

## **Review**

From professor **Boyan Balev, MD**

according to the procedure for acquiring the educational and scientific degree

## **Doctor**

Of Dr. **Dimitrina Nikolova Markova**

full-time doctoral student in the Department of "Imaging diagnostics and interventional radiology", scientific specialty Medical radiology and radiology (incl. use of radioactive isotopes), code: 03.01.28, Professional direction "Medicine" (code 7.1)

On the subject:

### **CT ASSESSMENT OF ABDOMINAL FAT, BONE DENSITY AND SARCOPENIA**

Order of the Rector of the Medical University, Varna No. R-109-268/05.08.2024

Scientific supervisor, **Assoc. Dr. Chavdar Bachvarov, MD**

#### **1. Personal data about the author**

Dr. Dimitrina Markova was born on 11.07.1981. She graduated from the Technical School of Veterinary Medicine in Lovech in 2000. In 2003 she graduated from the Medical College - Pleven, majoring in "Rehabilitator". From 2005 to 2011, he was a student at the Medical University - Pleven, majoring in "Medicine". In 2011, he graduated with honors in medicine from the Medical University - Pleven. From 17.09.2018 to the present, he is a physician assistant at the Imaging Diagnostics Clinic of UMBAL "St. Marina" - EAD Varna. In 2018, he acquired a specialty in "Image diagnostics". Since September 17, 2018, he is an assistant at the Department of Imaging, Interventional Radiology and Radiotherapy. Since 02.11.2020, she has been enrolled as a full-time doctoral student at the department. He has research interests in Breast Imaging, Abdominal Imaging, Female Pelvic Imaging and Pediatric Imaging.

#### **2. Relevance and appropriateness of the topic**

Obesity, and more specifically the accumulation of visceral adipose tissue, is a risk factor associated with many types of diseases. It is also associated with a higher risk of relapse after

treatment and mortality. It is even believed that visceral fat is an independent risk factor for the development of malignant diseases of the colon and pancreas. Abdominal adipose tissue can be quantified in several ways: body mass index (BMI) measurement, anthropometry (little used) or through the diagnostic imaging methods CT and MRI. Using BMI is not appropriate because a high number is not necessarily associated with an increase in visceral fat. In fact, various anthropometric measurements (measurement of thigh circumference, waist or abdominal sagittal diameter) are not reliable and often confuse visceral fat with subcutaneous fat. In fact, only cross-sectional imaging methods, especially computed tomography, allow to distinguish between the two compartments: subcutaneous and visceral fat, due to the excellent differentiation of adipose tissue from the rest.

### **3. Structure of the dissertation**

The dissertation is developed on 203 pages and includes 4 tables and 82 figures. Its structure includes introduction 2 pages, literature review 72 pages, purpose, tasks, hypothesis, material and methods 7 pages, results 43 pages, discussion 25 pages, conclusion 2 pages, conclusions 6 nos., contributions - 8 nos. . (divided into three groups – theoretical contributions, practical-applied contributions and original contributions). 511 literary sources were used, 1 in Cyrillic and 510 in Latin.

### **4. Knowing the problem**

The literature review is comprehensive and detailed. Obesity, osteoporosis, and sarcopenia were addressed sequentially. The imaging methods are extensively presented, with data on conventional methods, as well as ultrasound, computed tomography and magnetic resonance, presented. The methods and clinical application of computed tomography and magnetic resonance enteroclysis are reviewed. Literature data on the imaging findings of these methods in the assessment of abdominal adipose tissue in the setting of osteoporosis and sarcopenia are summarized.

The first section of the literature review details the definition, epidemiology of obesity, and increased cardiovascular and other risks associated with obesity. Clinical (anthropometric) methods and imaging methods (DXA, CT, MPT and US) are described in detail. The quantification (quantitative measurement) of abdominal adipose tissue, its division into two separate compartments visceral and subcutaneous adipose tissue, as well as the methods for measuring it planimetric methods (measurements from a single CT or MRI slice) and volumetric methods (volume segmentation) are also discussed in detail adipose tissue). A



separate point in the first section discusses the clinical and practical significance of adipose tissue quantification.

The second section is devoted to an analysis of literature data on osteoporosis as the most common metabolic bone disease among the elderly. This disease has various causes and can be classified as primary or secondary osteoporosis. Complications related to osteoporosis, such as vertebral or hip fractures, can create a social and economic burden, making early diagnosis essential for timely treatment and to identify patients who are at risk of fracture. Definition, historical notes, epidemiology, clinical picture of osteoporosis, imaging diagnostic methods applied to diagnosis of osteoporosis (DXA, US and CT) are described in detail and consistently in several points.

The third section is devoted to sarcopenia. Sarcopenia is a condition characterized by loss of skeletal muscle mass and function. Although it is primarily a disease of the elderly, its development can be associated with conditions that are not seen exclusively in them. Sarcopenia is a syndrome closely associated with physical disability, poor quality of life and a higher risk of death. In this point, the definition of sarcopenia, evolution of the concept over time, historical notes, epidemiology, populations in which it is observed, such as adults, cancer patients and obese people, are comprehensively examined. The clinical picture and imaging methods for the diagnosis of sarcopenia (DXA, US, CT and MRI) were studied in detail. The methods for CT evaluation of sarcopenia HUAC (Hounsfield Unit Average Calculation) and PI (Psoas Index) are also very well defined.

