

# An experience on primary thinning and secondary debulking of anterolateral thigh flap in head and neck reconstruction

E. CIGNA, A. MINNI, M. BARBARO, G. ATTANASIO, V. SORVILLO,  
G. MALZONE, <sup>§</sup>H.C. CHEN, \*D. RIBUFFO

Units of Plastic Surgery and ENT, "Sapienza" University of Rome, Policlinico "Umberto I" Hospital;  
\*Unit of Plastic Surgery, University of Cagliari (Italy) and <sup>§</sup>Department of Plastic Surgery,  
E-Da Hospital/I-Shou University, Taiwan (ROC)

**Abstract. – OBJECTIVES,** The antero-lateral thigh flap (ALTF) has become one of the workhorses of reconstructive procedures of the head and neck. The cosmetic result of this flap is uncertain during the main reconstructive procedure, so free flap contouring in head and neck reconstruction following cancer ablation is usually performed at the end of therapy. To obtain an adequate symmetry of the flap a safe thinning during the primary inset or a secondary defatting may be performed.

**PATIENTS AND METHODS,** The study includes 45 patients underwent reconstruction with ALTF for head and neck tumors. Patients were divided into two groups: Group 1 (20 patients underwent a primary thinning of the flap), Group 2 (25 patient underwent a secondary debulking of the flap). Patients were evaluated in terms of total number of cosmetic reconstruction procedures performed, hospital stay and aesthetic satisfaction.

**RESULTS,** Epidemiological analysis showed an average age of 51 years old in patients. Patients were affected by squamous cell carcinoma in 33 cases.

Within Group 1, 14 patients underwent surgery only once, 5 underwent surgery twice and one patient three times. In group 2, 8 patients underwent surgery once, 10 patients twice, 3 patients three times and 4 patients four times. Considering total of hospital stay, the average length of stay was 18.83 days in the group of patients subjected to primary debulking, versus 23.67 days in the group subjected to secondary defatting.

**CONCLUSIONS,** The ALT flap is a safe and reliable free flap for head and neck reconstructive surgery. As showed in the study and in previous reports, the thinning of the flap is a safe procedure, without increasing the flap complications and allowing an immediate symmetry of the recipient site contour. Furthermore, ALTF thinning reduces major defatting revisions requiring general anesthesia and the total number of secondary procedures.

## Keywords:

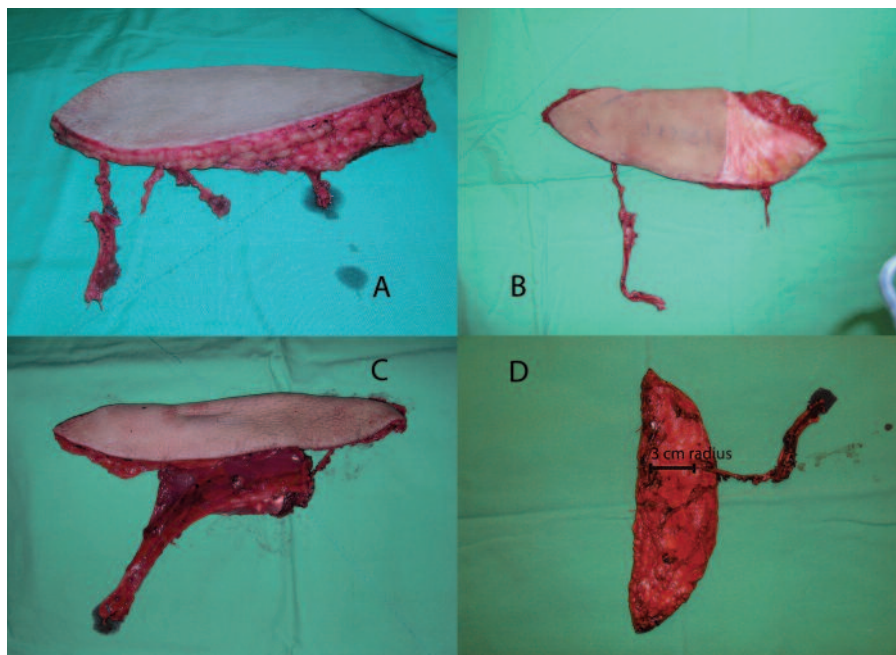
Head and neck cancer, Head and neck reconstruction, Anterolateral thigh flap, Free flap thinning, Aesthetics in head and neck.

