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Neurotization of isolated axillary nerve palsy in a teenage patient

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ABSTRACT

BACKGROUND AND AIM: The aim of this article was to study isolated axillary nerve injury, its etiologies, symptomatology and treatment via nerve transfer or neurotization.**METHODS:** We describe the procedure of long head triceps radial branch transfer to the axillary nerve motor branch in adolescent patient with right deltoid muscle palsy and shoulder anesthesia following a motorcycle crush six months ago.**RESULTS:** Total recovery of the shoulder sensibility, abduction and extension at one-year follow-up, and patient returned progressively to his normal life and sports activities without any functional effect on the donor muscle.**CONCLUSION:** The advantages of the axillary nerve transfer are demonstrated through many publications. It is a good therapeutic option if it concerned a young patient and practiced at early time followed by adequate rehabilitation.© 2020 Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Isolated axillary nerve palsy also named circumflex nerve palsy is very rare condition that represents only 3%–6% of all brachial plexus palsies [1]. It is secondary to peripheral nerve trauma, generally during shoulder dislocation or traffic accident, it can also be iatrogenic after shoulder arthroscopic or open surgery. It lead to loss of active shoulder abduction and skin anesthesia of inferior region of the shoulder or “regimental badge area” [4].

In this paper, we shall look at the etiologies of isolated axillary nerve palsy, his diagnosis, his treatment particularly through nerve transfer and rehabilitation.

2. Case report

An 18-year-old male patient was involved in a motorcycle accident six months ago with impact on his right shoulder leading to homolateral clavicle fracture (Fig. 1), with damage to the C5–C6 root of brachial plexus causing deficiency of shoulder abduction and sensibility. He was operated for his fracture in foreign facility by plate fixation and shoulder rehabilitation. After extensive and continuous physical therapy program he had a spontaneous sensitive recovery except for the motricity of the axillary nerve documented during several Electromyography's (EMG) tests.

Patient was received in our institution with shoulder anesthesia and weakness of right upper limb abduction, he cannot raise his arm. Thus, it was decided to grant an operative treatment through neurotization procedure by transferring a long head triceps branch of the radial nerve to the axillary nerve.

Surgery was done patient in prone position under general anesthesia, without any neuromuscular block or regional anesthesia to permit nerve stimulation during surgery, an 8–10 cm longitudinal posterior approach to the shoulder was made along the axis of the external edge of the acromion to the olecranon lying directly over axillary ply.

Under microscopic visualization and nerve stimulation, the three branches of axillary nerve are identified; anterior, posterior and teres minor branches. We used the anterior branch as a recipient for the transfer and divided it proximally in suitable length to avoid possible tensioning. Then we identified the branch of the radial nerve to the long head of the triceps and cut it distally. The two branches ends are directly sutured in reliable orientation and tension (Fig. 2).

The patient was discharged home with upper limb immobilization by an arm sling with shoulder abduction for 3 weeks, after that a passive mobilization is authorized, without excessive passive abduction until two month evolution. Useful functional recovery of shoulder abduction up to 120 degrees and full extension of 45 degrees were achieved at the last follow-up evaluation of one year after surgery, without any deficit of the triceps function, patient had improved deltoid strength against resistance (M4) (Fig. 3).

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Fig. 1. Osteosynthesis of clavicle fracture.

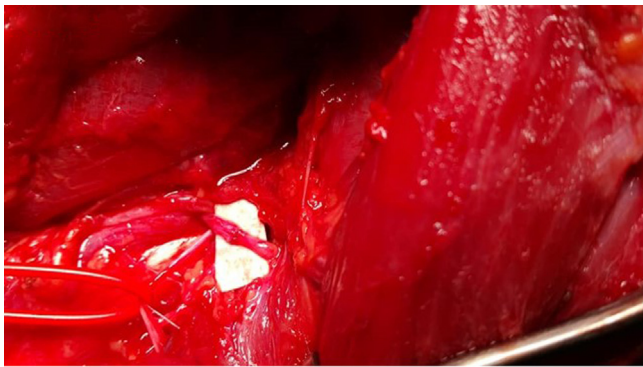


Fig. 2. Operative view of the axillary nerve neurotization.

3. Discussion

Axillary nerve or circumflex nerve derives from the brachial plexus, It is a terminal branch of the posterior cord and carries nerve fibers from C5 and C6, It traverses the inferior border of subscapularis muscle and the quadrangular space in company with posterior circumflex humeral artery before terminating at the level of humeral surgical neck into three terminal branches; anterior branch beneath the deltoid muscle, posterior branch supplying the teres minor and the posterior part of the deltoid and articular branches to the shoulder joint. Isolated axillary nerve injury is very rare, It is secondary to shoulder dislocation or motorcycle accident affecting predominantly young patients [2], it can also be iatrogenic after shoulder arthroscopy or osteosynthesis of proximal humeral fractures causing denervation of deltoid, and rotator cuff muscles [3].

