

# Causes and consequences of anterior pharyngeal pouch after total laryngectomy

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## Abstract

**Objectives:** To assess the frequency of anterior pharyngeal pouch formation after total laryngectomy, and to discuss the causes and consequences of anterior pharyngeal pouch formation.

**Study design:** A prospective, observational study of 43 patients undergoing total laryngectomy.

**Methods:** Data collected included laryngeal defect closure type, tumour staging and demographic information. A barium swallow was performed on day 7–14 after surgery to assess for anterior pharyngeal pouch formation and fistula formation.

**Results:** The incidence of anterior pharyngeal pouch formation was 47 per cent. Patients who did not have an anterior pharyngeal pouch on swallow imaging assessment were less likely to develop a pharyngo-cutaneous fistula. There was no statistically significant association between laryngeal defect closure type and anterior pharyngeal pouch formation.

**Conclusion:** The anterior pharyngeal pouch is a dynamic phenomenon best investigated with a fluoroscopic swallow imaging study. Its causes are multi-factorial. Absence of an anterior pharyngeal pouch appears to confer protection against pharyngo-cutaneous fistula formation, hastening commencement of adjuvant therapy and an oral diet.

**Key words:** Laryngectomy; Fistula; Laryngeal Neoplasm; Surgical Closure Technique

## Introduction

After total laryngectomy, the laryngeal defect in the pharynx is closed primarily if sufficient mucosa remains. This forms a ‘neopharynx’. There are several variations of closure technique, which concern the number of layers closed and the shape of closure. Typically, the neopharynx is formed by closing the laryngeal defect in either a horizontal, vertical or T-shaped fashion. Each closure method has its advocates, but the final choice is often dictated by which method will provide the most tension-free closure.

Amongst patients undergoing total laryngectomy, one of the leading causes of increased morbidity, delayed adjuvant therapy and increased hospital stay is the development of a pharyngo-cutaneous fistula. The treatment of these fistulae remains a challenge for head and neck surgeons. The reported incidence of pharyngo-cutaneous fistula varies from 5 to 65 per cent.<sup>1</sup>

Some surgeons believe that early oral feeding contributes to pharyngo-cutaneous fistula formation,

while others argue that it has no effect and offers psychological benefits.<sup>2–4</sup> There are also other patient factors which have been shown to produce a statistically significant increase in the risk of pharyngo-cutaneous fistula development, namely: previous radiotherapy, a pre-operative haemoglobin concentration of less than 125 g/l, cardiac failure, concurrent neck dissection, positive tumour margins, gastroesophageal reflux disease, tumour size, type of suture material, not performing a cricopharyngeal myotomy, tumour recurrence and hypoalbuminaemia.<sup>1,5</sup>

In our institutions, we use a barium swallow imaging study on day 7–14 post-operatively to assess for the development of salivary fistula, prior to commencing oral intake.

On barium swallow study, an anterior diverticulum of the neopharynx is frequently observed. In the literature, this diverticulum is often referred to as an ‘anterior pharyngeal pouch’ or a ‘pharyngeal pseudo-diverticulum’. These pouches were first described in 1962 by Kirchner *et al.* as a cause of dysphagia after total

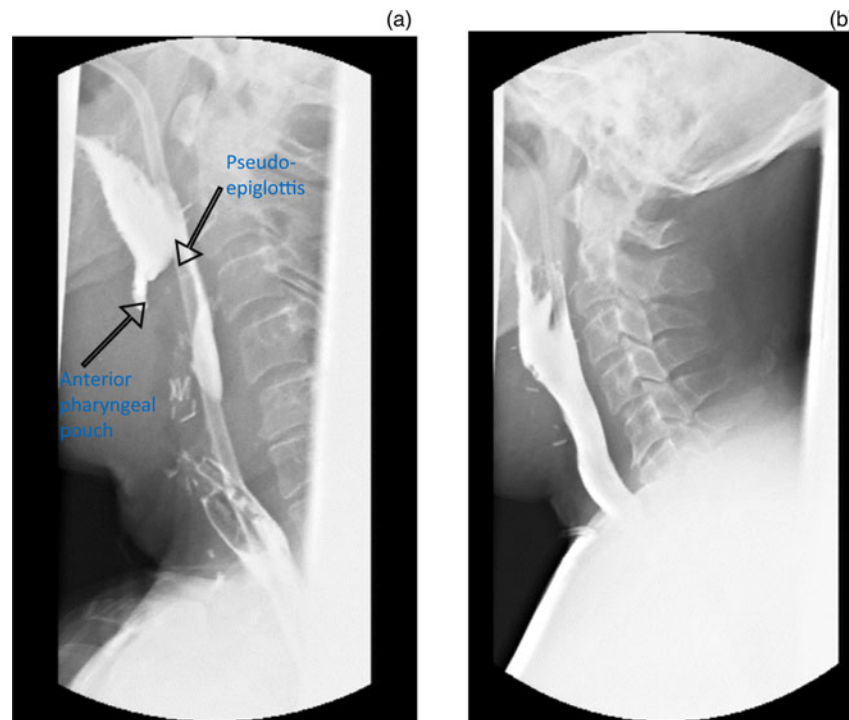


FIG. 1

Lateral barium swallow studies showing (a) the appearance of an anterior pharyngeal pouch and pseudo-epiglottis after laryngectomy, and (b) the normal appearance of the neopharynx after total laryngectomy.

