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FEATURES OF SARCOPENIA IN CANCER PATIENTS

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Abstract: Sarcopenia is quite common in clinical practice among various categories of therapeutic and surgical patients, and most importantly for this work, among the category of cancer patients. Sarcopenia is an independent risk factor for complications, including life-threatening ones such as sepsis and multiple organ failure.

Keywords: sarcopenia, cancer patients.

The relevance of the problem. According to the scientific literature, the frequency and severity of cachexia and sarcopenia in cancer patients depend on the location of the malignant tumor itself and the stage of the tumor process. Most often, these pathologies occur in tumors of the digestive and lung organs, less often-in breast cancer, uterine and ovarian cancer, and other localization [2].

Sarcopenia is diagnosed in 20-70% of patients with common malignant neoplasms, in which there is a combination of reduced food intake and protein-energy deficiency, which affects metabolism, ultimately leading to loss of skeletal muscle mass and a decrease in the functional capabilities of the body [10].

The reasons for the development of sarcopenia and cachexia in cancer patients are both a violation of nutrition, and directly the metabolic effect on the body of the malignant tumor itself. However, even the antitumor treatment itself, both drug and radiotherapy, often leads to numerous side effects that cause the development of malnutrition [2].

The cancer patients had less muscle and more abdominal fat compared to the control group. According to the study, about 50% were classified as suffering from malnutrition. Survival time significantly and negatively correlated with cancer stage and sarcopenia regardless of age and gender [33].

It has been shown that sarcopenia is detected in more than 50% of patients with advanced gastrointestinal and lung tumors at the time of treatment initiation, which is explained by a combination of alimentary deficiency and rearrangement of the patient's metabolism against the background of proinflammatory cytokines released by tumor cells [14].

It has also been shown that sarcopenia is a factor that reduces the life expectancy of patients with late-stage lung cancer and gastrointestinal tumors, regardless of the initial BMI [32].

Sarcopenia is an independent predictor of serious postoperative complications, longer hospitalization and stay in intensive care, as well as infectious, gastrointestinal, pulmonary, and cardiovascular complications in patients who have undergone severe operations, such as pancreato-duodenal resection for ductal pancreatic adenocarcinoma [7, 34].

Moreover, sarcopenia is also independently associated with postoperative outcomes after resection of a malignant neoplasm in colorectal cancer, esophageal cancer, hepatocellular cancer, and a number of others [27, 35].

To date, there are also data on the effect of sarcopenia not only on immediate, but also on long-term postoperative results. According to a meta-analysis conducted by I.. Mintziras et al., sarcopenia is a prognostically unfavorable predictor of the duration of overall survival in patients undergoing pancreatoduodenal resection for pancreatic cancer [36].

Thus, CT diagnosis of sarcopenia is a useful marker for predicting the preoperative risk of eating disorders, postoperative complications, and long-term outcomes in elderly patients with CRC [12].

Drug therapy is an essential component of combined treatment of tumors. The combinations recommended for use in clinical practice usually include from 2 to 4 drugs, which leads to the development of toxic side effects in most patients. Today, the most relevant method for selecting drug doses is to recalculate dosages to the so-called lean (fat-free) mass of soft tissues of the body, which is as close as possible to the volume of distribution of drugs and, therefore, allows you to more accurately predict the result of treatment [14].

The consequence of increased toxicity of chemotherapy is the need to reduce the dose of drugs or refuse drug antitumor treatment, which occurs in half of patients with advanced solid tumors [10].

Given that the distribution of drugs in tissues and their toxicity is determined primarily by fat-free body weight, SMI may be a more reliable predictor of toxicity than body surface area or BMI [10, 32].

A number of authors note that CT data can be used to assess body structure without conducting additional studies and without increasing the radiation load. Thus, from a clinical point of view, this approach allows us to consider CT as the method of choice for characterizing the condition of patients with cancer [32].

Materials and methods

The study was conducted on the basis of St. Petersburg State Medical Institution "City Mariinsky Hospital" and St. Petersburg State Medical Institution "City Clinical Oncology Dispensary" in April-May 2023.

A total of 32 CT images of patients aged 60-90 years were analyzed. To work with CT files in DICOM format, we used programs installed on the computers of medical institutions, namely:

AlmmageViewer и Philips IntelliSpace Portal.

