

# Traumatic injury of the axillary nerve identified after rotator cuff repair

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## ABSTRACT

**Introduction:** The prevalence of shoulder pain varies between 6.7% and 66.7%; whereas rotator cuff disorders—especially rupture—can reach a prevalence of 22.1%. Due to the important advances and studies in the repair of this injury, arthroscopic surgery has allowed a better identification, visualization and classification, as well as a better handling of the patients. In addition, rotator cuff ruptures or greater tuberosity fractures increase the risk of nerve injury (relative risk -1.9), which is more significant in patients >60 years old. We discuss the case of a patient with post-traumatic rotator cuff rupture who required minimally invasive arthroscopic repair. No weight-bearing was allowed during the postoperative period. Patient presented a non-self-limited axillary nerve injury secondary to anterior dislocation and resulting instability after the original trauma. **Conclusions:** axillary nerve injuries are more common than expected and, in many cases, early identification is not possible due to its high rate of association with other injuries. Therefore, treating physicians must be very careful in order to achieve a timely diagnosis and management of the patient.

**Key words:** Rotator cuff injury; post-traumatic injury; axillary nerve; electromyography; shoulder instability.

**Level of evidence:** III

## Lesión traumática del nervio axilar identificada luego de la reparación del manguito rotador

## RESUMEN

**Introducción:** La prevalencia del dolor de hombro oscila entre el 6,7% y el 66,7%; los trastornos del manguito rotador y especialmente la ruptura pueden alcanzar una prevalencia del 22,1%. Debido a los importantes avances y estudios en la reparación de esta lesión, la cirugía artroscópica ha permitido una mejor identificación, visualización y clasificación, y un mejor manejo de los pacientes. Además, la ruptura del manguito rotador o la fractura de la tuberosidad mayor del húmero incrementan el riesgo de lesión nerviosa (riesgo relativo -1,9), más significativa en pacientes >60 años. Se presenta a un paciente con ruptura postraumática del manguito rotador, quien requirió reparación artroscópica mínimamente invasiva, con evolución posoperatoria estacionaria y diagnóstico de lesión del nervio axilar, sin recuperación autolimitada atribuida a luxación anterior e inestabilidad secundaria al trauma inicial. **Conclusiones:** La lesión del nervio axilar es más frecuente que lo esperado y, en muchas ocasiones, la identificación temprana se pasa por alto debido a la alta asociación con otras lesiones. Por lo tanto, el diagnóstico y el manejo oportunos requieren mucho cuidado por parte del médico tratante.

**Palabras clave:** Lesión del manguito rotador; lesión postraumática; nervio axilar; electromiografía; inestabilidad del hombro.

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## INTRODUCTION

The prevalence of shoulder pain varies between 6.7% and 66.7%. Rotator cuff disorders—especially rupture—can reach a prevalence of 22.1%. Thanks to the advances and research in the repair of this injury, arthroscopic surgery has allowed a better identification, visualization and classification, as well as a better handling of the patients. In addition, rotator cuff ruptures or greater tuberosity fractures increase the risk of nerve injury (relative risk -1.9), which is more significant in patients >60 years old. The significance of this case lies in the early diagnosis as well as the timely and interdisciplinary management of patients.

## CASE REPORT

A 62-year-old man was admitted to the Orthopedics and Traumatology Department on May 9, 2014 due to trauma in the left-hand side of his body after falling down the stairs. He had experienced persistent left shoulder pain for 15 days.

His relevant medical history included: high blood pressure treated with verapamil and losartan, and rhinoseptoplasty and cholecystectomy. Upon initial physical examination, the patient had ecchymosis on the anterior face of his left arm, pain when the greater tuberosity was palpated, painful active and complete passive arcs of motion, muscle strength scored as 2/5 and positive trumpeter sign. Due to the clinical suspicion of rotator cuff injury, analgesics and physical therapy were prescribed, and magnetic resonance imaging (MRI) of his left shoulder was requested.

Fifteen days later, the patient was admitted again and reported 10/10 sessions of physical therapy with moist heat, transcutaneous electrical nerve stimulation (TENS), stretching, joint mobilization and ultrasound without any improvement in his left shoulder pain or movement. The MRI (Figure 1) showed supraspinatus and infraspinatus muscle rupture with 3 cm retraction, no fatty infiltration, type IV SLAP tear and partial dislocation. Therefore, it was considered a posttraumatic rotator cuff rupture that required surgical management.



