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POSSIBILITIES OF EXOSONOGRAPHY IN DIAGNOSING STRUCTURAL-MORPHOLOGICAL CHANGES OF THE INTESTINES IN CHILDREN WITH LEDD'S SYNDROME

Toshmatov Kh.Z
Andijan regional children's multidisciplinary medical center, head of the neonatal surgery department,
Uzbekistan
Toshboyev Sh.O
Andijan State Medical Institute, Head of the Department of Anesthesiology-Reanimatology and Emergency Medicine, PhD.,
Uzbekistan
Ajimamatov Kh.T
Andijan State Medical Institute, assistant of the Department of Children's Surgery,
Uzbekistan

Abstract. In this article, the structural and morphological signs of the intestines, as well as exosonographic signs of the level of inflammation, were studied in children with Ladd's syndrome. Positive and negative results characteristic of intestinal malrotation, as well as features such as intestinal cavity, wall thickness, and surrounding tissue structure were compared in both methods, and the specificity and sensitivity of UTS in diagnosing intestinal malrotation and Ladd's syndrome were analyzed using ROC-analysis. It has been proven that the method of ultrasound sonography has high information in the diagnosis of Ladd's syndrome, and it allows determining the tactics of operative treatment in this category of patients.

Keywords: ultrasound sonography, "whirlpool" sign, Ladd's syndrome, midgut circulation, intestinal necrosis, children.

Introduction

According to the literature, the incidence rate of incomplete intestinal circulation in infants is 1:500 - 1:6000. It is 2 times more common in boys than in girls [2, 6]. Modern information on the embryogenesis of congenital anomalies with intestinal rotation and fixation disorders [11], their specific characteristics in their course according to the anatomical form, paraclinical examinations, including the visualization of mesenteric blood vessels, allows to determine the surgical tactics in the neonatal period.

Late diagnosis of rotational anomalies of the intestines causes necrosis of the middle intestine, and the possibility of death increases. Therefore, early diagnosis of this dangerous condition is crucial in determining indications for urgent operative intervention [5]. The diagnosis of intestinal malrotation is usually based on X-ray imaging of the abdomen, which is not always informative [7]. Currently, ultrasound sonography (UTS) is more informative than contrast radiography of the upper parts of the digestive tract for accurate diagnosis of intestinal malrotation [1, 9]. The UTS criteria of malrotation are the appearance of the superior mesenteric artery (SMA) and veins (SMV) in the opposite direction. In addition, the "whirlwind" symptom is a pathognomonic symptom of UTS and has a high prognostic value for this condition. According to these signs, malrotation with or without twisting of the intestine can be effectively diagnosed without irradiating the patient [1, 3].

The aim of the study.

Determination of structural and morphological changes of the intestine in children suspected of Ladd`s syndrome, as well as assessment of the possibilities of the exosonography method in predicting the risk of intestinal necrosis according to the degree of circulation of mesenteric blood vessels.

Materials and methods.

Research work Statistical indicators on the number of babies admitted to the neonatal surgery department of the Andijan regional children's multidisci plinary medical center (ARCHMMC) during 2015-2020 were analyzed, and the proportion of babies born with intestinal rotation and fixation was determined.

A total of 91 children were selected for the study, the main group consisted of 24 children with Ladd's syndrome, the comparison group consisted of 37 children with intestinal obstruction without malrotation, and 30 healthy children without clinical and laboratory intestinal disorders (control group). Ultrasound sonography was performed using convex 1.8-5.0 MHz and linear sensors 5.0-15.0 MHz. Changes in the ultrasound examination were evaluated according to the following criteria: 1) the thickness of the intestinal wall; 2) structural changes of intestinal layers; 3) changes in the intestinal cavity according to the duration of stenosis and localization of suprastenotic expansion; 4) the level of blood circulation in the intestinal wall; 5) thickening or infiltration of the mesentery and colon; 6) assessment of the condition of the terminal part of the ileum; 7) extraintestinal symptoms (ascites, mesenteric lymph node reaction).

