ABSTRACT

Many aspects of surgical treatment of intestinal malrotation in children remain to be debatable. In the opinion of the majority of the specialists, surgical treatment is required after the diagnosis taking into account serious complications of intestinal malrotation.

Purpose. The purpose of this research was to conduct an analysis of surgical tactics and operative treatment method for isolated and associated intestinal malrotations in children.

Material and methods. We observed 123 children at the age of one day to 15 years with malrotation during the period of 2002 to 2013.

Results. We presented the data from observing 123 children at the age of one day to 15 years with various clinical-anatomic forms of intestinal malrotation over from 2002 to 2013. In 62 patients (50.4%), the evidences of the high intestinal obstruction were prevalent, while 61 (49.6%) showed signs of low intestinal obstruction. 116 patients (94,3%) were given operative intervention: radical – 95(81,9%) and palliative – 21 (18,1%). In 56 % of the cases, various simultaneous surgeries were required. There are proposed differential approaches in relation to anatomic form of malrotation and possibility of the fixation of large intestine in the physiological position.

Conclusion. The results obtained from the operative treatment are presented. The lethal outcomes could be reduced from 54.7%, among the patients being observed from 2002 to 2010, to 16,7% in patients being operated during 2011 to 2013.

INTRODUCTION

Many aspects of surgical treatment of intestinal malrotation in children remain to be debatable. In the opinion of the majority of the specialists, surgical treatment is required after the diagnosis taking into account serious complications of intestinal malrotation. To address rotational disorders of the intestine, the optimal operation is known as Ladd’s procedure, which is named after a well-known American children’s surgeon, who, for the first time, developed the method of operative intervention being used for this time (Emanuwa, Ayantunde, & Tony, 2011, p. 6). However, this intervention cannot serve as a universal method of correction for diverse variants of malrotation. The frequency of associated anomaly at HIO (high intestinal obstruction) is observed in 30-70% of the patients. In the publications, there are malrotations associated with defects of the gastrointestinal tract development as well as other organs and systems (Morozov & Filippov, 2007, p. 48.). The development of adhesive process is observed in 7-24% of the operated patients. In some authors’ opinion, the adhesions prevent recurrence and intestine fixing is not necessary (Nasir, Abdur-Rahman, & Adeniran, 2011, p. 10). The surgical correction of malrotation is has been performed by laparoscopic method over the last decades. In the research of Hagendoorn, Travassos, & Zee (2011, p. 219), it was noted that from 45 operated newborns and children with malrotations, the surgery was successful in 76% of the patients; for the rest of the cases, laparotomy was required. In 19% of patients at long-term periods, recurrence of disease was observed requiring repeated opening or laparoscopic operation, in 86% and 14% of patients, respectively. Parameters of morbidity rates due to malrotation fluctuated from 6.9% to 22.2% (Troy et al., 2008, p. 1004). In some countries, lethality reaches 50% (Osifo & Okolo, 2009, p. 99).

Research Purpose

The purpose of the present research was the analysis of surgical tactics and ways of operative treatment for isolated and associated intestinal malrotations in children.

Material and Methods

We observed 123 children at the age of one day to 15 years with malrotation during the period from 2002 to 2013. Among them, 81 (65.9%) were boys, and 42 (34.1%) were girls, including 77 (62.6%) newborns; 17 (13.8%) were between 1-12 months old; 6 (4.9%) were between 1 to 3 years old; 9 (7.3%) were between 3 to 7 years old; 11 (14.4%) were between 7 to 15 years old. In 7 (5.7%) cases, the parents refused temporary operation because of an absence in real signs of intestinal obstruction and pain syndrome. In 116 (94.3%) patients, the final type of incomplete intestinal rotation was verified during operation: Ladd’s syndrome - 34 (29.3%); small intestine volvulus - 22 (18.9%); midgut volvulus - 16 (13.8%); mesocolicoparietal hernia - 14 (12.1%); incomplete rotation - 5 (4.3%); absence of rotation - 3 (2.6%); reversal rotation - 3 (2.6%); pathological fixing - 19 (16.4%).
Results and Discussion

