Academic Orthopedic Research and Rheumatology
Ribeiro Pinto GM`. Acad Orthop Res Rheum 5: 135.
www.doi.org/10.29011/2688-9560.100135
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Research Article

Surgical Treatment of the Proximal Humeral Fracture with Transosseous Sutures Technique

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Citation: Ribeiro Pinto GM, Dantas CN, Schütz Filho GZ, de Oliveira Campos MC, Rezende RC, et al. (2022) Surgical Treatment of the Proximal Humeral Fracture with Transosseous Sutures Technique. Acad Orthop Res Rheum 5: 135. DOI: 10.29011/2688-9560.100035

Received Date: 21 July, 2022; **Accepted Date:** 31 July, 2022; **Published Date:** 04 August, 2022

Abstract

Objective: Evaluate clinical and radiographic results as well as the index of complications related to fractures in two or three parts of the proximal humerus treated with non-absorbable sutures through the "transosseous suture technique" performed with endobutton and with or without grafts.

Method: Ten patients underwent operations, there were eight women and two men, with an average age of 60.9 years old and follow-up of 12 months. According to Neer's classification, all the patients included in the study were classified in two or three parts. All of them were operated by the same surgeon. All the fractures were reduced and fixed with non-absorbable suture and endobutton. The evaluation was made using UCLA score and radiographs.

Results: The UCLA average score was 31 points (28 - 33). All the fractures consolidated. Complications were reported in two patients (20%) but did not compromise the final outcome. All the patients included in the study returned to the same level of the activities before the trauma.

Conclusion: The "transosseous suture technique" with endobutton annulling the rotator cuff forces for the treatment of the proximal humerus fracture has been found to be stable and reliable with good functional results using a low cost material.

Introduction

The proximal humerus fractures represent 5% of all lesions of the appendicular skeleton. The prevalence is higher in the elderly population, nearly 85% occur in people older than 50 years old and the frequency reaches the peak between 60 to 90 years old [1]. Most of the time patients can be treated in a more conservative way, however some patterns of fractures require surgical treatment. Several surgical techniques were described to treat these ones, but regardless of the treatment, they presented difficulties in restoring the joint surface congruency and the function of the rotator cuff, keeping the vascularization of the humeral head [2]. In addition to the possible complications with some fixation methods routinely used in proximal humerus fractures (breakage of implant, migration and loosening of the synthesis), there is still, sometimes, the necessity of a second intervention to remove the implanted material [3]. Therefore, the creation of new techniques of surgical treatment that avoid the mentioned problems have been a constant concern. We chose to use the transosseous sutures technique due to the low cost and lower complications due to traditional implants. The objective of this study is to describe the results of the surgical treatment of the proximal humerus fractures using the transosseous sutures technique.

Materials and Methods

This is a case series study in which twelve patients were selected with proximal humerus fractures in two or three parts according to Neer's classification [4], and surgically treated with the described technique at Pedro Ernesto Universitary Hospital (Rio de Janeiro, Brazil) with at least one year follow-up. The inclusion criteria were mature skeleton with proximal humerus fracture in two or three parts. The exclusion criteria were incomplete fractures or minimally deviated that could be treated conservatively, four parts fractures, articular fractures, pathological fractures, open fractures and fractures with rotator cuff tear associated.

Surgical technique

All the operations were performed by the same surgeon. The patients were operated in beach chair position with a deltopectoral approach. A tenodesis of the long head of the biceps was performed on the pectoralis major muscle at the humeral insertion, thus identifying the biceptal groove and tuberosities. The rotator cuff tendons were repaired separately along with the greater and lesser tuberosities using one high tensile surgical thread in each tendon. Then three drill holes were made in the humeral diaphysis - anterior, lateral and posterior - in order to pass the endobutton of each repaired tendon and tuberosities. The fracture was properly reduced and a synthetic graft was used when necessary. For each tendon one braided polyethylene thread (Ethibond® #5 Ethicon Inc., Somerville, NJ, USA) were used along with the endobutton; the subscapularis muscle thread were passed through the posterior hole; the supraspinatus muscle thread through the lateral hole; and the infraspinatus muscle thread through the anterior hole; considering the nullment of the deforming forces of the rotator cuff (Figure 1).

