

Subjective Evaluation of Subclavicular Hypoesthesia After Open Reduction and Internal Fixation of Clavicle Fractures

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ABSTRACT

Introduction: Clavicle fractures account for 4% of adult fractures, with mid-shaft fractures accounting for 80%. Although surgical treatment reduces the risk of pseudarthrosis, malunion, and residual pain, it is not without complications such as regional hypoesthesia (12-29%). **Objective:** To determine the prevalence of subclavicular hypoesthesia following open reduction and internal fixation for clavicle fracture, as well as if and how it impacts the patient's quality of life. **Materials and Methods:** A prospective cross-sectional analytical study of patients with displaced clavicle midshaft fractures treated with ORIF between 2018-2021 was performed. The research team used a questionnaire with six items that were completed anonymously. The presence of infraclavicular hypoesthesia, regional pain, and daily life interference was assessed. **Results:** Twenty-nine patients treated surgically with a longitudinal approach and with a minimum postoperative follow-up of one year were evaluated. Twenty-two patients (76%) had altered sensitivity, whereas seven (24%) denied the existence of the symptom. In 97% of individuals with subclavicular hypoesthesia, quality of life was impaired minimally or not at all. **Conclusions:** Before undergoing surgery, it is important to inform the patient about the risk of cutaneous numbness as a postoperative consequence due to its high frequency but improbable impact on daily activities.

Keywords: Clavicle fracture; internal fixation; numbness; supraclavicular nerve.

Level of Evidence: IV

Evaluación subjetiva de la hipoestesia subclavicular luego de una reducción abierta y fijación interna de fracturas de clavícula

RESUMEN

Introducción: Las fracturas de clavícula representan el 4% de las fracturas del adulto; el 80% son mediodiafisarias. Se ha demostrado que el tratamiento quirúrgico disminuye el riesgo de pseudoartrosis, consolidación viciosa y dolor residual, aunque no está exento de complicaciones, como la hipoestesia regional (12-29%), entre otras. **Objetivo:** Evaluar la incidencia de hipoestesia subclavicular luego de una reducción abierta y fijación interna para una fractura de clavícula, si afecta la calidad de vida del paciente y cómo la afecta. **Materiales y Métodos:** Se realizó un estudio transversal analítico prospectivo de pacientes con una fractura mediodiafisaria desplazada de clavícula tratados con reducción abierta y fijación interna entre 2018 y 2021. Se utilizó un cuestionario elaborado por el equipo, que consistió en 6 preguntas para responder de forma anónima. Se evaluó la presencia de hipoestesia infraclavicular, dolor regional y afectación de la vida cotidiana. **Resultados:** Se evaluó a 29 pacientes con un seguimiento posoperatorio mínimo de un año, operados mediante un abordaje longitudinal. Veintidós (76%) tenían alteración de la sensibilidad y siete (24%) negaron este síntoma. La hipoestesia subclavicular afectó la calidad de vida de manera leve o nula del 97% de los pacientes con hipoestesia subclavicular. **Conclusión:** Es importante advertirle al paciente antes de la cirugía sobre la posibilidad de hipoestesia cutánea como complicación posoperatoria, debido a su alta frecuencia, aunque es poco probable que dicha complicación afecte la calidad de vida.

Palabras clave: Fractura de clavícula; fijación interna; hipoestesia cutánea; nervio supraclavicular.

Nivel de Evidencia: IV

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How to cite this article: Pierro I, Simone JP, Fornas G, Vasallo MB. Subjective Evaluation of Subclavicular Hypoesthesia After Open Reduction and Internal Fixation of Clavicle Fractures. *Rev Asoc Argent Ortop Traumatol* 2023;88(4):419-426. <https://doi.org/10.15417/issn.1852-7434.2023.88.4.1721>

INTRODUCTION

Clavicle fractures account for 4% of adult fractures and 44% of shoulder region fractures, and represent one of the most common bone injuries in young adults.¹ They are classified, according to Allman, into three types according to their location: 80% are fractures of the middle third of the clavicle (Allman type 1).² The injury mechanism is usually indirect trauma after a fall on the shoulder, and is common in contact sports and road traffic accidents.

