Early oral feeding following total laryngectomy

J Aswani, M Thandar, J Otiti, J Fagan

Abstract
Objectives: To determine whether, in a developing world context, early oral feeding after laryngectomy is safe, cost-effective and appropriate.

Study design: A prospective study of early oral feeding after laryngectomy, compared with retrospective, historical delayed feeding controls.

Method: Forty patients underwent total laryngectomy for advanced carcinoma of the larynx with or without hypopharyngeal involvement, not requiring tongue base resection or myocutaneous flaps, and were commenced on oral feeding on the second post-operative day. Thirty-nine laryngectomy patients previously managed in the same unit who had received conventional, delayed oral feeding served as controls.

Results: Pharyngocutaneous fistulae developed in 20 per cent of the early feeding patients, compared with 15.4 per cent of the delayed oral feeding controls ($p = 0.592$). For patients who did not develop fistulae, hospitalisation was shorter in the early oral feeding group ($p = 0.007$).

Conclusion: Early oral feeding for laryngectomy patients is recommended, both in developed and developing countries.

Key words: Laryngectomy; Feeding; Complications; Nutrition

Introduction

Following total laryngectomy, the purported advantages of early oral feeding are increased patient comfort and confidence, reduced length of hospital stay and reduced financial cost. The safety of early oral feeding has been previously investigated.[1–3] More than 50 per cent of the world's people live in developing countries. Unlike developed nations such as the USA, developing countries in Africa and elsewhere have a high prevalence of human immunodeficiency virus infection, tuberculosis, malnutrition and extreme poverty, and a shortage of healthcare staff. All these factors place an additional strain on available health resources and necessitate cost-saving measures. Although there has been a shift toward treating advanced laryngeal cancer with chemoradiation and reserving surgery for salvage in developed countries, primary laryngectomy remains the mainstay of treatment in developing nations due to limited resources.[4]

Groote Schuur Hospital is situated in Cape Town, South Africa, and serves a low socioeconomic group of patients. Until the commencement of this study, post-operative laryngectomy patients at this hospital were tube-fed for a week via a tracheoesophageal fistula, before oral feeding was commenced. It was considered that early oral feeding following total laryngectomy could have benefits in this hospital, and within underfinanced and understaffed health systems in general.

Materials and method

The aims of this study were: to compare early feeding with conventional, delayed feeding of laryngectomees; to compare complication rates of early feeding in our clinical setting with those reported elsewhere; to identify factors associated with higher rates of early feeding complications; to determine the cost–benefit ratio of early feeding, within a developing country setting; and to determine whether early oral feeding, as reported in centres in developed countries, is appropriate in a developing world context.

A prospective study was performed of early oral feeding in laryngectomy patients at Groote Schuur Hospital, Cape Town, South Africa. The study was submitted to and approved by the University of Cape Town ethics committee. We excluded from the study patients who required myocutaneous flaps to augment pharyngeal repair; those who had tumour extension to the tongue base, and one patient in whom the cricopharyngeal myotomy inadvertently breached the mucosa. Table I outlines the

TABLE I

EARLY FEEDING PROTOCOL

Post-op day	Feed
0	IVI GMS
1	IVI GMS & stomagastric feeds
2	Clear fluids orally & stomagastric feeds
3	Free fluids orally
4	Soft diet
5	Normal hospital diet

Post-op = post-operative; IVI = intravenous infusion; GMS = general maintenance solution

early feeding protocol used. Data sheets were completed for each patient regarding age, sex, tumour stage, surgery, reported risk factors for pharyngocutaneous fistula formation, and the development of pharyngocutaneous fistulae.

The outcomes for this early feeding group were compared with those for a (conventionally treated) delayed feeding group. Data for the latter group were collected by retrospective chart review of patients previously treated in the same surgical unit.

