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Initial values of skeletal muscle parameters in patients presenting with acute pancreatitis

Aysun Isiklar[1], Taha Yusuf Kuzan[2]

[1]Department of Internal Medicine, Acibadem Altunizade Hospital, Istanbul, Turkey
[2]Department of Radiology, Sancaktepe Sehit Profesor Ilhan Varank Training and Research Hospital, Istanbul, Turkey

ABSTRACT

Objectives: Predicting the clinical course of acute pancreatitis has been discussed previously on the basis of visceral adipose tissue. This study was conducted to determine the relationship between clinical outcomes of acute pancreatitis and changes in skeletal muscle parameters.

Method: This is a single-center, cross-sectional, retrospective study. Patients who were diagnosed with acute pancreatitis between 01-28 February 2019 and had abdominal computed tomography (CT) taken in the first week of their hospitalization were included in the study. L3 level of abdominal CT images were used to evaluate skeletal muscle parameters.

Results: During the hospital database scanning, 127 patients newly diagnosed with acute pancreatitis were included in the study. The median age was 50 (18-88) years, 47% were male, and 53% were female. The median body mass index (BMI) was 26,42 (19.4-46.8) kg/m2. Fifty-one % of patients were diagnosed with biliary acute pancreatitis, and 48.8% were diagnosed with non-biliary acute pancreatitis. At the same time, acute pancreatitis severity was classified according to revised Atlanta criteria, 67.7% were mild (n = 86), 28.3% were moderate (n = 36) and 5 (3.9%) patients were severe. Skeletal muscle mass was evaluated using the total psoas index (TPI) and, skeletal muscle density calculated by HU. Median TPI was 6.3 (2.5-13.7). The median of Hounsfield Unit (HU) average calculation was 18.9 (3.8-28.5) (Table 1). There were no statistically significant differences on sex, age, BMI, skeletal muscle parameters, and acute pancreatitis clinical outcome (Table 2).

Conclusion: Skeletal muscle parameters determined by TPI and HU were not a predictor of the clinical course, and viewing them always cannot be effective to investigate their effect on acute pathologies. So, this way couldn't be proposed as a perfect method for predicting clinical outcome of acute pancreatitis.

Keywords: skeletal muscle parameters, pancreatitis, computed tomography, L3 level

Acute pancreatitis is the most seen disease of the pancreas. The incidence varies between 13 and 45 per 100,000. [1] Acute pancreatitis is typically a mild disease, it can be severe at about 10%, and also the fatality rate is higher in these patients. [2, 3] Various scoring systems like acute physiology evaluation, age and chronic disease assessment II (APACHE-II) [4] or Ranson classification criteria have been developed to predict the prognosis in acute pancreatitis. [2, 3]

Visceral adipose tissue and skeletal muscle mass around pancreas can be affected by cytokines secreted

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Address for correspondence: *Aysun IŞIKLAR, M.D., Department of Internal Medicine, Acibadem Altunizade Hospital, Istanbul, Turkey. E-mail: aysun.isiklar@acibadem.com. Phone: +90 216 649 44 44*

in acute pancreatitis, and its damage is associated with the development of necrotizing pancreatitis. [5] Unsaturated fatty acids produced by adipose tissue in case of acute pancreatitis can cause inflammation, necrosis and organ failure. [6] This relation between the severity of acute pancreatitis, visceral adipose tissue, and muscle parameters are controversial; therefore, there has also been some study which has shown no association. [5, 6]

Skeletal muscle parameters can be evaluated by measuring psoas muscle area and muscle density using cross-sectional imaging (computed tomography) methods. [7] Mean skeletal muscle attenuation measured by HU is an indicator of skeletal muscle density (SMD). Low skeletal muscle density indirectly reflects increased intramuscular adipose tissue and low skeletal muscle quality. Skeletal muscle mass has been shown to affect cancer-related outcomes. Skeletal muscle mass has prognostic effects in patients treated with cancer treatments and is a general predictor of clinical outcomes. Also, skeletal muscle mass affects operative complications such as colectomy, hepatic and pancreatic resection. [8, 9, 10]
Atlanta criteria has been changed in 2012 for better clinical evaluation, and treatment of acute pancreatitis. Radiological scanning has become more important in the diagnosis and follow-up of patients with acute pancreatitis. [11, 12] The contrast-enhanced CT is the first step for the diagnosis and follow up of acute pancreatitis.

