Original Article

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The Possibilities of Complex Echography in the Diagnosis of Acute Appendicitis in Children

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Abstract

Acute appendicitis (OA) is currently the most common urgent disease of the abdominal cavity and occurs in 2-5 people per 1,000 populations. In the Republic of Uzbekistan, this indicator is 3.05 people per 1,000 populations according to the statistical materials on the activities of healthcare institutions of the Republic of Uzbekistan. Children with acute appendicitis were admitted to the hospital with complaints lasting up to 12 hours - 110 (46.6%), from 12 to 24 hours - 49 (20.8%), from 24 to 48 hours - 43 (18.2%) and from 48 hours or more - 34 (14.4%) children. In children with a disease duration of more than a day, only destructive forms of inflammation of the vermiform process were recorded. After 24 hours from the onset of clinical manifestations, children with phlegmonous and gangrenous appendicitis were admitted. Various variants of the location of the cecum and the vermiform process made it necessary to thoroughly examine the entire abdominal cavity. In 15 children, the diagnosis of OA was excluded due to the presence of other acute abdominal diseases. Thus, ovarian apoplexy was observed in 3 girls, pelvic pain syndrome caused by various gynecological diseases in 5 girls, acute pancreatitis with diffuse pains in 2, an attack of renal colic on the right in 5 children. Thus, the study of the features of the course of various clinical forms of acute appendicitis in children allowed to increase the effectiveness of diagnosis and improve the results of treatment. Ultrasound examination is a promising and safe method of diagnosing acute appendicitis, which allows to bring the effectiveness of complex diagnostics to 100% and is of important importance when choosing treatment tactics.

Keywords: Acute Appendicitis, Inflammation, Vermiform Process, Ultrasound, Abscess.

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Introduction

Acute appendicitis (OA) is currently the most common urgent disease of the abdominal cavity and occurs in 2-5 people per 1,000 population.[1] In the Republic of Uzbekistan, this indicator is 3.05 people per 1,000 population according to the Statistical materials on the activities of healthcare institutions of the Republic of Uzbekistan in 2019. Special attention should be paid to the study of the clinic and diagnosis of acute appendicitis in children. Despite the successes achieved in modern pediatric surgery, a large number of pathological conditions remain in practice, in which timely diagnosis of acute appendicitis in children continues to be an urgent problem.[2]

The solution of this problem is more connected with the improvement of medical imaging methods. One of these methods is ultrasound, which is used in the diagnosis of OA in children and has established itself as an effective way to establish this pathology. However, to date, the possibilities of the method in the timely establishment of various forms of inflammation of the appendix have not been sufficiently studied.[3,4]

The aim of the study was to improve the diagnosis of acute appendicitis and its complications in children by using modern ultrasound examinations.

Materials and Methods

The paper presents the results of a study of 251 children admitted to the emergency department of the Tashkent Pediatric Medical Institute clinic with acute abdominal syndrome for the period 2018-2020.

Children with acute appendicitis were admitted to the hospital with complaints lasting up to 12 hours - 110 (46.6%), from 12 to 24 hours - 49 (20.8%), from 24 to 48 hours - 43 (18.2%) and from 48 hours or more - 34 (14.4%) children.

In children with a disease duration of more than a day, only destructive forms of inflammation of the vermiform process were recorded. After 24 hours from the onset of clinical manifestations, children with phlegmonous and gangrenous appendicitis were admitted.

Clinical and laboratory and complex ultrasound methods were used. The examination was carried out using SONOSCAPE S22 and APLIO 500 ultrasound machines. In the study, the technique of step-by-step gradual compression was used, using additionally anterior and posterior manual compression. Scanning was carried out using a linear high-frequency sensor, which provided a higher resolution of surface structures. The frequency used depends on the height and age of the child (from 5 to 12 MHz).

Results and Discussion

We observed 251 patients with suspected OA. Of these, 236 had the diagnosis confirmed by the results of surgery and morphological studies of the drug. The main contingent of patients was aged from 7 to 17 years. Boys made up 137 (56.0%) and girls 99 (44.0%). In the distribution of examined children with acute appendicitis by forms: catarrhal appendicitis was (18) 7.7%, destructive appendicitis was - 92.3% (of which: phlegmonous - (149) 63.1%, gangrenous - (38) 16.1%) and gangrenous-perforated appendicitis - (31) 13.1% of cases.

The disease began acutely with the appearance of pain in the epigastric or umbilical region. Within a few hours (or within a day), the pain migrated to the right iliac region with increasing intensity. With a typical clinical picture of OA, its diagnosis was not difficult. The problems were associated with atypical forms of OA, the development of complications of destructive forms of OA, the development of a picture of diffuse peritonitis, empyema or periappendicular abscess.

Various variants of the location of the cecum and the vermiform process made it necessary to thoroughly examine the entire abdominal cavity. In 15 children, the diagnosis of OA was excluded due to the presence of other acute abdominal diseases. Thus, ovarian apoplexy was observed in 3 girls, pelvic pain syndrome caused by various gynecological diseases in 5 girls, acute pancreatitis with diffuse pains in 2, an attack of renal colic on the right in 5 children.

The catarrhal form of acute appendicitis was visualized only in 7.7% of cases out of the total number of patients. The accumulated experience made it possible to systematize direct and indirect echographic signs of OA. At the same time, the following direct and indirect signs of the catarrhal form were noted: the possibility of visualizing changes in the CHO in the form of a tubular structure when examined in a craniocaudal projection.

