Palatal Myoclonus (syn. Palatal Tremor)

J.M.S. Pearce

Emeritus Consultant Neurologist, Department of Neurology, Hull Royal Infirmary, Hull, UK

Key Words

Palatal tremor • Palatal myoclonus • Guillain-Mollaret triangle • Hypertrophic inferior olivary nucleus • Neuronal coupling

Abstract

Symptomatic palatal tremor is caused by a lesion in the triangle of Guillain and Mollaret and is associated with hypertrophic olivary degeneration that has multiple causes. Essential palatal tremor has no currently demonstrable cause and no accompanying physical or radiological signs. But it is probable that an organic genesis will become apparent. I suggest that some examples of palatal tremor may depend on an 'upper motor neurone type', i.e. supranuclear, lesion in the striatum or rostral brainstem releasing medullary activation with denervation hypersensitivity of olivary neurones.

Copyright © 2008 S. Karger AG, Basel

Case Report [1]

In 1968 a retired ship worker aged 67 was admitted to the recently opened Hull Royal Infirmary (UK). For 12 months he had experienced typical recurrent episodes of cerebral ischaemia with motor and sensory defect in all limbs. His last attack was associated with double vision and ataxia. He had been treated for hypertension for 4 years.

On examination, his blood pressure was 190/110, equal in both arms. He had nystagmus on left lateral gaze and internuclear ophthalmoplegia with weakness of the right medial rectus. The remaining cranial nerves were normal except for the striking ap-

pearance of myoclonus of the soft palate on the right side, consisting of involuntary movements with a rate varying from 120 to 180 per min. The lips, tongue, larynx and diaphragm were not involved. No carotid or subclavian bruit. His legs showed a mild spastic weakness with slight incoordination, and with exaggeration of all deep tendon reflexes. Both plantar responses were extensor; no sensory deficit. Routine laboratory investigations and CSF normal. (This was before CT and MRI.)

The diagnosis was of recurrent attacks of brainstem ischaemia causing palatal myoclonus (PM), based on a hypertensive vascular lesion [1] involving the medial longitudinal fasciculus and the Guillain-Mollaret triangle. He recovered without drug therapy apart from for his hypertension, but his PM persisted.

History

In 1886 H.R. Spencer (1860–1941)¹ described myoclonic movements of the pharynx and larynx, and noted the similarity to nystagmus [2]. The inferior olivary nucleus ('the olive'), in certain pathological conditions, is apt to show a peculiar type of abnormality whose main feature is a conspicuous enlargement. Early references to such 'hypertrophy' of the olive are those of Oppenheim [3] in 1887, Thomas [4], and Marie and Guillain [5]. There was renewed interest in 1928 when van Bogaert and Ber-

¹ Herbert Ritchie Spencer was Professor of Obstetric Medicine at University College, London. He gave the Harveian oration and Lettsomian and Fitzpatrick Lectures. He examined for both Royal Colleges (Munk's Roll, vol. IV, p. 416).

Table 1. Features of essential versus symptomatic palatal myoclonus

	Essential PM	Symptomatic PM
Main muscle involved	tensor veli palatini	levator veli palatini
Other signs	no	ocular and/or pharyngeal myoclonus, ± ataxic syndrome
Ear clicking	infrequent	frequent
Disappears in sleep	yes	no
MRI	usually no lesion	medullary lesion
Electrophysiology	abnormal polysynaptic brainstem reflexes	abnormal monosynaptic, oligosynaptic and polysynaptic reflexes

trand [6] showed the constant presence of these olivary changes in 'rhythmic and synchronous' PM.

Over the next 40 years, Guillain and Mollaret [7], Bender et al. [8], Nathanson [9] and many others reported small groups of patients with PM.

Clinical Features

Certain features separate this form of myoclonus from other varieties of myoclonus (table 1). Careful study in the above case report and in the patients described by Nathanson [9] have shown that the myoclonus can persist during phonation and sleep in symptomatic PM. Intravenous barbiturates which can abolish nystagmus do not affect PM, nor is it influenced by caloric stimulation, the inhalation of carbon dioxide or the advent of coma. It may persist indefinitely but is not a cause of disability, although patients may complain of a 'clicking' sound in the ear, made by the spasmodic contractions of the levator veli palatini part of whose origin is from the cartilaginous auditory tube. Associated disordered, synchronous eye movements include nystagmus, vertical and pendular or horizontal and torsional or hypermetropic saccades: so-called 'oculopalatal myoclonus'. PM may be also accompanied by synchronous contractions in the oropharynx, larynx, oesophagus and diaphragm.