From 62 (50.4%) patients admitted to the surgical hospital with intestinal malrotation, there were noted signs of high intestinal obstruction; in 48 (77.4%) - partial, in 14 (22.6%) - complete; in 61 (49.6%) with low intestinal obstruction: 32 (52.5%) - complete; 29 (47.5%) - partial. 23 patients were admitted with signs of acute volvulus and peritonitis. Among 116 children operated, clinical signs before operation and pre-operative findings of examination did not always allow identification of some types of intestinal malrotation; the patients underwent urgent or planned surgery with various diagnosis. Among them, high or low intestinal obstruction and perforate peritonitis were frequently found.

In the patient with high intestinal obstruction (HIO), the duration of preoperative preparation accounted for 10 to 48 hours. The indications for the urgent surgery at HIO were: clinical-roentgenological signs of malrotation with volvulus, peritonitis due to perforation of the hollow organ. The duration of preoperative preparation in these cases changed from 3 to 6 hours. At low intestinal obstruction, the operative intervention was performed after 2 to 4 hours of preparation. At the manifestations of the partial low intestinal obstruction with characteristic sub-acute development and with moderate expression of intoxication, the duration of preoperative preparation was 4 to 6 hours. Clinical-roentgenological findings of malrotation with volvulus or perforated peritonitis in 23 (19.8%) patients, independent on the level of intestinal obstruction localization, were indications for the urgent operation after 2 to 4-hour preoperative preparation. During the analysis of intraoperative data about selective kinds of malrotation, it was established that many anatomic components of rotation disturbance were similar, differed by complications, characteristic for the individual forms and structure of associated anomalies. Specific features of rotational intestinal disturbances, except of isolated volvulus of the small intestine at which the high frequency of necrosis is characteristic, are: lymph – venous stasis in the intestine without necrosis or critical disturbances of mesenteric blood circulation because of rare volvulus 360° and more and intestinal adaptation to chronic ischemia, arising still in the intrauterine period. Intestinal necrosis, caused directly by malrotations, was observed in 21.3% of the patients. The rest (78.7%) of the patients underwent intestinal resection due to complications of intestinal obstruction. In Ladd’s syndrome, malrotations with mid gut volvulus and mesocolicoparietal hernia, the primary (congenital) and secondary (complications) changes in the intestine were variable with specific high association of the development anomalies of the intestinal tube. The variants of pathological fixations were predominantly observed on the background of a completed rotation. The reasons for development of such complications were partial or strangulation obstruction, acute appendicitis at atypical location of the vermiform process.

The way to conclude the operative intervention depended on anatomic variant of malrotation, character of an accompanying pathology, somatic status of the patient caused by the main disease, and a competing pathology and arisen complications.

The main principles of operations for malrotations are careful revision of the rotation disorders, liquidation of the manifestations of intestinal obstruction, mesocolicoparietal hernia, pathological fixations, and performance of appendectomy. In 88 (75.9%) cases, irrespective of a kind of malrotation after elimination of pathological fixation because of underdevelopment of the mesentry or relative shortness of enteric vessels, the intestine is left in an initial condition, i.e. in an incomplete rotation. In 28 (24.1%) patients, at sufficient length and width of the mesentery without tension of the mesenteric vessels, it was possible to transfer and to fix the large intestine in the physiological position along peritoneal wall with typical localization of the small intestine and ileocecal angle.

Individual surgery should only be performed for each patient depending on the type of malrotation and character of associated anomaly. Operative tactics at left mesocolicoparietal hernia includes hernia elimination and cervix of the hernia gate of mesocolicoparietal hernia in formation of which the mesenteric hernia participates. At goffered sites of the mesentery in a longitudinal direction, the bed of hernia is eliminated, and it is possible to place a vessel and intestine on the usual position. At a combination of mesocolicoparietal hernia with other pathological conditions during operation, the hernia sac is liquidated with removal of the small intestine loops.