For years, the treatment of choice has been conservative; however, in the last decade, surgery has been shown to decrease the risk of pseudarthrosis, malunion, residual pain and achieve better short-term functional rates, allowing the patient an early return to work.³ However, surgery causes complications and one of the most frequent is regional hypoesthesia (12-29% incidence).^{3,4}

The objective of this study was to evaluate the incidence of subclavicular hypoesthesia after open reduction and internal fixation (ORIF) for a clavicle fracture using an anterior superior longitudinal approach, whether it affects the patient's quality of life and how it affects it.

MATERIALS AND METHODS

A prospective analytical cross-sectional study of patients with a mid-shaft clavicle fracture treated with ORIF by the same team of hospital surgeons was conducted between January 1, 2018 and June 30, 2021.

The inclusion criteria were: 1) age >16 years, 2) Allman type 1 fractures with >100% displacement of clavicle width or shortening >1.5 cm, 3) postoperative follow-up of at least one year, 4) ORIF with plates and screws.

The exclusion criteria were: 1) open fractures, 2) fractures with neurovascular injury on admission, 3) refractures, 4) floating shoulder, 5) loss of follow-up within one year of surgery.

Surgical technique

Antibiotic prophylaxis with 1 g of cephalexin was administered intravenously 30 min before the skin incision. Surgery was performed with the patient under general anesthesia and regional block, in the beach chair position. Antisepsis of the corresponding hemithorax and upper limb was performed with povidone-iodine. The sterile drapes were placed according to the surgical technique. A longitudinal approach was performed on the corresponding clavicle. Resection by planes, repair and identification of the superficial cervical plexus branches were performed. If the cutaneous branch interfered with reduction or plate placement, it was cauterized and severed (Figure 1).

The fracture was identified and anatomical reduction and osteosynthesis were performed. Subsequently, radioscopy monitoring, wound washing and layered closure were performed.

Patients who met the inclusion criteria were contacted via WhatsApp or phone call. The purpose of the contact was explained and each patient was requested to verbally consent to participate in the study. A questionnaire was sent using the QuestionPro application and patients answered all six questions anonymously (Appendix). During the follow-up of the first postoperative year, the presence of infraclavicular hypoesthesia, its impact on activities of daily living, and the presence of psychological effects and pain were assessed.

RESULTS

After applying the inclusion and exclusion criteria, 29 patients formed the study group. Twenty-seven were male (93%) and two were female (7%). The average age was 39.8 years (range 19-63).

Twenty-two (76%) reported having regional hypoesthesia and seven (24%) denied having this symptom. This finding is noteworthy because, according to published studies, regional hypoesthesia affects 12-29% of patients.

Three of the 22 patients with altered sensation reported hyperesthesia of the surgical wound site, with no associated pain.



Figure 1. Illustration of the supraclavicular nerve with its superficial sensory branches.

Figure 2 shows the severity of hypoesthesia after the first year of surgery.

Twenty-four patients (83%) reported no discomfort due to hypoesthesia during their daily activities; four (14%) reported a mild grade and only one (3%) a moderate grade.

Regarding the evolution of hypoesthesia during the first year of rehabilitation, 13 patients (45%) reported no improvement. On the other hand, two (7%) reported excellent outcomes after the first year of rehabilitation, while the remaining 14 (48%) reported a slight improvement.

Only four (14%) experienced psychological effects and pain in the surgical wound region during the postoperative period.

DISCUSSION

The incidence of clavicle fractures is high in young adults and their surgical treatment with plate and screw ORIF achieves good outcomes with high success rates and low complication rates.⁵ Regional hypoesthesia is one of the most frequent complications due to injury to the superficial sensory branches of the supraclavicular nerve.^{2,6} This complication has not been taken into account for many years and is an important factor to discuss with the patient before the operation.

