



Different clinical symptoms and surgical treatment of Meckel's diverticulum in children

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Received: 08.11.2021; Revised: 03.01.2022; Accepted: 21.01.2022

Abstract

Objective: Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract and is usually identified incidentally during surgery for other reasons, upon radiological workup while investigating another disease or during autopsy. Among certain major symptoms of Meckel's diverticulum include gastrointestinal bleeding, volvulus, diverticulitis, intussusception, Littre's hernia or stool discharge from the umbilicus. In this study, we examined pediatric patients who were operated on for Meckel's diverticulum presenting with different clinical symptoms.

Methods: The files of pediatric patients who were operated for Meckel's diverticulum in the pediatric surgery clinic between July 2002 and July 2017 were retrospectively reviewed. Patients who underwent incidental diverticulectomy were excluded from the study.

Results: The 47 patients included in the study were 34 boys, 13 girls, and their mean age was 4.8 (1 day, 16 years). 49% of the patients were younger than 2 years old. The most common symptom observed in the patients was abdominal pain (63.8%). The most common indication for surgery was intestinal obstruction (53.2%). Intussusception was the cause in 64% of the patients in whom intestinal obstruction was the initial diagnosis. We detected gastrointestinal (GI) bleeding complaint in 12.8% of the patients. Segmentary bowel resection (46.8%) was the most common surgical procedure. In the pathological examination, ectopic tissue was found in 27 (57.4%) pathological specimens. While postoperative complications developed in 9 patients, 4 patients were treated conservatively and 5 patients were treated surgically.

Conclusion: Establishing a preoperative diagnosis of Meckel's diverticulum may be difficult non other than rectal bleeding with currant jelly stool. In symptomatic Meckel's diverticulum, simple diverticulectomy, wedge resection or segmental bowel resection should be planned according to the complication caused by the diverticulum.

Keyword: Meckel's Diverticulum, Child - Intestinal Obstruction, Ectopic Tissue

DOI: 10.5798/dicletip.1086111

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Çocuklarda Meckel Divertikülünün Farklı Klinik Semptomları ve Cerrahi Tedavisi

Öz

Giriş: Meckel divertikülü gastrointestinal sistemin en sık görülen konjenital anomalisidir ve genellikle başka bir ameliyat sırasında insidental olarak, başka bir hastalığı araştırırken radyolojik olarak tesadüfen veya otopsi sırasında saptanır. Meckel divertikülü gastrointestinal kanama, volvulus, divertikülit, intusepsiyon, volvulus, Littre hernisi, umblikustan gaita deşarjı semptomatik hale gelir. Bu çalışmada farklı klinik semptomlarla başvuran Meckel divertikülü nedeniyle ameliyat edilen çocuk hastaları inceledik.

Yöntemler: Temmuz 2002-temmuz 2021 tarihleri arasında çocuk cerrahisi kliniğinde meckel divertikülü nedeniyle opere edilen pediatrik hastaların dosyaları retrospektif olarak incelendi. İnsidental divertikülektomi yapılan hastalar çalışma dışında tutuldu.

Bulgular: Çalışmaya dahil olan 47 hastanın 34 erkek, 13 kız ve ortalama yaşı 4,8 (1 günlük, 16 yaş) idi. Hastaların %49'u 2 yaşından küçüktü. Hastalarda görülen en sık semptom karın ağrısı (%63,8) idi. En sık ameliyat endikasyonu intestinal obstrüksiyondu (%53,2). İntestinal obstrüksiyon gelişen hastaların %64'ünde neden intususpsiyondu. Gastrointestinal (GİS) kanama şikayeti %12,8 hastada saptadık. Cerrahi olarak en sık segmenter barsak rezeksiyonu (%46,8) yapıldı. Patolojik incelemede 27 (%57,4) piyeste ektopik dokuya rastlandı. Ameliyat sonrası 9 hastada komplikasyon gelişirken 4 hasta konservatif olarak 5 hasta da cerrahi olarak tedavi edildi.

Sonuç: Klasik vişne çürüğü gaita olan rektal kanamalar dışında meckel divertikülünün preoperatif tanısı zordur. Semptomatik meckel divertiküllerinde divertikülün neden olduğu komplikasyona göre basit divertikülektomi, wedge rezeksiyon veya segmenter barsak rezeksiyonu planlanmalıdır.

Anahtar kelimeler: Meckel Divertikülü, çocuk, intestinal obstrüksiyon,ektopik doku.

