E-ISSN: 2616-3470
P-ISSN: 2616-3462

https://www.surgeryscience.com
2024; 8(1): 120-128
Received: 16-11-2023
Accepted: 28-12-2023

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Versatility of scapular and parascapular free flaps in limb reconstruction

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DOI: https://doi.org/10.33545/surgery.2024.v8.i1b.1060

Abstract
Background: Reconstructing the soft tissue defects caused by trauma in the extremities remains a challenging procedure in reconstructive surgery. The present work aimed at evaluating the versatility of scapular and parascapular free flaps in limb soft tissue defects reconstruction.
Methods: This work was a prospective study, conducted on 30 cases with clinical criteria of traumatic soft tissue defects of the extremity and defects after removal of scar contracture at upper or lower limb.
Results: Reconstruction was performed to 27 patients using para-scapular free flaps (90%) and the other 3 patients were reconstructed by scapular free flaps (10%). The length of the flaps ranged from 13-38 cm (mean: 27.3±3.1cm), the width of the flaps ranged from 6-12 cm (mean: 7.4±1.7 cm). The flap thickness ranged from 7-14 mm (mean 8.5±1.3 mm). The vascular pedicles length ranged from 3-5 cm (mean 4±0.6 cm). The operative time for the scapular and para-scapular free flaps was ranged from 250-550 minutes (mean: 290±39.4).
Conclusions: The scapular and parascapular flaps are a multipurpose alternate in reconstructing soft tissue of the upper & lower extremities, that might be utilized for various indications in properly selected cases. These flaps should be ones of cornerstone flaps in reconstructing soft tissue defect of the upper and lower limbs reconstruction since it has numerous advantages and versatility as reliable blood supply, thin (No need for further debulking), large coverage area, and less donor-site morbidity to provide the required functional and aesthetic outcomes. Finally, the decision concerning the best method for reconstruction requiring free flaps is better to be individualized according to patient's factors as well as the experience of the surgeon.

Keywords: Versatility, scapular, parascapular free flaps, limb reconstruction

Introduction

Reconstructing soft tissue defect of extremities caused by trauma remains a challenging procedure in reconstructive surgery. Because the defects are usually large and accompanied by exposure of nerves, vessels, bones, or tendons [1]. Local soft tissues are commonly not available for usage as a coverage in cases suffering a permanent high impact injury [1-3].

Free tissue transfer might be only surgical option in the vast majority of patients. Nevertheless, the recipient blood vessels are occasionally insufficient, and the patient might be not healthy thus can be subjected to a free tissue transfer procedure [2, 4]. Of note, functional reconstruction of the upper extremity results in a better outcome in comparison with using prothesis. It aims at preserving the highly required facility of touch sensation. In the 1991s, Costa *et al*. documented the single stage resurfacing along with revascularization of 2 limbs with traumatic injury with a flow via radial forearm flaps [5, 6]. Also, it's pivotal to utilize a safe free flap with a considerable reduced rates of complications [7]. The scapular and parascapular flaps were utilized for various defect coverage techniques in different anatomical sites [8, 9]. Since more in-depth knowledge concerning the human anatomy has emerged in addition to rising advancement in microsurgical techniques, reconstructive surgeons have considered many characteristics of free flaps that include the composition of the flap, being reliable, functional and cosmetic outcomes of the recipient site and donor-site morbidity [1, 5, 10]. The subscapular vascular system and being suitable for flap harvesting was 1st evaluated in an anatomical study by Saijo [11]. Two years later, Dos Santos [12] depended on these previous anatomical findings in description of the scapular flap as a cutaneous flap supplied by a transverse septo-cutaneous branch from the circumflex scapular artery (SCA) [11, 12].

Gilbert succeeded to transfer this flap in which the axis is directed inferiorly and parallel to the scapular spine [13]. Furthermore, more detailed anatomical studies and clinical series have been documented to use such flap that was immediately accepted as another effective method to cover soft tissue defect [8, 11, 13].

Nassif *et al*. [14] reported a flap variation as proposing the usage the descending septo-cutaneous branch of the CSA as the nourishing skin vessel. Hence, they designed the axis of the skin paddle of the parascapular flap across the lateral border of the scapula. The subscapular vascular system is a very efficient vascular source because it can offer skin, fascia, muscles, and bones for reconstruction in different combinations [9, 14].

This work aimed at evaluating the versatility of scapular and parascapular free flaps in limb soft tissue defects reconstruction.

Patients and Methods

This prospective study was conducted on 30 cases aged 20-55 y, both genders, with traumatic soft tissue defects of the limbs and defects after removal of scar contracture at upper or lower limb. The study was done from October 2020 to November 2022 following approval from the Ethical Committee Tanta University Hospitals. An informed written consent was taken from the patients or their relatives.

Exclusion criteria included children younger than six years old, patients who were unfit for general anesthesia and unfit for vascular anastomosis (Peripheral vascular diseases).

