CASE REPORT

Reconstruction of a large upper arm defect with muscle sparing latissimus dorsi

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SUMMARY

Reconstruction of large soft tissue defects in the upper arm represents a challenge for the reconstructive surgeon. The latissimus dorsi flap is widely used and preferred for this latter type of reconstruction due to its reliability and versatility, although sacrificing the entire muscle can lead to higher incidences of postoperative seroma and functional disability. The recent introduction of the perforator-based flap concept has led to an evolution in upper extremity reconstruction by significantly reducing donor-site morbidity and simultaneously ensuring optimal soft tissues coverage. We report a case of a large soft tissue defect of the posterolateral part of the upper arm, consequent to a sarcoma resection, in which a muscle-sparing latissimus dorsi technique was used to obtain total soft tissue coverage. A 2-year follow-up showed a satisfactory functional result and no evidence of recurrence.

BACKGROUND

The management of medium and large upper limb soft tissue defects resulting from tumour excision, trauma or extensive infection usually requires flap reconstruction.

The use of the pedicled latissimus dorsi (LD) flap for upper arm reconstruction is well described and reliable.¹ Despite the simplicity of the harvesting procedure and predictable vascular anatomy, the relatively high donor-site morbidity is a drawback of the procedure.² The recent introduction of the perforator-based flap concept has led to an evolution in upper extremity reconstruction by significantly reducing donor-site morbidity and simultaneously ensuring optimal soft tissues coverage.³

In the early 1980s, Tobin *et al*⁴ was the first to introduce the concept of splitting the LD muscle and this was the basis for the development of the thoracodorsal artery perforator (TDAP) flap and eventually the muscle-sparing LD (MS-LD).^{5 6}

It is worth noting that sparing the LD muscle has a significant impact on reducing seroma formation and functional disability as well as giving better aesthetic outcomes.⁷

Different authors have described the use of the muscle-sparing-LD either pedicled or free for breast and trunk reconstruction but not many papers advocate its use in upper arm reconstruction.⁸

We report a case of a large soft tissue defect of the posterior and lateral part of the upper arm, consequent to a sarcoma resection, in which a muscle-sparing LD technique was used to obtain total soft tissue coverage.

CASE PRESENTATION

We report a case of a 69-year-old man who underwent reconstruction of a big upper arm defect following resection of a sarcoma (17×22×13 cm) using a muscle-sparing LD flap (*figure 1*).

The sarcoma was excised in the posterior compartment of the arm. Part of the triceps and deltoid muscle was resected and blunt dissection of the radial nerve along its course was performed sparing the nerve and leaving a defect measuring ~22×13 cm.

TREATMENT

Preoperative markings: the course of the descending branch of the thoracodorsal vessel is located at the lateral border of the LD using an audible Doppler and the course is marked. The vertically oriented skin island (28 cm long and 16 cm wide) and the segment of muscle (12 cm long×4 cm wide) that will be harvested in the flap are marked.

Operative technique: the patient is positioned in the lateral decubitus position with the arm abducted and the elbow mobile. The skin island is incised and undermining of the surrounding skin flaps is performed to achieve wound closure without tension. The 12×4 cm segment of muscle is elevated using bipolar electrocautery (*figure 2*).

Dissection continues until visualisation of the thoracodorsal pedicle division into its two branches and the transversal branch is then ligated. The thoracodorsal nerve is spared to maintain normal function of the LD at the donor site. A subcutaneous tunnel is created in the axillary fold to allow the inset of the flap into the defect in the upper arm. Wound closure of the donor site is performed in layers after the placement of two drains (1 in the donor site and the other in the recipient site) (*figure 3*).

OUTCOME AND FOLLOW-UP

Postoperatively, there were no complications in the immediate period and the patient was discharged from the hospital on postoperative day 3 without any drains in place.

At 24 months follow-up, there was no impairment of shoulder function and good aesthetic appearance of the scars was noted.

No lower back contour deformity was seen due to sparing of the majority of the LD muscle and an acceptable profile contour at the recipient site was obtained (*figure 4*).

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Figure 1 The case with the defect in the upper limb. The defect measuring 17×22 cm and the radial nerve spared during surgery.

Figure 3 Details of reconstruction. Flap is tunneled and inset into the defect. Donor site is closed primarily.

Figure 2 The beginning of the reconstruction. Flap is raised with the vertical skin island.

Figure 4 Postoperative result. Follow-up at 12 months, a good result is obtained.

DISCUSSION

Reconstruction of large soft tissue defects in the upper arm represents a challenge for the reconstructive surgeon. Local flaps such as the pedicled lateral arm flap are best suited to small to medium defects, while large defects involving the lateral and posterior parts of the upper limb often require the use of free flaps or pedicled flaps from the trunk.

The disadvantages of using free flaps are mainly related to the increase in operative time and the longer postoperative recovery, resulting in a greater economical impact to the hospital.

