

Clinical Paper
Reconstructive Surgery

A 10-year retrospective study of free anterolateral thigh flap application in 872 head and neck tumour cases

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Z. Xu, X.P. Zhao, T.L. Yan, M. Wang, L. Wang, H.J. Wu, Z.J. Shang: A 10-year retrospective study of free anterolateral thigh flap application in 872 head and neck tumour cases. *Int. J. Oral Maxillofac. Surg.* 2015; 44: 1088–1094. © 2015 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Abstract. The aim of this study was to report the clinical features, reliability, and various applications of free anterolateral thigh (ALT) flaps and to provide a 10-year retrospective review of the application of this flap in head and neck tumour patients. A retrospective study was performed of 872 patients who underwent immediate reconstruction of head and neck tumour-induced defects with ALT flaps between April 2005 and April 2014. The study sample consisted of 609 males and 263 females aged 18–79 years. The shapes and sizes of the flaps were designed individually to meet various demands of reconstruction in the head and neck region. The overall rate of successful reconstruction was 97.4%. The reasons for 57 cases of flap compromise were analyzed. The time to detection of flap crisis was often within the first 8 h after surgery (64.9%). One- and two-vein anastomosis strategies in microsurgery were compared, and significant differences were observed in terms of the time to detection of flap compromise and the rate of successful flap salvage. In conclusion, the free ALT flap provides unique features for the reconstruction of oral and facial defects in a reliable and versatile approach. The ALT flap is a favourable and versatile ‘workhorse’ flap for head and neck reconstruction.

Key words: anterolateral thigh flap; head and neck reconstruction; reliable and versatile; anastomosis strategies; quality of life.

Accepted for publication 15 June 2015
Available online 5 July 2015

The surgical treatment of various head and neck tumours may result in severe defects, which may significantly reduce quality of life. The reconstruction of such defects is a high priority for head and neck surgeons and plastic surgeons. The demands of oral and maxillofacial reconstruction are increasingly high, from shape recovery to

functional and aesthetic restoration, providing an increased quality of life after surgery. Great progress has been made in maxillofacial reconstruction surgery to achieve better cosmetic and functional outcomes. Loco-regional flaps such as the platysma musculocutaneous flap and pedicled flaps like the pectoralis major

myocutaneous flap have been used widely, while free flaps have undoubtedly heralded a revolution in head and neck reconstruction.^{1–5} Progress in microsurgery has also made the free flap a more reliable choice.

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Craniofacial and neck tumour-induced defects consist largely of multi-fold soft defects, including defects of the facial skin, mucosa, muscle of the tongue, cheek, and floor of the mouth. Favourable reconstruction requires a free flap that is reliable and pliable and supplies sufficient tissues; the length of the pedicle and diameter of the pedicle-containing vessels should be appropriate for vascular anastomosis. Over the last several decades, numerous free flaps have been introduced and applied in oral and facial defects, including the free anterolateral thigh flap (ALT) and latissimus dorsi flap.^{3,6} The introduction of the first free ALT flap in 1984 by Song gained worldwide attention, and many studies have since reported the features of the ALT flap. The donor site contains abundant soft tissues, and different types of flap can be harvested and tailed, such as fasciocutaneous, musculocutaneous, perforator, adipofascial, thinned ALT, de-epithelialized, folded, and chimeric flaps.^{4,7-10} The clinical value of the ALT flap is also widely recognized, and many advances in surgery related to the harvesting and application of ALT flaps have been reported in the literature. However, large-scale systematic and comprehensive studies on ALT flap utilization in head and neck reconstruction are still limited, which may reduce the variation by different surgical techniques. In the present study, the data of 872 patients who underwent tumour resection and immediate reconstruction using ALT flaps were investigated with the aims of presenting our experience of the use of the ALT flap and providing information on this 'workhorse' free flap.

Methods

Patients and surgical procedures

A total of 872 patients who underwent tumour excision and immediate reconstruction with an ALT flap at the Hospital of Stomatology, Wuhan University or Second Xiangya Hospital, Central South University, were recruited into this retrospective study. General patient information was collected, including age, gender, the site and pathological features of the tumour, and previous treatment.

