

Outcomes following pharyngolaryngectomy reconstruction with the anterolateral thigh (ALT) free flap

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Abstract

We retrospectively reviewed 15 cases of pharyngolaryngectomy for advanced laryngeal carcinoma reconstructed with the anterolateral thigh (ALT) free flap. Thirteen patients had primary surgery and adjuvant treatment (radiotherapy or chemoradiotherapy), and two had salvage surgery. Thirteen had stage III or IV disease, and eight had cervical nodal extracapsular spread. In this series all the flaps survived, and at median follow-up of 14.5 months (range 3.7–31.2), 12 of the 15 patients were alive. One patient developed a chronic pharyngocutaneous fistula, and five required repeat balloon dilatations for late pharyngeal strictures. Six patients enjoyed restoration of full oral intake, seven were able to take a soft diet, and two were dependent on feeding by percutaneous endoscopic gastrostomy. Four patients developed adequate tracheo-oesophageal speech, and one successfully developed oesophageal speech. In this series many of the surgical problems associated with pharyngolaryngectomy reconstruction were addressed successfully by the ALT, but late dysphagia remained troublesome in an appreciable minority. While adjuvant radiotherapy could have contributed to this, future innovations will focus on the reduction of late strictures.

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Introduction

The pharyngolaryngectomy defect poses a reconstructive challenge both in terms of complications, and the desire for optimal swallowing and speech. Several reconstructive methods have been described, either with a pedicled flap (pectoralis major) or free tissue transfer (jejunum, radial fasciocutaneous, anterolateral thigh (ALT) flaps).¹ The gold standard for such reconstruction would avoid acute or chronic

pharyngocutaneous fistulas, minimise donor site morbidity, and be reliable.

In our experience (unpublished) of 20 reconstructions of partial pharyngectomy defects with the pectoralis major or fasciocutaneous radial forearm free flap (RFFF) there was an unexpectedly high rate of fistulas ($n = 14$). They occurred at the suture line of the tongue base to the flap in half the cases despite excellent viability of the flap, and were associated with prolonged admissions, and sometimes delay to adjuvant radiotherapy. Six (43%) of the fistulas failed to heal with conservative management and required further reconstruction or revision. As a result we sought new reconstructive solutions.

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The ALT flap has an important role in head and neck reconstruction because of its versatility, two-team method of operating, and favourable donor site. Its use in the reconstruction of pharyngolaryngectomy defects has been reported to result in superior outcomes for swallowing and speech, and shorter hospital stays than other methods of reconstruction.^{2–4} Genden and Jacobson² found that while both the ALT and RFFF provided adequate tissue for pharyngo-oesophageal reconstruction in 23 patients, the RFFF had a higher rate of donor site morbidity (loss of skin graft, extremity oedema, and stiffness) and had a higher rate of stricture. Murray et al.⁵ reported a series of 14 patients where the use of a salivary bypass tube and ALT free flap in pharyngo-oesophageal reconstruction avoided fistula forming in 14 patients. To our knowledge the largest series of pharyngo-oesophageal reconstruction using the ALT was reported by Yu et al.⁶ Of the 114 patients 91% (67 circumferential defects and 47 partial defects) managed an oral diet without tube feeding, and rates for fistulas and strictures were 9% and 6%, respectively. These reports support the use of ALT free flaps in the reconstruction of pharyngolaryngectomy defects.

We aimed to assess complications, functional outcome, recurrence, and survival, in a cohort of patients who had reconstruction with the ALT, and to compare our results with those previously published.^{2,5–7}

Patients and methods

This is a retrospective review of 15 consecutive cases of reconstruction of pharyngolaryngectomy defects using the ALT free flap from 2007 to 2009 in University Hospital Aintree, Liverpool, and Manchester Royal Infirmary. Data on patients' characteristics, comorbidity, type of defect, surgical details, adjuvant therapy, surgical and medical complications, donor site morbidity, pathology, swallowing and speech, and overall survival, were collected from medical records and from contributions from speech and language therapists.

