Case Report

Diagnosis and treatment approach of delayed presentation of anterior branch axillary nerve injury following shoulder dislocation: case report

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ABSTRACT

In this case report, a unique instance of delayed isolated anterior branch axillary nerve injury following shoulder dislocation is highlighted. The patient, a 55-year-old manual laborer, presented with severe deltoid wasting and reduced power 18 months postdislocation, necessitating a specialized treatment approach. The use of axillary nerve neurolysis and an innovative upper trapezius to anterior deltoid transfer via a subacromial path posterior to the clavicle, facilitated by an autologous semitendinosus graft, resulted in significant improvement with 160 degrees of abduction and Grade 4+ power Medical Research Council grading (MRC) at the 5-year follow-up.

The case:

- 55-year-old manual laborer with left shoulder weakness 18 months posttraumatic dislocation.
- Severe deltoid wasting and reduced power due to isolated anterior branch axillary nerve palsy.
- Treatment involved axillary nerve neurolysis and upper trapezius to anterior deltoid transfer using an autologous semitendinosus graft fixed with a biotenodesis screw.

Lessons learned:

- Innovative Surgical Approach:
  - Sub-acromial path with semitendinosus graft for anterior branch axillary nerve palsy.
  - Offers a more direct transfer line than conventional methods.
- Precision in Insertion Point:
  - Sub-acromial path with semitendinosus graft allows accurate insertion near anatomic insertion point.
- Functional Outcome Emphasis:
  - Emphasizes improved function over traditional methods.
  - Need for tailored techniques for enhanced patient functionality and quality of life.

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INTRODUCTION

The vulnerability of the anterior branch of the axillary nerve near the surgical neck of the humerus is well-known but often under-addressed in literature. In response, an approach involving the transfer of the upper and middle trapezius to the anterior deltoid via a subacromial path, facilitated by an autologous semitendinosus graft, has been introduced. This technique, aimed at restoring anterolateral deltoid fiber congruence, offers a viable option for patients with isolated anterior branch axillary nerve paralysis, particularly in cases where conventional treatments may have limited effectiveness, including nerve grafting, shoulder arthrodesis, and described techniques involving osteotomy [1,2]. Despite chronicity, functional improvements have been observed, mitigating the need for more morbid interventions like humerus osteotomy or shoulder arthrodesis. This underscores the importance of tailored approaches to nerve injuries, emphasizing the restoration of muscle integrity for optimal recovery.

CASE REPORT

A 55-year-old male patient presented to our clinic with a 5-month history of progressive reduction in muscle mass and weakness in the left shoulder, particularly during abduction, accompanied by a gradual decline in muscle mass and alteration in shoulder contour. He recounted an incident 18 months prior when he experienced a shoulder dislocation while losing balance while unloading a heavy load. Seeking the assistance of a traditional bone setter, the dislocation was reduced, but subsequent months were marked by persistent pain, mitigated with self-administered oral analgesics. He had no history of cerebrovascular accident, and described techniques involving osteotomy [1,2]. Despite chronicity, functional improvements have been observed, mitigating the need for more morbid interventions like humerus osteotomy or shoulder arthrodesis. This underscores the importance of tailored approaches to nerve injuries, emphasizing the restoration of muscle integrity for optimal recovery.

The general physical examination was within normal limits. During the left shoulder examination, we observed reduced muscle mass in the anterior deltoid region (Fig. 1A, B). The patient had limited active shoulder abduction, reaching 120°, and forward elevation limited to 70° with grade 3 deltoid power and grade 5 trapezius power (MRC grading). Importantly, no signs of shoulder impingement or rotator cuff injury were found. The latissimus dorsi and teres minor muscles showed normal function.

Imaging

Plain radiographs indicated a dislocated shoulder with a slight inferi or sag (Fig. 2A). Magnetic resonance imaging scan revealed deltoid muscle fatty infiltration and atrophy, while cuff muscles and the brachial plexus appeared normal, no mass lesion was found (Fig. 2B). Nerve conduction studies indicated left axillary axonal neuropathy. An axillary artery angiogram ruled out quadrangular space syndrome [3].

Electrophysiological analysis

Electromyography (EMG) confirmed denervation in the anterior, lateral deltoid area, while posterior deltoid function remained unaffected. The diagnosis was isolated anterior branch axillary nerve injury.

Surgical technique

Given the duration of the injury, a surgical plan was devised, involving the exploration and neurolysis of the axillary nerve. Additionally, decompression of the quadrilateral space and intraoperative stimulation of the nerve branches were planned. If the anterior branch exhibited stimulability, the plan was to conclude with neurolysis; otherwise, an upper trapezius transfer was intended.

The patient was positioned in right lateral decubitus, and the upper limb and leg were prepared and draped for surgery [4]. An incision, resembling a mirrored lazy “S,” commenced above the acromion, curving along the posterior border of the deltoid, and extending below its insertion (Fig. 3). Thick skin flaps were raised on both sides, with a cautious dissection along the posterior skin flap to identify the cutaneous branch of the axillary nerve (Fig. 4A). Subsequently, tracing led to the quadrangular space for identification of the nerve to the teres minor, along with the posterior and anterior branches. While the posterior branch displayed stimulability, the anterior branch did not. Consequently, the decision was made to proceed with the harvest of the upper trapezius transfer.