All cases were subjected to complete history taking, local examination of the affected limb [vascular assessment (Arterial & venous), neurological assessment (Sensory & motor), musculo-skeletal assessment (Muscles & tendons injury, bone fracture, and joint dislocation) and defect (Site, size, complexity)], preoperative routine laboratory investigations to assess the fitness for surgery according to age patient (CBC, hepatic and kidney functions, coagulation studies), specific laboratory investigations for any present co-morbidity, imaging studies (X-ray on the injured limb, duplex ultrasonography on recipient vessels and CT angiography on the recipient vessels), photography, preoperative marking, flap design, operative procedure and postoperative (Follow up and care).

The flaps were harvested from the contra lateral aspect of the defects to help the synchronous work of the 2 teams. The outlines of the scapular angle, and lateral scapular border, the lateral border of LD from posterior axillary fold to iliac crest, spine of the scapula, the angle between the upper border of the TM and palpation of the lateral scapular border was and marked as the main principal point of the flap and at the site where the SCA emerge into the SC tissue (At the junction between the superior 2/5th and the inferior 3/5th of the distance from the spine to the scapular angle).

A line was drawn extending from the above-mentioned point parallel to the spine of the scapula, indicated the orientation of the horizontal branch of the SCA. With abduction of the arm about 900, the lateral scapular border indicated the orientation of the vertical branch. The longitudinal axis of the flap followed such line. The anterior end of the flap is positioned at the level of the axillary crease. The caudal end can reach the twelfth rib and can be extended to the iliac crest (Fascial flap). Figure 1

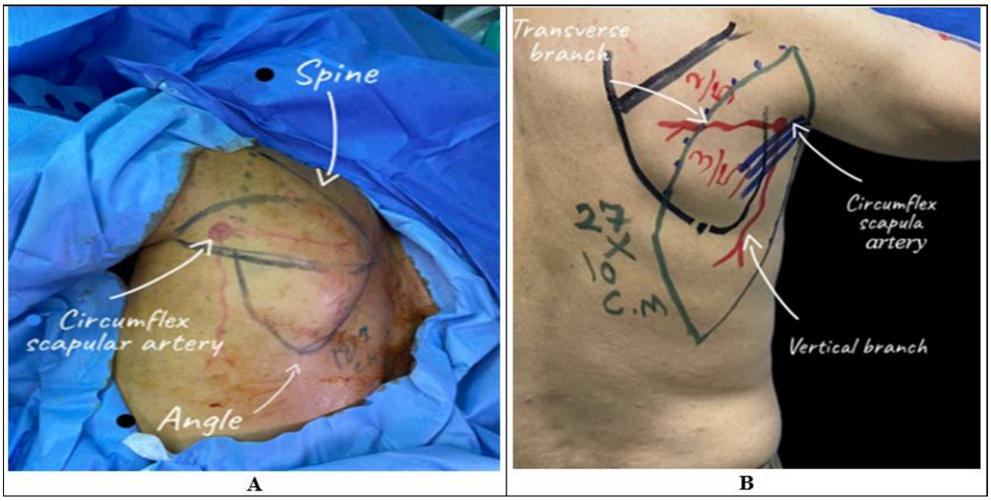

Fig 1: A) showing design of scapular free flap with marking of transverse branche of circumflex scapular artery; B) showing design of para-scapular free flap with marking of vertical branche of circumflex scapular artery

The operation was carried out for all cases under GA. Intravenous administration of a broad-spectrum antibiotic with the induction of anesthesia. The anesthesiologist was instructed to keep patients hemodynamically stable without giving any vasopressors. Adequate Warming of patients was ensured during the whole procedure.

After patients were intubated, the patients were positioned in a lateral position with the flap harvesting side away from the table.

Recipient Site Preparation

The recipient wound bed was meticulously debrided allowing a clean and uniform inset of the flap. A precise template of the defect was made.

The preparation of recipient site differs according to etiology of the soft tissue defect, which included

Excision of post burn or post traumatic scar contractures, debridement of devitalized tissues in case of recent trauma and excision of chronic ulcers.

Regarding both scapular and parascapular flaps harvest

The dissection was continued inside the quadrangular space, so as to attain sufficient vessel length & greater diameter. Using micro-surgical instruments and bipolar diathermy instead of monopolar diathermy to avoid lateral thermal damage of the vessels. Continuation of dissection of the vascular pedicle was done. The deep periosteal branch and any muscular side branches from the circumflex scapular vessel were clipped using micro clips. Frequent irrigation with saline lidocaine solution was done to prevent vessel spasm. Dissection extends to the origin of the thoracodorsal artery. Checking the capillary refill of the flap after islanding of the flap. After confirmation of good capillary refill and adequate flap perfusion. The skin paddle was left attached to the pedicle and covered with saline soaked gauze. Then attention was paid to the 2nd team that started to prepare and dissect the recipient vessels. Clamping of the recipient arteries was done before their ligation to ensure adequate distal perfusion and normal capillary refill. Figure 2