**Figure 1.** Shoulder MRI. Supraspinatus muscle rupture associated with retraction is observed.

The patient underwent an arthroscopic surgery to his shoulder on June 13, 2014. Intraoperative findings included supraspinatus and infraspinatus muscle rupture with 2 cm retraction, no tendon atrophy and type IV SLAP tear with type IVB anterior extension. Synovectomy, capsulorrhaphy, rotator cuff suture and acromioplasty were performed without any complication. The patient was recommended to take analgesics and to continuously wear a sling at home until further advice.

During postoperative follow-up, the patient went through a rehabilitation process that allowed him to achieve 3/5 muscle strength as well as active and passive arcs of motion with an abduction angle of 60° and 90°, a flexion angle of 80° and 100°, and an extension angle of 45° and 50°, respectively. In spite of continuous follow-up by his physical therapist, medical improvement was not achieved, and physical examination showed deltoid muscle atrophy and axillary nerve hypoesthesia. Three months after the surgery, an electromyography and a nerve conduction velocity test were requested, which showed axillary nerve injury in reinnervation process. The patient continued receiving physical therapy, and a follow-up electromyography was requested in three months.

By January 2015, the patient had had no improvement in pain or arcs of motion and experienced associated deltoid muscle atrophy. The follow-up electromyography showed no reinnervation in the anterior, middle and posterior portions of the deltoid muscle in comparison with the previous exam. An indirect arthrography of his left shoulder and a cervical spine MRI without contrast showed bilateral narrow canal injury and further rotator cuff rupture. Physicians decided to perform a nerve transposition from the long portion of the radial nerve to the triceps in another center.

## DISCUSSION

The prevalence of shoulder pain is high in the general population and varies between 6.7% and 66.7%.<sup>1</sup> Rotator cuff disorders play an important role in these conditions, and rupture can reach a prevalence of 22.1%,<sup>2</sup> which increases over every decade of life; around two thirds of patients do not have symptoms.

Rotator cuff rupture is associated with certain already identified risk factors, which include intrinsic risk factors, such as age, smoking, obesity, diabetes mellitus, genetic disorders and anatomic variants, and extrinsic factors, such as sports and occupation.

Diagnosis is based on the patient's medical history and physical examination, guided by multiple semiology maneuvers that allow rupture location. In addition, imaging tests, such as shoulder X-rays, which identify the shoulder and acromioclavicular joints as well as associated conditions, ultrasound and MRI, which is the most widespread test for diagnosis and surgical planning, are important.<sup>1</sup>

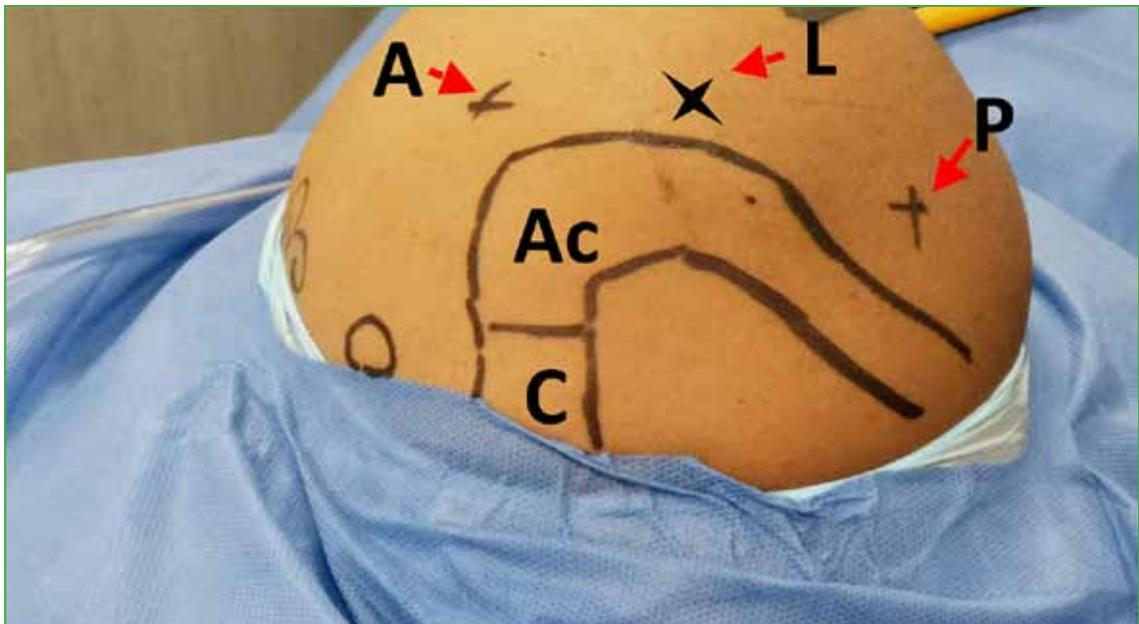
The ideal management of rotator cuff injury has always been a major topic of debate in Orthopedics. It goes back to 1933 when Codman<sup>2</sup> described rotator cuff injury (supraspinatus, infraspinatus, subscapular and teres minor muscles) for the first time. However, DeOrio and Cofield<sup>2</sup> proposed the first classification system for this injury. Thanks to the advances and research in the repair of this injury, we may say that rotator cuff rupture arthroscopic surgery has allowed a better identification, visualization and classification, as well as a better handling of the patients.

