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Patients Presenting Acute Abdomen Later Found to Have Complications Related to Meckel's Diverticulum: A 10-Year Study

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Abstract: In this study, it is aimed to investigate the symptoms, diagnostic tools and treatment of pediatric patients admitted with acute abdomen symptoms due to Meckel's diverticulum. The patients with surgical complications of Meckel's diverticulum were analyzed retrospectively in terms of age, gender, symptoms, imaging techniques, complications of Meckel's diverticulum, method of treatment and duration of hospitalization. Statistical analysis was performed using SPSS software and $P<0.05$ was considered statistically significant. There were 14 patients. Complaints on admission were as follows: abdominal pain, bilious vomiting, abdominal distention, lack of defecation, lethargy, bloody stool, and foul-smelling discharge from the umbilicus. Abdominal x-ray and ultrasonography were performed in all patients. None was diagnostic. Meckel's diverticulum was a leading point in 7 patients with intussusceptions. Other complications were volvulus (n=4), diverticulitis (n=2) and Meckel's diverticulum perforation (n=1). Patients with ileal resection hospitalized significantly longer when compared to patients who underwent diverticulectomy. Bands extending from the remnants of the omfalomesenteric canal causing obstruction should be kept in mind in patients with sudden onset abdominal pain and ileus if there is no apparent pathology such as intussusception, incarcerated hernia or history of abdominal surgery that can explain the ileus.

Keywords: Meckel's diverticulum; intestinal volvulus; intussusception; complication; child.

INTRODUCTION

Hildanus described the Meckel's diverticulum (MD) for the first time in 1598. MD occurs in the gastrointestinal tract with a frequency of 1.2% [1]. The typical location of MD is 60-100 cm proximal to the ileocecal valve on the antimesenteric side in adults. Because it contains all intestinal layers, MD is a real diverticulum. MD is often encountered incidentally because it is usually asymptomatic. Nevertheless, life-threatening serious complications can occur in 4-6% of patients [2, 3]. There are some problems, such as diagnostic confusion, decision of the surgery, location of the incision, surgical method (open / laparoscopic) and type of pathology to be encountered during operation in these patients presenting with acute abdominal symptoms. That's why patients with the diagnosis of MD and its complications, who admitted to our clinic with symptoms and signs of acute abdomen, will be discussed within the light of literature to increase awareness of the subject for true diagnose and appropriate treatment.

MATERIAL AND METHODS

Ethics committee approval was received according to the Declaration of Helsinki and Good Clinical Practice Guidelines (Ethics Committee Approval No. 2015-Kaek-86 / 07-142).

The patients, who admitted with symptoms and signs of acute abdomen and operated because of MD complications in Afyon Kocatepe University Department of Pediatric Surgery in the recent 10 years, from January 2006 to December 2015, were analyzed retrospectively. Patients were evaluated in terms of demographic characteristics, complaints, diagnostic modality, complications of MD, the length MD, the presence of ectopic mucosa, the method of treatment and the duration of hospitalisation. The relation between complications and the length of MD or the presence of ectopic mucosa and the relation between the surgical method and duration of hospitalisation were examined. Statistical analysis of the data was performed

using SPSS software and P<0.05 was considered statistically significant.

RESULTS

Fourteen patients were included. The average age of the patients was 51 months (with a range of 8 days - 180 months). Twelve patients (85.7%) were male and 2 (14.3%) were female. Complaints of the patients on admission were as follows: Abdominal pain in 11 patients (78,5 %), bilious vomiting in 10 patients (71,4 %), abdominal distention in 8 patients (57,1 %), lack of defecation in 3 patients (21,4 %), lethargy in 3 patients (21,4 %), bloody stool in 3 patients (21,4 %) and foul-smelling discharge from the umbilicus in 1 patient (7,1%). Palpable mass ('sausage sign') was detected in 3 patients on abdominal examination. There are some changes in laboratory findings such as leukocytosis with the left shift in 8 patients, electrolyte disorders in 6 patients, C-reactive protein elevation in 4 patients, increase of prothrombin time (PT) and activated partial thromboplastin time (aPTT) in 1 patient, elevation of aspartate aminotransferase (SGOT) and alanine aminotransferase (SGPT) in 1 patient. There was no statistically significant difference in terms of biochemical parameters between with ileal resection and diverticulectomy patients (P=0.14).

Abdominal X-ray was performed in six patients. The gasless abdomen was seen in one patient, bowel loops were pushed to the left upper quadrant in one patient, the air-fluid level was observed suggesting ileus in two patients (Figure 1).

Fig-1: Air and fluid levels in abdominal x-ray in patient with fibrous band extending from Meckel's diverticulum to caecum (arrows)

There were no specific findings on abdominal X-ray in two patients. Abdominal ultrasonography was also performed in all patients. Operation decision was given with physical examination findings and supporting ultrasound/x-ray. Computerized tomography nor scintigraphiy were not used for diagnosis.

