



## Bioimpedance parameters in patients with emergency abdominal pathology

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### Abstract

**Relevance.** One of the methods that allows noninvasive analysis of the dynamics of water content in the body is bioimpedance, based on the ability of biological tissues to conduct electric current.

**Purpose of the research.** To study the water status and body composition of patients with acute appendicitis in the immediate postoperative period by bioimpedance.

**Material and methods.** Bioimpedance using the human body composition analyzer "InBody 230" was performed in 30 patients with acute appendicitis. Of these, 15 patients were female and 15 were male. The average age was  $24.7 \pm 3.4$  years.

**Results.** Regardless of the gender of patients with emergency abdominal pathology, there was a decrease in the overall level of fluid in the body, which remain unnoticed during the examination.

**Conclusion.** The state of dehydration in the examined patients, in our opinion, is associated with the participation of two inextricably linked pathological processes: violation of the body's water balance and structural disorganization of cell membranes.

**Keywords:** acute appendicitis, diagnostics, bioimpedance, water balance.

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### INTRODUCTION

Currently, laparoscopy successfully competes with traditional methods of surgical diagnosis and treatment of diseases of the abdominal cavity. This is explained by the generally recognized advantages of this method: wide possibilities for diagnosing diseases of the abdominal cavity; low injury rate; high efficiency. As a result, the course of the postoperative period is facilitated by reducing the pain syndrome, reducing the number of complications - inflammatory and adhesive. The length of stay of patients in the hospital is significantly reduced, which leads to a reduction in the cost of treatment. Excellent cosmetic results allow patients to forget about the operation as soon as possible (4, 5, 6).

However, laparoscopy is far from a safe procedure. In the middle of the XX century, doctors drew attention to changes in hemodynamics and gas exchange caused by the imposition of pneumoperitoneum. The performance of such operations, as it turned out, is associated with the occurrence of small and large surgical and anesthetic complications, up to a fatal outcome, mainly associated with an increase in intra-abdominal pressure when applying pneumoperitoneum and a change in the position of the patient's body on the table during the operation (1, 7).

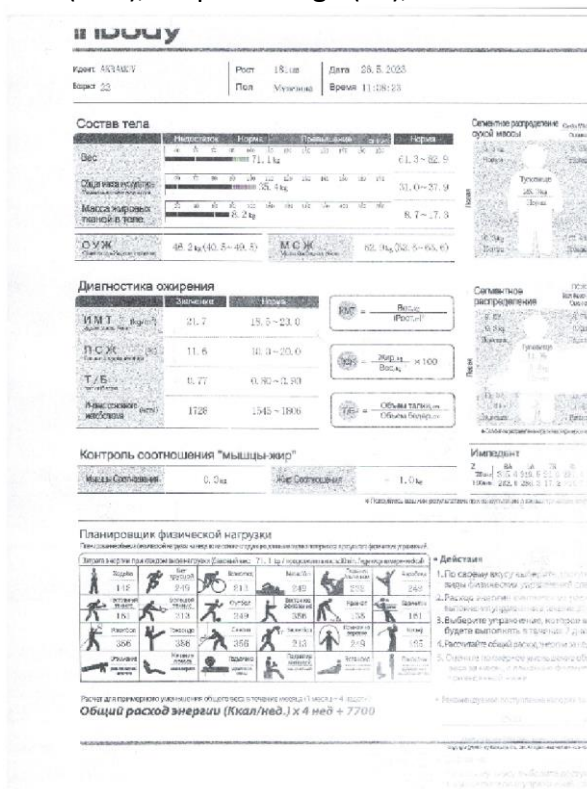
It is known that a change in the position of the body in space leads to the redistribution of water along the segments of the body. The redistribution of fluid when the patient's position changes

may cause changes in hemodynamics. To correct the emerging changes in hemodynamics, it is necessary to identify the nature and degree of redistribution of water in the body (3). One of the methods that allow for a non-invasive analysis of the dynamics of water content in the body is bioimpedance, based on the ability of biological tissues to conduct electric current (2, 8, 9, 11). During laparoscopic operations, both orthostatic effects and pneumoperitoneum affect the patient's body. In this connection, the purpose of this study was to study the water status and body composition of the body in the immediate postoperative period by bioimpedance analysis (BIA) in patients with acute appendicitis.