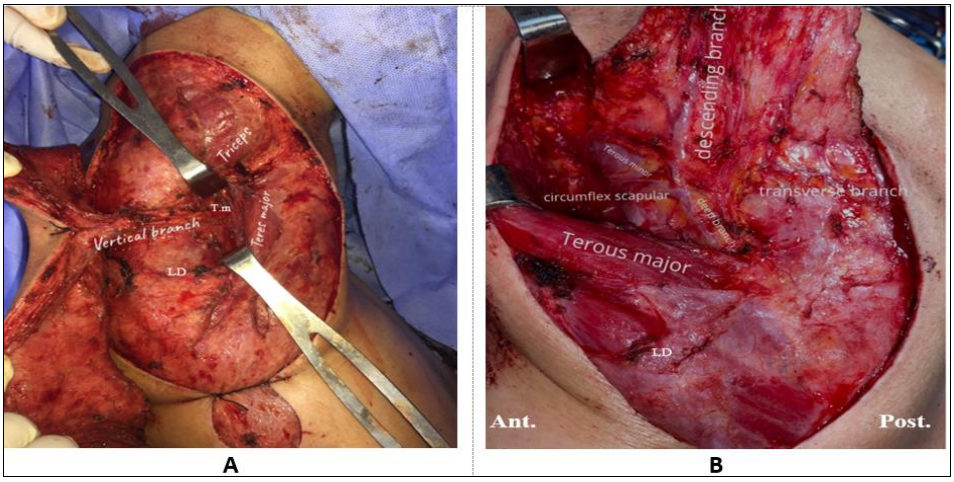

Fig 2: A) continuation of dissecting of the vascular pedicle with in the quadrangular space with micro clipping of the deep periosteal branch and any muscular side branches and B) close view; the superficial and deep branches of circumflex scapular artery with in the quadrangular space, LD: Latissimus dorsi muscle, Ant.: anterior, Post.: posterior

Flap Inset and Vascular Anastomosis: the flap was transferred and inset, the microsurgical anastomosis was carried out via the use of magnifying loupe (4.5 X), or by using the operating microscope (Leica surgical microscope 6-40 X) and secured with some staying sutures to one side of recipient defect for prevention of pulling the pedicle until anastomosis was completed with ensuring that there was not any twisting or pressure on the pedicle. End to end anastomosis or end to side anastomosis was done in all cases using a micro suture material (nylon 9/0, 10/0 Ethilon, 1 dozen Ethicon, US). Fig (3)

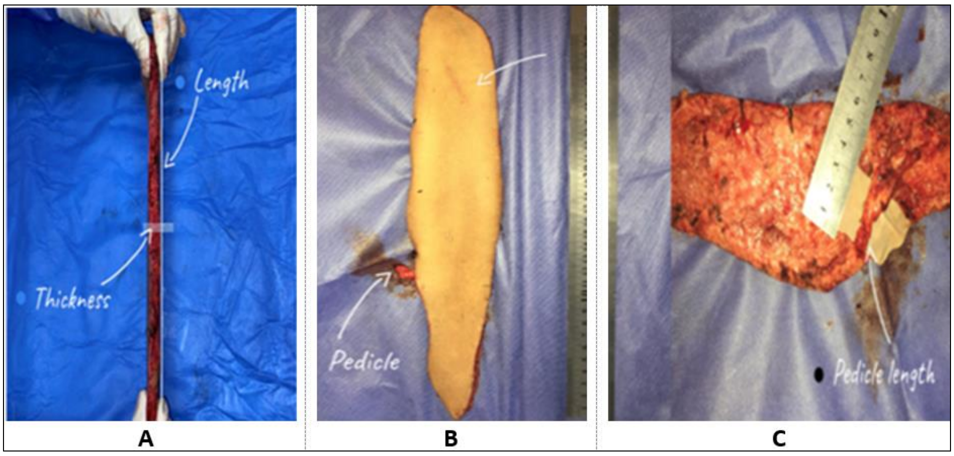

Fig 3: A & B) assessment of flap length, width, and thickness; C) measurement of the pedicle length

Postoperative follow up and care

Patient was transferred post-operatively to surgical care unit where the monitoring of the patient and the flap was done.

Patient monitoring

Central Venous Pressure (C.V.P) Monitoring, vital signs (pulse, BP, RR, temp.), urine output and laboratory investigations (complete blood count, prothrombin time and activity, liver enzymes; SGOT, SGPT; renal function tests).

Flap monitoring

Monitoring begun just following operation and repeated every two hours for the first 24 hours, every four hours on 2nd postoperative day, every six hours on 3rd day after surgery and two to three times per day afterward until the patient was discharged.

Monitoring of the flap perfusion postoperatively was performed via a range of clinical bedside tests and included the evaluation of the flap color, temperature, capillary refill, and pin pricing test.

Doppler monitoring of the flap pedicle, Doppler examination was performed every two hours in the first 24 hours. Convenient patient position was confirmed to avoid resting on the flap. Surgical dressing was observed and avoided to be tight particularly circumferential bandages on the extremities. The involved limb was elevated 30 degrees to aid in controlling edema, that might accumulate and lead to compression on the microvasculature of the flap.

Statistical analysis

Statistical analysis was carried out via SPSS v26 (IBM Inc., Chicago, IL, USA). Quantitative variables were presented as mean and SD. Qualitative variables were presented as frequency and %.