Unlike the unchanged CHO, with the development of acute inflammation, the visualized process coming from the cecum did not have peristaltic movement, the next important sign was a thickening of the width of the process more than 6 mm with a simultaneous increase in its thickness of more than 2 mm. At the same time, the layers of the walls remained preserved. One of the signs that we noticed was the distinct identification of the contours of the organ surface. This phenomenon was explained by the fact that already in the first hours of the development of the inflammatory process, swelling-swelling occurred around the CHO, which echographically created a contrast of the visualized surface of the CHO.

With local compression by the sensor on the area of the visualized area, we observed the rigidity of the process, which was one of the indirect signs. The weakening of peristalsis in the terminal part of the small intestine also served as an indirect sign of the catarrhal form of OA. There was an increase in the vascular pattern in CDK and ED only in 9 cases, and they were not always registered in the first 6 hours after the appearance of clinical symptoms.

Phlegmonous appendicitis was characterized by an increase in the diameter of the CU (up to 11 mm) and the thickness of its wall up to 5 mm. Due to the appearance of multilayering of the CS wall, the contrast between the mucous, muscular layers and the serous membrane increased. Anechoic contents were visualized in the cavity of the process. They are especially pronounced during the blockade of CHO by coprolites. During compression, pronounced rigidity of the CHO was noted. Indirect signs of this form of the disease were the presence of adhesions with an omentum and/or with a loop of the small intestine. In a number of cases (36 observations), mesentery infiltration was noted, which was displayed as a limited zone, increased echogenicity behind the inflamed CHO. The detection of fluid accumulation around CHO was one of the important signs of phlegmonous appendicitis.

The data obtained by us during the study showed that all the parameters of the appendix in the group of children with FA were significantly ($p<0.01$) greater than in children with catarrhal: the length of the visualized fragment of the appendix is 29.6 mm (34.6±8.5mm); thickness - 9.5mm (10.2±3.7mm); width - 4.5 mm (4.65±2.3 mm).

In the modes of color and energy Doppler mapping, the intrahepatic blood flow was displayed in the form of a numerous color mosaic. With CDK and ED, along with an increase in the vascular pattern of CHO, increased blood flow was detected in the adjacent loops of the intestine. The nature of changes in the vascular pattern in the phlegmonous form increases in dynamics. Therefore, periodic echographic observations are important in clarifying phlegmonous OA, which can objectively assess the transition to the gangrenous stage of the disease.[5,6]

The gangrenous form of OA was characterized primarily by a violation of the integrity of the wall in any area with the development of inflammatory thickening of the dome of the cecum. In these cases, the layers of the walls of the CHO are practically not differentiated and are often traced in separate sections. At the same time, the width of the process in the visualized area reaches more than 10 mm. And its wall thickness is more than 4 mm. Destructive changes in all layers were displayed in the form of a bizarre picture combining hypoechoic areas with isoechoic and hyperechoic, depending on the development of degenerative-destructive changes. When compressing CHO, its complete rigidity was noted. The accumulation of fluid, unlike the phlegmonous form, is significant and it spread into the pockets of the abdominal cavity and pelvis. In none of the cases of visualization of the vermiform process at the stage of gangrenous inflammation, peristaltic movements were recorded in it.[7–9]

At GA, 87.7% of the observations revealed changes in the mesentery and omentum. In the projection of the location of the process, the separation of the leaves of the peritoneum and the accumulation of fluid in them took place. With empyema, the diameter of the CHO increases significantly and reached up to 16-20 mm.

The structure of the process wall is characterized by heterogeneity, insufficient differentiation of layers due to a pronounced destructive process. The contrast of the adjacent loops of the intestine was enhanced.[10–12]

Doppler examination of the vessels does not reveal their pattern, as is observed in catarrhal and phlegmonous OA. It should be noted the transience of the development of empyema CHO. So, in our observations, it developed within 36 - 56 hours from the onset of the disease.

With gangrenous-perforated appendicitis, it is appropriate to talk not only about the visualization of the appendix, but also about the visualization of complications associated with its perforation. After perforation, the intracavitary pressure in the vermiform process decreases, in some cases its lumen may be collapsed, which significantly impairs its visualization. In our case, appendicular infiltrate was found only in 3 (1.27%) cases, peritonitis was mainly local in 46 (19.6%) cases, periappendicular abscess in 6 (2.5%) cases and empyema of the appendix in 2 (0.8%) children.

In AI, the absence of appendix localization is explained by sclerotic proliferative changes with the formation of fibrous tissue in the lumen of the CHO. The inflammatory process, due to its duration, regressed and localized in the form of a clearly delimited infiltrative focus, with ultrasound it looked like a hyperechoic formation with clear contours. According to clinical, laboratory and ultrasound data, children with AI were recommended to carry out conservative therapy. The use of echographic methods in children with destructive appendicitis complicated by peritonitis provided an opportunity to clarify its prevalence and the phase of its course. A specific radiation sign of local peritonitis was a free anechoic, homogeneous fluid located in one or two topographic and anatomical zones. Common peritonitis was characterized by localization of fluid in 3 or more topographic-anatomical zones (usually between intestinal loops), expansion of the small intestine more than 3 cm and the absence of peristaltic waves were detected in 6 children. The contents of the liquid were heterogeneous with fine inclusions.[13]

Conclusion

Thus, the study of the features of the course of various clinical forms of acute appendicitis in children allowed to increase the effectiveness of diagnosis and improve the results of treatment. Ultrasound examination is a promising and safe method of diagnosing acute appendicitis, which allows to bring the effectiveness of complex diagnostics to 100% and is of important importance when choosing treatment tactics.

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