**MATERIALS AND METHODS**

*The object* of the study was 30 patients with acute appendicitis hospitalized in an emergency in the department of surgery of the Samarkand branch of the Republican Scientific Center for Emergency Medical Care for the period 2023. Of these, 15 patients were female and 15 were male. The patients included in the studies were of young age from 19 to 35 years (10). The average age was 24.7±3.4 years. All patients underwent laparoscopic appendectomy, during which 24 patients had a phlegmonously altered process removed, 5 had a gangrenous process and 1 patient had a catarrhally altered vermiform process.

*Research design.* In the review devoted to the above characteristics, bioimpedance was included using the Tel Aviv analyzer "InBody 230". The following BIA parameters were studied: height, weight, total muscle mass (TMM), body fat mass (BFM), total fluid level (TFL), fat-free mass (FFM), body mass index (BMI), fat percentage (FP), basal metabolic rate (BMR) (figure 1).



**Figure 1.** Table of human body composition BIA results

*Research methodology.* The study was conducted 2-3 days after the operation. Taking into account that sweating and evaporation also affect the result, causing temporary changes in body composition, data monitoring was carried out under the same conditions: at room temperature 22-24 C0 and the vertical position of the body of patients. BIA of the human body composition was performed on an empty stomach, after urination and bowel emptying. All studies were

conducted at the same time of day in the period from 11.00 to 12.00 hours (unit of measurement 24 hours).

*Parameter analysis* was performed in absolute (cm, kg) and relative units (%), as well as in calculated indicators (kg/m<sup>2</sup> ratio). The data obtained are presented in the form of average values ( $M \pm m$ ). The reliability of the differences in the mean values was determined by the Student's t-criterion. The significance level was considered reliable at  $p < 0.05$ . The obtained parameters of the patient's body composition were automatically compared with the reference values of practically healthy children.

## RESULTS AND DISCUSSION

Bioimpedance analysis of the body composition of patients with acute appendicitis hospitalized for emergency indications revealed (Table 1): the height of female patients was  $162.6 \pm 2.3$  cm, the weight was  $53.6 \pm 4.2$  kg. In men, height and weight were  $181.4 \pm 6.3$  cm and  $89.7 \pm 9.5$  kg, respectively.

**Table 1.**

**Results of bioimpedance measurement in patients with acute appendicitis**

Analyzer indicators	women		men	
	measure	standart	measure	standart
Height (sm)	162,6±2,3	168,9±7,6	181,4±6,3	175,4±6,2
Weight (kg)	53,6±4,2	62,5±5,3	89,7±9,5	78,7±6,3
TMM (kg)	21,7±1,3	23,9±4,6	38,4±5,3	34,5±4,1
BFM (kg)	13,6±5,4	24,3±2,1	22,2±3,7	13,4±3,6
TFL (kg)	24,3±2,1	32,5±3,4	35,3±3,1	45,3±5,2
BMI (kg /m <sup>2</sup> )	20,4±1,6	20,5±2,3	27,2±5,3	20,7±2,4
FP(%)	24,3±2,1	23,5±3,5	23,3±4,2	15,6±5,5
BMR (kcal)	1234,7±96,4	1308,7±100,6	1834,6±107,5	2117,6±115,3