The supraclavicular nerve is a sensitive cutaneous nerve that originates from the C3-C4 nerve roots of the superficial cervical plexus. Its innervation zone includes the anteromedial region of the shoulder and the proximal region of the chest under the clavicle. The nerve divides into two branches, one medial and one lateral, and may occasionally present a third intermediate branch. The medial branch crosses the medial third of the clavicle and the lateral branch crosses the lateral third, each divided into 2-3 superficial branches (**Figure 3**).⁷

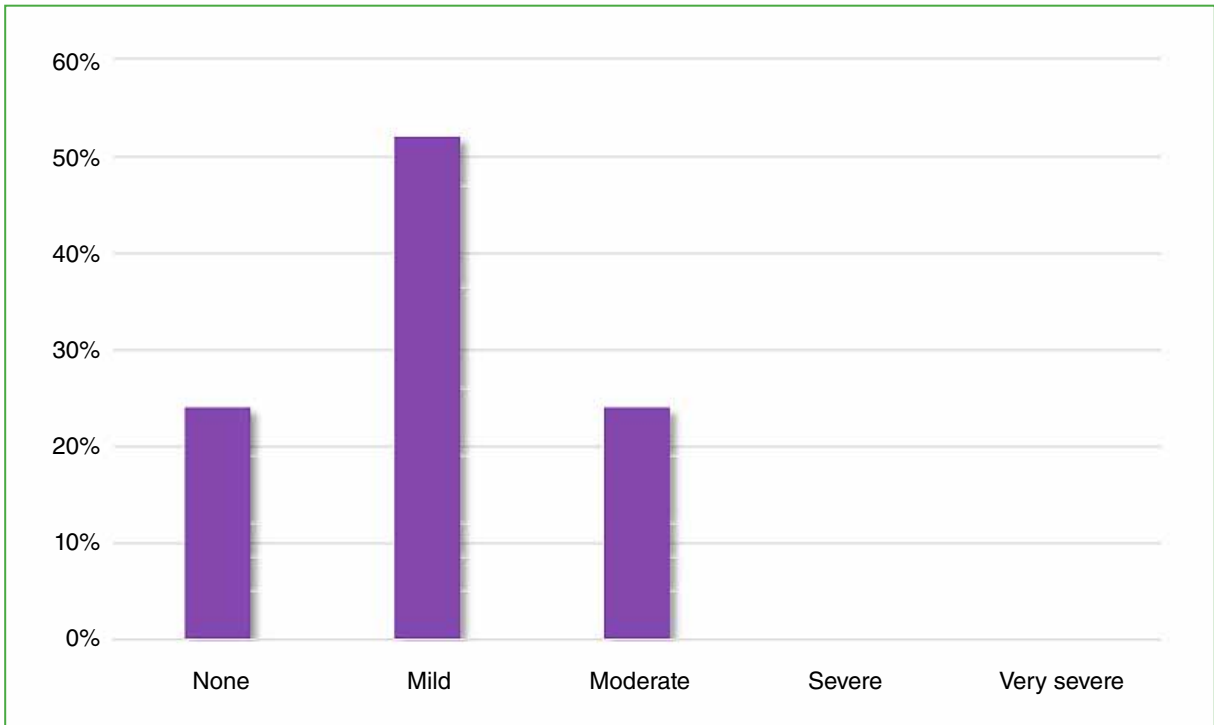


Figure 2. Severity of hypoesthesia after the first year of surgery.

