

Diagnosis importance of an ultrasound sonography while infantile appendicular peritonitis

Shukhrat Abdusasulovich Yusupov
Jamshed Ostonkulovich Atakulov
Jasur Olimjanovich Ruziyev
Anvar Komilovich Raximov
Begzod Nasriddinovich Raxmatov
Samarkand State Medical University

Abstract: In order to study the possibilities of ultrasound sonography (US) for diffuse purulent appendicular peritonitis (SGAP), complicated by intestinal paralysis (IP) in children, for an objective assessment of intestinal motor activity, the extent of the pathological process in the abdominal cavity and for dynamic monitoring of the effectiveness of treatment, we examined 93 patients aged 2 to 15 years with appendiceal peritonitis. The patients were divided into 2 groups: comparison group I - 45 patients with appendiceal peritonitis complicated by stage I-II paresis. Group II included 48 children with RGAP complicated by PC (main group). The following echographic indicators were assessed: the presence of fluid in the abdominal cavity and its localization; the presence of intestinal peristalsis; intestinal diameter and thickness; accumulation of fluid and air in the intestinal lumen; the nature of the movement of chyme through the intestine. When comparing preoperative ultrasound parameters with the results of intraoperative examination of the abdominal cavity, it was revealed that in 91.2% of cases, echographic data coincided with intraoperative data. Ultrasound scanning in the postoperative period allows not only to detect a positive clinical picture, but also to contribute to the early recognition of postoperative intra-abdominal complications (abdominal abscesses, adhesive complications).

Keywords: appendiceal peritonitis in children, ultrasound sonography, diagnosis

Diffuse purulent appendicular peritonitis (SGAP), complicated by intestinal paralysis (IP), is one of the urgent problems in pediatric surgery [2,5,16].

Diagnosis of RGAP complicated by PC and correct assessment of its severity before surgery in children is the basis for choosing further treatment tactics and prognosis of the disease [10,11,13]. To study the prevalence of the purulent process and intestinal motor function in appendiceal peritonitis, various methods are used [1,4,8]. Studies that require the introduction of foreign bodies (instruments, contrast and radioactive substances) are acceptable only in the preoperative period according to indications, but they cannot be used in the immediate hours and days after surgery,

since they themselves can cause serious complications [12, 6]. Phonoenterography and electroenterography, used for objective assessment of intestinal activity, along with registration peristaltic bowel sounds, heart sounds and pulmonary rales are also recorded [3, 7, 19], which leads to diagnostic difficulties. All this proves that the problem of diagnosing the form of appendiceal peritonitis, as well as the severity of intestinal paresis in the preoperative period remains relevant [17,18,20].

In this regard, the use of ultrasound sonography (US) of the abdominal cavity to assess the prevalence of the pathological process in the abdominal cavity and the degree of intestinal paresis during peritonitis in children in the pre- and postoperative periods is of great scientific and practical interest [9, 14, 15].

The purpose of our study was to study the possibilities of ultrasound in RGAP complicated by PC in children for an objective assessment of intestinal motor activity, the extent of the pathological process in the abdominal cavity and for dynamic monitoring of the effectiveness of treatment.

Materials and Methods

We observed 93 patients aged 2 to 15 years (40 girls, 53 boys) who were admitted to the surgical department with a diagnosis of peritonitis. To clarify the severity of intestinal paresis, the prevalence of the inflammatory process in the abdominal cavity, determine further surgical tactics and evaluate the effectiveness of treatment in patients with RGAP complicated by PC, a dynamic ultrasound scan of the abdominal organs was performed as part of the examination. At the same time, the motor-evacuatory activity of the intestine, the degree of prevalence of the inflammatory process in sick children with appendiceal peritonitis in dynamics were studied, the localization and prevalence of free fluid in the abdominal cavity, the presence of intestinal motility and its nature, the diameter of the intestine, the accumulation of liquid and gas in its lumen were assessed, dynamics of chyme movement through the intestinal tube. The studies were carried out without preliminary preparation of the patient, in a horizontal position on the back, using ALOKA-500-SSD, SIEMENSE SOWOLINE SI-450 devices using linear sensors 3.5; 5.5; and 7.5 MHz, in real time using dosed compression with a sensor on the abdominal wall.

Results and Discussion

Depending on the results of the initial surgical examination and the severity of clinical manifestations of intestinal paresis, as well as the type of treatment performed, all examined patients were divided into two groups. The first group included 45 patients with appendiceal peritonitis complicated by stage I-II intestinal paresis (comparison group). The second group included 48 children from 98 patients with RGAP complicated by PC (main group). In terms of age composition, both groups were equal, which facilitates comparative analysis.

