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DIAGNOSTIC ROLE OF ULTRASONIC EXAMINATION IN ACUTE ADHESIVE INTESTINAL OBSTRUCTION IN CHILDREN

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Abstract. Acute intestinal obstruction is one of the most common conditions encountered in emergency pediatric surgery. This paper presents the results of a survey of 47 children with acute adhesive intestinal obstruction treated at the Tashkent Pediatric Medical Institute from 2020 to 2022. Of the total number of patients, 43 underwent surgery for early adhesive intestinal obstruction. Surgical treatment was performed in two ways: open (12 patients) and laparoscopic (31 patients). Conservative treatment proved effective in 11 cases. Ultrasound was widely used for both primary diagnosis and dynamic monitoring of children receiving conservative therapy, allowing for an assessment of the condition of the intestinal wall and structure, as well as the restoration of peristaltic activity. Ultrasound examination plays an important role as a primary screening method to confirm or exclude acute adhesive intestinal obstruction, ensuring timely diagnosis and early inclusion of the patient in the treatment process.

Key words: acute adhesive intestinal obstruction, diagnostics, children, ultrasound examination, computed tomography, information content.

Relevance. Acute intestinal obstruction (AIO) is one of the most common conditions encountered in emergency surgery, accounting, according to various authors, for 9.4 to 27.1% of all acute surgical cases. In 85–90% of cases, acute adhesive intestinal obstruction (AAO) is associated with previous surgical interventions. Adhesions account for 40–75% of all forms of intestinal obstruction, while mortality from AAO remains high, at 6–10%, with no signs of decline [5, 6, 9].

Various imaging techniques are used to diagnose patients with suspected acute adhesive intestinal obstruction, including plain radiography, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Plain radiography of the abdominal organs in the standing and supine positions has a diagnostic accuracy of 50–70% and is characterized by low specificity. Furthermore, radiographic findings may be false-negative in cases of complete, closed, or strangulated obstruction.

Computed tomography is recognized as the "gold standard" in the diagnosis and staging of small bowel obstruction, but its use in pediatric practice is limited by the high radiation exposure. Magnetic resonance imaging is a highly informative and reliable method, but has several limitations, including the length of the examination, reduced image quality during respiratory movements and bowel movements, and limited availability in emergency settings.

The use of CT and MRI is not always feasible, especially in remote regions where expensive equipment and specialists with sufficient experience interpreting tomographic data are lacking. Diagnostic laparoscopy, despite its high information yield, has a number of specific contraindications [7, 10], and in cases of severe adhesions, it is associated with a high risk of iatrogenic damage to the intestinal wall.

Ultrasound currently plays a leading role in the diagnosis of acute abdominal surgical diseases. Ultrasound diagnostics is a key method for detecting acute intestinal obstruction due to its accessibility, speed, high information yield, non-invasiveness , the possibility of repeated dynamic use, and the absence of ionizing radiation and side effects for both the patient and medical staff. Furthermore, ultrasound allows for the detection of signs of acute intestinal obstruction at earlier stages of the disease, which is crucial for the timely selection of treatment strategies.

The aim of the study was to investigate the possibilities of the ultrasound method in the diagnosis of acute adhesive intestinal obstruction in children.

Materials and methods. This study presents the results of a survey of 47 children with acute adhesive intestinal obstruction (AAO) treated at the Tashkent State Medical University Clinic from 2020 to 2022.

Of the total number of patients, 43 children (91.4%) underwent surgery for early adhesive intestinal obstruction. Surgical interventions were performed using two methods: open surgery in 12 children (25.5%) and laparoscopic surgery in 31 patients (65.6%). Conservative therapy was effective in 11 patients (23.4%).

A predisposing factor for the development of acute abdominal adhesions was the presence of adhesions in the abdominal cavity, primarily due to previous abdominal surgery. Of the 47 children, 43 (91.4%) had a history of abdominal surgery. Only 4 (8.6%) patients had not previously undergone surgery; in this group, chronic inflammatory bowel disease and pelvic diseases were the cause of acute abdominal adhesions.

The average time for acute adhesive intestinal obstruction to develop was 3.2 years after the last surgical intervention. Early adhesive intestinal obstruction developed between 2 and 14 days after the initial surgery.

All patients underwent ultrasound examination using Sonoscape S22 (China) and Aplio 500 (Japan) devices, operating in real time, in grayscale mode with color Doppler mapping. The examination was conducted with the child lying on his back with spontaneous breathing. A convex transducer with a frequency of 2-6 MHz was used. Scanning was performed sequentially: from the epigastric region to the mesogastric and hypogastric regions on the right and left with an assessment of the loops of the small and large intestine, after which the pelvic region was examined. The examination was performed in multiple positions . Differential diagnostics with other acute surgical diseases of the abdominal organs was simultaneously performed. For a more detailed assessment of the condition of the intestinal wall and clarification of the level of obstruction, a high-frequency linear transducer (7-12 MHz) was used.

