

REVIEW

By Prof. Dr. Margarita Mihailova Kâteva - Vrabcheva, DM, member of the Scientific Jury appointed
by
Order No. RD-26-1162/14.06.2024,
UMBALS "N.I. Pirogov" EAD - Sofia

Regarding:

Procedure for granting the educational and scientific degree "Doctor" to Dr. Maria Andreeva
Hadzhinikolova for the dissertation entitled:

"SHOULDER ARTHROPLASTY – ANALYSIS OF RESULTS AND COMPLICATIONS

in the scientific specialty "Orthopedics and Traumatology" within the professional field 7.1. Medicine
in the area of higher education 7. Healthcare and Sports

Biographical Information

Education and Professional Experience

Dr. Maria Hadzhinikolova obtained her professional qualification as a Master of Medicine from Sofia Medical University in 2014. She obtained a specialization in "Orthopedics and Traumatology" in 2021. She was enrolled in a free doctoral program in the same specialty in March 2019, and her term was extended by one year, after which she was dismissed with the right to defend her dissertation. All procedural deadlines have been observed.

Dr. Hadzhinikolova has participated in a number of specializations and training programs abroad, some of which include: AO Trauma Seminar - Pelvic and Acetabulum, AO Trauma Seminar—Shoulder and Elbow, Sofia, Bulgaria; London Osteotomy Virtual Masterclass, Shoulder Arthroplasty Course, Plovdiv, Bulgaria; Practical Course "The Distal Radio – Ulnar Joint", Geneva, Switzerland; Küntsher Society Course on Intramedullary Osteosynthesis, Bulgaria; Paris International Shoulder Course, Paris, France; Basic Principles of Fracture Management, Davos, Switzerland; 9th EFAS Instructional Course, Budapest, Hungary. She speaks English, German, and Russian.

Since obtaining her specialization, she has worked in the Second Clinic of Orthopedics and Traumatology.

Dissertation

The goal set by Dr. Hadzhinikolova in her dissertation has been successfully achieved. She has conducted a retrospective analysis of the results and complications in patients treated with hemi and reverse shoulder prostheses and has proposed a developed algorithm for their follow-up. A total of 136 patients with hemishoulder prostheses and 62 patients with reverse shoulder prostheses were included in the study. The research was conducted at UMHATEM "N.I. Pirogov". A deltopectoral approach was used for each patient being followed. The follow-up algorithm includes the assessment of complications: non-union and resorption of the tubercles, migration of the implant, glenoid erosion (radiological follow-up), and evaluation of the integrity of the rotator cuff (ultrasound). The complication evaluation algorithm after reverse shoulder arthroplasty (RSA) includes: instability, resorption, and non-union of the tubercles (radiologically) and evaluation of the mechanical properties of the deltoid muscle (ultrasound). The dissertation itself is written on 170 pages, plus 33 pages of bibliography. It is illustrated with 18 tables and 65 figures, graphs, and images. The bibliography includes 520 literary sources.

The dissertation considers various trends in diagnostic and therapeutic practice: the increase in shoulder joint arthroplasty in recent years; the decline in hemiarthroplasty due to a high complication rate; and the increased use of reverse shoulder arthroplasty (RSA) systems. Despite the accumulated experience with shoulder arthroplasty as a widely used surgical technique, there is still no standardized approach for patient follow-up. This is where the current dissertation makes a significant contribution. It develops an algorithm for follow-up using imaging (radiological and ultrasound) and clinical methods based on various scales for assessing functional outcomes. A comparative analysis of the two techniques has been conducted, which confirms the results of several other studies regarding clinical outcomes and complication rates. In reverse shoulder arthroplasty, the functional results are better. Hemiarthroplasty finds increasingly limited application, mostly in very well-selected patients. A key factor for achieving good functional outcomes in arthroplasty patients is the restoration of the anatomical relationships of the humerus: its height, version, and most importantly, the anatomical reconstruction of the tubercles. In patients with RSA, in addition to the positioning of the components according to Gramont's principles, the function of the deltoid muscle is crucial. Systematic follow-up of patients and the development of a unified algorithm for this at certain stages of the postoperative period help to detect a number of complications early and prevent the need to address challenging surgical problems.

The literature review is written over 63 pages. It contains a detailed section dedicated to surgical anatomy, another section focusing on the clinical evaluation of patients after prosthetic surgery, and imaging diagnostics for prosthetized patients (CT, MRI, ultrasound examination, elastography, etc.). Additionally, the literature review discusses shoulder arthroplasty, including hemi shoulder, bipolar, and reverse bipolar designs. Information about the design of different implants is also provided.

In the "Aims and Objectives" section, five tasks are outlined, which are sufficient to give the study a complete and scientific character:

1. To analyze the results from the literature.
2. To follow enough patients treated with hemi shoulder and reverse shoulder arthroplasty.
3. Based on the clinical results analysis, to assess the strengths and weaknesses of the two methods.
4. To evaluate the use of B-mode ultrasonography for assessing rotator cuff lesions in patients after hemi shoulder arthroplasty and elastography for evaluating the mechanical properties of the deltoid muscle in RSA patients.
5. To develop a standardized protocol for patient follow-up to optimize the early detection of possible complications using clinical and instrumental methods.