Based on data from scientific articles, we selected two main indicators suitable for measuring muscle area on CT images of the abdominal cavity-SMI (musculoskeletal index) and PMI (skeletal index m. Psoas). These CT parameters were found in the vast majority of research studies with available CT scans at the lumbar vertebral level.

The first indicator is SMI (Musculoskeletal index). For his

The cross-sectional area of all striated muscles included in the scanning area was measured at the level of the caudal edge of the body of the LIII vertebra (m. psoas major, m. erector spinae, m. quadratus lumborum, m. obliquus externus abdominis, m. obliquus internus abdominis, m. transversus abdominis, m. rectus abdominis). Measurements were made manually using software tools, and the area of muscle tissue (sm2) was determined, followed by correction for the square of growth (m2).

The second indicator is PMI (skeletal index m. Psoas). For it, the measurements were carried out in the same way, on the same image and cross-section, but only the area of m. psoas major (sm2) was taken into account, followed by correction for the square of growth (m2).

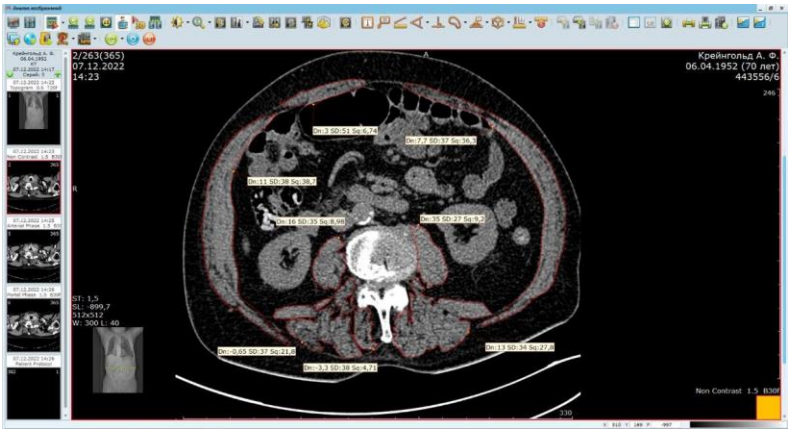


Figure 1 - Example of manual muscle selection on a LIII sliceusing the AlmmageViewer program

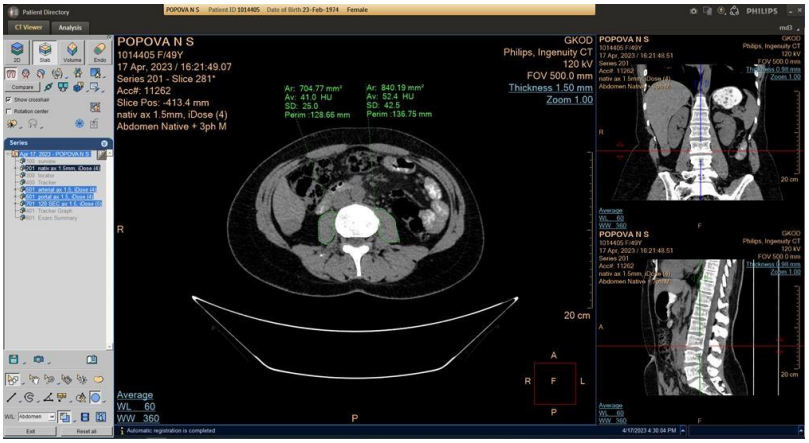


Figure 2 - Example of manual selection of m. Psoas major on a LIII sliceusing the Philips IntelliSpace Portal program

Figures 1 and 2 show examples of manually selecting an array of muscles using different programs, just as it was performed during our study. Figure 2 – the entire muscle array, with further output of SMI. Figure 3 – Only m. Psoas major for PMI output.

Also, data on age, height, weight, BMI, and clinical diagnosis were found for each patient. As mentioned earlier, unfortunately, there is currently no consensus in the scientific community on unified standardized methods for the radiation diagnosis of sarcopenia, as well as on specific threshold values.

Therefore, the index thresholds used in this study were taken from the following articles:

Для SMI – Trussardi Fayh AP, de Sousa IM (2021) Comparison of revised EWGSOP2 criteria of sarcopenia in patients with cancer using different parameters of muscle mass [37].