Emergency surgery was performed in all patients except the newborn patient who had a patent omphalomesenteric canal. This baby was operated on the third day of hospitalisation in newborn intensive care unit when he developed intestinal obstruction findings (Figure 2).

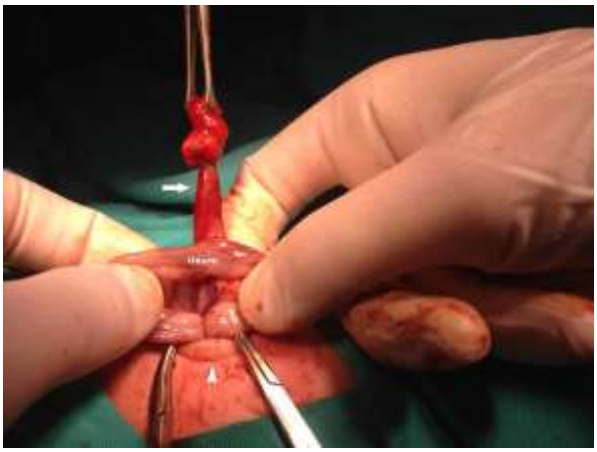

Fig-2: Patent omphalomesenteric canal (arrow) in the newborn after released from umbilicus (arrowhead). It caused non-ischemic volvulus

Diverticulectomy was performed in seven patients while ileal resection and anastomosis was done in seven patients. A periumbilical incision was used in one; while an inferior umbilical incision was performed in one other patient. On the other hand, a right transverse incision was preferred in all of the other patients.

MD had a role as a leading point in the etiology of intussusception in seven patients. The manual reduction was performed in all of these patients. Diverticulectomy was performed in three patients with narrow-based diverticulum, while ileal resection-anastomoses were preferred in four patients with broad-based diverticulum or ileal necrosis.

Ischemic volvulus was found around the band extending between MD and umbilicus in two patients and ileal resection-anastomoses was performed.

Bowel obstructions were present two patients due to the mesodiverticular band in one and diverticula-cecal band in the other one. These patients underwent excision of the band because simple volvulus without ischemia would not require resection.

Perforation of the MD and appendicitis was found together in one patient. Appendectomy was performed due to appendix circulatory disorder or acute appendicitis in five patients in addition to major surgery (Table 1).

Table 1: Demographic characteristics of patients, complication of Meckel's diverticulum and surgical technique

Patient	Age	Gender	Complications	Surgical technique
1	5 m	M	Intussusception	Resection-Anastomosis
2	11 y	M	Intussusception	Resection-Anastomosis + Appendectomy
3	5 y	M	Intussusception	Resection-Anastomosis
4	10 y	M	Intussusception	Diverticulectomy + Appendectomy
5	1,5 y	F	Intussusception	Diverticulectomy
6	11 m	M	Intussusception	Resection-Anastomosis
7	4 m	M	Intussusception	Diverticulectomy + Appendectomy
8	8 day	M	Patent vitello-intestinal canal/ volvulus	Resection-Anastomosis
9	15 y	M	Ileal volvulus around vitello-umblical band	Resection-Anastomosis
10	2 y	M	Ileo-colonic volvulus around vitello-umblical band	Resection-Anastomosis
11	4 y	M	Mesodiverticular band	Diverticulectomy
12	4 y	M	Volvulus around diverticulum-cecal band	Band excision + Diverticulectomy + Appendectomy
13	2 y	M	Diverticulitis	Diverticulectomy
14	4 y	F	Appendicitis + Perforated MD	Resection-Anastomosis + Appendectomy

m: month, y: year, M: male, F: female, MD: Meckel's diverticulum

The mean length of MD was 2.9 cm (ranged 1-5.5 cm). The ectopic gastric mucosa was observed in four patients and ectopic pancreatic tissue was found in the patient in the histopathological examination of MD tissues.

There was no statistically significant difference between diverticulectomy and resection-anastomosis with regard to the length of MD (P = 0.06). The mean period of hospitalisation was 5.9 (4-9 days) days. The hospitalisation time was 5.1 days in diverticulectomy group and 6.7 days in ileal resection-anastomosis group and the difference was statistically significant (P = 0.02). There is no mortality in this series.

DISCUSSION

MD is one of the most frequent anomalies found in the gastrointestinal system. During normal embryonic development, the omphalomesenteric canal, which connects the yolk sac and primitive intestine, is disappeared in 5-7 weeks after placental nutrition begin [4]. The pause of this process at different stages causes anomalies associated with MD. As the tip of the diverticulum may be free, it can remain connected to the umbilicus with a fibrous band. Moreover, with the persistence of vitelline arteries, the possibility of a mesodiverticular band that can cause intestinal obstruction becomes more likely [5, 6].

According to the results of 50 years autopsy series, MD prevalence has been reported at a rate of 1-2% [1]. Male / female ratio is known as 1.5-4/1 [1]. Male / female ratio in the series was 6/1, which is consistent with the literature.