Surgery was standardised for both the early and the delayed feeding groups, including pharyngeal closure technique. A Gluck–Sorenson apron flap was used for access. Neck dissection was performed in patients with advanced tumours or with clinical evidence of cervical metastasis. A cricopharyngeal myotomy was routinely performed. A primary tracheoesophageal fistula was created and a Foley catheter inserted through the fistula to act both as a stent and a conduit for stomagastric feeding. A T-shaped or horizontal pharyngeal closure was performed in two continuous layers with vicryl 3/0 thread (Connell suture), depending on whether horizontal repair could be achieved without undue suture-line tension. Methods to test the closure of the pharynx after suturing and before closure, such as the 'Ambu bag water-leaking test', were not employed. The platysma muscle was approximated with vicryl, and staples were used to close the skin. A 6 mm closed suction drain was left in situ until the drain fluid was ≤50 mls/24 hours. Antibiotics (ampicillin 1 g 6-hourly and metronidazole 500 g 8-hourly, or augmentin 1.2 g) were administered for 24 hours.

Results

Between November 2002 and December 2006, 56 patients underwent total laryngectomy with or without partial pharyngectomy for advanced cancer of the larynx and hypopharynx. Forty of these fulfilled the criteria for inclusion in the study. Of these 40 patients, 82.5 per cent ($n = 33$) were male and 17.5 per cent ($n = 7$) were female. Patients' ages ranged from 36 to 77 years (mean, 60.5 years).

All patients had advanced (tumour (T) grading T_3 or T_4) squamous cell carcinoma of the larynx with or without hypopharyngeal involvement. Thirteen (32.5 per cent) patients had stage III disease and 27 (67.5 per cent) were stage IV. Partial pharyngectomy for hypopharyngeal tumour extension was required in five patients (12.5 per cent). Twenty-six

patients (65 per cent) underwent modified neck dissection, 12 (30 per cent) of which were unilateral and 14 (35 per cent) bilateral.

Pharyngocutaneous fistulae developed in eight (20 per cent) of the 40 patients, being diagnosed on post-operative days three, 10, 10, 11, 11, 12, 12 and 19. These patients were managed by converting oral feeding to stomagastric feeding, using antibiotics where appropriate.

Additional complications observed were haematomas ($n = 3$) and skin flap necrosis ($n = 1$). The haematomas were detected on the day of surgery and drained immediately. None of these patients developed pharyngocutaneous fistulae. One patient who underwent salvage laryngectomy and bilateral modified neck dissection, for recurrent carcinoma of the larynx following CO_2 laser resection and radiation therapy, developed necrosis of the apron skin flap without developing a pharyngocutaneous fistula. This patient had additional co-morbid factors (hypertension, non-insulin dependent diabetes and a pre-operative haemoglobin level of 9.5 g/dl).

We recorded the following potential risk factors for pharyngocutaneous fistulae development: patient age, gender, other co-morbid factors, tumour stage, hypoalbuminaemia (i.e. serum albumin concentration <26 g/dl), anaemia (i.e. haemoglobin level <12.5 g/dl), prior radiotherapy, chemotherapy, tracheotomy, extent of surgery, and tumour margins. Table II lists possible risk factors for fistula formation. There were no statistically significant relationships between any of these factors and fistula formation.

Table III summarises a comparison between the early feeding group and the 39 similar, control patients who had previously undergone laryngectomy with or without partial pharyngectomy, in the same surgical unit, and who had received a delayed oral feeding regime. There was no significant difference in fistula rates between the two groups ($p = 0.825$), and there was no significant difference in the median post-operative day of fistula diagnosis ($p = 0.389$).

Comparison of the median durations of hospital stay for the early and delayed feeding groups is shown in Table IV. The length of hospital stay was calculated from the day of surgery to the day of hospital discharge. The duration of hospital stay ranged from seven to 37 days for the patients receiving delayed oral feeding and from six to 63 days for those receiving early oral feeding; medians were 14 and 13 days, respectively ($p = 0.153$). Hospitalisation was less than or equal to 36 days, except for one 66-year-old man with stage III cancer of the larynx, who was hospitalised for 63 days. This patient had chronic obstructive airways disease and a low pre-operative haemoglobin level. He developed wound sepsis post-operatively and, on the 11th post-operative day, wound dehiscence. His pharyngocutaneous fistula was diagnosed on the 19th post-operative day, hence the extended hospital stay. Statistically, there was no difference in overall lengths of hospitalisation between the two groups. However, if patients who developed pharyngocutaneous fistulae

