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(CASE REPORT)

Surgical Management of Proximal Humerus Fractures: palm tree pinning versus anatomical plate

M. abartal *, M. Hammouti, M. Amahtil, M. Arroud, J. Jebbari, W. Bouziane and A. Daoudi

Department of Orthopedics and Traumatology, Mohammed VI University Hospital, Faculty of Medicine and Pharmacy of Oujda, Mohammed I University, Oujda, Morocco.

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Abstract

Background: This study aims to compare the functional and radiological outcomes of two surgical techniques used in the treatment of proximal humerus fractures: open reduction and internal fixation (ORIF) and closed reduction with percutaneous pinning.

Patients and methods: We conducted a retrospective study in the Department of Orthopedic and Trauma Surgery, including 18 patients treated for proximal humerus fractures by ORIF using an anatomical locking plate. A second group of 20 patients was treated using the Kapandji intrafocal percutaneous pinning technique. Functional outcomes were evaluated using the Disabilities of the Arm, Shoulder and Hand (DASH) score and the Constant–Murley score. Radiological outcomes included time to union and quality of reduction.

Results: Statistical analysis showed no significant difference between the two groups in functional or radiological outcomes. Union was achieved in all patients. Mean time to union was 6.2 weeks in the ORIF group and 6.05 weeks in the pinning group. The mean DASH scores were 19.4 and 18.6, respectively. The mean Constant–Murley scores were 80.6 and 84.6, respectively.

Conclusion: Both techniques provide comparable functional and radiological outcomes, with no evidence of superiority of one method over the other.

Keywords: Proximal humerus fracture; Open reduction and internal fixation; Percutaneous pinning; Kapandji technique

1. Introduction

Proximal humerus fractures are a common traumatic injury accounting for 4-5% of adult fractures [1,2]. This type of fracture is characterized by its important impact on the function of the shoulder and its treatment has given rise to a controversial debate in the literature. If orthopedic treatment is intended for treatment of non displaced fractures, surgical treatment remains a challenge for the orthopedic surgeon because several surgical treatment options are available including open reduction and internal fixation (ORIF), closed reduction and percutaneous pinning (CRPP), hemiarthroplasty (HA), besides reverse total shoulder arthroplasty(RSA).3–4 and none of which has proven to be ideal.

This study, hence, seeks to establish a statistical comparison of the functional and radiological outcomes between two groups of patients who underwent surgical treatment for a fracture of the upper end of the humerus On the one hand, the first group underwent open reduction and internal fixation with an anatomical humeral plate, and the second group,

* Corresponding author: M. abartal

on the other hand, underwent percutaneous palm tree pinning using the Kapandji technique. This enabled the research to ascertain and contrast the results of surgical interventions for proximal humerus fractures in order to pinpoint the variables that might affect the selection of one approach over another.

2. Patients and Methods

This is a retrospective study conducted in the department of Orthopedic and Trauma Surgery at Mohamed VI University Hospital of Oujda, Morocco, between 2014 and 2020. Among all patients treated for fracture of the proximal humerus, a group was treated with open reduction and internal fixation using plate when another group was treated with pinning.Patients with the same type of fracture but treated with another surgical technique were excluded from the study while all patients included were followed up during this period and we did not note any loss of sight. The exclusion criteria included pseudarthrosis, pathologic fractures and refractures, open fractures, or concomitant fractures of the ipsilateral elbow or distal radius. Further, patients with existing disorders like having an effect on the healing process and function such as multiple sclerosis, paraplegia or other relevant neurologic disorders, polytrauma with an Injury Severity Score greater than 16, and posttraumatic brachial plexus injury or peripheral nerve palsy were also excluded.

Surgery was performed in the supine or *beachchair* position on a radiolucent table. The patients treated by pinning were operated according to the technique described by Kapandji [8]. Yet, for the group treated by Open Reduction and Internal Fixation, we used a deltopectoral approach, (in which) reduction was obtained by direct manipulation of the fragments and fixation was done with a non-locking anatomical plate.

Postoperative treatment involved immobilizing the arm in a sling and passive range-of-motion and exercises started two days after surgery. Then, controlled active mobilization with abduction and flexion beyond 90 was started one to three weeks postoperatively, depending on the stability of the osteosynthesis and the bone quality.

Fractures were classified according to the Neer classification [5] on the basis of plain radiographs.

At each follow-up visit, the patient was examined and interviewed with regard to pain. Mobility, strength, and the Constant and Murley score[6] were determined for the injured and contralateral shoulders.

the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire were used as a validated patient-focused outcome tool at the one-year follow-up visit.

