

REVASCULARIZATION OF A SUBTOTAL AMPUTATED EXTREMITY AND ITS SYNCHRONOUS FUNCTIONAL RECONSTRUCTION

SUBTOTAL AMPÜTE EKSTREMİTENİN REVASKÜLARIZASYONU VE EŞZAMANLI FONKSİYONEL REKONSTRÜKSİYONU

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ÖZET

Otuz yaşında erkek hasta, araç içi trafik kazası geçirdikten 2 saat sonra bölümümüz el cerrahisi ekibine danışıldı. Fizik muayenesinde sağ önkolda dolaşım kaybı, median ve ulnar sinirlerde yaralanma ve önkolda fleksiyon kaybı gözlemlendi. Ayrıca 14x7 cm. alanda cilt kaybı olduğu görüldü. Ven grefti ile brakial arter anastomozunu takiben median ve ulnar sinirler koapte edildi. Doku defektini kapatmak ve önkola fleksiyon kazandırmak için fonksiyonel latissimus dorsi kas-deri flebi dirsek ön yüzüne taşındı. Ancak ameliyat sonrası 3. ayda kasta ekskürsiyon problemi olduğu gözlemlendi. Bunu düzeltmek için kasın insersiyosu daha proksimal bir konuma taşındı. Ameliyat sonrası birinci yıl sonucu olarak dirsek eklemine tam fleksiyon gözlemlendi. İlk ameliyat sonucu yaşanan ekskürsiyon problemi intraoperatif yetersiz kas gevşekliğine bağlandı. Bu çalışmada, optimum sonuca ulaşmak için fonksiyonel kas transferi sırasında kas gevşekliğinin yakın monitörizasyonun önemi vurgulanmıştır.

Anahtar Kelimeler: Dirsek Rekonstrüksiyonu, Önkol Revaskülarizasyonu, Fonksiyonel Kas Transferi, Latissimus Dorsi Flebi

ABSTRACT

A thirty year old male patient presented to our hand surgery team 2 hours after a motor vehicle accident. His physical examination revealed lack of circulation in his right forearm with totally severed median and ulnar nerves and loss of forearm flexion. Additionally, a 14 x 7 cm skin area was lost. After brachial artery anastomosis with vein graft and median and ulnar nerve coaptation, a functional latissimus dorsi musculocutaneous flap was transferred to maintain elbow flexion and defect coverage. However, an excursion problem occurred in the post operative third month. In order to fix this, insertio of the muscle was transferred to a more proximal position. Post operative one year result was satisfactory with the complete flexion of the elbow. This problem appears to occur due to insufficient muscle relaxation during first surgery. In this report the importance of the monitoring anaesthesia and muscle relaxation during this type of functional muscle transfer was stressed to ensure optimum results.

Keywords: Elbow Reconstruction, Forearm Revascularization, Functional Muscle Transfer, Latissimus Dorsi Flap

INTRODUCTION

Major extremity amputations are generally seen with severe soft tissue injuries such as crush or avulsion injuries. Preservation of the function of the replanted or revascularized unit is as important as its viability. We present an elbow injury which was treated with revascularization and functional latissimus dorsi musculocutaneous flap.

CASE REPORT

A thirty year old male patient presented to our hand surgery team 2 hours after a motor vehicle accident. His physical examination revealed lack of circulation in his right forearm with totally severed median and ulnar nerves and loss of forearm flexion. Additionally, a 14 x 7 cm skin area was lost (Figure 1).

Intraoperative findings supported the initial physical examination findings. A 7 cm segment was lost

from the brachial artery. Median and ulnar nerves were seen ruptured. The biceps brachii tendon and bicipital aponeurosis, the brachialis muscle and its tendon, pronator teres muscle, flexor carpi radialis muscle, medial intermuscular septum and medial cutaneous nerve of the forearm were also injured with associated segmental tissue lost. It was impossible to repair these muscles because their segmental tissue lost, however if we could, this would be the best functional solution. Additionally, the brachioradialis muscle was partially severed.

