

Radial Nerve Palsy after Arthroscopic Rotator Cuff Repair Caused by Functional Abduction Brace

Jeong Woo Kim, MD, Kim Tae Kyun, MD, Kwon Seok Hyun, MD, Kang Hong Je, MD, Park Jung Hyun, MD, Lee Yong Chan, MD, Choi Ji Woong, MD

Jeong Woo Kim, Kim Tae Kyun, Kwon Seok Hyun, Kang Hong Je, Park Jung Hyun, Lee Yong Chan, Choi Ji Woong, Department of Orthopaedic Surgery, School of Medicine, Wonkwang University Hospital, Iksan city, Chunbuk, S. Korea

Correspondence to: Jeong Woo Kim, MD, Department of Orthopaedic Surgery, School of Medicine, Wonkwang University Hospital, Iksan city, Chunbuk, S. Korea

Email: serina@wonkwang.ac.kr

Telephone: +82-63-859-1360

Fax: +82-63-852-9329

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ABSTRACT

Rotator cuff tears and degeneration are among the most common problems that cause shoulder pain and dysfunction in adults. In additions, the number of patients who underwent operative treatment being increased because of increased aged populations and sports activities. Among various surgical treatment methods used for the repair of rotator cuff tears, arthroscopic surgery has become a very useful diagnostic and therapeutic modality. Unfortunately, like many other invasive procedures it can have complications. One of the most terrible complications, for both the patient and surgeon, is that nerve injuries. Various possible explanations have been suggested for the nerve injuries that have occurred after shoulder arthroscopy, including joint distension, fluid extravasations, position, manipulation, and excessive traction. We will describe a case of radial nerve palsy caused by functional abduction brace in patient treated with arthroscopic rotator cuff repair that has not been reported

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Key words: Rotator cuff tear; Radial nerve palsy; Functional abduction brace

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INTRODUCTION

Rotator cuff tears and degeneration are among the most common problems that cause shoulder pain and dysfunction in adults. In additions, the number of patients who underwent operative treatment being increased because of increased aged populations and sports activities. Among various surgical treatment methods used for the repair of rotator cuff tears, arthroscopic surgery has become a very useful diagnostic and therapeutic modality. Unfortunately, like many other invasive procedures it can have complications. One of the most terrible complications, for both the patient and surgeon, is that nerve injuries. Various possible explanations have been suggested for the nerve injuries that have occurred after shoulder arthroscopy, including joint distension, fluid extravasations, position, manipulation, and excessive traction. We will describe a case of radial nerve palsy caused by functional abduction brace in patient treated with arthroscopic rotator cuff repair that has not been reported.

CASE REPORT

A fifty-three-year-old woman visited our hospital because of left shoulder pain and weakness. She worked as a nail art technician. When we performed the physical exam to this patient, she showed the positive result in 'Empty Can Test' and 'Drop Arm Sign', but she did not show any neurologic deficit. When plain X-ray, ultrasonography were taken, the full thickness tear of rotator cuff and tendinopathy of long head biceps tendon were observed, but there were no other abnormal findings (Figure 1).

We decided to perform arthroscopic repair of teared rotator cuff. The surgery was performed with the patient in the beach-chair



Figure 1 Magnetic resonance imaging of left shoulder. (A) Shows full thickness tear of supraspinatus tendon(white arrow). (B) Around the Biceps tendon, it shows the fluid collection and biceps tendinopathy related to synovitis.

position under general anesthesia. Continuous traction was not used. There were large size (4.3 cm) tear of supraspinatus tendon, partial tear of subscapularis with laminations, tendinopathy with synovitis on long head of biceps tendon in the arthroscopic exam (Figure 2).

After glenohumeral inspection, tenotomy of the long head of biceps tendon, repair the subscapularis with tendon to tendon suture using nonabsorbable suture (No. 2 Ethibond, Ethicon®). Subacromial decompression was conducted to remove inflamed bursal tissue, and acromioplasty was performed using motorized burr to create flat acromion. Then, the greater tuberosity of the humerus was prepared with a motorized burr to create a bleeding cancellous bone bed. In order to perform a tendon-to-bone repair, the senior author(J-W Kim) used by the suture bridge technique (Figure 3).

After the arthroscopic procedure, we protected the shoulder with functional abduction brace to immobilize the shoulder in abduction position. Post surgery showed no abnormal symptoms from the neurological exam.

