

Efficiency of an ultrasound sonography in case of appendicular peritonitis among children

Shukhrat Abdurasulovich Yusupov
Bobir Latibovich Davranov
Uktamjon Toirovich Suvonkulov
Bekzod Nasretdinovich Rahmatov
Samarkand State Medical University

Abstract: Sonographic indicators were evaluated: the presence of liquid in peritoneal cavity and its localization; the presence of the peristalsis of intestines; the diameter and the thickness of intestines; accumulation of the liquid and gases in intestines; and movement of the chyme through the intestines. It was found that, 91.2% of sonographic findings were similar, when preoperational indicators of USS were compared with findings of intraoperational revision. USS in postoperational period allows recognizing not only positive clinical picture, but also identifying postoperational intraperitoneal complications (such as abscesses of peritoneal cavity, complications in commissure).

Keywords: children's appendicular peritonitis, ultrasound sonography, diagnostics

Diffuse appendicular peritonitis is the most frequent and severe complication of acute appendicitis in childhood, occurring in 8-10 % of all cases, and 4-5times more often in the first 3 years of childhood than in older age. In recent years, it was managed to reduce mortality among patients hospitalized in the early phases of the disease, however mortality remains very high in advanced forms

Diagnosis of diffuse purulent appendicular peritonitis (DPAP), complicated with intestinal paralysis (IP), and the correct assessment of its severity before surgery in children are the basis for the further therapeutic tactics selection and prognosis of the disease [5,10, 11]. To assess spread of pathological process in the abdominal cavity and the severity of intestinal paresis in children, we used ultrasound sonography (USS) of the abdominal cavity in the pre- and postoperative periods [1, 2, 4, 8].

Studies that require the insertion of foreign bodies (e.g. instruments, contrast and radioactive substances) is acceptable only in the preoperative period, when indicated, but they cannot be used in the next few hours and days after the operation, because they themselves can cause serious complications [6]. Phonoenterography and electroenterography, which are commonly used to objective assessment of bowel activity, record of heart sounds and lung rales as well, along with registration of

peristaltic bowel noises [7], which lead to the difficulties of diagnosis. All of them prove that the problem of diagnosis of appendicular peritonitis form and degree of severity of paresis of the intestines in the preoperative period remains actual.

In this context, it is of great scientific and practical interest to use abdominal ultrasound sonography (USS) to assess the spread of pathological process in the abdominal cavity and the degree of paresis of the intestines in case of peritonitis in children in the pre- and postoperative periods [3, 9,12].

The aim of our study was to improve the non-invasive diagnostics, ultrasound study opportunities of USS, complicated with IP, in pre- and postoperative periods among children.

Materials and methods. The research is based on the data of USS of 93 children with peritonitis in Clinic № 2 of the Samarkand State Medical University. Their age ranged from 2 to 15 years (40girls,53boys). Children's conditions were assessed without prior preparation, in a horizontal position on the back, with ALOKA-5Q0-SSD and SIEMENSE devices: SOWOLIN E S1-50 using linear sensors 3.5; 5.5; and 7.5 MHz, in real time using the dosed compression of the sensor to the abdominal wall, and motor-evacuation activity of the intestine, the spread of inflammation in children with appendicular peritonitis in dynamics were evaluated: the localization and distribution of free fluid in the abdominal cavity, the presence of intestinal peristalsis and its character, intestine diameter, accumulation of fluid and gas in the lumen, the dynamics of promotion of chyme on intestinal tube.

Depending on the results of the primary surgical examination and clinical manifestations of IP as well as a type of treatment carried out, all the examinees were divided into two groups. The first group included 45 patients with appendicular peritonitis complicated with IP of I-II stage (control group). The second group included 48 of 98 children with DPAP and IP (main group). Both groups were comparable in age, which facilities comparative analysis.

Results and discussion. 96% of the patients of the first group with appendicular peritonitis were admitted to the Clinic on 1-4 days from onset of the disease, in the second group all patients were admitted in later days (3-10 days). In the first group, in 4 patients local, in 36 - diffuse and in 5 patients - spilled appendicular peritonitis was diagnosed. In the second group, all patients were diagnosed with DPAP.