When it comes to performing a rotator cuff arthroscopic repair, it is necessary to consider certain specifications and concepts. For example, the patient should be in the lateral decubitus position over the shoulder that is not to be operated on (Figure 2), skin traction should be 4 kg, and anatomic structures (clavicle, acromioclavicular joint and acromion) should be identified and marked. Posterior, anterior and lateral portals, which are away from the axillary nerve location, are then marked (Figures 3 and 4).

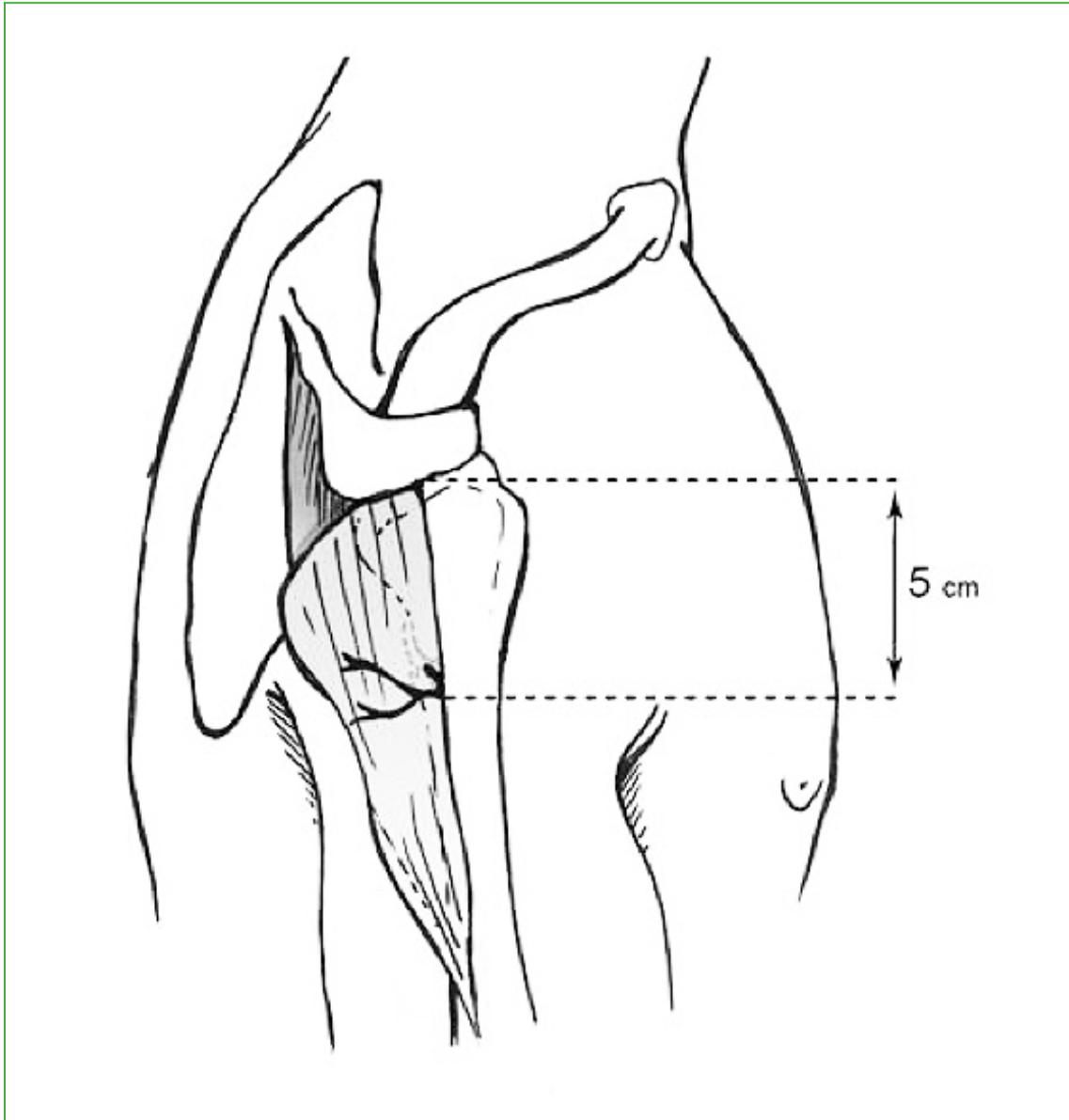
Next, the joint is approached by introducing a camera through the posterior portal and a shaver through a working cannula in the anterior portal. This way, the anterior and posterior capsules, the long head of the biceps tendon insertion, and the subscapularis and supraspinatus tendons are assessed. Generally, a synovectomy is performed, and biceps tendon injury is repaired by tenotomy and tenodesis, depending on the patient's age and functionality. In addition, the subscapularis tendon is repaired, if necessary, and the footprint is prepared for supraspinatus tendon repair, if applicable. Figure 5 shows how close the axillary nerve and the inferior glenohumeral ligament complex are, so it is important to properly place arthroscopic portals and identify anatomic structures to avoid an iatrogenic axillary nerve injury.<sup>1-3</sup>