Results

All the patients' demographic data; (Age, gender, etiology of defect, smoking, BMI, and comorbidities: diabetes, hypertension); were collected. Table 1

Table 1: Demographic data of the patients

Age (Yrs.)			**34.4±4.6**
Gender	Male	27 (90%)	
	Female	3 (10%)	
Defect Etiology	Acute trauma	24 (80%)	
	Excision of unstable scar	3 (10%)	
	Post burn contracture	3 (10%)	
Regions	Upper limb	24 (80%)	
	Lower limb	6 (20%)	
BMI (Kg/m2)			28.3±2.7
Smoking	Smoker	21 (70%)	
Comorbidities	Diabetes	4 (13.3%)	
	Hypertension	5 (16.6%)	

Data are presented as Mean± SD or number (%), Yrs.: years, BMI: body mass index.

Reconstruction of 27 patients was carried out by para-scapular free flaps (90%) and the other 3 patients were reconstructed by scapular free flaps (10%). The length of the flaps ranged from 13-38 cm (mean: 27.3±3.1cm), the width of the flaps ranged from 6-12 cm (mean: 7.4±1.7 cm). The flap thickness ranged from 7-14 mm (mean 8.5±1.3 mm). The vascular pedicles length ranged from 3-5 cm (mean 4±0.6 cm). The operative time for the scapular and para-scapular free flaps was ranged from 250-550 minutes (mean: 290±39.4). (Table 2, Figure 4)

Table 2: Flap characteristics

Flap type	Parascapular	27 (90%)	
	Scapular	3 (10%)	
Skin paddle dimensions	Length (cm)		27.3±3.1
	Width (cm)		7.4±1.7
	Thickness (mm)		8.5±1.3
Pedicle length (cm)			4±0.6
Donor site closure	Primarily	27 (90%)	
	STSG	3 (10%)	

Data are presented as Mean± SD or number (%), STSG: Split Thickness Skin Graft.

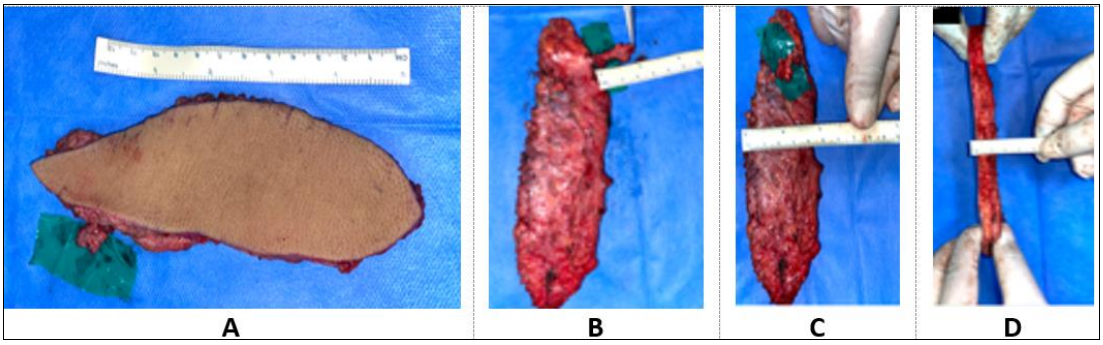

Fig 4: Flap dimensions, A) flap length (cm), B) pedicle length (cm), C) flap width (cm), D) flap thickness (mm)

Patients; themselves via the use a non-standardized questionnaire; were asked for the subjective satisfaction degree of cosmotic outcomes with comparison to the contralateral side. According to this questionnaire the results were rated on a five-point scale as follow: one excellent, two very good, three good, four fair and five poor. This questionnaire was applied for both the recipient and the donor sites separately and combinedly. Table 3

Table 3: Aesthetic outcomes

Aesthetic outcomes	Recipient sites	Donor sites
Excellent	21 (70%)	6 (20%)
Very good	3 (10%)	3 (10%)
Good	3 (10%)	12 (40%)
Fair	0 (0%)	3 (10%)
Poor	3 (10%)	6 (20%)

Data are presented as number (%).

The post-operative complications in this study were categorized into flap complications and donor site morbidities. Table 4

Table 4: Postoperative complications

Type of complication	
Flap complications:	10 (33.3%)
Total flap loss	3 (10%)
Wound infection	4 (13.3%)
Wound hematoma	3 (10%)
Donor site morbidities:	15 (50%)
Wound dehiscence	4 (13.3%)
Wound infection	2 (6.7%)
Wound ecchymosis & hematoma	3 (10%)
Widened scar	4 (13.3%)
Hypertrophic scar	2 (6.7%)

Data are presented as number (%).

Case 1

A male aged 44 y, smoker, was presented with a traumatic crushing injury of the dorsal aspect of the Lt wrist, and hand by threshing machine. Surgical debridement was done with preservation of viable extensor tendons. The resulting soft tissue defects were covered using a 38×10 cm parascapular free flap elevated from the right back. Primary closure of the donor site was done. Figure 5

Fig 5: A) surgical debridement of the recipient site, B) preoperative marking of parascapular free flap, C) complete flap elevation (38 x 10 cm), D) complete in setting of parascapular flap (pedicle length:3,5cm, flap thickness:8mm), E) primarily closure of the donor site, F) dorsal view, G) lateral view

Case 2

A 52-year-old, hypertensive, hepatitis C positive patient was presented with a crushing injury of the dorsal surface of the Lt hand. Surgical debridement was done with reconstruction of the dead extensor tendons with palmaris longus tendon graft. The resulting soft tissue defect was covered using a 32×12 cm parascapular free flap elevated from the right back. Donor site was primarily closed. Figure 6