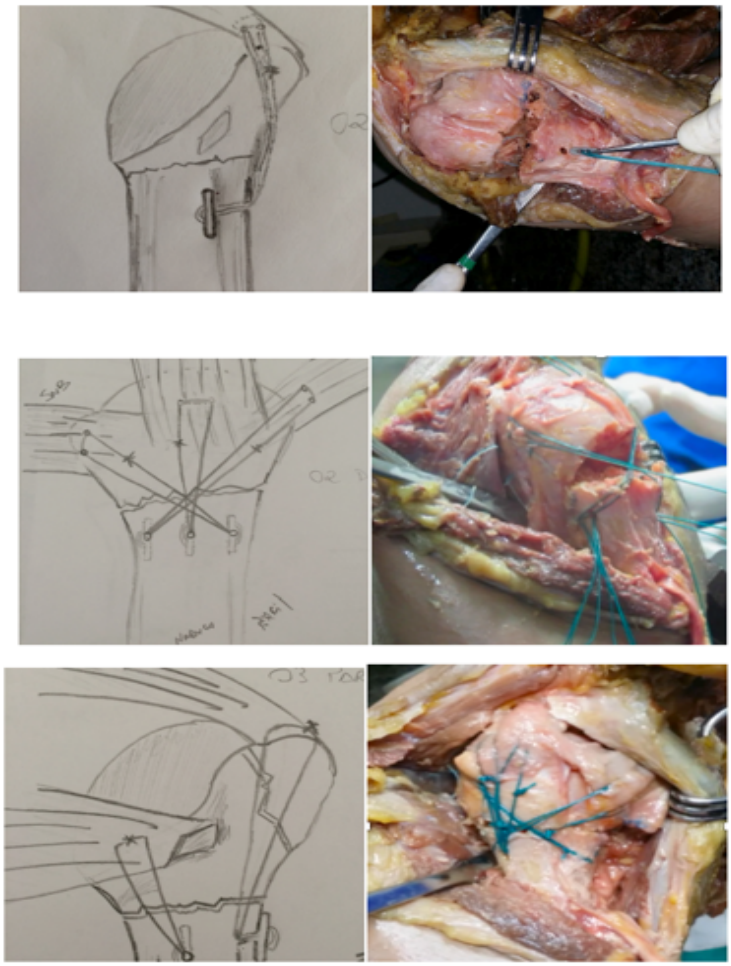

Figure 1: Greater tuberosity fracture: lateral hole fixation; B/C. Surgical neck fracture and three parts fracture: the fixation is made against the deforming forces of rotator cuff.

Postoperative follow up

During the postoperative follow up, all patients used a sling for four weeks and received instructions to start performing gravitational pendular movements from the third week on. Physiotherapy started from the sixth week, in order to improve the range of passive movements, gradually evolving, and in the twelfth week the muscle strengthening began.

Evaluation by image

The radiographic evaluation of the operated shoulder was performed through a true AP view, scapular Y view and velpeau view, obtained every 4 weeks until completing 6 months from surgery. After this period, a last radiograph was obtained within 12 months from the surgery (Figura 2 and 3). Radiographic consolidation was defined as ossification on the fracture site with the joint of corticals in orthogonal radiographs, and clinical consolidation when there was absence of pain on physical exam and passive mobilization [5].

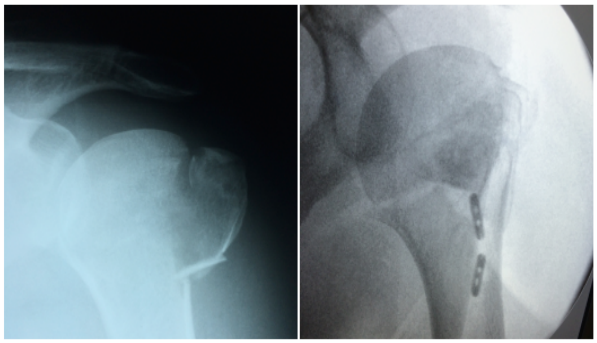

Figure 2: A. Two parts fracture: radiography; B. Radiographic post operative evaluation.

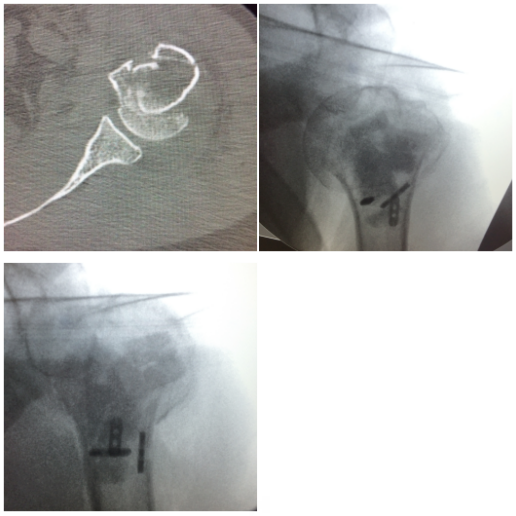

Figure 3: A. Three parts fracture: CT scan; B/C. Radiographic post operative evaluation.

Clinical evaluation

Functional evaluation was performed following the University of California Los Angeles (UCLA) score changed by Ellman6 twelve months after surgery.