The radiological evaluation was based on True AP and trans-scapular Y-view radiographs obtained postoperatively and at each follow-up. These same images were used to assess the time to consolidation and the quality of reduction based on the cephalodiaphyseal angle measurement [7].

3. Results

38 patients were studied, all of whom had a fracture of the upper end of the humerus: 18 were treated with an anatomical screw plate and 20 with pinning.

The overall mean age was 50.3 (±15.3) [17-73], the sex ratio (M/F) was 1.37.

21 of the treated patients had a two-fragment fracture, 17 had a three- or four-part fracture.

The etiology of the injury mechanism was a violent trauma in 21 patients, i.e. 55% of our study population

The overall mean absolute constant score was 86.9 (±6.7) [69 to 97]. The overall mean cephalodiaphyseal angle was 51 [17 to 81].

We operated 18 patients with an ORIF, and 75% of them suffered blunt trauma: 10 of this group had a two-fragment fracture, and 8 had a three- and four-fragment fracture. The group treated with pinning included 20 patients: 12 of them had a two-fragment fracture and 8 of them had a three- and four-fragment fracture

Concerning complications, we noted 2 cases of aseptic necrosis of the humeral head in the screw-plate group, and 7 cases of malunion in the pinning group, but no functional repercussions that would indicate a second surgery

Statistical analysis of the functional and radiological results did not show superiority of one technique over the other. The mean time to consolidation was 6.2 (±0.5) weeks in the plate group and 6.05 (±0.5) weeks in the pinning group (p = 0.4) while the mean absolute Constant score was 87.7 (±9.1) and 89.95 (±3.5) respectively (p = 0.08). Neither was there any difference between the study groups in terms of subjective patient satisfaction.

The mean postoperative Disabilities of Arm, Shoulder, and Hand (DASH) score was 19.4 in the ORIF groupe , and 18.6 in the pinning groupe .

The univariate analysis of our findings revealed no statistically significant correlation between the two surgical procedures under investigation and the evaluation criteria for surgical outcomes. Consequently, the study did not demonstrate a statistical advantage for one surgical procedure over another.

Table 1 Patients Distribution

	ORIF	Pinning	Total
No of patients	18	20	38
Mean age (years)	46.7	53.6	50.3
Sex			
Male	9	13	22
Female	7	9	16
Mechanism			
Low-energy	7	10	17
High-energy	8	13	21
Neer classification			
2 fragments	9	12	21
3 fragments	5	7	12
4 fragments	3	2	5
Mean follow-up (months)	39	46	42

Table 2 Complication rate for each group

	ORIF	**Pinning**
Malunion	0	7
Humeral head necrosis	2	0

Table 3 Results for each group

	ORIF	**Pinning**	**p**
mean time to consolidation	6.2	6.05	0.45
mean absolute Constant score	86	90.92	0.09
The mean postoperative DASH score	19.4	18.6	0.23