Fig 6: A) Crushed Lt hand, B) recipient site surgical debridement with reconstruction of extensor tendons by palmaris longus tendon graft, C) dorsal view and D) volar view with smooth contouring of the proximal end of the flap (Arrow)

Case 3

A male aged 28 y, smoker, was presented with crushing injury of the dorsal surface of the left foot after a road traffic accident (RTA). Surgical debridement was done with repair of extensor hallucis longus tendon. The resulting soft tissue defect was covered with a 21×8 cm parascapular free flap elevated from the right back. Primary closure of the donor site was done. Figure 7

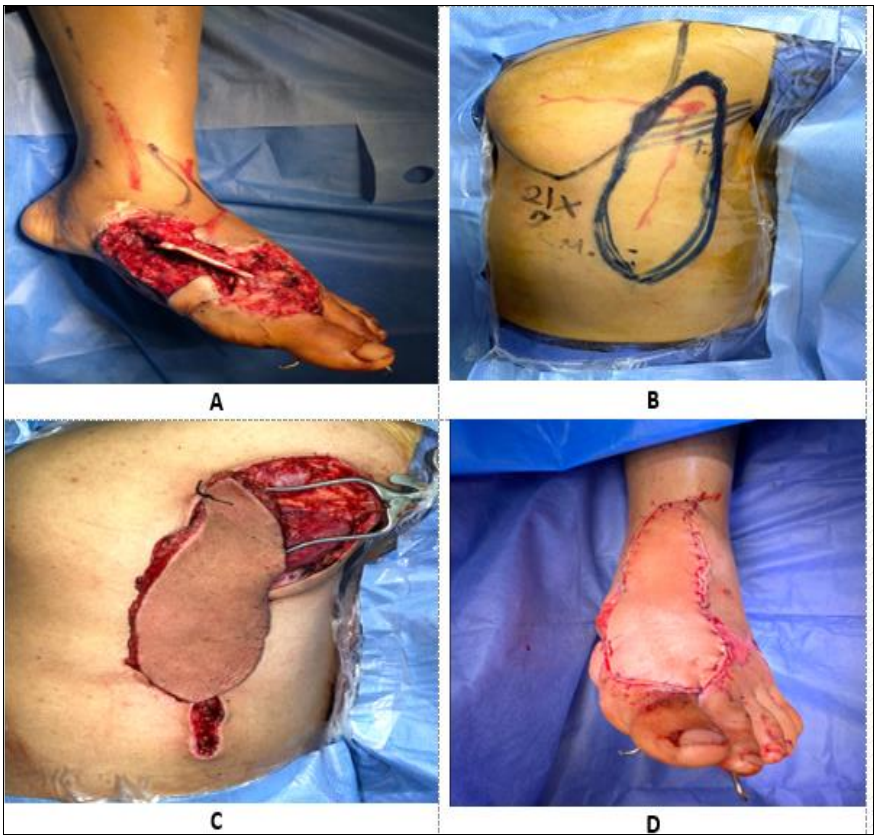

Fig 7: A) recipient site debridement and bones fixation using k-wires by orthopedic surgeons, B) preoperative marking of parascapular free flap, C) complete flap elevation (21 x 8 cm), D) complete flap in setting (thickness: 8 mm, pedicle length: 3 cm), E) primarily closure of the donor site with suction drain, F) oblique view and G) anterior view showing good contour matching

Discussion

Lower and upper extremities trauma frequently lead to complex soft tissue defects. Suitable tissue coverage is necessary for protection of the exposed bone and tendons as well as for prevention of amputation. The goals of upper and lower extremities reconstruction are optimization of functional and cosmetic outcomes while reducing the incidence of donor site morbidity [1, 2, 4].

In our study we aimed to evaluate the versatility of scapular & parascapular free flaps in limb reconstruction and its advantages and disadvantages. We consider the retrograde flap harvest during the elevation of the flap because it's simpler than the antegrade one. This matched with Nassif *et al.* [14] according to Rowsell *et al.* [15]; the vascular anatomy of the subscapular axis along with its related flaps are well-established. However, vascular variances of the subscapular artery might be present. The thoracodorsal artery in addition to CSA may arise from the axillary artery when the subscapular artery is absent. So, the arterial supply to such flaps appears to be constant unlike the anterolateral thigh flaps [16].

In our study, thirty patients were assessed as regarding the flap vascular pedicle, we agreed with Rowsell *et al.* [15]; as there was constant arterial supply of circumflex scapular artery related flaps but we found one vein accompanying the circumflex scapular artery instead of the normal two venae comitantes in only one case (3.3%).

Prantl L *et al.* [17] study reported parascapular flap harvested as a composite flap including osteo-fascio-cutaneous components but in our study, we harvested the scapular and parascapular flaps as a cutaneous flap. Concerning the trauma zone, it is described as the zone of soft tissue inflammatory response to the limb trauma that spreads beyond the gross wound and lead to perivascular alterations which affect the vascular integrity [18]. The response of tissue to trauma is hardly defined. The zone of injury is the region that surrounds the wound [19]. Loss *et al.* [19] observed in his review that appreciation of the zone of injury resulted in a contradictory outcomes in the literature concerning the definition and management of the traumatic injury necessitating free-tissue coverage. There is debate about how to clinically identify zone of injury and to select an appropriate recipient vessel for micro-anastomosis either proximal or distal to that zone [18].

