Clinical Outcome of the Latissimus Dorsi Muscle Flap in Orthopedic Reconstruction

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ABSTRACT

Introduction. The latissimus dorsi muscle has been the "workhorse" of reconstructive surgery because of its predictable neurovascular anatomy and ability to perform both wound coverage and restoration of function.

Objectives. We determined the flap viability, complications, and muscle function (if used as muscle transfer) of our latissimus dorsi flaps for orthopedic reconstruction.

Methods. This is a retrospective review of all cases done in the Microsurgery Unit of the Philippine General Hospital and The Medical City from January 2005 to present using the latissimus dorsi muscle for reconstructive surgery. All patients were followed-up for six months.

Results. There were 14 patients who had reconstructive surgeries using the latissimus dorsi muscle. Three patients had traumatic brachial plexus injuries where the latissimus dorsi muscle was used for the reconstruction of elbow flexion. Eleven patients required coverage of a large defect, where seven were secondary to tumor resection and four were secondary to trauma. Of the fourteen patients, nine were pedicled flaps and five were free flaps. We had one failure (free flap group/tumor resection). The rest of the flaps survived completely. The smallest flap was 10 x 8 cm, and the largest flap was 28 x 24 cm.

Conclusion. The latissimus dorsi muscle remains to be a versatile muscle in the field of orthopedic reconstructive surgery.

Keywords: latissimus dorsi, brachial plexus, soft tissue reconstruction

INTRODUCTION

Soft tissue extremity reconstruction is a challenge to surgeons who deal with lost function and large wound defects caused by trauma or oncologic resections. Often, reconstruction must be robust, covering exposed critical structures (like bone, nerves, muscles, and tendons) that would not be amenable to simpler coverage. Choice of coverage can range from local, pedicled, to free flaps. Several workhorse flaps have been identified based on their versatility and usability. Especially in the hands of a skilled and experienced surgeon, refinements in the use of familiar flaps help improve the outcomes and reduce the complications.[1]

The latissimus dorsi (LD) flap is considered a workhorse flap in microvascular reconstruction because of its versatility in terms of size, location, transferability, and expendability. It has a predictable neurovascular anatomy[2] which can be used as a pedicled flap (diameter 1 to 2.5 mm, length 11-16 cm), with a wide arc of rotation on the torso or upper extremity.[3–6] The flap can be transferred as a pedicled or free flap. As a pedicled flap, it can be used to cover defects from the

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shoulder up to the proximal forearm. It can also be transferred as a functional flap to restore elbow flexion.[6–9] It can also be used as a free flap to the contralateral side of the body, or in the lower extremity.

Its large size and robust vascular supply allow it to be used in various configurations, such as bilobed or trilobed to cover irregular defects.[10] The donor site scar is cosmetically acceptable, and can be hidden underneath clothing.[3] The ease of use of this flap helps in early coverage of traumatic defects, decreasing the risk for subsequent infection or soft tissue desiccation.[3]

This flap, however, has its own complications. Most commonly described is the donor site seroma,[11] (a fluid collection beneath the donor site causing dehiscence and wound complications) which can be mitigated by careful dead space management,[11] use of donor site drains,[2,4,5] and multiple aspirations.[4] Still others describe distal flap necrosis, scar hypertrophy, unsightly graft sites, and weakness in shoulder internal rotation and shoulder extension.[12]

OBJECTIVES

The primary objective of the study was to determine the clinical outcomes of LD flap reconstruction. We determined outcomes in terms of flap viability, complications, and muscle function (when used as a functional transfer).

METHODS

This is a retrospective observational study where we reviewed medical records of all patients from the Microsurgery Unit Database of the Department of Orthopedics who had LD flap reconstructions from January 1, 2005 to present.

Inclusion criteria

- patients with flap reconstruction for soft tissue defect
- patients with functional restoration using the LD flap, either as pedicled or free
- surgeries done by surgeons from the Microsurgery Unit

Exclusion criteria

- done by surgeons not from the Microsurgery Unit

Withdrawal criteria

- patients with incomplete data on clinical outcomes
- follow-up of less than 6 months

Sample Size

Sample size calculation was not done for this study. Total enumeration was done instead, given the rarity and low number of cases seen at the institution.