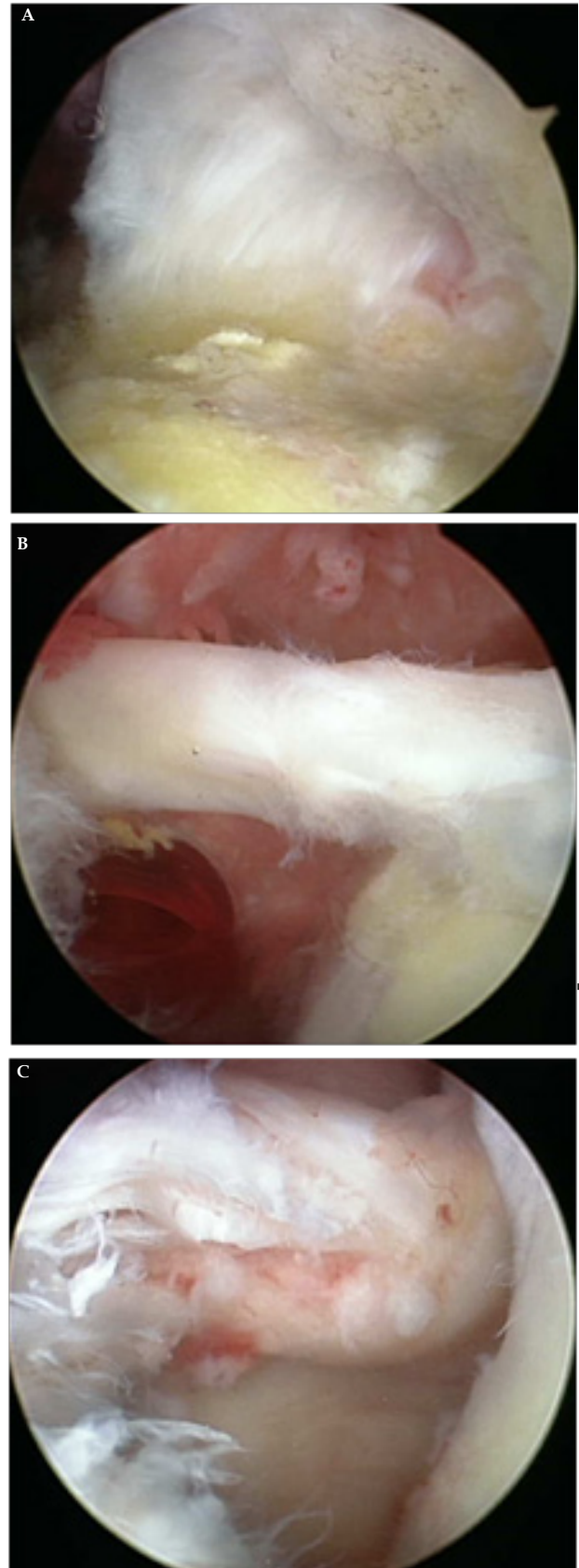


Figure 2 Arthroscopic findings. (A) Large size (4.3cm) tear was observed in supraspinatus tendon. (B) Biceps tendon's fraying and biceps tendinopathy related to synovitis were observed. (C) Shows partial tear along with multiple lamination.

In general cases, postoperatively, patients are commonly protected with functional abduction brace for 6 weeks according to our rehabilitation protocol. Pendulum exercise will commence on the first postoperative day and will continue for six weeks. Patients are also advised to perform these exercise for five minutes at a time and five times a day for the first three weeks and, at three weeks, then they are sent to a physical therapist for passive motion exercise. However, the patient in this case complained of pain in her operated shoulder, therefore, she wasn't able to perform any of the pendulum exercise for the first three days after the surgery. The patient was discharged three days after the surgery. Before leaving, we performed another neurological exam, and the result showed no issues.

Three weeks after surgery, the patient presented with symptoms of sudden inability to extend the wrist and fingers. When we examined the patient, she showed drop hand with paralysis (grades 1 or 2) of the left extensors of the wrist and fingers and of the long abductor of the thumb. The patient also showed incomplete paralysis (grade 4) of the supinator muscles (Figure 4). There was a markedly sensory deficit on the dorsum of the hand, in the space between the first and the second metacarpals, and in the forearm in the area of the

superficial radial nerve. The power of elbow extension and flexion was normal. The joints of the wrist, fingers, and thumb had a full passive range of motion.

Radiographs of the cervical spine, arm, and elbow were normal. Laboratory test results including blood sugar level were normal.

Mild fibrillations(1-2+) and positive sharp waves(1-3+) were evident as were electromyographic evaluation indications of abnormal spontaneous activity at rest in the left brachioradialis, supinator, extensor carpi radialis and ulnaris, and extensor indicis proprius. The radial motor nerve conduction after a stimulus of 0.1- ms duration at 300-V intensity applied from 9-10cm above the elbow joint was within a normal range (50-76 m/s) but showed slightly delayed motor nerve conduction velocity 54 m/s. It also showed a reduced amplitude of the compound motor action potential (CMAP). We concluded that these findings were suggestive of left radial nerve neuropathy around the spiral groove area with neuropraxia (Figure 5).

