

## **Durability and versatility of free latissimus dorsi muscle flap in leg defects**

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### **Abstract**

**Background:** The objective of this study was to assess the outcome of free latissimus dorsi muscle flap used for soft tissue reconstruction of leg defects.

**Methods:** This prospective non-randomized study was conducted on 13 patients with leg defects of different causes attended emergency unit and outpatient clinic of plastic surgery department in Sohag University Hospital in the period between June 2013 and May 2014. Durability of coverage, flap success, infection, pain and overall satisfaction were studied.

**Results:** Complete flap survival was 92.3% with only one total flap loss.

**Conclusion:** The choice of the flap to cover leg defects should be tailored according to favorable criteria as regarding patient age, defect site, size and depth, presence or absence of infections.

The free latissimus dorsi muscle flap can cover huge sized defects, robust blood supply and less need for secondary thinning operations.

### **Introduction**

Leg and foot reconstruction is challenging. Soft tissue management around the lower third of the leg poses a considerable challenge to the reconstructive surgeon because of the composite tissue defects, inadequate and tight local tissues and poor circulation [1]. Tendons, bone or hardware are frequently exposed because of the thinness of subcutaneous tissues, making skin grafting a poor option [2]. In the absence of specific knowledge of the pattern or reliability of the blood supply, the flaps were used initially as random pattern flaps constrained by length to width ratios to ensure viability [3]. The free flaps have been successfully used for lower extremity reconstruction for the past 40 years. Free Latissimus dorsi muscle flaps had been used in reconstruction of the complex lower extremity defects.

#### **Patients and methods:**

This is a prospective non-randomized study conducted on 13 patients with leg defects of different causes attended emergency unit and outpatient clinic of plastic surgery department in Sohag University Hospital in the period between June 2013 and May 2014.

Preoperatively, full history and examination was done. Initial debridement of the defect was done in cases with crushing injuries and also with delayed presentation.

Operative details as described elsewhere.

The minimum follow up period was 6 months, and patients were examined for durability of coverage, flap success, infection, pain and overall satisfaction.

#### **Statistical analysis:**

Data were analyzed using Statistical Package for Social Sciences (SPSS) software program. Qualitative variables were recorded as frequencies and percentages and were compared by chi-square test. Quantitative variables were presented as means  $\pm$  standard deviation (SD) and compared by student t- test. P value < 0.05 will be significant.

## Results

The age incidence was ranged between 5 to 54 years with the mean age was 23.85, the sex distribution was 9 males and 4 females. Defect size was ranged between 70 to 725 cm with the mean size was 184.15 and Table (1) show patients demographic data. Complete flap survival occurred in 12 cases which represent 92.3% success rate and 1 flap was completely lost and Table (2) show the success rate and the outcomes.

**Table 1:** Patients demographic data.

<b>Patient number</b>	<b>13</b>
<b>Age (years)</b>	<b>23.85 +/- 14.39</b>
<b>Sex (percentage)</b>	<b>Male: 69.2 % Female: 30.8 %</b>
<b>Defect size (cm.)</b>	<b>184.15 +/- 70.56</b>
<b>Defect site</b>	<b>4 middle 1\3 of the leg, 4 lower 1\3 of the leg, 3 ankle, and 2 tendoachillis.</b>
<b>Time before reconstruction</b>	<b>1 day to 2.5 months.</b>
<b>Follow up time</b>	<b>6 months to 1.5 years</b>
<b>Smokers(percentage)</b>	<b>30.8 %</b>

**Table 2:** The success rate and outcomes.

<b>Ischemia time (minutes) P= 0.02</b>	<b>152.31 +/- 43.23</b>
<b>Operation time (minutes) P= 0.22</b>	<b>348.46 +/- 55.51</b>
<b>Hospital stay (days) P= 0.02</b>	<b>16.08 +/- 4.481</b>
<b>Total flap loss (percentage)</b>	<b>7.7 %</b>
<b>Overall flap complications (percentage)</b>	<b>30.8 %</b>
<b>Donner site morbidity (percentage)</b>	<b>30.8 %</b>
<b>Secondary procedures (percentage)</b>	<b>15.4 %</b>

## Case Presentation

### Case (1):

Male patient, 28 years old, with roll over MCA and raw over the middle 1/3 of the Rt. leg. Defect size was 12\*8 cm. Soft tissue debridement and split-thickness skin graft was done immediately after trauma. The patient then develops chronic osteomyelitis of the exposed tibia.

