

# THE UNDENIABLE IMPORTANCE OF ULTRASOUND IN DIAGNOSTICS ACUTE SMALL INTESTINAL OBSTRUCTION

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## Abstract

The purpose of the study is to study the informativeness of transabdominal ultrasound in the diagnosis and assessment of the effectiveness of conservative and surgical treatment of acute small intestinal obstruction.

**Material and methods.** An ultrasound examination and analysis of 69 clinical observations of acute small intestinal obstruction in patients who were inpatient treatment at the clinical base of the Bukhara branch of the Republican Scientific Center for Emergency Medical Care for the period from 2018 to 2023 were carried out.

The data were compared with the results of X-ray (57 patients) and laparoscopic (10 patients) research methods. Echography was carried out on ultrasound devices "Esaote MyLab 40" and "SonoScape S40" using convex and sector sensors with a frequency of 1-22 MHz.

**It has been** established that the use of ultrasound in the diagnosis of acute small intestinal obstruction is justified from a tactical point of view, since it does not take too long, does not aggravate the patient's condition, is sufficiently informative and does not incur radiation exposure. Due to its safety and ease of use, this technique can be used many times during conservative treatment to determine further treatment tactics.

**Key words:** acute small intestinal obstruction, ultrasound examination.

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## Introduction

Acute small intestinal obstruction is one of the most rapidly and dramatically developing conditions among acute surgical diseases of the abdominal organs in emergency surgery, which is characterized by a severe clinical course and unfavorable prognosis. Almost acute small intestinal obstruction occurs in all age groups, without selecting populations. It ranks first among acute diseases of the abdominal organs in terms of mortality, which ranges from 4.2 to 30.8% [2; 5].

The main reason for high mortality rates is severe conditions, which are caused by untimely treatment of patients, diagnostic and tactical errors, as well as a significant number of postoperative complications against the background of uncorrectable severe conditions. The frequency of diagnostic errors even in a hospital setting reaches 13-33%. Many issues of diagnosis and treatment of acute small intestinal obstruction remain unresolved and controversial [1; 9]. Difficulties arise when diagnosing high-grade small intestinal and gallstone obstruction, where a significant number of diagnostic errors are observed [3; 4; 6; 12].

In case of acute small intestinal obstruction, many traditional radiation diagnostic methods are in some cases uninformative [7; 11]. The availability of computed tomography also has limitations [10; 13]. Therefore, it is very relevant for clinical surgery to conduct research to assess the informativeness of ultrasonography in the diagnosis of acute intestinal obstruction, which is a painless, quickly implemented visual diagnostic method that evaluates the structure of various organs and soft tissues, including the intestines. Taking into account a number of advantages of the method: accessibility, possibility of use in seriously ill patients, ease of implementation, high information content, non-invasiveness make it necessary to expand the role of ultrasonography in the diagnosis of emergency surgical diseases, in particular acute intestinal obstruction [8; 12].

**The purpose** of the scientific work was to study the information content of transabdominal ultrasound in the diagnosis and assessment of the effectiveness of conservative or surgical treatment of acute intestinal obstruction.

### **Material and research methods.**

An analysis of 69 clinical observations of acute small intestinal obstruction in patients who were hospitalized at the clinical base of the Bukhara branch of the Republican Scientific Center for Emergency Medical Care for the period from 2018 to 2023 was carried out. All patients admitted to the hospital initially underwent physical, laboratory and instrumental examinations. All patients were divided into two groups: the first group included 48 (69.6%) patients whose intestinal obstruction

was resolved by conservative measures, the second group included 21 (30.4%) patients who underwent surgical treatment.

The data were compared with the results of X-ray (57 patients) and laparoscopic (10 patients) research methods. Echography was carried out on ultrasound devices “Esaote MyLab 40” and “SonoScape S40” using convex and sector sensors with a frequency of 1-22 MHz. The studies were carried out without preliminary preparation with the patient lying on his back using a convex sensor. In some cases, ultrasonography was performed in a sitting position leaning against a wall or, if the patient’s condition allowed, standing. A polypositional study of all parts of the abdominal cavity was carried out, including dosed compression of both parenchymal organs and the small, large intestines and stomach. Initially, acute surgical diseases of the liver, gallbladder, pancreas, spleen, pelvic organs and retroperitoneal space were excluded. Inspection of intestinal loops in patients with suspected acute small intestinal obstruction was carried out polypositionally and polyprojectively using dosed compression with an ultrasound sensor on the anterior abdominal wall to minimize interference from gas in the dilated loops. Particular attention was paid to the search for dilated loops of the small intestine with intraluminal deposition of liquid contents and with a complete absence of movement of echo inclusions in its composition during continuous observation for 4-5 minutes. The depth and frequency of peristalsis of the small intestine was studied, and its absence in individual loops was determined. In addition to the generally accepted method, to determine the cause of obstruction, we examined the mobility of the peritoneal layers in the area of greatest pain and in other parts of the abdominal cavity during forced “belly breathing.” During laparotomy, during surgery, it was in areas with limited mobility of the loops relative to the anterior abdominal wall, recorded by ultrasonography, that visceroparietal and viscerovisceral adhesions were detected.