Aetiology

The aetiology in about 70% of cases has been a vascular infarct. Multiple sclerosis, metastatic and astrocytic tumours, syringobulbia, and trauma have been invoked as occasional causal lesions. Of 287 cases with PM from the literature 75% were symptomatic and no cause was

found in the 25% 'essential' cases. Myoclonic contractions are located in the levator veli palatini muscle (facial or nucleus ambiguus innervation) in symptomatic, and in tensor veli palatini (trigeminal innervation) in 'essential' cases. MRI may be normal, but a hyperdense signal in the region of the inferior olive on T₂ or proton density images is often seen in symptomatic PM [10].

A heterogeneous syndrome of progressive ataxia with palatal tremor and dysarthria has been reported [11]. Rare instances of an association with Alexander's disease and Rosenthal fibre encephalopathy [12], supranuclear palsy, and, prominent bilateral activation of the putamen [13] have been associated with PM.

Possible Mechanisms

Palatal myoclonus (syn. palatal tremor) is of two types: symptomatic and essential. (1) *Symptomatic palatal tremor* is caused by a lesion in the triangle of Guillain and Mollaret and is associated with hypertrophic olivary degeneration visible on MR images. (2) *Essential palatal tremor* has no currently demonstrable cause, and no accompanying physical or radiological signs, and is almost certainly heterogeneous.

Experimental stimulation or destruction of the inferior olivary nucleus produces PM in the monkey. In 1931, Guillain and Mollaret [7] described anatomical features related to PM. These comprised the dentate nucleus, red nucleus and inferior olivary nucleus – referred to as the Guillain-Mollaret triangle (fig. 1) [14, 15]. The dentato-rubral-olivary pathway comprises efferents from the dentate nucleus which ascend through the superior cerebellar peduncle, cross the midline in the brachium conjunctivum to the red nucleus, and descend via the central tegmental tract to the inferior olivary nucleus. Inferior olivary efferent fibres cross the midline in the inferior

Fig. 1. Guillain-Mollaret triangle. SCP = Superior cerebellar peduncle; ICP = inferior cerebellar peduncle; CTT = central tegmental tract.

cerebellar peduncle, terminating in the original dentate nucleus (fig. 1) [16, 17].

In 1935, Julio Óscar Trelles (1904–1990), a neurologist from Lima, Peru, reported that isolated lesions of the inferior cerebellar peduncle do not cause PM because there are no direct connections between the inferior olive and the contralateral dentate nucleus. When damaged they were associated with olivary enlargement [17].

The site of the lesion is of interest. In all pathologically studied cases of symptomatic PM it has involved the dentate nuclei of the cerebellum, the central tegmental tract, and the inferior olivary nucleus [18] on the opposite side. The inferior olivary nucleus shows marked hyper-

trophy [19, 20], usually after a delay of 1–6 months; palatal tremor may appear within days or after a delay of up to 30 months after an acute vascular lesion [21]. However, there are recorded instances of comparable olivary hypertrophy not accompanied by PM [21]. Hypertrophy of the olivary nucleus can result from transneuronal degeneration caused by any lesion of the ipsilateral central tegmental tract, the contralateral superior cerebellar peduncle or the dentate nucleus.

The inferior olivary nucleus receives a GABA-ergic input densely concentrated in the β -nucleus. The GABA-ergic system inhibits electronic coupling of inferior olivary neurons, and if disrupted may result in hypersynchronous firing of these polysynaptic neurons. This may derive from putaminal, ipsilateral brainstem or contralateral cerebellar lesions, with resulting PM. The neurons of the olive are extensively coupled by gap junctions ('connexons'), which may relate to their capacity to oscillate when there is loss of normal GABA-ergic inhibition [22]. Speculations of the mechanism consider interruption of inhibitory projections from the deep cerebellar nuclei, via the central tegmental tract, to the inferior olive. Blockade of cerebellar inhibition is followed by olivary hypertrophic degeneration with the development of *connexons* between cell bodies, causing synchronized oscillation of large groups of inferior olivary nucleus neurons. The synchronized signal is sent to the cerebellar cortex via climbing fibres, producing oscillations [23]. Symptomatic PM and its persistence result from denervation hypersensitivity of olivary neurones starting 1–2 months after the onset, because of the inhibitory blockade.

I suggest that essential palatal tremor may depend on an 'upper motor neurone type', i.e. supranuclear, lesion in the striatum or rostral brainstem releasing activation with denervation hypersensitivity of olivary neurones.