Results

There were twelve patients selected but two patients (16.6%) abandoned the treatment during monitoring, and were excluded from the study, remaining 10 patients. The average age was 60.9 years old, the women (80%) and the left side (60%) were the most affected. The average time between the trauma and surgery (ΔT) was 15.2 days. During the procedure, it was necessary to use graft in 60% [6] of the patients. All the patients presented clinical and radiological fracture consolidation. The patients' UCLA score was considered a

good functional result, with an average of 31 points in the final monitoring. All the patients included in the study returned to the same level of the activities before the trauma.

Patient	Age	Side	Neer's classification	Graft	ΔT (days)	UCLA
1	60	Left	2 parts	No	28	31
2	59	Right	3 parts	Yes	8	28
3	62	Left	2 parts	No	38	32
4	44	Right	3 parts	No	40	32
5	42	Right	3 parts	Yes	14	32
6	64	Right	3 parts	No	13	33
7	57	Left	2 parts	Yes	1	30
8	69	Left	3 parts	Yes	1	30
9	88	Left	2 parts	Yes	1	30
10	64	Left	3 parts	Yes	8	32
ΔT: Time interval between the data of trauma and data of surgery; UCLA: University of California Los Angeles						

Table 1: Patient's data.

Complications

Two (20%) complications were documented. Among these, there was a superficial infection in the surgical wound that was treated with wound irrigation and antibiotic therapy oriented by the microbiological culture of the material. This patient was monitored by regular laboratorial tests results with positive progress and final UCLA score of 31 points. Another patient presented a delayed consolidation, although after 6 months the fracture was fully consolidated and the UCLA score was 30 points. There was no pseudoarthrosis, avascular necrosis, shoulder rigidity or implant complications among the operated patients.

Discussion

The treatment of the proximal humerus fractures is a great challenge even for the most experienced orthopedists, and a significant part of this is attributed to the varieties of fractures types occurring mainly in osteoporotic bone.

A conservative treatment with a sling immobilization is an option for the minimally deviated fractures or in patients without clinical condition of surgical treatment, presenting good functional and radiological results [7]. The surgical conduct definitely allows a better predictability of the patient's evolution. The intramedullary nail are most indicated to fractures concerning the humerus meta-diaphyseal region; however they have disadvantages as the opening of the rotator cuff in order to introduce the nail [8].

In addition, Gracitelli and collaborators, in a randomized study compared the results of an osteosynthesis of the proximal humerus fractures in two or three parts with blocked plate versus the intramedullary nail, and showed higher complication and reoperation rates with the intramedullary device [9]. Despite the good results illustrated in medical literature with the proximal humerus fractures in two or three parts with blocked plate, the complication rates of this technique remain high, around 36% [10-12]. In the cases of avascular necrosis and late varus collapse deformity of the humerus head, the rigid attachment of the screws seems to be a larger problem, causing cutout and consequently the joint destruction [10,13]. To prevent these complications, we chose the "transosseous suture technique like". We described this technique as an option for the treatment of proximal humeral fractures in two or three parts in order to nullify the deforming forces of the rotator cuff using the endobutton. McLaughlin was the first to use the suture method to fix tuberosities avulsion fractures [14]. Neer and collaborators reported 86% of good results on fixing with transosseous suture the proximal humerus fractures in three parts, as well as Cuomo and collaborators that also demonstrated good results on fixing two or three parts through this method [4,15]. Dimakopoulos and collaborators described a similar technique, however the arrangement of the threads doesn't include the vector annulment of the rotator cuff. The tuberosities were tied up among each other, and the fractured tuberosity was fixed in the opposite metaphyseal region [2].

Another study that supports the use of transosseous suture technique to treat these fractures was performed by Veado et al., in which the surgical technique used consisted in impacting the valgus head in the metaphysis, without graft, and suturing the fragments in "8 configuration". The authors obtained 88% of good results however the technique does not have the concept of annulment the rotator cuff forces [16]. In our technique we used a braided polyethylene thread to fix at the suture made from rotator

cuffs to the humeral diaphysis using a transosseous technique with endobutton. We believe that opposing the traction forces of these tendons is the main point of our fixation. The supraspinatus muscle attaches to the superior facet of the greater tuberosity of the humerus with a force vector that pulls predominantly to the medial and superior direction. The infraspinatus muscle and the teres minor, together, exert a force vector to the posterior and medial direction on the medium and superior facet of the greater tuberosity of the humerus. Still, the subscapularis muscle makes an anterior and medial force vector on the lesser tuberosity of the humerus [17]. So, to contemplate the annulment of deforming forces of the rotator cuff, the subscapularis tendon thread was passed through the posterior hole; the supraspinal tendon thread passed through the lateral hole; and the infraspinatus tendon thread passed through the anterior hole. The fixation with endobutton has a higher failure load and effectively resists displacement more than that with simple transosseous suture because it is cortically anchored [18]. The resistance vectors are oriented toward the cortex-implant interface, the load concentration is inversely proportional to the implant contact surface area [19]. Our technique has a high rate of consolidation (100%) and a satisfying functional result (UCLA average of 31 points). We provided stable fixation for all the patients, allowing early mobilization during the postoperative period. In addition, it is a low cost technique that can be reproduced with simple surgical material with high resistance threads associated with endobutton and without the complications of the rigid fixation methods such as painful arm elevation (plates may compromise the surface underneath the deltoid or cause impingement if it is too high); arthrosis (by penetrating intra-articular metallic material); and synthesis instability in osteoporotic bone.

