

Anterior Interosseous Nerve Syndrome Secondary to Diaphyseal Humerus Fracture in Adults

Gonzalo Viollaz, Juan Ramallo

Department of Traumatology and Orthopedics, Hospital Británico de Buenos Aires, Autonomous City of Buenos Aires, Argentina.

ABSTRACT

Diaphyseal fractures of the humerus are associated with radial nerve injuries in up to 17% of adult patients. However, median nerve involvement is rarely reported. We present a median nerve injury affecting primarily fibers of the anterior interosseous nerve in the context of a humerus diaphyseal fracture in an adult patient. This report focuses on the clinical presentation, treatment, and evolution.

Keywords: Anterior interosseous nerve; humeral fracture; adults.

Level of Evidence: IV

Lesión del nervio interóseo anterior secundaria a una fractura diafisaria de húmero en un adulto

RESUMEN

Las fracturas diafisarias de húmero en los adultos pueden acompañarse de lesiones en el nervio radial (hasta el 17% de los casos). Sin embargo, es extremadamente infrecuente la afectación del nervio mediano luego de estas fracturas. Presentamos a un paciente adulto que sufrió una lesión en continuidad del nervio mediano luego de una fractura cerrada de húmero, con compromiso fundamental de las fibras correspondientes al nervio interóseo anterior. Se detallan la presentación clínica, el tratamiento y la evolución.

Palabras clave: Nervio interóseo anterior; fractura de húmero; adultos.

Nivel de Evidencia: IV

INTRODUCTION

Humerus fractures can be associated with nerve injuries. Radial nerve involvement is the most frequent neurological complication following a long bone fracture.¹ Less frequently, lesions of the anterior interosseous nerve, a branch of the median nerve, have been reported in children as a complication of supracondylar fractures.² However, median nerve palsy following a closed diaphyseal fracture of the humerus in an adult is exceptionally rare.

We found only two published reports describing this injury. Therefore, the aim of this article is to present a case of interosseous nerve palsy resulting from a diaphyseal humeral fracture, along with its presentation and treatment.

CLINICAL CASE

A 50-year-old man with no significant medical history presented to the clinic with a diagnosis of a closed fracture of the left humerus, which had occurred 24 hours earlier. He exhibited an abnormal position of the affected hand and an inability to make a fist, which had developed suddenly following a fall. He had not sustained injuries to any other anatomical site, and examination of the cervical spine revealed no notable abnormalities.

Received on February 7th, 2024. Accepted after evaluation on May 5th, 2024 • Dr. GONZALO VIOLLAZ • gonzaloviollaz@gmail.com  <https://orcid.org/0000-0002-4573-883X>

How to cite this article: Viollaz G, Ramallo J. Anterior Interosseous Nerve Syndrome Secondary to Diaphyseal Humerus Fracture in Adults. *Rev Asoc Argent Ortop Traumatol* 2024;89(4):425-430. <https://doi.org/10.15417/issn.1852-7434.2024.89.4.1923>

On physical examination, the patient displayed an extension posture of the thumb and index finger, with an inability to actively flex the interphalangeal joint of the thumb and the distal interphalangeal joint of the index finger (*Medical Research Council* grade M0). However, the tenodesis effect was preserved in all fingers, indicating muscle-tendon continuity. Active range of motion was observed in the remaining fingers, wrist, elbow, and shoulder, with minor limitations expected due to the pain associated with the humerus fracture.

Tinel's sign along the nerve pathway of the arm and forearm was negative. Sensitivity was slightly reduced in the median nerve territory (S4 of the *Medical Research Council*) (Figure 1). The vascular examination revealed no abnormalities.



Figure 1. Initial presentation. Extension position of the thumb and index finger, with inability to actively flex the interphalangeal joint of the thumb and distal interphalangeal joint of the index finger.

The findings were interpreted as a closed median nerve lesion, with significant damage to the fibers corresponding to the anterior interosseous nerve (which innervates the flexor pollicis longus muscle, flexor digitorum profundus, and pronator quadratus).

