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The palmomental reflex – overview and clinical significance

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ABSTRACT

The palmomental reflex is a well-known neurologic sign, however its current diagnostic value is considered limited and its role in the neurologic examination has been questioned. Given that a century has passed since its first description in 1920, we conducted a review of the literature about the palmomental reflex, beginning with its physiology and prevalence in the general population, and continuing with its possible diagnostic and prognostic value in relation to neurologic disorders such as dementia, Parkinson disease, amyotrophic lateral sclerosis, stroke and frontal lobe disease.

Keywords: palmomental reflex, primitive reflex, dementia, frontal release sign

Abbreviations (in alphabetical order)

AIDS – acquired immune deficiency syndrome
AD – Alzheimer's disease
ADL – activities of daily living
ALS – amyotrophic lateral sclerosis
HIV – human immunodeficiency virus
LBD – Lewy body dementia
MRI – magnetic resonance imaging
PD – Parkinson's disease
PMR – palmomental reflex
VP – vascular parkinsonism

INTRODUCTION

The palmomental reflex (PMR) was first described in 1920 by Gheorghe Marinescu and Anghel Radovici, in a patient with amyotrophic lateral sclerosis (ALS) [1,2]. The reflex can be elicited by stroking the thenar eminence with a blunt object, which leads to contraction of the ipsilateral mentalis muscle [3,4].

The pathway of the PMR is thought to be polysynaptic [5]. The sensory innervation of the thenar eminence is provided by first order neurons of the C6 dorsal root ganglia, via the palmar branch of the median nerve [6]. These neurons synapse with intermediate second order neurons, whose axons then ascend in the lateral columns of the spinal cord (as part of the spinothalamic tracts) and give collaterals to the facial nerve nucleus of the pons. The motor neurons of this nucleus innervate the chin muscles via the facial nerve [1,2].

The PMR is included in the group of *primitive* or *"archaic" reflexes*, along with the snout, suck and grasp reflexes, since they are normally seen in infants (during the first year of life) [7]. These reflexes can reemerge during adulthood in the setting

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of frontal lobe disease, hence the term *frontal release signs* [8]. This has been hypothesized to be a release phenomenon of sensorimotor automatisms, which are normally inhibited by the frontal lobe [9].

The PMR has also been noted in lesions of the cortico-nuclear and cortico-spinal tracts [3,4], and even in normal individuals, thus being considered very nonspecific [8].

For this review, we conducted a search on Pubmed using the keywords "palmomental" and "palm-chin" and selected all articles which had abstracts available in English.

PHYSIOLOGIC VERSUS PATHOLOGIC

The overall incidence of the PMR in healthy adults ranges between 0 and 58% [10]. It can be encountered in all age groups (often occurring alone), hence some authors consider it a normal phenomenon [11]. It has also been stated that primitive reflexes should be considered abnormal only in the setting of overt cerebral pathology [12].

There are, however, certain features of the PMR which orient towards neurologic disease:

- Instead of simply testing for its occurrence, it is perhaps more relevant to search for responses that are *strong*, *sustained* and *easily repeatable*, and also for mentalis contractions elicited by stimulation of other skin areas than the palm [13].
- *Habituation behavior* (in the setting of repeated stimulation) is different between healthy subjects and those with neurologic disease [14].
- If present in normal individuals, the PMR is usually symmetrical, whereas an *asymmetrical response* may be a more reliable indicator for a lesion of the nervous system [15].
- Finally, one study comparing 50 patients with prolonged coma, 50 patients with recent cerebrovascular events and 100 age-matched controls, found that only the *presence of at least two primitive reflexes* could differentiate between normal and neurological patients [16].

One thing to note is that *the inter-rater reliability for PMR detection may be weak*, as was shown in a study of 97 patients examined by 2 neurologists in a blind fashion [17].

The PMR was studied electromyographically both in neonates [18] and adults [19], by recording the electrical response of the mentalis muscle after repetitive mechanical stimulation of the thenar eminence. In neonates, PMR potentials showed variability in amplitude and duration, but not in latency, and were present bilaterally in almost all subjects. In adults, PMR potentials showed variability in amplitude, duration and latency, and were obtained even when the PMR was not clinically apparent.

