

Drop hand treated with modified jones transfer

Meirizal, Sudaryanto, Rahadyan Magetsari

ABSTRACT

Introduction: The radial nerve is the most frequently injured nerve caused by fractures of the humeral shaft. Loss of hand function secondary to radial nerve injury can dramatically impair the person's ability to perform normal activities of daily living. When nerve repair is not possible or the window of opportunity for nerve repair is missed, tendon transfers can be done to restore lost functions. **Case Series:** There were 2 cases of drop hand, the first patient was male, 30-year-old with close fracture of middle third of the right humerus with radial nerve palsy due to motorcycle accident. From electroneuromyography (ENMG) examination the nerve lesion was said to be a neurotmesis. The patient underwent open reduction followed with plating of the humeral fracture, and nerve repair. After six months, the drop hand still remain and then the patient underwent tendon transfer (Jones procedure); palmaris longus (PL) transferred to extensor pollicis longus (EPL), pronator teres (PT) transferred to extensor carpi radialis brevis (ECRB), flexor carpi radialis (FCR) transferred to extensor digitorum communis (EDC). **Second patient** was male 28-year-old with close fracture of middle third of the right humerus with neurotmesis of radial nerve due to motorcycle accident. The patient underwent open reduction, plating

of humeral fracture, and nerve repair. After five months follow up drop hand still remain then underwent tendon transfer (modified Jones procedure); PL transferred to EPL, FCR transferred to EDC and ECRL. There was good result after operation of the patient with tendon transfers. Both patients can extend wrist, extend the finger and extend the thumb. **Conclusion:** Both patients with Radial nerve palsy treated with tendon transfers showed good clinical results and improvement of the hand function.

Keywords: Jones transfer, Radial nerve palsy, Tendon transfers

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INTRODUCTION

One of complication of the humeral shaft fracture is Radial nerve palsy. The radial nerve is the most frequently injured nerve caused by fractures of the humeral shaft because the radial nerve lies in contact with diaphysis of the humerus [1]. Radial nerve injury caused by humeral fracture for about 10–17% of all humeral fracture. Clinical sign of radial nerve injury is drop hand where the patient cannot extend the wrist and thumb. Neuropraxia commonly happened in close fracture of middle third of the humerus and it can recovered without any surgical management [2]. In some cases after several time of injury, in patient in non-operative management there

could be delayed union, mal union, or non-union of the fracture do end up with or without recovery of the radial nerve. The delay in nerve recovery could be due to nerve being transected or crushed during the time of injury [3, 4]. Therefore nerve exploration is performed in some cases when there is no sign of spontaneous recovery within three months [3]. In patient with certain sign of the radial nerve palsy should be treated operative management by ORIF of the humerus with radial nerve exploration. If the nerve is transected and repairable, end to end repair will be attempted. If the nerve is not repairable, other nerve procedures, such as nerve transfer or nerve grafting, should be considered [5].

Loss of hand function secondary to radial nerve injury can dramatically impair the person's ability to perform normal activities of daily living. When nerve repair is not possible or the window of opportunity for nerve repair is missed, tendon transfers can be done to restore lost functions especially restore wrist extension, finger extension, and thumb extension [6]. In order for successful return of function, tendon transfer should be meet the principles such as : Tissue Equilibrium (Resolution of Wound Healing, Bony Union, and Correction of Contractures), Expendable Donor, Adequate Strength, Appropriate Excursion, Straight line of Pull, One Tendon – One Function, Synergism [7].

One of the famous techniques to treat radial nerve palsy was Jones transfer. In classic Jones transfer, PL transferred to EPL, PT transferred to ECRB, and FCR transferred to EDC. In this technique require large incision which cause multiple scar, long surgery duration, and bulging of the pronator teres. Then developed modified Jones transfer where the PL transferred to EPL and FCR transferred to EDC and ECRL [8]. This technique was better than the classic Jones transfer because of smaller incision with better cosmetic, quicker surgery duration, and no bulging of the pronator teres.

The purpose of this paper is to report the successful treatment of two cases of radial radial nerve palsy coming to surgery after nerve injury treated with classic Jones transfer and modified Jones transfer.

CASE SERIES

Case 1

The first patient was male, 30-year-old right handed gentleman working as a bricklayer with close fracture of middle third of the right humerus with radial nerve palsy due to motorcycle accident. From ENMG examination the nerve lesion was said to be a neurotmesis. The patient underwent open reduction followed with plating of the humeral fracture, and nerve repair. After six month of surgery the patient could not extend the wrist and fingers.