References

- 1 Pearce JMS: Palatal myoclonus. *Proc R Soc Med* 1969;62:267.
- 2 Spencer HR: Pharyngeal and laryngeal 'nystagmus'. *Lancet* 1886;2:702–704.
- 3 Oppenheim H: Über Olivendegeneration bei Atheromatose der basalen Hirnarterien. *Berl Klin Wochenschr* 1887;34:638–639.
- 4 Thomas A: Recherches sur le faisceau longitudinal postérieur. *Rev Neurol* 1903;2:94–96.
- 5 Marie P, Foix C: Sur la dégénération pseudo-hypertrophique de l'olive bulbaire. *Rev Neurol (Paris)* 1913;26:48–52.
- 6 van Bogaert L, Bertrand I: Sur les myoclonies associées synchrones et rythmiques par lésion en foyer du tronc cérébral: nouvelle observation anatomoclinique. *Rev Neurol* 1928;1:202–214.
- 7 Guillain G, Mollaret P: Deux cas de myoclonies synchrones et rythmées vélo-pharyngo-laryngo-oculo-diaphragmatiques: le problème anatomique et physio-pathologique de ce syndrome. *Rev Neurol (Paris)* 1931;2:545–566.
- 8 Bender MB, Nathanson M, Gordon GG: Myoclonus of muscles of the eye, face and throat. *Arch Neurol Psychiatry* 1952;67:44–58.
- 9 Nathanson M: Palatal myoclonus: further clinical and pathophysiological observations. *Arch Neurol Psychiatry* 1956;75:285–296.
- 10 Deuschl G, Toro C, Valls-Solé J, Zeffiro T, Zee DS, Hallett M: Symptomatic and essential palatal tremor. 1. Clinical, physiological and MRI analysis. *Brain* 1994;117:775–788.
- 11 Samuel M, Torun N, Tuite PJ, Sharpe JA, Lang AE: Progressive ataxia and palatal tremor (PAPT): clinical and MRI assessment with review of palatal tremors. *Brain* 2004;127:1252–1268.

- 12 Howard RS, Greenwood R, Gawler J, et al: A familial disorder associated with palatal myoclonus, other brainstem signs, tetraparesis, ataxia and Rosenthal fibre formation. *J Neurol Neurosurg Psychiatry* 1993;56:977–981.
- 13 Haller S, Winkler DT, Gobbi C, Lyrer P, Wetzel SG, Steck AJ: Prominent activation of the putamen during essential palatal tremor: a functional MR imaging case study. *Am J Neuroradiol* 2006;27:1272–1274.
- 14 Guillain G, Molleret P, Bertrand I: Sur la lésion responsable du syndrome myoclonique de tronc cérébral. *Rev Neurol (Paris)* 1933; 666–674.
- 15 Gerace C, Fele MR, Luna R, et al: Bilateral hypertrophic olivary degeneration. *J Neurol Neurosurg Psychiatry* 2006;77:73–76.
- 16 Trelles JO: L'hypertrophie des olives bulbaires; thèse de médecine, Paris, 1935.
- 17 Trelles JO: La oliva bulbar: su estructura, funcion y patologia. *Rev Neuro-Psiquiatr* 1943;6:433–521.
- 18 Gautier JC, Blackwood W: Enlargement of the inferior olivary nucleus in association with lesions of the central tegmental tract or dentate nucleus. *Brain* 1961;84:341–361.
- 19 Salamon-Murayama N, Russell EJ, Rabin BM: Diagnosis please. Case 17: hypertrophic olivary degeneration secondary to pontine hemorrhage. *Radiology* 1999;213:814–817.
- 20 Venturi F, Tampieri D, Brassard R, et al: Hypertrophic olivary degeneration (HOD): an unusual way to degenerate. *Neuroimage* 2001;17:7–8.
- 21 Nishie M, Yoshida Y, Hirata Y, Matsunaga M: Generation of symptomatic palatal tremor is not correlated with inferior olivary hypertrophy. *Brain* 2002;126:1348–1357.
- 22 Mugnaini E, Nelson BJ: Corticotropin-releasing factor (CRF) in the olivo-cerebellar system and feline olivary hypertrophy; in Strata P (ed): *The Olivocerebellar System in Motor Control*. Berlin, Springer, 1989, pp 187–197.
- 23 Leigh RJ: Ocular oscillations and the inferior olive: glucose utilization and symptomatic ocular myoclonus. *Neurology* 2006;67:3.