12 patients examined had postoperative ventral hernias. Such patients needed to assess the condition of the aponeurosis and the possibility of defects in it, which we took into account without fail. They also studied the contents of hernial sacs in the thickness of the anterior abdominal wall, the presence of loops of the small intestine and limited accumulations of fluid in them. At the moment of forced “belly breathing” and when straining the patient in a lying or standing position, special attention was paid to changes in the intestinal loops leading to the pinched zone: their expansion, intraluminal deposition of fluid, the pendulum-like nature of the movement of echoes of inclusions in the intestine. During this examination, signs of small intestinal obstruction were found in 9 patients. At the end of the ultrasound examination, a search for free fluid was performed in the area of greatest

pain. 6 patients had difficult diagnostic cases. With such an atypical clinical ultrasound picture, we considered it advisable to conduct follow-up ultrasound observations at intervals of 2 to 5 hours. In our observations, mechanical small intestinal obstruction was most often caused by postoperative adhesions in the abdominal cavity (29 cases). In 12 patients, the cause of obstruction was strangulation of a loop in the hernial sac, and in 3, small intestinal volvulus. In 4 cases, disruption of the passage of intestinal contents resulted from obstruction of the lumen due to compression of the intestine by tumors. To make a diagnosis, we relied on ultrasound criteria for small intestinal obstruction: dilation of small intestinal loops with intraluminal fluid deposition. Among 17 patients with adhesive strangulation obstruction, in 8 patients with a disease duration of up to 12 hours, with dosed compression with a sensor in the area of greatest pain, a loop of the small intestine was found to be absolutely akinetic, without peristalsis and without movement of echoes of inclusions with liquid contents within 5-6 minutes of ultrasound examination.

In the loops of the small intestine leading to the zone of strangulation, with a short period from the onset of the disease in 5 patients, propulsive movement of echoes of inclusions in the intraluminal contents and rapid peristalsis of the loops were noted. When the disease lasted more than 12 hours, in the remaining 3 cases of strangulation adhesive obstruction against the background of an increase in the amount of liquid content in the loops, a change in peristalsis to superficial was noted, the movement of the echo of inclusions in the lumen became pendulum-like. The search for a loop with signs of impaired innervation and blood supply to the intestinal wall in these patients was difficult due to the overflow of the small intestine leading to the loop with liquid contents. The distal zones of intestinal loop strangulation were collapsed in all cases, which helped clarify the level of obstruction. The diameter of the dilated small intestinal loops ranged from 2.7 to 4.8 cm.

One of the informative ultrasound signs of adhesive obstruction is the ability to detect during scanning the fixation of intestinal loops by adhesions to the anterior abdominal wall. In our studies, with a disease duration of up to 12 hours in 6 patients, when examining the abdominal cavity against the background of forced abdominal breathing, the mobility of the intestinal loops relative to the anterior abdominal wall was reduced and amounted to  $1.4 \pm 0.8$  cm. At the same time, in parts of the abdominal cavity, distant from the strangulation zone, it was  $3.8 \pm 0.8$  cm. The difference in mobility of the peritoneal layers averaged 2.3 - 4.1 cm. When the duration of the disease was more than 12 hours, in the remaining 5 patients there was no difference in the mobility of the peritoneal layers in different parts,

which is associated with an increase in the amount of intraluminal contents in the loops of the small intestine located proximal to the strangulation zone. In this case, the disposition of overstretched loops, limitation of the respiratory excursion of the diaphragm due to increased intra-abdominal pressure and, accordingly, a decrease in the mobility of all loops were noted.

In 8 cases of postoperative ventral hernias, ultrasonography revealed a defect in the aponeurosis of the anterior abdominal wall. Loops of the small intestine with thickening of the walls from 0.5 to 1.1 cm and reduced echogenicity were visible in the contents of the hernial sac. Peristalsis of the loops was very weak or absent. In the lumen of the intestinal loop, liquid contents were determined without movement of the echo of inclusions. Along the contour of the loop, limited fluid accumulations were visualized in the contents of the hernial sacs. The main criterion for loop entrapment in all 10 cases was the expansion of the afferent loops of the small intestine in the abdominal cavity with intraluminal deposition of liquid contents, the presence of pendulum-like movements of echoes of inclusions in its composition, free fluid in the abdominal cavity - in the area of the hilum of the hernial sac.

