Reconstructive Options for Large Back Free Flap Donor Sites

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Manuscript Details

Number of words in paper: 2093

Number of words in abstract: 228

Number of Tables: 1

Number of Figures: 3

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: [10.1111/ans.14240](https://doi.org/10.1111/ans.14240)

Abstract

Background: Reconstruction of posterior thoracic and trunk defects can prove challenging even to the most seasoned surgeons. Many commonly used techniques for closing back defects include primary closure and split skin grafts. Often times, however, other techniques are needed in order to give the patient the best aesthetic and functional outcome. In this study we focus on and evaluate donor site closure techniques for defects in the back created by harvesting scapular and parascapular flaps.

Methods: 20 patients were operated on to remove pathologically diagnosed sarcomas using a wide local excision. The defects, ranging from 5-22cm in width, were closed using donor flaps from the scapular/parascapular region. Nine donor sites were then closed primarily with wide undermining while 11 donor sites were closed using multiple techniques such as large transposition flaps, large rotation advancement flaps, keystone neurovascular island flaps, latissimus-dorsi advancement flap, and large Y-V advancement flaps.

Results: All recipient and donor flaps survived with good aesthetic and functional outcome. Patient satisfaction was high and only 2 of 20 donor site flaps required further surgery due to wound dehiscence. No other complications were seen during the follow-up period.

Conclusion: The proposed advanced techniques for donor site closure in back defects have shown that primary wound healing can be achieved with the use of a variety of different techniques and the avoidance of the complications of a skin graft.

Introduction

Reconstruction of any defect requires careful analysis, planning and appropriate selection of tissues which will ultimately provide coverage while maximizing both form and function. Reconstruction of posterior trunk defects especially for cancer patients-however, can be challenging due to factors such as a lack of reliable axial pattern flaps, poor elasticity, 3-dimensional contour of the wound, and a shortage of recipient vessels for microsurgical reconstruction¹. Fortunately, the dorsal trunk is host to several muscle groups that may be transferred on their vascular pedicle². These include the widely used latissimus dorsi and trapezius flaps.³.

After tumour excision on the trunk, extremities, or back, the choice of treatment for a skin defect caused by the tumour as well as the donor area is highly variable. Many surgeons prefer to use local flaps rather than skin grafts for small- or moderately-sized circular defects on the back and revert to split skin grafts for larger defects. In this study we mainly used parascapular/scapular free flaps for large extremity defects and pedicled flaps for adjacent defects all of which occurred as a result of sarcoma excision. Donor site closure for these

large defects can create a secondary problem and this paper focuses on different reconstructive options to close the donor site, including free flap design modification and Y-V advancement flap, transposition as well as rotation advancement flaps. In this paper we evaluated the functional and aesthetic results of these donor site closure techniques.

Methods

Patients

A prospective database collecting all patient demographics, defect size, flap choice and complications was analysed (see Table 1). A search for scapular and parascapular flaps revealed 20 patients (ten women and ten men) with ages ranging from 36 to 83. They had all been pathologically diagnosed with sarcomas in various anatomical locations. All patients had received preoperative neoadjuvant radiotherapy to a total dose of 50 gray. Surgery was performed between 4 and 6 weeks post cessation of radiotherapy whilst still in the acute phase of radiotherapy effects. The malignancies were resected by a separate oncologic team leaving a variety of large skin defects requiring reconstruction ranging from a width of 5-14 cm. The sarcomas were removed utilising a wide local excision and the following flaps served as donors: 9 free parascapular repairs (FPF), 3 pedicled parascapular repairs (PPF), 6 combined free scapular/parascapular repairs (FSPF), one pedicled scapular repair (PSF) and one keystone flap from July 2009 to April 2016.

Of the 20 donor sites, 9 were closed by primary closure with or without generous undermining in the traditional fashion. The remaining 11 were unable to be closed directly and required a variety of techniques to achieve closure and the avoidance of a skin graft. They were closed using the following techniques: large transposition flap (2), large rotation

advancement flap (1), latissimus-dorsi advancement flap (1), large Y-V advancement flap (6), and keystone flap (1). All patients were recommended to wear a sling post-op for a period of at least 4 weeks in order to prevent wound dehiscence. If a wound infection developed or the donor site dehisced they were treated topically with dressings or by debridement and secondary direct closure. Physiotherapy for strengthening and mobilisation of the shoulder joint was instituted at 4 weeks and continued until 12 weeks. We analysed the complication rate, as well as the range of motion and aesthetic outcome. The patients were followed up for a minimum of six months

