

# Isolated Musculocutaneous Nerve Palsy after the Reverse Total Shoulder Arthroplasty

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Reverse total shoulder arthroplasty has been performed with promising results in rotator cuff tear arthropathy. However, the global complication of the reverse total shoulder arthroplasty is relatively higher than that of the conventional total shoulder arthroplasty. Neurologic complications after reverse total shoulder arthroplasty are rare but there are sometimes remaining sequelae. The cause of the neurologic complication is multifactorial, including arm traction, position and the design of the implant. Most cases of neurologic palsy following reverse total shoulder arthroplasty occur in the axillary nerve and the radial nerve. The authors report on a case of a 71-year-old man with isolated musculocutaneous nerve palsy after reverse total shoulder arthroplasty with related literature.

(Clin Shoulder Elbow 2016;19(2):101-104)

**Key Words:** Rotator cuff arthropathy; Musculocutaneous nerve palsy; Reverse total shoulder arthroplasty

Reverse total shoulder arthroplasty can produce good results in patients with an arthritic rotator cuff deficient shoulder. However, in a recent systemic review on reverse total shoulder arthroplasty, the global complication rate was reported relatively high as much as 24%.<sup>1)</sup> Neurologic complications following reverse total shoulder arthroplasty are rare but there are sometimes remaining sequelae.<sup>1,2)</sup> Most cases of neurologic palsy after reverse total shoulder arthroplasty occur in the axillary nerve and the radial nerve.<sup>1)</sup> The author reported a case of a 71-year-old man with isolated musculocutaneous nerve (MCN) palsy after reverse total shoulder arthroplasty for rotator cuff tear arthropathy with related literature.

## Case Report

A 71-year-old man presented with a chief complaint of the right shoulder pain for 2 years. He reported no antecedent trauma or neurologic symptoms and his previous clinical history was unremarkable. Pain was exacerbated with attempted overhead activities. On physical examination, the active forward elevation of the right shoulder, the passive forward elevation, the inter-

nal rotation, and the external rotation at arm at side were 70°, 120°, buttock, and 30°, respectively. Preoperative radiographic demonstrated the cuff arthropathic change of the shoulder with Hamada grade 3, defined as erosion and so-called acetabulization of acromion with narrowing of the subacromial space to ≤5 mm (Fig. 1A).<sup>3)</sup> The patient was diagnosed with rotator cuff tear arthropathy. Despite conservative management for 3 months, the patient complained of sustained symptoms at the right shoulder and underwent reverse total shoulder arthroplasty.

The procedure was performed in the beach-chair position under general anesthesia using a standard deltopectoral approach. A chronic and full-thickness subscapularis tear was observed during exposure. A thorough release of the tendon was done to reattach the subscapularis tendon to the lesser tuberosity without tension. Release at the subcoracoid space was done using a finger in order not to damage the brachial plexus.

The bone preparation was performed using a routine method. Non-cemented humeral stem type reverse shoulder system (Biomet, Warsaw, IN, USA) was used (Fig. 1B). Final components showed an acceptable range of motion, good stability, and no toggle under distal traction. The subscapularis tendon and joint

**Received** October 28, 2015. **Revised** February 24, 2016. **Accepted** March 20, 2016.

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**Financial support:** None. **Conflict of interests:** None.