Adam RK *et al.* [20] concluded in his study that the consideration of microanastomosis away from zone of injury are encouraged. However, the decision to carry out microanastomosis to clear uninjured vasculature proximal to the injury especially for lower limbs reconstruction have to be done.

Twenty-six cases (93%) of Breugem CC *et al.* [18] was categorized as Gustilo IIIB or worse before surgery. Distance from the micro-anastomosis to the proximal bone fracture line (Refers to injury zone) averaged 45.7 mm. No vein graft was needed in any case. Healing of the flaps occurred without loss. They concluded that the principle of zone of injury is based on analysis the quality of the recipient vasculature; not their site as it is clinically pivotal [18, 21].

Meticulous preoperative planning and usage of CTA help in clinical decision to define the injury zone of the soft tissue along with the vessel condition. Duplex ultrasonography additionally shows occult VT so that microvascular anastomosis is done out to a patent venous system [22, 23].

Regarding the ideal timing of soft tissue reconstruction, especially following major type of trauma (Gustilo type IIIB/IIIC) accompanied by fracture, is considered an essential point of contradiction [18, 21].

In the extremity defects, timing of microsurgical reconstruction is very significant factor that affecting the flap survival and the complications. The Godina's landmark work decided that microsurgical reconstruction of limb's injuries is better to be carried out within the 1st 72 hours of the injury [23]. He recognized that free flap failure rate of 12 percent in postponed reconstructions (Three days – three months) and 9.5 percent in late reconstruction (Following three months). Also, infection rates of 17.5 percent in the delayed reconstruction group was considerably greater in comparison with early reconstruction (1.5 percent) or late reconstruction (6 percent) [23].

However, from clinical point of view of Lee *et al*. [23], the Godina's role cannot be practical in every case due to several issues as: Patients transferred from another hospital after 72 hours from the injury, Patients with significant concomitant injuries, Institutional factors including available operating room place and support staff.

Alongside Lee *et al*. [23] there are many studies confirming that microsurgical reconstruction of defects caused by trauma in the upper & lower limb is safely achieved after ≥ 72 h from injury. This could be made by serial debridement and using negative pressure wound therapy helping in decreasing wound edema and risk of infection [22].

From our clinical point of view, we think that it is not possible to describe the ideal time for soft tissue reconstruction requiring free flap after the injury as it depends on the individual circumstances of the status of the defect and the patient (Microsurgical free tissue transfer should be undertaken only once the patient has been stabilized, adequately prepared, investigated, no need for further debridement of the defect and should be performed under elective conditions). The mean operative time in our study was 290±39.4 minutes (ranged from 250 to 550 minutes) for the scapular and para-scapular free flaps.

Our mean operative time was lesser than that reported by Mohamad HM *et al*. (37) which was 381.5±34.6 minutes in parascapular free flaps group. Also, it was slightly lesser than that reported by Mitsimponas KT [24], Izadi D [25].

Regarding to the flap parameters, Mohamad HM *et al*. [26] study showed parascapular flap mean thickness was 11.1±2.6 mm, similar to what was reported by Busnardo FF [16] and Izadi D *et al*. [25] they concluded that parascapular free flap had excellent aesthetic outcome and contour matching in neck reconstruction and large extremity defect coverage. we agreed with them as in our study; we reported mean flap thickness 8.5±1.3 mm with the same conclusion in soft tissue limb defect reconstruction.

Roll *et al*. [27] in his case series showed a maximum dimension of the flap was 22 x 14 cm, comparing to our study the maximum dimension of the parascapular free flap was 38 x 12 cm to cover upper limb large soft tissue defect.

Sano K *et al*. [28] reported that the length of the pedicle along with the external diameter of the artery might differ based on the region of transection and thus has to be adapted to the size of the recipient blood vessel. If the surgeon chose the subscapular artery, the external diameter of 4 - 4.5 mm is available with a length range from 10-14 cm.

Mohamad HM *et al*. [26] reported that the mean pedicle length was 8.3 cm, this was slightly lesser than the mean pedicle length reported by Izadi D *et al*. [25] which was 9.07±1.2 cm. they transected the pedicle at subscapular artery level. However, in our study, the mean pedicle length was 4±0.6 cm, we always transected the pedicle before the site where thoracodorsal artery originates to preserve the latissimus dorsi muscle free flap as reconstruction option.

Mohamed HM *et al*. [26] denoted that the capability of doing primary closure of the donor site of up to 10 cm width. We denoted that the primary closure of the donor site was sometimes valid in flap width up to 12 cm. The donor sites of the flap which weren't suitable for primary closure were skin grafted (3 cases, 10%).

The early post-operative complications of flaps occurred in ten patients (33.3%) as following: 3 patients with totally lost flaps (10%), four cases of wound infection (13.3%), three cases of wound hematoma (10%). Closely, Mitsimponas KT *et al*. [24] informed nearly percentage of complications in a study that was conducted on 130 patients had head & neck reconstruction with parascapular free flaps. According to donor site morbidities, four cases of wound dehiscence (13.3%), two cases of wound infection (6.7%), three cases of hematoma (10%).