Variants of this reflex have been described over the time, such as the thumb-chin reflex [20,21], palmo-cervical reflex [22] and palmo-levator labii superioris reflex [5]. A planto-mental reflex has also been identified by electromyographic stimulation of the plantar skin, but only in subjects with focal or diffuse brain injury [23].

RELATION WITH AGING

The prevalence of the PMR follows a "U-shaped" curve during lifetime: initially, the reflex is present in almost all infants; its occurrence decreases during early adulthood and then increases in persons over 65 years old. Thus, the frequency of the PMR is highest during the developing and aging stages of the nervous system [24].

Other authors established that its incidence rises progressively after the age of 20 years, with about 10% per decade [15].

It is unclear if the PMR and other primitive reflexes are associated with cognitive decline, as different studies have given conflicting results:

- The PMR, glabellar tap and snout reflex were exhibited by approximately 33% of 1241 healthy adults (aged 45-91 years-old). Their frequency increased with age and their presence was associated both with worse performance on cognitive tests, and with brain MRI changes (white matter hyperintensities, lacunar infarcts, caudate nuclei atrophy and global brain atrophy) [25].
- In another study, the PMR, glabellar tap and snout reflex were elicited by half of 68 normal aged individuals and their presence correlated with incidental findings on brain MRI, but not with brain atrophy or cognitive decline [26].
- Finally, in a study of 470 patients aged 25-82 years-old, the primitive reflexes did not cor-

relate with cognitive decline neither at baseline, nor at 3- and 6-years follow-up. They did however increase in frequency with age [27].

In another train of thoughts, presence of the PMR was identified as a *potential predisposing factor for falling*, based on a prospective 1-year study of 336 elderly persons [28].

RELATION WITH DEMENTIA

Whether or not primitive reflexes have a role in diagnosing dementia is debatable. Demented patients do seem to exhibit multiple primitive reflexes, which is understandable:

- In a study involving 128 elderly patients living in retirement facilities, the coexistence of three primitive reflexes (palmomental, glabellar tap and snout) was consistently associated with dementia [29].
- Likewise, in another study, the occurrence of *more than two primitive reflexes* was not seen in elderly controls but was noted in cerebrovascular patients and especially in those with vascular dementia, having 93% specificity (however with low sensitivity) [30].

But do primitive reflexes have any additional clinical or prognostic value? In an analysis of 136 cases of Alzheimer's disease (AD), *no differences regarding duration of dementia or cognitive decline* were noted between those with primitive reflexes (including the PMR) and those without. Patients exhibiting primitive reflexes did have *greater functional limitations* (as measured by the ADL scale) and a higher incidence of gait disturbance, rigidity and apraxia [31].

The PMR was also proposed as an *early sign of AD* in persons under 80 years old. The PMR was more frequent in AD patients compared with age-matched controls, both 2 years before diagnosis (25% versus 7%), and at the time of diagnosis (30.3% versus 12.3%). This may be related to early amyloid deposition in the frontal lobes [32].

In patients who suffered traumatic brain injury, the occurrence of primitive reflexes and paratonia may help predict the degree of cognitive impairment and functional independence [33].

Although termed "frontal release signs", according to one study, primitive reflexes were not predictive of frontally based dementias (frontotemporal dementia and vascular dementia), being more prevalent in Lewy Body Dementia and in Alzheimer type dementia [34].

RELATION WITH ALS

As mentioned above, the PMR was described for the first time in a person with ALS and is a *common occurrence* in this group of patients, especially in those with bulbar onset. This is easily explained by (a) its integration in the brainstem and (b) its release secondary to cortico-bulbar tract dysfunction. In one study, the frequency of the PMR in non-demented ALS patients was 46%, significantly greater than that seen in non-demented patients with other neurological disorders (29%) or in healthy individuals (16%) [35].

Apart from its frequency, the PMR may also have prognostic value in ALS since its presence is associated, as mentioned, with higher rates of *bulbar involvement and upper limb involvement* [36].

Other primitive reflexes are also seen in ALS, especially the corneomandibular reflex and glabellar tap. Patients with 3 or more primitive reflexes appear to have *greater cognitive decline*, as measured in one study by the Frontal Assessment Battery and Weigl's Sorting Test [37].