96% of patients in the first group with appendiceal peritonitis were admitted on days 1-4 from the onset of the disease, while in the second group all patients (100%) were admitted at a later date - on days 3-10. In the first group, local peritonitis was determined in 4 patients, diffuse in 36, and diffuse appendiceal peritonitis in 5 patients. In the second group, all patients were diagnosed with RGAP.

Patients of the first group (45 children, comparison group), depending on the method of eliminating intestinal paresis, were divided into three subgroups. In the pre- and postoperative periods, patients of the first subgroup (24 patients) had stagnant gastric contents sucked out using a nasogastric tube and the stomach was periodically washed with a 2% sodium bicarbonate solution, a cleansing hypertonic enema, infusion detoxification therapy, and correction of potassium deficiency were used. As a result, intestinal paresis resolved.

In order to relieve intestinal paresis, children of the second subgroup (11 patients) were additionally treated with proserin in addition to the above treatment of intestinal paresis.

In patients of the third subgroup (10 patients), it was not possible to eliminate intestinal paresis using the above methods, and the treatment complex was supplemented with long-term epidural anesthesia with lidocaine.

In 48 children with RGAP complicated by PC (second group), when the above set of measures to stimulate the motor-evacuatory functions of the intestine did not have an effect, retrograde decompression of the small intestine was additionally used with a special probe through cecostomy or appendicostomy.

Primary ultrasound examination of patients was performed within 1 to 12 hours from the moment of admission to the hospital. Then, in the postoperative period, the dynamics of each patient was studied 3-4 times. The ultrasound results were compared with clinical signs, and they were confirmed by intraoperative data.

During ultrasound examination of the abdominal cavity, to diagnose the extent of the inflammatory process and the severity of intestinal paresis, the following echographic indicators were assessed: the presence of fluid in the abdominal cavity and its localization; the presence of intestinal peristalsis; intestinal diameter and thickness; accumulation of fluid and air in the intestinal lumen; the nature of the movement of chyme through the intestine.

In children with appendiceal peritonitis of the first subgroup, the following echographic signs were characteristic. In the right iliac region, local intestinal paresis was always observed: areas with "silent" intestinal loops, the diameter of which was not changed, were visualized, pneumatosis of intestinal loops, a small local accumulation of fluid in the lumen of the small intestine in one or two areas, or the fluid was not detected. The advancement of chyme is slowed down in the area of greatest pain. In other parts of the abdominal cavity, the advancement of chyme is

uniform, without slowing down. Local appendiceal peritonitis was echographically characterized by the accumulation of free fluid in the area of the dome of the cecum.

In patients of the second and third subgroups, the intestinal loops are moderately distended with a predominance of liquid contents over pneumatization, the movement of chyme is weak, progressive, peristaltic movements are rare. In diffuse appendiceal peritonitis, accumulation of free fluid was determined in the interloop spaces, the right lateral canal, the right iliac region and in the projection of the small pelvis.

In patients of the second group (48 children), intestinal loops were visualized throughout the entire abdominal cavity, sharply distended with liquid contents with or without single gas bubbles. There is no intestinal peristalsis, the movement of the chyme is weak, pendulum-like, or completely absent. A significant amount of fluid in all parts of the abdominal cavity. In RGAP complicated by PC, the accumulation of free fluid was visualized in all parts of the abdominal cavity (5 or more parts of the abdominal cavity).

The obtained clinical signs and ultrasound data in patients with RGAP complicated by intestinal paresis were compared with intraoperative parameters.

In patients of the first and second subgroups, intraoperatively the spread of the inflammatory process beyond the cecum was detected; purulent exudate was located between the intestinal loops, without going beyond the border of the lower floor of the abdominal cavity. The parietal peritoneum looked dull and swollen. The diameter of the intestinal loops was not changed, vascular pulsation and intestinal motility were preserved.

In the examined children of the third subgroup, the operation revealed that the inflammatory process spread to the lower and middle floors of the abdominal cavity, leaving the subdiaphragmatic spaces free. The effusion in all cases was purulent, often with a characteristic colibacillary odor. The parietal and visceral peritoneum looked edematous, dull, with fibrinous deposits in the area of the ileocecal angle. The intestinal loops were moderately swollen, hyperemic, and there were fibrinous deposits at a distance of 40-70 cm from the ileocecal angle. Intestinal motility and pulsation of mesenteric vessels were visually weakened; the lumen contained a lot of liquid and gases.

