



Para-scapular free flap versus free antero-lateral thigh flap (ALT) for resurfacing of post burn neck contractures

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Abstract:

The aim of this study is to compare the outcomes of resurfacing of postburn neck contractures with two free flaps; Para-Scapular free flap and free Antero-lateral thigh flap considering functional, aesthetic outcome, technical difficulties and donor site morbidity. Free flaps have been found to be a good single stage option for reconstruction of post-burn contractures of the neck. This is a prospective randomized comparative study that has been conducted in the period from January 2017 to May 2018 for 20 patients with postburn neck contractures. The patients have been randomly classified into 2 groups; group (A) patients were resurfaced by free anterolateral Thigh flap group (B) patients were resurfaced by parascapular free flap. Results revealed improved functional and aesthetic outcome at recipient site. Moreover, Parascapular free flap has better aesthetic outcome regarding donor site scar and required secondary procedures for debulking less than free ALT flap. On the other hand, ALT flap favors two teams' approach and avoid changing position of the patient during surgery.

Keywords: Burn; neck contractures; anterolateral thigh flap; parascapular free flap.

1. Introduction:

Burn injury is a source of significant morbidity and mortality in developing nations [1]. Post-burn contracture (PBC) of the neck is a serious and common complication of neck burns. There is an increase in incidence due to decline in mortality of extensive burns. [2]. Burn scar contractures involving the anterior cervical neck present a unique set of problems

[3], which not only affect the movement of the neck but can also affect the function of the lower face [4]. The management of post-burn neck contracture is a challenging task that can test the skills of the surgeon and the patience of the victim [5]. The goals of neck reconstruction after a severe burn are to restore range of motions and aesthetic appearance [6].

The conventional method of postburn neck reconstruction is to completely excise the scar, release the underlying structures and cover the wound with either a skin graft or a flap [7]. Many methods have been advocated to reconstruct neck contractures, including Z-plasties, split-thickness skin grafts, full thickness skin grafts, local or pedicled skin flaps with or without tissue expanders, pedicled or free musculo-cutaneous flaps, and free cutaneous flaps [8]. The release of wide burn contractures leads to defects that cannot be closed with local flaps. In these cases, tissue expansion of local tissues may be a solution. However, when local tissues are also burned, distant tissue transfer remains the only option [9]. Since introduction of anterolateral thigh (ALT) flap in 1984, it has proven to be a workhorse for reconstruction of soft tissue defects throughout the body [10]. The scapular/parascapular system of flaps is a unique system of flaps available for free tissue transfer based on the subscapular artery and its branches [11].

Anterolateral thigh flap and parascapular flap offer a reliable option for reconstruction of post-burn neck contracture. Both are providing a large good-quality skin flap that can cover the defect after contracture release.

This study was conducted to evaluate and compare between free antero-lateral thigh (ALT) flap and para-scapular free flap for reconstruction of post burn neck contracture.

2. Patients and Methods:

This was a prospective randomized comparative clinical trial performed in Beni-Suef university hospital and Al-Hussien university hospital from January 2017 to February 2019 involving 20 patients.

After informed consent was obtained, eligible study participants were divided randomly into 2 groups:

- Group (A): 10 patients were resurfaced by free Anterolateral thigh flap.
- Group (B): 10 patients were resurfaced by parascapular free flap.

Randomization was done by computer-generated random numbers.

2.1 Inclusion criteria:

1- All patients with post-burn neck contracture unamenable for reconstruction with local tissue either due to:

- Expected wide defect after release of neck contracture
- Burned surrounding tissues

2- Cases with a stable neck contracture for more than one year

2.2 Exclusion criteria:

Patients younger than 12 years and older than 60 years, and patients with severe status of chronic illness such as severe diabetes mellitus, hypertension, chronic renal failure, severe mental or psychological disorders. In addition to inability to complete the follow up and rehabilitation program.

