

*Scientific Journal of the Faculty of Medicine in Niš 2013;30(3):145-150*

*Original article* ■

## Treatment of War Trauma Fractures of the Proximal Humerus

---

Predrag Grubor<sup>1</sup>, Milorad Mitković<sup>2</sup>, Milan Grubor<sup>3</sup>, Milan Mitković<sup>2</sup>

<sup>1</sup>Orthopaedics and Traumatology Clinic Banja Luka, Republic of Srpska, Bosnia and Herzegovina

<sup>2</sup>Clinic of Orthopedics and Traumatology, Clinical Center Niš, Serbia

<sup>3</sup>School of Medicine Banja Luka, Republic of Srpska, Bosnia and Herzegovina

---

### SUMMARY

A war wound to the proximal humerus is characterised by profuse bleeding, multi-fragmentary fracture-dislocations, defects of the muscle tissue, capsule, skin and by primary contamination with polymorphic bacterial flora, and it is rarely isolated.

Out of 27 injured people, subluxation/dislocation of the humeral head occurred in the first four patients who suffered a proximal humeral fracture resulting from a war-related trauma stabilized with an external fixator. Two pins were inserted into the humeral head, and the other two into the diaphysis. In the other wounded people, there was no subluxation/dislocation of the humerus because the pins were placed into the clavicle, into the acromion or spinous process of the scapula.

Out of the 27 patients treated for proximal humeral injuries, the contact was established with 11. Out of these 11 patients, only in one patient we did not use the clavicle, the acromion or spinous process of the scapula to stabilize the fracture. The result of the treatment was poor due to avascular necrosis of the head and ankylosis of the shoulder. In the ten remaining patients we used 'temporary' placement of a pin into the clavicle or into the acromion or spinous process of the scapula. The final outcome of the treatment was satisfactory. The average Constant score was 59 points.

There is little data in professional literature about injuries to the proximal humerus caused by war-related trauma. The most commonly used system of classification of peacetime traumas is the Neer or AO classification system as there are balanced algorithms in the protocol for treating the trauma.

Proximal humeral fractures should be stabilized with an external fixator, inserting one pin into the clavicle or into the acromion or scapular spine. This prevents the subluxation/dislocation of the humeroscapular joint and facilitates early mobilisation, and thus improves the clinical result and reduces complications.

**Key words:** proximal humeral fracture, external fixator, war wound

---

Corresponding author:

**Predrag Grubor** •

phone: 065 513 115 •

e-mail: predraggrubor@gmail.com •

## INTRODUCTION

The specific structure of the glenohumeral joint makes possible the greatest range of motion in the human body. That is feasible due to the ratio between the size of the humeral head coming into contact with the glenoid with one fourth of the joint surface (1). The joint capsule is twice the size of the humeral head, and the anatomy of the ligaments and muscles of the shoulder, cuff-shaped, and the muscle tone gives mobility, stability and function to the shoulder. The anterior and posterior circumflex humeral arteries supply the shoulder area with blood (2). The anterior circumflex humeral artery plays the major part in the vascularisation of the humeral head through its ascendant branch which goes into the posteromedial metaphysary region of the humerus, by the lesser tuberosity (2). Upon entry, it anastomoses with the intraosial artery (1, 2). Fractures in the region of the short medial metaphysary widening of the anatomical neck of the humerus disrupt the medial periosteum of the humeral neck and in 97% of cases, which leads to avascular necrosis of the humeral head (2). Proximal humeral fractures account for about 5% of all fractures. Fractures occur more frequently in elderly persons: in women three times more than in men, and in this population almost 75% of these fractures receive non-surgical treatment (3).

The most frequently used systems of classification of proximal humeral fractures in peacetime trauma are the Neer and AO classifications (4, 5). In war surgery, every proximal humeral fracture is specific (6). A war-related wound to the proximal humerus is characterised by profuse bleeding, multifragmentary fracture-dislocations, defects of the muscle tissue, capsule, skin. Injuries can be as extensive as to result in semi-amputation of the upper arm. It is primarily contaminated with polymorphic bacterial flora (6). A war-related wound to the proximal humerus is rarely isolated. Most frequently, it is the organs of the chest cavity, abdomen, head, etc. that are injured (Figure 1).

