Egyptian Journal of Surgery Vol. 29, No. 4, October, 2010

ORIGINAL ARTICLE

DELAYED INSET OF PARASCAPULAR FASCIOCUTANEOUS FREE FLAP, AS A WISE TECHNIQUE FOR RECONSTRUCTION OF SPEFICIC SOFT TISSUE DEFECTS

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Abstract

Aim: The aim of this study is to elaborate the concept of delayed inset of free parascapular flap over certain soft tissue defects in head and neck and lower limbs. The final inset is usually done 5-7 days following the main microsurgical operation after being sure of flap survival.

Methods: Twelve patients (9 males, 3 females), patient age range 12 to 58 years were treated with free fasciocutaneous parascapular flaps from the period from January 2007 to January 2010. The soft tissue defects were 4 in the head and neck region and 8 cases in middle and distal third of the leg.

Results and Conclusion: In all the twelve flaps the concept of delayed inset of the flap was applied, and final inset was achieved after 5-7 days after the first microsurgical operation.
The time of the first operation was reduced (average time was 3-5 hours). The second operation time was between 70 minutes -100 minutes.
The delayed inset of the parascapular flap prevents exposure of important structures that could occur if debridement around the recipient defect is done and then partial or total flap loss occurs, it also avoids the blood loss that results from excision and preparation of the area around the recipient defect. This blood loss if added to the blood loss of the flap dissection and microsurgical anastomosis may affect the healing power of the flap.

Keywords: Inset, parascapular, subscapular, thoracodorsal.

INTRODUCTION

The armamentarium for treatment of large soft-tissue defects has expanded rapidly in recent years with the description of various free tissue transfers, including cutaneous, muscle, myocutaneous, and fasciocutaneous flaps. Flap selection demands careful attention to recipient site requirements (e.g., surface area, bulk, contour, cosmoses) as well as donor-site considerations, including ease of dissection, vascular pedicle length and reliability, flap territorial limits, functional and cosmetic deficits, and ease of donor site closure.(1)

The parascapular flap is easily accessible and its dissection is moderately difficult. The vascular system is constant and the pedicle is long (up to 14 cm) and large (up to 4.5 mm in diameter at the origin of the scapular artery). The intradermal network is rich, the skin is usually hairless, and the flap contains a reasonable amount of subcutaneous tissue. The operative position (lateral) allows a two-team approach and easy access to

any recipient site. The flap has no functional morbidity and leaves the muscular anatomy of the area undisturbed. The donor site is closed primarily, even for large flaps.[2,3]

The flap can be as wide as 15 cm and as long as 25 cm. The anatomy of the parascapular flap allows it to be harvested with a large number of other flaps on a single pedicle, allowing for complex and large reconstructions of composite tissue defects. The parascapular flap can be combined with one or more flap on the subscapular vessel axis like the Scapular flap, the latissmus dorsi muscle, the serratus muscle with or without rib and the lateral border of the scapula.[4-6]

The delayed inset of flaps is a concept that increases the maximum benefit of the patient from the flap as mentioned in cases of immediate breast reconstruction with skin sparing mastectomy where the healthy, viable mastectomy skin is known to be a critical factor in the outcome of immediate breast reconstruction. Unfortunately, mastectomy skin viability can be problematic and intraoperative assessment is unreliable. For this reason, the approach to immediate transverse rectus abdominus myocutaneous flap (TRAM) reconstruction. Instead of completing the reconstruction with a definitive inset at the time of the mastectomy, the TRAM flap is left intact and buried beneath the mastectomy skin for 3 to 5 days. This falls within the normal period of postoperative hospitalization, and at this point, the viability of the mastectomy skin is clear. Ischemic skin is debrided and replaced with healthy TRAM skin, and nipple reconstruction can be performed at the time of this interval inset.[7]