Anteroposterior and lateral radiographs of the humerus revealed a diaphyseal fracture of the left humerus (OTA/AO 12A1; Figure 2).



Figure 2. Anteroposterior and lateral radiographs of the arm. Spiral humerus fracture, AO12A1.

The condition was interpreted as a traction injury of the median nerve, classified as type I-III according to the Sunderland classification, with primary involvement of the fibers corresponding to the anterior interosseous nerve. Surgical treatment of the fracture was carried out using osteosynthesis with an intramedullary nail, and a conservative approach was chosen for managing the neurological injury.

At the first follow-up seven days after surgery, slight interphalangeal mobility of the thumb and index finger was observed (M1 according to the *Medical Research Council*). The wounds healed properly, and the patient began physical therapy two weeks after surgery.

During follow-up, progressive and consistent functional improvement in active flexion of the thumb and index finger was observed. The fracture consolidated nine weeks after surgery (Figure 3).



Figure 3. Anteroposterior arm radiograph and lateral control radiograph after 9 weeks. Radiographic consolidation.

Four weeks after surgery, a neurophysiological study, including electromyography and nerve conduction velocity testing, was performed to assess the extent of the injury and provide a definitive prognosis. An axonal injury, classified as Sunderland type II-III, with continuity of the fascicles corresponding to the flexor pollicis longus and flexor digitorum profundus of the index finger, with significant reinnervation, was confirmed.

After 12 weeks, the ability to clench a fist and perform a two-point pinch had been restored, along with functional shoulder abduction and elevation, as observed during the same clinical examination (Figures 4 and 5).



Figure 4. Functional changes 12 weeks after surgery.



Figure 5. Functional evaluation of the shoulder 12 weeks after surgery.

DISCUSSION

Nerve injuries secondary to humerus fractures are frequent complications. In 2-17% of cases, radial nerve injuries occur due to the close proximity of the nerve along its path.¹

Similarly, involvement of the anterior interosseous nerve has been reported in 6-16% of supracondylar humerus fractures in the pediatric population, making it the most frequent complication associated with these fractures.³

However, median nerve palsy following a closed humerus fracture in adults is rare and typically occurs in isolated cases.

In 2013, Pongowski and Panasiuk described anterior interosseous nerve palsy following a supracondylar humerus fracture in a 24-year-old woman.⁴ That same year, Tanagho et al. reported a similar complication secondary to a proximal humerus fracture in an 87-year-old female patient.⁵

Only two cases involving diaphyseal fractures have been documented: one by Manicol in 1978, involving a 10-year-old patient,⁶ and another by Apergis et al. in 1998, involving a 19-year-old patient.⁷ Both cases featured short transverse/oblique fractures with overriding of one medial bone segment over the other.

In 1978, Sunderland described how the fascicles of the anterior interosseous nerve could be distinguished from their emergence in the brachial plexus. These nerve fibers are situated in the posterolateral portion of the nerve and are particularly susceptible to compression and traction along their path.⁸ Finally, as Vincelet observed in laboratory-induced supracondylar fractures, the posterior interosseous nerve may be more affected in these fractures due to its attachment to the interosseous membrane, which limits the nerve's ability to slide after traction.

Another controversy arises regarding the need to explore these lesions. In the case of the radial nerve, opinions are divided. Some advocate for early exploration to achieve a rapid diagnosis and initiate early management.^{9,10} However, those in favor of expectant management argue that spontaneous recovery is most common, with similar outcomes even after delayed exploration. For this reason, they recommend watchful waiting for 16-18 weeks.¹¹⁻¹³ In all reported cases, functional restoration occurred spontaneously between the third and sixth month, without the need for surgical exploration.

Based on previous experience with radial nerve injuries following these fractures, we opted to observe these injuries for a prudent period of time.