Surgical Techniques

Depending on the skin laxity of the back after flap harvest, wounds of up to 8-10 cm were able to be closed directly using traditional techniques. The aim of this article is to enunciate alternative techniques for closure of the larger posterior thorax wounds. For defects unable to be directly closed either a secondary flap from the back or a regional flap was used. These included either the well described keystone neurovascular island flap⁴ based on paraspinal segmental thoracic perforators or a large latissimus dorsi myocutaneous advancement flap (see figure 1). This flap was designed and raised as a large V-Y flap (see figure 2)⁵ based on the vascularity of the latissimus dorsi muscle. In order to get sufficient mobility the entire musculotendinous origin of the muscle was released using sharp diathermy dissection and the flap completely islanded. The paraspinal perforators were divided in an orderly stepwise fashion from distal to proximal allowing preservation of the more proximal perforators. The vascular supply of this secondary flap was then based on both the traditional thoracodorsal pedicle and the mid-thoracic paraspinal perforators

allowing a dual supply to the myocutaneous flap. The flap was then advanced and inset in a V-Y pattern using a 3 layer closure.

The most common technique used by the senior author for defects too wide to be closed directly was in fact to modify the design of the flap choice in order to allow a large Y-V flap closure (see figure 2)⁵. This differs from the classical V-Y flap which is a complete island advancement flap. For a defect that is too large to close directly the flap design was changed from a purely parascapular flap to a combined scapular/parascapular flap. This allowed for the width of the defect to be shared between each flap and allowed subsequent flap closure. This was used successfully in 6 cases. For example in case 3 (see Figure 3) a 14 cm wide flap was divided into two flaps of 7 cm width each in an axis at 90 degrees to each other. This allowed the total width to be shared and the tension shared in both a vertical and horizontal fashion. The flaps of course were still based on the same vascular axis utilising the known anatomy of the circumflex scapular vessel⁶. The remaining skin could then be mobilised and advanced in a Y- V fashion and allowing closure once again in 3 layers. All patients had drains placed at both the recipient and donor sites. The donor site drain was removed at 3-7 days when the total drainage was less than 40mL in 24 hours.

Results

All flaps had 100% survival with no total or partial flap losses. There were no microsurgical takebacks or microvascular complications. There were no recipient site wound healing issues. The range of motion of the shoulder joint was assessed by a physiotherapist at 3 months and judged to be normal in all cases. Postoperative recovery was usually rapid, and

complications developed at the donor sites in two patients. Case 4 and 6 had a wound dehiscence (Table 1). The patient in case 4 had poorly controlled diabetes and had wound breakdown 6 weeks postoperatively while case 6 was unable to wear a sling postoperatively due to pain and discomfort in the lateral positioning required to protect the microsurgical anastomosis from pressure. After partial removal of the sutures, debridement, and washout the wounds were closed and healed well. Aesthetic results were deemed satisfactory by patients at both the donor and recipient sites. There was no need for a secondary skin graft in any patient.

Discussion

Large defects in the upper thoracic/posterior neck region can be a reconstructive challenge. Despite the common use of workhorse flaps from the back such as the latissimus dorsi, scapular and parascapular flaps, there is a paucity of literature on how to address closure of the large resultant defect. The defects in these areas can be reconstructed by numerous flaps including, a local skin flap, a musculocutaneous flap, a fasciocutaneous flap, or a muscle flap. For example, a study by Wu et al. made use of adjacent island flaps for closure of scapular donor sites with good end results⁷. There are advantages and disadvantages to each option. While many local or regional flaps can be used for small defects, larger defects require more planning and work to close in order to prevent recurrence of the defect or dehiscence of the flap. Moreover, posterior thoracic tissue can be relatively thick which allows it to adhere strongly to underlying layers and makes it moderately inelastic. The use of local or regional flaps for covering large defects of this area may end in necrosis of the flaps, with high risk of infection and unstable wounds⁸. Nevertheless, most

donor sites are usually reported to be closed primarily⁹⁻¹¹. In the case where direct donor site closure is achieved under excessive tension, wound dehiscence is apt to occur and the full range of motion of the upper limb may be impaired after the initial surgery. If the resultant defect is sufficiently large then the reconstructive surgeon needs to employ other techniques in their armoury in order to achieve wound closure. An alternative technique commonly used in this scenario is a large split thickness skin graft. In smaller defects for the closure of radial forearm donor sites, split skin grafts have not been shown to be statistically inferior to full thickness grafts in terms of healing at the donor or recipient sites¹². However, they have the inherent problem of poor graft take, prolonged wound healing times and their aesthetic outcome, contour and long term texture and durability are known to be far less superior. Hence we have employed differing techniques in order to avoid skin grafting

In this series, as per the aforementioned reasons 11 out of 20 donor sites created by the harvesting of scapular/parascapular flaps were closed using other techniques rather than primarily (Table 1). The simpler methods (large rotation, transposition) need no further explanation and are easily achievable by many reconstructive surgeons. However, we have described a number of techniques which may easily be utilised by reconstructive surgeons. By using the flexibility of the vascular axis of the circumflex scapular vessel, and the abundant remaining surrounding skin on the posterior thorax skin, skin grafting can be avoided. The scapular/parascapular axis allows two different flaps to be raised in two different axes and the subsequent tension of donor site closure to be divided equally amongst them and subsequently halving the tension on any single wound. The technique of sharing the width of the defect in planes at 90 degrees makes inherent sense and requires minimal extra

operating time. Whilst this modification is not exactly novel as it has been reported before¹³, it is manifestly underutilised and to our knowledge this report is on the second case series in the literature.