INTRODUCTION

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract¹. It was described by Johann Friedrich Meckel in 1809 that the anomaly develops as a result of non-obliteration of the ompholomestic duct². In 1,4-2% of the population, the omphalomesenteric duct persists resulting in a Meckel's diverticulum³. It generally comprises 2% of the population, the male-female ratio is 2/1; 2% of Meckel's diverticulum is symptomatic, symptoms begin before 2 years of age, it is located approximately 2 feet away from the ileocecal valve, the diverticula is 2 inches wide and most often contains 2 types of ectopic mucosa. This is called the rule of two's⁴.

Meckel's diverticulum becomes symptomatic with clinical conditions and findings such as gastrointestinal bleeding, volvulus, diverticulitis, intussusception, volvulus, Littre's hernia or stool discharge from the umbilicus^{1,5,6}. In this study, we present 47 patients who were

operated on in our clinic for Meckel's diverticulum.

METHOD

After the approval of the ethics committee dated 18.10.2021 and numbered 21.18.21, the files of patients who were operated on for Meckel's diverticulum in the pediatric surgery clinic between July 2002 and July 2021 were reviewed retrospectively. Patients who underwent incidental diverticulectomy were excluded from the study. The patients were examined in terms of age, gender, symptoms, operative findings, type of surgery performed and histopathological findings.

The patients were divided into 4 groups as intestinal obstruction (intussusception and non-intussusception intestinal obstruction), gastrointestinal bleeding, diverticulitis and POMD (Patent omphalomesenteric duct).

RESULTS

Of the 47 patients included in the study, 34 were male, 13 were female and the mean age was 4.8

(between 1 day to 16 years of age) respectively. 49% of the patients were younger than 2 years old. The most common symptom observed in the patients was abdominal pain (63.8%). Other symptoms were vomiting (38.3%), abdominal

distention (21.3%), rectal bleeding (17%), and stool discharge from the umbilicus (10.6%). Demographic characteristics of the patients, symptoms, surgical findings and characteristics of the diverticulum are given in Table I.

Table I: Demographic characteristics, symptoms, surgery and pathological findings of patients

	Total (n:47)	Intestinal obstruction (n:25)		GIS bleeding (N:6)	Diverticulitis (n:11)	POMD (n:5)
		Intussus- ception (n:16)	NI intestinal obstruction (n:9)			
Mean age	4,8	4	4,2	1,7	10,5	0
Gender (M/F)	34/13	11/5	6/3	4/2	9/2	4/1
<2 years	14/9	4/4	2/3	4/1	-	4/1
>2 years	20/4	7/1	4/0	0/1	9/2	-
Symptoms	30					
Abdominal pain	18	13	6	-	11	-
Vomiting	10	10	5	-	3	-
Abdominal distention	10	3	5	-	2	-
Rectal bleeding	8	2	-	6	-	-
Stool discharge	5	-	-	-	-	5
Type of Surgery						
Diverticulectomy	12	6	6	-	-	-
Wedge resection	13	2	-	5	6	-
Segmentary resection	22	8	3	1	5	5
Ectopic mucosa	27	8	6	6	5	2
Gastric	18	5	3	5	3	2
Pancreatic	6	2	2	-	2	-
Other	3	1	1	1	-	-
Complication follow-up	9	2	2	1	3	1
Conservative	4	1	1	1	1	-
Surgery	5	1	1	-	2	1

Abbreviations: (NI:Non-intussusception; GIS:Gastrointestinal system; POMD:Patentomfolomezenteric duct)

In our study, the causes that led to surgery for Meckel's diverticulum were intestinal obstruction (56.8%), diverticulitis (23.4%), GI bleeding (12.8%) and POMD (10.6%) consecutively. Intussusception was the main cause in 64% of the patients which gave rise to intestinal obstruction. Diagnosis was established in 3 patients with intestinal

obstruction by abdominal CT (figure 1) and in 1 patient with abdominal pain by abdominal USG. Segmentary bowel resection (46.8%) was the most common surgical procedure. In the pathological examination, ectopic tissue was found in 27 (57.4%) specimens. The most common ectopic tissue detected was gastric mucosa (66.7%).



Figure 1: Contrast-enhanced tomography of the lower abdomen. Red arrow indicates to Meckel's diverticulum.

Pneumatic reduction was attempted in 4 (25%) patients younger than 2 years of age who presented with intussusception. Pneumatic reduction was not successful in 2 patients, and recurrent intussusception developed in the other 2 patients. In 2 patients who underwent segmental resection and 1 patient who underwent wedge resection, ileus developed in the first 2 months post-operatively. Only 1 patient underwent reoperation.