2.3 All patients were subjected to:

1. Proper history taking
2. Full general and local examination
3. Routine preoperative investigations.
4. Control of patient's medical condition e.g., DM or hypertension.
5. Preoperative photography.

No routine radiological investigations were done to assess flap perforators.

2.4 Surgical technique

- The contracted neck scar was excised with the end point being full cervical extension. Dissection of recipient vessels was performed.
- The resultant neck defect was covered by free antero-lateral thigh (ALT) flap in 10 cases, and with para-scapular free flap in the other 10 cases.
- After harvest, any flap was a thickness 15 mm or more was thinned down to 1cm or less thickness by removal of subcutaneous fat.
- End-to-end microsurgical anastomosis of the vessels was then performed using 9-0 nylon under loupe (4.5x) magnification.

2.5 Post-operative protocol

1. For the 1st 48 hours post-operative the patients were observed every hour for vital signs, bleeding and for any signs of flap failure (venous or arterial).
2. The patients were maintained on I.V fluids according their weights to ensure tissue perfusion.
3. After discharge patients were followed up every week for one month then at 2, 3 and 6 months.

4. Study investigators and participants were aware of group assignments (open label).
5. At each visit the patients was questioned and examined for any complications or side effects.

2.6 Evaluation

1- Ease of harvesting

- Patient positioning
- Possibility of two teams' approach
- Constancy of perforators
- Operative time

2- Flap parameters

- Thickness of flap
- Length of pedicle (Artery and vein)
- Diameter of pedicle (Artery and vein)

3- Aesthetic Outcome

- The patients themselves using a self-made, non-standardized questionnaire assessed the subjective satisfaction with the aesthetic results. Results were rated on a scale from 1 to 6 according to the German school marking system (1 excellent, 2 good, 3 fair/satisfactory, 4 sufficient/pass, 5 deficient/bare pass, and 6 poor/fail).
- This questionnaire was applied for both donor site and the reconstructed neck.

4- Complications

2.7 Statistical methodology

Data were statistically described in terms of mean \pm standard deviation (\pm SD), frequencies (number of cases) and relative frequencies (percentages) when appropriate.

The normal distribution of continuous variables of the demographic data was evaluated with the use of the Kolmogorov-Smirnov test.

Comparison of numerical variables between the study groups was analyzed with the independent-samples t test (when the data showed normal distribution) and using Mann-Whitney U test for data which was not normally distributed.

For comparing categorical data as all complications e.g., flap failures, infections, partial necrosis, donor-site complications. Chi square (χ^2) test was performed, and for small sample sizes, Fisher's Exact Test was used as appropriate.

Statistical significance was set at a probability value (**P value \leq 0 .05**). The Statistics Package for Social Science (**version 22; SPSS Inc.**) was used for all statistical analyses.

The study includes 20 cases with post burn neck contracture with age ranged between 18 and 41 years and female predominance (75%).

Patient positioning and possibility of two teams' approach

All cases of ALT flap did not require change the position of the patient, with two teams operating simultaneously. A Team for neck contracture release and preparation of recipient vessels and the other team to harvest the ALT flap.

All Cases of Parascapular flap required change of patient position twice which added 35-45 minutes to total operative time.

Constancy of perforators

Eight of ALT flaps had an intramuscular perforator (80%) with only two flaps (20%) with septocutaneous perforators; while all the parascapular flaps perforators had almost the same intermuscular course.

3. Results:

Table (1): Summarizes the relevant patients' baseline characteristics of the patients who had free

	Group A (ALT) Mean (SD) or Frequency (%)	Group B (PS) Mean (SD) or Frequency (%)	Test of significance	P-value
Age	33.1 (8.69)	29.9 (10.17)	Independent-samples t test t (18) = 0.76	0.46
Gender	Male (30%)	Male (20%)	Chi square (χ^2) test $\chi^2(1, N= 20) = 0.27$	0.6
	Female (70%)	Female (80%)		
BMI	29.9 (2.9)	29.9 (4.36)	Independent-samples t test t (18) = 0	1
Duration since burn (months)	13.6 (4.22)	12.1 (1.97)	Independent-samples t test t (18) = 1.02	0.32

Anterolateral thigh flap (Group A) or parascapular free flap (Group B).