The most severe among our patients were children of the second group with RGAP complicated by PC. During the operation, total damage to the visceral and parietal peritoneum was revealed. A large amount of purulent-fibrinous effusion with a colibacillary odor was found in the abdominal cavity. Macroscopically, the peritoneum looked thickened, infiltrated with massive fibrinous deposits throughout. In 38.3% of patients, petechial hemorrhages were noted on the serous cover of the small intestine, often with multiple interloop abscesses. The intestinal loops are sharply swollen in diameter, filled with intestinal contents - "heavy intestine". There is no

intestinal peristalsis, the pulsation of the vessels of the intestinal mesentery is sharply weakened, the color of the intestine is changed, hyperemic, with a purple tint, the walls are thickened, covered with fibrinous plaque.

Consequently, clinical preoperative symptoms in almost all patients were verified based on intraoperative examination of the abdominal cavity. When comparing preoperative ultrasound parameters with the results of intraoperative examination of the abdominal cavity, it was revealed that in 91.2% of cases, echographic data coincided with intraoperative data. In the remaining 8.8% of cases, overdiagnosis associated with mastering the method was noted.

The use of dynamic ultrasound in all patients with appendiceal peritonitis in the postoperative period allows us to detect not only a positive clinical picture, but also contribute to the early recognition of postoperative intra-abdominal complications.

Thus, in 17 (18.3%) sick children out of 93, various intra-abdominal complications were identified. Using ultrasound, postoperative complications were diagnosed in 8 patients on days 4-7, and in the remaining 9 patients - on days 7-14.

In two patients, ongoing peritonitis was diagnosed in the postoperative period. This complication appeared 3-4 days after surgery. A severe clinical course was observed, the temperature consistently exceeded 39°C, and manifestations of intoxication progressed in the form of delirium, sometimes a euphoric state, and psychomotor agitation. Tachypnea, sharp tachycardia over 120 beats per minute were observed, sharpness of facial features, dry lips, skin, decreased turgor. The tube released copious stagnant gastric contents mixed with bile and the smell of *E. coli*. Indicators of endotoxicosis remained at high levels, intestinal motility was not auscultated. On palpation, either severe or moderate pain was noted throughout the abdomen. Tension of the muscles of the anterior abdominal wall was moderate or insignificant, but there was a pronounced positive Shchetkin-Blumberg sign.

Ultrasound examination revealed a predominance of liquid content over pneumatization in dilated loops of the small intestine, rare peristaltic movements or absence of peristalsis, the presence of edema of the walls, and a small amount of free fluid between the loops. If such changes are suspected after surgery, daily dynamic ultrasound scanning of the abdominal organs is necessary; in the absence of positive dynamics, a change in treatment tactics is recommended.

Abdominal abscesses (ACA) were found in 12 children. Of these, interloop abscesses were found in 3 patients, subhepatic abscesses in 3 patients, right iliac abscesses in 4 patients, lateral canal abscesses in 1 patient, and intrapelvic abscesses in 1 patient. On days 3-5 of the postoperative period, the temperature tended to increase, and soon exceeded 39 ° C, toxemia rates also increased, local pain appeared in the anterior abdominal wall, but these symptoms were less pronounced than with ongoing peritonitis.

Sonographic signs of intra-abdominal abscesses were the presence of irregularly shaped formations with unclear contours with reduced echogenicity, often with heterogeneous contents. When observed over time, the ultrasound picture did not change after eating and intestinal stimulation.

4 patients with unformed, interloop, multiple and complicated ABPs underwent relaparotomy, and 8 patients with formed intra-abdominal abscesses underwent local mini laparotomy or percutaneous drainage if they were located near the wall.

3 children had signs of early adhesive intestinal obstruction (AIO). On ultrasound, it is difficult to distinguish between paralytic and mechanical intestinal obstruction. In this case, the diagnosis is facilitated by a thorough examination of all parts of the abdominal cavity, if it is possible to detect areas of collapsed intestinal loops, along with stretched ones. In the early stages of SCI, with ultrasound it is possible to see a section of the intestine with peristaltic wave. The pendulum-like movement of the chyme, as if hitting an obstacle, rolls back. An uneven accumulation of liquid and gases in the lumen of the adductor intestine is determined. Patients with SCI underwent repeated surgery.

Thus, the use of ultrasound for RGAP, complicated by PC, in children in the preoperative period allows not only to establish the extent of peritonitis, but also to determine the severity of the violation of motor-evacuation function of the intestine. Dynamic ultrasound allows one to predict the course of the postoperative period, timely identify postoperative intra-abdominal complications and select the most optimal surgical treatment option.

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