The cause of NI intestinal obstruction was band-related obstruction in 7 patients (figure 2) and volvulus in 2 patients (figure 3). Volvulus was in the form of internal herniation due to a patent omphalomesenteric band. Ileus developed in the first month postoperatively in both of the patients who were operated for volvulus, and bridectomy was performed in only one of them.

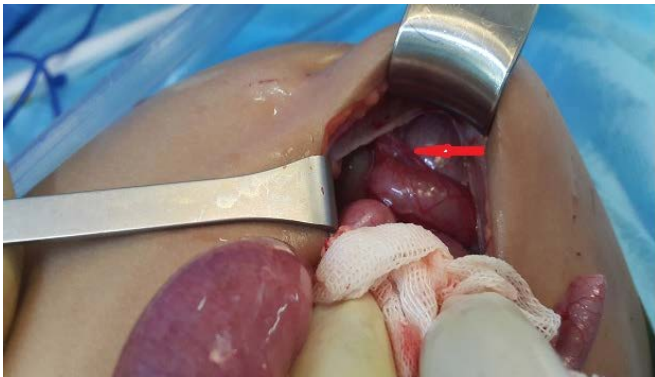


Figure 2: Red arrow indicates the omphalomesenteric band.



Figure 3: Volvulus due to Meckel's diverticulum

Tc-99m pertechnetate scintigraphy was performed on all patients presenting with GI bleeding. The diagnosis was made by the presence of ectopic gastric mucosa in the right lower quadrant of all patients on scintigraphy. Pre-op erythrocyte transfusion was performed in 4 patients because of low hemoglobin/hematocrit values due to massive bleeding. Elective surgery was performed after all patients were hemodynamically stable. Laparoscopy-assisted Meckel wedge resection and 16.7% (n:1) and laparoscopy-assisted segmental bowel resection were performed in 83.3%(n:5) of the patients who presented with GI bleeding. In the postoperative period, ileus developed only in 1 patient, which resolved with conservative treatment.

All patients who developed diverticulitis or perforation were older than 7 years of age (mean age was 10.5). 2 of the 3 patients with perforation had ectopic gastric mucosa. In 1 patient, there was obstruction with fecalitis because the diverticulum was long in length and narrow at the base (figure 4). Laparoscopy-assisted Meckel wedge/segmentary resection was performed in 11 patients with diverticulitis. While wedge resection was performed in 6 patients, segmental bowel resection was performed in 5 patients because of inflammation of the adjacent ileum wall. Ileus developed in 3 patients in the first 2 months post-operatively. While 1 patient recovered with conservative treatment; of the two patients who underwent surgery, intestinal adhesions were detected in one patient and pelvic abscess in the other patient. The patient with pelvic abscess died after the reoperation due to sepsis.



Figure 4: Meckel diverticulitis

Babies with POMD had a complaint of stool coming out of the umbilicus and segmental bowel resection was performed in all of them (Figure 5). Since 1 patient was premature, the operation was performed 1 month later. Other patients underwent elective surgery after delivery. Only 1 patient developed ileus and was reoperated.



Figure 5: Patent omphalomesenteric duct

DISCUSSION

Although Meckel's diverticulum was first described anatomically by Hildanus in 1598, Johann Friedrich Meckel mentioned it embryologically in 1908 by identifying its origin⁷. In the early period of fetal life, the omphalomesenteric duct (OMD) connecting the yolk sac and the intestinal system becomes obliterated between the fifth and the seventh week of pregnancy⁸. A number of congenital anomalies occur due to partial or complete failure or involution of OMD. These anomalies of OMD include Meckel's diverticulum, patent omphalomesenteric duct (POMD), umbilical fistulas, umbilical sinus tracts, umbilical cysts, umbilical polyps, and congenital bands⁹. Meckel's diverticulum is usually detected incidentally during another surgery, radiologically while investigating another disease or during autopsy^{10,11}. Complications such as bleeding, perforation, diverticulitis or intestinal obstruction may develop in approximately 4% of Meckel's diverticulum patients¹². While the male/female ratio of symptomatic Meckel's diverticula was 2.37 in one study, it was found 7.5/1 in another study^{13,14}. In our study, it was found to be 2.6/1, which is close to classical knowledge.