The latest meta-analyses show a 60% and 80% asymptomatic prevalence in the pediatric and adult population respectively [7, 8]. According to the results of large case series, the lifetime risk of complications due to MD is 4-6% and this risk decreased as the age increase [6]. The most common symptoms are bleeding, obstruction and diverticulitis. Diverticulitis may often mimic acute appendicitis. In addition, MD can be the reason of some other pathology such as intussusception, volvulus, perforation and Littre's hernia [6, 9]. Unlike the literature, the most common complication of MD in the present series is intussusception that was followed by volvulus, perforation, diverticulitis and patent vitello-intestinal canal. There were no patients in the series presented with gastrointestinal bleeding due to Meckel's diverticulum without intussusception.

It is difficult to diagnosis complications of MD except gastrointestinal bleeding which can be detected by scintigraphy easily. The sensitivity of CT in the diagnosis of MD is 47.5% even in patients known to have an MD [10]. Although not conclusive for the diagnosis of MD, preoperative abdominal x-rays and ultrasonography guided by physical examination were sufficient to decide for operation in our patients. Therefore, preoperative definitive diagnosis is not always possible in patients presenting with symptoms of acute abdomen. As seen in our study, we may encounter complications such as volvulus due to patent omfalomesenteric canal in the neonatal period, intussusception, perforation, diverticulitis and volvulus due to the band extending from the MD in older children. Delayed diagnosis can lead sepsis and death.

Two patients were presented with abdominal pain and vomiting. One of these patients was operated

with the diagnosis of acute appendicitis and perforated MD was detected simultaneously. The other patients with a history of bloody stools were operated with the diagnosis of intussusceptions and diverticulitis revealed. The food residues located within the diverticulum such as fish bone, faecalith, and mussel shell fragments may lead to perforation of the MD [11-13]. There are no such cases in our series. MD related pathologies should be kept in mind in the differential diagnosis of appendicitis that causes acute abdomen and most commonly seen in children.

About 10 % of MD is connected to the umbilicus with fibrous bands while the tip of MD is free in the rest of the cases [14]. Unlike the literature, there were vitello-umbilical bands in three patients (21%), a diverticular-cecal band in one patient (7%) and mesodiverticular band in one patient (7%).

Patent vitelline duct, patent vitello-intestinal canal, vitelline-umbilical fistula, umbilical faecal fistula and umbilicus-intestinal fistulas are used to describe the same entity in which case Vitelline canal remained open and lined with mucus-secreting intestinal mucosa [15]. The clinical manifestations of vitello-umbilical bands are volvulus depends on the axial torsion of MD and internal hernias [16]. One ileal and one ileocolonic torsion around the vitello-umbilical band was encountered and resection anastomosis was required in this study. Also, the bands extending from MD to mesentery or intra-abdominal other organs may lead internal herniation or bowel obstruction. In such cases, emergency surgery is needed [17]. Intestinal obstruction was observed related to mesodiverticular and diverticular-cecal bands in two cases in this study. Diverticulectomy was carried out after the excision of the bands. These patients had a history of sudden onset of abdominal pain, bilious vomiting and radiological examination revealed no specific pathological findings except mechanical ileus.

The mortality rate of MD resection was found 0.01% in a meta-analysis of 246 articles published between the years 1952-2012 about MD. Deaths were observed in patients with intestinal prolapse through the patent vitello-intestinal canal [15]. The neonate with a patent vitello-intestinal canal had sepsis and this baby had the longest hospitalisation time (9 days) in the series.

In decreasing frequency stomach, pancreatic and colon mucosa can present in some MD. In asymptomatic children, the ectopic mucosa was found in 11% of MD, while ectopic mucosa is found in 59% of MD in symptomatic patients [8, 18]. The ectopic gastric mucosa was detected in 43 of 71 patients (68.3%) in a study performed by Menezes et al. This study includes patients suffering from gastrointestinal bleeding [19]. In our study, five ectopic mucosa (35%), including four stomach and one pancreatic tissue, were detected histopathologically.

A relationship between the length of the MD and the risk of developing complications was found in some reports. The length of the MD in our case series varied from 1.5-5 cm. The surgical technique is preferred according to the type of MD and the complications. Diverticulectomy is sufficient if MD has a narrow base and there is no edema and necrosis in the intestine adjacent to the base of MD. Otherwise, the ileal resection and end-to-end anastomosis would be more appropriate [6].

The mean hospitalisation period of patients who underwent diverticulectomy or the ileal resection and anastomosis was 5.9 days. Patients with ileal resection hospitalized statically significant longer when compared to patients who underwent diverticulectomy.

CONCLUSION

Accurate diagnosis of symptomatic MD is difficult preoperatively. Laparoscopy may be used for diagnosis and treatment in suitable cases. Bands extending from the remnants of the omfalomesenteric canal causing obstruction should be kept in mind in patients with sudden onset abdominal pain and ileus if there is no apparent pathology such as intussusception, incarcerated hernia or history of abdominal surgery that can explain the ileus.

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