Conclusion

The proximal humerus fractures in two or three parts can be treated with the transosseous suture technique with endobutton annulling the deforming forces of the rotator cuff. This technique has been found to be stable and reliable with good functional results using a low cost material.

References

1. Court-Brown CM, Caesar B (2006) Epidemiology of adult fractures: A review. Injury 37: 691-697.
2. Dimakopoulos P, Panagopoulos A, Kasimatis G (2007) Transosseous suture fixation of proximal humeral fractures. J Bone Joint Surg Am 89: 1700-1709.
3. Neto AAF, Filho AAF, Filho AZ, Benegas E, Negri JH (1997) Osteosíntes das fraturas em duas e três partes da extremidade proximal do úmero com hastes de Ender modificadas associadas com amarrilhos de 'Ethibond'. Rev bras ortop 32: 707-712.
4. Neer CS 2nd (1970) Displaced proximal humeral fractures. I. Classification and evaluation. J. Bone Joint Surg Am 52: 1077-1089.
5. Koval KJ, Zuckerman JD, Bucholz RW, Heckman JD (2001) Rockwood and Green's fractures in adults. Chapter 45: 1794-1825.
6. Ellman H, Hanker G, Bayer M (1986) Repair of the rotator cuff. End-result study of factors influencing reconstruction. J. Bone Joint Surg Am 68: 1136-1144.
7. Anley C, Vrettos BC, Rachuene P, Roche SJL (2019) Proximal humerus fractures - Part 1: Conservative management. SA Orthop J 18.
8. Maier D, Jäger M, Strohm PC, Südkamp NP (2012) Treatment of proximal humeral fractures - a review of current concepts enlightened by basic principles. Acta Chir Orthop Traumatol Cech 79: 307-316.
9. Gracitelli MEC et al. (2016) Locking intramedullary nails compared with locking plates for two- and three-part proximal humeral surgical neck fractures: a randomized controlled trial. J Shoulder Elbow Surg 25: 695-703.
10. Owsley KC, Gorczyca JT (2008) Fracture displacement and screw cutout after open reduction and locked plate fixation of proximal humeral fractures [corrected]. J Bone Joint Surg Am 90: 233-240.
11. Solberg BD, Moon CN, Franco DP, Paiement GD (2009) Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. J Orthop Trauma 23: 113-119.
12. Südkamp N, Bayer J, Hepp P, Voigt C, Oestern H, et al. (2009) Open reduction and internal fixation of proximal humeral fractures with use of the locking proximal humerus plate. Results of a prospective, multicenter, observational study. J Bone Joint Surg Am 91: 1320-1328.
13. Greiner S, Kääb MJ, Haas NP, Bail HJ (2009) Humeral head necrosis rate at mid-term follow-up after open reduction and angular stable plate fixation for proximal humeral fractures. Injury 40: 186-191.
14. McLAUGHLIN HL (1952) Posterior dislocation of the shoulder. J Bone Joint Surg Am 24: 584-590.
15. Cuomo F, et al. (1992) Open reduction and internal fixation of two- and three-part displaced surgical neck fractures of the proximal humerus. J. Shoulder Elbow Surg 1: 287-295.
16. Veado MAde C, Moura ALL (2007)) Fraturas em duas e três partes do úmero proximal tratadas com sutura não absorvível. Revista Brasileira de Ortopedia 42: 333-342.
17. Khmelnitskaya E, Lamont LE, Taylor SA, Lorich DG, Dines DM, et al. (2012) Evaluation and management of proximal humerus fractures. Adv Orthop 2012: 861598.
18. Ahmad CS, Gardner TR, Groh M, Arnouk J, Levine WN (2004) Mechanical properties of soft tissue femoral fixation devices for anterior cruciate ligament reconstruction. Am J Sports Med 32: 635-640.
19. Milano G, Mulas PD, Ziranu F, Piras S, Manunta A, et al. (2006) Comparison between different femoral fixation devices for ACL reconstruction with doubled hamstring tendon graft: a biomechanical analysis. Arthroscopy 22: 660-668.