Surgical technique

A two-team approach was used in all cases. After mapping the perforator anatomy using hand-held Doppler⁸ the ALT free flap was harvested.⁹ It is often possible to raise the trapezoid-shaped flap on two or more perforators; the case shown in Fig. 1 has four perforators. The skin island is usually around 12 cm in circumference for anastomosis of the tongue base, and 10 cm for oesophageal anastomosis. The length of the reconstruction is decided by the resection, but generally is around 9 cm. An additional V-shaped extension of tissue is usefully included, and is inset to the suture line of the distal flap to the oesophagus (Fig. 2). This is spatulated by incising the anterior oesophagus longitudinally for 2 cm to avoid late strictures.^{4,10}

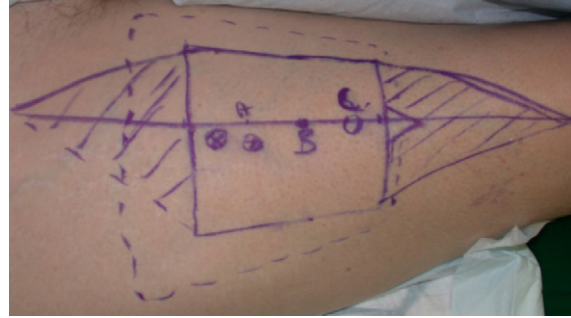


Fig. 1. Planning the tubed anterolateral thigh free flap. Note the dashed line to indicate the extent of fascia included for a second sutured layer.

Several aspects of this design have been incorporated to avoid the formation of a fistula. Flaps with a large surface area, typically 10–12 cm × 9 cm correspond to the calibre of the resected pharynx, and using this larger circumference at the base of the tongue avoids the mismatch of size that is often encountered with more limited donor sites. Use of a salivary bypass tube for 10–14 days⁵ secured with sutures to the nasogastric feeding tube prevents displacement and facilitates removal. The vertical tubing anastomosis is carried out with a meticulous technique using two-layer closure and interrupted sutures and is placed posteriorly against the intact prevertebral fascia. For two-layer closure an additional 5 cm of fascia beyond the skin incision is raised (dashed line in Figs. 1 and 2), which allows a supplemental waterproofing suture line, particularly at the base of the tongue. Laterally the fascia is draped over and sutured to the prevertebral fascia. Dead space is avoided with the favourable volume of tissue used (Figs. 3 and 4) and the careful placement of suction drains.¹¹

In subtotal pharyngectomy, reconstruction using the ALT free flap is done only when the defects are more than 75% of the pharyngeal circumference (smaller defects are reconstructed either by primary closure, or with the pectoralis major flap). Similar principles are used in the design of the ALT free flap, and the dimensions are reduced proportionately.

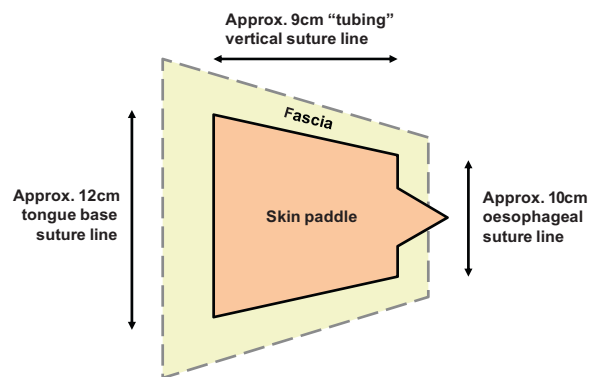


Fig. 2. Diagram of trapezoid anterolateral thigh flap with dimensions and wide fascial cuff.

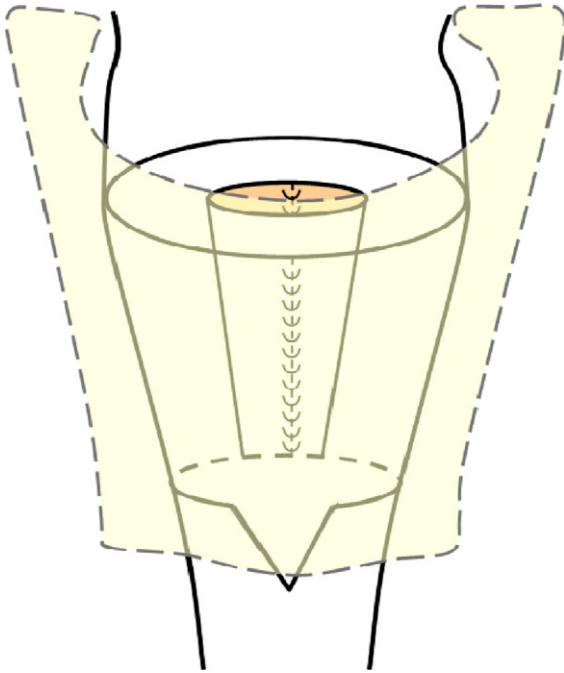


Fig. 3. Diagram to show completion of closure of the posterior wall with interrupted sutures.