## AIM

The retrospective study was aimed at presenting the results of treating proximal humeral fractures which were caused by war wounds and at presenting the significance that the pin insertion point has on the final result.



**Figure 1.** War-related wound to proximal humerus accompanied by polytrauma

## PATIENTS AND METHODS

Two thousand one hundred and ninety-five wounded patients with extremity injuries were primarily attended at the CHC in Banja Luka. Three hundred and eighty-eight patients suffered an upper arm injury, while 27 (6) had an injury in the proximal humeral region, out of which number five were women. Their average age was 26.7 years. In one patient, the proximal humeral fracture was accompanied by the dislocation of acromioclavicular joint.

In the first four patients with proximal humeral injuries, fragments of the proximal humerus were stabilised with an external fixator after the primary treatment of the wound. Following a short incision of the skin, we placed the guide wire next to the humeral head and we inserted two pins into the head and then two into the diaphysis. Repositioning was performed by direct visualisation, as well as the placement of the external fixation frame. The soft-tissue defect of the proximal humerus, weight of the external fixator and gravitation resulted in subluxation/dislocation in all four patients, which was diagnosed during the follow-up that took place three to four weeks later (Figure 2).

In order to avoid these complications in the others (23 patients), we placed one pin into the clavicle or into the acromion or spinous process of the scapula. The insertion of pins is simple because the said protrusions can be palpated through the skin. We placed two pins into the diaphysis, the third one into the clavicle or into the acromion or spinous process of the scapula, and the fourth one into the humeral head.

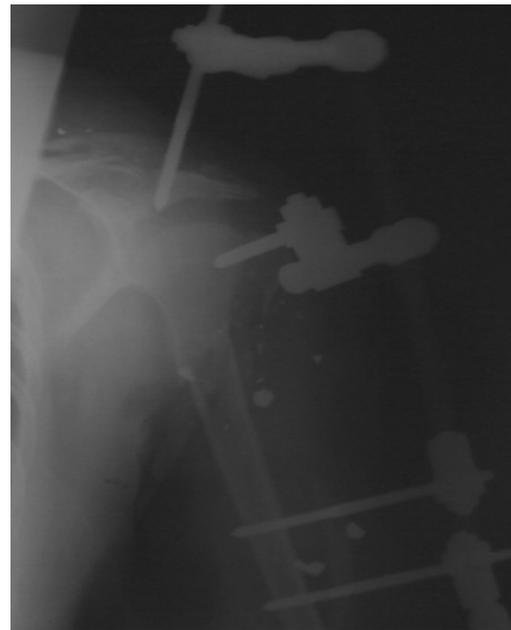
One pin was enough to keep the humeral head from moving into a varus/valgus position. It should be inserted into the place where it least jeopardises the cir-

cultation of the head (2). The pin insertion point should enable the insight into the muscular and cutaneous defect, bandaging and unhindered placement of the secondary stitches.

On average, secondary stitches were placed on the wound on the twelfth day following the primary treatment of the wound, and between the fifteenth and twentieth day we started with loosening the holders of the pin inserted into the clavicle or into the acromion or spinous process of the scapula, without jeopardising the stability of the fracture. This procedure made early rehabilitation possible, i.e. it made possible incomplete shoulder abduction/adduction or flexion/extension (Figure 3).



**Figure 2.** Fixator weight, muscle defects resulting in subluxation/dislocation of humeral head



**Figure 3 (a and b).** Clinical and radiographic presentation of pin insertion

In the fifth week after placing the external fixator it was visible that the soft tissue had been completely repaired and callus was radiographically visible. Then, we removed the pin inserted into the clavicle or into the acromion or spinous process of the scapula. The average time for carrying the external fixator was 3.5 months. There was no subluxation/dislocation of the humeral head. The result of testing the differences between the groups by applying the Chi-squared test showed a high statistical significance in the manner of applying the external fixator ( $p=0061$ ).

This pin was placed into the clavicle or into the acromion or the spinous process of the scapula for preventive reasons and in order to stabilize diaphysary fractures of the humerus. There were indications for major damages to the muscular and cutaneous tissue of the upper arm.

