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Diagnostic yield of the palmomental reflex in patients with suspected frontal lesion

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ABSTRACT

Background: The purpose of this study was to determine the diagnostic value of the palmomental reflex in order to identify frontal lesions in neurological outpatients.
Methods: Two hundred twenty-six neurological patients with suspected intracranial lesion with an indication for magnetic resonance imaging (MRI) were included. All patients underwent the same MRI protocol. The reflex was elicited by trained and standardized nurses, and was evaluated by two neurologists. The evaluation was blind and independent. The test's accuracy was calculated. The Kappa coefficient was used to calculate the interobserver and intra-observer reliability.
Results: The interobserver reliability between neurologists was 0.53 with 93% of agreement ($p < 0.001$). The diagnostic accuracy measures were as follow: sensitivity of 19%, specificity of 93%, positive predictive value of 30%, negative predictive value of 88%, positive likelihood ratio of 2.7 and negative likelihood ratio of 0.87. The area under the curve was 0.56.
Conclusion: The palmomental reflex is associated with frontal structural lesions but the sensitivity is low, indicating a high percentage of frontal lesions with a negative reflex. When the test is used on its own, it is insufficient to detect frontal damage.

1. Background

The palmomental reflex (PMR) consists of an involuntary contraction of the mentalis and orbicularis oris muscles as a result of nociceptive stimulation of the thenar region [1]. PMR is present from birth and disappears with the frontal lobe maturation at 12 months and it is known as a ‘frontal lobe sign’ or ‘cortical release sign’. The frontal cortex inhibits subcortical motor networks, theoretically, the presence of a frontal lesion alters those inhibitory pathways and the primitive sign is ‘released’ [2].

The validity of the PMR has been debated since it was first described more than 90 years ago [1]. Although historically it was considered a pathognomonic sign of frontal injury [3], in the last years it has been described in neurological disorders that have no structural visible lesion on the magnetic resonance imaging (MRI), such as Parkinson, encephalopathies, delirium, as well as psychiatric diseases [4].

The prevalence of PMR in healthy and neurological patients is unknown because of the variability eliciting the reflex [5,6]. To date, the majority of primitive reflex investigations have been conducted in patients with acute brain damage using cranial tomography (CT) scan as the gold standard [2,7–9], nevertheless CT has a low yield to detect structural brain disease when the lesions are smaller than 10 mm [10]. The aim of this study was to evaluate the diagnostic yield of the PMR to detect lesions in the frontal lobe using the MRI as a gold standard. We hypothesized that PMR had a higher sensitivity and specificity to identify frontal lesions compared with other locations in the brain.

2. Methods

This cross-sectional study was performed at the ‘Instituto de Alta Tecnología Médica’ (IATM) between January of 2012 and 2014 in Medellin, Colombia. The Institutional Review Board of the IATM and

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the college of medicine of the University of Antioquia approved this study.

2.1. Patients

Adult patients with suspected structural brain lesion undergoing MRI at the IATM were included. Subjects were asked to voluntarily participate in the study. A full explanation of the nature of the investigation was provided to them. Informed consent of participants was obtained before any test. The medical history of each patient was obtained from clinical charts. The imaging data was obtained from the MRI report. Patient's exclusion criteria were as follows; 1) facial nerve palsy; 2) facial abnormal movements, such as spasms or dystonia; 3) cervical myelopathy by clinical history; 4) deformity or absence of the thenar region or the chin; 6) full bear to conceal the chin and hinder the evaluation of PMR; 7) no patient cooperation to preserve the required position during the test; 8) not available clinical history; and 9) technical mistakes on the reflex recording process.

2.2. Gold standard

MRI is the gold standard to identify structural lesions in the brain [10]. All patients were scanned on a 3 Tesla Philips Ingenia MRI or a 1.5 Tesla Philips Achieva Nova Dual Series MRI (Philips Medical Systems®, Best, Netherlands) at the IATM, Medellín, Colombia. Sequences acquired for each patient included: 3D T1-weighted, axial and coronal T2-weighted, axial and coronal FLAIR (Fluid Attenuated Inversion Recovery), axial DWI (Diffusion Weighted Imaging) and axial SWI (Susceptibility Weighted Imaging). OsiriX (Geneva, Switzerland) version 4.1.1 was used by five experienced radiologists of the IATM who interpreted the scans. A lesion was defined as any structural injury visible on MRI. Unilateral lesions causing contralateral mass effect or edema as well as lesions associated with hydrocephalus were considered to represent bilateral lesions [9]. Incidental lesions as pituitary adenomas or unspecific white matter hyperintensities were not considered significant.