It has become our standard practice whenever possible to monitor such buried flaps – for example, with implantable Doppler probes.¹² These reconstructions are otherwise difficult to monitor, and the consequences of undiagnosed flap necrosis may be catastrophic (including neck and mediastinal sepsis, and “blow-out” from large vessels). The probes are removed at day seven.

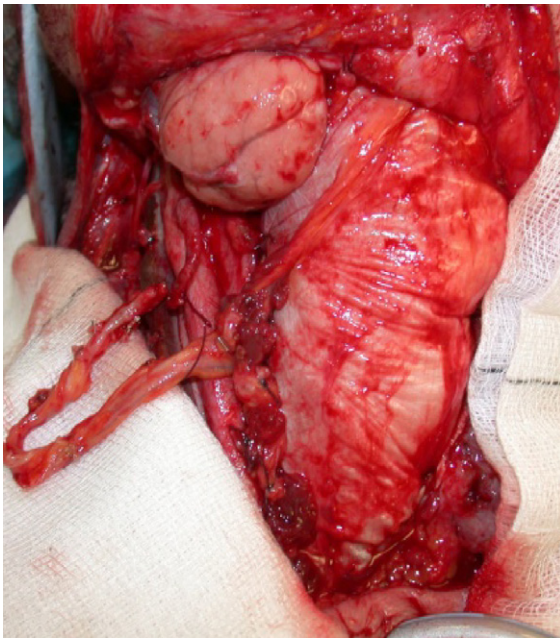


Fig. 4. Setting in the flap and second fascial layer sutured to the base of the tongue and prevertebral fascia.

As the thigh wound usually exceeds the 9 cm recommended for primary closure,¹³ a skin graft is sometimes required (salvaged from the “dog ears” as seen hatched in Fig. 1). After removal of the salivary bypass tube at day 10, a contrast swallow is done to check anastomotic integrity, after which oral intake can be resumed.

Results

There were nine male and six female patients in the three-year cohort (mean age 63.9 years, range 50.1–78.7) (Table 1). Thirteen patients had primary surgery; of these 10 had adjuvant radiotherapy, and three had adjuvant chemoradiotherapy. Two patients had salvage surgery; one after chemoradiotherapy for SCC of the base of the tongue with laryngeal involvement, and the other after induction and concurrent chemotherapy for SCC of the oropharynx with laryngeal involvement. Ten patients had partial pharyngectomy defects and patch ALT reconstructions, and five had circumferential pharyngectomy defects with tubed reconstructions. Perioperative salivary bypass tubes were introduced from 2008 onwards and were used in 11 patients. Salivary tubes were removed between 11 and 28 days after operation (median 16 days). The Swartz–Cook Doppler was used to monitor the flap in 11 patients. The ALT donor site was closed primarily in 12 patients while three required full-thickness skin grafts. The median duration of hospital stay was 29 days (range 8–63).

Early complications

All the flaps survived. Six patients required a return to theatre. In one case the implanted Doppler signal was lost, but on surgical exploration the probe was found to have been detached from the pedicle, which had functioning vascular anastomoses. No microvascular complications or revisions were required, and tissue viability was 100% in all cases. Three patients were returned to theatre in the early postoperative period for bleeding or formation of a haematoma. One was returned to drain a collection of saliva from the neck, and another for dehiscence of the neck wound after a fall.

In three patients early salivary leaks suspected to be from the tongue base-to-flap suture line healed with conservative management. One patient who was returned to theatre with bleeding on day three developed an early pharyngocutaneous fistula. Two of the ALT donor sites became infected (managed by local wound debridement and systemic antibiotics). When the donor sites were closed with full thickness skin grafts, one skin graft was lost completely and another had a loss of 25%. They were managed by local debridement, and dressings were used to allow healing by secondary intention. One patient developed pneumonia and fast atrial fibrillation in the early recovery period, which resolved with medical treatment. One patient developed *Clostridium difficile*-related diarrhoea postoperatively but made a good recovery with

Table 1
Surgical pathology details and survival outcome of patients (n = 15).