## RESULTS

Out of the 27 patients treated for proximal humeral injuries, contact was established with 11.

Out of these 11 patients, in only one patient we did not use the clavicle or the acromion or spinous process of the scapula in order to stabilise the fracture. The result of the treatment was poor due to avascular necrosis of the head and ankylosis of the shoulder.

In the ten remaining patients we used 'temporary' placement of a pin into the clavicle or into the acromion or spinous process of the scapula. The final outcome of the treatment was satisfactory. The average Constant score was 59 points.

## DISCUSSION

There is little data in professional literature about injuries to the proximal humerus caused by war-related trauma (8). The most commonly used system of classification of peacetime trauma is the Neer or AO classification system and it has balanced algorithms in the protocol for treating the trauma (4, 5). Thus, in his prospective epidemiological analysis of the research (9), Court-Brown shows the prevalence of proximal humeral fractures according to the Neer classification system and it is as follows: Type I accounts for 49%, Type II for 28%, Type III for 9% and Type IV for 14% (9). Court-Brown classifies the same sample according to the AO system as follows: Type A 67%, Type B 27% and Type C 6% (9). Most of the proximal humeral fractures, undisplaced ones, are treated conservatively, non-surgically (10). Between 20% and 40% of proximal humeral fractures are displaced and are treated surgically (10).

In our sample, all patients were treated surgically. Primary treatment of the wound requires an acute surgical treatment. Stabilization with an external fixator (6) is the method of choice as it provides a good insight into wound care; compared to other osteosynthetic material, it decreases the possibility of an iatrogenous infection, as well as of subsequent reconstructive surgeries on the skin, muscles and bones (6). Defects on the skin and muscles resulting from primary surgical treatment, disuse atrophy of the shoulder muscles, weight of the fixator, gravitation, all lead to unnecessary subluxation/dislocation of the shoulder. All these complications are avoided by placing one pin into the clavicle or into the acromion or spinous process of the scapula.

Conservative treatment and percutaneous osteosynthesis minimise additional trauma of soft tissues and decrease the risk of avascular necrosis of the humerus (11-13). However, research has shown that percutaneous methods have theoretical advantage in the vascularization of fragments, and that they are inferior in terms of stability of the fractured fragments of the bone in comparison with the intramedullary pin and AO plates with screws (14).

In a series of 14 patients with proximal humeral fractures that were followed for 10 years, Zyto presented a result according to the Neer system of classification which was as follows: satisfactory in nine patients (Constant score 59 points) and poor in five patients (Constant score 47 points) (15).

Werner *et al.* showed a series of 53 patients with proximal humeral injuries who were followed for 17 months and treated with intramedullary pins (16). The treatment was completed with partial necrosis of the humeral head in six patients (11%), total necrosis in one (2%), pseudoarthrosis in five patients (9.4%). The results were excellent (Constant score 83 points) in 14 patients (24%) and satisfactory (Constant score 61 points) in 27 patients (59%) (16).

Lill *et al.* presented results of non-surgical treatment in their retrospective study: they graded Neer Type II and III fractures with a good average score (Constant scores 72 and 78 points) and Type IV fractures with a satisfactory score (Constant score 61 points) (17).

In their prospective study, Gorschewsky *et al.* present the experience of surgically treating 95 patients aged 70 years. The patients were scored using the Constant testing after completing their treatment (18). Post-operative results for Neer Type I fractures after one year received an excellent score (Constant score 95 points), for Neer Type II fractures good (Constant score 73 points), and for Neer Type III and Type IV fractures it was satisfactory (Constant score 53 points). There were treatment complications in 11.6% of the patients in the tested sample. Reosteosynthesis was performed in 3.2% of patients and 2.1% of patients had necrosis of the humeral head (18).

After conservative treatment of Neer Type II, III and IV proximal humeral fractures, the authors (19) present favourable results in multifragmentary fractures of the proximal humerus in comparison with surgical treatment (19).

## CONCLUSION

Pre-operative classification of proximal humeral fractures resulting from war-related wounds is individual.

