

Laparoscopy-assisted Approach for Meckel's Diverticulum in Pediatric Age

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ABSTRACT

Background: Meckel's diverticulum (MD) is the most common congenital gastrointestinal tract (GIT) anomaly, with incidence approximately 2–4%. It is usually asymptomatic and it is usually discovered accidentally during laparotomy or presenting with complication as perforation, bleeding, and bowel obstruction. The surgical treatment of MD includes exploratory laparotomy with either diverticulectomy or segmental small bowel resection.

Materials and methods: A retrospective review performed for the cases of MD operated by laparoscopy-assisted excision of the diverticulum in Zagazig University Hospital and International Medical Center Jeddah, during the period from November 2012 to October 2018, all data regarding patients' demographics, clinical features, diagnostic tests performed, histopathology reports, operative time, conversion to laparotomy, hospital stay, and complications were analyzed.

Results: This study includes 17 patients with MD who underwent laparoscopy-assisted excision of MD. The median age of the patients was 8.3 years. The male to female ratio was 11:6. Lower GIT bleeding was the most common presenting symptom. All patients were subjected to a laparoscopy-assisted excision. Four patients underwent wedge excision and 13 patients underwent segmental bowel resection.

Conclusion: Laparoscopy-assisted resection of MD is safe, simple, and inexpensive. Moreover, it avoids the risk of intra-abdominal contamination.

Keywords: Bleeding per rectum, Children, Laparoscopy, Meckel's diverticulum.

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INTRODUCTION

Meckel's diverticulum (MD) is one of the most common congenital anomaly of the gastrointestinal tract (GIT), with incidence approximately 2–4%.^{1,2}

It arises from remnants of the omphalomesenteric duct, which connects the midgut to the yolk sac in the fetus, and usually undergoes complete involution between the fifth and sixth weeks of gestation as the bowel return back normal anatomical position.³

Meckel's diverticulum mostly is asymptomatic and it is usually an incidental finding when laparotomy is performed for other abdominal conditions but can be presented by intestinal obstruction, intussusception, gastrointestinal bleeding, diverticulitis, or perforation.⁴

Surgical treatment of MD involves laparotomy with either diverticulectomy or segmental small bowel resection. Recently, some authors have described the use of laparoscopy as minimally invasive for the resection of MD.^{5,6}

MATERIALS AND METHODS

A retrospective review was performed for the cases of MD treated surgically by laparoscopy-assisted excision of the diverticulum in Zagazig University Hospital and International Medical Center Jeddah between January 2010 and December 2017.

All of the following data were collected and analyzed: patients' demographics, clinical features, investigations, histopathology reports, operative time, any operative or postoperative complications, and duration of hospital stay.

Operative Procedure

Laparoscopy-assisted excision of MD was performed through three or two ports. After general anesthesia with endotracheal intubation,

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a 5 mm port for the camera was placed through the umbilicus using open technique. Another two 5 mm working ports were placed, one in the suprapubic region and one in the left iliac fossa, after creation of pneumoperitoneum with an insufflation of 0.5 L/minute to a maximum pressure of 10–12 mm Hg. Exploration of the small intestine was performed by 2 a traumatic grasper to identify the MD.

The MD was dissected from the mesentery and was grasped with a traumatic forceps passed through the umbilicus (Figs 1 and 2).

The umbilical incision was extended and the diverticulum was brought out from the umbilicus. We perform wedge resection in case of long diverticulum and narrow base but in case of short diverticulum and broad base we performed bowel resection and anastomosis, in one case, the resection was performed using a linear stapler device, the anastomosed bowel was returned back into the abdomen, and the umbilical wound was closed.

RESULTS

This study includes 17 patients with MD who underwent laparoscopy-assisted excision of MD. The median age of the patients