Symptoms and physical signs of axillary nerve injury are variable and can easily might go unnoticed, because of delayed deltoid atrophy sign and deficiency due to compensation by supraspinatus muscle and associated shoulder trauma as in our case because of his clavicular fracture [4]. Upper limb examination should be performed bilaterally beginning by inspection, palpation and sensory testing. Then, we appreciate muscle strength according to the British Medical Research Council (MRC) grading, finally, shoulder mobility must be assessed especially abduction defined as the angle between the arm axis and the thoracolumbar spine measured with a goniometer. Therefore, specific tests of axillary nerve palsy must be practice like modified swallow-tail test or Bertelli test that is a

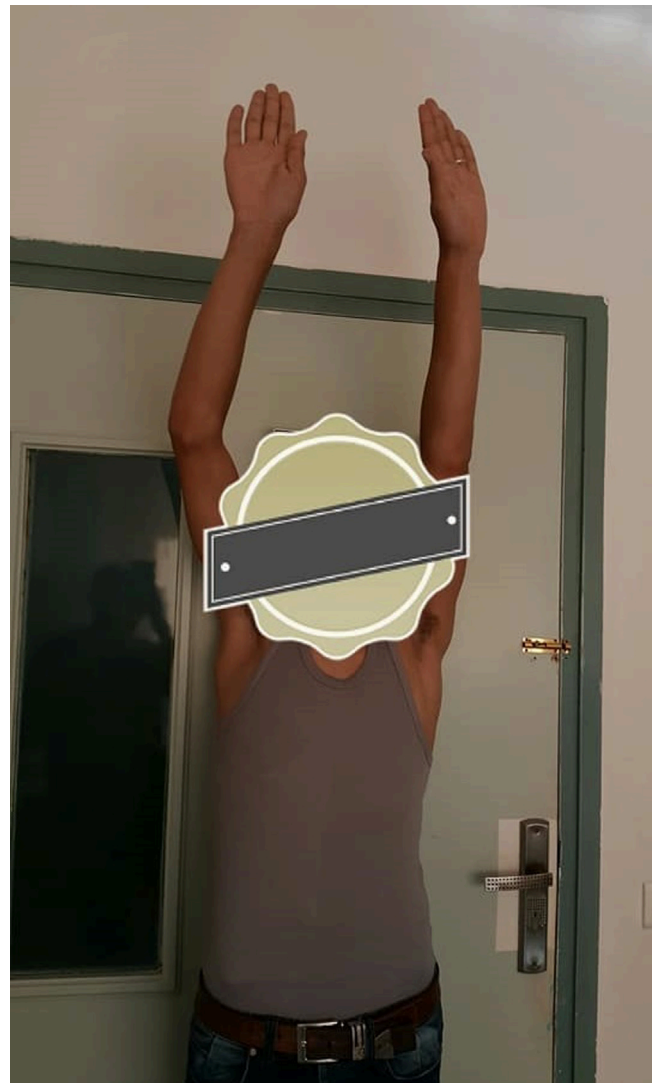


Fig. 3. Clinical results at one year follow up.

pathognomonic test of axillary nerve palsy [5]. Electromyography is the main test to explore any nerve injury and evaluate post-operative recovery, However, substantial nerve damage may not be recognized until 2–3 weeks post-injury [6].

Nerve transfer of triceps branches to the axillary nerve has become widely used technique, since the first description by Lurje in 1948 [7]. The triceps long head branch is the most widely used, it is clearly recognized because it is the first emerging branch from radial nerve and usually remains postero-medially to it. The branch of triceps lateral head can also be handled without any differences in functional results. Concerning the recipient site, the anterior branch is adequate receiver fibers, because it innervates exclusively the anterior parts of deltoid muscle, while the posterior terminal branch innervates both posterior part of deltoid and teres minor. Posterior approach can be used safety and easily to access both nerves, but do not facilitate to combine it with other nerve transfers compared to the anterior approach even if very challenging to practice [8]. However, both anterior and posterior approaches may be required. Latissimus dorsi tendon is a good anatomical landmark to identify axillary nerve and triceps motor branches to the long and upper medial heads of triceps muscle, the first one is located on his medial border and the second on his lateral border.

Adequate length of donor and receptor nerves is important factor to success the transfer without excessive tension. Therefore,

triceps long head branch must be cut as distally as possible just before penetrating the muscle belly of the triceps, while the axillary nerve should be cut as proximally as possible right at the divisions into anterior and posterior branches.

Timing of surgery is always delayed offering opportunity to spontaneous recovery during the acute phase of injury, through shoulder immobilisation, and extensive rehabilitation program emphasizing range of motion and deltoid muscle strengthening. If any improvement is observed at 3–6 months after injury, operating procedure may be indicated, especially if the mechanism of injury is reliable with nerve rupture [9].

Through multiple studies, results of nerve transfers are higher compared to nerve grafts in patients with traumatic axillary nerve injury. Worse results are associated only with delayed time to surgery up to 12 months, old age and obesity [10]. However, other studies are needed to provide exact guidelines for this shoulder nerve injury.

4. Conclusion

Nerve transfers are an increasingly popular and successful method for surgical treatment of nerve injuries compared to nerve grafts. Among them, triceps radial branch transfer to the axillary nerve in isolated palsy.

Declaration of Competing Interest

The authors report no declarations of interest.

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Ethical approval

The study is exempt from ethnical approval in our institution.

This is a case report and the patient give us informed consent for publication.

Consent

Parent give us informed consent for publication.

Author contribution

Doctor Abderrahim Zaizi, Dr Omar Dellerio and Dr Badr Rouijel make substantial contributions to acquisition of data, conception and design, and analysis and interpretation of data.

Professor Abdelouahed Amrani participate in revising it critically for important intellectual content and give final approval of the version to be submitted.

Registration of research studies

This case report doesn't need to be registered because is not first-in-man.

Guarantor

Abderrahim Zaizi and Professor Abdelouahed Amrani are the guarantor of this publication.

Provenance and peer review

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