While free flap delayed inset was also mentioned in very few studies, like the case of a partial upper lip replantation after dog bite, with delayed inset as a new treatment option. Revascularization of the central upper lip segment was enabled by anastomosis to a single labial artery. Inset compression at the time of initial closure caused arterial insufficiency. Therefore, a delayed, sequential inset was performed over the following 2 weeks resulting in an esthetically and functionally successful replantation.[8]

Also, the case of extensive radionecrotic ulcer of the anterior aspect of the thigh and exposure of the femur. There was difficulty in the revascularisation of a free omental transfer due to radiation damage to the recipient vessels for that delay excision of the defect and storage of the flap temporarily in a plastic bag close to the recipient site was done. Then 48 hours later satisfactory appearance of the free omentum allowed excision of the defect and successful final inset of the omentum.[9]

Anatomy

The superior aspect of the flap is centered over the triangular space, where the circumflex scapular artery nourishes the parascapular flap after it travels through the triangular space. The borders of the triangular space are made up of; Teres minor, Teres major and long head of triceps. The latissimus and teres major muscles are important landmarks since flap dissection proceeds from inferior to superior and these are identified early in the dissection. The elevation of the flap is performed in the areolar fascial layer just above the thick muscular fascia of the back. The infraspinous fascia overlying the infraspinatous muscle and the teres minor fascia overlying the teres minor are particulary thick. If the flap is elevated deep to the muscular fascia, the dissection can become confusing and especially difficult around the pedicle where the fascia surrounds the triangular space.[10]

The circumflex scapular artery is a branch of the subscapular artery which takes origin off the axillary artery. The circumflex scapular arises about 1 to 4 centimeters from the origin of the subscapular artery, but can on occasion arise directly from the axillary artery. After the circumflex scapular artery pierces the triangular space it gives a transverse cutaneous scapular branch and a vertical parascapular branch. The parascapular branch forms the basis of the parascapular flap. The subscapular artery pedicle can be from 3 to 7 cm in length with vessel circumference at this level up to 4 millimeters in size. Although the circumflex scapular artery is usually accompanied by two venae comitans, the subscapular artery is typically accompanied by one vein.[10]

According to surgical requirements, the course of the circumflex scapular artery can be transected at different levels, allowing us to describe three principal types of procedures: type A with only the descending branch; type B including the entire circumflex scapular artery; and type C with the scapular artery. According to the level of artery transection, the diameter of the artery ranges from 1.5 to 4.5 mm and the diameter of the vein from 2 to 5 mm. In clinical situations that require a long pedicle, it is possible to extend the dissection more proximally up to the axillary artery.[4] (Fig. 1b).

FLAP DESIGN AND DIMENSIONS

Methods of designing the flap vary according to its orientation, its particular anatomic type, and the personal preference of the surgeon. A unanimously accepted landmark is the point of emergence of the pedicle from the omotricipital space and the lateral edge of the scapula. This space, limited by the teres minor above, teres major below, and long head of the triceps laterally, is felt as a depressed area with finger palpation. Otherwise, the following procedure may be used for measurement. The omotricipital triangle is usually located at distance D1from the middle part of the spine of the scapula, given by the formula D1= (D-1)/2, where D is the distance between the middle part of the spine and the tip of the scapula.[10] Then the main axis of the flap is outlined at the same level.

