Case Report

Functional outcome of modified Jones procedure in patient with non-union Humerus and high radial nerve palsy: A case report

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ABSTRACT

Background: Middle to distal humeral fractures can cause high radial nerve palsy. A tendon transfer surgery can be performed to treat irreversible and longstanding radial nerve palsy in order to improve the lost hand function.

Case report: A 39-year-old right-handed female office worker presented with deformity in her left arm and drop hand. She had a motorcycle accident a year before and was treated by a traditional bonesetter. The extension movements in her left wrist and fingers were restricted. We performed an ORIF with bone graft at her left nonunion humerus and also tendon transfer procedure to treat the high radial nerve palsy. We use the modified Jones procedure to attach the palmaris longus to the extensor pollicis longus. After that, we attached the flexor carpi radialis to extensor digitorum communis and extensor carpi radialis brevis with the Pulvertaft technique. After five months of follow up, the patient finally can extend her wrist and thumb.

Conclusion: Modified Jones procedure is a viable option to treat high radial nerve palsy with great functional outcomes after 5 months of follow up.

Introduction

Fractures of the humeral shaft contribute to 1–3% of musculoskeletal fractures. The fracture is usually caused by a low-energy injury mechanism. Meta-analysis of 21 studies showed that the incidence of radial nerve palsies caused by humeral shaft fractures is 1.18% (532/4517), with middle to distal humerus as the most common site [1]. Permanent nerve dysfunctions can be treated by reconstructive surgeries i.e. tendon transfers, especially for longstanding radial nerve palsy in order to improve the lost hand function. Tendon transfer surgery can be called successful if it can restore pre-injury functions of the wrist and fingers without any significant motor deficit on the hand [2].

Case report

A 39-year-old female came to our clinic with a deformity in her left arm and drop hand after previous road traffic injury. One year

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before, the patient had a motorbike accident and fell to the left side. The patient is a right-handed office worker who has to drive a motorbike to her work office. After the accident, she felt numbness, tingling, and weakness in her left arm. She cannot extend her elbow, wrist, and fingers. She was then treated by a traditional bonesetter but the symptoms do not improve.

Clinical findings

The inspection of the left arm showed the presence of deformity with no redness or swelling. There was no tenderness, but crepitation was felt on palpation. Active range of motion (ROM) was impaired. The patient could not do finger and wrist extensions. Elbow flexion and extension were also limited.

Diagnostic assessment

The pre-operative AP/Lateral X-ray of left humerus showed non-union humerus bone fracture with pseudoarthrosis (Fig. 1A, B). The patient was then diagnosed with a non-union left humerus and left high radial nerve palsy based on clinical findings and the imaging result.

Fig. 1. Preoperative X-ray of left humerus: non-union humerus bone fracture with pseudoarthrosis (A) AP view (B) lateral view; postoperative X-ray of left humerus: fixation using plate and screw from anterior approach (C) AP view (D) lateral view.

Fig. 2. Tendon transfer procedure using modified Jones procedure: (A) PL identification, (B) attaching PL to EPL, (C) EDC and ECRB identification, (D) FCR identification, and (E) attaching FDC to EDC and ECRB with Pulvertaft technique. PL: palmaris longus, EPL: extensor pollicis longus, FCR: flexor carpi radialis, EDC: extensor digitorum communis, ECRB: extensor carpi radialis brevis.
Therapeutic intervention

We performed an open reduction and internal fixation (ORIF) with bone graft to treat the nonunion humerus (Fig. 1 C, D). The tendon transfer surgery was performed using modified Jones procedure to attach palmaris longus (PL) to extensor pollicis longus (EPL). We attached flexor carpi radialis (FCR) to extensor digitorum communis (EDC) and extensor carpi radialis brevis (ECRB) with Pulvertaft technique (Fig. 2). The patient received post-operative care. The left arm was immobilized using splint for six week. After that, we began early mobilization with active and passive ROM exercises.

