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Use of a portable manometer as a screening procedure in voice rehabilitation

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Abstract

Abnormal tone in the pharyngo-oesophageal (PO) segment may lead to failure in developing oesophageal speech. Videofluoroscopy may give a qualitative assessment of the PO segment but is expensive, time consuming and lacks quantification. A custom built PO segment manometer was therefore assessed as a means of predicting eventual oesophageal speech outcome. Two groups of patients were studied. In group 1 (18 patients) the PO segment pressures were compared to their videofluoroscopy findings. Videofluoroscopy categorized the patients into four groups. The PO pressures corresponded to this grouping, pressures above 20 mmHg being associated with voice failure. In group 2 (12 patients) the PO pressures in the early post-operative period were compared to their eventual speech outcome. In all cases the pressures predicted the eventual speech outcome . The pressure manometer is a simple, cheap and portable device which is a reliable screening test to predict the potential for oesophageal speech.

Introduction

A significant number of laryngectomies fail to acquire oesophageal speech due to abnormalities of the PO segment (Cheesman *et al.*, 1986), the abnormality being a variation in the muscular tone in the reconstructed pharyngeal musculature which forms the PO segment. A functional classification of five different categories of voice production have been identified (hypotonic, tonic, hypertonic, spasm and stricture) (Perry *et al.*, 1987).

Videofluoroscopy is the best way of assessing and categorizing the PO segment; however, it is expensive, time consuming, demands skill and lacks quantification. We, therefore, have developed a custom built manometer and used it to assess the use of the PO segment manometry as a means of predicting eventual oesophageal speech outcome.

Materials and methods

A cheap, custom built, battery powered manometer (Fig. 1) was developed by the Royal National Throat, Nose and Ear Hospital Medical Physics Department. The manometer measured peak pressures in mm of mercury utilizing a water perfusion catheter technique. The water was perfused through a Schwann Gantz catheter which had been passed transnasally to the PO segment. (Approximately 25 cm from the anterior nares). The catheter was connected via a pressure transducer to the manometer. The oesophagus was insufflated following transnasal placement of a 14 French rubber catheter 25 cm measured from the nares. Insufflation was performed using a compressed air source at flow of 3 litres/min and initial opening pressure of the PO segment recorded during fluent speech. Two groups of patients were studied. In group 1 (18 patients), the PO segment pressures were compared to their videofluoroscopy findings. The pressures in five patients before and after pharyngeal myotomy were also studied. In group 2 (12 patients), the PO segment pressures were recorded early in the post-operative period and compared to their eventual speech outcome, following at least two months speech therapy. Fluency was judged as being able to count over 15 and producing sounds for longer than 10 s. Serial measurements were also performed to see if the PO segment tonicity changed with time.

Results

Group 1: Videofluroscopy allowed the patients to be classified into four groups (Table I, Group 1a). The PO

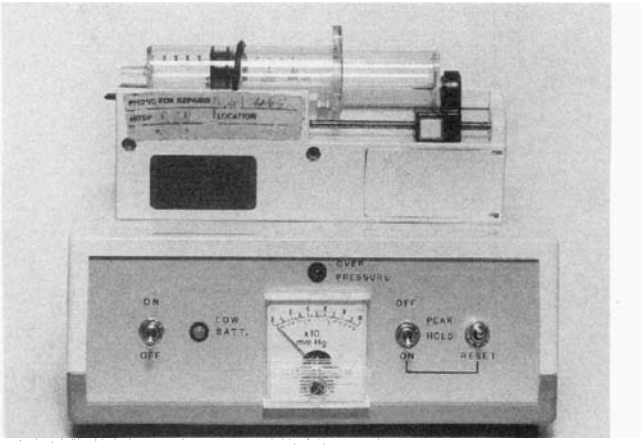

FIG. 1
Custom built manometer with infusion pump.

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TABLE I

GROUP 1A: VIDEOFLUOROSCOPY CATEGORIZATION AND ASSOCIATED PRESSURE MOVEMENTS. GROUP 1B: PRE- AND POST-MYOTOMY PRESSURE MEASUREMENTS

Group 1a—Videofluoroscopy group

Classification	No.	Mean pressure (mmHg)	Range
Hypotonic	3	11.3	10–14
Tonic	3	18.3	15–20
Hypertonic	4	45	35–50
Spasm	3	66.2	60–80

Group 2b—Myotomy group

	Mean pressure (mmHg)	
	Pre-myotomy	Post myotomy
Case 1	52	12
Case 2	54	18
Case 3	70	15
Case 4	58	18
Case 5	64	14

pressures also corresponded to the four groups on an increasing continuum (Fig. 2). Pressures above 20 mmHg were associated with voice failure. The PO segment pressures in our patients who underwent myotomy fell to below 20 mmHg and resulted in voice acquisition (Table I; Group 1b).

Group 2: In all cases the PO segment pressures in the early post-operative period predicted eventual speech outcome (Fig. 3) Failure was associated with a pressure of <20 mmHg (statistically significant p = 005 Fisher exact test). Only in one case did the PO segment pressure change significantly from 20 mmHg to 40 mmHg with an associated loss of voice. This patient received post-operative radiotherapy which resulted in a marked fibrotic reaction as identified by tracheostome migration.