The literature review presents the author as thoroughly familiar with the issues underlying the dissertation work.

## **5. Material and methods**

The material and methods are presented in the chapter "Aim, tasks, hypothesis, material and methods of the dissertation". There is a retrospective and prospective analysis in the study. The inclusion and exclusion criteria are clearly stated in the patient material. 96 patients were examined, by means of low-dose abdominal CT, who passed through the Imaging Clinic at the UMBAL "St. Marina", divided into four groups:

- 1) patients with colorectal carcinoma – 22 patients
- 2) patients with lung carcinoma - 18 patients
- 3) patients with chronic pancreatitis – 20 patients

4) control group – 36 patients

The first three groups of patients were retrospectively selected and examined on Siemens Spirit, Somatom Definition and Somatom Force CT scanners, and the subsequent control group was prospectively examined using a Siemens Somatom Force CT scanner. The control group included healthy volunteers.

The statistical methods used are appropriately chosen and reasoned.

The material and methods allow the fulfillment of the set goal of the dissertation work and the drawing of conclusions from the results of the study.

## **6. Characterization and evaluation of the dissertation work**

The aim of the dissertation is "To assess abdominal adipose tissue, bone, density and sarcopenia indicators using low-dose abdominal CT and to analyze the relationship between them in patients with colorectal carcinoma, lung carcinoma and patients with chronic pancreatitis". Six tasks are listed that complement the specified objective.

The exposition in the chapters "Results" and "Discussion" follows the set tasks. The distribution and density of subcutaneous and visceral adipose tissue was studied and analyzed. The indicators of sarcopenia - HUAC, Psoas Index (PI) were studied and analyzed. Bone density was assessed with computed tomography using phantoms, and a phantom model specially developed for the purpose of the dissertation was presented. The relationship between bone density and subcutaneous and visceral adipose tissue was investigated and evaluated. The relationship between CT indices of subcutaneous and visceral adipose tissue, bone density and sarcopenia was investigated and evaluated. The relationship between indicators of subcutaneous, visceral adipose tissue, bone density, sarcopenia and markers of inflammation (CRP, ESR, leukocytes) and blood glucose levels were investigated. All the results of the own study are compared with the literature data in the discussion.

The conclusion of the paper roughly summarizes the results of the study, emphasizing the role of imaging methods in the assessment of abdominal fat tissue. Eight conclusions from the study are drawn, which respect the sequence of the tasks and the construction of the study and follow logically from the obtained results.

The dissertation work is multifaceted. It compares the results of modern imaging studies with some laboratory and anthropometric indicators. Methods were used that characterize the



structural changes of abdominal fat tissue and have a quantitative expression, which is a modern trend in medicine. The statistical processing of the results is impeccable.

The abstract correctly reflects the content of the dissertation work. The author presents three work-related publications in Bulgarian periodical scientific journals and two participations in national conferences. There are no related publications in foreign publications.

From the attached documents, it is clear that the procedure for the doctoral studies was followed according to the Regulations for the development of the academic staff at the Medical University - Varna.

## **7. Contributions and significance of the dissertation work**

Seven contributions are drawn from the results obtained and the conclusions drawn. Among them, I will single out those of an original nature: For the first time in Bulgaria, a study was carried out for CT evaluation of abdominal fat tissue, bone density and sarcopenia in patients with oncological diseases and chronic pancreatitis.

Also, for the first time in our country, the comparative application of low-dose CT of the abdomen with other used imaging methods is reflected – ultrasound, DEXA and magnetic resonance imaging. The relationship between indicators from CT assessment of abdominal fat tissue, bone density and sarcopenia was established.

The author reveals a perspective for wide application in gastroenterology, in endocrinology and oncology to monitor the therapeutic response of applied treatment. The developed methodology can also be successfully used in clinical trials of new oncological drugs by monitoring the therapeutic response when applying chemotherapy.

Of practical contribution is the creation of a bone density assessment phantom suitable in ambulatory settings.

## **8. Critical notes and recommendations**

I have no significant, major critical comments on the nature of the study, the results obtained, and the conclusions drawn in the peer-reviewed dissertation proposals. The dissertation would not lose its merits if Bulgarian authors were also included, especially in the field of osteoporosis diagnostics.

As a recommendation - to prepare the results of the study for publication in an international periodical.

## 9. Conclusion

The dissertation meets the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria, as well as the Regulations for the Development of the Academic Staff of the Medical University - Varna. Given the topicality of the problem and the obtained results, the significant theoretical, practical-applied and original contributions of the dissertation student, I give my positive vote and strongly recommend to the members of the respected scientific jury to award the educational scientific degree "doctor" to Dr. Dimitrina Nikolova Markova for the dissertation work "CT ASSESSMENT OF ABDOMINAL FAT TISSUE, BONE DENSITY AND SARCOPENIA".

30 Sep 2024

Varna

Professor Boyan B<sup>1</sup>-----

Заличено на основание чл. 5,  
§1, б. „В“ от Регламент (ЕС)  
2016/679