Follow-up and outcomes

The patient was followed up clinically at one-month intervals. Based on Medical Research Council (MRC) for Muscle Scale, the muscle strengths were 5/1, 5/1, 5/1, 5/2, and 5/3 for wrist extension and 5/1, 5/1, 5/1, 5/2, and 5/3 for elbow flexion at 1st, 2nd, 3rd, 4th, and 5th month of follow-up respectively. The ROM also improved significantly. After five months of follow up, the functional outcome was good enough for the patient to be actively involved in her daily routine, drive her motorbike, and do her pre-accident job as an office worker (Fig. 3).

Discussion

Deep to the axillary artery, the radial nerve passes over the latissimus dorsi muscle [2]. The most common nerve lesion complicating long bone fractures is radial nerve palsy linked with humeral shaft fractures [3,4]. The incidence rate of radial nerve palsy is 2–17 % [5]. It is usually treated conservatively, but in some cases, nerve exploration surgery is needed. A tendon transfer surgery is indicated when the conservative treatment failed to give functional improvement after 4 months [3]. In our case, the patient had already been injured for one year with no functional improvement, so she was scheduled for surgery [6].

Several conditions should be assessed before a tendon transfer surgery: (1) supple joints prior to transfer, the joint should have a maximum score of passive range of motion before the surgery; (2) soft tissue equilibrium, the tissue maturation before surgery; (3) sufficient donor tendon excursion, similar to the original tendon, to restore the recipient muscles’ function; (4) adequate donor tendon strength; (5) expendable donor tendon; (6) donor motor site that can be pulled in a straight line from the recipient insertion site; (7) synergism of contractile period of the donor tendon with the previous tendon, and (8) single tendon function per procedure [7].

Jones transfer is the most popular procedure for tendon transfer. Classic Jones transfer is done by transferring PL to EPL, PT to ECRB, and FCR to EDC. The procedure requires a large incision, which requires a longer surgery duration, causes the bulging of pronator teres muscle, and leaves multiple scars [8,9]. We performed a modified Jones procedure as it provides a good functional result for the patient with better cosmetic results [10]. PL has often used as a donor tendon to restore the extension function of the thumb, whereas FCR is often used to restore the function of finger extension. The Pulvertaft weave (PW) is the most popular for tendon grafts and tendon transfer operations. PW is performed by weaving Flexor Digitorum Superficialis (FDS) through three different incisions in

Fig. 3. Functional outcome of the patient five months after surgery: improved range of movement of (A) thumb extension, (B) finger extension, (C) finger flexion, (D) elbow flexion, (E) elbow extension, and (F) wrist extension.
the Flexor Digitorum Profunda (FDP). At the free-end of each tendon one double-loop suture was made, after that, mattress sutures is performed in between. The mattress sutures connect the tendons with two points of connections: at the top of the loop and at the end of the stitch [10].

In this case, we performed a modified Jones procedure by suturing PL to EPL and FCR to ECRB and EDC with the Pulvertaft technique (Fig. 4). The main limitation of this procedure is that the donor tendon’s length is long not enough for the tendon transfer and that the palmaris longus tendon is not always found in all patients.

The surgery is usually followed by post-operative care by using a cast or splint. In the sixth week, the splint can be removed. Early mobilization can start from 4 to 6 weeks after the surgery. Early mobilization is achieved by active and passive ROM exercise. After that, the physiotherapist will muscle training. In our case, the patient had good ROM improvement and was able to actively use her left arm for daily activity 5 months after the surgery [10].

Conclusion

Radial nerve palsy can result from humeral shaft fracture. Modified jones procedure is a viable option to treat high radial nerve palsy with great functional outcome after 5 months of follow up.

CRediT authorship contribution statement

APS and MRS performed manuscript draft writing, conceptualization, and resources. GDP and DK performed a critical review and editing of the manuscript. All authors have checked the final version of the manuscript.

Conflict of interest

The authors declared no conflict of interest.

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Informed consent

Patient has consented the publication of this case to the journal.

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