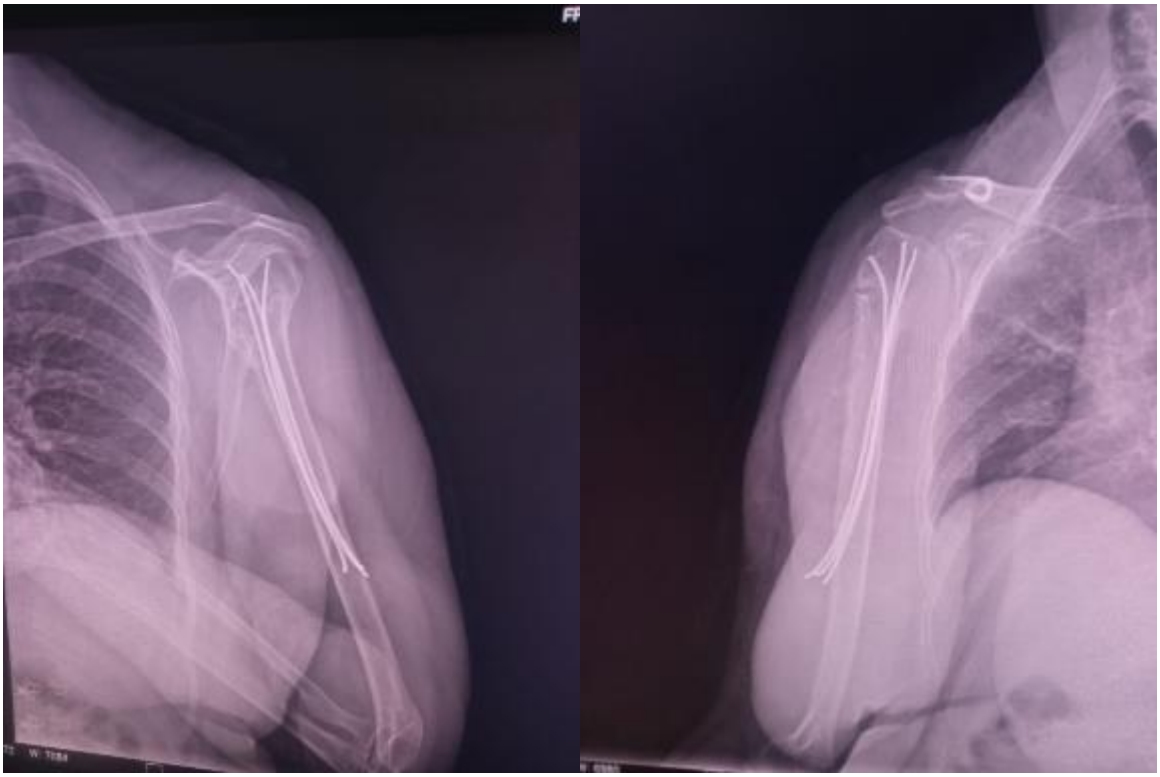

Figure 1 Follow up X-ray of a patient treated by pinning .

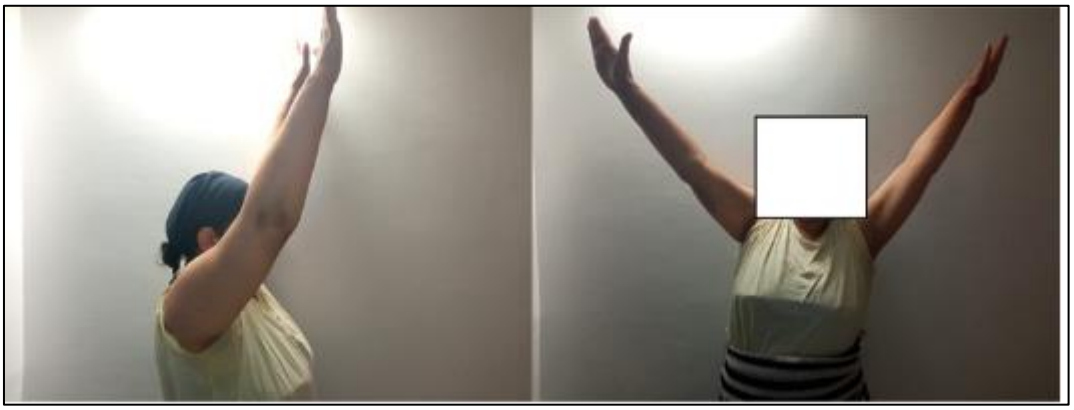

Figure 2 Follow up functional result of pinning

4. Discussion

Fractures of the proximal humerus are frequent traumatic injuries, of which surgical treatment is essentially aimed at 20% of them, in cases where they are complex or the patient's activity level requires an optimal functional result is required. 11

The literature describes many options for treatment of displaced proximal humerus fractures.9-10. After many years, the most appropriate kind of management in these fractures is still debated. In other words, there is no consensus about the proper surgical technique for the treatment of PHF, and several factors influence the decision-making process such as variables related to the patient (age, comorbidity, compliance and risk factors), to the fracture (radiological pattern, bone quality, concomitant vascular or nervous accidents and soft tissues damages) and to the surgeon's experience.

The palm-tree pinning technique was described by Kapandji, who published a series of 15 patients in 1989, with very specific indications represented by displaced single-line fractures of the surgical neck in adults or elderly subjects who are still very active [8]. This technique differs from Hacketal's technique, which was initially used for diaphyseal

fractures, and its variants used for proximal fractures. It was then widely used and various series reported good results. According to Monin et al., 70.5% were excellent results [12], which is a simple minimally invasive technique with an original approach that offers many advantages over other centromedullary pinning techniques: the short and direct route of the pins, which allows for easier placement passage at a distance from the elbow joint, can lead to stiffness and no tendon crossing of the extensor elements. Moreover, various series have reported good results: while Monin et al, as seen above, reported 70.5% of the results were excellent [12], Le Bellec et al. also reported satisfactory results in 83.8% of patients[13].