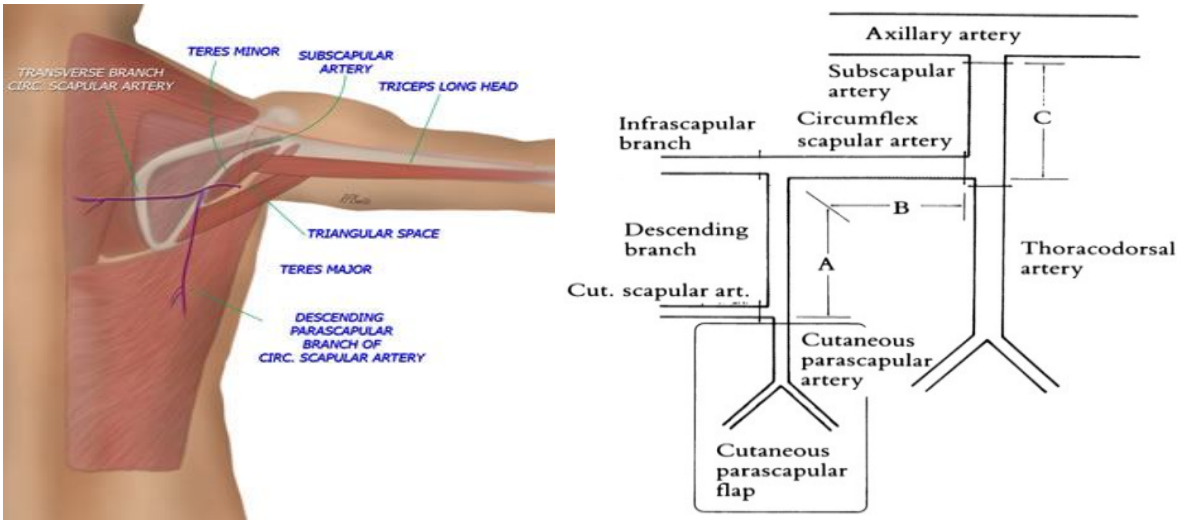

Fig 1. Showing the anatomy of parascapular flap and its vascular supply.

a- Anatomy of the scapular region and the triangular space and descending branch of circumflex scapular vessels.

b- The arterial tree from axillary artery till the cutaneous distribution.

As the emergence of the pedicle, the lower edge as far as 25cm from the upper edge. The main axis is constituted by the lateral border of the scapula. The width of this flap that proved consistent with direct closure of the donor defect is about 15 cm (minimal width 6 cm, maximum width 20 cm).[10]

PATIENTS AND METHODS

Twelve patients (9 males, 3 females) , patient age range 12 to 58 years, treated with free fasciocutaneous parascapular flaps from the period from January2007 to January 2010 in Kasr El-Aini hospitals-Cairo University.

The soft tissue defects were 4 in the head and neck region and 8 cases in distal third of the leg. Causes of the tissue defects were neurosurgical operation with skull irradiation in all head cases , and acute tissue injury following trauma (Gustilo grade IIIB) with compound fractures, non-union of the tibia after open fracture (chronic situation) in lower limb cases.

Six of the 12 patients were smokers at the time of surgery. Repeated irrigation and debridement was required in most patients to remove devitalized soft tissue and bone. Three to four operations were necessary in most cases prior to flap coverage.

The size of the soft tissue defects before flap coverage ranged from 6-8 cm to 20- 15 cm and flap size ranged from 8 - 14 cm to 16 -22 cm, respectively Table 1.

Multiple wound swabs were taken. Bacterial contamination was present at the time of flap coverage in 8 out of the 12 patients.

Technical details Pre-operatively, all patients had an angiography and color Doppler examination to identify the recipient vessels. Flap harvest was performed with the patient in the lateral decubitus. We integrate the fascia of the teres major muscle in the flap design. Therefore, we had to split the flap vessels at the level of the circumflex scapular artery or subscapular artery.

In all our study two teams of surgeons work simultaneously. One for parascapular flap elevation and the other team for reciepient vessel preparation which is always proximal to the defect which is pathological (the defect itself is not disturbed at the first operation). The area around the reciepient vessels is dissected wide enough to allow for microsurgical anastomosis and after that it should allow perfect closure of soft tissues and skin around the pedicle to secure the anastomosis. The distal part of the flap is then dressed with vasline gauze (sufra-tulle), and left in place over the planned reciepient defect without its excision which is postponed for few days (between 5-7 days) after being sure of flap survival. In the scalp and skull defect cases all the anastomoses were done on the facial artery and retro-facial vein in the neck by end- to- end anastomosis. In lower limb cases flaps were connected by end-to-end anastomosis to the posterior tibial artery in 2 patients and 2 cases were connected to very proximal anterior tibial vessels , in the last 4 cases flap vessels were connected to one of the sural arteries(muscular branch to gastrocnemius muscle heads) arising from the popliteal artery in the popliteal fossa.