Diagnosis and site	Surgical defect	pTNM	Stage	Extracapsular spread	ASA grade	Duration of stay in hospital (days)	Survival
SCC left pyriform fossa	Circumferential	pT4aN2b	IV	Yes	3	49	RIPLC
SCC left pyriform fossa	Circumferential	pT2N0	II	No	2	8	AW
Adenoid cystic carcinoma right subglottic larynx and trachea	Circumferential	pT4aN0	IV	No	2	43	AW
SCC right pyriform fossa	Circumferential	pT4N2c	IV	Yes	2	63	RIPOC
SCC left pyriform fossa	Circumferential	pT3N2c	IV	Yes	3	53	AW
SCC right pyriform fossa	Patch	pT2N0	II	No	3	35	AW
SCC left pyriform fossa	Patch	pT4aN2	IV	Yes	2	36	RIPLC
SCC right pyriform fossa	Patch	pT1N1	III	No	3	39	AW
Adenosquamous carcinoma right supraglottis	Patch	pT3N2b	IV	Yes	2	23	AW
SCC right pyriform fossa	Patch	pT2N1	III	No	3	24	AW
SCC left supraglottis	Patch	pT4N2c	IV	Yes	2	19	AW
SCC right supraglottis	Patch	pT4N0	IV	No	2	17	AW
SCC right pyriform fossa	Patch	pT4N2b	IV	Yes	2	21	AW
Recurrent SCC left oropharynx extending to left pyriform fossa ^a	Patch	^b	IV	No	2	29	AW
SCC left vallecula or base of tongue	Patch	pT2N1	III	Yes	3	28	AW

^a Induction chemotherapy and concurrent chemotherapy.

^b PET scan positive for recurrence but no tumour in specimen.

AW – alive and well; RIPOC – died of other cause; RIPLC – died of laryngeal cancer.

medical treatment. One who developed an iatrogenic left-sided pneumothorax secondary to insertion of a central venous catheter required video-assisted thoracoscopic surgical repair. Wedge biopsy examination from the apex of the left lung showed that the patient had undiagnosed subpleural bullous disease. One patient who developed tracheitis after initial discharge from the ward was readmitted with dehiscence of the neck wound, which was debrided and closed.

Late complications

Seven patients had no late complications, but eight reported dysphagia while being followed up as outpatients, five of whom developed strictures that required repeated balloon dilatation. All the strictures had formed at the anastomosis of the neopharynx to oesophagus. The incidence of strictures was higher in circumferential defects when a salivary tube was not used, and when postoperative irradiation or chemoradiation was used (Table 2). None of these associations were statistically significant. A fistula progressed from acute to chronic in one patient. One patient who developed an epidural abscess secondary to a complication of tracheo-oesophageal puncture, which ultimately progressed

to vertebral osteomyelitis 20 months after primary operation and radiotherapy, required surgical drainage and C5–C6 spinal fusion.

Functional outcomes

When discharged from hospital, five patients were coping well with normal diet, five were managing soft diet, and five

Table 2
Late strictures.

Variable	Stricture rate (n)	P value (Fisher exact)
Timing		
Primary surgery	38% (5/13)	0.52
Salvage surgery	0 (0/2)	
Salivary tube		
Not used	50% (2/4)	0.56
Used	27% (3/11)	
Extent of surgery		
Partial	30% (3/10)	>0.99
Circumferential	40% (2/5)	
Tracheo-oesophageal puncture		
Primary	22% (2/9)	0.33
None or secondary	50% (3/6)	

were dependent on enteral tube feeding (although one of these managed fluids orally). At the most recent follow-up appointments, six were on a normal diet, and seven were managing a soft diet. Of the two patients who were dependent on enteral tube feeding at the last review, one was maintaining part oral and part enteral nutrition, while the other had had substantial resection of the base of the tongue and could not initiate a swallow reflex.

On analysis of the effect of strictures on swallowing and diet, two patients were eating a normal diet and three were managing a soft diet. In the non-stricture group, four patients were eating a normal diet, four were managing a soft diet, and two required enteral feeding. It seems that strictures were managed successfully by repeated endoscopic dilatations, and did not prevent swallowing.