Patients of the first group (45 children, control group), depending on the method used to eliminate enteroparesis, are divided into three subgroups. In the first subgroup of patients (24 patients) during the pre- and postoperative periods gastric contents was aspirated periodically by nasogastric probe and stomach was rinsed using 2% of sodium bicarbonate solution, hypertonic cleansing enema was administered, as well as detoxicating infusion therapy, and potassium deficiency correction. As a result the intestine paresis was resolved.

Children of the second sub-group (11 patients) were additionally administered proserinum to relief intestine.

In the third sub-group (10 patients), it was not possible to eliminate IP using above-mentioned methods, and they were complementarily administered prolonged epidural anesthesia with lidocaine.

48 children with DPAP complicated with IP (second group), when the above-mentioned set of measures to stimulate the motor-evacuation function of the intestine did not give an effect, were additionally administered retrograde decompression of the small intestine through a special probe through ceacostomy or appendicostomy.

Primary USS was carried out in patients 1-12 hours later after admission. Then, in postoperative period dynamics was studied 3-4 times in each patient. The USS results were compared with clinical manifestation, and they confirmed each other.

During the abdominal USS in order to diagnose the extent of inflammation and severity of IP the following sonographic characteristics were evaluated: the presence of fluid in the abdominal cavity and its location; the presence of intestinal motility; diameter and thickness of the intestine; accumulation of fluid and air in the lumen of the intestine; character of chyme advancement by the intestine.

In children with appendicular peritonitis of the first subgroup had following sonographic characteristic. In the right iliac region it was always observed local intestinal paresis: areas with "dumb" bowel loops are visualized, the diameter of which did not changed, pneumatosis of the intestinal loops are detected, a small local accumulation of fluid in the lumen of the small intestine in one or two areas, or liquid is not determined. Chyme promotion is slow in the most painful area. In other parts of the abdomen chyme promotion is uniform and normal. Local appendicular peritonitis is echographically characterized by the accumulation of free fluid in the dome of the cecum.

In patients of the second and third sub-group bowel loops were moderately stretched with the predominance of the liquid contents on pneumatization, the movement of chyme was weak, progressive, and peristaltic movements are rare. In diffuse appendicular peritonitis free fluid accumulate in interloopal spaces, right lateral channel, right iliac fossa and pelvic projection.

In the second group of patients (48 children) across the abdominal bowel loops sharply stretched liquid contents were visualized with or without isolated gas bubbles. Peristalsis of intestine was absent, the movement of chyme was weak and pendulum or entirely absent. A significant amount of fluid were in all parts of the abdominal cavity. In DPAP, complicated with IP, free fluid accumulation was visualized in all parts of the abdominal cavity (5 or more parts of the abdominal cavity).

These clinical manifestations and ultrasound findings in patients with DPAP

complicated with IP, were compared with intraoperative parameters.

In patients of the first-second sub-groups intraoperative was detected the spread of the inflammatory process beyond the cecum, purulent exudate was located between loops of intestine, without going beyond the border of the lower floor of the abdominal cavity. Parietal peritoneum looked dull, edematose. Intestinal loop's diameter was not changed, the pulsation of blood vessels and the intestinal peristalsis were normal.

In examined children of the third sub-group during the operation it was found that the inflammatory process extended to the lower and middle floors of the abdomen, leaving free a subdiaphragmatic space. Effusion in all cases was purulent, often with specific colibacillus odor. The parietal and visceral peritoneum looked edematous, dull, with fibrinous deposits in the region of the ileocecal angle. Intestinal loops were moderately swollen, hyperemic, at the distance of 40-70 cm from the ileocecal angle there were fibrinous deposits. Intestinal motility and pulsation of mesenteric vessels were visually impaired, in the lumen contained plenty of fluids and gases.

The most severe condition among our patients had children of the second group with DPAP complicated with IP. During the operation it was revealed the total impaired visceral and parietal peritoneum, large amount of purulent-fibrinous effusion with specific colibacillus odor. Macroscopically peritoneum looked thickened, infiltrated with massive fibrinous deposits all over. 38.3 % of patients had serous petechial hemorrhages on the cover of the small intestine, often with multiple interloopal deposits of pus. Intestinal loops sharply inflated in diameter, filled with intestinal contents - "heavy intestine." Peristalsis is absent, pulsation intestinal mesenteric vessels sharply weakened, color of intestines was changed and hyperemic with a tone, walls were thickened with fibrinous coating.