A brachial artery anastomosis was performed using a saphenous vein graft in an end to end fashion. Median and ulnar nerves were repaired. The brachioradialis muscle was repaired with absorbable "U" sutures. The other muscle remnants were debrided and a functional latissimus dorsi muscle was transferred to maintain forearm flexion. The thoracodorsal neurovascular pedi-

cle was dissected carefully as far as its junction with the circumflex scapular vessels (after the branch to the serratus anterior muscle was ligated). A subcutaneous tunnel, located in the axillary region and upper arm, was created between the donor and recipient sites. Muscle insertion in the intertubercular sulcus was preserved and the thoracolumbar fascia of the transferred muscle was sutured to the radial forearm superficial fascia over the brachioradialis muscle. On the other hand this insertion would be done to the biceps brachii and brachialis muscle tendons if these muscles' tendons have not been totally severed. Suturing the thoracolumbar fascia to the proximal end of the radius and ulna bones was another option. But fixation to the superficial radial forearm fascia was strong enough.

Three months after the first operation, flexion of the forearm was insufficient (only 20°) because of lack of latissimus dorsi excursion. We, therefore, carried the origin (intertubercular sulcus) of the latissimus dorsi muscle to a more proximal position by drilling holes into the greater tubercle of the humerus. Also the tendinous portion of the latissimus dorsi muscle was shortened 5 cm to achieve appropriate excursion.

In the recovery period, an early active motion regimen and physical therapy were undertaken. As a result, the patient recovered M4 muscle power and complete forearm flexion (130°) at the end of one year (Figures 2-3). In addition, nerve recovery and hand function were satisfactory. Grasping and pinch powers were examined using a Jamar hydraulic hand dynamometer and hydraulic pinch gauge (Sammons Preston Rolyan, Bolingbrook, IL, USA). Pinch power of the right thumb was 57% of the non-injured hand, grasping power of the right hand was 75% of the non-injured hand. Sensation was tested with Semmes-Weinstein monofilament test in all digits of the injured right extremity. The values were 5.18 for the ulnar nerve and 5.88 for the median nerve (numbers indicate highest achieved



Figure 1. Preoperative view



Figure 2. Postoperative view



Figure 3. Postoperative functional result

monofilament index number). These results were correlated with EMG results. According to the Ipsen test, the patient scored 30.6 and by Chen criteria, he attained a class 3. Using the DASH test, he achieved a score of 60. Additionally, a biphasic flow pattern within the saphenous vein graft was documented on Doppler ultrasonography.

DISCUSSION

When a soft tissue defect occurs, the lower extremity has the advantage of providing sufficient local tissue flaps for reconstruction, however, the upper extremity is more limited. Therefore, distant or free flaps are essential when neurovascular structures, joints or bones of the upper extremity cannot be covered by local flaps.¹ The latissimus dorsi musculocutaneous functional flap is the hand surgeon's first choice when reconstructing the shoulder, elbow or finger²⁻⁴ as well as reconstructing tissue defects of shoulder, arm and forearm⁵⁻⁷, and has remained popular since its introduction in 1955 by Schottstaedt.⁸

Ma, et al. presented 20 cases using a pedicled latis-

simus dorsi flap to reconstruct large soft-tissue defects of the upper extremity.⁹ However, they did not define the vascular management of the patients who had Gustilo Type 3c injury. Another important study was published by Kawamura, et al. in 2007¹⁰, in which pedicled latissimus dorsi functional flap was used to reconstruct elbow flexion and extension in 17 patients. Most of these patients had brachial plexus injury and their post-operative results were satisfactory (11 patients reached grade 4 muscle strength).

We used the same latissimus dorsi flap to reconstruct the elbow defect and to maintain elbow flexion. But after the first operation, we have encountered an inappropriate excursion problem of the latissimus dorsi muscle. Although the thoracolumbar fascia of the latissimus dorsi muscle was attached as distally as possible, insufficient forearm flexion (20°) was noted. We, therefore, have changed the origin of the muscle from the intertubercular sulcus to a more proximal position. We have also shortened the tendinous portion of the muscle. As a result, the patient achieved 130° forearm flexion with M 4 muscle power.

We have not encountered such an excursion problem in our previous elective functional latissimus dorsi transfers (such as reconstruction of brachial plexus injuries or haemangiomas). We think that the maximum distal forearm point that was determined to inset the flap, was not the real maximum distal point. This problem appears to occur due to insufficient muscle relaxation during first surgery. Therefore, it is important to monitor anaesthesia and muscle relaxation carefully during this type of a functional muscle transfer to ensure optimum results.

CONCLUSION

We presented a case of revascularization and functional reconstruction of the right forearm using a latissimus dorsi musculocutaneous functional flap initially complicated by inappropriate excursion of the latissimus dorsi muscle. Sufficient patient relaxation under general anaesthesia during functional muscle transfer is the key point for optimum results in this type of surgery.

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