Eight patients had primary tracheo-oesophageal puncture (TEP) and insertion of a speaking valve, and one had secondary surgical voice restoration. Overall five patients managed oesophageal or TEP speech while ten could not talk and were either mouthing words or using a communication aid. Four of the patients who had primary TEP managed TEP speech at the latest review, while one who did not have primary TEP developed oesophageal speech. Three patients had problems associated with narrowing of the tracheal stoma and had to use a tracheostomy tube for a prolonged period, while the rest managed with either a laryngectomy tube or button.

Survival

At mean follow-up of 14.5 months (range 3.7–31.2) overall survival was 80% ($n = 12$). There were no deaths in the immediate postoperative period. Of the three patients who died, one developed locoregional recurrence, one presented synchronously with both a metastatic and a new primary palatal SCC, and one died free of disease five months after operation because of cardiac arrest after myocardial infarction.

Discussion

Our results show excellent reliability and vascularity of the ALT free flap. The fistula rate in this series correlates with reported rates of 0–12.5% in several published series of pharyngolaryngectomy reconstruction with the ALT,^{2–7} and favourably with our local experience of the RFFF. Our rates of late stricture and dependence on enteral tube feeding seem inferior to aggregated published data¹ (16% strictures, 94% oral alimentation, and 5% dependent on enteral feeding). One possible explanation is that our series was biased towards primary surgery and postoperative radiotherapy, whereas many cases in other published series had had salvage pharyngolaryngectomy after chemoradiation had failed.^{2,3,6,7} It is possible that postoperative irradiation of the anastomosis of the neopharynx to the oesophagus predisposes to strictures. On the other hand, our rate of fistulas

(which usually occurred in other series at the anastomosis of the tongue base to neopharynx) was acceptable, and again, this might be partly related to reconstruction in a non-irradiated field. It is reassuring that in most patients with a stricture, swallowing was maintained acceptably by a programme of periodic endoscopic dilatations. This has also been observed in a previous series of patients who had circumferential pharyngo-oesophageal reconstruction with the RFFF.¹⁰ The precise value of salivary fistula tubes in this setting has yet to be proved although our data offers some encouragement for this approach.

Despite the fact that two patients had a donor site infection, and two had problems associated with the skin graft, recovery or discharge from hospital did not seem to be seriously delayed. Use of additional methods such as vacuum dressings to address issues of viability of skin grafts may be worthwhile. Morbidity at the ALT donor site has been found to be better tolerated than at the RFFF donor site by previous reports of exposure of the flexor carpi radialis tendon (20%),¹⁰ failure of the skin graft (36%), and stiffness and limitation of movement of the donor site hand (78%).² We had no perioperative deaths unlike the previously reported mortality rates of 2–4.5% associated with the jejunal free flap, which also carried a 5.8% rate of abdominal complications.^{14–16} It has been suggested that pharyngo-oesophageal reconstruction with the ALT gives clinical and functional outcomes that are superior (speech, swallowing, and recovery from operation) to reconstruction with the jejunum.¹⁷

We think that the ALT free flap provides a reliable and functional single stage reconstruction of pharyngolaryngectomy defects with minimal morbidity to patients burdened with advanced disease and multiple comorbidities. In a multidisciplinary head and neck oncology team where laryngeal preservation strategies may also be available, the indication for such radical ablative and reconstructive surgery has to be justified. Although these are early data, it is encouraging that 12 of 15 patients survived overall given that most patients had advanced disease. As recurrences in SCC tend to occur within 18 months,¹⁸ it is hoped that these survival trends will be maintained, but it clearly focuses on any unacceptable late functional outcomes. The excellent reliability of the ALT free flap, coupled with acceptable rates of acute complications due to surgery, allows surgical management of these patients with a more than acceptable outcome (93% (14/15) capable of oral alimentation). These data reinforce the radical approach taken but also highlight the need for satisfactory long-term rehabilitation of speech and swallowing. Having addressed the preventable issues of reliability of the flap, acceptability of the donor site, and formation of fistulas with the ALT, this review redirects future audits and surgical innovation to the prevention of late strictures.

Conflict of interest

None declared.

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