The patient was a well-developed, muscular man whose only positive physical findings were limited to the right upper extremity. The triceps muscle and the entire

extensor apparatus of the right forearm were atrophied. The brachioradialis, extensor carpi radialis longus and brevis muscle bundle was atrophic. He could not extend the wrist and the proximal phalanges of the fingers or the thumb. Extension of the elbow against gravity was present. There was no hypoesthesia in the right arm. Passive motion of the joints was unrestricted, the hand, wrist and fingers were held in a position of extreme flexion. The thumb was cupped in the hollow of the flexed fingers. The flexor musculature of the wrist and fingers was active and strong. The palmaris longus tendon was palpable. Radiographic examination of the right forearm showed there was fixation system of the right humerus using narrow plate 7 hole with 6 screws.

Then the patient underwent tendon transfer, according Jones procedure, which consist of trasfering some tendon: PL transferred to EPL, PT transferred to ECRB, FCR transferred to EDC.

Postoperatively, there was slight edema of the dorsum of the wrist. Two weeks after surgery, the dressing was changed, all suture were removed, and a new splint was applied. One week latter the splint was removed and passive and active motion allowed. Three months following surgery the patient had achieved what appeared to be maximum range of motion of the right arm and hand as seen in Figure 1. The patient can extend the wrist, extend the thumb and extend the fingers. He

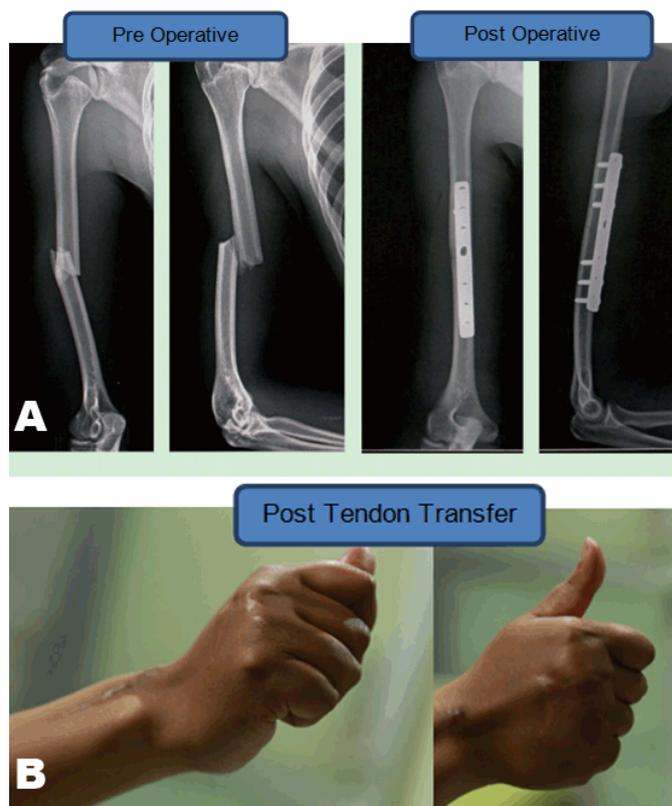


Figure 1: Plain X-ray pre-operative and post-operative. Open Reduction and Internal Fixation of first patient (A). Clinical picture of the first patient six months after tendon transfer, patient can extend the thumb and wrist (B).

was completely satisfied with the results, found his right hand entirely useful, and did not notice any limitation of function. Compared with other hand, there was less strength. Examination revealed full pronation and supination of the right forearm. Flexion power of fingers and wrist was grossly equal bilaterally. Extension on the right side was forceful but weaker than on the left. There was full and equal flexion of the wrist with complete finger extension.

Case 2

Male, 28 years old righthanded working as a carpenter diagnosed as close fracture of middle third of the right humerus with radial nerve palsy due to motorcycle accident. From ENMG examination the nerve lesion was said to be a neurotmesis then the patient underwent open reduction followed with plating of the humeral fracture, and nerve repair. After 6 month of surgery the patient unable to extend the wrist and thumb.

The patient was a physically healthy with normal physical findings on another examination. The local examination of the right upper extremity was similar to the previous case such as brachioradialis, extensor carpi radialis longus dan brevis muscle bundle was found to be atrophic and the patient could not extend the elbow. Radiographic examination of the right forearm showed there was fixation system of the right humerus using narrow plate 8 hole with 6 screws (Figure 2).

Then the patient underwent tendon transfer, according modified Jones procedure, which consist of



Figure 2: Plain X-ray pre-operative and post-operative. Open Reduction and Internal Fixation of second patient (A). Clinical picture of the second patient six months after tendon transfer, patient can extend the thumb and wrist (B).

transferring some tendon: PL transferred to EPL, FCR transferred to EDC and ECRL.