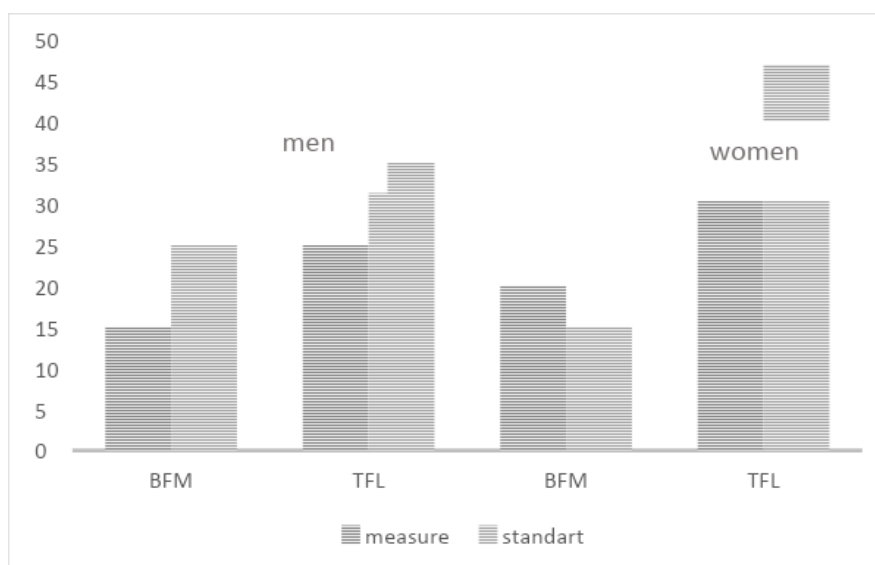
BMI was determined by the ratio of body weight to height, according to the formula  $BMI = \text{Weight (kg)} / (\text{Height m})^2$ . BMI values depending on the gender of patients had corresponding values, for women -  $20.4 \pm 1.6 \text{ kg/m}^2$  and for men -  $27.2 \pm 5.3 \text{ kg/m}^2$ .

As can be seen from the above Table 1, the total body fluid level (TFL), depending on gender, had different received and normative data. So in patients with acute appendicitis after surgery, the weight in women was  $24.3 \pm 2.1$  kg. and in men  $35.3 \pm 3.1$  kg.

**Discussion.** The patterns of general organizational changes in the body composition of patients with acute appendicitis were studied. As a result of the application of bioimpedance analysis, the data presented in Table 1 were obtained.

The mathematical analysis of the obtained results of bioimpedance measurement of body composition indicators in comparison with the normative data allowed us to identify the following. BFM had different values depending on gender (figure 1). Thus, in women with acute appendicitis, BFM was significantly lower than the standard values ( $p < 0.05$ ). In men, the data were diametrically opposed and were higher than the standard ( $p \leq 0.05$ ).

Regardless of the gender of patients with emergency abdominal pathology, there was a decrease in the overall level of fluid in the body, which remain unnoticed during the examination (diagram 1). The state of dehydration in the examined patients, in our opinion, is associated with the participation of two inextricably linked pathological processes: violation of the body's water balance and structural disorganization of cell membranes. This manifests itself in the form of nausea, vomiting, the development of pain syndrome and, in general, a decrease in the quality of life in these patients.



**Diagram 1. Mathematical analysis of bioimpedance results (p<0,05)**

As can be seen from Diagram 1, the BIA revealed the influence of the developed acute abdominal pathology on the water balance in patients with acute appendicitis. The analyzer's indicators were significantly lower than the standard ones ( $p < 0.05$ ). Commenting on the data obtained, it should be noted that emergency surgery for acute inflammation of the appendix increases tissue pressure, which leads to the development of ischemic processes. The earliest manifestation of this is a symptom of pain proportional to the morphofunctional change in the appendix.

## CONCLUSION

The study of BIA indicators in patients with acute appendicitis showed that the inflammatory process in the abdominal cavity in case of emergency abdominal pathology leads to the development of general organizational disorders in the body composition of patients. Assessing the place and diagnostic value of bioimpedance in the study, we consider it necessary to note that bioimpedance allows us to obtain objective data on the initial violations of the body's water balance. The BIA method seems to be the simplest, safest and most informative for assessing the water balance and the development of physical status in everyday clinical practice.

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