Authors using other retrograde pinning techniques have obtained the following results:

- Apprill and Boll[14]: 71.5% excellent and good results.
- Vichard[15]: 84% excellent and good results.
- Rogez[16]: 90% excellent and good results.
- Bombart[17]: 69% of excellent and good results

ORIF has been widely used for this type of fracture, and multiple series have been described in the literature. The advantages of ORIF lie in the possibility of better control of reduction by direct manipulation of the fragments, as well as in the better primary stability, which allows rehabilitation to be started as early as possible, and thus to achieve better functional results.

However, the complication rate was significantly higher following ORIF in the meta-analysis done by Anil K. Gupta (15%) and a much higher reoperation rate following ORIF (12.7%) according to the same study (18) and almost all series reported cases of humeral head necrosis following ORIF. (19-20)

In his 2011 study, Hardeman et al. investigated the factors that determine the functional prognosis after plate treatment of fractures of the upper end of the of the humerus, the outcome is therefore correlated with the degree of displacement, the vascular status of the head, and the quality and the peroperative bone quality, the study found an overall failure rate of 15.3% and a re-operation rate of 23.8% at mean follow-up of 4.3 years.(21)

According to Magovern and Pospula et al., percutaneous fixation of proximal humerus fractures shows good-to-excellent results in approximately 70% of the cases (22,23). Magovern concluded, later, that percutaneous fixation is an important alternative to open reduction and internal fixation with PHP. Matziolis had conducted a retrospective case-control study, in which they compared percutaneous pinning using the Zifko technique with screw plate osteosynthesis, and found no radiological or clinical difference between the two techniques. (24)

The same results were reported by M. Elidrissi et al in a study comparing ORIF with palm tree pinning. The study showed no statistically significant difference between palme tree pinning and ORIF; it also stated that despite the number of malunion noted in the group treated by pinning, this had no effect on the final functional result. (25)

in a study published in 2008, DARIN M. et al concluded that despite Locking Compression Plate of Proximal Humerus offering several theoretical advantages over other treatment modalities no differences were detected among treatment groups with regard to functional outcomes and that the trends noted did not reach statistical significance(26)

In his study published in 2000, Gerald et al. (27) concluded that the choice of the appropriate surgical method is delicate and depends on several factors: the type of fracture, the quality of the underlying bone, the patient's ability to cooperate, and the surgeon's experience. According to this study, percutaneous pinning should be reserved for two-fragment fractures and valgus impacted fractures. Surgical reduction with osteosynthesis is indicated for two-part fractures not reduced by percutaneous treatment, and for three- and four-part fractures.

In our study, we attempted to clarify the fact that there was no statistically significant difference between palm-tree pinning and ORIF. Thus, neither osteosynthesis technique has been found to be free of complications, although screw plate osteosynthesis can be considered superior in control of the reduction

5. Conclusion

These results, like those in the literature, do not favor one approach over the other, but we would opt for Kapandji palm-tree pinning over Plate Fixation thanks to its ease of use, preservation of soft tissues, which is crucial for maintaining the vascularization of the head, and its cheaper cost. Such conclusions support the findings of the literature:

percutaneous pinning is still used, despite the advancements in techniques for osteosynthesis of the upper end of the humerus. However, this study had a number of drawbacks, including a small sample size and a brief duration.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Matziolis D. Surgical treatment of two-part fractures of the proximal humerus: comparison of fixed-angle plate osteosynthesis and Zifko nails. Injury 2010;41(10):1041–6.

[2] Charles M. Epidemiology of adult fractures: a review. Injury Int J Care Injured 2006;375:691–7.

[3] Guy P, Slobogean GP, McCormack RG. Treatment preferences for displaced three- and four-part proximal humerus fractures. J Orthop Trauma. 2010;24:250–254.

[4] Lenarz C, Shishani Y, McCrum C, et al. Is reverse shoulder arthroplasty appropriate for the treatment of fractures in the older patient? Early observations. Clin Orthop Relat Res. 2011;469:3324–3331.

[5] Neer CS. Displaced proximal humeral fractures: part I. Classification and evaluation. J Bone Joint Surg Am 1970;52:1077–89.

[6] Constant CR, Murley AHG. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res 1987;214:160–4.

[7] Gaumet G. (2010). Intramedullary Nailing of Proximal Humerus Fractures Using the T2 Nail: A Retrospective Study of 38 Cases. Hand Surgery and Upper Limb Surgery (Chirurgie de la Main), Vol. 29, pp. 58–66.