These thresholds were <52.3sm^2/m^2 for men and <37.6sm2/m2 for women with a BMI of <30 kg/m^2 and <54.3sm^2/m^2 for men and <46.6 sm^2/m^2 for women with a BMI >30 kg /m^2.

The values were chosen specifically from this article, as they were taken from a reliable source – the most current European Consensus on sarcopenia, adopted in 2018 by the European Working Group on Sarcopenia in Older People – EWGSOP2 (European Working Group on Sarcopenia in Older People).

The calculation of PMI turned out to be more difficult – there were no generally accepted thresholds for this CT indicator, since the values were diverse in each scientific and clinical study. Often, they were displayed

directly on an existing sample, using the calculation of 2 standard deviations (2 SD standard normal distribution) [38] or special software (for example, X-tile) [39].

The threshold values for the PMI index were 6.36sm^2/m^2 for men and 3.92sm^2/m^2 for women (the average age was 71 years, which was comparable to the sample obtained in our study). Unfortunately, the distribution of BMI for this indicator was not found in scientific works.

Static processing was carried out using descriptive statistics methods, as well as using the calculation of Spearman's rank correlation coefficient.

Research results and discussion: general characteristics of the examinees

We studied 32 patients aged 60-90 years (WHO criteria – 60-74 years old, 75-90 years old). The age distribution is shown in Figure 6. It can be seen that the vast majority of patients from the sample were aged 61 to 79, and only 3 people were over 80 years old.

The median age was 72 years. Of these, 18 were men and 14 were women (see Figure 3). The gender distribution of patients was 56% and 44%, respectively.

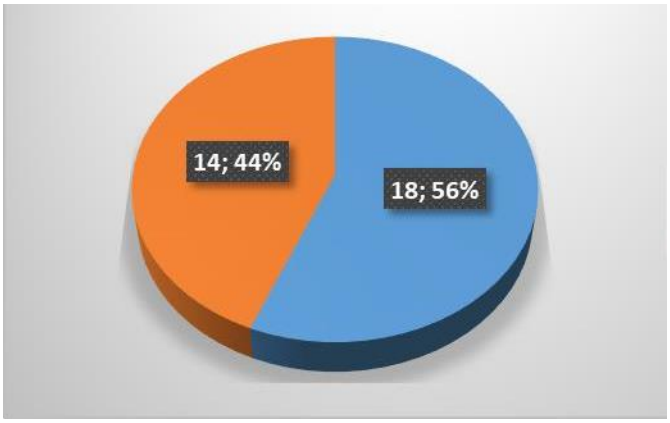


Figure 3 Gender distribution in the sample

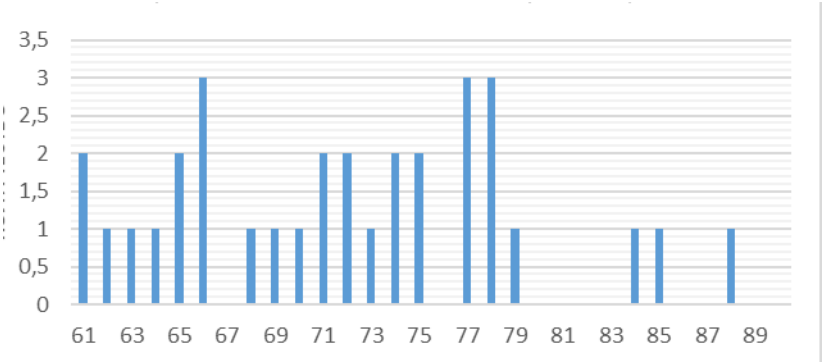


Figure 4 Distribution of ages in the sample

The distribution by BMI is as follows: only 3 patients were underweight, 9 had normal indicators, 12 were overweight, 6 were obese of the 1st degree, 2 were obese of the 2nd degree (see Figure 5). As can be seen from the diagram, most patients were overweight, regardless of the presence or absence sarcopenia. This corresponds to the literature data: 9 patients out of 19 patients with overweight or obesity were found to have sarcopenia [32].

The average BMI in this sample was 26.5 kg /m^2. In the group with cancer in the diagnosis, the average value was 26.58 kg /m^2, and without cancer-26.35 kg/m^2.