## Introduction

The free anterolateral thigh flap (ALTF) is a free flap based on the septocutaneous or musculocutaneous perforators of the descending branch of the lateral circumflex femoral artery (LCFA). First described by Song et al<sup>1</sup> the ALTF slowly became widespread in clinical practice around the world<sup>2-5</sup>; many Head and Neck Cancer Departments adopted it as the gold standard in complex reconstructive procedures<sup>6-11</sup>.

This approach was started in Asian countries, but then became frequently adopted also in Western countries. Its slow spread in the West was mainly due to two factors. One was the anatomic variability of the flap perforators, which resulted in a tedious and sometime difficult dissection, and the other was the thicker fat tissue of the thigh, typical of Western populations, that limited the flap applications. However, the devotees of this flap emphasize its versatility, its wide and long pedicle, and its distance from the resection site, thus enabling a two-team simultaneous surgical approach<sup>12-14</sup>.

The ALTF's characteristics make it ideal for microsurgical reconstructive procedures in head and neck tumors, thanks to a 12-15 cm long vascular pedicle and the possibility of harvesting it as a musculocutaneous flap, with a vascularized bone segment and as a chimera flap<sup>15-17</sup>. An additional advantage, is that the flap may be harvested during cancer ablation being far from the head



**Figure 1. Different applications of thin anterolateral thigh flap (ALTF).** **A**, The flap is harvested with different thickness thinned proximally (closed to the pedicle site) and thicker distally. **B**, The flap has been dehepited distally to be buried and cover the defect of the resection. **C**, A musculocutaneous ALTF has been harvested to repair the defect, a small perforator is visible coming off the muscle portion to supply the distal part of the flap that was used thinned. **D**, Thin ALTF. A 3 cm radius of full thickness of the fat has been kept around the point of penetration of the perforator to avoid damage to the blood supply of the flap. If necessary a further thinning is possible to reduce bulkiness preserving the perforator with a further dissection.

and neck region<sup>2,3,5,18</sup>. Another initial difficulty, which has now been definitively overcome, was the possible great thickness of the subcutaneous tissue of the flap. Some Authors later described the possibility of considerably reducing the flap's thickness by thinning it down to 3-4 mm, without compromising its viability<sup>7,13,15,18-21</sup>. This modified the traditional reconstructive approach in head and neck surgery, according to which cosmetic reconstruction was performed only after the end of the therapeutic protocol. Though we no longer consider a thick adipose tissue to be a problem in the preparation of the flap, in this study we wanted to examine the advantages and disadvantages of the primary thinning of the ALTF in head and neck reconstruction versus its secondary defatting procedures.

### Patients and Methods

Between 2002 and 2010 the anterolateral thigh flap was performed on 45 patients for head and neck reconstruction in the Plastic Surgery and ear nose throat (ENT) Unit of "Sapienza" University of Rome, Cagliari University and I-Shou Univer-

sity Hospitals. Patients' inclusion criteria were defects larger than 2 cm, ASA < 3. Exclusion criteria were ASA > 3, previous surgery on the ALTF donor area and age < 18 or > 75 years old. Epidemiological data were collected (age, sex, age of lesion onset, histology and localization). Patients were divided into two groups: Group 1 (20 patients underwent a primary thinning of the flap), Group 2 (25 patient underwent a secondary debulking of the flap). Epidemiological analysis was made to determinate the most frequent histological type of lesions, the average age of patients and localization. In addition all examined patients were assessed in terms of the total number of cosmetic reconstruction procedures performed under general and local anesthesia; in addition the two groups were evaluated in terms of hospital stay.

Two months after the last surgical treatment, patients completed an evaluation questionnaire to assess aesthetic satisfaction (VAS = 1-10)<sup>22</sup>. In addition patients were evaluated from a cosmetic point of view mainly by measuring the symmetry between the reconstructed side and the healthy side. A team composed of a plastic surgeon and a head and neck surgeon, who were not part of the operating team, and another caregiver evaluated

the outcome using the same evaluation scale (VAS = 1-10).

The average follow-up was 5.2 years (minimum follow-up 2 years).