A narrowed fragment of the intestinal cavity and an area of suprastenotic expansion in its upper part were taken as the area of stenosis. The activity of the inflammatory process in the intestinal wall was assessed by color doppler mapping (CDM) according to the level of blood circulation in this area. The blood circulation speed range was up to 7 cm/s. Usually, the mesentery cannot be detected on ultrasound examination, and the mesentery is visualized as a hyperechoic area around the mesenteric blood vessels, that is, the detection of hyperechoic tissue around the damaged intestinal fragment indicates the infiltration of the mesentery and the mesentery . Due to the fact that the intestine and the mesentery are the same, i.e., they are made up of connective tissue, and they have the same echogenicity, it will not be possible to separate them sonographically. Only the presence of lymph vessels and nodes in hyperechoic tissue can be evaluated as intestinal mesentery. To evaluate the state of mesenteric lymph nodes, Pykov M.I. and co-authors' data were used [10]. Quantitative results obtained were expressed as median, minimum and maximum values using the standard statistical method, differences were considered reliable when $r<0.05$. ROC-analysis was performed to assess the level of information of quantitative tests (intestinal wall thickness, number of signals in the intestinal wall).

Results and its discussion.

With the help of ultrasound sonography, it was possible to diagnose the number of rotations of SMV around the BMA, and the range of these rotations was from 180 to 720°. According to the results of the study, sonographic signs of malrotation were detected in 26 children suspected of Ladd's syndrome, in 24 of them this diagnosis was confirmed intraoperatively, and 360° rotation was the most common with an accuracy of 92.3% (Table 1, Figure 1).

Table 1
Intestinal circulation in children with a "whirlpool" sign exosonographic diagnosis of the level

No	The degree of intestinal rotation,°	Sonographic diagnosis, abs	Confirmed diagnosis in operation , abs	Accuracy of diagnosis, %
1	180	0	1	0
2	270	2	2	100
3	360	12	11	91.7
4	540	5	4	80.0
5	720	7	6	85.7
Total		26	24	92.3

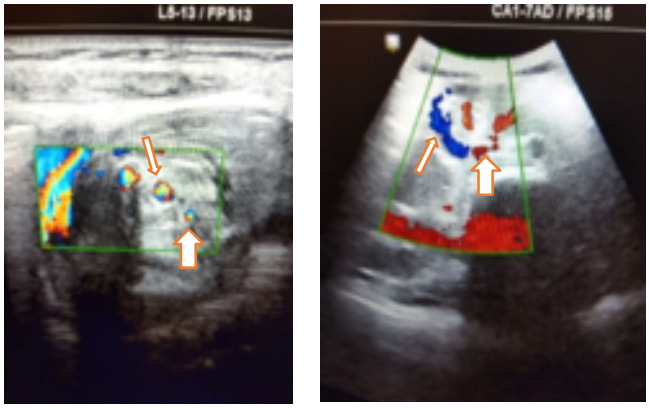

Figure 1. Ultrasound dopplerography, transverse and longitudinal sections. SMA is indicated by a large arrow, SMV by a small arrow

The table and echosonogram data, the most common bowel rotation corresponded to 360° and the accuracy rate of diagnosis was 100%. However, it was not possible to accurately diagnose 180° rotations using sonography.

We also studied the degree of intestinal necrosis in patients with different degrees of intestinal rotation (Table 2, Figure 2).

Table 2
Correlative relationship between degree of rotation and intestinal necrosis in children with Ladd's syndrome

No	Degree of rotation	n	Intestinal necrosis		total		R
			there is	the y axis	abs	%	
1	≥540°	14	1	13	14	7.1	-4,427
2	≤540°	12	2	8	10	20.0	3,758*
Total		26	3	21	24	12.5	6,467*