The donor site scar related problems occurred in six cases (20%): four cases of widened scars (13.3%) and two cases of hypertrophic scars (6.7%). Nearly percentage of complications were reported by Mitsimponas KT [24], Klinkenberg M [29], Fischer S. [30].

In our study we didn't find any case of donor site seroma. We believe that this is due to adequate hemostasis and minimal vessel and tissue injury during flap elevation. Similarly in Roll *et al*. [27] in contrast; De LA *et al*. [31] stated that it is important to take into account that seromas commonly occurred at the donor site following LD muscle flap or TDAP flap. Patho-physiologically, acute inflammatory exudates in addition to dead space are the core causes of seromas. But it can be reduced by Firstly, vessel and tissue injuries can be decreased via the usage of bipolar cautery to achieve gentle hemostasis. Secondly, concurrent quilting sutures can be used in closing the donor-site to reduce creation of dead space. Regarding Giordano S *et al*. [32], harvest of LD muscular or musculocutaneous flap may lead to noticeable drops in shoulder joint strength, ranges of movement, and general functions especially in cases suffering an excessive level of activity. Of note, Scapular free flap might be advantageous in these patients since it is used to reconstruct large defects without functional loss at donor area. We agreed with Giordano S *et al*. study as we didn't find any case of shoulder impairment in all our cases.

Roll *et al*. [27] demonstrated that parascapular flap donor-site morbidities (osteo-cutaneous & fascio-cutaneous harvest) were acceptable and less in comparison with the other free flaps including the LD flap.

Klinkernberg M *et al*. [29] found that the least donor-site morbidities and most elevated patients' satisfaction were determined in the parascapular flap group. This might be explained by the presence of the scar site out of field of vision of the patient and thus subjectively less visible, while the scar at the thigh as well as the upper arm can be seen easily by the patients and others. We found that no significant recipient site infection reappearance after surgical debridement and flap coverage. However, bigger studies are needed to show the efficiency of therapy using free fascio-cutaneous and cutaneous flaps for infected injuries and chronic osteomyelitis.

Our limitation: small sample size and single centre study.

Conclusions

The scapular and parascapular flaps are a multipurpose alternate in reconstructing soft tissue of the upper & lower extremities, that might be utilized for various indications in properly selected cases. These flaps should be ones of cornerstone flaps in reconstructing soft tissue defect of the upper and lower limbs reconstruction since it has numerous advantages and versatility as reliable blood supply, thin (no need for further debulking), large coverage area, and less donor-site morbidity to provide the required functional and aesthetic outcomes. Finally, the decision concerning the best method for reconstruction requiring free flaps is better to be individualized according to patient's factors as well as the experience of the surgeon.

Financial support and sponsorship

Nil.

Conflict of Interest

Nil.

