

POSITION

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By order № RD 26-524 / 14.02.2022 from the executive director of UMHATEM "N. I. Pirogov" I was determined to present a position on the dissertation on the topic: **„Intramedullary allograft augmentation in unstable proximal humerus fractures fixed with locking plate”** for the acquisition of the educational and scientific degree "Doctor" (Ph.D.)

The topic of the dissertation is to defend the thesis - whether the proposed method gives better results in the treatment of unstable, multifragmentary fractures of the proximal humerus, namely to be able to perform osteosynthesis of the proximal humerus, preserving their patient's bone, without proceeding to replacement with arthroplasty. Examining the method of osteosynthesis with LP over the time, it showed many problems and complications that gave rise to many researches in the field of augmentation. There is a need for further stabilization of the specific feature of this segment of the humerus, especially in elderly patients with concomitant osteoporosis. Since there is no panacea method, this method must prove its benefits, advantages and disadvantages. This is what this work is exactly dedicated to. In addition to a purely practical and clinical part, it also contains biomechanical testing of models performed at the AO Research Institute, Davos, Switzerland. We should be proud to note that this biomechanical study was published in one of the most prestigious trauma journals – Journal of Orthopaedic Trauma (JOT).

It is important to say that this method in no way changes the concept of using arthroplasty in adult patients, but is suitable for patients between 50 and 70 years of age, who can save their own shoulder head.

The dissertation of Dr. Lyubomir Rusimov demonstrates the advantages of LP and the properties of intramedullary allograft and impartially seeks the results of the combination of the two methods.

Hypothesis. ORIF or MIPO with LP and intramedullary allograft, provide biomechanical stability and reduce the risks of specific deficiencies of LP alone and contribute for consolidation without the development of AVN of the humeral head.

The dissertation of Dr. Rusimov has a volume of 174 pages, of which 22 pages are bibliography. It is illustrated with 34 tables and 49 figures, graphics and photos. The bibliography includes 389 literature sources with 55% of them are from the last 10 years!

The dissertation is structured classically and contains an introduction, purpose, tasks, usual sections (literature review, patients and method, results and complications, discussion), conclusion, deductions and bibliography.

Particular attention is paid to augmentation methods in locking plate fixation.

The aim is clear and precise. 6 tasks have been set for its implementation. The tasks are logical, aim-oriented and feasible

"Biomechanical experiment" contains the design, description and results of the experimental study conducted in the Department of Biomechanics at the AO Research Institute, Switzerland (AO Research Institute Davos) and as I said before, the experiment was performed with extreme precision and under the control of a highly prestigious laboratory, which is significant to confirm the results. Statistical software was used, which does not allow subjective attitudes and interpretations.

"Clinical study" contains a retrospective analysis of clinical cases and it is conducted at the University Hospital "N. I. Pirogov ". It includes a contingent of 47 patients with displaced unstable fractures of the proximal humerus, operated with a locking plate and intramedullary cryo allograft from the fibula or allograft from the lyophilized tibia. The series gives statistically reliable conclusions.

What is valuable here is the well-described and illustrated surgical technique, as well as tricks and accumulated surgical experience. The follow-up is for a period of 12-79 months.

Functional results were examined using four scales. Complications are reported correctly. AVN is the most common late complication 13 (27.7%), which is really the main question whether there is a need for this method of treatment. Interestingly, its percentage is relatively low compared to the prognosis: 22 (47%) of the fractures in the study demonstrate the three Hertel criteria at the same time, which predicts a 97% risk of developing AVN. Although Hertel's criteria are important, Dr. Rusimov

proves that the method has its place in the treatment of unstable proximal humerus fractures.

All other complications in the clinical series are considered, as well as whether there is a correlation according to the type of allograft.

The **Discussion** contains an analysis of the results, compared to other similar series and some features of the use of this method. Behavior towards tubercles and anatomical reposition, as well as when MIPO technique can be used, caclar support, reposition, concomitant osteoporosis, use of tight tendon suture, biomechanical role of intramedullary allograft. Based on this, the indications and contraindications for surgical treatment are specified and an approach to the operative technique is proposed.

There are 5 **deductions**, they are related to the set tasks, objectively reflect the results of the research and have both theoretical and practical value.

In relation to the dissertation, 1 scientific publication with an impact factor and 9 participations in conferences, meeting the Minimum National Requirements of the Regulations for the Implementation of the Academic committee Development were presented.

Contributions:

1. The mechanical properties of the construct of a locking plate and intramedullary graft were tested in a reference laboratory on a sufficient number of specimens and the construct was applied in the treatment of a large enough number of patients to create their own database.

2. An in-depth and detailed statistical analysis was performed on the dependence of the final results and complications in the application of the method on various factors: age of the patients; surgical technique; quality of the achieved reposition; type of allograft; local bone quality.

3. Based on the analysis of the results and complications, the optimal surgical technique was tested with an algorithm for achieving anatomical reposition in unstable and threatened with ischemia fractures of the proximal humerus.

4. For the first time, a retrospective analysis was performed on the dependence of the method as an organ-preserving in ischemic fractures of the

proximal humerus, taking into account the Hertel criteria, which have the highest prognostic value for the occurrence of this complication.

5. For the first time in experimental conditions the mechanical properties of the locking plate and intramedullary graft construct were tested in a four-fragment fracture model.

6. For the first time in experimental conditions, the mechanical properties of the locking plate and intramedullary graft construct were tested on a fracture model reproducing an osteoporotic fracture with a massive bone defect of the cancellous bone.

Disadvantage, but not significant, and more of a difficulty for reviewers is the too extensive and unnecessary bibliography. It could easily be shortened in half, and meta-analyses with large databases could be cited if necessary. Of course, these are more technical marks that in no way diminish the value of the work.

CONCLUSION

The dissertation presented for my opinion is a real scientific development, which not only biomechanically - "theoretically", but also clinically defends the method of osteosynthesis with LP and intramedullary allograft at the world level. It is the result of some major shortcomings in the armament of traumatologists, such as LIMOS (third generation) and the recently missing modular and intraoperatively replaceable elements of arthroplasty (hemi, stemless, bipolar and Reverse).

The work fully meets the requirements of the Regulations on the terms and conditions for obtaining scientific degrees and holding academic positions in the University Hospital "N. I. Pirogov " for obtaining the educational and scientific degree " DOCTOR ".

Personally, I will vote **positive** and call on the other members of the jury to support the award of the degree of Dr. Lyubomir Rusimov.

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