TABLE II

POSSIBLE RISK FACTORS FOR PHARYNGOCUTANEOUS FISTULA DEVELOPMENT

Factor	Patients (n (%))		p
	Fistula	No fistula	
Age (years)	60.7	60.4	0.19
Gender			
Male	6 (18.2)	27 (81.8)	0.65
Female	2 (28.6)	5 (71.4)	
Co-morbidities	5 (38.5)	8 (61.5)	0.12
Hypoalbuminaemia (<26 g/dl)	1 (100)	0 (0)	0.2
Pre-op anaemia (Hb <12.5 g/ld)	4 (30.8)	9 (69.2)	0.4
Pre-op radiotherapy	2 (50)	2 (50)	0.21
Pre-op chemotherapy	0 (0)	1 (100)	1.0
Pre-op tracheotomy	4 (33.3)	8 (66.7)	0.2
Tumour stage			
III	1 (7.7)	12 (92.3)	0.23
IV	7 (25.9)	20 (74.1)	
Partial pharyngectomy	0 (0)	5 (100)	0.5
Neck dissection			
Unilateral	3 (25)	9 (75)	0.8
Bilateral	1 (7.1)	13 (92.9)	0.3
Positive resection margins	1 (16.7)	5 (83.3)	1.0

Pre-op = pre-operative; Hb = haemoglobin

are excluded from analysis, the median duration of hospital stay was shorter for those receiving early oral feeding (*p* = 0.007).

Discussion

The principal objectives of early feeding of laryngectomees are: to reduce financial costs; to expedite the patient's psychological rehabilitation; to increase patient comfort; to reduce nursing requirements; and to reduce length of hospitalisation.

Traditionally, oral feeding has been delayed for at least seven days after laryngectomy.[1–3] This has been based on a misunderstanding of the healing process of the pharynx, according to which oral feeding was delayed to allow for healing of the pharyngeal suture line.[5,6] It is now known that the skin incision heals in a watertight fashion within 24 to 48 hours. It is reasonable to assume that the pharyngeal mucosa could also do so within the same period of time.[1]

Reported pharyngocutaneous fistula rates in conventional, delayed feeding groups of laryngectomy patients vary from 5.5 to 26.8 per cent (Table V). Our historical delayed feeding control group had a fistula rate of 15.4 per cent.

TABLE III

PHARYNGOCUTANEOUS FISTULA DEVELOPMENT IN EARLY *VS* DELAYED ORAL FEEDING GROUPS

Parameter	Feeding		p
	Early	Delayed	
Patients (n)	40	39	
Fistulae (n (%))	8 (20)	6 (15.4)	0.8247
Median fistula diagnosis day	11	14	0.389

TABLE IV

PATIENTS' MEDIAN LENGTH OF HOSPITAL STAY

Patients	Feeding (n)		p
	Early	Delayed	
PC fistula	26	22	0.474
No PC fistula	10.5	14	0.007
All	14	13	0.153

PC = pharyngocutaneous

Table VI presents the results of three previous reports that compared early and delayed postlaryngectomy feeding, plus those of the present study.[2,14,16] Meta-analysis of all these results reveals no significant difference in fistula rates between early and delayed feeding groups (*p* = 0.442). In the study by Medina and Khalif, lower fistula rates could be attributed in part to exclusion of patients with abnormal haemoglobin, albumin and total protein levels, as well as of those who had undergone partial pharyngectomy or had been previously irradiated. These authors also ensured intra-operatively that there was no leakage through the pharyngeal repair, by injecting water into the pharynx.[16] Seven and colleagues' inclusion criteria were similar to our own.[2] Whereas our pharyngeal closure was T-shaped or horizontal, Medina and Khalif's was

