

The cloverleaf plate and proximal humerus fractures

A placa em trevo e fraturas do úmero proximal
La placa en trébol y las fracturas del húmero proximal

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Abstract

Background: Fractures of the proximal humerus are challenging injuries. They have a functional impairment and can be managed by non-operative or operative methods. Surgical methods can be intramedullary nails, tension-band wiring, or plates and screws. **Aim of the study:** This study aims to show the outcomes of managing fractures of the proximal humerus using the trefoil plate method. **Methods:** Eight young patients with type 2 or 3 part proximal humerus fractures were retrospectively analyzed concerning the cloverleaf plate fixation and consolidation method. Patients with 4-part fractures were excluded. **Results:** We obtained 100% consolidation with a mean ROM of 109 degrees for abduction, 4.4 degrees for external rotation, and good internal rotation. **Conclusion:** the trefoil plate osteosynthesis method can be used in young patients with 2- or 3-part fractures of the proximal humerus.

Descriptors: Humerus; Humeral Fractures; Wounds and Injuries.

Resumo

Introdução: As fraturas do úmero proximal são lesões desafiadoras. Associam-se a deficiência funcional e podem ser gerenciadas por métodos não operatórios ou operatórios. Os métodos cirúrgicos podem ser hastes intramedulares, fiação de banda de tensão ou placas e parafusos. **Objetivo do estudo:** Este estudo visa mostrar os resultados do tratamento das fraturas do úmero proximal pelo método da placa trifólio. **Métodos:** Oito pacientes jovens com fratura proximal do úmero do tipo 2 ou 3 partes foram analisados retrospectivamente quanto à fixação da placa de trevo e método de consolidação. Pacientes com fraturas em 4 partes foram excluídos. **Resultados:** Obtivemos 100% de consolidação com ADM média de 109 graus para abdução, 4,4 graus para rotação externa e boa rotação interna. **Conclusão:** o método de osteossíntese de placa trifólio pode ser utilizado em pacientes jovens com fratura em 2 ou 3 partes do úmero proximal.

Descritores: Úmero; Fraturas do Úmero; Ferimentos e Lesões.

Resumen

Antecedentes: las fracturas del húmero proximal son lesiones desafiantes. Tienen un deterioro funcional y pueden ser manejados por métodos quirúrgicos o no quirúrgicos. Los métodos quirúrgicos pueden ser clavos intramedulares, alambres con bandas de tensión o placas y tornillos. **Objetivo del estudio:** Este estudio tiene como objetivo mostrar los resultados del tratamiento de las fracturas del húmero proximal mediante el método de la placa de trébol. **Métodos:** Se analizaron retrospectivamente ocho pacientes jóvenes con fracturas de húmero proximal de tipo 2 o 3 en relación con el método de fijación y consolidación con placa en trébol. Se excluyeron los pacientes con fracturas en 4 partes. **Resultados:** Obtuvimos una consolidación del 100% con un ROM medio de 109 grados para abducción, 4,4 grados para rotación externa y buena rotación interna. **Conclusión:** el método de osteosíntesis con placa de trébol se puede utilizar en pacientes jóvenes con fracturas en 2 o 3 partes del húmero proximal.

Descriptores: Húmero; Fracturas del Húmero; Heridas y Traumatismos.

INTRODUCTION

Proximal humerus fractures are commonly observed in the elderly population, the third most common fracture in that group, after hip and distal radius fracture¹. These fractures are seen in elderly patients with osteoporotic bones and young patients with high-energy trauma^{2,3}.

Non-surgical management is usually the choice and widely accepted, even for complex fractures.³ In the group of younger patients with good bone mineral density, the surgical approach is more commonly desired, given the opportunity for early rehabilitation and adequate bone alignment. According to Neer's classification, several biomechanical studies have been performed for different methods of fixation of fractures in two parts⁴. Currently, the most accepted methods are intramedullary nails, fixed-angle locking devices, tension band

wiring, and conventional plates⁵.

The advent of fixed-angle locking plates represents a significant advance in fixation techniques due to their plate-locking screw interface, rather than relying solely on their bone acquisition for stability⁶.

Furthermore, biomechanical studies in cadavers have shown lower screw pullout rates with these implants⁴. However, its clinical relevance remains unclear.

The use of tension-band wiring associated with conventional plates (i.e., cloverleaf plate) has shown to be a safe option in previous studies for proximal humerus fracture in the elderly⁷. The use of this combination of methods becomes much more relevant in regions with limited resources.

The objective of the present study is to evaluate young patients with previous proximal

humerus fractures, classified as two-part or three-part fractures, treated with open reduction and internal fixation using tension-band wiring and cloverleaf plate.