RELATION WITH STROKE

It is known that the PMR has a high incidence in patients with vascular hemiplegia [38], however, during the first few weeks of acute ischemic stroke, it tends to be absent on the affected side, as was shown in a Romanian study comprising 71 patients [39].

RELATION WITH PARKINSON'S DISEASE AND RELATED DISORDERS

Primitive reflexes are prevalent in Parkinson's disease (PD) with or without dementia, *especially the PMR and glabellar tap* [40]. The occurrence of these reflexes does not correlate with plasma dopamine levels, however the PMR and corneomandibular reflex are more likely to be encountered *in patients with advanced disease* [41].

By comparing 109 parkinsonian patients with 356 normal subjects, a much higher prevalence of

the PMR (71.5%) was noted in the parkinsonian group, as opposed to only 16.3% in the control group. There was a positive correlation between *presence and intensity of the PMR* on one hand, and *degree of akinesia* on the other [42].

There may also be a role for the PMR and snout reflex in *differentiating between PD and vascular parkinsonism (VP)*. In one study comparing 132 PD patients with 55 VP patients, the snout and palmomental reflexes were more prevalent in the VP group, with 82% specificity and 84% sensitivity [43].

During neuroleptic treatment, the primitive reflexes can become exaggerated, as was shown in a study of 14 psychotic patients with organic brain damage treated with Haloperidol. The authors interpreted this as a "decompensation phenomenon" induced by blockage of dopamine receptors in the brain [44].

As mentioned above, primitive reflexes are also frequent in Lewy Body Dementia, and in fact the coexistence of at least two primitive reflexes has been more frequently seen in LBD than in other parkinsonian syndromes [45].

RELATION WITH FRONTAL LOBE LESIONS

Since they are termed "frontal release signs", one would expect to elicit PMR and other primitive reflexes in the setting of frontal lobe lesions. However, this was not the case in one study involving 226 patients who underwent brain MRI for suspicion of intracranial lesions. Occurrence of the PMR was associated indeed with a high specificity (93%), but with a low sensitivity (19%), indicating that a *large proportion of patients with frontal lobe lesions had negative PMRs* [46].

The PMR and snout reflex were noted temporary in a patient with catatonic schizophrenia, perhaps because of transient frontal lobe dysfunction [47].

RELATION WITH HEAD AND NECK PAIN

A Russian study revealed a statistically significant prevalence of the palmomental reflex *in patients with cervicalgia and migraine* (86.4%), compared to patients with cervicalgia accompanied by tension-type headache and/or cervicogenic headache (7%) [48].

RELATION WITH OTHER DISORDERS

A higher prevalence of the PMR was found *in HIV-1 positive patients*, as compared with HIV-1 negative drug abusers and with healthy subjects. Additionally, the snout reflex and/or glabellar tap could also be elicited in the seropositive group along with the PMR, but not in the other two groups [49]. The occurrence of the PMR is also higher in those with terminal AIDS than in asymptomatic HIV-positive patients [50].

The PMR seems to be have a low frequency in patients with diabetes mellitus without cerebrovascular disease. This is possibly due to microvascular lesions involving the perforating pontine arteries [51]. Given that the integrating center of the PMR is in the pons, an ischemic lesion at that level could lead to abolition of the reflex.

A greater likelihood for *development of postoperative delirium* was noted in patients who presented with more than one primitive reflex preoperatively or postoperatively [52].

Finally, one study showed a significantly increased frequency of the PMR in persons with Down syndrome (47%) compared with controls (7%), however its presence did not correlate with the level of mental retardation [53].

CONCLUSIONS

The palmomental reflex may occur in both healthy subjects and neurological patients. Although it is not "per se" pathological, it may have some diagnostic and prognostic value in certain settings (association with brain MRI findings in the elderly, possible early clinical sign of AD, association with bulbar and upper limb involvement in ALS, occurrence with frontal lobe disease, high prevalence in parkinsonian patients).

Despite its low sensitivity and specificity, its presence (especially with other primitive reflexes), may help refine the clinical diagnosis.

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