Table 1. Showing the patients data and the size and cause of defect and flap size.

Case no	Sex	Age (Years)	Size of the defect (cm.)	Site of the defect	Cause
1	M	19	10x22	Junction of middle and lower 1/3 tibia unstable chronic scar (post 3 months) of external fixator	Compound fracture tibia with exposed tibia with unstable scar.
2	F	57	14x22	Skull (in areas both tables are lost with exposed dura)+scalp	Post neurosurgical operation +external irradiation.
3	M	21	8x17	Unstable scar over lower 1/3 tibia with lost segment.	Compound fracture lower third
4	M	30	8x20	Unstable scar over lower 1/3 tibia with lost segment	Compound fracture lower third
5	M	42	10x19	Skull (in areas both tables are lost with exposed dura)+scalp	Post neurosurgical operation +external irradiation.
6	F	12	13x21	Unstable scar over lower 1/3 tibia with lost segment	Compound fracture lower third
7	M	14	10x16	Unstable scar over lower 1/3 tibia with lost segment	Compound fracture lower third
8	M	26	11x20	Unstable scar over lower 1/3 tibia with lost segment	Compound fracture lower third
9	M	52	7x18	Skull (in areas both tables are lost with exposed dura)+scalp	Post neurosurgical operation +external irradiation.
10	F	23	9x18	Unstable scar over lower 1/3 tibia with lost segment	Compound fracture lower third
11	M	58	13x21	The whole parietal and occipital scalp with outer table	Post irradiation of haemangiosarcoma with osteomyelitis scalp radionecrosis
12	M	15	8x19	Unstable scar over middle 1/3 tibia with lost segment	Compound fracture middle third

A **B** **C**

Fig 2. The kind of defects that needs delayed flap insetting.

- ***a- Unstable scar with multiple sinuses and exposed bones of the skull post irradiation and osteoplastic flap for neurosurgical intervention.***
- ***b- The free parascapular fasciocutaneous flap one week post flap anastomosis (the anastomosis is in the neck) with complete flap survival.***
- ***c- The defect after debridement and excision of unhealthy scalp and osteomyelitic bones.***

RESULTS

Twelve soft tissue defects were managed by twelve free parascapular fasciocutanous free flaps. Four flaps were used for skull and scalp defects to cover dura and/or skull bones after debridement. And eight flaps were used in lower and middle third coverage of exposed bones or exposed plate of internal fixation. In all the twelve flaps the concept of delayed insetting of the flap was applied, and final insetting was achieved after 5-7 days after the first microsurgical operation.

The time of the first operation was reduced (average time was 3-5 hours). The second operation time was between 70 minutes -100 minutes.

In all the cases the distal part of the flap is sutured to the healthy edges around the recipient defect to stretch the flap. In 3 cases the edges of the parascapular flaps were inflamed and edematous that necessitated refreshment of the edges before final in setting. All the surviving flaps provided satisfactory coverage for the defects and the underlying bones or prostheses without occurrence of infection and with reasonable contour for either the head or the leg regions as shown in (Figs. 3,4). Also in 2 cases we used partial thickness skin graft to cover the raw area of the flap (undersurface and the edges) to avoid infection, this necessitated the graft removal during the second stage.

