

DISSERTATION REVIEW

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With reference to: Dissertation paper, submitted by Dr. Stoyan Zhelyazkov Hristov on the topic

“Operative treatment of proximal humeral fractures by locking plate with and without augmentation-comparative analysis” for awarding the educational and scientific Doctorate degree / Ph.D./

By Order Nr. RD-26-523/14.02.2022 by the Director of UMHATEM N.T. Pirogov EAD I have been assigned to provide this review.

The orthopedics society attitude regarding proximal humeral fractures (PHFx) in the last twenty years has been showing a pendulum-like dynamic. After years of extreme conservatism, there was the time of surgical enthusiasm, and all kinds of known fracture fixation tools have been applied on the proximal humerus, however with some success. Recorded functional results and especially complications frequency put surgeons and patients in the position to ask the questions “Why did this happen?” Subsequently publications of some authoritative researches lead to reevaluation of therapeutic behavior, especially in patients over 65 y.

Up to date, rational approach considering these frequently occurring fractures always includes as follows:
- precise clarifying of indications for non-operative / operative approach

- choosing of fixation tool- locking compression plate (LCP), nail or arthroplasty

- filling of metaphyseal void in cases of plate fixation

- “parachute technique” for tuberculae fixation

From above mentioned four fixation approaches most interest in the last years enjoy the techniques for managing the metaphyseal defect and from mechanical point of view medial and posterior comminution, which are issues of critical importance.

Tools, proposed for fixation augmentation by LCP include bone auto- and allografts with aimed osteoconductive, osteoconductive and structural function and artificial bones substitutes of various origin as well.

Optimal option for plate osteosynthesis augmentation in the praxis should be biologically tolerable, mechanically effective, easy for use and last but not least always available.

Meeting all these requirements represents a serious selection problem.

The dissertation scientific paper, submitted for official defense by Dr. Stoyan Zhelezakov Hristov, on the topic **“Operative treatment of PHFx by LP, with and without augmentation-comparative analysis”** addresses these current questions.

The scientific paper includes 135 pages in a typical structured form, namely- literature review, materials and methods, goal and tasks, results, discussion and conclusions. This undoubtedly allows logical tracing of various problematic components and introduces author's experience to the audience.

Assigned goal is sufficiently clearly formulated- to analyze the PMMA bone cement augmentation potentials in operative treatment of PHFx by LP.

For the achievement of assigned goal, the author aims for finding a solution of four tasks. They are logically justified, goal- resulting and tangible achievable.

The paper begins with a brief introduction chapter, reflecting Dr. Stoyan Hristov motivation to focus on this topic and the relevance of the presented scientific study. From the very beginning the author puts an emphasis on the high complication frequency – up to 49% in cases with treatment by LP.

The Chapter Literature review includes analyzed by the author classical and current publications / 251 pcs. on the topic Treatment of PHFx. Literature sources have been presented accurately and critically.

I find some strong insights in the review of the available literature:

- definition of blood supply problems in head fragment
- accurate presentation of mechanic and biological consequences after applying of bone grafts and substitutes

- presentation of convincing volume of materials dealing with complications risk factors – pages 37-41, which eventually justifies the augmentation necessity.

- clear definition/ page 46 of main goal of augmentation approach – not to improve biology, but to ensure mechanic support of the fixation in a osteoporotic bone

However, carefully reading of the paper discovers some imperfections. There's no clarity about the anatomical boundaries of proximal humerus. Indications for operative treatment haven't been exhaustively described. “Parachute technique” has a vague presentation in a short paragraph.

In **Chapter Patients and Methods** we see a presentation of clinical target group, treated in compliance with specific treatment algorithm. In the four-year period 112 patients with 114 PHFx have been operated by LCP. Augmentation has been conducted in 50 cases – 25 with autograft and 25 with PMMA cement. Operative technique has been described excessively clear and well illustrated. The assessment system, used by the author – Constant-Murley score and DASH-score provide an entirely adequate option for recovery evaluation. In this Chapter we find a description of used documentation and applied statistical methods, which ensures the exactness and reliability of present scientific study.

However, I find that criteria for fracture selection in the part concerning making a decision for operative treatment and choosing an augmentation method not precisely clarified. Introducing an excluding criteria- fracture of more than a week is in my opinion disputable. Comments related to citation 19, 111, 131, 192 on pages 54,67,68 should have been placed in Discussion chapter.

The next **chapter** includes presentation of **author's results**. It demonstrates good visualization by photographs, charts and pictures. Doctorate candidate's desire to deliver a valuable scientific research is clearly visible.

The fact, that patients have been operated short after the trauma is very impressive, average period is 1 day, which is possible only in case of motivated staff and accurate organization. Results' processing is correctly based on Schmetzke and Agudelo criteria. Complex assessment of function is thoroughly performed on the 3rd, 6th and 12th month, which ensures this research's persuasiveness and credibility.

In Results chapter I notice a number of interpretations, comments and assessments, which I consider to be find a more appropriate placement in chapter Discussion – pages 73,75. The conclusion about augmentation resulting in better stability of construction and less loss of reposition 12 months after operation is without doubt of essential importance, placed on p. 77 should not be included in this chapter.

Last **Chapter Discussion** is actually the core of present dissertation paper. Most valuable discussion topics are focused as follows:

- applying of bone autograft (BA) or PMMA cement

- detailed analysis of complications

The author states that bone cement augmentation manages to fill the metaphyseal void, to evenly distribute the load on the entire screw length and to reduce working length, thus contributing for a better stability of the construction. I agree with above statements in full.

Statements about anatomic reposition's strong correlation to good final outcome seem convincing, same goes for the position that relative stability has no place in treatment of PHFx by LCP as well.

Risks factors causing complications have been studied and discussed in details.

The discussion focus in this direction is another prove that the author has performed a meaningful scientific research.

In my opinion fig. 48 and chart 37 should be included in chapter Results.

Dr. Hristov's paper finishes with 5 conclusions, which represent the essence of above described scientific study. I totally agree with these conclusions.

After I became acquainted with Dr. Hristov's paper on the topic **"Operative treatment of PHFx by LP with and without augmentation-comparative analysis"** I believe following position is absolutely justified:

Discussed topic is relevant. Structure requirements are met. Dissertation writer's efforts in processing the clinical materials are valuable. I have some remarks on the dissertation paper, I have been assigned to as a reviewer, and they are of a technical nature. They do not influence the major impression by this study, which obviously has a practical value. I allow myself to share following substantial contributions of the dissertation's author:

1. Indications for augmentation in treatment of PHFx have been analyzed and clinical and biomechanical aspects of augmentation by bone cement as well.

2. PHFx cases, treated by LCP and PMMA augmentation in the metaphyseal void area have been followed purposefully.

3. The option to use PMMA augmentation in bone-preserving operations of PHFx has been justified.

4. Results, recorded during PHFx treatment without and with both type of osteosynthesis augmentation by LP have been compared and analyzed.

CONCLUSION: The dissertation paper deals with a relevant topic and is properly structured. It includes sufficient contingent, objectively represents the results and ends with valuable conclusions. By these qualities the dissertation paper fulfills the criteria for obtaining the educational and scientific Doctorate degree/ Ph. D.

Based on above stated I encourage the Scientific Jury to award Dr. Stoyan Zhelyazkov Hristov the educational and scientific Doctorate degree/ Ph. D. in scientific specialty Orthopedics and Traumatology.



Sincerely:

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15.04.2022

Sofia