Free latissimus dorsi flap was done after bone and soft tissue debridement. Anastomosis was done end to end with post. tibial vessels. Ischemia time was 2 hours, total operation time was 5.5 hours, hospital stay was 15 days and the donor site was closed primary with no complications. Late post-operative results of the flap was satisfactory (**Fig 1**).



**Figure (1):** pre and post-operative picture of case 1.

### Case (2):

Male patient, 13 years old, with MCA and raw over the medial malleolus of the Rt. foot. Defect size was 10\*6 cm.

Free latissimus dorsi flap was done after soft tissue debridement. Anastomosis was done end to end with post. tibial vessels. Ischemia time was 2.5 hours, total operation time was 5.5 hours, hospital stay was 23 days and the donor site was closed primary with no complications. Late post-operative results of the flap and donor site were satisfactory (**Fig 2**).



**Figure (2):** pre and post-operative picture of case 2.

## Discussion

The lower extremity has a mechanical component and must bear weight. These functional requirements make an effective reconstruction difficult. Moreover, the stress caused by weight-bearing makes durable repair of the foot is difficult and unreliable [4].

Leg trauma, with open high-energy soft-tissue and tibial injuries, most often occurs after motorcycle or car accidents and frequently requires reconstructive surgeon involvement. Tibial fractures are the most common long bone fractures of the body. The anteromedial portion of the tibia is only covered by skin and subcutaneous fat. This relatively unprotected anatomy leads to many instances of bone exposure, which require soft-tissue coverage.

In a 45 cases with leg and foot defects treated with 47 free flaps, Santanelli et al found that about 50% of cases were due to trauma [5]. Also in Demirtas et al series of cases, they found that 36 cases out of 53 patients the etiological cause was traumatic [6]. In our study, motor car accident was the commonest cause of injury in accounting for 92.3% of cases and only one case due to firearm injury and one case secondary to cast sore. Other mechanisms of lower extremity defects includes diabetes and vascular disease, cancer ablation which are less common than trauma.

The free flap has been successfully used for lower extremity reconstruction for the past 40 years. The characteristics of an ideal soft tissue free flap donor for leg and foot reconstruction might be described as having a large skin territory, good color and texture match with the recipient site, a long and large caliber vascular pedicle, reliability for different flap designs, constant pedicle anatomy, acceptable donor-site morbidity, feasibility for a two-team approach, no requirement for major artery or muscle sacrifice, applicability as a flow-through flap, and suitability for usage as a thin flap [7].

Melissinos and Parks reported that the success rate of free flap was 96.8%, 100%, 98.8%, and 95.6% in the reconstruction of defects of the head and neck, the trunk, the upper extremities, and the lower extremities, respectively [8]. Likewise, Percival et al. reported values of 94%, 100%, 91%, and 85%, respectively, for the same four types of defects [9]. In our study, complete flap survival was noticed in 12 cases which represent 92.3% success rate. Reported success rates by many authors with early wound coverage with microvascular free flaps have been 85% to 100% [10].

Time interval between the onset of injury and reconstruction was ranged

between 1 day to 2.5 months with the mean of 31 days.

Most authors argue that early soft tissue coverage is associated with a lower complication rate. Byrd et al. found that the overall complication rate of wounds closed within the first week of injury was 18% compared with a 50% complication rate for wounds closed in the subacute phase of 1 to 6 weeks [11].

In a review of Godina's work, closure of wounds within the first 72 hours after injury was associated with the lowest complication rate and highest success rate [12]. Yaremchuk et al. believe that serial, complete debridement is more important than the absolute timing of soft-tissue coverage [13]. Platelet counts increase nearly fourfold in the subacute phase after injury, which may play a role in the increased complication rate seen during this period.

Recent reviews have had conflicting results. Although Steirt et al found that the free flap coverage of open fractures could be delayed by initial treatment with vacuum-assisted closure (VAC) therapy without significantly increased complication rates [14]. Hou et al. found that the VAC therapy decreased flap size requirements but use beyond 7 days showed higher infection and amputation risks [15].

Although still controversial, it has been recognized that, from several perspectives, such as survival, complication rates, and bone tissue healing, the muscle flap is more advantageous than the fasciocutaneous flap [16] [17] [18].

A musculocutaneous free flap is a good choice to fill dead space due to its large size and ability to bring a greater blood supply to the bone fragments and may be better in preventing osteomyelitis in lower extremity reconstruction [19]. However recent studies have indicated

that the ALT flap offers a rich blood supply that can overcome infected wound beds and contribute to the sterilization and healing [20].

