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Restoring elbow flexion with latissimus dorsi to biceps transfer in an incomplete brachial plexus injury: a case report

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ABSTRACT

A brachial plexus injury is a common injury to the peripheral nerves, which can impair upper arm motion and diminish the quality of life. A 19 y.o. male experienced weakness in his right upper extremity after undergoing an open reduction and internal fixation (ORIF) procedure for distal third radius and ulnar fracture fractures of the distal third of the radius and ulna four mo before the visit. Electroneuromyography revealed a dysfunction of the C4-T1 nerves, particularly affecting motor functions such as elbow flexion. The patient underwent latissimus dorsi advancement to biceps transfer with satisfactory results. The latissimus dorsi transfer procedure involves detaching a portion of the latissimus dorsi muscle and rerouting it to attach to the area where the biceps tendon inserts into the forearm. This transferred muscle can then be used to regain elbow flexion function. The latissimus dorsi is a powerful muscle, and transferring it offers the potential for greater restored elbow flexion strength and range of motion.

ABSTRAK

Cedera pada pleksus brakialis adalah cedera umum pada saraf perifer yang dapat mengganggu fungsi pergerakan lengan atas dan menurunkan kualitas hidup. Seorang laki-laki berusia 19 tahun mengalami kelemahan pada lengan kanan atas setelah menjalani prosedur *open reduction and internal fixation* (ORIF) untuk fraktur sepertiga distal radius dan ulna empat bulan sebelum kunjungan. Electroneuromyography menunjukkan adanya disfungsi saraf C4-T1, terutama yang mempengaruhi fungsi motorik, seperti fleksi pada siku. Pasien menjalani transfer latissimus dorsi ke bisep dengan hasil yang memuaskan. Prosedur transfer latissimus dorsi melibatkan pelepasan sebagian otot latissimus dorsi dan mengubah perlekatan otot agar menempel pada area tempat tendon bisep ke lengan bawah melekat. Otot yang ditransfer ini kemudian dapat digunakan untuk mendapatkan kembali fungsi fleksi siku. Latissimus dorsi adalah otot yang kuat, dan memindahkannya memberikan potensi pemulihan kekuatan fleksi siku dan jangkauan gerak yang lebih besar.

Keywords:
brachial plexus injury;
latissimus dorsi transfer;
case report;
latissimus dorsi;
biceps

INTRODUCTION

Brachial plexus injury (BPI) is a common injury to the peripheral nerves, primarily affecting young males aged 15-25 yr, who are in the prime of their working lives and can result in significant socio-economic impacts.[1] Unfortunately, there has been a rise in the occurrence of traumatic brachial plexus injuries, which present significant challenges to the overall well-being of the affected individuals. Therefore, it is crucial to expedite the restoration of function to enhance the patient's quality of life.[2]

Many surgical techniques have been developed in the last few years. Various procedures have been devised for muscle transfer, such as the pectoralis major, flexor-pronator muscle, and

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triceps-to-biceps transfer.[3] However, within this selection, there are consistent disadvantages that accompany the restoration of elbow function. We reported our experience in performing latissimus dorsi advancement to bicep transfer for individuals with BPI, particularly to restore elbow flexion.

CASE

The patient presented to the clinic with complaints of weakness in the right upper limb. He had a history of a traumatic accident four months earlier, which was initially suspected to have caused only caused a fracture. However, the weakness in the limb became apparent later, further medical evaluation. The neurological examination revealed dysfunction of the C4-T1 nerves (FIGURE 1A). Electromyography indicated a complete injury affecting the right median, ulnar, and radial nerves, as well as motor impairment in the right musculocutaneous and axillary nerves. Based on these findings, the patient was diagnosed with a closed traumatic incomplete BPI accompanied a united fracture of the distal third of the right radius and ulna.

We decided to perform a latissimus dorsi to biceps transfer to restore elbow flexion. The patient was placed in the lateral position under general anesthesia (FIGURE 2B). To ensure stability, we utilized buttock and abdominal support. A surgical incision was made, starting at the back of the midaxillary line and extending down to the region around the ribs and iliac crest, passing through the lower part of the axilla. The incision was deepened to locate the latissimus dorsi muscle, which was distinct from the serratus anterior muscle. All perforator vessels from the intercostal artery to the muscle were ligated. The neurovascular pedicle was located and conserved at the upper part of the incision. The humeral insertion was found between the tendons of the pectoralis major and the teres major muscles.