In 26% of Meckel's diverticulum, a fibrous band connecting the diverticulum to the umbilicus or a mesodiverticular band that can lead to

intestinal obstruction may occur as a result of persistence of the vitelline arteries^{15,16}. While these congenital bands now and then may directly compress the intestine and form ileus or more rarely, volvulus may develop due to an internal bowel hernia. Another cause of bowel obstruction is intussusception as a result of Meckel's diverticulum acting as a leading point. In different series, intestinal obstruction was found to be the most common symptom with a high rate of 35-47%¹⁷. In our series, it was 53.2%, which is just above this value range. Patients presenting with bowel obstruction were treated with conventional surgery because of a residing abdominal distension.

According to some studies, up to 50% of Meckel's diverticulum cases may contain heterotopic tissue such as gastric mucosa, colon, or pancreatic tissue, with a highly variable incidence¹⁸. Gastric mucosa is the most common heterotopic tissue with a rate of 60-82%, while pancreatic tissue is observed with a rate of 1-16%¹⁹. In our study, we found ectopic tissue in 12.8% of patients; gastric mucosa was detected in 66,7% and pancreatic tissue in 22.2% of these cases. Gastrointestinal bleeding due to acid secretion in Meckel's diverticulum containing gastric mucosa and rectal bleeding with a color of currant jelly may be encountered. In a study, the incidence of bleeding due to Meckel's diverticulum was found to be 35%⁵. In our study, the rate of rectal bleeding associated with Meckel's diverticulum was 17%, but this rate was 21.7% in patients under 2 years of age. Only 1 patient with rectal bleeding was older than 2 years old. Blood transfusion was performed in 80% of our patients in the preoperative period, and this rate has been reported as 67-71% in different studies⁶.

The incidence of diverticulitis in patients with Meckel's diverticulum has been reported to be 6-14%²⁰. Preoperative diagnosis is difficult because patients with diverticulitis have nonspecific abdominal pain symptoms²¹. The

underlying mechanism of Meckel's diverticulitis is the obstruction of the orifice of the diverticulum by an enterolith (gastrointestinal stone), fecalitis, foreign body, parasite, neoplasm, or fibrosis due to recurrent peptic ulcer²². In a study, diverticulitis was found in 30% of patients who underwent symptomatic Meckel's diverticulum surgery²³. In our study, we found diverticulitis rate of 23.4%. We detected perforation due to a diverticulitis in 1 patient.

In the neonatal period, a stoolish umbilical discharge or a bilious, mucous or serous drainage out of the umbilicus suggests a POMD which is a very rare anatomical entity²⁴. In our series, POMD was seen with a rate of 10.6%.

Surgical treatment of Meckel's diverticulum is not standardized and varies according to the patient's symptom and clinic. It has been reported that the surgical technique selection should be decided according to the external appearance of Meckel's diverticulum⁶. However, in the study of Gezer et al., they suggested that deciding on appearance does not always give the right result⁵. Our recommendation is wedge resection to include adjacent ileum tissue in surgeries performed for gastrointestinal bleeding, but segmental resection may be required if the bleeding focus in the adjacent ileum is advanced or large. Laparoscopy-assisted surgery can be performed in cases such as GI bleeding and diverticulitis without massive abdominal distension. Simple diverticulectomy should be attempted if manual reduction is easily performed in early intussusceptions. If the patient presents with late intussusception, segmental resection is a better choice because of edema in the adjacent bowel tissues. Simple diverticulectomy can be performed if there is no necrosis in non-intrusive bowel obstructions. In POMD, resection-anastomosis is our method of choice because the base of the diverticulum is wide.

CONCLUSION

Contrary to the classical knowledge, we attribute the low rate of rectal bleeding in our Meckel's diverticulum series to the fact that, patients with hemorrhage were already treated in public hospitals before they were admitted to advanced level health centers because the diagnosis was already simple. Preoperative diagnosis of Meckel's diverticulum is a challenging one, except for rectal bleeding with classic currant jelly stool. Because of the low complication rate, we do not recommend surgery for incidentally detected Meckel diverticulum. In symptomatic Meckel's diverticulum, simple diverticulectomy, wedge resection or segmental bowel resection should be planned according to the complication caused by the diverticulum.

Ethics Committee Approval: After the approval of the ethics committee dated 18.10.2021 and numbered 21.18.21, the files of patients who were operated on for Meckel's diverticulum in the pediatric surgery clinic between July 2002 and July 2021 were reviewed retrospectively.

Conflict of Interest: The authors declared no conflicts of interest.

Financial Disclosure: The authors declared that this study has received no financial support.

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