Data Collection

Data was taken from the medical records of The Medical City and the Philippine General Hospital. All personal data is maintained anonymous and confidential in accordance with the Data Privacy Law of 2012, Republic Act 10173. The following non-identifiable data was collected for this study: age, sex, diagnosis, defect size (in cm^3), flap size (in cm^3), flap viability at final follow-up, length of follow-up (in months), complications, muscle function (in MMT; for functional transfers). Data was collected and encoded by the investigators only.

Oversight of the accountability, and responsibility for ethical conduct of the research was done by the senior author. A waiver of informed consent was secured from the UPMREB panel for the conduct of this study through review of records for data collection for this study cannot be practicably carried without the waiver, and the waiver will not adversely affect the rights and welfare of the participants, in accordance with the National Ethical Guidelines of Health and Health-related Research 2017.

All data collected were de-identified by removing name, age, sex, and identifiable case record number, and encoded into a master list. All patients were assigned a study-specific code which was the only identifier throughout data analysis and reporting, known only to the investigators. The MIS database is accessed only from the desktop module provided by the Department of Orthopedics administrative assistant. All files are secured in password-protected computers. The MRD records were accessed only from the physical office by the investigators, with prior approval by the MRD.

Data Analysis Plan and Statistical Considerations

Data was encoded and assessed for accuracy and completeness. Frequencies and percentages were used to summarize categorical variables (e.g., sex, flap viability).

RESULTS

We had a total of 14 patients who had reconstructive surgeries using the LD muscle, with follow up between 6-12 months. The smallest flap was 10 x 8 cm, and the largest flap was 28 x 24 cm.

The most common indication was for soft tissue defect coverage (n=11). These patients needed reconstruction after resection of orthopedic tumor on the trunk (n=1), clavicle (n=1), upper extremity (n=5), or lower extremity (n=4). Of the patients with malignant tumor resection (n=7), two have already died on recent follow-up. Four patients required coverage of soft tissue defects secondary to traumatic injuries to the upper extremity. The next most common indication was restoration of elbow flexion in patients with traumatic brachial plexus injuries (n=3), with a restoration of a mean of Manual Muscle Testing (MMT) of M3- strength at final follow-up.

As for the manner of transfer, of the fourteen patients, nine were pedicled flaps and five were free flaps. We had one failure in the free flap group (for resection of tumor in the lower extremity) due to postop flap thrombosis. The rest of the flaps survived completely (92% success rate).

DISCUSSION

Like previous studies, our institution's most common indications for LD transfer were for reconstruction of soft tissue defects. In contrast with other studies,[3,4,13] we had a higher percentage of neoplasm cases versus traumatic cases. This may be from hesitancy to do lengthy flap surgery in morbid traumatic cases. This needs to be explored, because the use of this functioning muscle flap could potentially restore functional elbow flexion when there is severe tissue loss around the elbow.[9]

We found the elbow function was comparable to those of other studies,[6,9] achieving flexion against gravity. Other authors have noted that it is imperative to document the LD preoperative strength, accurately isolating the muscle, and requiring an LD strength of at least M4.

Our success rate of overall flap survival (92%) was comparable to that of other studies. We had one patient with total flap necrosis, notably a free flap to the lower extremity for tumor resection. The most common documented cause of flap necrosis in the literature is due to kinking of the pedicle, and thrombosis.[13] Notably, in other studies, partial and marginal necrosis were more common. While donor site seroma is a well-documented complication in the literature, we did not experience any in our patient group.

Limitations and Recommendations

We present with a small number of cases in our local setting despite the widespread use of this flap in other countries. This may be due to the small number of specialists and centers that can perform the procedure, or the few patients that consent or are deemed candidates for the procedure. Our population is also skewed towards neoplasm cases, as opposed to the larger percentage of traumatic cases in other studies. While our flap viability and muscle strength outcomes are like other studies, this small number and difference in case variety most likely affected our complication rate (namely, seroma formation).

Functional complications data (related to the loss of the original function of the LD), cosmetic outcome (appearance and satisfaction), and comorbidity information were not available for all patients, hence these were not analyzed in this study. It would also be worthwhile to include in future studies more patient information that could help predict flap outcomes.

CONCLUSION

The latissimus dorsi muscle remains to be the most versatile and useful muscle in the field of orthopedic reconstructive surgery, presenting with excellent flap viability, good muscle function, and minimal complication outcomes like previous studies.

Statement of Authorship

Both authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising, and final approval of the version to be published.

Author Disclosure

The investigators declared no conflicts of interest.

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