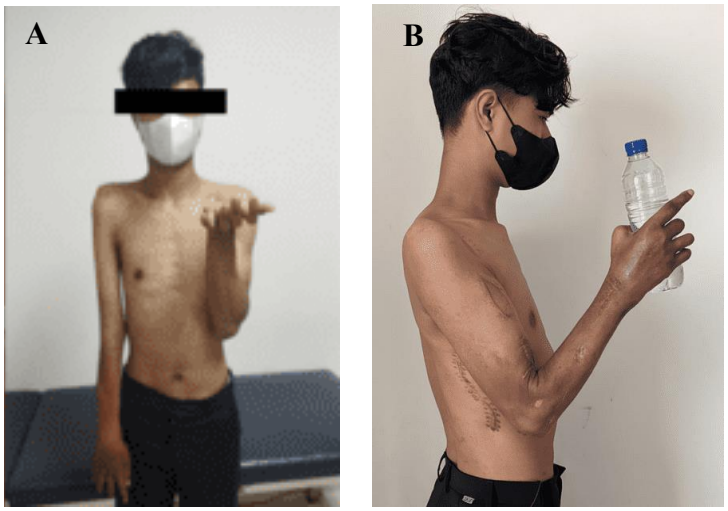

FIGURE 1. Preoperative compared post operative brachial plexus examination demonstrated disability of the function of the elbow extension.

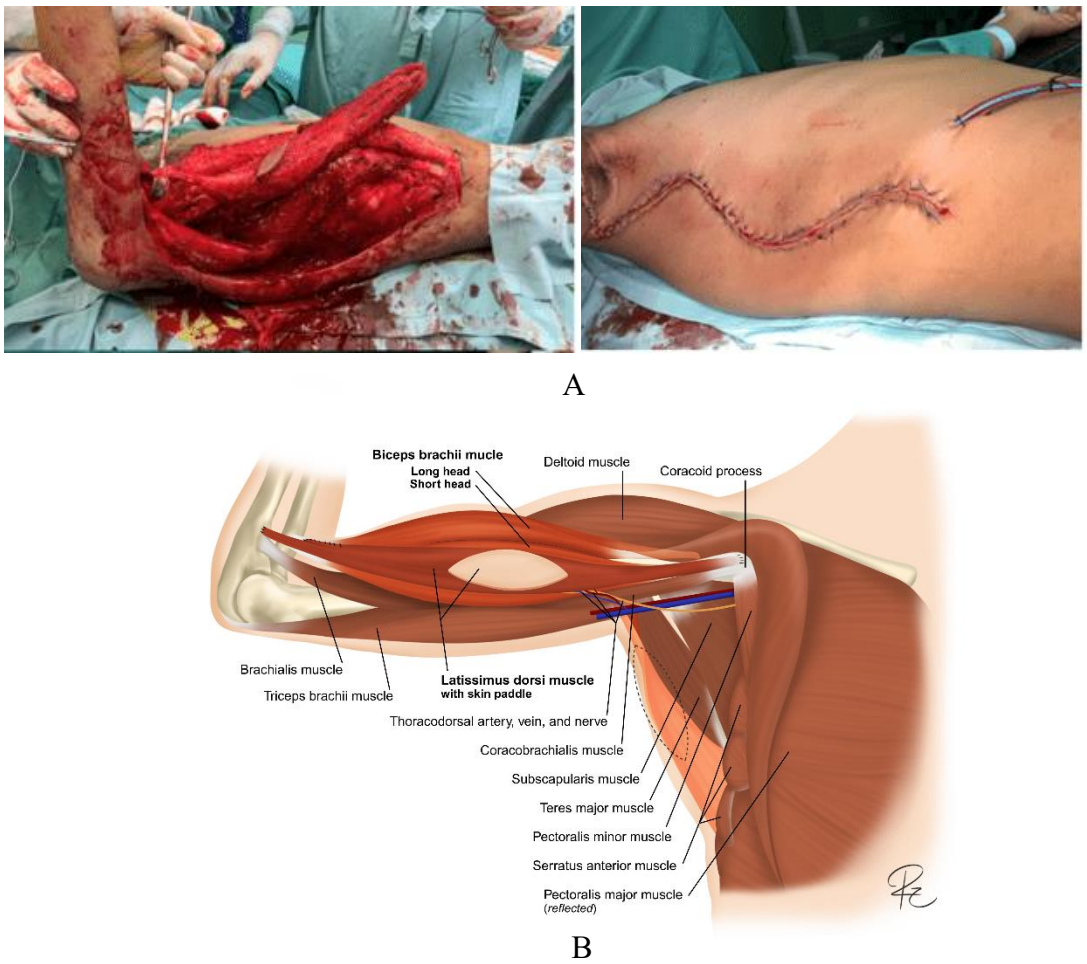

FIGURE 2. Surgical procedure depicting Lattisimus dorsi advancement to bicep transfer.