In the chapter "Materials and Methods," presented over 13 pages, the design of the study, the selected clinical material from patients, the method of follow-up and evaluation through imaging and radiological diagnostics, criteria, documentary follow-up, and statistical methods are concisely and clearly outlined. The chapter "Results and Complications" provides important information by highlighting the radiological results related to implant migration, glenoid erosion, and the ultrasonographic results for evaluation, and analyzes the relationship between them. The clinical results of patients are divided into those following hemi shoulder arthroplasty and those for RSA patients. The fifth chapter, "Discussion," is useful and important, where the dissertation author thoroughly analyzes the presented content to show the fulfillment of the initial objective and defend the conclusions of her scientific work. The importance of a follow-up algorithm for patients and the various stages of their recovery is established. It becomes clear that achieving good clinical outcomes in shoulder prosthesis patients depends on the surgeon's experience, proper surgical technique, post-operative rehabilitation, and patient follow-up during the post-operative period. At the core of defining a clear protocol for the follow-up of endoprosthesis patients is the early detection of complications in asymptomatic patients, accurate assessment of their condition, and how changes affect the patients' clinical status. Monitoring patients who underwent shoulder replacement in the post-operative period is a prerequisite for early detection of problems or complications, which allows for precise assessment of the need for revision surgery. The dissertation effectively defends the need to optimize the follow-up of shoulder prosthesis patients, which focuses on asymptomatic patients, early detection of complications that could lead to prolonged and challenging revision, such as scapular notching or aseptic loosening of the glenoid component and stem.

It is evident that when accounting for the results, the frequency of different complications varies with both surgical techniques. Despite the appearance of the specific RSA complication—scapular notching (which is challenging regarding the reconstruction of the glenoid and fixation of the revision components), in reverse shoulder arthroplasty, the frequency of complications decreases with the modification of implants and the accumulation of more experience. The doctoral candidate reports better clinical outcomes

and a decreasing incidence of complications following hemi shoulder arthroplasty, due to more precise patient selection for the methodology and the evolution of the implants. In her analysis of studies related to RSA prosthesis, she identifies a large number of retrospective studies that monitor possible complications in the studied cohorts of patients. The complications are categorized into those related to the tubercles (non-union, resorption), glenoid erosion, and complications related to the rotator cuff, which are proven through clinical, ultrasonographic, and radiological methods.

The undeniable contributory nature of the dissertation is contained in six main points:

1. A detailed retrospective analysis has been made of the results and complications in the application of hemi shoulder arthroplasty and reverse shoulder arthroplasty.
2. A thorough and detailed comparative statistical analysis of the final outcomes has been conducted for both applied methodologies with respect to each investigated complication: non-union and resorption of the tubercles, malposition of the greater tuberosity (GT), implant migration, rotator cuff lesions, glenoid erosion, and shoulder instability.
3. An analysis has been made of the relationship between shoulder instability in reverse shoulder arthroplasty and factors that could lead to instability: BMI, size of the glenosphere, surgical approach, number of previous interventions, restoration of the subscapularis muscle, and developing infection.
4. A conventional ultrasound method has been proposed for monitoring rotator cuff tendon lesions in patients with hemi shoulder arthroplasty.
5. An ultrasound technique – elastography – is introduced to assess the biomechanical characteristics of the deltoid muscle in shoulder arthroplasty patients and its relationship with clinical outcomes.
6. An algorithm for patient follow-up is proposed for early monitoring of complications.

I agree with the conclusion, which confirms, through a detailed analysis of both techniques, the results of other studies regarding clinical outcomes and complication rates. In reverse shoulder arthroplasty, the functional results are better. Hemi shoulder arthroplasty finds increasingly limited application in very well-selected patients. Achieving good results is associated with the restoration of the anatomical relationships of the humerus: its height, version, and most importantly, the anatomical reconstruction of the tubercles. In patients with reverse shoulder arthroplasty, in addition to positioning the components according to Gramont's rules, the deltoid muscle plays a crucial role. Systematic follow-up of patients and the development of a unified algorithm for follow-up at specific stages of the postoperative period helps to detect several complications early and avoid seeking solutions to surgically challenging problems.

In conclusion, I believe that the dissertation by Dr. Maria Andreeva Hadjnikolova, titled "Shoulder Arthroplasty – An Analysis of Results and Complications", demonstrates a deep and serious approach to the study of shoulder arthroplasty surgical practice. It thoroughly analyzes all aspects of the diagnostic and therapeutic process, adding high scientific value to the work. For these reasons, and because the dissertation fully meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Development of the Academic Staff at UMHATEM "N. I. Pirogov" EAD – Sofia, I confidently and without hesitation recommend to the esteemed members of the Scientific Jury to award the educational and scientific degree of "Doctor" in the scientific specialty Orthopedics and Traumatology to Dr. Maria Andreeva Hadjnikolova.

Respectfully,

Prof. Dr. Margarita Kъteva, DM