Consequently, preoperative clinical symptoms in almost all patients were verified on the basis of intraoperative revision of abdominal cavity. When preoperative indicators of USS with the results of intraoperative abdominal revision were compared, it was revealed that 91.2 % of the sonographic findings are consistent with intraoperative data. In remaining 8.8 % of the cases hyperdiagnosis was revealed, which was associated with the mastering of the method.

The use of postoperative dynamic USS in all patients with appendicular peritonitis can detect not only the positive clinical picture, but also contributes to early detection of postoperative intra-abdominal complications.

So, in 17 (18.3 %) of the 93 patients, various intra-abdominal complications were identified. With USS postoperative complications were diagnosed in 8 patients on 4-7 days, and in the remaining 9 patients on 7-14 days.

Two patients in the postoperative period were diagnosed with the ongoing

peritonitis. This complication manifested on 3-4 days after surgery. There was a severe clinical course, the temperature steadily exceeded 39 °C, manifestation of toxicity progressed in the form of delirium, sometimes - euphoric state of agitation. There were tachypnoe, severe tachycardia more than 120 beats per minute, pointed facial features, dry lips and skin, reduced turgor. Through probe from stomach was allocated stagnant gastric contents with bile and the smell of E. coli. Indicators of endotoxin remained at high values, intestinal peristalsis was not listenable. Severe or moderate pain around the abdomen was marked on palpation. Muscle tension of anterior abdominal wall was moderate or slight, but there was a pronounced positive Shetkin-Blumberg symptom.

Predominance of the liquid contents on the pneumatization in extended loops of small intestine, a rare peristaltic movement or absence of peristalsis, the presence of edema of the walls, and a small amount of free fluid between the loops were revealed on USS. When such changes are suspected, it is necessary to perform USS of the abdominal cavity in dynamic after the operation on daily basis and in case of absence of positive dynamics recommended to change treatment strategy.

In 12 children abscesses of abdominal cavity(AAC) were found: 3 patients had interlopal abscesses; sub-hepatic-3patients, right iliac region-4 patients, the lateral channel - 1 patient and intrapelvic - 1 patient. At 3-5 days of postoperative temperature tended to rise, and soon exceeded to 39 °C, toxemia indicators also rose, appeared local tenderness in the anterior abdominal wall, however, these symptoms were less pronounced than in the ongoing peritonitis.

Echographic sign of intra-abdominal abscesses was the presence of irregular shape with indistinct contours with decreased echogenicity, often with heterogeneous content. During the dynamic examination ultrasound picture did not change after a meal and stimulation of the intestine.

On 4 patients with formed interlopal, multiple and complicated AAC were performed relaparotomy; on 8 patients with formed intra-abdominal abscesses were performed local minilaparotomy or percutaneous drainage, when abscesses had parietal location.

Signs of early adhesive intestinal obstruction (AIO) were observed in 3 patients. It is very difficult to distinguish paralytic and mechanical ileus. In this case the diagnosis is facilitated by careful examination of all parts of the abdominal cavity by detection of empty areas intestine loops, along with stretched loops. In the early stages of the AIO peristaltic wave of piece of intestine can be seen on USS. Pendulum movement of chyme, as if hitting at obstacle, and rolled back. Also, uneven accumulation of fluid and gas is detected in the lumen of the adducing intestine. Patients with AIO had a repeated surgical intervention.

Conclusion. Application of USS at DPAP, complicated with IP in children in the

preoperative period allows us not only to establish the spread of peritonitis, but also to determine the severity of impairment of the motor-evacuation function of the intestine. USS in dynamic allows timely identification of postoperative intraabdominal complications and choosing the best surgical treatment strategy.

Perspectives of the further investigations. In the diffuse purulent appendiceal peritonitis in children the active use of dynamic sonography of the abdominal cavity could allow us to determine the significance of motor-evacuator function of intestine and promotes the early recognition of postoperative intraabdominal complications. However hereinafter it is needed to carry out investigation directed to elaboration of the new methods intended for prediction the development and prevention of complication (purulent-inflamed and commissural processes) in the abdominal cavity in such disease.