All surgical procedures were performed simultaneously using a 'two-team' approach. The experienced senior surgeons were responsible for tumour resections, which were performed with or without neck dissections depending on the nodal status. The other team was responsible for

reconstruction of the defects, including flap harvesting, vascular anastomosis, and postoperative flap monitoring.

The flaps were harvested according to the standard procedures mentioned in the literature, with several modifications.^{3,4,7-11} Doppler ultrasonography was used to assist in locating the perforator position before surgery. Surgical procedures consisted mainly of incision line design, localization of the perforators, and harvesting and preparing the ALT flaps. After localization of the perforators, the rectus femoris muscle was retracted internally to expose the branches of the lateral circumflex femoral artery (LCFA). The perforators were then dissected along the branch to the main trunk of the lateral circumflex femoral system while carrying the required muscle tissue. The skin paddle was incised after freeing the pedicle. Different types of ALT flap, such as musculocutaneous, fasciocutaneous, chimeric, folded, thinned, de-epithelialized, and myofascial, were designed and harvested based on the size and shape of the defect. Good communication was maintained between the two teams during this procedure because any extension of the excision could affect the reconstruction required to a significant degree. Data on the flap types, perforators, and pedicle features were collected for this study. After completion of the tumour resections, vascular anastomoses were performed using hand-sewing and/or mechanical techniques. Two- and one-vein anastomosis strategies with the hand-sewing technique were applied separately in 389 cases in this study during the 2 years from April 2012 to April 2014; differences between the two types of vein anastomosis strategy were compared. The donor sites were closed primarily in almost all cases; otherwise a skin graft was applied to close wounds.

Postoperative flap monitoring and follow-up

Postoperatively, clinical examinations and peripheral vascular Doppler ultrasound testing were used for flap monitoring. Flap monitoring was performed every 30 min for the first 24 h, then every 1 h for the second and third days, and then every 24 h for the following days. In the case of adverse changes in the flap, such as a change in colour to pale or dark, a loss of lustre, or a lowering in temperature, an acupuncture bleeding test using needles (diameter 0.5 mm) was done. Doppler ultrasonography was then also used to judge the patency of the anastomosed vessels. Low molecular weight heparin calcium

(5000 IU) injection was used to prevent thrombus and/or papaverine to prevent arteriospasm in the situation in which a blood flow Doppler signal was still observed. Exploration and salvage surgery was performed immediately if the flap did not improve during the next 2 h of monitoring. In completely failed cases, the ALT flap was replaced with another flap, such as a contralateral ALT flap, free radial forearm flap, pedicled pectoralis major myocutaneous flap (PMMF), etc.

The duration of follow-up ranged from 6 to 50 months, with an average of 27 months. During follow-up, the cosmetic results were evaluated by clinical examination and medical photography and the patient's own perception; the aesthetic outcome was categorized as good, satisfactory, or unsatisfactory. Diet was assessed by the patient's dietary intake and was classified as tolerating a normal diet, a soft diet, or a liquid diet. The assessment of speech was based on whether the patient could be understood easily by a listener (fluent and intelligible) or whether it required concentration on the part of the listener (intelligible with effort). Speech was judged as unintelligible if the patient could not be understood.

Statistical analysis

Comparisons between the one- and two-vein anastomosis strategies was done by χ^2 analysis and/or the Student's *t*-test using IBM SPSS Statistics for Windows, version 19.0 software (IBM Corp., Armonk, NY, USA). A *P*-value of <0.05 was considered statistically significant.

Multivariate logistic regression analysis was used to investigate risk factors for flap failure among the flap compromise cases using IBM SPSS Statistics for Windows, version 19.0 software. Odd ratios (OR) are provided with 95% confidence intervals (CI). A *P*-value of <0.05 was considered statistically significant.

Results

The subjects consisted of 609 males and 263 females aged 18–79 years (mean 43.6 years). The length of hospitalization ranged from 5 to 23 days, with a mean duration of 11.8 days. In terms of the site and histological features of the tumours, the most common defects resulted from tongue tumours and a squamous cell carcinoma (SCC) pathology. In addition to SCC, other pathological types of tumour, including sarcoma, adenoid cystic carcinoma, and mucoepidermoid carcinoma, were

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