These data shows that there was no statistically significant difference between the 2 groups regarding baseline characteristics.

Table (2): Operative time in both groups.

	Group A (ALT) Mean (SD)	Group B (PS) Mean (SD)	Test of significance	P-value
Operative time (minutes)	386.5 (32.7)	381.5(34.6)	Independent-samples t test t (18) = 0.33	0.744

The mean operative time was 386.5 ± 32.7 minutes in ALT group and 381.5 ± 34.6 minutes in PS group. There is no significant difference between two groups.

Table (3): Flap parameters in both groups

	Group A (ALT) Mean (SD)	Group B (PS) Mean (SD)	Test of significance	P-value
Flap Size (cm)	12.6 (1.35) x 23 (1.76)	12 (1.5) x 22.5 (1.96)	Independent-samples t test.	0.36
Flap thickness (mm)	15.8 (4.7)	11.1 (2.6)	Independent-samples t test t (18) = 2.75	0.56
Arterial pedicle diameter (mm)	2.9(0.35)	3.1(0.47)	Independent-samples t test t (18) = 1.17	0.13
Venous pedicle diameter (mm)	3.3 (0.55)	3.5(0.44)	Independent-samples t test t (18) = 0.98	0.26
Pedicle Length (cm)	12.56 (1.1)	8.3 (1)	Independent-samples t test t (18) = 8.82	0.34
				$\leq 0.0001^*$

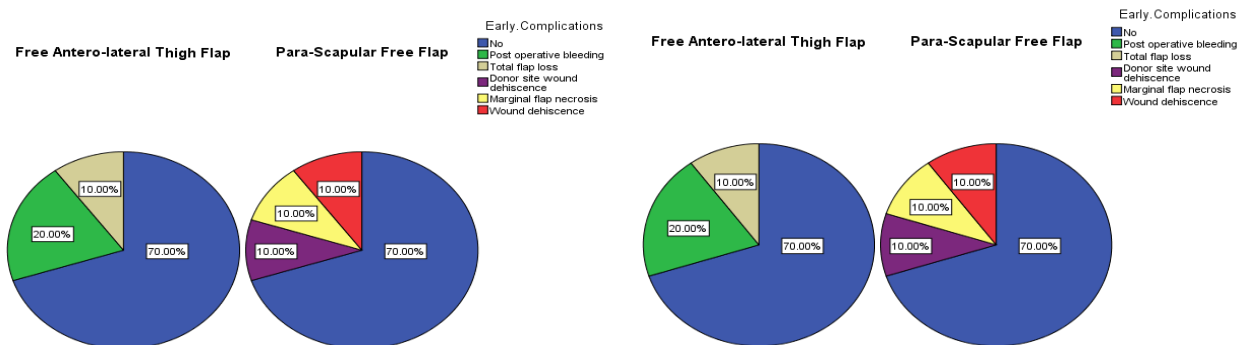
*Significantly difference between pedicle length of the parascapular and the anterolateral thigh flaps ($P < 0.001$).

Table (4): The distribution of patients by aesthetic outcome.

		ALT group	PS group	P value
Donor site	Excellent	0%	30%	0.027*
	Good	10%	20%	
	Fair	20%	0%	
	Sufficient/pass	0%	30%	
	Deficient	20%	0%	
	Poor/Fail	30%	20%	
Recipient site (Reconstructed neck)	Excellent	10%	0%	0.57
	Good	20%	20%	
	Fair	30%	50%	
	Sufficient/pass	40%	30%	
	Deficient	0%	0%	
	Poor/Fail	0%	0%	

*Significantly difference regarding aesthetic outcome between both groups in donor site.

Figure (1) Early and late complications in both groups



4. Discussion

Post-burn contracture of the neck is a serious and common complication of neck burns that cause many devastating functional and cosmetic deformities for the patients [2].