References

1. Belyaeva O. A. Echographic diagnostic of intraabdominal complication of acute appendicitis in children / O. A. Belyaeva, A. K. Konovalov: Collec.: scien. train. «Diagnostics and treatment of surgical emergency disease in children». -M., 2001. – P. 102–103.
2. Opportunities of echographic differentiated structure of the tissue on diagnosing of acute appendicitis in children / V. A. Bikovskiy, S. A. Zarubina, E. B. Olkhova, L. I. Petukhova // Visualization in Clinic. – 2002. – №12. – P. 30–33.
3. Bikovskiy V. A. Echographia on abdominal pathology in children / V. A. Bikovskiy. – M.: “Real time”, 2001. – 178 p.
4. Dvoryakovskiy I. V. Ultrasound diagnostics in children surgery / I. V. Dvoryakovskiy, O. A. Belyaeva. V.A. M. : “Profit”, 1997. – 244 p.
5. Children ultrasound diagnostics: Clinical leadership / Under gen. red. M. I. Pikova, K. V. Vatolina – M., : Vi-dar, 2001. – 680 p.
6. Akhmedov I, Khamidov A, Kholmirezayev S, Yusupov Sh, Umarov I. Improving river sediment distribution calculation in mountain rivers // “Science and innovation” V.1 № A8. - P. 1014-1019
7. Юсупов Ш.А. Диагностическая значимость ультразвуковой сонографии при аппендикулярных перитонитах у детей // Журнал “Сибирский медицинский журнал” (Иркутск) – 2009. – Т. 86, №3. – С. 138-141.
8. Шамсиев М.А, Атакулов Д.О, Юсупов Ш.А. Экспериментальное изучение влияния озона на течение перитонита и спайкообразование // Журнал “Детская хирургия”- 2000. - Т.6 - С. 22-25
9. Shamsiev A.M, Yusupov Sh.A, Shahriev A.K. Ефективність ультразвукової сонографії при апендикулярних перитонітах у дітей // Журнал “Здобутки клінічної і експериментальної медицини” – 2016. №2. –С. 38-43.

10. Yusupov Sh.A, Kurbaniyazov Z.B, Davlatov S.S, Rakhmanov K.E, Daminov F.A. Отдаленные результаты оперативного лечения узловых образований щитовидной железы // Журнал “Здобутки клінічної і експериментальної медицини” -2017. №1. – С. 29-35.

11. Юсупов Ш.А, Исламова Д.С, Гаффаров У.Б. Структура патологии гастродуоденальной зоны у детей с дискинезией желчного пузыря // Журнал “Ученые записки Орловского государственного университета” – 2014. –Т.2, №7. –С. 73-74.

12. Бердиярова Ш.Ш, Юсупов Ш.А, Назарова Г.Ш. Клинико-лабораторные особенности хронического гематогенного остеомиелита // Журнал “Central Asian Research Journal for Interdisciplinary Studies (CARJIS)” – 2022. – Т. 2, №5. – С. 116-125.

13. Юсупов Ш.А, Шамсиев А.М, Атакулов Ж.О, Джалолов Д.А. Оценка интенсивности синдрома эндогенной интоксикации у детей с распространенным аппендикулярным перитонитом // Журнал “Медицинский альманах” – 2019. № 5-6(61) . – С. 57-61.

14. Шамсиев А.М, Юсупов Ш.А, Шарипов Р.Х. Влияние озонотерапии на показатели перекисного окисления липидов у детей с распространенными формами аппендикулярного перитонита // Журнал “Анналы хирургии” – 2001. – Т. 5. – С. 77.

15. Юсупов Ш.А, Шамсиев Ж.А, Суванкулов У.Т, Данияров Э.С. Хирургическая тактика при обструктивном калькулезном пиелонефрите у детей // Журнал “Саратовский научно-медицинский журнал” – 2007. – Т. 3, №2. – С. 79-80.

16. Юсупов Ш.А, Мардыева Г.М, Бахритдинов Б.Р. Особенности рентгенологической семиотики при пневмонии у детей раннего возраста // Журнал “Актуальні питання педіатрії, акушерства та гінекології” – 2017. №2. – С. 21-24.

17. Шамсиев А.М, Юсупов Ш.А, Юлдашев Б.А, Мухамадиева Л.А. Состояние иммунного статуса у детей с хроническим бронхитом // Журнал “Педиатрический вестник Южного Урала” – 2017. №1. – С. 84-89.