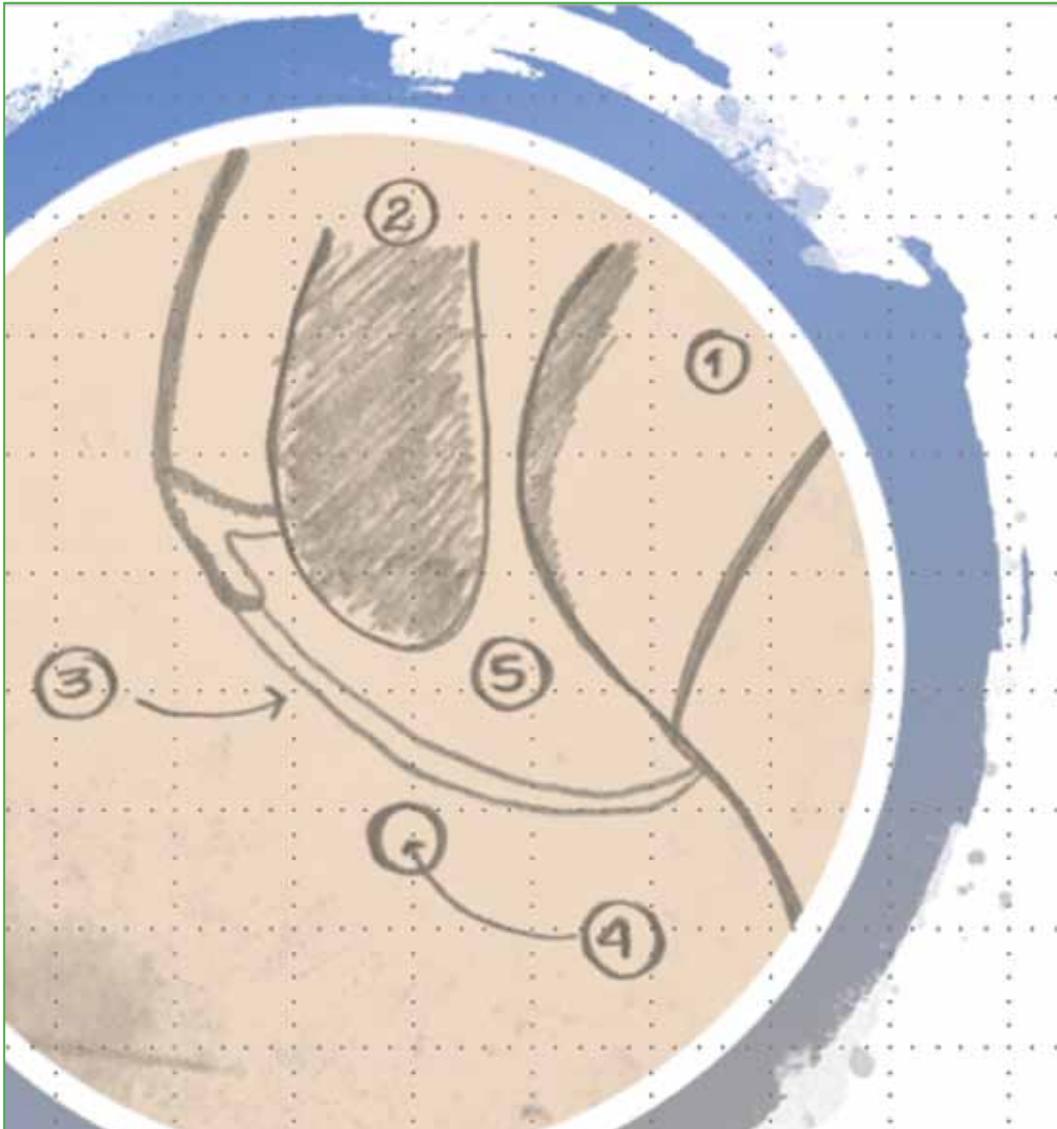
**Figure 2.** Patient in the lateral decubitus position for shoulder arthroscopy.