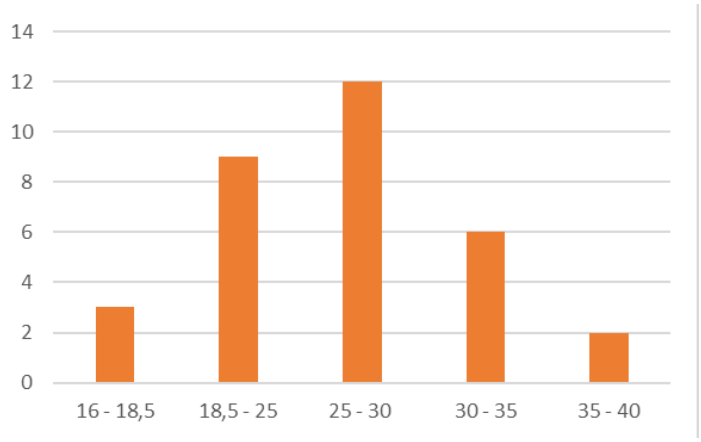


Figure 5 Distribution of the sample by BMI

Thus, more than half of the patients had a higher BMI than normal, even with cancer, and this fact did not affect the presence of sarcopenia in both groups.

Among the group with oncological diseases of various etiologies, there were 20 patients, 1 (5%) patient with breast cancer, 3 (15%) patients with pancreatic cancer and 3 (15%) with prostate cancer, 3 (15% and 15%) patients with kidney cancer and lung cancer, 8 (40%) of patients with gastrointestinal cancers.

The distribution by stage is as follows: 5 (25%) patients of stage 1, 3 (15% – - stage 2, 1 (5%) - stage 3, 11 (55%) patients of Stage 4. (see Figure 6)

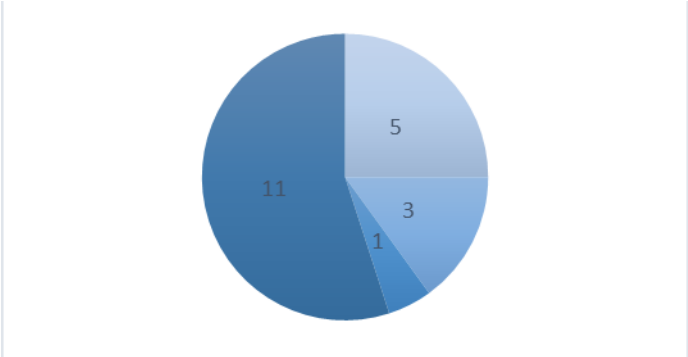


Figure 6 Distribution of the sample by cancer stage

Thus, the largest number of patients were with gastrointestinal cancers of various localization, and as can be seen from Figure 8, the majority (55%) were stage 4.

All patients in the control group without cancer had a therapeutic profile. Among them, 5 people (41%) were diagnosed with CHD, 4 more patients had chronic pancreatitis (33%), and the remaining 3 had other diseases (COPD and hepatitis).

Conclusion

The aim of this study was to compare CT parameters of sarcopenia in patients with and without cancer.

In the process of implementation, the set goals were achieved. Based on the current scientific literature and clinical studies, we studied and selected two main indicators of sarcopenia suitable for diagnosis by CT of the abdominal cavity – SMI (musculoskeletal index) and PMI (lumbar muscle index).

When comparing these indicators, it was found that only the SMI criterion on the example of this sample, when using specific threshold values, showed itself to be more statistically reliable than the PMI criterion,

and therefore it is preferable to use in diagnostics. However, it is worth noting that since there are no uniform standardized thresholds, it is impossible to unequivocally declare the failure of the PMI criterion as such. Therefore, this result does not prove the impossibility of using the PMI criterion. The obtained indicators indicate the expediency of further studying the phenomenon of sarcopenia in cancer patients with a large sample.

To date, there is no universally recognized method of radiation diagnosis of sarcopenia. All of them have their pros and cons.

CT diagnosis of sarcopenia is undoubtedly the most important step for reducing complications and improving the quality of treatment of both cancer patients and patients of other profiles.

Further search for radiation techniques and, in particular, CT indicators and their threshold values is needed for more convenient diagnosis of sarcopenia.

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