The resultant defect following neck contracture release may be too wide to be closed by local tissue. Moreover, burned surround tissues preclude use of tissue expanders, in such conditions free tissue transfer provide the only solution [9]. Both ALT flap and parascapular flap are known as a workhorse flaps. They are providing a large skin paddle with minimal donor site morbidity. Hence, we conducted this study included 20 patients with post-burn neck contracture to compare between these two flaps considering ease of harvesting, flap parameters, aesthetic outcome and rate of complications.

There were no significant differences between the two groups in terms of age, sex, BMI and co-morbidities in both groups; therefore, the outcome was related mainly to the selected procedure.

Regarding duration since burn (in months). The mean duration since burn was 13.6 in ALT group and 12.1 in Parascapular group. This was in accordance with [12]. However, they included some patients with only 6 months duration since burn

Regarding the mean operative time it was near equal in both groups (386 minutes for ALT flap and 381.5 min for parascapular flap).

The time wasted in changing patient position in parascapular group was balanced by the time needed for tedious dissection of intramuscular course of ALT perforator.

Compared to literature, our operative time was within average time reported by [12], [13] and [14].

Regarding flap parameters:

- Flap thickness: There was no significant difference between both groups. However, our finding regarding mean ALT flap thickness (15.8 mm) was not in agreement with [15] who reported mean thickness of 9.3 mm, but [15] included only males with BMI 20-24.9 kg/m².
- Pedicle diameter (arterial and venous): No significant difference between both groups regarding this point. Our reported pedicle diameter was similar to what is reported by [15] but larger than findings reported by [12].
- Pedicle length: ALT mean pedicle length (12.56 cm) was significantly longer than parascapular flap mean pedicle length (8.3 cm). this was in accordance with the values reported by [15] which was 13.43 ± 3.92 cm pedicle length of ALT flap and 9.07 ± 1.2 cm pedicle length of parascapular flap.

Regarding aesthetic outcome of donor site. There was a significant statistical difference between both groups regarding aesthetic outcome of the donor site in favor of parascapular group. Similarly, [16] Compared anterolateral thigh, lateral arm,

and parascapular free flaps with regard to aesthetic outcome. They reported that, although score outcomes did not differ significantly in all groups, patients with parascapular flaps were the most satisfied with the donor site. Also, [17] compared donor sites in the same individual. PS harvest site was preferred to ALTs in 7 of the 10 patients (70%). Interestingly, none of the patients answered indifferently, indicating significant differences between both donor sites.

Superiority of the PS harvest site may be attributed to the fact that the scar is out of the patient's field of vision whereas the scar at the thigh is easily visible for the patients themselves and third parties.

Regarding complications

- Early complications

Early complications were reported in 6 cases (3 cases in each group) in form of total flap loss, marginal flap necrosis, post-operative bleeding and wound dehiscence. Closely, [11] reported the same rate of complications in a study included 130 cases of head and neck reconstruction with parascapular free flap. Also, [12] reported the following early complications: 2 cases of epidermal loss and 2 cases of distal flap necrosis in a study included 11 cases of post burn neck reconstruction with free ALT flap.

- Late complications

It was in the form of contracture along flap border, hypertrophic scar at donor site wound

which was similar to what is reported by [11] and [18].

5. Conclusion:

Free anterolateral thigh flap and free parascapular flap offer a reliable option for reconstruction of post-burn neck contracture. Both are providing a large good-quality skin flap that can cover the defect after contracture release.

Significant advantages of the parascapular flap are relative fixed anatomy of its perforator, as well as relatively thin skin, together with minimal donor sites scars.

The most obvious disadvantage and probably the reason for the relatively limited use of parascapular flap in neck reconstruction is the need to change the patient position during surgery.

The main advantages of ALT flap are the possibility of two teams' approach and the significant longer vascular pedicle.

In contrary to parascapular flap, ALT flap perforator has a variable course that necessitates a tedious dissection especially for its intramuscular part.

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