For reversal rotation, pathological adhesions revealed around the upper mesenterial artery and hepatoduodenal bands inducing squeeze of adjacent organs (duodenal intestine and common bile duct) and presence of the additional vessel connected with main mesenteric vessels; the presence of which requires especially cautious mobilization and removal of the retro-arterially located site of the large intestine from under superior mesenteric artery. It is important to determine an opportunity of preservation orlegation of an additional vessel, the state of intestine blood supplying after its mobilization.

At some forms of intestinal malrotation, when the level of intestinal obstruction is located lower the major duodenal papilla, the changes of syntopy and anatomic form of duodenal intestine were the characteristics. At complete obstruction, there was dilatation of the duodenum – megaduodenum. The more overextension and increase of volume, consequently, the more developed the excessive megaduodenum with the expressed disorders of the organ motility. In similar cases, our proposed “Method of surgical treatment of duodenal obstruction in children accompanying by megaduodenum” were used (the patent for the invention RÚZ Ne IAP 04826 is shown in Figure 1). This method allowed us to reduce the diameter and to give the normal anatomic form of the duodenum without dissection of the body wall. The method of duodenooplasty according to our technique was used in 3 patients: in complete volume in 2 patients, and in one patient only an angle has been created in a zone of transition of the upper horizontal part into a descending department of the duodenum.

The indications for simultaneous surgeries, including resection of the intestine with anastomosis or ending operation by use of entero- or colostoma, were determined during operation taking into account the complications occurred (intestinal necrosis, peritonitis) and associated pathology of the organs of abdominal cavity. Resection of the intestine at malrotations in 47 (40.5%) operated children independently on the level of obstruction was performed with the purpose of achieving the maximum organ-preserving technique by restoration of the gastrointestinal tract continuity. The anastomosis "end-to-end" or creation of term-lateral anastomosis was preferable. The volume of resection depended on the level of atresia or intensity of the secondary changes in the site of volvulus. The extensive resections of volume 60-90 cm were performed in 8 cases; in the rest of the cases the length of intestine removed did not exceed 40-50 cm. The level of resection was selected individually with scope of the changed site of the intestine.

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SURGICAL TACTICS FOR INTESTINAL MALROTATION IN CHILDREN

Resection within the limits of small intestine was carried out in 13 patients (11.2%) with the maximal preservation of Bauhin’s valve and terminal department of the ileal intestine at a distance of 10-15 cm from the ileocecal angle. Resection of a terminal department of the ileus and ileocecal angle was required in 7 (6.0%) cases. For intestinal malrotations with excessive lengthening of the large intestine in 2 (1.7%) observations, resection was carried out for the excessive part of the large intestine with anastomosis “end-to-end.” 21 (18.1%) cases, with extensive necrosis, intestinal perforation, peritonitis, heavy general condition of the child health on the background of polyorgan insufficiency caused by complications of the main disease and somatic pathology and/or associated malformations of development the operations, were completed by application of intestinal fistulas: double enterostomy - 17 (14.7%) and colostomy - 4 (3.4%). Time of stomach closing and character of restoration of continuity of the gastrointestinal tract (thin – small intestinal, ileo-coloanastomosis or coloanastomosis) was selected individually by taking into account the patient’ state, progress and outcome of the main disease, and characteristics of the operations performed.

33 simultaneous surgeries were performed for malrotations in a combination with high intestinal obstruction in 24 (20.7%) children, in addition to correcting the intestinal malrotation. Two patients with the absence of rotation at presence of multiple defects simultaneously received two interventions, that is, an application of esophageal anastomosis at atresia and dissection of the anal membrane, elimination of duodenal obstruction and formation of artificial anus in connection with the high form of anorectal anomaly.