### **Surgical Technique**

The anterolateral thigh flap was harvested in all cases according to a subfascial approach. The flap was thinned by removing all the fat below Scarpa's fascia and beyond until about 3-4 mm of subdermal adipose tissue. During the thinning procedure, attention was paid to the 3 cm of radius area where the perforator penetrates the flap (Figure 1)<sup>7,13,14</sup>. Whenever a maximal flap thinning was required, the radius of the area was reduced by following the perforator until the type of flap penetration was identified<sup>19</sup>. When necessary, following the pattern of the perforators, we employed loop magnification for intramuscular dissection, as described by other Authors<sup>14,15,23</sup>.

When performed first, the thinning procedure was mainly carried out before cutting the pedicle from the donor area. In 11 cases a further thinning was performed during the flap inset before microsurgical time. To avoid hematomas from small vessels cutted during the ischemia time, a gentle squeeze of the flap was performed to show the bleeding thus indicating where bipolar was necessary.

The procedures used in secondary defatting included surgical lipectomy, liposuction using a dry technique and flap debulking with an arthroscopic shaver<sup>24,25</sup>.

### **Statistical Analysis**

The collected data were subjected to statistical analysis. VAS mean values were compared using the Student's *t* test. Other statistical indicators evaluated were mean, *p* value, 95% confidence interval, degree of freedom and standard error of difference.

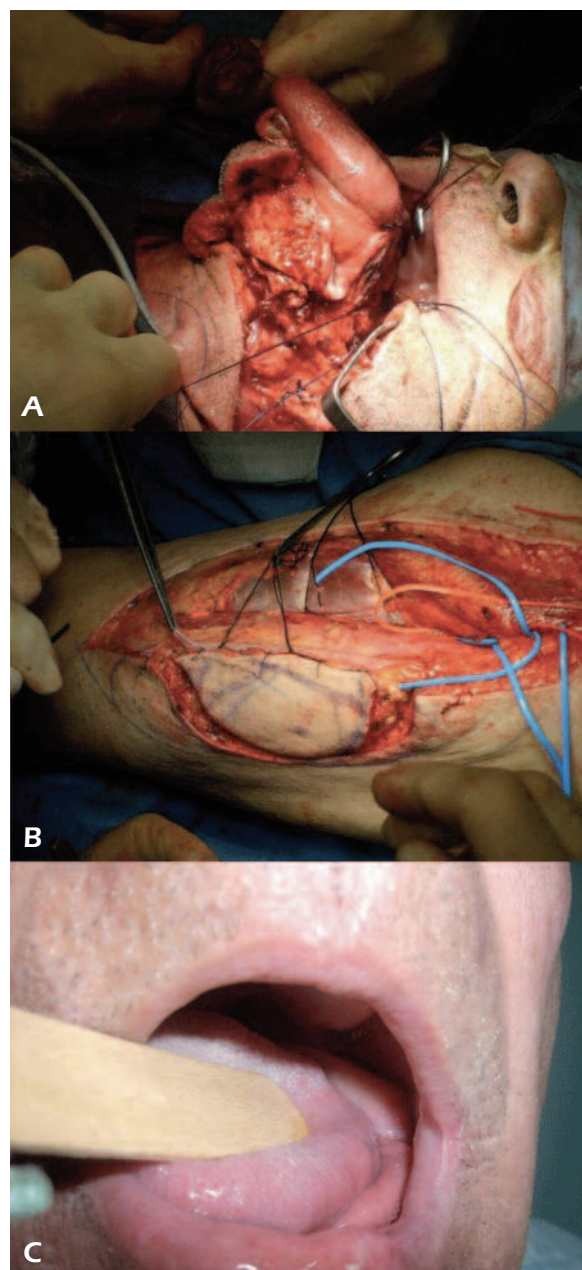
## **Results**

Epidemiological analysis showed an average age of 51 (34-68). Thirteen patients were females and 32 were males.

Patients were affected by squamous cell carcinoma in 33 cases: 18 involving the oral cavity (Figure 2), 7 the tongue, 5 the retromolar trigone, and 3 the cheek. Three patients were affected by soft tissue sarcomas; in the remaining 9 cases the reconstruction with a flap was necessary following primary radiation therapy.

In 26 patients, the reconstruction was performed during primary ablation, while in 19 cases the reconstruction was performed in a second time after cancer ablation.