Dynamic ultrasound examinations were performed 1 to 3 times during conservative therapy, with monitoring intervals of 2–4 hours. If positive changes were detected during treatment, follow-up ultrasound examinations were performed every 4 hours.

Research results. Upon admission, the most common and persistent complaints in children with acute adhesive intestinal obstruction were abdominal pain of varying intensity and nature, as well as gas and/or stool retention. Vomiting was observed in only a third of patients and was not a leading clinical symptom.

All children underwent plain abdominal radiography in the standing and/or sitting positions upon admission. Direct radiographic signs of acute intestinal obstruction included the detection of Kloiber cups in 26 patients (55.3%), visualization of the intestinal wall in 12 (25.5%), intestinal arches in 15 (31.9%), and Casey's sign (transverse striation of the small intestine) in 9 (19.1%) children.

Pneumatization of the small intestine was detected in all patients examined (100%). The first, initially solitary, Kloiber cups were visible on radiographs as early as 2 hours after the onset of the disease, and their number increased after 3–4 hours. When the gas component predominated over the liquid component, intestinal arches formed within the lumen of the intestinal loops. The presence of multiple fluid levels within the intestinal arches was considered a sign of mechanical intestinal obstruction. In the dynamic (paralytic) form, the surface of the fluid conglomerates was located at a single level, and pneumatization of the loops of the small and large intestine was uniform.

In later and more advanced cases, Casey's symptom was detected, which arose as a result of swelling of the Kerckring folds, which became radiopositive due to the accumulation of fluid in the intestinal wall.

An abdominal ultrasound was performed on all children as an emergency procedure upon admission. The examination assessed the degree of dilation and thickness of the intestinal wall, the nature of the luminal contents, intestinal motor and evacuation activity, and the presence and amount of free fluid in the abdominal cavity. A general ultrasound revealed dilated small bowel loops in 27 (57.4%) patients.

After identifying a group of dilated intestinal loops, their diameter, peristaltic activity, wall thickness, and valve condition were assessed. Among 35 (74.4%) children admitted to hospital within the first 12 hours of illness onset, 15 (32.0%) patients had a small intestinal diameter ranging from 2.0 to 2.5 cm. 63.2% of children were admitted to the group of patients hospitalized later than 12 hours of illness onset. In this group, the average small intestinal diameter was most often in the range of 2.6 to 3.0 cm; in 13 observations, it was 3.0 to 3.5 cm, in 10 - 3.5 to 3.8 cm, and only in 5 patients did it exceed 4.5 cm.

An anechoic small intestinal contents in 45 (95.7%) patients . In 7 (14.8%) cases, heterogeneous contents were observed, with small hypoechoic inclusions or suspensions of varying echogenicity . In 39 (82.9%) children, the intestinal contents were virtually homogeneous, with a minimal number of hyperechoic inclusions, which were isolated. Only in 2 (1.7%) cases were the luminal contents distinguished by moderately reduced echogenicity , heterogeneous structure, and multiple dense inclusions. It should be noted that both of these patients were hospitalized in the first hours after the onset of the disease, while the diameter of the small intestine did not exceed 2.0 cm.

Dynamic ultrasound monitoring revealed a gradual decrease in the echogenicity of the small intestinal chyme, reaching an anechoic state, with a simultaneous increase in its homogeneity. The ultrasound findings during the initial examination in this patient group were due to the short duration of the disease and the relatively preserved functional state of the intestine.

The intestinal wall thickness on ultrasound examination ranged from 2 to 5 mm. The intestinal wall structure remained homogeneous, with increased echogenicity . Echo structural characteristics and wall thickness were similar both in the area of the dilated loops and in other areas of the small intestine.

Thanks to the use of ultrasound, the diagnosis of acute adhesive intestinal obstruction was established in most patients within the first 6 hours of onset, allowing for timely treatment. However, radiographic confirmation of this diagnosis was generally only possible after the illness had lasted longer than 6 hours. Thus, ultrasound is more informative in the early stages of acute adhesive intestinal obstruction than radiographic methods.

Conclusions. Ultrasound is a highly informative and accurate imaging method for the diagnosis and staging of acute adhesive intestinal obstruction in children. The ability to assess intestinal peristaltic activity in real time using ultrasound is crucial for early diagnosis, determining the nature of the obstruction, and dynamic patient monitoring. Ultrasound is effectively used to monitor patients receiving conservative therapy, allowing for the assessment of the condition and structure of the intestinal wall, the nature of the contents, and the restoration of peristalsis. Ultrasound should be considered as a primary screening method to confirm or exclude acute adhesive intestinal obstruction, ensuring timely diagnosis and early initiation of treatment.

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