2.3. The palmomental reflex

The PMR was elicited and recorded by six nurses. A single neurologist trained and standardized six nurses through theoretical and practical classes during a week. The course included two evaluations. Only nurses who scored higher than 90% in the two tests participated in the study. All patients underwent PMR examination in a quiet room. Every patient was positioned in an identical way, lying up, with the neck in neutral position, arms besides the trunk and lower limbs extended. The chin had to be relaxed and there must be a space of 5 mm between the lips. The patient should not smile or frown during the test. The subject was not informed about the nature of the expected response, but was given instructions about the nature of the stimulus in order to prevent startle reactions.

A digital camera was located 10 cm from the patient's face. A mechanical arm designed and built by engineers of the IATM held the camera during the evaluation. The camera was focus on the lower third of the patient's face, including the free edge of the chin and nostrils (Fig. 1). The PMR was elicited stroking the thenar eminence in an oblique direction using a Taylor® reflex hammer (Fig. 2). The stimulus should be firm and cause a change in the color of the skin of the palm. The reflex was elicited 10 times on every hand, starting always with the right hand. In order to homogenize the procedure a voice message recording counting from one to ten on loud voice was used with every patient. The message allowed a space of one second between each stimulus.

Two senior neurologists assessed the videos. Contraction of the mentalis muscle was registered as a positive PMR. Amplitude and persistence were scored as follows: for amplitude, 1 = weak (muscle contraction was visible in less than 50% of the chin) and 2 = strong (muscle contraction was visible in more than 50% of the chin). For persistence, 0 = response for one to four consecutive times and 1 = response for five or more times. The assigned final score was the result of the sum of amplitude and persistence scores, therefore PMR was classified as subtle (score = 1), moderate (score = 2), or severe (score = 3). The score was blind and independent. Neurologists were not aware of the clinical history or the result of the MRI. When inconsistencies were found in the report of the two neurologists a consensus was

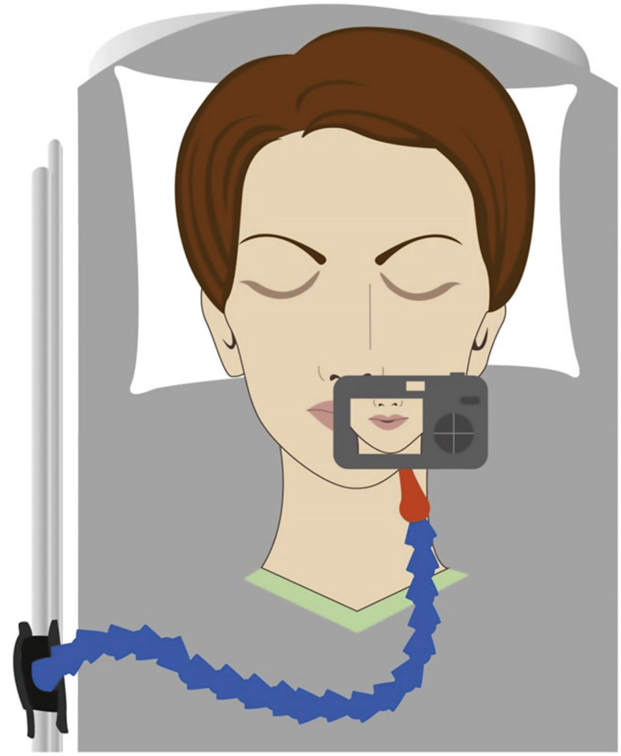

Fig. 1. Mechanical arm and camera.

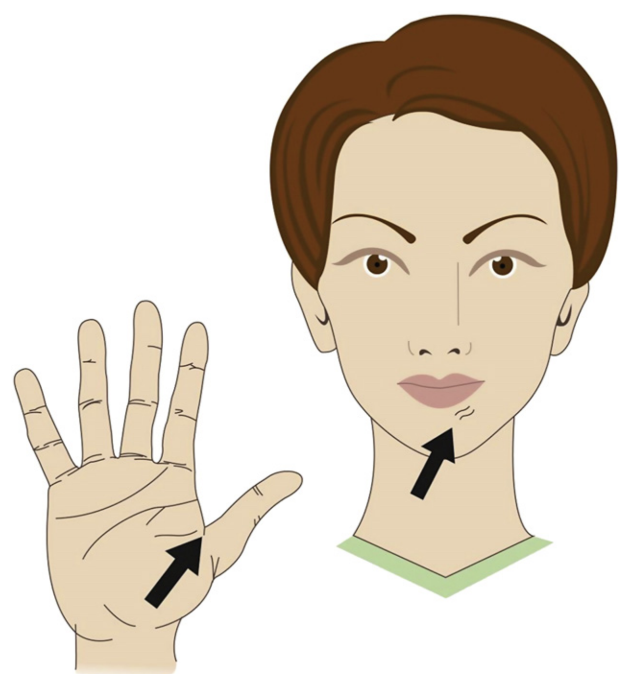

Fig. 2. Palmomental reflex evaluation.