**Figure 3.** Shoulder anatomic references for arthroscopic approach. C = clavicle, Ac = acromion, A = anterior portal, L = lateral portal, P = posterior portal.



**Figure 4.** Axillary nerve located 5 cm away from the lower acromial edge. (Extracted from Maman E, Morag G, Safir O, Benifla M, Mozes G, Boynton E. The anterior trunk of the axillary nerve: surgical anatomy and guidelines. A fresh, cadavers study. *J Orthopaedics* 2008;5(2):e7. <http://www.jortho.org/2008/5/2/e7>).



**Figure 5.** Anatomic relationship between the axillary nerve and the inferior glenohumeral ligament complex. 1 = humeral head, 2 = glenoid cavity, 3 = inferior glenohumeral ligament complex, 4 = axillary nerve, 5 = joint cavity.

The second approach is made in the subacromial space, where a bursectomy is performed, if necessary, through a lateral portal located 2.5 cm away from the acromion next to the acromioclavicular joint; the supraspinatus injury is identified and, using a hypodermic needle, the working area next to the injury is identified to place another portal, through which the footprint is prepared with superficial drilling to finish repairing the injury by putting anchors and single-row or double-row stitches at physicians discretion.

Finally, an acromioplasty is performed, and acromioclavicular osteophytes are resected if the joint is clinically painful and this procedure means an improvement in the patient's quality of life. The skin is sutured, and the patient's shoulder is immobilized in abduction and external rotation with a sling.

In this clinical case, trauma was associated not only with rotator cuff rupture, but also with axillary nerve injury that, as in the patient's case, is related with shoulder joint dislocation and instability.

Vascular and nerve injuries are rare in shoulder dislocation, but they cause major functional damage. Although most traumatic shoulder dislocations occur among young patients (90%), with a greater incidence of anterior dislocations (96-98%),<sup>4</sup> there is another incidence peak in people in their sixties, as in the case of our patient.<sup>4-8</sup>

Even though many posttraumatic nerve injuries may be identified during medical assessment, some symptoms are disguised when the patient has additional injuries, such as rotator cuff rupture. However, the presence of rotator cuff ruptures or greater tuberosity fractures increase the risk of nerve injury (relative risk -1.9),<sup>4,9</sup> which is more significant in patients >60 years old.

Diagnosing nerve injury involves a careful examination and management of the patient. At the beginning, it is necessary to perform an electromyography, ideally during the first three weeks and, depending on the patient's condition, a cervical spine MRI.<sup>4</sup> Nerve injury surgical management is indicated in the event total and isolated loss of axillary nerve function that has not improved after 3-6 months. Research studies show that the injury heals spontaneously in only 20% of patients; the remaining 80% requires surgery, typically a nerve transposition.<sup>10-12</sup>

Shoulder joint dislocation in elderly patients is mostly associated with instability in the anterior part of the shoulder due to Bankart lesion, which refers to an injury of the labrum and capsule/ligaments in the anteroinferior part of the glenoid cavity. In these cases, management should be surgical, in general, using an arthroscopic approach.<sup>5</sup>

## CONCLUSIONS

Axillary nerve traumatic injury is a common condition in patients >60 years old and, in most cases, it is associated with rotator cuff rupture, anteroinferior instability and fractures. However, early diagnosis is not easy, and symptoms are disguised as those of associated injuries. Therefore, the patient's progress and follow-up, postoperative follow-up in this case, are essential for a timely diagnosis and management that is surgical in almost 80% of cases. However, care should be exercised with the surgical approach when introducing arthroscopic portals in order to avoid an iatrogenic axillary nerve injury.

Conflict of interest: Authors claim they do not have any conflict of interest.

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