laryngectomy.<sup>6</sup> When a partition exists between the pouch and the native pharynx, the structure is termed a ‘pseudo-epiglottis’ (Figure 1). In post-laryngectomy patients, the reported incidence of anterior pharyngeal pouch varies from 35 to 85 per cent.<sup>6–8</sup> There is often no correlation between endoscopic and fluoroscopic appearances, suggesting that the dynamic process of swallowing is what gives the appearance of a pouch on barium swallow studies.

This paper aims to report our experience of anterior pharyngeal pouch formation in a cohort of 43 patients undergoing total laryngectomy, and to discuss the causes and clinical consequences of this anomaly.

## Methods

Forty-five patients undergoing total laryngectomy had prospective data recorded between 2007 and 2011. Data included demographic, tumour staging, radiotherapy and surgical technique information. Only patients undergoing reconstruction of the neopharynx with primary closure were included.

The standard protocol of our institutions was to perform a barium swallow study 7 to 14 days after surgery to assess for the presence of a fistula. Until this investigation had been performed, patients received enteral feeding via a nasogastric tube or percutaneous feeding tube.

The chi-square distribution was used to test the statistical significance of factors possibly affecting the incidence of pouch formation and, when a pouch was present, pharyngo-cutaneous fistula formation.

## Results

A total of 43 patients were included in the study. Nineteen patients had T-shaped closure of the laryngeal defect, 16 had vertical closure and 8 had horizontal closure. Two patients were excluded, as early fistula formation and wound breakdown made interpretation of swallow study results impossible.

Twenty (47 per cent) patients had an anterior pharyngeal pouch on barium swallow study. Eleven (26 per cent) patients developed a pharyngo-cutaneous fistula, all of whom had a pharyngeal pouch on barium swallow study. There was a statistically significant

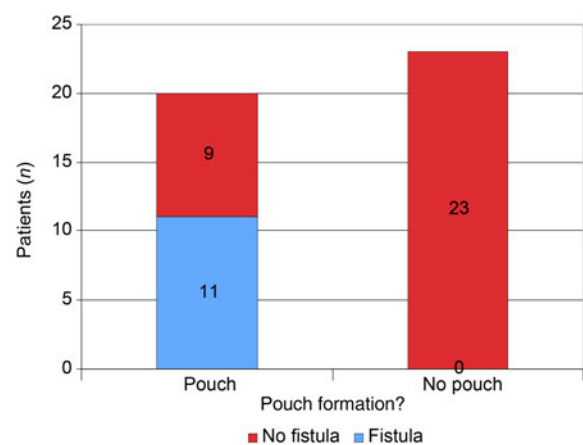


FIG. 2

Incidence of fistula formation in patients with and without an anterior pharyngeal pouch. Data values within graph represent patient numbers.

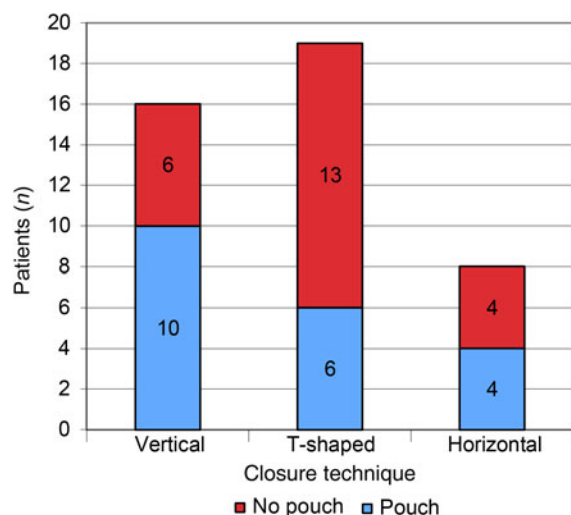


FIG. 3

Incidence of anterior pharyngeal pouch formation in patients undergoing different laryngeal defect closure techniques. Data values within graph represent patient numbers.

association between absence of an anterior pharyngeal pouch and the absence of pharyngo-cutaneous fistula formation ( $p \leq 0.001$ ) (Figure 2).

The incidence of pouch formation by laryngeal defect closure type was: vertical, 63 per cent; T-shaped, 32 per cent; and horizontal, 50 per cent (Figure 3). There was no statistically significant association between closure type and pouch formation ( $p = 0.16$ , chi-square distribution), although the trend was towards less frequent pouch formation in patients with a T-shaped closure. Patients receiving different closure types had no statistically significant differences regarding demographics, oncological staging or radiotherapy.