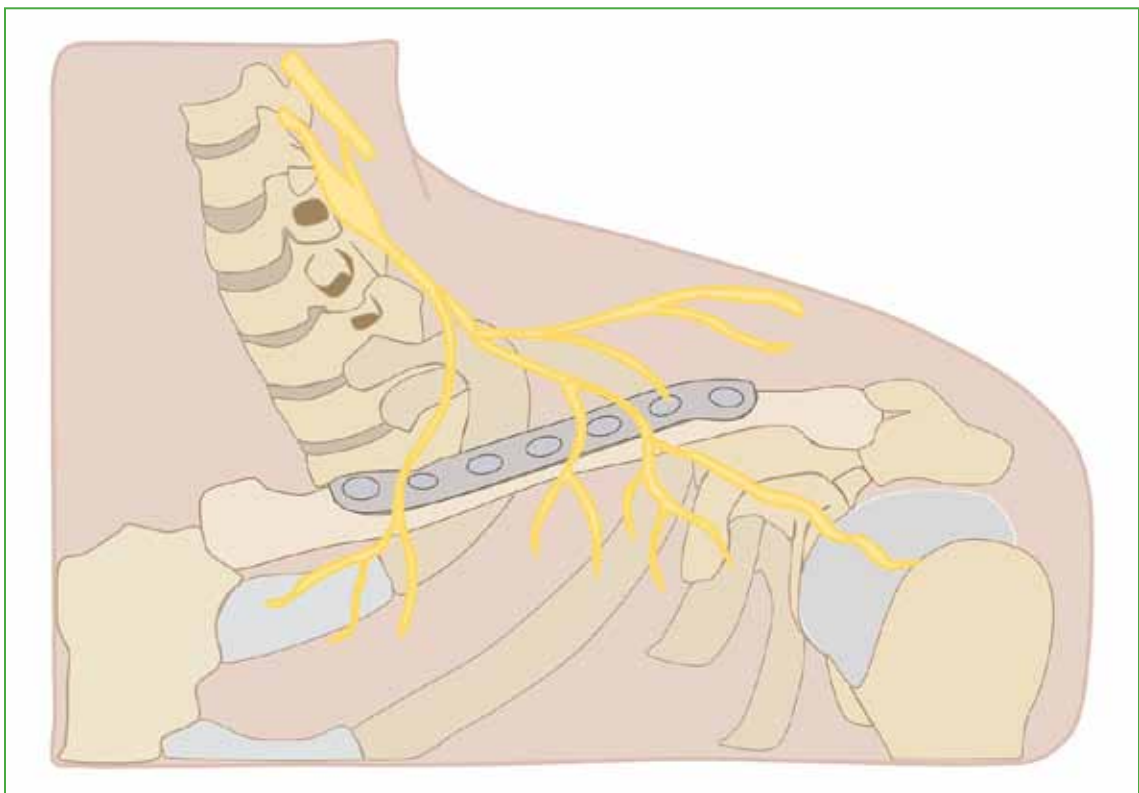


Figure 3. Supraclavicular nerve and its branches.

Two main approaches have been described for the surgery of clavicle fractures with plates and screws: one longitudinal and one vertical (Figure 4). In our institution, the longitudinal approach that runs over the anterosuperior edge of the clavicle is used. Such an approach may compromise the superficial sensory branches of the supraclavicular nerve, generating regional hypoesthesia if severed. They can be preserved and better identified using microsurgery loupes. Repair and care of these sensitive branches may require a longer surgical time and therefore more exposure time with the risk of infection and surgical discomfort for the surgeon when performing reduction and osteosynthesis.^{4,8,9}

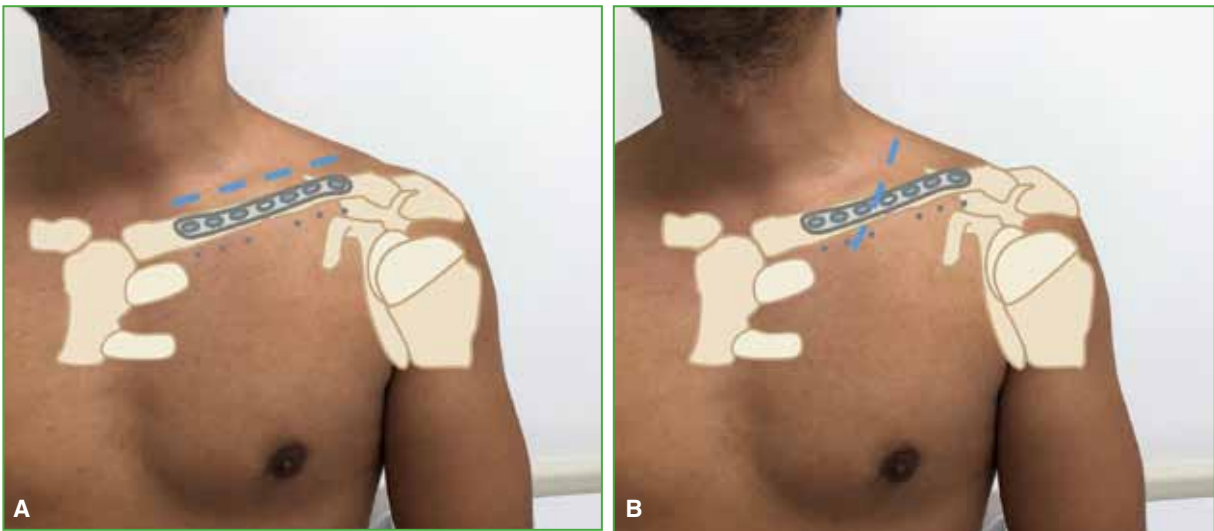


Figure 4. A. Longitudinal approach. B. Oblique approach.