DISCUSSION

The parascapular flap as a free flap is very reliable, versatile, easily accessible and its dissection is moderately difficult. Its vascular system is constant and the pedicle is long and large. The intradermal network is rich, the skin is usually hairless, and the flap contains a reasonable amount of subcutaneous tissue.[2]

The operative position for harvesting the parascapular free flap is the lateral position. This position allows a two-team approach and easy access to any recipient site. The flap has no functional morbidity and leaves the muscular anatomy of the area undisturbed. The donor site is closed primarily, even for large flaps.[3]

The delayed inset of flaps is a concept that increases the maximum benefit of the patient from the flap as mentioned in cases of immediate breast reconstruction with skin sparing mastectomy where the TRAM flap is left intact and buried beneath the mastectomy skin for 3 to 5 days. So the viability of the mastectomy skin is clear. Ischemic skin is debrided and replaced with healthy TRAM skin, and nipple reconstruction can be performed at the time of this interval or delayed inset.[7]

While free flap delayed inset was also mentioned in very few studies, like the case of a partial upper lip replantation after dog bite, with delayed inset as a new treatment option. Revascularization of the central upper lip segment was enabled by anastomosis to a single labial artery. Inset compression at the time of initial closure caused arterial insufficiency. Therefore, a delayed, sequential inset was performed over the following 2 weeks resulting in an esthetically and functionally successful replantation.[8]

Delayed inset of free omental flap was also mentioned with difficulty in the revascularisation of a free omental transfer due to radiation damage to the recipient vessels for that delay excision of the defect and storage of the flap temporarily in a plastic bag close to the recipient site was done. Then 48 hours later satisfactory appearance of the free omentum allowed excision of the defect and successful final inset of the omentum.[9]

In our study, we applied this concept of delayed insetting of free parascapular flap for our twelve patients with satisfactory outcome in all of them, we have no flap loss either complete or partial, only in 3 cases the edges of the parascapular flaps were inflamed and edematous that necessitated refreshment of the edges before final inset. All the surviving flaps provided satisfactory coverage for the defects and the underlying bones or prostheses without occurrence of infection and with reasonable contour for either the head or the leg regions.

In our study, the delayed inset of the free parascapular flaps as a technical option for defects in the head and the distal leg regions had shown many advantages; as it shortens the primary operation so that it is beneficial for the patient (no prolonged surgery with all its disadvantages). (In our hands it took usually between 3-5 hours as we work in 2 teams one for flap harvest and the other for recipient vessel preparation). Secondly, it prevents the catastrophic exposure of important structures that could occur if the flap is lost (comparing the unstable scar with sinuses in scalp area with the exposed dura, venous sinuses and skull bone after debridement and loss of the flap). Thirdly, the 2nd operation is usually very easy and rapid without any special equipment. The delayed insetting of a flap may allow for debridement and pus evacuation; if any, before edge to edge suturing. The delayed inset of free flap may give time for 2nd look for osteomyelitic bones or necrotic shreds before complete closure of edges. Finally it avoids the blood loss that results from excision and preparation of the area around the recipient defect. This blood loss if added to the blood loss of the flap dissection and microsurgical anastomosis may affect the general condition of the patient (anemia), and hence the flap viability in addition to the healing power of the flap.

In conclusion Delayed in-setting of free flap is a safe and wise option that could be resorted to if the recipient site is dangerous as in cases of exposed dura after debridement or exposed plate or vascular anastomosis, in this case it is wiser to wait for one week after anastomosis, after being sure of flap survival and then you go for debridement and final flap insetting, without any fear of losing the flap with dangerous exposure of vital structures or prosthesis.

Fig 3. A case of 57 years old female with scalp unstable scar (Post neurosurgical operation and external irradiation), the patient was treated by free parascapular flap with delayed insetting after one week.