In many diseases, some body parameters are associated with the severity of clinical outcomes, but this cannot be said for severe and necrotizing pancreatitis. With this study we aimed to answer the question "is there a relationship between the severity of acute pancreatitis and skeletal muscle parameters?"

METHODS

Study design and patient selection

This is a retrospective single-center cross-sectional study. We do not need informed consent owing to its retrospective design. To establish a homogenous cohort, patients diagnosed with acute pancreatitis in our hospital between 01-28 February 2019 were identified by retrospective screening of the hospital database. The baseline characteristics on initial admission including age, sex, body mass index, etiology and medical records were obtained from the hospital database. Patients diagnosed with acute pancreatitis and abdominal CT taken within the first week after admission to hospital were included in the study. Axial CT images at L3 level were performed for calculation.

CT was taken by 16-slice CT scanner (Optima 520 CT, General Electric (GE) company). All images were used from Picture Archiving and Communication System (PACS), and reviewed by a trained radiologist who was blinded of patient outcomes. Measurement of the psoas muscle area was calculated from the L3 vertebra level by measuring with the free hand technique. The severity of pancreatitis was classified according to Atlanta criteria.

Evaluation of muscles parameters

Psoas area values were calculated based on height in the first method of cross-sectional imaging, and cm^2 / m^2 unit was used for total psoas index (TPI). TPI calculation formula was used according to patient height: [right psoas area + left psoas area] / [height2]. Gender-specific quarters were produced and taken as a cut off value for the lowest 25% undercut in each approach. Cut off was taken as 6.3 cm^2 / m^2 in men, and 3.9 cm^2 / m^2 in women for the TPI calculated from the L3 level. [5, 6, 7]

Determination of skeletal muscle density was obtained by measuring a mean skeletal muscle attenuation in Hounsfield Unit (HU). Low skeletal muscle density is equal to increased intramuscular adipose tissue and poor skeletal muscle quality. HU average is calculated by the following formula; [right average HU x right psoas area] + [left average HU x left psoas area] / [TPA]. [5, 6, 7] Gender-specific lower quarter was 17,4 for men and 14 for women.

Statistical analysis

SPSS for Windows (v. 22; IBM Corp., NY, USA) was used to analyze the data. While evaluating the data, descriptive statistics were evaluated as mean, standard deviation, median, frequency, and ratio. Pearson Chi-Square test, Mann–Whitney test, and General Linear Model were used to compare qualitative data. Statistical significance was predicted as $p < 0.05$.

RESULTS

During the hospital database scanning, 127 patients newly diagnosed with acute pancreatitis were included in the study. The median age was 50 (18-88) years, 47% were men, and 53% were women. The median body mass index (BMI) was 26,42 (19.4-46.8) kg/m^2.

Table 1. Baseline characteristics of all patients

Characteristics		*Statistics*	
Age, median in years		50 (18-88)	
BMI, median in kg/m²		26,42 (19.4-46.8)	
Sex	**Female n (%)**	60	47,2%
	Male n (%)	67	52,8%
TPI, median		6,3 (2,5-13,7))	
Pancreatitis type	**Biliary**	62	48,8%
	Non-biliary	65	51,2%
HUAC, median		18,9 (3,8-28,5)	
Atlanta classification	**Mild AP n (%)**	86	67.7%
	Moderate AP n (%)	36	28.3%
	Sever AP n (%)	5	3.9%

* Hounsfield Units Average Calculation (HUAC)= (right area x density) + (left area x density) / total area;
*Total Psoas Muscle Index (TPI)= (Total Psoas Muscle Area/ height square). *AP: acute pancreatitis

Most common etiologies were biliary 51%. Sixty-seven % were mild (n = 86), 28.3% were moderate (n = 42) and 5 patients were severe, according to Atlanta criteria at the time of admission. Skeletal muscle mass was evaluated using the total psoas index (TPI) and, skeletal muscle density calculated by HU. Median total psoas index (TPI) was 8,2 ± 2,1 in men, and 5,3 ± 1,4 in women. The median of Hounsfield Unit (HU) average calculation was 20,7 ± 4,2 in men and 17,3 ± 5 in women (Table 1). There was no statistical significance between acute pancreatitis clinical outcome and skeletal muscle parameters (Table 2).

DISCUSSION

The focus of our study was to find the answer of a question about the relationship between acute pancreatitis criteria and muscle condition, as well as to evaluate its effect on clinical outcomes. Severe pancreatitis rate was numerically lower, it should be noted that 2.4% of patients were necrotizing pancreatitis at the time of CT scanning on admission to the hospital.