Anthony et al. treated 34 patients with chronic osteomyelitis with debridement and immediate muscle flap coverage and antibiotics. They had an overall success rate of 96% [21]. May reviewed a 13-year experience with treatment of chronic traumatic bone wounds with microvascular free tissue transfer. He had a 95% success rate in his series of 96 patients [22].

As regarding the overall flap complications, Kang et al experienced an overall complication rate of 36.5% (19 of 52 patients) [23]. Demirtas et al also had an overall complication rate of 56.5% (30 of 53 patients) [6]. In retrospective chart review of 74 patients undergoing free tissue transfer for lower extremity limb coverage Christy et al had complication rate of 18% (13 cases) [24]. In our study, the overall flap complication rate in was 30.8 % (4 of 13 patients). The overall donor site morbidity was 30.8 % in our study which is higher than that of literature 4%to 10% [25] [6].

## Conclusions

Traumatic leg and foot defects require collaboration between specialized plastic, vascular and orthopedic surgeons to ensure excellent vascular, bone and soft tissue assessment and to obtain satisfactory and optimum management for the patient.

Resuscitation and management of major life-threatening injuries takes precedence over treatment of the injured lower limb. Priority should be given, therefore, to the identification and control of vascular injury in the immediate post-traumatic period. Debridement of all devitalized tissue is crucial to final success of any reconstruction and often requires serial

operative debridement prior to final wound coverage.

When free tissue transfer is indicated in leg defect the free latissimus muscle flaps have the following advantages, high success rate, they can cover huge sized defects, better donor site cosmetic results, and wide caliber vascular pedicle, robust blood supply to the recipient area and less need for secondary thinning operations.

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## الملخص العربي

يعتبر إصلاح إصابات القدم والساق بمثابة تحدى نظرا لصعوبتها وضعف الأوعية الدموية لها وقلة الشراخ الجلدية الموضعية العشوائية حول القدم خصوصا عندما تكون الأوتار والعظام والأوعية الدموية والأعصاب مكتشفة نتيجة الإصابه.

وقد بدا استخدام الشراخ العضلية والعضلية الجلدية منذ السبعينيات من القرن الماضي حيث تميزت بأنها ذات تشريح ثابت وتعمل على زيادة تدفق الدم لمكان الإصابه ولكن وجد أنها تقتصر إلى الجانب الجمالي إلى حد ما وأنها سميكة.

وكان الهدف من هذه الرسالة هو التحقق من مدى نجاح استخدام الشريخه العضليه الظهرية العريضه لتعويض اصابات الساق وذلك للحالات التي تحضر استقبال وعيادة قسم جراحة التجميل بكلية الطب جامعة سوهاج فى الفتره من يونيو ٢٠١٣ حتى مايو ٢٠١٤.

وقد كانت النتائج كالتالى:

نسبة النجاح الكامل فى الحالات حوالى ٩٢,٣% وحاله واحده فقط من اجمالى ١٣ حاله كانت تعانى من فقد كامل. اصابات حوادث السيارات كانت بنسبة ٩٢,٣% من نسبة الاصابه، بينما اصابات اطلاق النار وقرح الجبس كانت تمثل ٧,٧% من الاجمالي. اعمار المصابين كانت تتراوح بين ٤ الى ٥٤ سنه. حجم الفقد بالجلد والانسجه يتراوح بين ٦٠ الى ٧٢٥ سم بمتوسط حوالى ١٨٤,١٥ سم. نسبة المشكلات كانت ٣٠,٨%. معدل اجراء عمليات ثانويه تكميليه كان ١٥,٤%. فترة المتابعه للحالات كانت تتراوح بين ٦ شهور الى سنه ونصف. ومن خلال هذه الرسالة تم استنتاج الاتى:

اصابات الساق تستلزم التعاون بين كلا من جراحى التجميل والعظام والأوعية الدموية للحصول على افضل النتائج. اجراء عملية تنظيف الجرح من الانسجه الميتة امر ضرورى لضمان نجاح عملية التعويض باستخدام الاشرائح الميكروسكوبيه. مميزات الشريخه العضليه الظهرية العريضه هي: نسبة نجاح عاليه، امكانية تغطية اصابات كبيره من ناحية المساحه، افضل من ناحية الشكل للجزء المانح للشريخه، كبر قطر الأوعية الدموية المغذيه للشريخه، توصيل دم اكثر للجزء المصاب و اقل من ناحية الاحتياج لعمليات ثانويه وتكميليه.