TABLE V

REPORTED PHARYNGOCUTANEOUS FISTULA RATES FOR DELAYED POSTLARYNGECTOMY ORAL FEEDING

Study	Country	Pts (n)	Fistula rate (%)
Krouse & Metson[7]	USA	109	5.5
Rodriguez-Ceuvas et al.[8]	Mexico	35	5.7
Kent et al.[9]	UK	66	7.4
Ikiz et al.[10]	Turkey	92	8.7
Udaipurwala et al.[11]	Pakistan	68	8.9
Seven et al.[2]	Turkey	33	9
Aprigliano[12]	Brazil	625	9
Papazoglou et al.[13]	Greece	310	9
Song et al.[14]	China	21	9.5
Volling et al.[15]	Germany	42	9–12
Medina & Khalif[16]	USA	18	11
Fradis et al.[17]	Israel	56	12.5
Saydam et al.[18]	Turkey	48	12.5
Soylu et al.[19]	Turkey	295	12.5
Markou et al.[20]	Greece	377	13
Natvig et al.[21]	Norway	197	14
Lundgren & Olofsson[22]	Norway	53	15
Vertaniemi et al.[23]	Finland	133	15
Current study	South Africa	39	15.4
Mendelsohn & Bridger[24]	USA	100	15.3–21.4
Chee & Siow[25]	Singapore	69	15.9
Tomkinson et al.[26]	Wales	50	16
Redaelli de Zinis et al.[27]	Italy	246	16
Moses et al.[28]	USA	132	21
Herranz et al.[29]	Spain	471	21
Akyol et al.[30]	Turkey	110	21
Parikh et al.[31]	Canada	125	22
Smith et al.[32]	Australia	223	22.9
Wei et al.[33]	Hong Kong	124	24.2
Seikaly & Park[34]	Canada	21	26
Kasapoglu et al.[35]	Turkey	138	26.8

Pts = patients

TABLE VI

STUDIES OF EARLY VS DELAYED POSTLARYNGECTOMY FEEDING, AND META-ANALYSIS

Feeding	Pts (*n*)	Fistula rate (%)	*p*
Medina & Khalif[16] (USA)			
Early	55	3.6	0.229
Delayed	18	11	
Song et al.[14] (China)			
Early	21	4.8	0.555
Delayed	21	9.5	
Seven et al.[2] (Turkey)			
Early	32	6.2	0.671
Delayed	33	9	
Current study (South Africa)			
Early	40	20	0.593
Delayed	39	15.4	
Meta-analysis			
Early	148	8.8*	0.442
Delayed	111	11.7[†]	

*13/148 patients; [†]13/111 patients. Pts = patients

T-shaped and Seven and colleagues' was T-shaped or straight. In the latter two studies, peri-operative antibiotics were administered until the drains were removed, while we gave antibiotics for 24 hours only.

No factors predisposing to fistula formation emerged from our analysis of our patients receiving early oral feeding. Similarly, Seven *et al.*[2] did not find any statistically significant predisposing factors, although they observed a trend suggesting that advanced T stage increased the risk of pharyngocutaneous fistula development. Parikh *et al.*[31] found no association between pharyngocutaneous fistula development and age, gender, patient morbidity factors, tumour–node–metastasis stage, choice of ablation, choice of reconstruction, modality of post-operative feeding or primary tracheoesophageal puncture. Morton *et al.*[36] reported that extended laryngectomy and increased amylase in the neck drains were the only significant predictors of fistula formation; previous radiotherapy, neck dissection, pre- and post-operative haemoglobin and albumin levels, and post-operative transfusion were not significant predictors. Pre- and post-operative haemoglobin levels of <12.5 g/dl have been associated with pharyngocutaneous fistulae in some studies.[27,37,38] This was not evident in our series. Similarly, Seikaly and Park[34] did not find pre-operative haemoglobin level to be a significant risk factor. Hypoalbuminaemia has been shown to delay the rate and quality of wound healing.[39] However, as only one patient in our study had a low serum albumin level (25 g/dl), it is not possible to draw any conclusions as regards hypoalbuminaemia and pharyngocutaneous fistula formation. There are conflicting reports about the association between pre-operative radiotherapy and pharyngocutaneous fistulae.[9,12,17,21,24,27,34,40–44] Four patients in the present study had received pre-operative radiotherapy, half of whom later developed fistulae. Advanced tumour stage is associated with more frequent pre-operative tracheostomy, wider surgical resection and a higher likelihood of neck dissection. These factors have been reported in some studies to predispose to pharyngocutaneous fistulae,[3,33,38,45] while others have found no such association.[1,37,41,46]

No such association was found in our study. Cavalot *et al.*[46] reported lower rates of pharyngocutaneous fistulae in patients who had undergone accompanying neck dissection. Markou *et al.*[20] found a statistically significant correlation between positive surgical margins and pharyngocutaneous fistula development; however, Qureshi *et al.*[47] did not find any such association.