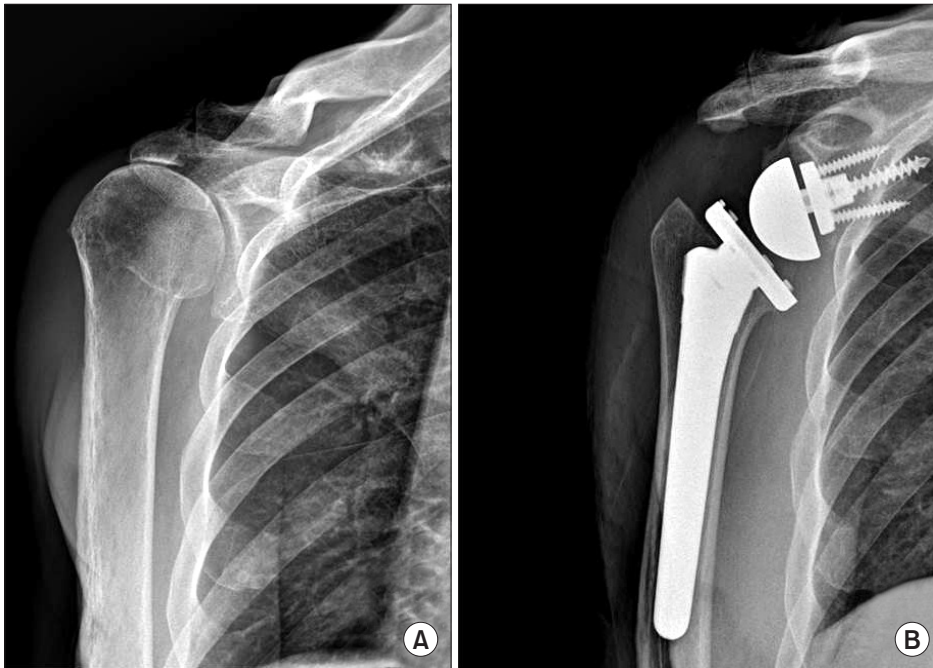


Fig. 1. Plain anteroposterior radiograph. (A) Preoperative image showed superior migration of the humeral head, erosion of the undersurface of the acromion with reduction in the subacromion space. (B) Postoperative image showed the distalization of the humerus from the acromion.



Fig. 2. Clinical photograph at follow-up 6 months postoperatively. (A) The patient showed 140° of the active elevation of the operative shoulder. (B) The patient showed the resolution of the musculocutaneous nerve palsy completely without any effect on the functional outcome.

capsule were reattached to the lesser tuberosity of the humerus.

In the postoperative care unit, the patient could not flex the ipsilateral elbow immediately postoperatively. Examination showed marked weakness of right biceps brachialis (grade 2), reduced biceps and brachialis reflex, no tenderness, and reduced sensation in the lateral forearm. The operated shoulder was placed in an abduction brace for 6 weeks. During that time, only range of motion exercise of the elbow and pendulum-type exercise was allowed. Passive range of motion exercises were

initiated after 6 weeks from the surgery, beginning with forward flexion. Electromyogram 4 weeks postoperatively indicated MCN mononeuropathy and no evidence of axonal discontinuity. The patient showed improvement of the active flexion of the elbow at 6 weeks postoperatively. At 6 months postoperatively, the MCN lesion resolved completely with no effect on the functional outcome (Fig. 2). Electromyogram 1 year postoperatively showed mild sequelae of the right MCN lesion in chronic status. The clinical outcome was increased from 22 to 68 in the Con-

stant score. The active forward elevation of the right shoulder, the internal rotation, and the external rotation at arm at side were 140°, L5, and 45°, respectively at the last follow-up of 18 months.

## Discussion

This case may offer new informations on isolated MCN palsy after reverse total shoulder arthroplasty. The rate of 1% to 2% has been reported for neurologic complications after reverse total shoulder arthroplasty.<sup>1,2)</sup> The most common neurologic complication is radial nerve palsy which accounts for 66.7% of the cases with neurologic complication. However, most cases were related to the humerus fracture during the follow-up after the operation.<sup>1)</sup> The study by Lädermann et al.<sup>4)</sup> reported that abnormal finding on the electromyographic evaluation following reverse total shoulder arthroplasty was mainly observed on the axillary nerve. To the best of our knowledge, only one case of MCN palsy following reverse total shoulder arthroplasty has been reported.<sup>5)</sup> However, it is unclear whether or not the case was isolated MCN palsy because the MCN palsy in the report was combined with other neurologic complications. To the best of the author's knowledge, the isolated MCN palsy has not been reported.