In 32 cases, the anterolateral thigh flap was harvested as a fasciocutaneous perforator flap, and in 13 cases, when the reconstruction required the coverage of the mandibular synthesis with muscle tis-



**Figure 2.** Primary thinned ALTF for tongue reconstruction following cancer ablation. **A**, resection, **B**, flap elevated from the left thigh, **C**, postoperative view after six months..





**Figure 3. Primary thinned ALTF.** Left preoperative view, right postoperative view after six months.

sue or major vessels of the neck or the obliteration of anatomical dead space, a free flap combined with a muscle segment was elevated (Figure 1).

In 20 cases the fasciocutaneous flap was initially harvested as a thin flap (Figure 3). In 25 patients no primary thinning of the flap was performed [13 cases of musculocutaneous flap and 12 cases of fasciocutaneous flap (Figure 4)].

The average flap size was 13 x 8 cm (9 x 6 cm to 18 x 9 cm). In 21 cases the ALTF was supplied by one perforator, in 8 cases two, and in 3 cases three.

All microsurgical flaps were successfully transferred and no partial flap necrosis was observed. In six cases swelling of the flap for the edema required loosening some skin sutures to relax microcirculation. No cases of infection of the flap or hematoma due to the flap thinning were observed.

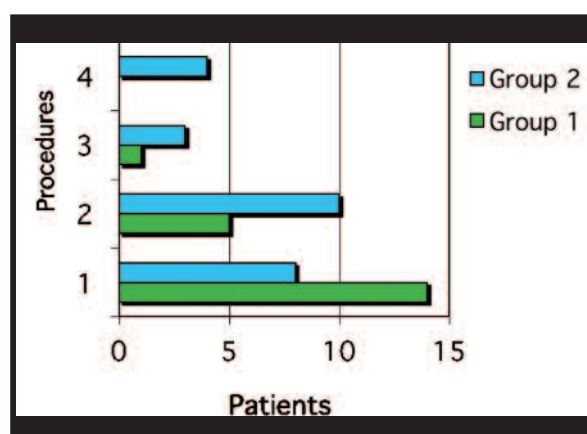
Within Group 1 (N = 20) 14 patients underwent surgery only once (70%), 5 underwent surgery twice (25%) and one patient three times (5%). In group 2 (N = 25), 8 patients underwent surgery once (32%), 10 patients twice (40%), 3 patients three times (12%) and 4 patients four times (16%) (Figure 5). In all cases, semi-solid feeding was resumed with successful swallowing within 22.4 days (18-28) after surgery.

Considering total of hospital stay, the average length of stay was 18.83 days in the group of patients subjected to primary debulking, versus 23.67 days in the group subjected to secondary defatting.

VAS average value in Group 1 patients was of 7.1 (range from 4 to 9) according to patients. The same group of patients evaluated by the medical team



**Figure 4. Secondary debulking after an ALTF reconstruction.** Up the patient after six months from the cancer resection, Below the patients after two thinning procedures.



**Figure 5.** Number of procedures performed in Group 1 and Group 2.

showed an average VAS value of 6.9 (range from 5 to 8). VAS average value in Group 2 patients was of 5.68 (range from 4 to 7) according to patients and 5.48 (range from 4 to 7) according to medical team (Table I).

VAS mean values, studied with Student’s *t* test, were found to be significant both in patients and medical team evaluation ( $p < 0.0001$ ) (Tables II and III).

### Discussion

The ALT flap is a safe and reliable free flap for head and neck reconstructive surgery. Today it is the procedure of choice because of its versatility and low donor site morbidity, especially if compared to the radial forearm free flap which was in the past the “gold standard” procedure for this type of reconstructions<sup>3,6,7,9,15,26</sup>. The original problem for surgeons to limit its applications was the anatomical variability of the descending branch of the lateral circumflex femoral artery, that was overcome by a number of anatomical, radiological and clinical studies which led to a systematic flap preparation using both musculocutaneous and septocutaneous perforators<sup>1-4,8-10,12,15-21,27-28</sup>.