The latissimus dorsi is a familiar and commonly used flap and can similarly be utilised as a large V-Y advancement flap to avoid a skin graft. This involves the generous release of the musculotendinous origin of the muscle and division of distal secondary pedicles. A not uncommon problem with long distally placed skin paddles over the muscle is distal flap necrosis. This can be ameliorated by the preservation of secondary mid-thoracic paraspinal perforators which enhance distal perfusion whilst not limiting advancement of the flap.

The protocol of the oncologic team in our institution is to give neoadjuvant radiotherapy to most sarcomas. Given that surgery was instituted whilst still in the acute inflammatory phase of radiotherapy it was surprising that there were no recipient site wound healing issues. No doubt the introduction of new non-irradiated tissue and a tension free closure contributes to this unexpected result, however, we admit that by design the nature of this paper is limited due to a small sample group.

In summary, this paper has elucidated a number of techniques to solve a clinical problem which to date have been poorly described. We believe they have a positive aesthetic and functional outcome when used to close back defects created by parascapular and/or scapular free and pedicled flaps and hope that it will add to the reconstructive surgeon's armamentarium.

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Figure Legend

Fig 1. Case 9. (a) A 20 x 10 cm defect was created after harvest of a free parascapular flap in the usual fashion based on the lateral circumflex humeral vessel. *(b)* A large V-Y latissimus dorsi myocutaneous flap was raised and advanced allowing primary wound healing. *(c)* Long term result at 12 months with no shoulder morbidity.

Fig 2. Modified flap closing techniques. (a) V-Y advancement flap. *(b)* Y-V advancement flap. Arrows point in the direction of tightened tissue.

Fig 3. Case 3. (a) Operative view of the right calf defect created by wide local excision of sarcoma. *(b)* Outline of combined scapular/parascapular donor site flap sharing the width of the defect between the 2 flaps in an axis of 90 degrees to each other. The vascular axis is marked by an X. *(c)* Defect closed over donor site using large Y-V advancement flap dressings applied. *(d)* Defect site of sarcoma closed using combined scapular/parascapular flap sutured together.

Figure 1.tif

a

b

Figure 2.tif

Figure 3.tif

Legend: PPF - pedicled parascapular flap, PSF – pedicled scapular flap, FSPF – free scapular/parascapular flap, FPF – free parascapular flap

Table 1. Patient Details

Case No.	Sex	Age	Site of Sarcoma	Donor Flap	Size of Defect (cm)	Donor site closure technique	Complications at donor site
1	M	53	Right back	PPF	14 x 9	Large transposition flap	-
2	M	45	Right shoulder	PSF	8 x 10	Large transposition flap	-
3	F	63	Left calf	FSPF	18 x 12	Large Y-V advancement flap	-
4	M	49	Left shoulder	FSPF	10 x 8	Large Y-V advancement flap	Wound dehiscence
5	M	41	Left shoulder	FSPF	20 x 10	Large Y-V advancement flap	-
6	M	53	Right calf	FSPF	16 x 12	Large Y-V advancement flap	Wound dehiscence
7	F	74	Left lateral thigh	FPF	15 x 9	Large Y-V advancement flap	-
8	M	36	Right calf	FSPF	20 x 9	Large Y-V advancement flap	-
9	F	73	Right lower leg	FPF	10 x 14	Latissimus dorsi advancement flap	-
10	F	83	Left calf	FPF	15 x 11	Large rotation advancement flap	-
11	M	60	Right lower leg	FPF	20 x 10	Keystone flap	-
12	F	58	Left shoulder	FPF	12 x 9	Primary	-
13	F	51	Right arm	PPF	14 x 5	Primary	-
14	M	68	Right shoulder	PPF	12 x 7	Primary	-
15	M	55	Right popliteal fossa	FPF	-	Primary	-
16	F	54	Right popliteal fossa	FPF	15 x 10	Primary	-
17	F	68	Right forearm	FPF	18 x 8	Primary	-
18	F	67	Right scapula	FPF	22 x 9	Primary	-
19	F	62	Left posterior thigh	FSPF		Primary	-
20	M	76	Left knee	FPF	10 x 20	Primary	-

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Title:

Reconstructive options for large back free flap donor sites

Date:

2018-10-01

Citation:

Azizzeddin, A., Choong, P. F. M. & Grinsell, D. (2018). Reconstructive options for large back free flap donor sites. ANZ JOURNAL OF SURGERY, 88 (10), pp.1066-1070. <https://doi.org/10.1111/ans.14240>.

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