- **Most centres still delay oral feeding following total laryngectomy**
- **Three previous studies have demonstrated the benefits and safety of early feeding**
- **This prospective study compared patients receiving early oral feeding with retrospective, historical controls receiving delayed feeding**
- **There was no significant difference in pharyngocutaneous fistula rates**
- **In patients who did not develop fistulae, hospitalisation was shorter in the early oral feeding group**
- **Early oral feeding is recommended**

The median length of hospital stay for the early feeding study group did not significantly differ from that of the (historical) delayed feeding group. Statistically, there was no significant difference in overall lengths of hospitalisation between the two groups. However, when one excludes patients who developed pharyngocutaneous fistulae, the median duration of hospital stay was shorter for patients receiving early oral feeding. These findings are however not necessarily an accurate reflection of the minimum duration of hospitalisation that can be achieved under more optimal socioeconomic conditions, as hospital discharge of poor patients or those living far from the hospital is often delayed by waiting for speech prosthesis fitting or for public transport. Kishore *et al.*[1] reported a shorter duration of hospital stay among patients receiving early oral feeding compared with controls. Seven *et al.*[2] found no significant difference in the length of hospital stay between the study and control groups with or without pharyngocutaneous fistulae.

Although we did not measure the psychological benefit of early feeding, Kishore *et al.*[1] reported that all the patients in their control group (i.e. delayed oral feeds) stated their desire for removal of the feeding tube and initiation of oral feeding. Soylu *et al.*[19] reported that patients felt more comfortable and confident without a feeding tube.

Conclusions

For lower socioeconomic group patients within developing nation health systems, early commencement of postlaryngectomy oral feeding may not reduce the overall length of hospitalisation, but it has advantages in terms of psychological benefit to the patient, reduced need for specialised nursing care and

reduced financial cost (by avoiding special enteral tube feeds). The results of the present study concur with those of previous reports, i.e. that early oral feeding is safe in patients who have undergoing laryngectomy, both with and without neck dissection, and that it can be recommended in both developing and developed world settings.

References

1 Kishore CP, Suja S, Naveen KD, Sampath CP, Satish C. Early oral feeds in laryngectomized patients. *Ann Otol Rhinol Laryngol* 2006;**115**:433–8

2 Seven H, Asli BC, Suat T. A randomized controlled trial of early oral feeding in laryngectomized patients. *Laryngoscope* 2003;**113**:1076–9

3 Boyce SE, Meyers AD. Oral feeding after total laryngectomy. *Head Neck* 1989;**11**:269–73

4 Genden E, Ferlito A, Rinaldo A, Silver CE, Fagan JJ, Suárez C *et al.* Recent changes in the treatment of patients with advanced laryngeal cancer. *Head Neck* 2008;**30**:103–10

5 Applebaum EL, Levine HL. Pharyngeal reconstruction after laryngectomy. *Laryngoscope* 1977;**87**:1844–90

6 Cantrell RW. Pharyngeal fistula: prevention and treatment. *Laryngoscope* 1978;**88**:1204–8

7 Krouse JH, Metson R. Barium swallow is a predictor of salivary fistula following laryngectomy. *Otolaryngol Head Neck Surg* 1992;**106**:254–7

8 Rodriguez-Ceuvas S, Labastida S, Gutierrez F, Granados F. Oral feeding after total laryngectomy for endolaryngeal cancer. *Eur Arch Otolaryngol* 1995;**252**:130–2