Postoperatively, there was slight edema of the dorsum of the wrist. Two weeks after surgery, the dressing was changed, all suture was removed, and a new splint was applied. One week later the splint was removed and passive and active motion allowed. Three months following surgery the patient had achieved what appeared to be maximum range of motion of the right arm and hand. The patient can extend the wrist, extend the thumb and extend the fingers. He was completely satisfied with the results, found his right hand entirely useful, and did not notice any limitation of function. Compared with other hand, there was less strength. Examination revealed full pronation and supination of the right forearm. Flexion power of fingers and wrist was bilaterally equal. Extension on the right side was forceful but weaker than on the left. There was full and equal flexion of the wrist with complete finger extension.

DISCUSSION

Neuropraxia is the most type of the radial nerve injury in the humeral shaft fracture. Neurapraxia (first-degree Sunderland, first-degree Seddon) is the mildest injury that affects only myelin without Wallerian degeneration or axonal cell death causes temporary blockade of nerve impulse transmission. It takes about 8–12 weeks to recover with process of remyelination [9]. Therefore, the nerve exploration is indicated in order to find out the nerve status whether it is still in continuity or transected. If the nerve is intact there are 2 possibilities the neuropraxia and the axonotmesis, if the nerve is transected, it means neurotmesis and nerve repair must be done without tension [10]. Axonotmesis is when there is an injury to the axon within intact endoneurium. Wallerian degeneration occurs distal to the lesion within hours post injury and the proximal stump of the axon will proliferate and regenerate the new axon distally within the endoneurial tube until reach the target tissues about 1mm/day [11]. Neurotmesis is a complete severance of the nerve trunk involving the endoneurium, perineurium, and epineurium or when there is total cut of the nerve. The distal and proximal stump of the axon will undergo Wallerian degeneration and the proximal axon will regenerate new axon, therefore if there is no neural tube the regeneration will loss its direction and divert to the surrounding soft tissues if left untreated [12]. The nerve transfer and nerve grafting should be considered if the nerve is not repairable or presence of large nerve gap.

Irreparable or long-standing radial nerve injury is treated with tendon transfers to restore wrist extension, finger extension, and thumb extension [13]. Most surgeons have used the pronator teres (PT) to extensor carpi radialis brevis (ERCB) transfer to restore wrist extension. Restoration of finger extension may be done by transferring the flexor carpi radialis (FCR), flexor carpi

ulnaris (FCU), or flexor digitorum superficialis (FDS) to extensor digitorumcommunis (EDC). Restoration of thumb extension may be done by transferring palmaris longus (PL) to extensor pollicis longus (EPL) [14].

In this study both of the patient suffered humeral shaft fracture with radial nerve injury neurotmesis type. Immediate after the injury the patient was treated with exploration, open reduction and internal fixation of the humeral shaft then proceed with radial nerve direct repair end to end epineuroraphy. After 6 month of follow up, there were no recovery of the radial nerve function for thumb, finger and wrist extension [15]. Then both the patient underwent tendon transfer with the technique of classic Jones transfer by transferring PL to EPL, PT to ECRB, FCR to EDC, and modified Jones transfer by transferring PL to EPL, FCR to EDC and ECRL [5]. Despite all measures the most important management is the post-transfer therapy in order to ensure the successful outcome tendon transfers. It consists of post-operative rehabilitation exercises, scar management as well as muscle tendon reeducation. The hand was in this case immobilized in the position of the wrist in 45 degrees of extension, the MCP in 90 degrees of flexion and the interphalangeal (IP) joints are in extension. The thumb is extended and abducted within the splint. The immobilization was continued for four to five weeks before the formal occupational therapy session started [7].

After underwent tendon transfers both of the patient showed good clinical result marked by the return of the hand function which is measured by quick DASH score. The quick DASH score is abbreviated version of the original DASH score that measures an individual's ability to complete tasks, absorb forces, and severity of symptoms of the patient's hand. The result of the quick DASH measurement was 33.3 for 1st patient and 31.8 for 2nd patient. Both of the patient can extend the thumb, finger and wrist. The advantage of the modified Jones transfer compares to the classic Jones transfer are: the duration of surgery was quicker, the incision is smaller, better cosmetic result, and no bulging at pronator teres. This modified Jones transfer technique can be used as one of the methods for the reconstruction of wrist, fingers and thumb extension in patients with radial nerve palsy with favorable outcome.

CONCLUSION

This case report showed that both modified and classic Jones transfer had equally good clinical outcome, but modified Jones transfer had some advantages such as faster duration of surgery, smaller incision, better cosmetic result, and no bulging at pronator teres.

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Author Contributions

Meirizal – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Sudaryanto – Substantial contributions to conception and design, Drafting the article, Final approval of the version to be published

Rahadyan Magetsari – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Conflict of Interest

All authors disclose any financial and personal relationship with other people or organization that could inappropriately influence (bias) this work.

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