References

1. Dow T, ElAbd R, McGuire C, Corkum J, Youha SA, Samargandi O, *et al*. Outcomes of free muscle flaps versus free fasciocutaneous flaps for lower limb reconstruction following trauma: A systematic review and meta-analysis. J Reconstr Microsurg. 2023;39:526-39.
2. Zayed EF. Lateral supra-malleolar flap for reconstruction of the distal leg and foot, clinical experience with 25 cases. Egypt J Plastic Reconstr Surg. 2011;35:279-86.
3. Hantash S, Ayad W, Hendy AA, Sadaka MS. Clinical applications of the thoracodorsal artery perforator flap in extremity soft tissue reconstruction. EJPRS. 2020;44:353-9.
4. Mégevand V, Suva D, Mohamad M, Hannouche D, Kalbermatten DF, Oranges CM. Muscle vs. fasciocutaneous microvascular free flaps for lower limb reconstruction: A meta-analysis of comparative studies. J Clin. Med. 2022;11:123-47.
5. Costa H, Guimarães I, Cardoso A, Malta A, Amarante J, Guimarães F. One-staged coverage and revascularisation of traumatised limbs by a flow-through radial mid-forearm free flap. Br J Plast Surg. 1991;44:533-7.
6. Higazi M, Mandour S, Shalaby H. Post-burn contracture of the axilla: Evaluation of three methods of management. Ann Mediterr Burns Club. 1990;3:21.
7. Shalaby H. Island parascapular flap for the treatment of diffuse axillary burn scar contracture. Ann Medit Burns Club. 1995;8:147-23.
8. Jelski CAE, Szendler GB, Cavalheiro CS, Vieira LA, Caetano EB. Reconstruction of upper limb soft tissue injuries, except for fingertips lesions. Acta Ortop. Bras. 2021;29:81-6.
9. Wade SM, Brandenburg LR, Michael NL, Souza JM. A modified scapular-parascapular flap design for optimal coverage of the residual limb. Ann Plast Surg. 2022;89:408-11.
10. Zayed EF. Lateral supramalleolar flap for reconstruction of the distal leg and foot, clinical experience with 25 cases. Egypt J. Plast Reconstr Surg. 2011;35:279-86.
11. Saijo M. The vascular territories of the dorsal trunk: a reappraisal for potential flap donor sites. Br J Plast Surg. 1978;31:200-4.
12. Dos Santos LF. The vascular anatomy and dissection of the free scapular flap. Plast Reconstr Surg. 1984;73:599-604.
13. Gilbert A, Teot L. The free scapular flap. Plast Reconstr Surg. 1982;69:601-4.
14. Nassif TM, Vidal L, Bovet JL, Baudet J. The parascapular flap: a new cutaneous microsurgical free flap. Plast Reconstr Surg. 1982;69:591-600.
15. Rowsell AR, Davies DM, Eisenberg N, Taylor GI. The anatomy of the subscapular-thoracodorsal arterial system: Study of 100 cadaver dissections. Br J Plast Surg. 1984;37:574-6.
16. Busnardo FF, Coltro PS, Olivan MV, Faes JC, Lavor E, Ferreira MC, *et al*. Anatomical comparison among the anterolateral thigh, the parascapular, and the lateral arm flaps. Microsurgery. 2015;35:387-92.
17. Prantl L, Babilas P, Roll C, Jung M, Nerlich M, Kinner B, *et al*. The use of 'fasciocutaneous' and 'osteofasciocutaneous' parascapular flaps for lower limb reconstruction: a retrospective study of 20 patients. J Plast Reconstr Aesthet Surg. 2009;62:973-80.
18. Breugem CC, Strackee SD. Is there evidence-based guidance for timing of soft tissue coverage of grade III B tibia fractures? Int J Low Extrem Wounds. 2006;5:261-70.
19. Loos MS, Freeman BG, Lorenzetti A. Zone of injury: A critical review of the literature. Ann Plast Surg. 2010;65:573-7.
20. Kolker AR, Kasabian AK, Karp NS, Gottlieb JJ. Fate of free flap microanastomosis distal to the zone of injury in lower extremity trauma. Plast Reconstr Surg. 1997;99:1068-73.
21. Kozusko SD, Liu X, Riccio CA, Chang J, Boyd LC, Kokkalis Z, *et al*. Selecting a free flap for soft tissue coverage in lower extremity reconstruction. Injury. 2019;50 32-9.
22. Patterson CW, Stalder MW, Richardson W, Steele T, Wise MW, St Hilaire H. Timing of free flaps for traumatic wounds of the lower extremity: Have advances in perioperative care changed the treatment algorithm? J Reconstr Microsurg. 2019;35:616-21.
23. Lee ZH, Stranix JT, Rifkin WJ, Daar DA, Anzai L, Ceradini DJ, *et al*. Timing of microsurgical reconstruction in lower extremity trauma: An update of the godina paradigm. Plast Reconstr Surg. 2019;144:759-67.
24. Mitsimponas KT, Iliopoulos C, Stockmann P, Bumiller L, Nkenke E, Neukam FW, *et al*. The free scapular/parascapular flap as a reliable method of reconstruction in the head and neck region: a retrospective analysis of 130 reconstructions performed over a period of 5 years in a single department. J Craniomaxillofac Surg. 2014;42:536-43.
25. Izadi D, Paget JT, Haj-Basheer M, Khan UM. Fasciocutaneous flaps of the subscapular artery axis to reconstruct large extremity defects. J Plast Reconstr Aesthet Surg. 2012;65:1357-62.
26. Mostafa MH, Elsayed GM, El Naggar AN, Ayad W. Para-scapular free flap versus free antero-lateral thigh flap (ALT) for resurfacing of post burn neck contractures. Egyptian Journal of Medical Research. 2022;3:401-10.
27. Roll C, Prantl L, Feser D, Nerlich M, Kinner B. Functional donor-site morbidity following (Osteo-) fasciocutaneous parascapular flap transfer. Ann Plast Surg. 2007;59:410-4.
28. Ferri A, Perlangeli G, Bianchi B, Zito F, Sesenna E, Ferrari S. Maxillary reconstruction with scapular tip chimeric free flap. Microsurgery. 2021;41:207-15.
29. Klinkenberg M, Fischer S, Kremer T, Hernekamp F, Lehnhardt M, Daigeler A. Comparison of anterolateral thigh, lateral arm, and parascapular free flaps with regard to donor-site morbidity and aesthetic and functional outcomes. Plast Reconstr Surg. 2013;131:293-302.
30. Fischer S, Klinkenberg M, Behr B, Hirsch T, Kremer T, Hernekamp F, *et al*. Comparison of donor-site morbidity and satisfaction between anterolateral thigh and parascapular free flaps in the same patient. J Reconstr Microsurg. 2013;29:537-44.
31. de la Fuente A, Jimenez A. Latissimus dorsi free flap for restoration of facial contour defects. Ann Plast Surg. 1989;22:1-8.
32. Giordano S, Kääriäinen K, Alavaikko J, Kaistila T, Kuokkanen H. Latissimus dorsi free flap harvesting may affect the shoulder joint in long run. Scand. J Surg. 2011;100:202-7.

How to Cite This Article

Khalifa MO, Zayed EF, Shalaby HH, Ghoraba SM, El Hawary YM, Khedr M. Versatility of scapular and parascapular free flaps in limb reconstruction. International Journal of Surgery Science 2024; 8(1): 120-128.