The MCN arises from the lateral cord of the brachial plexus, then passes through the coracobrachialis muscle and traverses between the brachialis and biceps brachii muscles. The terminal MCN pierces the deep fascia as the lateral antebrachial cutaneous nerve, which innervates the lateral aspect of the forearm.<sup>6)</sup> The MCN is fixed at the place where each point pierces the coracobrachialis muscle and the lateral side of the biceps aponeurosis.<sup>6)</sup> The MCN might be prone to traction injuries in lesions which the nerve is fixed.<sup>6)</sup>

The cause of neurologic complication after reverse total shoulder arthroplasty is multifactorial, including intraoperative traction, manipulation of the arm, retractor placement, or relative lengthening of the arm.<sup>7)</sup> During exposure of the glenoid using a deltopectoral approach, the humerus is posteriorly retracted, externally rotated, and abducted, which may accentuate traction across the brachial plexus.<sup>7)</sup>

The inadvertent placement of retractors in this patient could also cause isolated MCN palsy. According to the cadaveric study by McFarland et al.,<sup>8)</sup> the minimal distance from the MCN to the glenoid was 5 mm. The MCN was within 1.5 cm of the glenoid rim at 0°, 60°, and 90° shoulder abduction in all arm positions. Retractors placed anterior to the subscapularis muscle might make contact with the MCN in all positions. Therefore, retractors should be placed between the subscapularis and the capsule because the nerves were protected from the retractors by the subscapularis.

The Grammont-type reverse total shoulder arthroplasty re-

verses the shoulder ball and socket, medializes and distalizes the shoulder center of rotation in patients with cuff tear arthropathy. This design converts the normal shear forces into compressive forces, creating a rotational moment and enabling the deltoid to raise the arm by means of medializing the center of rotation and distalizing the humerus increases the tension on the deltoid. Biomechanically, the Grammont-type reverse total shoulder arthroplasty lengthens the arm by an average of 2 to 3 cm,<sup>4)</sup> and therefore can put strain on the brachial plexus. Van Hoof et al.<sup>9)</sup> reported the degree of strain placed on elements of the brachial plexus using 3-dimensional computer modeling in the reverse total shoulder arthroplasty. Their model calculated direct prosthesis-related strains as up to 19.3% for some components of the brachial plexus. According to the study by Lädermann et al.,<sup>4)</sup> the prevalence of acute postoperative nerve injury on the electromyographic evaluation was significantly higher in patients who had undergone reverse shoulder arthroplasty compared with conventional shoulder arthroplasty. In this case, we could not calculate the distance of the distalization of the humerus using the method by Lädermann et al.,<sup>4)</sup> because we did not take an image of the whole humerus. However, the distance of the distalization of the humerus may not exceed those of other cases considering surgeon's familiarity with routine operative method.

The MCN may be injured during the subscapularis release using a finger. The patient showed stiffness of the shoulder, upward migration and anterior displacement of the humeral head due to the retraction and thinness of the subscapularis. This altered anatomy could cause more traction force and closer vicinity to the MCN from the subscapularis during the operation. Therefore, meticulous care is required when releasing the subscapularis in shoulders with complete and retracted tear of the subscapularis.

Regarding neurologic complication after reverse total shoulder arthroplasty, there are sometimes unrecovered sequelae but usually show spontaneous improvement. The proper management of neurologic complication should focus on maintaining passive motion of the affected joints through the recovery phase. A temporary static brace can be beneficial. However, if there is no improvement within 3 months, surgical exploration is recommended.<sup>10)</sup>

Although we could not precisely determine the cause of isolated MCN palsy, this report showed the occurrence and complete resolution of isolated MCN palsy after routine reverse total shoulder arthroplasty. We recommend that care should be taken to prevent possible neurologic complication when performing reverse total shoulder arthroplasty in shoulders with stiffness, tightly retracted subscapularis and severe upward migration of the humerus.

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