Lately, the main restrictive factor for ALTF application in western countries was the increased thickness of the flap if compared to its rival the radial forearm free flap. Nevertheless, among its several advantages the anterolateral flap may be used as a thin flap<sup>7,13-15,18</sup>, thus avoiding the need for subsequent secondary debulking procedures; however, some Authors have reported a reduced flap reliability after its thinning<sup>21</sup>. The likelihood of transplant necrosis, albeit partial, combined

with the many variables inherent in the healing process, led a number of surgeons to harvest the flap according to the traditional approach. Any surgical revisions were postponed to a later stage, in particular at the end of radiation therapy.

As showed in the study and in previous reports, the thinning of the flap is a safe procedure, without increasing the flap complications and al-

**Table I.** Patient’s and Surgeon’s aesthetical evaluation (VAS: 1-10).

Patient	Group	Patient VAS	Surgeon’s VAS
1	1	7	8
2	2	5	5
3	1	7	7
4	1	8	7
5	1	6	7
6	2	6	7
7	2	7	6
8	2	5	5
9	2	5	4
10	1	7	8
11	2	7	6
12	2	6	5
13	1	6	6
14	2	6	6
15	2	5	6
16	2	7	6
17	1	8	8
18	2	4	4
19	1	8	7
20	1	6	6
21	2	6	5
22	2	6	6
23	1	7	7
24	2	5	6
25	1	7	7
26	2	4	5
27	2	7	6
28	1	8	7
29	2	5	5
30	1	8	7
31	2	5	6
32	1	7	7
33	2	6	6
34	2	6	5
35	1	8	7
36	1	5	5
37	2	7	6
38	1	8	8
39	1	7	6
40	2	4	4
41	2	5	5
42	1	7	6
43	1	7	7
44	2	7	7
45	2	6	5

**Table II.** Student's t test of aesthetical evaluation (VAS) after two months according to patients.

N	M	SD	p	95%ci	df	sed	t
20 (1)	7.10	0.85	< 0.0001	0.86-	43	0.28	5.0
25 (2)	5.68	0.99		1.98			

Legend: N= number of patients, M= mean, SD= standard deviation, p= p value, 95%ci= 95% confidence interval, df= degree of freedom, sed= standard error of difference, t= Student's t value.

lowing an immediate symmetry of the recipient site contour<sup>7,13-15,18-20</sup>. Furthermore, ALTF thinning reduces major defatting revisions requiring general anesthesia and the total number of secondary procedures. The advantages in term of final result are minimal; however, a minimal increase in time during the first main surgery allows a major reduction of patients discomfort and stress. Furthermore, a reduction in the number of procedures performed is associated with a reduction of hospital stay and costs.

Moreover, thin flaps have shown a better and quicker reinnervation, albeit not statistically significant after 1 year, both as a result of their limited thickness and because simply small scar procedures were necessary instead of major flap lipectomies or liposuctions<sup>29</sup>. Restoring intraoral sensitivity is one of the most important factors for deglutition recovery, and even if the ALT may be thicker than the radial forearm free flap<sup>30-31</sup>, the transplanted flap is more sensitive than it was in its original position in ALT flap. In fact, in this flap the density of the neurosensory receptors in the thick skin is adjusted to the greater degree of sensory discrimination once transferred<sup>30</sup>. Whether restored sensitivity in the new tongue improves swallowing and speech articulation has not been completely demonstrated (for it is also influenced by tongue thickness, suprahyoid muscles<sup>32</sup> and postoperative RT), nevertheless better swallowing is reported in reinnervated subjects. Physiological swallowing was resumed in 90% of cases with an ALT flap and 80% with a radial forearm flap<sup>33</sup>, and it is further improved with the use of thin ALT flaps<sup>34</sup>.

## Conclusions

The primary thinning of the anterolateral thigh flap showed several advantages if compared to secondary debulking procedures, being a safe, simple, quick, procedure for the surgeon, cost effective for the hospital and more important, increasing the patient's quality of life. In our case-load the use of this flap is especially indicated for reconstruction of cephalad area, lies between the angle of the mandible and the skull base.

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**Table III.** Student's t test of aesthetical evaluation (VAS) after two months according to surgeons.

N	M	SD	p	95%ci	df	sed	t
20 (1)	6.90	0.79	< 0.0001	0.93-1.91	43	0.24	5.8
25 (2)	5.48	0.82					

Legend: N = number of patients, M = mean, SD = standard deviation, p = p value, 95%ci = 95% confidence interval, df = degree of freedom, sed = standard error of difference, t = Student's t value.



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