In a prospective cohort study conducted in the Netherlands, a total of 496 patients with a diagnosis of necrotizing pancreatitis were evaluated. They investigated the effect of body composition on hospital mortality using the first CT images and found no significant correlation between severe necrotizing pancreatitis and muscle parameters. [5] Another retrospective study from South Korea evaluated body fat and muscle distribution on acute pancreatitis in 203 patients from 2009-2015. Six % of patients were diagnosed with severe and 30% were moderately acute pancreatitis. They measure the muscle parameters with abdominal CT at L3 vertebral level. In this study,

Table 2. Statistical analysis for risk factors for severe acute pancreatitis

	Univariate OR (95%)	P value
Sex		
Male	1,18 (0,4-3,53)	1,000
Female	0,87 (0,41-1,82)	
Age		
≥ 65 years	0,65 (0,21-1,99)	,610
< 65 years	1,23 (0,59-2,53)	
BMI		
≥ 30kg/m²	1,03 (0,2-5,24)	1,000
< 30	0,98 (0,43-2,2)	
Etiology		1,000
Biliary	0,84 (0,4-1,7)	
Non-biliary	1,23 (0.41-3,65)	
Skeletal muscle index (cm²/m²)	3,4 (0,5-21,6)	,334
Skeletal muscle density (HU)	0,74 (0,67-0,82)	,207

high visceral fat was strongly correlated with the severity of acute pancreatitis. 10 Multicenter study conducted by Sternby et. al. [13] retrospectively and consecutively enrolled 454 patients with acute pancreatitis at first contrast-enhanced CT evaluated and measured adipose and muscle tissue parameters at L3 level. They declare that decreased muscle mass level was associated with severe acute pancreatitis. [13]

A single center prospective study from USA investigated the conversion of acute pancreatitis to severe pancreatitis, over 10 years period between 2009-2019. The median age was 53 years, median BMI is 28.3, etiologies include was alcohol 34.4% and biliary 34%. Abdominal CT images from L3 level was chosen for measurement. In this study it was shown that pancreatic lipases are responsible for the development of severe pancreatitis with lipolysis of visceral adipose tissue, independent of necrosis and inflammation. [14] Another study from Turkey evaluated the abdominal fat distribution and severity of acute pancreatitis in total 174 patients between January 2015-December 2018. The mean age was 58, 61% (107) were female, 38% (67) were male. Eighty-one % of patients had mild and 19% had moderate acute pancreatitis diagnosis. Sixty-five % among all patients were diagnosed with biliary etiology. It was found that increasing the adipose tissue ratio, is associated with an increase in acute pancreatitis clinical scores. [15]

Our cross-sectional study aimed to detect a change in skeletal muscles as an indirect indicator of visceral adipose tissue, at the time of acute pancreatitis and its effect on clinical outcomes. Most of the files scanned retrospectively were diagnosed with mild and moderate acute pancreatitis, only 5 patients at the time of diagnosis appeared with necrotizing pancreatitis. Based on our results, there was no significant relationship between skeletal muscle parameters and acute pancreatitis clinical presentation.

Limitations of the study

Firstly, our study was a single-center retrospective observational study design, and all data are reflecting just a muscle functions not intramuscular fat accumulation. In the next studies, muscle mass, and muscle function should be evaluated together in result-based analysis. Secondly, the duration of follow up in our study was short, the number of cases of severe pancreatitis was small; therefore, we cannot say that is strictly unrelated.

CONCLUSION

Skeletal muscle parameters determined by TPI and HU is not an important predictor of the clinical course and viewing them cannot be effective to investigate their effect on acute pathologies. As a result of these studies, a perfect method for predicting severe acute pancreatitis couldn't be proposed.

Statement of ethics

The study is retrospective conducted we did not get informed consent from patients, and all procedures performed were part of routine care. Approved by the local ethics committee (approval#03.01.2019/032). The study was conducted in accordance with the Helsinki Declaration, and Good Clinical Practices guideline.

Author's contribution

Conceptualization: [Aysun Isiklar], Methodology: [Aysun Isiklar, Taha Yusuf Kuzan]; Formal analysis and investigation: [Aysun Isiklar, Taha Yusuf Kuzan]; Writing - original draft preparation: [Aysun Isiklar]; Writing - review and editing: [Aysun Isiklar, Taha Yusuf Kuzan]; Supervision: [Aysun Isiklar, Taha Yusuf Kuzan]

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Conflict of interest statement

The authors have no conflicts of interest to declare.

Data availability statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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