Alkhooly Modification of Flexor-Plasty to Restor Elbow Flexion after Brachial Plexus Injury

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Abstract
Restoration of elbow flexion is of great importance for a good clinical and functional outcome. Depending on the level of injury and the degree of reinnervation there are different types of surgical procedure. The surgical goal is to restore good muscle strength through a range of elbow motion (30 to 130 degrees).

We introduced modification of flexor-plasty described by Steindler (1918) to restore elbow flexion after brachial plexus injury and paralysis of elbow flexor and the result was good after short period of follow.

INTRODUCTION
A mobile and stable elbow with adequate flexion strength is essential for adequate upper limb function in occupational, recreational and daily activities [1].

Damage to the brachial plexus produces considerable deficits in upper-extremity.

Total loss of elbow flexion is a very severe disability so restoration of elbow flexion is of great importance for a good clinical and functional outcome. The first factor to take into consideration is that we are attempting to achieve a flexible joint with a good range of motion. Therefore, tendon transfer on a stiff joint is pointless. In the case of a stiff joint, intensive physiotherapy is required to achieve an acceptable range of motion even with surgical release.

The most commonly used procedures are as follows:

(i) Transfer of the common origin of the flexor forearm muscles to a proximal section as described by Steindler (1918) [2]. Better results can be achieved via transfer of the common origin of the flexor forearm, 5 cm closer to the medial epicondyle, with bone attachment being preferred to periosteal attachment. This type of procedure provides nonsatisfactory outcomes when used in cases of complete elbow paralysis. In the case of resting elbow flexion following nerve transfer or as an accessory to other tendon transfer techniques, it provides us with better clinical results [3]. The Steindler technique may lead to disappointing outcomes such as elbow stiffness or over pronation;

(ii) Transfer of latissimus dorsi muscle to the tendon of the biceps brachialis provides great muscle strength, but this muscle is often denervated;

(iii) Transfer of pectoralis major brachial branch tendon to brachial biceps (Clark technique). A fused shoulder is required for the best postoperative result;

(iv) Transfer of triceps tendon to biceps provides good results not only with respect to muscle strength but also aesthetically [4].

MATERIAL AND METHOD
Male patient aged About 24 year with History of motor- Car accident since Two years
He suffered from open Wound in supra- Clavicular Area and shoulder of left side

Closure of the wound Has been done only in Other hospital and after Healing the patient Became unable to move left Upper limb with apparent wasting of muscles; only fingers and wrist both flexion and extension movement (Figure 1).

One year ago he was Diagnosed as brachial plexus Injury and operative inter-Ference has been done (neuritization) in other Hospital, and physiotherapy to left upper limb but the result was not good

Operative procedures to restor elbow flexion
Flexor- plasty was done with some modification

1. Curved longitudinal incision over the medial side of the elbow beginning 7.5 cm proximally and extending distally behind the medial epicondyle and then anteriorly

2. Location of the ulnar nerve and retract it posteriorly and
detach en bloc the common flexor origin from the tip of medial Epicondyle with its bony attachment (tiny part) with modification (Figures 2,3).

**Alkhooly modification**

Exclude origin of pronator teres (humeral head- the larger head- which arise from supracondylar ridge: to avoid more pronation of forearm and avoid tension on median nerve).

3. Free the common flexor origin of muscles (with above exclusion) distally for 4 cm and then with the elbow in flexion transfer them 5 cm proximal to the medial epicondyle to be attached to the anterior surface of the humerus ... to minimise the loss of supination

4. The transferred origin With part of bone was put into hall in anterior Surface of the humerus And tied with pull-out Suture in posterior surface the of humerus (Figure 4).

5. Closure of the wound, above elbow cast in flexion above-90-degrees for 6 weeks (Figure 5).


7. The patient was sent to department of physiotherapy and rehabilitation where he received the full program for elbow rehabilitation.

**RESULTS**

The period of follow up ten months

Good range of movement of elbow joint in short period of follow up and the patient can flex and extend elbow joint without support (Figure 6,7) also movement in wrist and fingers.

The movement of elbow joint was improved with follow up.

The patient not suffering from neuropathic pain.

In last follow up we advice the patient for other operation in shoulder region to support elbow movements.

**DISCUSSION**

The loss of active elbow flexion is disabling, particularly when the hand is functional. Several procedures have been devised to restore elbow flexion: Steindler flexorplasty and its modifications [5-11], anterior transposition of the tri-iceps tendon [10], transfer of the pectoralis major to bi-ceps [12-16], shoulder arthrodesis and sterno-mastoid transfer with the addition of a fascia lata graft to the biceps tendon [17], neurotization [18-21], free muscle transfer [18,22], and unipolar or bipolar transfer of the latissimus dorsi [23-28].

One of the earliest procedures for restoring function to the elbow, the Steindler flexorplasty 1918, is still preferred by
many surgeons [29]. In this procedure the origins of the flexor-pronator mass—including the pronator teres (PT), flexor carpi radialis, flexor carpi ulnaris, palmaris longus, and a portion of flexor digi-torum superficialis—are moved proximally onto the humeral shaft, 4 to 6 cm above the medial epicondyle of the humerus, thereby increasing their elbow flexion moment arms. The bony medial epicondyle may be transferred along with the muscles, causing the muscle origins to be up to 2 cm anterior to the surface of the humerus [29].

In an effort to decrease the incidence of pronation contractures frequently seen after the originally described procedure, Mayer and Green [29] modified the Steindler flexorplasty by moving the muscle attachment laterally toward the center line of the humeral shaft. The degree to which this modification accomplished its goal is unclear because pronation contractures still are seen after surgery.

In our case we exclude origin of pronator teres (humeral head-the larger head which arise from supracondylar ridge) from common origin transfer to avoid more pronation of forearm and avoid tension on median nerve. This gives good result without pronation contractures.

**CONCLUSION**

Steindler flexorplasty with new modification is a simple, effective and reliable procedure for the restoration of elbow flexion even if associated with other procedures.

N.B. patient is aware of the details of the surgery and its complications and what the mechanism and its results may perform and agreed to do so and approved in writing.

We do operation after consent of patient and he is aware of everything and expected result of operation.

**REFERENCES**


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