Patient in our case with neuropraxia, we decided to treat this condition with conservative treatment using physical therapy and medications. After 6 months of the conservative treatment, the patient was showing signs of improvement in motion just a little. So we decided to exploration about radial nerve.

We exposure the radial nerve at the level of lateral epicondyle just to distal area. In our operation finding, the radial nerve was compressed but there was not continuity defect. So we did adhesiolysis and neurolysis. And in 6 months, she fully recovered (Figure 6).

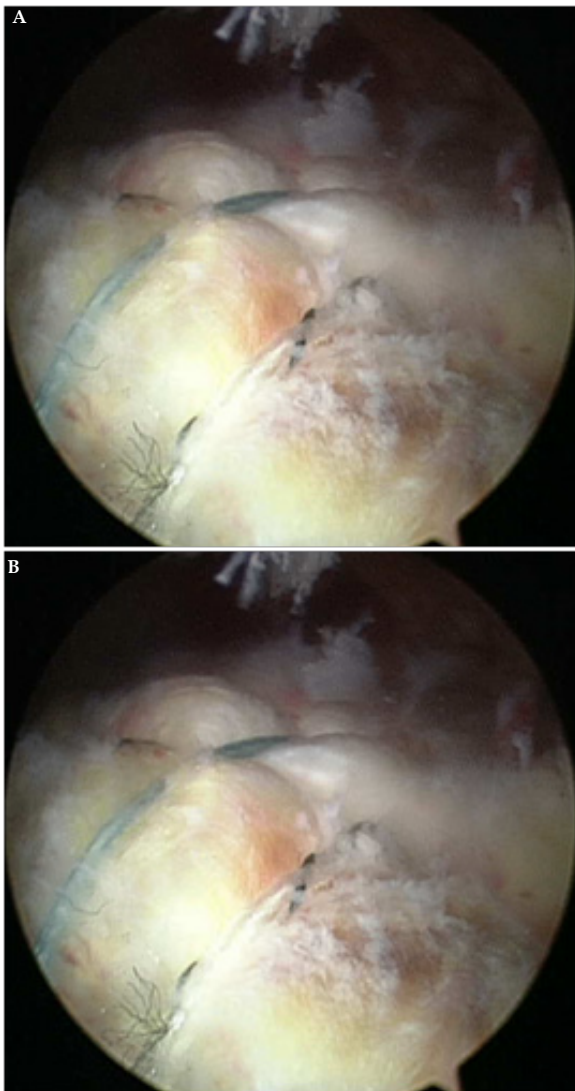


Figure 3 Arthroscopic findings. (A) Shows repaired the tear of supraspinatus tendon with operating suture bridge technique. (B) Tendon to tendon suture was performed on the subscapularis tendon with lamination.



Figure 4 The patient shows the wrist drop sign three weeks after the surgery. The extension of wrist and thumb seems ok in normal side, but the extension of damaged wrist and thumb seems problematic.

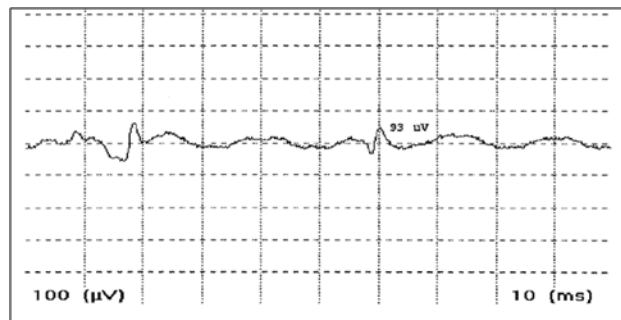


Figure 5 Performed needle EMG on the patient's extensor carpi radialis. Shows neuropraxia along with amplitude and fibrillation potential.



Figure 6 Radial nerve was compressed.

DISCUSSION

The incidence of nerve injury after arthroscopic rotator cuff repair has been reported as being quite significant^[1], although the actual incidence may be much lower^[2,3]. Various possible explanations have been suggested for the neuropathies that have occurred during arthroscopic shoulder surgery, including joint distension, fluid extravasations, position, manipulation, and excessive tractions^[4]. But, in our case the patient did not show any neurologic symptoms at 2 days after surgery that is not related to the intraoperative nerve damages. In additions, patient in our case typically showed that active wrist and finger and thumb extension was impaired, and electromyographic evaluation confirmed an isolated high radial nerve palsy.