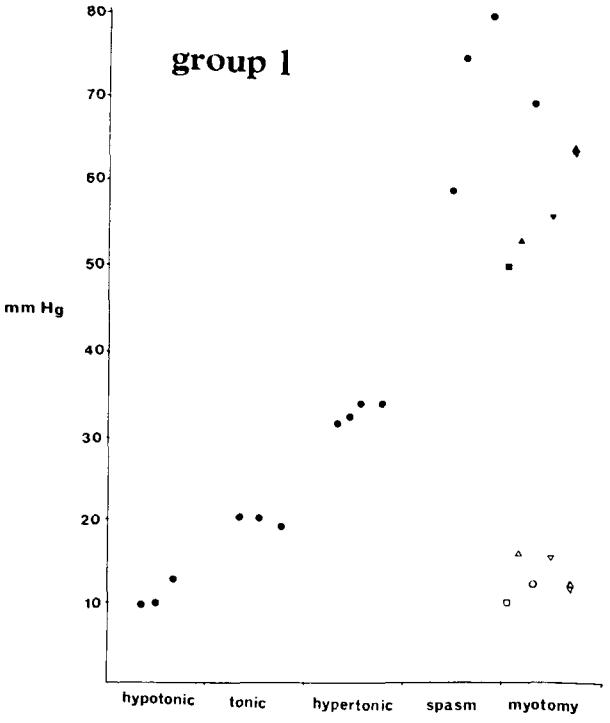

FIG. 2

Group 1 pressure measurements including pre- and post-myotomy pressures.

Discussion

A functional abnormality in the PO segment is the commonest cause of failure to achieve oesophageal voice. Perry *et al.* (1987) classify voice failure into four different qualitative categories. In the hypotonic segment the egress of air from the pharynx may not generate sufficient vibration to result in tracheo-oesophageal voice. In the hypertonic group an increase in tone in the PO segment prevents vibration on air insufflation and so poor voice production. In the third group oesophageal distension during insufflation may initiate spasm in the PO segment (Singer *et al.*, 1981). This is the commonest cause of voice failure (Baugh *et al.*, 1987).

Hypopharyngeal stricture is a rare cause of failure to achieve voice and is due to the stricture impeding the flow of air from the pharynx and oesophagus. Videofluoroscopy is the normal means of assessing the PO segment tonicity but is only quantitative and is expensive in terms of time and resources. Our results would confirm that manometry is a worthwhile and reliable alternative in assessing PO segment tonicity. The pressure measurements in group 1 confirm that an increase in tonicity in the PO segment is the causation of poor oesophageal voice. The measurements correlate with the videofluoroscopy categorization and suggest that there is a continum of increasing pressure from hypotonic to spasm. An initial opening pressure of the PO segment of between 15–20 mmHg correlates with the production of a good oesophageal voice. Our pressure movements confirm the findings of other workers (Baugh *et al.*, 1990).

In the voice failure group that underwent myotomy establishment of oesophageal voice corresponded to a reduction in the PO opening pressure into the normal range. This reduction in pressure has also been noted by Baugh *et al.* (1990). Pharyngeal myotomy can reliably reduce intro-oesophageal pressure and produce an acceptable oesophageal voice in these cases. However, if a long myotomy is performed from the tongue base to the tracheostomy there is a risk of producing a hypotonic PO segment.

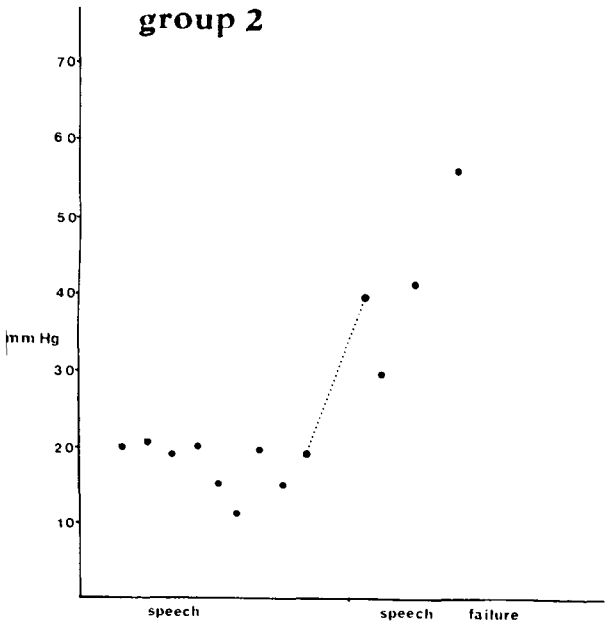

FIG. 3

Group 2 pressure measurements and voice acquisition. Note the rise in pressure of one case following radiotherapy.

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The prospective study group 2 shows that oesophageal manometry within four weeks of operation can reliably predict oesophageal speech outcome. In one patient a rise in PO segment pressure was noted following radiotherapy and this was associated with a loss of voice. It was thought that the radiotherapy had resulted in a fibrotic reaction affecting the PO segment tonicity. This fibrosis was also associated with migration from the tracheostome towards the left side of the neck.

The custom built manometry system has significant advantages over other established forms of manometry in that it is cheap, portable, simple to use and measures peak pressure. The study shows that an initial quantitative measurement of the PO opening pressure is a reliable estimator and predictor of oesophageal voice acquisition. Not only is manometry of use in predicting oesophageal speech in the early post-operative period but may be used as a screening test for voice failures in outpatients. However videofluoroscopy may be necessary for excluding the presence of a stricture and determining the length of myotomy if corrective surgery is contemplated.

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