Note: R is Pearson's correlation coefficient; * - r < 0.001

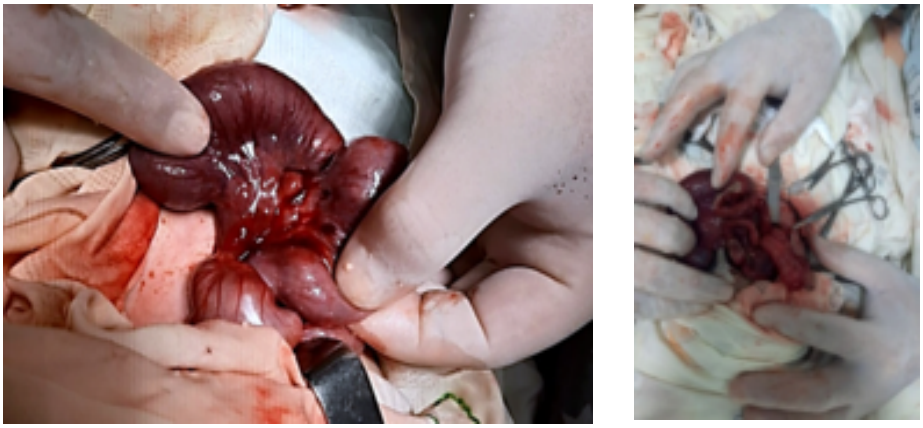

Fig. 2. Patient Kurbanova Z. 26 days. Case history #13072/606. 720° rotation of intestine, intestinal necrosis.

Necrosis of the intestine was 7.1% (1 out of 14) in the case of rotation of the UMA around 540° or less, and 20.0% (2 out of 10) in the case of rotation of more than 540° and statistically reliable had a positive correlation. This indicates that the risk of intestinal necrosis increases with the increase in the degree of intestinal rotation. From our side, the structural and morphological signs of the intestines, as well as the level of inflammation, were determined in children with Ladd's syndrome using exosonography.

In children patients in study groups is presented in Table 3.

Table 3
Comparative indicators of echosonographic criteria in patients in study groups

No	Exosonographic criteria		Results						
			Ladd syndrome (n=24		Constipation (n=37)		Total (n=61)		Control (n=30)
			abs	%	abs	%	abs	%	
1	Intestinal wall thickness, mm	Me	2.3 #		1.4 #		1.8 #		1.0
		min-max	1.7-4.6		1.5-4.0		2-4,3		0.7-1.4
2	Intestinal wall thickened >1.0		22 #	92.0	33 #	89.0	55 #	90.0	-
3	Length of lymph nodes, mm	Me	6 * #		8 #		7 #		4
		min-max	4-8		6-12		5-10		2-6
4	Intestinal disorders		6 #	25.0	12 #	32.0	18 #	30.0	-
5	Intestinal wall thickening due to the mucosa-submucosa layer:		14	58.0	27	73.0	41	67.0	-
	At the expense of all floors		8	33.0	6	16.0	14	23.0	-
6	The presence of stenosis and suprastenotic expansions		2	8.0	-	-	2	3.3	-
7	Pathological vascularization (The presence of 2 or more color signals)		20 * #	83.0	37 #	100	57 #	93.0	-
8	Omentum and mesenteric infiltration		24 * #	100	10 #	27.0	34 #	56.0	-
9	Damage to the terminal part of the ileum		20 * #	83.0	10 #	27.0	30 #	49.0	-
10	Mesenteric lymph nodes (> 6 mm)		6 * #	25.0	21 #	57.0	27 #	44.0	-
11	Ascites		10 * #	42.0	3	8.0	13 #	21.0	-

Note: # -reliability of the difference between the research groups and the control group ($p<0.05$);

*-Confidence level of differentiation between Ladd's syndrome and intestinal obstruction ($p<0.001$).

ROC-analysis was performed to assess the informative level of the quantitative indicators obtained by the thickness of the intestinal wall and the number of color signals in the intestinal wall in children with Ladd's syndrome and intestinal obstruction without malrotation.