Finally, we did not request neurophysiological studies upon the patient's admission but instead performed them in the third week after the injury to better quantify its extent.¹⁴

CONCLUSIONS

Due to the limited experience with this type of lesion and its infrequent occurrence, it is not possible to draw definitive conclusions on the best management approach. However, we believe that observation and expectant management without surgical exploration are advisable unless there is a vascular injury, evidence of overriding on radiographic images, or bone exposure/penetrating injury. Additionally, we believe that neurophysiological studies are useful for confirming the clinical diagnosis and aiding in the follow-up process to inform decision-making.

Conflict of interest: The authors declare no conflicts of interest.

J. Ramallo ORCID ID: <https://orcid.org/0000-0001-7907-5854>

REFERENCES

1. Shao YC, Harwood P, Grotz MRW, Limb D, Giannoudis PV. Radial nerve palsy associated with fractures of the shaft of the humerus: a systematic review. *J Bone Joint Surg Br* 2005;87(12):1647-52. <https://doi.org/10.1302/0301-620X.87B12.16132>
2. Spinner M, Schreiber SN. Anterior interosseous-nerve paralysis as a complication of supracondylar fractures of the humerus in children. *J Bone Joint Surg Am* 1969;51:1584-90. PMID: 5357177
3. Cramer KE, Green NE, Devito DP. Incidence of interosseous nerve palsy in supracondylar humerus fractures in children. *J Pediatr Orthop* 1993;13(4):502-5. <https://doi.org/10.1097/01241398-199307000-00015>
4. Pongowski B, Panasiuk M. Anterior interosseous nerve palsy after supracondylar fracture of humerus in adult. Case report. *Orthop Traumatol Rehabil* 2013;15(4):363-8. <https://doi.org/10.5604/15093492.1073836>
5. Tanagho A, Elgamil T, Ansara S. Anterior interosseous nerve palsy as a complication of proximal humerus fracture. *Orthopedics* 2013;36(10):e1330-2. <https://doi.org/10.3928/01477447-20130920-29>
6. Manicol MF. Roentgenographic evidence of median-nerve entrapment in a greenstick humeral fracture. *J Bone Joint Surg Am* 1978;60(7):998-1000. PMID: 701352
7. Apergis E, Aktipis D, Giota A, Kastanis G, Nteimentes G, Papanikolaou A. Median nerve palsy after humeral shaft fracture: Case report. *J Trauma* 1998;45(4):825-6. <https://doi.org/10.1097/00005373-199810000-00040>
8. Sunderland S. *Nerves and nerve injuries*. 2nd ed. New York: Churchill Livingstone; 1978, p. 656-90.
9. Foster RJ, Swiontkowski MF, Bach AW, Sack JT. Radial nerve palsy caused by open humeral shaft fractures. *J Hand Surg Am* 1993;18(1):121-4. [https://doi.org/10.1016/0363-5023\(93\)90255-2](https://doi.org/10.1016/0363-5023(93)90255-2)

10. Dabezies EJ, Banta CJ 2nd, Murphy CP, d'Ambrosia RD. Plate fixation of the humeral shaft for acute fractures, with and without radial nerve injuries. *J Orthop Trauma* 1992;6(1):10-3. PMID: 1556609
11. Larsen LB, Barfred T. Radial nerve palsy after simple fracture of the humerus. *Scand J Plast Reconstr Surg* 2000;34(4):363-6. <https://doi.org/10.1080/028443100750059156>
12. Bumbasirević M, Lesić A, Bumbasirević V, Cobeljić G, Milosević I, Atkinson HDE. The management of humeral shaft fractures with associated radial nerve palsy: a review of 117 cases. *Arch Orthop Trauma Surg* 2010;130(4):519-22. <https://doi.org/10.1007/s00402-009-0951-4>
13. Ekholm R, Ponzer S, Törnkvist H, Adami J, Tindermark J. Primary radial nerve palsy in patients with acute humeral shaft fractures. *J Orthop Trauma* 2008;22(6):408-14. <https://doi.org/10.1097/BOT.0b013e318177eb06>
14. Bergquist ER, Hammert WC. Timing and appropriate use of electrodiagnostic studies. *Hand Clin* 2013;29:363-70. <https://doi.org/10.1016/j.hcl.2013.04.005>