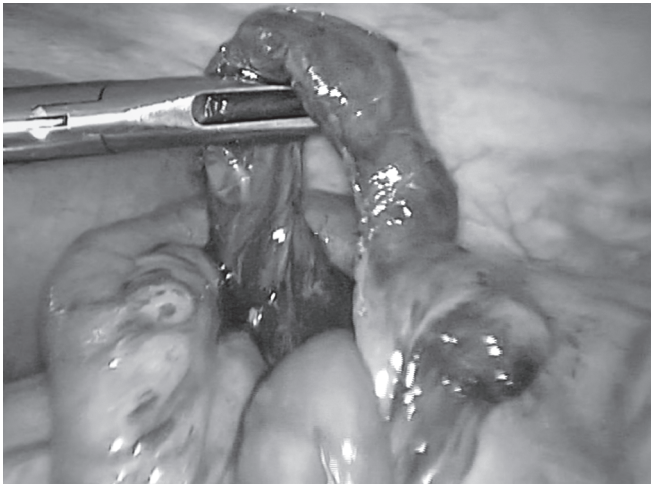


Fig. 1: Meckel's diverticulum with its tip attached to the cecum

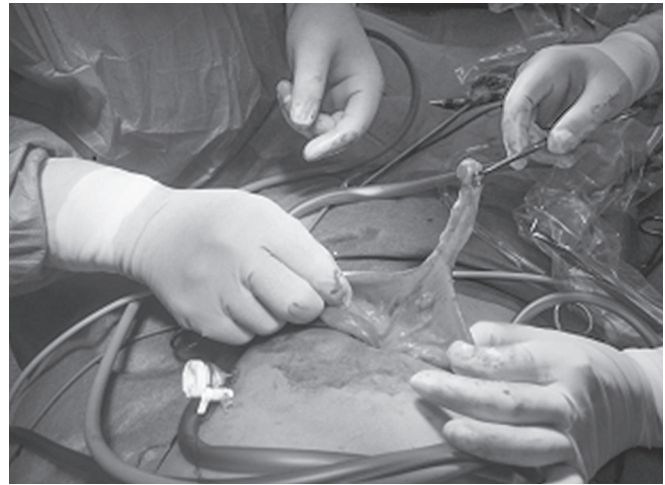


Fig. 2: Meckel's diverticulum exteriorized from the umbilicus

Table 1: Demographic data and presentations

	Number	Percentage
Mean age	8.3 years	
Male	11	64.7
Female	6	35.2
Rectal bleeding	11	64.7
Acute appendicitis	3	17.6
Intestinal obstruction	2	11.7
Chronic abdominal pain	1	5.8
Meckel's scan	13	76.4
CT	3	17.6
Abd US	4	23.5

was 8.3 years (range 5–14 years). The ratio of male to female was 11:6 (Table 1).

All patients were operated by a laparoscopy-assisted excision. Four patients underwent wedge excision and 13 patients underwent segmental bowel resection, in 1 patient, the resection of the diverticulum was performed with a linear stapler. Eleven patients had painless rectal bleeding, while one had chronic abdominal pain, and the CT study showed cystic mass attached to the umbilicus. Three patients were presented by picture similar to acute appendicitis and CT showed picture of acute appendicitis with dilated bowel loop in these cases the tip of the MD was inflamed and attached to the cecum and compressing the bowel (Fig. 3), and in one case the tip was perforated and forming inflammatory mass around the cecum (Fig. 4) and two patients were presented by intestinal obstruction (Fig. 5).

Meckel's scan was performed for 13 cases and was sensitive in 82.3% (Fig. 6).

The mean operative time was 71.4 minutes (ranges from 65 to 115 minutes). There was no intraoperative or postoperative complications, except for one patient, whose initial exploration was negative but the patient rebleed again after discharge and readmitted and diagnostic laparoscopy was repeated and the MD was identified and resected. Two patients had low-grade fever on the second day that was from minor atelectasis and resolved spontaneously with conservative treatment (Table 2).

Histopathology of the specimens showed ectopic gastric mucosa in 12 patients, and focal ulceration in 4 of them (Table 3).

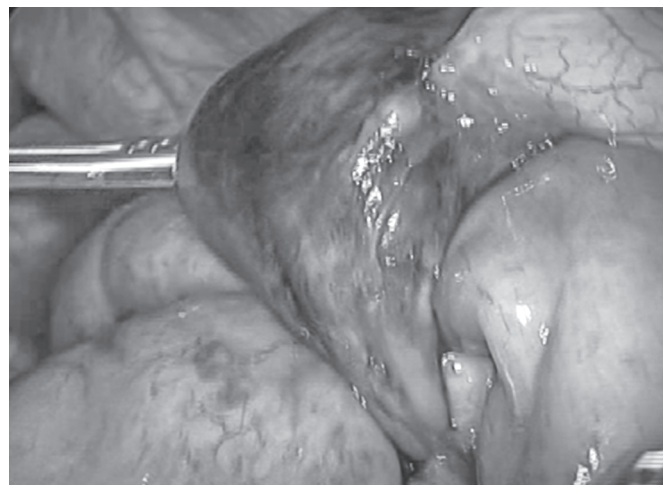


Fig. 3: Meckel's diverticulum forming inflammatory mass attached to the cecum

The median hospital stay was 3.8 days (range 4–7 days).