In the upper arm the radial nerve arises from the posterior cord of the brachial plexus. Thus, the radial nerve first is seen merging from the axilla at the lower border of the subscapularis after the axillary nerve departs the posterior cord. It then courses anterior to the subscapularis, teres major, and latissimus dorsi muscles on the medial surface of the humerus until it enters into the spiral groove of the humerus posteriorly^[5]. Giving muscular branches to the lateral and long head of the triceps, it courses beneath the long head of the triceps posteriorly in direct contact with the humerus along the supracondylar ridge until it pierces the lateral intermuscular septum 10 to 12 cm above the lateral epicondyle^[6,7]. The radial nerve innervates the extensor carpi radialis longus and brachioradialis before dividing as it enters the antecubital fossa.

The effects of compression on peripheral nerves can be attributed to alterations of blood circulation to and from the nerve as well as direct injury to the axonal transport systems. Venous blood flow from the peripheral nerves is shown to be reduced at 20 to 30 mm Hg, whereas frank ischemia can occur at pressures of 60 to 80 mm Hg^[8]. Blockade of axonal transport can occur at pressures as low as 50 mm Hg and loss of nerve impulse conduction occurs at pressures of 130 to 150 mm Hg^[9,10].

A compression neuropathy may begin as a mild injury to epineural vessels under mild pressure. The subsequent edema can lead to fibrosis, which increases further pressure on the nerve, leading to a progressive deterioration of the nerve^[11]. In addition to the mechanical effects, an increase in connective tissue has been hypothesized to cause secondary changes in the mechanical sensitivity of the thin afferent fibers responsible for pain^[12,13]. Finally, compression may also produce local intraneural sprouting and neuroma formation^[14].

Trauma has been a well-recognized cause of radial nerve injury

and compression^[15]. Other more obscure causes include tumors, infectious causes such as acute brachial neuritis (Parsonage-Turner syndrome)^[16], and anomalous muscular and arterial anatomy^[17,18]. External compression caused by crutches, tourniquet compression, improper sleeping position (Saturday night palsy), and injection trauma all have been reported^[15].

But, In our knowledge, there were not reported ever the compressive radial nerve palsy cause by functional abduction brace after arthroscopic rotator cuff repair. Abduction brace has angled edge on the superolateral side, and this angles edge possible to compress the radial nerve that pass posterior side to anterior side of upper arm at the spiral groove of humerus. In addition, extensively tighten the back strap of the brace was elevated pressure of upper arm tissue resulted in diminished blood flow of peripheral nerves can occur ischemic damages (Figure 7).

In our conclusions as follows; (1) round the lateral edge of the brace and use wide and soft materials; (2) prevent tightening of the pocket surrounding the upper arm; (3) do not wear the brace for a long period of time. When exercising, take the brace off; (4) As a physician, we should realize that patients could get nerve damage by using assistive devices incorrectly, so we should explain and educate the patients on how to use the devices correctly, and make aware of precautions.

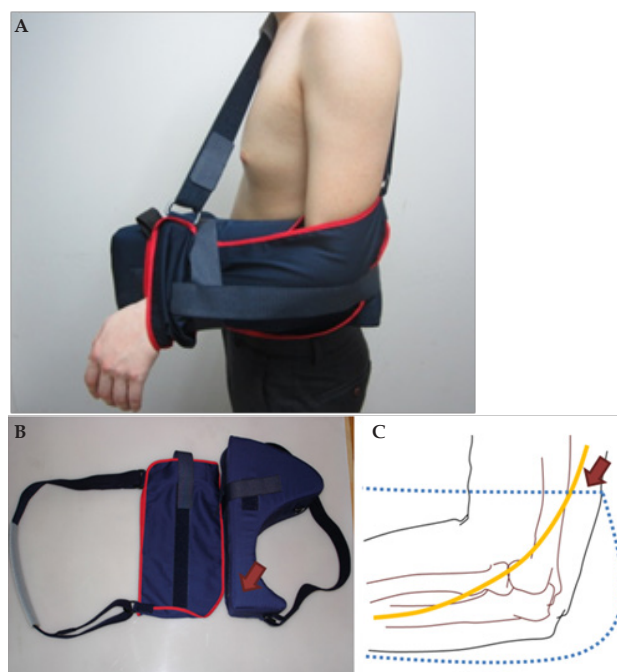


Figure 7 (A) The patient is wearing the abduction brace. (B) The form of the Abduction brace. It is possible to bring compression of radial nerve due to the lateral angled edge (red arrow) near the chest support. (C) The schematic feature shows that radial nerve's flow could be compressed while wearing the brace (large red arrow).

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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Peer reviewer: Riccardo Maria Lanzetti, MD, Orthopaedic Department, St.Andrea Hospital University of Rome, Italy.