[8] Kapandji A. L'ostéosynthèse par la technique des broches en palmiers des fractures du col chirurgical de l'humérus. Ann Chir Main 1989;8(1):39–52.

[9] Neer CS II. Displaced proximal humeral fractures. Part II. Treatment of three-part and fourpart displacement. J Bone Joint Surg Am. 1970; 52(6):1090-1103.

[10] Tanner MW, Cofi eld RH. Prosthetic arthroplasty for fractures and fracture-dislocations of the proximal humerus. Clin Orthop Relat Res. 1983; (179):116-128.

[11] Murray IR. Proximal humeral fractures current concepts in classification, treatment and outcomes. J Bone Joint Surg Br 2011;93-B:1–11

[12] Monin S. (1999). Proximal Humerus Fractures Treated by Intramedullary Pinning According to the Kapandji Technique: Review of 21 Cases. Acta Orthopaedica Belgica, Vol. 65, No. 2, pp. 176–181.

[13] Le Bellec Y. (2002). Osteosynthesis of Proximal Humerus Fractures Using the Palm-Tree Pinning Technique. Review of Orthopaedic Surgery (Revue de Chirurgie Orthopédique), Vol. 88, pp. 342–348.

[14] Apprill G, Boll P. (1968). Treatment of Fractures of the Humeral Neck by Intramedullary Pinning Without Opening the Fracture Site. Review of Orthopaedic Surgery (Revue de Chirurgie Orthopédique), Vol. 54, pp. 657–666.

[15] Vichard PH, Bellanger P, Laurain JM. (1982). The Role of Ascending Bipolar Elastic Intramedullary Nailing in the Treatment of Non-Impacted Fractures of the Proximal Humerus. Memoirs of the Academy of Surgery (Mémoires de l'Académie de Chirurgie), Vol. 108, pp. 381–389.

[16] Rogez JM, Trillat PH, Letenneur J. (1978). Internal Pinning of the Humerus via a Supracondylar (Supra-epitrochlear) Approach: Report of 20 Cases. Journal of Surgery (Journal de Chirurgie), Vol. 115, pp. 605–608.

[17] Bombart M, Moulin A, Danan JP, Alperovich R. (1978). Closed Reduction and Percutaneous Pinning in the Treatment of Fractures of the Proximal Humerus. Review of Orthopaedic Surgery (Revue de Chirurgie Orthopédique), Vol. 64, pp. 221–230.

[18] Gupta, Anil K. MD, MBA; Harris, Joshua D. MD; Erickson, Brandon J. MD; Abrams, Geoffrey D. MD; Bruce, Benjamin MD; McCormick, Frank MD; Nicholson, Gregory P. MD; Romeo, Anthony A. MD

[19] Fazal MA. Philos plate fixation for displaced proximal humeral fractures.J Orthop Surg 2009;17(1):15–8.

[20] Paavolainen P, Björkenheim JM, Slätis P, Paukku P. Operative treatment of severe proximal humeral fractures. Acta Orthop Scand 1983;54(3):374–9

[21] Hardeman F, et al. Predictive factors for functional outcome and failure in angular stable osteosynthesis of the proximal humerus. Injury 2012;43(2):153–8

[22] Magovern B, Ramsey ML. Percutaneous fixation of proximal humerus fractures. Orthop Clin North Am 2008;39(4):405–16

[23] Pospula W, Abu Noor T. Hackethal bundle nailing with intramedullary elastic nails in the treatment of two- and three-part fractures of the proximal humerus: initial experience at Al Razi Hospital, Kuwait. Med Prin Pract 2009; 18(4):284–8

[24] Doerte Matziolis *, Max Kaeaeb, Souska Sophie Zandi, Carsten Perka, Stefan Greiner . Surgical treatment of two-part fractures of the proximal humerus: Comparison of fixed-angle plate osteosynthesis and Zifko nails

[25] Elidrissi M, Bensaad S, Shimi M, Elibrahimi A, Elmrini A. Surgical treatment of fractures of the proximal humerus: anatomical locking plate versus palm-tree pinning, report of 26 cases.

[26] DARIN M. FRIESS, MD; ALBERT ATTIA, MD; HEATHER A. VALLIER, MD. Locking Plate Fixation for Proximal Humerus Fractures: A Comparison With Other Fixation Techniques

[27] Williams GR, et al. Two-part and three-part fractures open reduction and internal fixation versus closed reduction and percutaneous pinning. Orthop Clin North Am 2000;31(1):1–21.