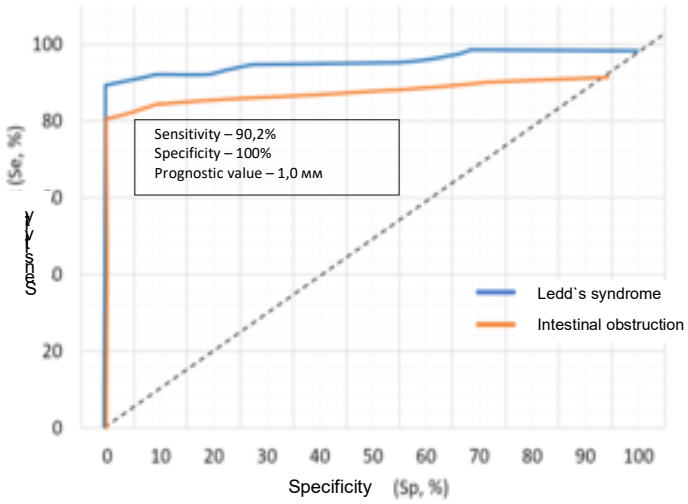

Fig. 3. Results of the ROC-analysis of the ultrasonographic sign "intestinal wall thickness" in the study groups.
Area under the curve (AUC) – 0.957

As shown in Figure 3, the specificity, sensitivity, positive and negative predictive values of UTS for bowel wall thickness greater than 1.0 mm were 100%, 90.2%, 100% and 83.3%, respectively.

According to the test results of the ultrasonographic sign "quantity of colored signals on the intestinal wall", the sensitivity level of the exosonography method was 93.4%, especially 100%, the prognostic value of the positive test was 100% and the negative test was 88.2% (Fig. 4).

Different authors recognize the wide range (from 1 to 5 mm) of normal indicators of the thickness of the intestinal wall [**Ошибка! Источник ссылки не найден.**, **Ошибка! Источник ссылки не найден.**].

According to our data, the normal thickness of the terminal part of the ileum in children of the control group (n=30) was ≤1.0 mm. In infants with Ladd's syndrome and intestinal obstruction without malrotation (n=61), it was found that the thickening of the intestinal wall reached 1.8 mm in 90.2% of patients, and in most of them, the thickening of the intestinal wall occurred due to the thickening of the mucosa and submucosa. In severe transmural damage of the intestinal wall, it was observed that this indicator is at the expense of all layers.

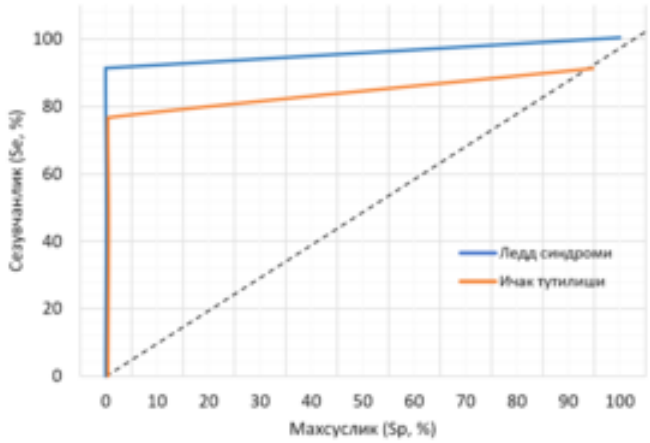

Fig. 4. Results of the ROC-analysis on the ultrasonographic sign "quantity of colored signals in the intestinal wall" in the study groups.

Area under the curve (AUC) - 0.967

Another important indicator for assessing the condition of the intestinal wall is the assessment of the level of blood circulation in it. It is known that increased blood circulation in the intestinal wall indicates the exacerbation of the process, and it is determined visually.

As shown in Table 3 and Figure 4, according to the results of the examination of the exosonographic visualization of two or more color signals on the intestinal wall, significant differences were found not only between individual pathological groups, but also in general indicators. In two patients with Ladd's syndrome, the stenotic area of the intestine and suprastenotic expansion zones were detected. There was no thickening of the intestinal wall in the stenotic area of the intestine, increased echogenicity of the submucosal layer of the intestinal wall was observed against the background of decreased blood circulation. Narrowing of the intestinal cavity due to thickening of the intestinal wall was found in 18 children, but suprastenotic expansions above these narrowed areas were not observed. All patients diagnosed with Ladd's syndrome (100%) showed hyperechoic heterogeneous tissue around the affected intestinal segment, indicating mesenteric infiltration, and enlarged (>6 mm) round lymph nodes with altered structure. The maximum size of lymph nodes did not exceed 10 mm. At the same time, a small amount of free fluid was observed in the small pelvic cavity, with a predominance in the lower part of the lateral channels.