9 Kent SE, Liu KC, Das Gupta AR. Post-laryngectomy pharyngocutaneous fistulae. *J Laryngol Otol* 1985;**99**:1005–8

10 Ikiz AU, Uca M, Guneri EA, Erdag TK, Sutay S. Pharyngocutaneous fistula and total laryngectomy: possible predisposing factors, with emphasis on pharyngeal myotomy. *J Laryngol Otol* 2000;**14**:768–71

11 Udaipurwala IH, Iqbal K, Jalisi M. Pharyngocutaneous fistula following laryngectomy. *J Pak Med Assoc* 1995;**45**:130–2

12 Aprigliano F. Use of the nasogastric tube after total laryngectomy: is it truly necessary? *Ann Otol Rhinol Laryngol* 1990;**99**:513–14

13 Papazoglou G, Doundoulakis G, Terzakis G, Dokianakis G. Pharyngocutaneous fistula after total laryngectomy: incidence, cause and treatment. *Ann Otol Rhinol Laryngol* 1994;**103**:801–5

14 Song J, Jing S, Shi H. The clinical observation of early oral feeding following total laryngectomy. *Lin Chuang Erh Pi Yen Hou Ko Tsa Chih* 2003;**17**:527–8 [in Chinese, Pubmed abstract in English]

15 Volling P, Singelmann H, Ebeling O. Incidence of salivary fistulas in relation to timing of oral nutrition after laryngectomy. *HNO* 2001;**49**:276–82 [in German, Pubmed abstract in English]

16 Medina JE, Khalif A. Early oral feeding following total laryngectomy. *Laryngoscope* 2001;**111**:368–72

17 Fradis M, Podoshin L, David JB. Post-laryngectomy pharyngocutaneous fistula – a still unresolved problem. *J Laryngol Otol* 1995;**109**:221–4

18 Saydam L, Kalcioglu T, Kizilay A. Early oral feeding following total laryngectomy. *Ann J Otolaryngol* 2002;**23**:277–81

19 Soylu L, Kiroglu M, Aydogan B, Cetik F, Kiroglu F, Akçali C *et al*. Pharyngocutaneous fistula following laryngectomy. *Head Neck* 1998;**20**:25–5

20 Markou KD, Vlachtsis KC, Nikolaou AC, Petridis DG, Kouloulas AI, Dahiilidis IC. Incidence and predisposing factors of pharyngocutaneous fistula after total laryngectomy. Is there a relationship with tumour recurrence? *Eur Arch Otorhinolaryngol* 2004;**261**:61–7

21 Natvig K, Boysen M, Tausj UJ. Fistula in patients treated with irradiation. *J Laryngol Otol* 1993;**107**:1136–9

22 Lundgren J, Olofsson J. Pharyngocutaneous fistulae following total laryngectomy. *Clin Otolaryngol* 1979;**4**:13–23

23 Virtaniemi JA, Kumpulainen EJ, Hirvikoski PP, Johansson RT, Kosma VM. The incidence and etiology of postlaryngectomy pharyngocutaneous fistulae. *Head Neck* 2001;**23**:29–33

24 Mendelsohn MS, Bridger GP. Pharyngocutaneous fistulae following laryngectomy. *Aust N Z J Surg* 1985;**55**:17–19

25 Chee N, Siow JK. Pharyngocutaneous fistula after total laryngectomy – incidence, predisposing factors and outcome. *Singapore Med J* 1999;**40**:130–2

26 Tomkinson A, Shone GR, Dingle A, Roblin DG, Quine S. Pharyngocutaneous fistula following total laryngectomy and post-operative vomiting. *Clin Otolaryngol* 1996;**21**:369–70

27 Radaelli de Zinis LO, Ferrari L, Tomenzoli D, Premoli G, Parrinello G, Nicolai P. Postlaryngectomy pharyngocutaneous fistula: incidence, predisposing factors and therapy. *Head Neck* 1999;**21**:131–8

28 Moses BL, Eisele DW, Jones B. Radiologic assessment of early post-operative total laryngectomy patient. *Laryngoscope* 1993;**103**:1157–60