DISCUSSION

Recently, the use of laparoscopy in pediatric surgery has much more increased.^{7,8}

Complicated MD can be presented at any age. Infants and children are at highest risk, and >50% of symptomatic Meckel's diverticula occurring in children <2 years. Also, younger children (<4 years) are most commonly present with obstruction, as opposed to older patients who tend to present with bleeding.⁹

In our study, the most common presentation was bleeding and, the median age at diagnosis was 5.4 years (range 5–14 years). In a study performed by Palanivelu et al.,⁵ the age ranges from 6 to 43 years. Also, Rho et al.¹⁰ reported an age ranges from 7 days to 19 years.

Tc99m pertechnetate scan has been the investigation of choice in children with MD containing heterotopic gastric mucosa (HGM).¹⁰ Premedication with histamine-2 blockers or proton-pump inhibitors has been described to increase the diagnostic accuracy of the scan, the reported sensitivity of the Meckel's scan ranges from 60 to 90% with the specificity ranges from 90 to 98%.^{10,11}

Menezes et al.¹¹ published a retrospective study and assessed the sensitivity of the Meckel's scan in patients with severe GIT



Fig. 4: Perforated Meckel's diverticulum

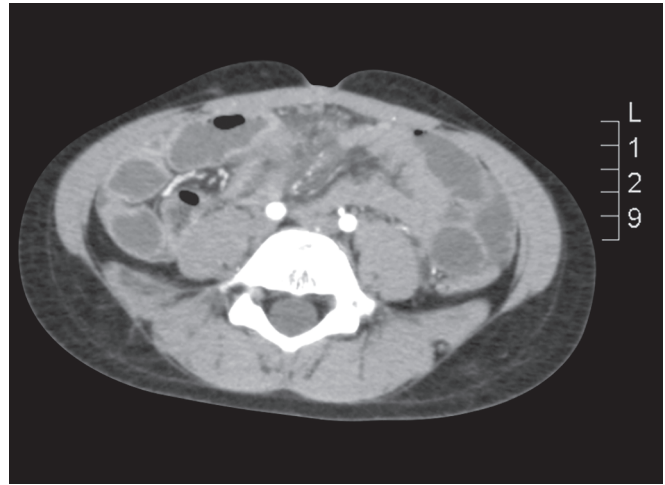


Fig. 5: Computed tomography scan showing irregular thick wall fluid collection with inflamed mesenteric fat plan (complicated urachal cyst vs Meckel's diverticulum)

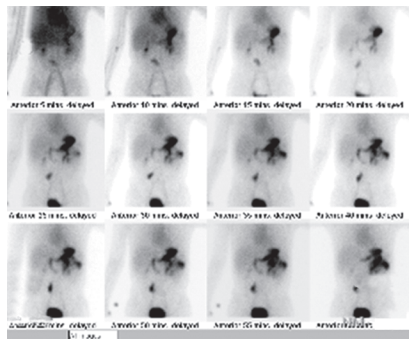


Fig. 6: Ectopic uptake of Tc99 by Meckel's diverticulum

Table 2: Types of surgery and complications

	Number	Percentage
Type of surgery		
Wedge resection	4	23.5
Segmental resection	13	76.4
Complications		
1—Conversion to minilaparotomy	1	5.8
2—Reexploration	1	5.8
3—Adhesive intestinal obstruction	1	5.8

bleeding. They report a sensitivity of 66.6% with a false-negative rate of 33.3%. In our study, MS was positive in nine patients (75%). False-negative results may be due to the absence of ectopic gastric mucosa, insufficient gastric mucosa to capture Tc99, or "wash out" phenomenon caused by accentuated intestinal transit time.¹¹

In our study, Meckel's scan was the first choice in cases presented by lower GIT bleeding which has been performed in 13 patients and was positive in 10 (76.9%) cases with bleeding per rectum and one case of chronic recurrent abdominal pain.

CT scan has been performed in three cases, one case who was presented by chronic abdominal pain and showed periumbilical mass that could be urachal cyst.

The other two cases were presented by acute abdominal pain and were diagnosed as acute appendicitis, so in the three cases, CT did not confirm the diagnosis.