Conclusions. Thus, it can be recognized that the ultrasonic sonography method has high information in the diagnosis of Ladd's syndrome, in particular, in determining its component that cannot be visualized radiologically - the rotation of the intestine around its axis. The method of ultrasound exosonography allows to determine the structural and morphological changes in the intestinal wall thickness, its cavity and layers, as well as in the surrounding tissues (intestinal mesentery, liver, lymph nodes) in children with intestinal rotation anomalies, as well as to visualize the location of the affected intestinal segment. With the help of ultrasound, complications such as stenosis of the intestinal fragment can be detected before invasive methods of diagnosis are performed, and the additional advantages of this method include the evaluation of functional signs such as intestinal peristalsis, the level of blood circulation in the intestinal wall. The method of color doppler mapping allows not only to evaluate the signs of inflammation in the affected intestinal segment, but also to monitor them dynamically during treatment.

References

1.Alehossein M, Abdi S, Pourgholami M, et al al. Diagnostic accuracy of ultrasound in determining the cause of bilious vomiting in neonates. Iran J Radiol 2012;9:190-4

2.Catania VD, Lauriti G, Pierro A, Zani A. Open versus laparoscopic approach for intestinal malrotation in infants and children: a systematic review and meta-analysis. Pediatric Surg Int. 2016 Dec;32(12):1157-1164. doi: 10.1007/s00383-016-3974-2. Epub 2016 Oct 5. PMID: 27709290.

3.Hennessey I, John R, Gent R, et al. Utility of sonographic assessment of the position of the third part of the duodenum using water instillation intestinal malrotation: a single-center retrospective audit. Pediatric Radiol 2014;44:387-91.

4.Hennessey I, John R, Gent R, et al. Utility of sonographic assessment of the position of the third part of the duodenum using water instillation in intestinal malrotation: a single-center retrospective audit. Pediatr Radiol 2014;44:387-91.

5.Lee HC, Pickard SS, Sridhar S, et al. Intestinal malrotation and catastrophic volvulus in infancy. J Emerg Med 2012;43:e49-51

6.Morozov DA, Pimenova ES, Tatochenko VK, Bakradze MD, Gadliya DD, Morozova OL, Talalaev AG. [Surgical treatment of rare combination of intestinal malrotation with secondary lymphangiectasia]. Westn Ross Acad Med Nauc. 2015;(1):56-62. Russian. doi: 10.15690/vramn.v70i1.1232. PMID: 26027272.

7.Tang W, Daneman A, Navarro OM, et al. Disorders of the midgut malrotation: making the correct diagnosis on UGI series in difficult cases. Pediatr Radiol 2013;43:1093-102

8.Zengin A, Ucar BI, D?zg?n SA, et al. Adult midgut malrotation presented with acute bowel obstruction and ischemia. Int J SurgCaseRep 2016;22:5-7.

9.Zhou LY, Lee SR, Wang W, et al. Usefulness of sonography in evaluating children suspected of malrotation: comparison with an upper gastrointestinal contrast study. J Ultrasound Med 2015;34:1825-32 ;

10.Pykov, M. I., Sokolov, Yu. Yu., Balashov, V. V., & Korovin, S. A. (2013). Ultrasound detection of the presence of lymphatic nodes in the abdominal cavity and normal and acute abdominal syndrome. Children's hospital, (1), 28-37.

11.Toshmatov K.Z., Toshboev Sh.O. (2021). Anomalous embryogenesis is a pathogenetic factor in the development of uterine malrotation. Universum : Chemistry and Biology, 3-1 (81). https://cyberleninka.ru/article/n/anomalnyy-embriogenez-kak-patogeneticheskiy-faktor-razvitiya-malrotatsii-kishechnika