Minimally invasive surgery has recently been described as a successful surgical technique for mid-shaft clavicle fractures, which allows for the reduction of complications associated with the open approach. It involves making small approaches away from the fracture focus that cause less bleeding and dissection, thus decreasing the risk of injury to supraclavicular nerves.¹⁰

There are few comparative studies between the minimally invasive technique and ORIF. So far, no significant differences have been found in radiological and functional outcomes, or in consolidation time.^{10,11} However, the minimally invasive technique causes a lower rate of surgical wound complications and especially a lower rate of regional hypoesthesia.^{11,12}

Studies comparing the longitudinal to the oblique or vertical approach were conducted in the literature.^{3,5} The vertical or oblique approach avoids compromising the sensory branches of the supraclavicular nerve; however, it may cause more discomfort for the surgeon, it exposes less of the clavicular fracture and has similar long-term functional outcomes to the longitudinal method. According to published studies, there is no statistically significant difference in complications in both groups of patients. It has been concluded that patients felt more satisfied with the aesthetic results of the longitudinal approach.⁵

Iatrogenic neuromas are a rare complication of clavicle fractures. Injury to the cutaneous branches of the supraclavicular nerve or compression with osteosynthesis material or a fracture callus can generate pain and hyperesthesia in and around the scar region. In such a case, a surgical examination and nerve decompression or stellate ganglion block should be performed as a technique of choice.^{8,13}

In this study, only 13% of patients felt pain in the wound area and 10% reported hyperesthesia, but none reported that these symptoms interfered with their daily activities or generated a psychological condition.

According to our findings, hypoesthesia is a frequent complication in the postoperative period of clavicle fractures treated with a longitudinal approach, however, it does not appear to impact quality of life. 97% of patients reported no discomfort or mild discomfort during daily activities. On the other hand, this alteration of sensation is more severe during the first months after surgery and, with the course of rehabilitation, the improvement is progressive. 76% of our patients reported a decrease in the severity of hypoesthesia after the first year.

The limitation of our study was the relatively low number of cases. This was a retrospective study in which patients provided a subjective opinion without an objective assessment of regional hypoesthesia; an objective regional examination should include neurophysiological and instrumental studies beyond the scope of our research. However, we believe that the patient's opinion and satisfaction largely reflect the success or failure of the outcome.

CONCLUSIONS

Injury to the supraclavicular nerve or its branches is a common complication during internal fixation of clavicle fractures. According to our results, 76% of patients had regional hypoesthesia that decreased over months and did not influence their daily activities or affect them psychologically. However, it is important to discuss the possibility of this complication before surgery to avoid the patient's affliction.

Given that complications or discomfort from regional hypoesthesia do not affect the quality of life of patients operated on using a longitudinal approach, the surgeon should operate comfortably and use the approach with which they have more experience and can perform the best reduction and desired osteosynthesis.

APPENDIX. Questionnaire sent to the patients

1. Do you have altered sensitivity in the region of the operated clavicle?

Yes.

No.

2. Degree of severity of hypoesthesia one-year after surgery.

1: None.

2: Mild.

3: Moderate.

4: Severe.

5: Very severe.

3. Do you have discomfort in your daily activities due to hypoesthesia?

1: None.

2: Mild.

3: Moderate.

4: Severe.

5: Very severe.

4. Were there improvements in hypoesthesia throughout rehabilitation?

- 1: None.
- 2: Mild.
- 3: Moderate.
- 4: Severe.
- 5: Very severe.

5. Have you experienced psychological effects due to regional hypoesthesia?

- 1: None.
- 2: Mild.
- 3: Moderate.
- 4: Severe.
- 5: Very severe.

6. Do you have pain in the scar or wound area?

- 1: None.
- 2: Mild.
- 3: Moderate.
- 4: Severe.
- 5: Very severe.

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

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