A deltopectoral approach was performed to reattach the proximal insertion of the pectoralis major. The origin of the latissimus dorsi muscle was sutured and tunneled, then introduced into the coracoid process through the conjoined tendon. The latissimus and biceps muscles were stitched together while the forearm was in the supination position should be FIGURE 2. The anterior aspect of the elbow was accessed via a horizontal line that aligns with the flexor crease of the upper arm. The attachment of the biceps muscle at the radial tuberosity was located and cleared of any debris.

The patient was immobilised with a shoulder abduction brace after surgery, which was positioned at 90 degrees of shoulder abduction and 100 degrees of elbow flexion. The patient began isometric exercises three weeks post-operatively and maintained the brace for 4-6 wk post-operatively. Subsequently, the patient-initiated range-of-motion exercises, commencing with passive exercises, followed by active exercises. The patient's exercises were then progressed to include strengthening exercises for elbow flexion. After a two-month follow-up, elbow function improved from 0 degrees to 120 degrees of flexion. The patient's muscle strength was evaluated post-operatively, revealing a score of 5 on the Medical Research Council (MRC) Scale. Furthermore, the functional outcome was assessed using the QuickDASH

scoring system, demonstrating a significant improvement from 77.3 pre-operatively to 43.2 post-operatively, indicating enhanced functional ability (FIGURE 1B).

DISCUSSION

Treatment objectives for BPI include hand reanimation, protective hand sensation, shoulder stability, and elbow function. Prioritizing elbow restoration in the hierarchy of upper extremity reconstruction is warranted, given its critical role in facilitating daily activities such as self-dressing, conducting personal hygiene, and engaging in a variety of activities.[4]

The latissimus dorsi was transferred to facilitate elbow extension and flexion. The latissimus dorsi was transferred to facilitate elbow flexion. The latissimus muscle was selected due to its elongated pedicle, morphology that facilitated contouring, and low donor morbidity. Due to these advantageous attributes, it has been employed in additional reconstructions, such as those of the trapezius, triceps, and deltoid, and most frequently to repair irreparable rotator cuff tears.[5]

The latissimus dorsi transfer procedure involves detaching a portion of the latissimus dorsi muscle and rerouting it to attach to the area where the biceps tendon inserts into the forearm. This transferred muscle can then be used to regain elbow flexion function. By transferring a strong and functional muscle like the latissimus dorsi, surgeons can restore a significant degree of elbow flexion, enabling patients to perform daily activities with greater independence. The latissimus dorsi muscle can be tailored during surgery to address specific needs. It can be used as a single flap (unipolar) or double flap (bipolar), depending on the extent of biceps paralysis. Compared to other muscle transfer options, the latissimus dorsi can be harvested with minimal long-term issues at the donor site on the back.[6,7]

There are several alternative methods for restoring elbow flexion in cases of brachial plexus injury, including the Oberlin and modified Steindler procedures.[8] The Oberlin procedure involves rerouting a nerve to enable biceps excitation. This procedure is less invasive compared to muscle transfer but requires the patient to have a functional biceps muscle and does not fully restore the range of elbow flexion.[9,10,11] In the modified Steindler procedure, elbow flexion is restored by transferring muscles such as the flexor carpi radialis, flexor carpi ulnaris, and sometimes the palmaris longus. Compared to latissimus dorsi muscle transfer, this procedure does not achieve optimal restoration of elbow flexion strength.[12,13]

This case report does not present a new technique or modification of a previous technique. Instead, the purpose of this case report is to provide an alternative approach or option for managing patients with brachial plexus injuries. Typically, patients with brachial plexus injuries undergo treatment with free functional muscle transfer (FFMT), which is a more complex procedure requiring specialized expertise, longer surgical procedures, and increased risk of morbidity and failure compared to the latissimus dorsi flap.[14]

The potential complications that may arise at the donor site following latissimus dorsi harvest for tendon transfer include visible scarring, which may pose cosmetic concerns for the patient. Additionally, there is a risk of post-operative hematoma formation, which can be effectively managed through the placement of a drain at the surgical site.[15]

CONCLUSION

Elbow function improves in

incomplete BPI patients following latissimus dorsi to biceps transfer. It is a recommended surgical procedure to restore elbow function with good outcomes. Our case highlights the effectiveness of latissimus dorsi to biceps transfer in significantly improving elbow function in patients with incomplete brachial plexus injuries. As a reliable and successful surgical intervention, this procedure offers renewed hope for restoring elbow function and enhancing quality of life.

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