fall risk in elderly people, resulting in a reliable predictor of falls within two years, and has therefore been suggested as a useful prevention tool. In this regard, a study that evaluated the sensitivity and specificity of mobility tests showed that a set of clinical tests -which included a radius of sway with the Romberg test, maximum anterior and posterior support, and arc of movement, lateral and medial, when sitting and standing up, as well as the degree of sway when sitting and standing up- had a sensitivity of 80% and specificity of 74% to predict falls (fall status) or risk of falls in elderly people.[17]

The test, in its modified Romberg variant described above, has also been used in the detection of balance deficits and vestibular disorders. It has been argued that this variant specifically evaluates vestibular function, however, the validity of this statement is unknown, since, as explained above, the pathophysiological basis of Romberg's sign refers to the assessment of proprioceptive pathways.

Conclusion

Although the literature offers different modifications of the Romberg sign, it continues to be one of the most useful clinical signs for the neurologist in the evaluation of alterations in the proprioceptive pathway.

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