## Discussion

Anterior pharyngeal pouches occur commonly after laryngectomy, and they can progress to form a pharyngo-cutaneous fistula. In the English language literature, there are few large studies that address anterior pharyngeal pouch formation. We found that the incidence of pouch formation in our cohort was 47 per cent. This is comparable with the findings of other published studies, which have reported incidences of 35 to 85 per cent.<sup>6–8</sup>

The mechanism of pouch formation is debated in the literature. Kirchner *et al.* proposed a mechanism involving separation of the edges of the pharyngeal closure at the point where the neopharynx joins the base of the tongue, due to opposing forces of tongue and pharynx contraction. This separation allows a potential space to form under the mucosa; if the space extends and reaches the skin, a fistula forms, if not, a pouch forms.<sup>6</sup> Davis *et al.* hypothesised that, when closing the laryngeal defect in a vertical fashion, the tongue must be stretched in a vertical direction; when this tension is released, the closure may fold up on itself.<sup>7</sup> Other explanations proposed in the

literature include incoordinated contraction of muscle remnants from the inferior and middle constrictors after laryngectomy, due either to poor approximation or deinnervation.<sup>8</sup> As a consequence, the pulsive forces of swallowing cause a pouch to form at the point of weakness, in a similar fashion to Zenker's diverticulum formation.

Davis *et al.* felt that T-shaped closure offered some protection from pouch formation, due to the fact that, in their cohort of 28 patients, pouch formation occurred in 67 per cent of patients with T-shaped closure but in all patients with vertical closure.<sup>7</sup> However, this study was under-powered to detect a statistically significant difference in pouch formation incidence between patients with different closure types, although the trend was towards protection with a T-shaped closure. This protective effect could be due to the formal approximation of the pharyngeal constrictors to the base of tongue which is performed during T-shaped closure, which may prevent dehiscence. However, clearly such formal closure does not prevent pouch formation in all patients.

If a pulsive mechanism is the cause of anterior pharyngeal pouch formation, then, as described by Hartley *et al.*, there must be a significant increase in pharyngo-oesophageal pressure, either due to oedema, stricture or lack of myotomy.<sup>9</sup> It is standard practice in our institutions for all patients to undergo myotomy; nevertheless, our incidence of pouch formation was still 47 per cent. Oedema and/or stricture could certainly be responsible for increased pharyngo-oesophageal pressure. However, again, several patients in our study developed an anterior pharyngeal pouch despite receiving enteral feeding for 10 days, which should have been enough time for oedema to resolve. Similarly, pouches formed in the absence of an identifiable oesophageal stricture. The lack of consensus in the literature, and our own findings, suggest that the cause of anterior pharyngeal pouch is multi-factorial.

The consequences of having an anterior pharyngeal pouch are variable. Certainly, we have demonstrated that absence of a pouch appears to protect patients against pharyngo-cutaneous fistula formation. An anterior pharyngeal pouch presumably allows saliva to pool in a compromised area, predisposing the patient to fistula. Hartley *et al.* noted that, in their patients, when a fistula was present it appeared to be related to an anterior pharyngeal pouch.<sup>9</sup> Most authors agree that a pouch can be symptomatic and can present with dysphagia, regurgitation and/or a foreign body sensation.<sup>9–11</sup> There is reasonable evidence for this sequence of events, and several published case series have reported various treatment techniques, including open pharyngoplasty,<sup>12</sup> laser excision<sup>9,11</sup> and endoscopic division.<sup>10</sup> However, Nayar *et al.* disputed this sequence of causation, and argued that the swallowing issues that present after total laryngectomy are a normal consequence of the treatment received.<sup>8</sup> Conclusive evidence that anterior pharyngeal pouch causes

swallowing dysfunction is lacking in the literature. However, it is hard to ignore the significant number of patients who report relief of symptoms after division of a pseudo-epiglottis, supporting the argument that such treatment does indeed improve swallowing.

- **Anterior pharyngeal pouch is commonly seen on swallow studies after total laryngectomy**
- **Causation is multi-factorial; neopharynx closure type may play a role**
- **Dysphagia and regurgitation can result, relieved by pseudo-epiglottis division**
- **Pouch absence appears to protect against pharyngo-cutaneous fistula formation**

Several institutions around the world have reported the results of early feeding after laryngectomy. These authors argue that patients benefit psychologically.<sup>3,4</sup> Opposition to this regime is based on concerns regarding promotion of fistula formation, even though relevant studies have demonstrated no difference in incidence between differently managed cohorts. Early post-operative investigation for the presence of an anterior pharyngeal pouch, via fluoroscopic study, may enable early feeding of those patients seen to be without a pouch.

### Conclusion

The anterior pharyngeal pouch is a dynamic phenomenon best investigated by a fluoroscopic swallow study. Its cause is multi-factorial. In this study, we were unable to demonstrate a statistically significant association between post-laryngectomy laryngeal defect closure type and pouch formation. Absence of a pouch appears to confer protection against pharyngo-cutaneous fistula formation, hastening commencement

of adjuvant therapy and return of normal swallowing function.

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Dr S Anderson takes responsibility for the integrity  
of the content of the paper  
Competing interests: None declared

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