The knowledge of anatomy and vascularization of the proximal humerus are required in order to preserve periosteal circulation and circulation of the humeral head.

Proximal humeral fractures should be stabilized with an external fixator, inserting one pin into the clavicle or into the acromion or scapular spine.

This prevents the subluxation/dislocation of the humeroscapular joint, facilitates early mobilization and thus improves the clinical result and reduces complications.

This form of treating a war-related wound has certain advantages in terms of pain score, functional assessment, range of motion and strength of the shoulder.

## References

1. Meyer C, Alt V, Kraus R, Giebel G, Koebke J, Schnettler R. The arteries of the humerus and their relevance in fracture treatment [in German]. *Zentralbl Chir* 2005; 130(6):562-7.  
<http://dx.doi.org/10.1055/s-2005-918157>  
PMid:16382405
2. Brooks CH, Revell WJ, Heatley FW. Vascularity of the humeral head after proximal humeral fractures. An anatomical study. *J Bone Joint Surg Br* 1993; 75 (1): 132-6.  
PMid:8421010
3. Copeland SA. Fractures of the proximal humerus. *Curr Orthop* 1995; 9(4):241-8.  
[http://dx.doi.org/10.1016/0268-0890\(95\)90023-3](http://dx.doi.org/10.1016/0268-0890(95)90023-3)
4. Neer CS II. Displaced proximal humerus fractures, I: Classification and evaluation. *J Bone Joint Surg Am* 1970; 52(6):1077-89.  
PMid:5455339
5. Muller ME, Nazarian S, Koch P, Schatzker J. *The Comprehensive Classification of Fractures of Long Bones*. Berlin, Germany: Springer; 1990.  
<http://dx.doi.org/10.1007/978-3-642-61261-9>
6. Predrag Grubor, Milan Grubor, Ivan Golubović, Predrag Stojiljković, Zoran Golubović. Importance of External Fixation in Primary Treatment of War Wounds to the Extremities (*Acta Fac Med Naiss*) 2011;28(4):225-33
7. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res* 1987;(214):160-4.  
PMid:3791738
8. Fakler JK, Hogan C, Heyde CE, John T.: *Current Concepts in the Treatment of Proximal Humeral Fractures*, *Orthopedics* 2008; 31(1)::42-51  
<http://dx.doi.org/10.3928/01477447-20080101-13>  
PMid:18269167
9. Court-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humeral fractures. *Acta Orthop Scand* 2001; 72(4):365-71.  
<http://dx.doi.org/10.1080/000164701753542023>  
PMid:11580125
10. Habermeyer P. Fracture of the head of the humerus [in German]. *Unfallchirurg* 1997; 100(10):820-37.  
<http://dx.doi.org/10.1007/s001130050199>  
PMid:9446238
11. Resch H, Aschauer E, Povacz P, Ritter E. Closed reduction and fixation of articular fractures of the humeral head. *Tech Shoulder Elbow Surg* 2000; 1:154-62.  
<http://dx.doi.org/10.1097/00132589-200001030-00003>
12. Gorschewsky O, Puetz A, Klakow A, Pitzl M, Neumann W. The treatment of proximal humeral fractures with intramedullary titanium helix wire by 97 patients. *Arch Orthop Trauma Surg* 2005; 125(10):670-5.  
<http://dx.doi.org/10.1007/s00402-005-0027-z>  
PMid:16217672
13. Bathis H, Tingart M, Bouillon B, Tiling T: Surgical treatment of proximal humeral fractures. Is the T-plate still adequate osteosynthesis procedure? *Zentralbl Chir* 2001;126(3):211-6.  
PMid:11301887
14. Zyto K. Non-operative treatment of comminuted fractures of the proximal humerus in elderly patients. *Injury* 1998; 29(5):349-52.  
[http://dx.doi.org/10.1016/S0020-1383\(97\)00211-8](http://dx.doi.org/10.1016/S0020-1383(97)00211-8)
15. Werner A, Bohm D, Ilg A, Gohlke F. Kapandji intramedullary wire osteosynthesis in proximal humeral fractures. *Unfallchirurg* 2002; 105(4):332-7.  
<http://dx.doi.org/10.1007/s00113-001-0346-7>  
PMid:12066472
16. Lill H, Bewer A, Korner J, et al. Conservative treatment of displaced proximal humeral fractures [in German]. *Zentralbl Chir* 2001; 126(3):205-10.  
<http://dx.doi.org/10.1055/s-2001-12495>  
PMid:11301886
17. Gorschewsky O, Puetz A, Klakow A, Pitzl M, Neumann W. The treatment of proximal humeral fractures with intramedullary titanium helix wire by 97 patients. *Arch Orthop Trauma Surg* 2005; 125(10):670-5.  
<http://dx.doi.org/10.1007/s00402-005-0027-z>  
PMid:16217672
18. Ilchmann T, Ochsner PE, Wingstrand H, Jonsson K. Non-operative treatment versus tension-band osteosynthesis in three- and four-part proximal humeral fractures. A retrospective study of 34 fractures from two different trauma centers. *Int Orthop* 1998; 22(5):316-20.  
<http://dx.doi.org/10.1007/s002640050268>  
PMid:9914936 PMCid:3619582
19. Lill H, Bewer A, Korner J, et al. Conservative treatment of displaced proximal humeral fractures [in German]. *Zentralbl Chir.* 2001; 126(3):205-210.