18. Шамсиев А.М, Юсупов Ш.А, Махмудов З.М. Хирургическое лечение детей с острым гематогенным остеомиелитом костей, образующих тазобедренный сустав // Журнал “Российский вестник детской хирургии, анестезиологии и реаниматологии” – 2014. – Т. 4, №3. – С.86-89.

19. Юсупов Ш.А, Курбаниязов З.Б, Зайниев А.Ф. Узловые образования щитовидной железы. состояние проблемы (обзор литературы) // Источник “Вісник наукових досліджень” – 2018. №1. – С. 10-15.

20. Шамсиев А.М, Саидов М.С, Аипов Р.Р, Атакулов Д.О, Юсупов Ш.А. Хирургическая коррекция недержания кала при свищах в половую систему у девочек // Журнал "Российский вестник детской хирургии, анестезиологии и реаниматологии" – 2014. – Т. 4, №2. – С.25-29.

21. Шамсиев А.М, Саидов М.С, Атакулов Д.О, Юсупов Ш.А, Шамсиев Ж.А, Суванкулов У.Т. Хирургическое лечение аноректальных пороков у детей // Журнал "Вестник хирургии имени ИИ Грекова" – 2011. – Т. 170, №2. – С. 40-43.

22. Timurbulatov V. M. Ultrasound research of peritonitis patients / V. M. Timurbulatov, I. V. Verzakova, R.G.Kalanov // Surgery. – 2000. – № 1. – P. 22–24.

23. Textbook of abdominal ultrasound / Edited by Bar-ry B. Goldberg. – Baltimore, USA, Copyright by «Williams& Wilkins», 1993. – 527 p.

24. Karaca I. The management of appendiceal mass in children: is interval appendectomy necessary? / I. Karaca, Z. Altinoprak, A. Karkiner // Surg. Today. – 2011. – Vol. 31.– P. 675–677.

25. Ultrasonography in the management of acute appendicitis / P. Rossi, P. Covarelli, F. Mosci [et al.] // Surg. Endosc. – 2006. – Vol.10, №6. – P. 619–621.

26. Williams R. J. Ultrasound scanning of the acute abdomen by surgeons in training / R. J. Williams, A. C. Windsor, B. Rosin // Ann. R. Coll. Surg. Engl. – 2014. – Vol. 76. – P. 228–233.

27. Shamsiev A.M., Yusupov S.A., Shahriev A.K. Ефективність ультразвукової сонографії при апендикулярних перитонітах у дітей // Здобутки клінічної і експериментальної медицини, 2016. Т. 26. № 2.

28. Shamsiev A.M., Yusupov Sh.A., Shahriev A.K. Efficiency of an ultrasound sonography in case of appendicular peritonitis among children // Здобутки клінічної і експериментальної медицини, 2016. № 2. С. 84-87.

29. Махмудова, А.Н., Ибрагимова, Э.Ф., Шукурова, Д.Б., Абдурахмонова, З.Э. and Наимова, З.С., 2020. Медицина Узбекистана-достижения и перспективы развития сферы. Достижения науки и образования, (3 (57)), pp.49-52.

30. Махмудова, А.Н. and Махмудова, С., 2022. Гуманитаризация медицинского образования как фактор повышения качества обучения в вузе. Science and Education, 3(6), pp.709-718.

31. Махмудова, А.Н., 2022. Правовая защита пациентов в сфере здравоохранения в новом Узбекистане. Academic research in educational sciences, (Conference), pp.102-107.

32. Махмудова АН, Камариддинзода АК. Защита прав пациентов в Республике Узбекистане. Science and Education. 2022;3(10):54-62.

33. Nugmanovna MA, Kamariddinova KA. Modern biotechnical problems of medicine and their solutions. InArchive of Conferences 2021 Jan 28 (Vol. 13, No. 1, pp. 169-173).

34. Kamariddinova KA, Nugmanovna MA. Improving population health the important task of the state. InArchive of Conferences 2021 Mar 30 (Vol. 17, No. 1, pp. 204-208).

35. Nugmanovna MA. BIOETHICS AS A FORM OF PROTECTION OF INDIVIDUALITY AND PERSONALIZED MEDICINE. Thematics Journal of Social Sciences. 2022 Oct 28;8(4).

36. Nugmanovna MA. Bioetika zamonaviy madaniyatda individuallikni himoya qilish shakli sifatida. философия и жизнь международный журнал. 2022 Nov 30(SI-2).