29 Herranz J, Sarandeses A, Fernandez MF, Barro CV, Vidal JM, Gavilan J. Complications after total laryngectomy in nonradiated laryngeal and hypolaryngeal carcinomas. *Otolaryngol Head Neck Surg* 2000;**122**:892–8

30 Akyol MU, Özdem CC, Elikkanat S. Early oral feeding after total laryngectomy. *Ear Nose Throat J* 1995;**74**:28–30

31 Parikh SR, Irish JC, Curran AJ, Gullane PJ, Brown DH, Rotstein LE. Pharyngocutaneous fistulae in laryngectomy patients: the Toronto Hospital experience. *J Otolaryngol* 1998;**27**:136–40

32 Smith TL, Burrage KJ, Ganguly P, Kirby S, Drover C. Prevention of postlaryngectomy pharyngocutaneous fistula. The Memorial University experience. *J Otolaryngol* 2003;**32**:222–5

33 Wei WI, Lam KH, Wong J, Ong GB. Pharyngocutaneous fistula complicating total laryngectomy. *Aust N Z J Surg* 1980;**50**:366–9

34 Seikaly H, Park P. Gastroesophageal reflux prophylaxis decreases the incidence of pharyngocutaneous fistula after total laryngectomy. *Laryngoscope* 1995;**105**:1220–2

35 Kasapoglu F, Erisen L, Coskun H, Basut O, Tezel I, Hizalan I *et al*. The management of pharyngocutaneous fistulas after total laryngectomy and the factors affecting their incidence [in Turkish]. *Kulak Burun Bogaz Ihtis Derg* 2003;**11**:5–10

36 Morton RP, Mehanna H, Hall FT, McIvor NP. Prediction of pharyngocutaneous fistulas after laryngectomy. *Otolaryngol Head Neck Surg* 2007;**136**(suppl 4):S46–9

37 Lavelle RJ, Maw AR. The aetiology of post-laryngectomy pharyngocutaneous fistulae. *J Laryngol Otol* 1972;**86**:785–93

38 Horgan EC, Dedo HH. Prevention of major and minor fistulae after laryngectomy. *Laryngoscope* 1979;**89**:250–8

39 Gray D, Cooper P. Nutrition on wound healing: what is the link? *J Wound Care* 2001;**10**:86–9

40 Weigrad DN, Spiro RH. Complications after laryngectomy. *Am J Surg* 1983;**146**:517–20

41 Heir M, Black MJ, Lafond G. Pharyngocutaneous fistulas after total laryngectomy: incidence, etiology and outcome analysis. *J Otolaryngol* 1992;**22**:164–6

42 Sellars SL. Complications of total laryngectomy. *South Afr J Surg* 1978;**16**:145–8

43 Gall AM, Session DG, Ogura JH. Complications following surgery for cancer of the larynx and hypopharynx. *Cancer* 1977;**39**:624–31

44 Sarkar S, Mehta SA, Tiwari J, Mehta AR, Mehta MS. Complications following surgery for cancer of the larynx and piriform fossa. *J Surg Oncol* 1990;**43**:245–9

45 Davidson J, Briant D, Gullane P, Keane T, Rawlinson E. The role of surgery following radiotherapy failure for advanced laryngopharyngeal cancer. *Arch Otolaryngol Head Neck Surg* 1994;**120**:267–76

46 Cavalot AL, Gervasio CF, Nazionale G, Albera R, Bussi M, Staffieri A *et al*. Pharyngocutaneous fistula as a complication of total laryngectomy. Review of the literature and analysis of case records. *Otolaryngol Head Neck Surg* 2000;**123**:587–92

47 Qureshi SS, Chaturvedi P, Pai PS, Chaukar DA, Deshpande MS, Pathak KA *et al*. A retrospective study of pharyngocutaneous fistulas following total laryngectomy. *J Can Res Ther* 2005;**1**:51–6

Address for correspondence:
Professor J J Fagan,
Division of Otolaryngology,
University of Cape Town,
H-53 OMB, Groote Schuur Hospital,
Observatory,
Cape Town, 7925, South Africa.

E-mail: johannes.fagan@uct.ac.za
Fax: +27 (0) 21 448 8865