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## Pharyngeal sensation and gag reflex in healthy subjects

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The gag reflex is often used in the assessment of swallowing, yet its absence does not predict aspiration in acute stroke. Disordered pharyngeal sensation has been found to be a sensitive predictor. The occurrence of gag reflex and pharyngeal sensation in healthy people is unknown. We studied these tests in 140 healthy subjects (half elderly and half young). Gag reflex was absent in 37% of subjects whereas pharyngeal sensation was absent in only 1. The results largely explain the low predictive value of gag reflex in the assessment of aspiration in acute stroke. Testing pharyngeal sensation would be more likely to be useful in these circumstances.

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Swallowing is often abnormal soon after stroke.<sup>1</sup> Laryngeal aspiration may occur, with risk of pneumonia, and increased morbidity and mortality. The presence of dysphagia does not always imply aspiration and conversely patients may aspirate in the absence of dysphagia.<sup>2</sup> Aspiration can be identified with certainty only with videofluoroscopy (liquid barium and barium-impregnated foodstuffs are ingested under screening), which is time-consuming and costly. Direct viewing of the larynx during swallowing is a promising technique but not yet widely

available. Several studies, mostly retrospective and in patients complaining of swallowing difficulties, have investigated the clinical correlates of aspiration defined by videofluoroscopy.<sup>2-5</sup> Despite the frequent assessment by physicians of the gag reflex after stroke, this reflex was of no diagnostic value in aspiration,<sup>3-5</sup> except in bilateral strokes.<sup>6</sup> Pharyngeal sensation is rarely tested (D Kidd, R W Stout, Belfast City Hospital), yet a prospective study found the presence of this sensation to predict absence of aspiration (sensitivity 100%, specificity 60%).<sup>2</sup> Interpretation of these results would be easier if the frequency of gag reflex and pharyngeal sensation in healthy subjects were known. We therefore tested for both in healthy people of an age at which stroke is prevalent, and, for comparison, in a younger population.

Elderly subjects from a cohort of healthy volunteers registered at the Human Performance Laboratory, Royal Free Hospital School of Medicine, were approached by letter. All had undergone rigorous screening; they had no history of cerebrovascular or other neurological disease, cardiovascular disease, or risk factors for the development of atheromatous disease. None used sedative or other neurotropic drugs. 70 subjects (37 female, mean age 76 years [SD 5.7]) agreed to attend. A full neurological examination was undertaken; only minor abnormalities, such as absence of ankle reflexes (39%) or loss of vibration sense at the distal extremities (18%), were found. The 70 younger subjects (44 female, 27 [3.8]) were medical students and members of hospital staff. The same exclusion criteria were applied, but a neurological examination was not done. All subjects gave informed consent and the study had ethical approval.

In well-lit conditions with the subject seated upright on an examination couch, the examiner depressed the tongue with a wooden spatula and touched each side of the posterior pharyngeal wall in turn with the tip of thin wooden stick. Subjects were asked whether or not they felt the stimulus and to

Gag reflex		Pharyngeal sensation		Elderly subjects (n=68)	Young (n=70)
R	L	R	L		
+	+	+	+	38 (56%, 44-68)*	49 (70%, 59-81)
-	-	+	+	28 (41%, 30-52)	18 (26%, 15-36)
-	+	+	+	1 (1.5%, 0-4)	2 (3%, 0-7)
+	-	+	+	0	1 (1%, 0-4)
-	-	-	-	1 (1.5%, 0-4)	0

+ = present, - = absent, +/- = present but reduced. R = right, L = left. \*95% CI.

Table: Occurrence of gag reflex and pharyngeal sensation

compare the sensation on both sides. Gag reflex was defined as constriction of the pharynx in response to the stimulus. All subjects were tested by one examiner to establish the frequency of gag reflex and pharyngeal sensation. Inter-test reliability was assessed in 30 young subjects with intervals of 1-7 days. Inter-observer reliability was assessed in 15 young subjects by a second examiner who was blinded to the results of the first.

Two elderly subjects declined to be examined and were excluded from analysis. Gag reflex was absent bilaterally in 29 (43%) of the elderly subjects and in 18 (26%) of the young subjects ( $\chi^2=3.97$ ,  $p=0.046$ ) and unilaterally in 1 and 3 of the elderly and young subjects, respectively (table). By contrast, pharyngeal sensation was absent in 1 elderly subject only. Inter-test reliability was good; two disagreements occurred for gag reflex and agreement was 100% for the presence of pharyngeal sensation in the 30 subjects retested. The inter-observer reliability of gag reflex was not as good; there was agreement in only 10 of the 15 subjects tested. Agreement was 100% for the presence of pharyngeal sensation.

Gag reflex was often absent in both groups, but more so in the elderly subjects. Conversely, pharyngeal sensation was absent in only 1 elderly subject. These findings may explain the failure of previous studies to identify gag reflex as a useful predictor of aspiration in acute stroke and lend support to the finding that disordered pharyngeal sensation strongly predicts aspiration.<sup>2</sup>

Inter-test reliability of pharyngeal sensation was high but memory of the first test result might have introduced bias. Inter-observer reliability was therefore tested and also showed complete agreement in the setting of high prevalence of pharyngeal sensation. By contrast, inter-observer reliability of gag reflex was low. Without a method to apply the same pressure to each side of the pharyngeal wall it is unclear whether the asymmetry of pharyngeal sensation found in this small number of subjects was due to asymmetry of stimulus or to pathological change.

Isolated abnormalities of the neurological examination in the absence of disease patterns are frequent in elderly people without overt functional impairment. There is debate on whether these abnormalities are related to normal ageing,<sup>7</sup> or to pathological change.<sup>8</sup> The higher frequency of absence of gag reflex in elderly subjects is another such sign. This may reflect an age-dependent decline in the integrity of the efferent pathway of the reflex, although it is not known whether dysfunction of the nucleus ambiguus due to accumulation of neuromelanin and lipofuscin (such as that seen in the Purkinje cells and inferior olivary and red nuclei<sup>9</sup>) occurs.

Absence of gag reflex does not appear to have functional consequences, which suggests that the motor component of the swallowing action is mediated independently of the reflex, whereas the presence of

pharyngeal sensation is an important determinant of normal swallowing. Most stroke patients are over 65 years of age and because the gag reflex is frequently absent in this and younger age groups, the reflex can no longer be considered a useful bedside test of swallowing after acute stroke. Pharyngeal sensation is rarely absent and, in view of its high reliability and predictive value,<sup>2</sup> is a more appropriate means to assess swallowing. It should be remembered, however, that no clinical test is an absolute predictor of aspiration in acute stroke.

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## Differentiation of follicular lymphoma cells after autologous bone marrow transplantation and haematopoietic growth factor treatment

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A patient with follicular lymphoma developed a striking but transient plasmacytosis in blood and bone marrow with paraproteinaemia after treatment by autologous bone marrow transplantation and interleukin-3 (IL-3). By immunophenotyping, cytogenetics and Southern blotting, we proved that the plasma cells were clonally related to the original lymphoma cells. This event was preceded by fever accompanied by high IL-6 concentrations. The patient recovered spontaneously and had a long-lasting remission. We speculate that the bone marrow-derived malignant B cells were stimulated by IL-3 and IL-6 into terminally differentiated plasma cells.

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