- ***a- Unstable scalp scar with multiple sinuses and exposed bones with osteomyelitis of the skull post irradiation and osteoplastic flap for neurosurgical intervention.***
- ***b- The free parascapular fasciocutaneous flap after pedicle separation with micro-vascular clamps on both the artery and vein.***
- ***c- Immediate postoperative photo showing the parascapular free flap after anastomosis and stretching of the flap over the undisturbed recipient defect with sufra-tulle in-between.***
- ***d- One week post flap anastomosis (the anastomosis is in the neck) with complete flap survival.***
- ***e- The excised osteomyelitic skull bones (necrotic osteoplastic flaps) and the unstable scalp scar.***
- ***f- Final flap insetting one week postoperatively.***
- ***g- Postoperative photo after 1 month with perfect healing.***
- ***h- Postoperative photo after 9 months before proximal flap debulking and temporal skin reorientation to remove the unnecessary bulge in the face.***
- ***i- The same patient after debulking and re-orientation of temporal scalp skin.***
- ***j- One year post operative with very satisfactory coverage of the skull defect.***

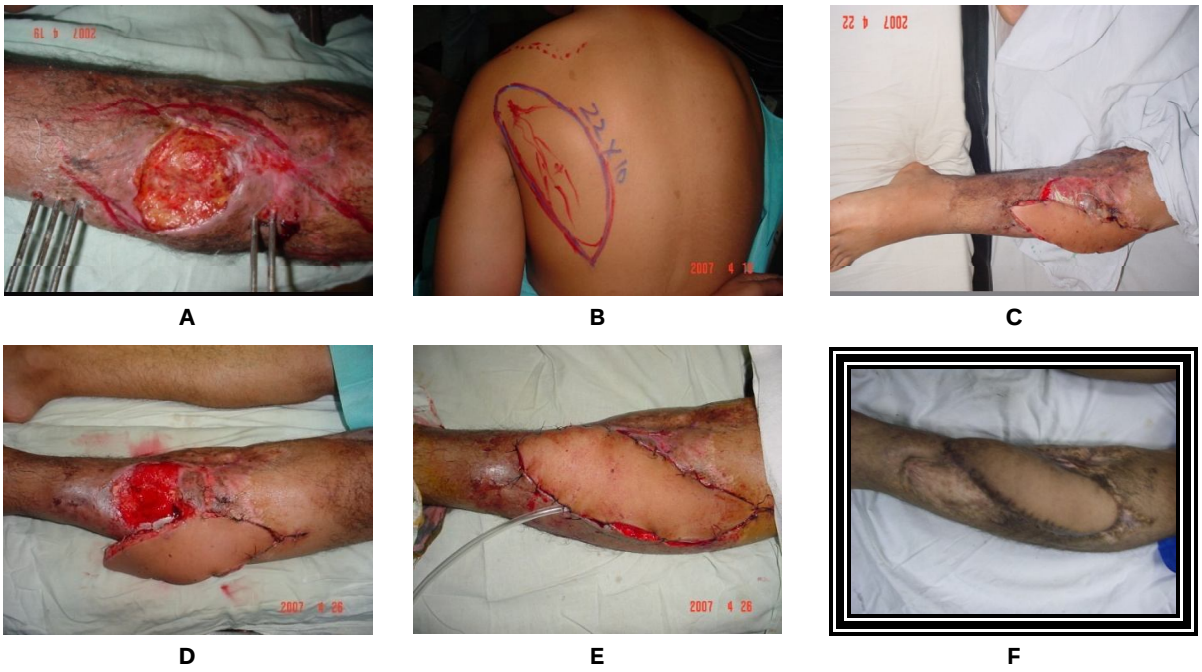

Fig 4. A 19 years old male with external fixator fixation of compound fracture tibia middle third, with unstable scar.

- ***a- The unstable scar over middle 1/3 tibia and a lost segment with external fixator in place.***
- ***b- Design of parascapular free falp10x22cm.***
- ***c- The free parascapular flap post 3 days with its distal ¾ not sutured(just stay sutures)***
- ***d- Before flap insetting. Note the excision of the recipient edges not yet done.***
- ***e- Complete Flap insetting post one week of microsurgical anastomosis with drainage.***
- ***f- Late postoperative photo showing the flap Post 18 months.***

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