

POSITION

From Prof. Dimitar Raykov, MD, DMS

Head of the Department of Orthopedics and traumatology,

Medical Faculty

Medical University – Varna

WITH REFERENCE TO: Thesis “Proximal humerus fractures: analysis of the results after fixation with angle stable locking plates” with the author Boris Emilov Kyurkchiev, MD for the acquisition of the educational and scientific degree "Doctor" on a doctoral program „Orthopedics and traumatology“, in a professional direction 7.1 „Medicine” from higher education 7. „Healthcare and sports”.

By order of the Rector of Medical University – Sofia № RD-26-1182/19.06.2019, following a meeting of the Scientific Council of UMHATEM “N. I. Pirogov”, Sofia, held on June 12, 2019, I was nominated and elected as a member of the scientific jury with position.

The most difficult thing in an acute or chronic post-traumatic disease is to make a close and long-range prognosis of what is its most appropriate treatment according to the degree of development of the injury and what are the possible final results of the treatment. This is a great challenge, especially in the pathology of the shoulder joint and more specifically in the treatment of fractures of the proximal humerus.

There are numerous surgical techniques for treating this pathology. The purpose of any such technique should be the anatomical reconstruction of the proximal humerus - head, metaphysis and diaphysis; ensuring maximal stability of the synthesis and early movement and loading. The risk of non-performance of some of these elements in surgical behavior determines late soft tissue and bone injuries, and hence difficulties and poor response to the rehabilitation program.

The doctoral worker Kyurkchiev, MD whose work I have the privilege of analyzing, presents material that meets the type, scope and content of the law's requirements. It is compiled into 124 pages, 167 are cited authors.

The literature review (Chapter 1) is set out on 27 pages. Historical and contemporary facts about the diagnosis, classification and treatment of proximal humerus fractures are presented. Anatomy, biomechanics, imaging, epidemiology, and the most common treatment methods in this field are

discussed. Already here in the literature review the doctoral worker places emphasis on the prognostic moment - the importance of the preoperative data from the clinic and the imaging results and the outcome of the treatment of the disease.

In the following pages (**Chapter 2**) of the dissertation, Kyurkchiev, MD formulates the purpose and the resulting five tasks, the clinical material, the methodology of the study, their own results and their discussion, their conclusions.

The doctoral worker points out as the purpose of his work: To apply the method of osteosynthesis with locking angularly stable plates in the treatment of fractures of the proximal humerus and to make a critical analysis of the results and the complications that have occurred.

From this aim the performance tasks also follow:

1. Application of the method to a statistically large contingent of patients with proximal humerus fractures and results reporting.
2. Reporting of the final functional results in patients treated with osteosynthesis with angle-stable implants.
3. Analysis of errors and complications obtained by the method.
4. Comparison of the results obtained with those in the literature.
5. Introducing an algorithm for treating patients with proximal humerus fractures.

Chapter 3 presents the material and methods of work.

A large group of patients is included in the dissertation - for a period of 1 year - April 2015 - April 2016, 617 patients with fractures in the proximal humerus area were admitted to the doctoral worker's hospital, 380 patients (61,60%) were hospitalized and 237 (38,40%) were not hospitalized. Out of the total number of patients, 185 have undergone surgery, and the trend in the treatment of this pathology is presented, which the doctoral worker presents: operative / conservative treatment is 70:30. This selection is subject to several criteria: age over 18 years, presence of 2-, 3- and 4-fragment fractures by Neer classification, limitation of the damage - up to 21 days after the incident, fracture was obtained in traumatic accident. These basic data are presented through several tables and figures.

Categorical criteria for surgical treatment according to the doctoral worker are 2-, 3-, and 4-fragment fractures that meet the Neer criteria for fragment displacement: diaphysis displacement >10 mm and / or $> 45^\circ$ angulation of the humeral head fragment and displacement of tuberculum majus et minus > 10 mm

relative to caput humeri. The deviation from the normal inclinations of caput humeri in the A-P and lateral view are also additional criteria. All types of angularly stable plates are listed - first and second generation. There are many details of the methodology that show the precision of the doctoral worker's job. This handwriting is particularly striking when describing the techniques for reduction of the 2,3 and 4 fragments fractures of the humeral head.