All cases of infringement were promptly confirmed. As our experience shows, conventional transabdominal ultrasound allows us to confidently diagnose acute small intestinal obstruction and differentiate strangulation and obstructive forms of adhesive obstruction. Using ultrasound echography it is possible to determine the level of obstruction. As the analysis of studies has shown, in addition to static ones, there are also functional ultrasound signs that make it possible to clarify the nature of the obstruction, namely, to establish the presence of visceroparietal adhesions in the abdominal cavity. In comparison with the x-ray method for obstructive small intestinal obstruction, transabdominal echography allows us to identify the nature of changes not only in the intestinal lumen, but also in the surrounding abdominal tissues, which makes it easier to determine the cause of the obstruction.

### **Results.**

Obstructive small intestinal obstruction was caused by the presence of a mechanical obstacle to the movement of intestinal contents and was observed in 27 patients. In these patients, during the initial ultrasound examination, heterogeneous liquid contents were more often determined due to intracavitary fluid deposition, impaired peristalsis in the form of its intensification and, especially, active antiperistalsis and segmental dilatation of the intestine. As the condition worsened, the contents became more homogeneous, acquired a mushy character, and then, as intestinal obstruction progressed, a decrease in the echogenicity of the contents down to anechoicity was observed. This period was usually combined

with a decrease in the intensity of contractile movements of the intestinal wall due to an antiperistaltic pause. In addition, attention was paid to the state of Kerkring's folds: when the obstruction was localized within the jejunum, its folds turned out to be preserved; when the obstruction was localized within the ileum, the mucous loops of the latter turned out to be devoid of folds. The closer to the site of obstruction, the more pronounced the thickening of the walls and folds was due to edema and fibrin overlay (Fig. 1-2).



**Fig.1.** Echogram of a patient with mechanical small intestinal obstruction - adhesions at the level of the proximal ileum. When scanning longitudinally at the level of the jejunum, it is noted inside luminal deposition of fluid, expansion of the lumen of thin intestines, thickening of folds.



**Fig.2.** The same patient. Transverse scanning.

The definition of visceroparietal adhesions in the abdominal cavity was based on the presence of intestinal loops fixed to the anterior abdominal wall, not displaced relative to it during active respiratory movements, as well as on sharp changes in the diameter of intestinal loops. In case of adhesive obstruction with the patient in the lateral position, fixation of the loops of the small intestine and their fusion with each other were detected. Moreover, a thorough examination of the intestinal loops

made it possible to identify the difference in intestinal diameters, as well as the place of compression by the expanded loops of the collapsed “tangle” and, as a result, more accurately state the presence of a level of obstructive obstruction (Fig. 3).



**Fig.3.** Echogram of the same patient. Dilated small intestinal loops compress the collapsed loops of the ileum located distal to the site of obstruction.

As our experience has shown, the use of ultrasound in the diagnosis of acute small intestinal obstruction is justified from a tactical point of view, since it does not take too long, does not aggravate the patient’s condition, is sufficiently informative and does not incur radiation exposure. The sensitivity of the method in diagnosing mechanical small intestinal obstruction in our studies was 97.3%. Due to its safety and ease of use, this technique can be used many times during conservative treatment to determine further treatment tactics.

### **Conclusions**

1. Determination of early ultrasound signs of acute small intestinal obstruction with a disease duration of up to 6-8 hours allows us to determine and assess in detail the condition of the intestinal wall, the nature of peristalsis, which contributes to the effective diagnosis of acute small intestinal obstruction.

2. The main ultrasound criteria for mechanical intestinal obstruction are: uneven dilation of small intestinal loops, a difference in the diameter of the small intestine and the presence of a collapsed loop, pendulum-like peristalsis not associated with breathing, visceroparietal and visceral-visceral adhesions.

3. Determination of visceroparietal and viscerovisceral adhesions by ultrasound allows one to assess the presence of adhesions.

### **Recommendations**

1. To improve diagnostic results, it is advisable to use a comprehensive ultrasound examination. If there is no suspicion of strangulation, dynamic studies

are carried out at intervals of 2-4 hours to assess the effectiveness of conservative therapy.

2. During the first ultrasound examination, you should pay attention to early ultrasound signs of acute small intestinal obstruction (slight dilatation of the intestine, changes in the nature of the contents and peristalsis). If there are signs of acute small intestinal obstruction, special attention should be paid to the structure of the wall of the small intestine and its lumen at the site of the difference in the diameter of the intestinal loops, which allows in some cases to determine the cause of acute small intestinal obstruction.

3. When diagnosing strangulated intestinal obstruction, attention should be paid to the presence of free fluid in the early stages of the disease, the structure of the intestinal wall, and compare ultrasound data and the clinical picture.

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