Associated low intestinal obstruction in 25 (21.5%) patients with malrotations was caused by internal and external reasons. Depending on the characteristics of pathology and arisen complications and the state of the “taken an interest” departments of the small and large intestines, 32 simultaneous operations were performed: radical (24-75.0%) or palliative (8-25.0%).

The management of an early post-operative period in children depended on characteristics and volume of operative interventions concerning malrotation, simultaneous correction of multiple, and associated anomalies of the organs in the abdominal cavity. The therapeutic measures were directed on maintenance of the vital bodies functions, restoration of the function of the gastrointestinal tract, total supplying physiological needs for water, electrolytes and proteins; adequate post-operative was combined with antibacterial therapy.

After an operation without an opening of the intestinal patency (dissection of the congenital adhesions, liquidation of pathological rotations), on the second day, the gastric tube was removed and the liquids were taken through the mouth; and, on the third day, the enteral feeding began. The period of infusion therapy was no longer than 2-3 days. For complex simultaneous interventions, involving an opening of gastric patency or resections with anastomosis application, the restoration of the gastrointestinal tract motility was achieved in 2-3 days, which excludes liquid taking through oral cavity and the stomach decompression with nasogastral tube. The patients may begin taking water on the 3rd or 4th day. Up to the complete elimination of the intestinal paresis and beginning of the feeding, infusion therapy was performed with additional parenteral feeding. Fractional enteral feeding was included 5-6 days after operation, gradually increasing in volume.

Among 116 children given surgeries for malrotation, 21 (18.1%) children experienced no unfavorable events during the post-operative period. However, 95 (81.9%) were noted with the development of various complications. Severity and characteristics of the complications were different among newborns and children at older age. Number of complications and outcome of diseases were also different among those with isolated and associated intestinal malrotation. The most frequent post-operative complications were paralytic intestinal obstruction in 23 cases, peritonitis development in 11, and complications due to somatic disease in 50 cases.

67 (57.8%) operated patients were discharged from the hospital; lethal outcomes were registered in 49 (42.2%) cases, predominantly among the newborns and children under 3 months old, at 62.3% and 11.1%, respectively. No lethal outcomes were found in operated children at the age of 3 months and older. The parameters of survival significantly improved over the last years. During the period of 2002-2010, the lethal outcomes were noted in 41 (54.7%) of the 75 patients; from...
2011-2013, the lethal outcomes were observed only in 8 (16.7%) cases out of 48 patients hospitalized. The high number of lethality among the newborns were explained by unfavorable somatic background due to heavy pathological states accompanying the perinatal and intranatal periods of infectious and traumatic genesis, serving as main cause in the tonatogenesis among dead children.

Conclusion

The tactics and method of the operative intervention are determined by anatomic variant of intestinal malrotation, presence of associated anomalies and accompanying pathology, the somatic status of the patient, due to the main disease, competing pathology, and occurrence of complications.

Although similar, many anatomic components of malrotation at some variants differed in the degree of complications in the associated anomalies structure, thus requiring non-standard tactics.

In the intestinal malrotation liquidation of the signs of intestinal obstruction, all components of the rotation disorders and pathological fixations appeared to be obligatory. The performance of appendectomy should be recommended.

In 24.1% of patients, with the sufficient width and length of mesentery and mesenteric vessels, it was possible to create physiological position for the small and large intestine and to perform operative fixation resembling a complete rotation. In 75.9% of cases, due to insufficient development of the mesentery or relative shortness of the mesenteric vessels independently on the type of intestinal malrotation, the intestine should be left at the state of the initial position—incomplete rotation.

For association of malrotation with high or low intestinal obstruction, the simultaneous operations were required for 56.0% of the patients. In relation to the state of patients, the organ-taking interest, and characteristics of complications occurred, the simultaneous interventions may be radical or ended by palliative interventions.

REFERENCES