MATERIAL AND METHOD

This is a retrospective study carried out at the Hospital das Clínicas of the Faculty of Medicine of Ribeirão Preto, University of São Paulo (USP) in Ribeirão Preto (SP), Brazil, and approved by the Research Ethics Committee of the Hospital das Clínicas of the Faculty of Medicine of Ribeirão Preto. We retrospectively reviewed eight young patients who had a displaced two-part or three-part fracture of the proximal humerus and had no access to the locking plates. Thus, they were submitted to osteosynthesis through a modified cloverleaf plate associated with tension-band wiring, according to the technique previously described⁷. According to the Neer classification, throughout X-Rays and CT-scan images, we identified those with two or three-part fractures at the trauma date for the analysis. Patients were evaluated on a regular basis until 6 months, during which the following variables were analyzed: consolidation period, range of motion (ROM), period for arm sling removal. No patients were lost during follow-up. The rehabilitation protocol was the same for all individuals, starting pendular activities with three weeks post-operatively and active range of motion with six weeks. Exclusion criteria were patients above 60 years of age, poor bone quality, pathologic fractures, fracture-dislocations, and patients with neuropraxia of the axillary nerve. The technique was performed through a transdeltoid lateral approach, in which the rotator cuff was repaired using Ethibond wires and fixation of the head and shaft with screws. In this way, the Ethibond wires were fixed to the plate, as observed in Figure 1.

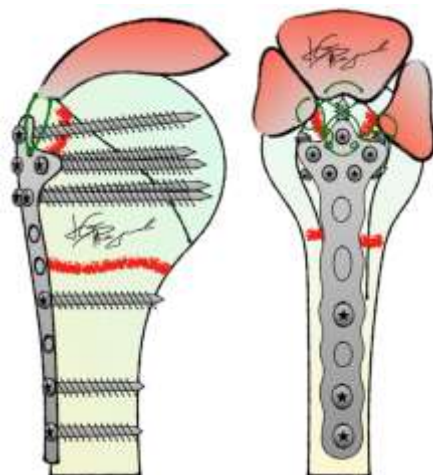


Figure 1: Cloverleaf Plate fixation associated with Ethibond wire tension-band to the Rotator Cuff. **A** anteroposterior view and **B** lateral view (Author: Rezende, LGRA – 2021)

RESULTS

The patients' demographics are depicted in Table 1. Their mean age was 36 years old (range 25-49), four patients were male (50%), two had comorbidities (25%, being hypertension in both cases), and 5 had a three-part fracture (62,5%).

Table 1. Cases and variables. M = Male; F = Female; AS = Arterial Hypertension; ER = External Rotation; IR = Internal Rotation. ROM (Abduction, ER and IR was evaluated at 6 months after surgery)

Case	Gender	Age	Neer Classification	CMB	6-Weeks R-X	ABDT	ER*	IR*
1	M	49	3 Part	AS	Healed	100°	5°	Lumbar
2	F	38	2 Part	No	Healed	90°	0°	Lumbar
3	F	25	3 Part	No	Healed	95° ^a	10°	Lumbar
4	M	34	3 Part	No	Healed	110°	5°	Lumbar
5	F	40	3 Part	No	Healed	130°	0°	Thoracic
6	M	41	2 Part	AS	Healed	140°	5°	Lumbar
7	M	32	3 Part	No	Healed	110°	5°	Sacral
8	F	31	2 Part	No	Healed	100°	5°	Lumbar

CMB = Comorbidities; R-X = Radiographic; ABDT = Abduction

All patients had their fracture healed within six weeks post-operatively confirmed on x-rays, as observed in Figure 2. They had started pendular activities at three weeks and active range of motion at week six. The sling was maintained intermittently throughout the day for physical therapy. However, only 2 (25%) required a full-time sling until six weeks. At six months, mean abduction was 109 degrees (range 90-140 degrees), mean external rotation 4,4 degrees (range 0-10 degrees), six patients reached internal rotation until their lumbar spine, 1 reached lower thoracic, and 1 reached sacrum (Figure 3).



Figure 2: Radiographic Anteroposterior view (A) and Lateral view (B), showing fracture healing.



Figure 3: Range of motion of case nº 8. External Rotation in abduction (A = Anterior view and B = Posterior View). Shoulder abduction in anterior view (C) and Internal Rotation (D).

DISCUSSION

This retrospective study supports the use of the cloverleaf plate in today's era as a safe and effective approach to proximal humerus fractures in a younger patient group. In addition, we found no complications in our sample, even though it is a small one.

The use of locking devices remains popular and probably one of the most used implants nowadays to manage such conditions, along with intramedullary nailing. However, such methods are still subject to failure and have a significant reoperation rate⁸. Besides, many of which are not readily available in low-income areas in developing countries, such as in our group of patients.

As for intramedullary nailing in the treatment of proximal humerus fracture, its results can be pretty unpredictable. High reoperation rates in some series and the choice of entry site are some of the potential complications for this method⁹.

Despite its benefits on pain control and immediate stability, management with hemiarthroplasty is not the first option in young patients¹⁰. Poor functional outcomes and associated complications such as glenoid wear in a very young population are disadvantages¹¹.

Overall, many reports of locking plate devices for the treatment of proximal humerus fracture are limited, with few cases per series¹².

Given this, some studies show biomechanical advantages to the use of locking devices instead of conventional plates. The question of whether this advantage is clinically significant remains unclear^{4,13}.

Indeed, a recent study has shown that the use of cloverleaf plates associated with tension-band wiring can be an effective treatment for three-part fractures⁷.

This study has several limitations. First, it is a non-randomized retrospective study, and our small sample makes it difficult to identify adverse events. However, our results are comparable to those found in previous literature.

CONCLUSION

The use of cloverleaf plate associated with tension-band wiring was an effective method for managing two-part fractures in a young population group, especially in centers where locking devices may not be readily available for use.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interests.

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