We then traced the trapezius muscle insertion on the acromion and detached the trapezius tendon along with the periosteum (Fig. 4B). The semitendinosus autograft was harvested, and the procedure involved executing it through a small posterior incision along its course using an open tendon stripper. The donor muscle tendon was pulvertafted using the semitendinous graft to attain the necessary length. Subsequently, it was passed beneath the acromion along the anterior portion of the deltoid to reach its insertion point, securing it in place with a biotenodesis screw while maintaining the upper arm abducted to approximately 45° (Figs. 5 and 6).

Postoperative management and rehabilitation

In the postoperative phase, the patient was given an abduction splint set at 50° for 8 weeks. Passive shoulder abduction exercises commenced after 2 weeks, and active shoulder abduction was allowed after 6 weeks postoperatively. Over four years of follow-up, the patient demonstrated significant improvement. His abduction power increased from grade 3 preoperatively to grade 4+ in the scapular plane (MRC grading), and the degree of abduction improved from 120° preoperatively to 160° postoperatively (Fig. 7).

Fig. 1. A, B: Deltoid muscle wasting over the left deltoid region.
Fig. 2. Figure A (left) radiograph and B (right) MRI image of the patient showing atrophy of the anterior and middle deltoid muscle. MRI = magnetic resonance imaging.

Fig. 3. A, B: Mirrored lazy “S” made starting above the acromion and extending down to below the deltoid insertion.

Fig. 4. A, B: A) Identification of the cutaneous sensory branch of the axillary nerve, tracing it to the quadrangular space. B) Trapezius muscle insertion on the acromion and detached the trapezius tendon along with the periosteum.
DISCUSSION

Isolated axillary nerve injuries are sparse and are frequently linked to brachial plexus injuries. The typical causes are listed (Table 1). The use of axillary nerve neurolysis and an innovative upper trapezius to anterior deltoid transfer via a subacromial path posterior to the clavicle, facilitated by an autologous semitendinosus graft, resulted in significant improvement with 140 degrees of forward flexion and Grade 4 power (MRC grading) at the 4-year follow-up.

Interestingly, the clinical symptoms of branch-specific axillary nerve injury, such as limited range of motion and pain, can make it difficult to detect during the initial evaluation. This is because the weakness in shoulder abduction is often compensated for by the supraspinatus muscle's inherent ability to perform abduction [5].
EMG findings indicated reduced amplitude and denervation in the anterior along with the lateral deltoid, strongly suggesting an involvement of the axillary nerve. Surprisingly, the posterior deltoid, infraspinatus, and teres minor muscles functioned normally. This contrast indicated selective impairment within the axillary nerve’s branches. Furthermore, it became evident that the anterior branch of the axillary nerve was primarily affected, while the posterior branch remained functional.

Commonly practiced approaches for the brachial plexus and its branch injuries are described. Neurolysis removes scar tissue from the axillary nerve, which is best for entrapment-related injuries. Neurolyrhaphy is for acute cases with minimal scarring, and nerve grafting is considered when repair isn’t possible. For extensive scarring, nerve grafting, or neurotization with options like a triceps-to-axillary transfer can be effective. Given the patient’s difficulty in daily activities like combing hair and lifting weights due to weak shoulder abduction, a treatment plan was procured. Nerve grafting wasn’t an option due to the prolonged injury duration (over 18 months) [6].

In the initial stages following an injury, nerve grafting and other repair techniques, in conjunction with physiotherapy, are typically the primary modalities of treatment. In chronic nerve injuries with limited regenerative potential, options like muscle transfers, humerus osteotomy, or shoulder arthrodesis are considered. However, our patient exhibited normal flexion, abduction, and a passive range of motion up to 150°, along with active abduction of 120°. Therefore, humerus osteotomy and shoulder arthrodesis should only be considered last-resort options to be opted for.

In our case, electromyography findings indicated an isolated axillary nerve injury, while the supraspinatus nerve, long thoracic nerve, and thoracodorsal nerve remained intact. The shoulder's external rotators, such as the infraspinatus muscle, contributed to external rotation at 0 degrees of abduction, while the teres minor facilitated external rotation at 90°. Despite comprehensive reconstruction efforts, published cases have shown an improvement in abduction of approximately 40% [7].

For near-full abduction recovery in isolated branch-specific axillary nerve palsy, restoring anterolateral deltoid fiber congruence is the key. In our patient, pectoralis major with coracobrachialis for flexion and posterior deltoid fibers with latissimus dorsi for extension were intact, indicating an isolated anterior branch injury.

This operative technique involves passing the trapezius tendon under the acromion process and pulvertafting it to the semitendinosus tendon at the deltoid insertion on the humerus offers distinct advantages over the Meyer technique, Bateman modification of Meyer [8], and Saha's technique [9]. Techniques involving acromion osteotomy have higher chances of injuring accessory spinal nerves and nonunion of the acromion following the repair [10]. Advantages of this technique include simplicity, shorter surgery duration, quicker post-operative rehabilitation, avoidance of unnecessary osteotomies, and reduced morbidity at the osteotomy site [4]. The patient expressed profound satisfaction with the care received for their delayed anterior branch axillary nerve injury. The innovative surgical approach restored the individual's shoulder function and surpassed expectations, enabling a return to manual laborer with enhanced strength and mobility, ultimately contributing to a significant improvement in overall quality of life.

Declaration of competing interest

The authors declare that no financial interests/personal relationships exist to be considered as potential competing interests.

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