## LIJEČENJE PRELOMA PROKSIMALNOG HUMERUSA IZAZVANOG RATNOM TRAUMOM

Predrag Grubor<sup>1</sup>, Milorad Mitković<sup>2</sup>, Milan Grubor<sup>3</sup>, Milan Mitković<sup>2</sup>

<sup>1</sup>Ortopedska i traumatološka klinika Banja Luka, Republika Srpska, Bosna i Hercegovina

<sup>2</sup>Klinika za ortopediju i traumatologiju, Klinički centar Niš, Srbija

<sup>3</sup>Medicinski fakultet Banja Luka, Republika Srpska, Bosna i Hercegovina

### Sažetak

Ratna rana proksimalnog humerusa karakteriše se: obilnim krvarenjem, multifragmentarnim prelomima sa dislokacijom, defektom mišićnog tkiva, kapsule, kože, te primarnom kontaminacijom polimorfnom bakterijskom florom i rijetko je izolovana.

Od 27 povrijeđenih, kod prva četiri bolesnika, koji su imali prelom proksimalnog humerusa kao posljedicu ratne traume sa učinjenom stabilizacijom spoljnim fiksatorom, došlo je do subluksacije/luksacije glave humerusa. Dva klina su aplicirana u glavu humerusa, a druga dva u dijafizu. Kod ostalih ranjenih, postavljanjem klina u klavikulu ili akromion ili procesus spinosus skapule, nije dolazilo do subluksacije/luksacije humerusa.

Od 27 liječenih bolesnika zbog povrede proksimalnog humerusa, kontakt je uspostavljen sa 11 liječenih. Od ovih 11 bolesnika, samo kod jednog nismo koristili klavikulu ili akromion ili procesus spinosus skapule za stabilizaciju preloma. Rezultat liječenja je bio slab zbog aseptičke nekroze glave i ankiloze ramena. Kod deset preostalih bolesnika koristili smo "privremeno" postavljanje klina u klavikulu ili akromion ili procesus spinosus skapule. Definitivni ishod liječenja bio je zadovoljavajući. Ocijenjen je prosječnom ocijenom 59 po Constantovoj klasifikaciji.

U literaturi je malo podataka o povredama proksimalnog humerusa ratnom traumom. U mirnodopskoj traumi najčešće se za prelome proksimalnog humerusa koristi klasifikacija po Neer ili AO, jer postoje ujednačeni algoritmi u protokolu liječenja traume.

Prelome proksimalnog humerusa treba stabilizovati spoljnim fiksatorom, uz obavezno postavljanje jednog klina u klavikulu ili akromion ili spinu skapule. Ovim se prevenira subluksacija/luksacija humero-skapularnog zgloba, omogućuje se rana mobilizacija, a time se poboljšava klinički rezultat i smanjuju komplikacije.

**Ključne riječi:** prelom proksimalnog humerusa, spoljni fiksator, ratna rana