The LD flap is widely used and preferred for this latter type of reconstruction due to its reliability and versatility, although sacrificing the entire muscle can lead to higher incidences of postoperative seroma² and functional disability, especially related to sporting activities.

Some authors reported the rate of seroma formation after LD muscle harvesting to be as much as 60–80%.^{9 10}

Eventually, efforts were made to reduce donor-site morbidity by the introduction of the TDAP flap⁵ and the muscle-sparing LD flap,⁶ in which the muscle is totally or partially spared, avoiding all the complications related to its sacrifice.¹¹

Functional impairment after LD muscle transfer has been a subject of debate. According to some authors, such as Button *et al*,¹² patients who undergo breast reconstruction using LD flap suffer transient donor morbidity, but return to normal shoulder function with time and exercise. In contrast, in their systematic review of functional donor-site morbidity after LD muscle transfer, Lee and Mun¹³ demonstrated that limitations in shoulder joint motion could be developed; meanwhile, shoulder strength could be reduced significantly and not recover to the preoperative value even in the long run. With regard to flap types, they stated that the muscle-sparing LD flap and the TDAP flap showed minimal functional morbidity.

Although the TDAP flap is an elegant and fascinating solution for the coverage of different types of defects, it still carries some drawbacks that should be taken into account when flap selection is decided. Safe TDAP harvest requires particular expertise and a steeper learning curve⁸ since intramuscular dissection of perforators requires meticulous technique with potential risk of damage leading to flap loss. Additionally, the skin paddle location and design is strictly dependent on the perforator(s) location; if an adequately sized perforator is not encountered, the risk of partial flap loss is higher.⁶ The use of a muscle-sparing LD flap permits a more free design of the skin island; furthermore, the inclusion of a strip of muscle allows more perforators to be incorporated into the flap, thus ensuring adequate blood supply without the need for further intramuscular dissection that extends operating time.

The extent of muscle strip that is harvested depends on the dimension of the skin island, thickness and on the characteristics of the recipient site. In our case, we used an LD-MS type 1 resection that involves the harvest of a small cuff of muscle (12 cm long × 4 cm wide). In defects that require more bulk or when the extent of the skin island could compromise its blood supply, a wider segment of LD can be harvested (MS-LD type 2).¹⁴

In a clinical experience with 99 patients treated with pedicled TDAP flaps, Hamdi *et al*¹⁵ confirmed that harvesting TDAP or muscle-sparing TDAP type I flaps dramatically reduces the incidence of seroma formation in the donor site compared to the LD muscle harvesting flap.

In this case, we based the design of the MS-LD flap on the descending-based perforators where it is more likely to encounter larger perforators.

The pivot point location and the wide arc of rotation of MS-LD increase the likelihood of reaching distant regions such as the upper arm more easily. Although some authors advocate the use of a transversely oriented skin paddle,⁸ we preferred the vertical oriented one as it fitted the defect adequately without the need for a higher degree of rotation that could cause kinking of the pedicle.

In addition, the long muscle strip also gives the possibility⁶ to harvest a very long skin island that can reach the elbow without tension.

Excessive bulk at the recipient site was avoided since the small cuff of muscle harvested atrophied over time, thus ensuring wound closure at the recipient site with less tension. With this flap, a smoother contour profile than a classical LD flap is obtained and this is extremely important, especially in the extremities.

The muscle-sparing LD flap is an extremely useful and reliable flap for the coverage of medium to large soft tissue defects in the upper arm. It provides all the advantages from sparing the muscle and also can be used as a salvage procedure in all cases when an adequately sized perforator in a planned TDAP flap cannot be found.¹⁵

Learning points

- Reconstruction of soft tissue defects in the upper arm represents a challenge for the reconstructive surgeon. Local flaps such as the pedicled lateral arm flap are best suited to small-to-medium defects, while large defects involving the lateral and posterior parts of the upper limb often require the use of free flaps or pedicled flaps from the trunk.
- The latissimus dorsi flap is widely used and preferred for this type of reconstruction, although sacrificing the entire muscle can lead to higher incidences of postoperative seroma and functional disability, especially related to sporting activities.
- The thoracodorsal artery perforator (TDAP) flap is an elegant and fascinating solution, but safe TDAP harvest requires particular expertise since intramuscular dissection of perforators requires meticulous technique with potential risk of damage leading to flap loss.
- The use of muscle-sparing latissimus dorsi (MS-LD) flap, including a strip of muscle, allows more perforators to be incorporated into the flap, thus ensuring adequate blood supply without the need for further intramuscular dissection that extends operating time.
- The muscle-sparing latissimus dorsi (MS-LD) flap can also be used as a salvage procedure in all cases when an adequately sized perforator in a planned TDAP flap cannot be found.

Contributors PC and DB led the study design, coordination and had the role of first surgeons. SR and MO collected clinical data before and after surgery. DB, PC and MO participated in study design and drafted the manuscript. All authors read and approved the final manuscript.

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