The results are presented in Chapter 4. Standard point systems in terms of function are used – Constant-Murley score and DASH Score. Precise measurements of the imaging data obtained from radiographs at 1, 3, 6 and 12 months after surgery are also provided.

I was personally impressed by the doctoral worker's approach to possible **complications** due to errors in operative techniques, also presented in details in this chapter. They are divided into two groups - early and late. As early complications were identified: poor fracture reduction in 32,26% patients, high positioning of plate – 11,83% patients, short locking screws in the head fragment in 4,3% patients, insufficient number of screws in the proximal fragment - <5 in 1,08% patients, lack of inferomedial (calcar) screw or its incorrect insertion in 2,15% patients, screw unlocking was reported in 1,08% patients, iatrogenic injury of axillary nerve was present in 6,45% patients, primary screw penetration in the joint was registered in 1,08% patients, early wound infection developed in 2,15% patients.

Later complications due to incorrect surgical techniques were also reported separately. These include: secondary displacement with loss of reduction and most commonly varus collapse of the head fragment - in 29,03% patients, subacromial impingement in 33,33% patients, stiffness of the shoulder joint in 12,9% patients, partial or complete avascular necrosis (AVN) in a total of 20% patients, migration of the unlocked screw in 5,38% patients, late wound infection in 1,08% patients, nonunion and fracture debricolage in 2,08% of all patients.

The doctoral worker summarizes these errors in the surgical technique as a serious and significant problem, reaching up to 48,39% of the total number of operated patients. Avoiding these high side effects requires thorough knowledge and adherence to the principles of surgical treatment of fractures in the proximal humerus region.

Chapter 5 is set out for **discussion**. Here Kyurkchiev, MD presents his thesis in an interesting way - comparing different approaches, methods or implants known so far. Such are the importance of preoperative grading of the fracture with the role of the soft tissue component and head fragmentation, operative and

non-surgical treatment, surgical approaches, osteosynthesis devices – Kirschner wires, single compression or sliding screws, various plates, intramedullary locking nails. The indisputable role of early rehabilitation, possibly due to the stability of the chosen osteosynthesis, is discussed. The doctoral worker analyzes the prognostic value of the various factors that adversely affect the final result. According to him, the most significant are the type of fracture, the used surgical approach and the generalized factor - intraoperative errors in reduction and fixation.

In this chapter, the doctoral worker presents a treatment algorithm for patients with proximal humerus fractures. It covers all possible combinations between: type of fracture - age - method of treatment. This algorithm is one of the important practical contributions of Kyurkchiev, MD's thesis.

Chapter 7 contains the author's **conclusions**. They once again summarize the need for a comprehensive approach in the analysis of clinical and imaging features for the treatment and postoperative prognosis of patients with proximal humerus fractures.

I am convinced that with the sum of the conclusions and the documentary presentation of the original protocol for diagnosis, monitoring and prognosis of the results in the treatment of this problem, the doctoral worker has completely exhausted the purpose of the dissertation.

I have no remarks on the final form of Kyurkchiev, MD's work.

In the scientific work thus presented, I can show the following important contributions:

With original character: The statistics presented and its analysis accurately predict the final result of the treatment of proximal humerus fractures.

With scientifically applied and confirmatory character:

1. The role of a detailed study of the pathoanatomy and pathophysiology of the shoulder joint and its relevance to the treatment and prognosis approach.
2. Validation of a clinical algorithm for determining the optimal method for the treatment of proximal humerus fractures.
3. Promotion of angularly stable plate osteosynthesis as a successful approach in the treatment of proximal humerus fractures.

The presented algorithm can be implemented in practice locally on a national scale, thus improving the final results of the treatment of proximal humerus fractures.

On the dissertation topic Boris Kyurkchiev, MD presents 4 publications. They contain separate parts of the material developed.

In conclusion, I express my complete positive attitude towards the qualities of this dissertation. It fully meets the qualitative and quantitative criteria set out in the "Requirements for Dissertation Work" in the Law for the development of the academic staff for the acquisition of educational and scientific degree "DOCTOR" of MU-Sofia. Therefore, I give a positive assessment and call on the members of the Scientific Jury to award of Boris Emilov Kyurkchiev, MD the educational and scientific degree "DOCTOR" in the specialty "Orthopedics and traumatology".

21.10.2019
DMS

Prof. Dimitar Raykov, MD,