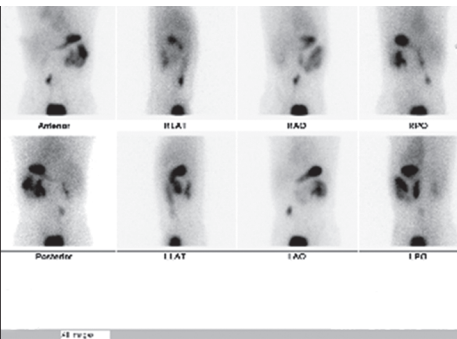


Table 3: Histology results

Histology	Number	Percentage
Ectopic gastric tissue	14	82.3
Ectopic pancreatic	1	5.8
Gastric and pancreatic	2	11.7

The incidence of heterotopic mucosa in MD varies from 15 to 50%. Shalaby et al.¹² reported that the incidence of HGM in MD was 77.8% in symptomatic and is much higher than asymptomatic cases of MD.

In our study, the incidence of ectopic gastric mucosa was 82.3%. This result could be attributed to the high incidence of bleeding MD in which the HGM varies from 80 to 100%.¹²

As Meckel's scan has false-negative and -positive rates, laparoscopy may have a great value for the diagnosis and surgical treatment.

The use of laparoscopy for the treatment of MD was first described by Attwood et al.¹³ who did laparoscopy-assisted diverticulectomy using a linear stapler device. Also it can be performed with the application of Roeder's loop on the base of the diverticulum, or with resection and intracorporeal suturing.^{5,12-15}

The advantage of laparoscopy-assisted excision of MD includes exteriorization of the bowel through the umbilical wound and palpation on the base of the diverticulum for the presence of ectopic mucosa, also the intestinal anastomosis can be performed

outside of the abdomen which is easy and associated with less risk for intra-abdominal contamination, also direct palpation on the base of the diverticulum and measurement of the height/diameter (HD) ratio could assist the plan of the surgical resection.^{6,12,16}

In order to achieve proper surgical plan, some authors studied the relationship between the location of ectopic gastric mucosa in the diverticulum and the external appearance of diverticulum and they conclude that in cases of long diverticula with a H/D ratio of >1.6 the heterotopic mucosa is only located in the distal area; so in these cases, simple diverticulectomy has been recommended. And in case of broad base or short diverticulum, resection of segment of the bowel containing the MD and an end-to-end anastomosis is preferred.¹⁶ In our study, we did resection anastomosis in 13 patients and wedge resection in 4 patients. In one case, we did laparoscopy-assisted diverticulectomy using linear stapler device was performed. It has been reported that adhesive intestinal obstruction is the most common complication after a Meckel's diverticulectomy, which occurs in 5 to 10% of the cases.^{12,13} In a study performed by Chan et al.,⁶ 20 patients underwent laparoscopy-assisted excision of MD and reported that none of the patients were readmitted for rebleeding or developed adhesive intestinal obstruction. In our series, we have conversion to minilaparotomy in one patient and reexploration in one patient in which the first diagnostic laparoscopy was negative and reexploration was performed due to recurrent lower GIT bleeding, and one patient develop adhesive intestinal obstruction which was managed by conservative treatment.

The limitation of the study is being retrospective in nature and small number of cases.

CONCLUSION

Laparoscopy-assisted resection of MD is minimally invasive, simple, and safe procedure that avoid the risk of intra-abdominal complication from bowel resection and anastomosis.

REFERENCES

1. Kher YR, Nadkarni SP, Rao GL, et al. Meckel's diverticulum. A clinico-pathologic study of 123 cases. *J Postgrad Med* 1974;20(1):1-9.
2. Kittle CF, Jenkins HP, Dragstedt LR. Patent omphalomesenteric duct and its relation to the diverticulum of Meckel. *Arch Surg* 1947;54(1):10-36. DOI: 10.1001/archsurg.1947.01230070013002.
3. Yahchouchy EK, Marano AF, Etienne JC, et al. Meckel's diverticulum. *J Am Coll Surg* 2001;192(5):658-662. DOI: 10.1016/S1072-7515(01)00817-1.
4. Kadian YS, Verma A, Rattan KN, et al. Vitellointestinal duct anomalies in infancy. *J Neonatal Surg* 2016;5(3):30. DOI: 10.21699/jns.v5i3.351.
5. Palanivelu C, Rangarajan M, Senthilkumar R, et al. Laparoscopic management of symptomatic Meckel's diverticula: a simple tangential stapler excision. *JSLs* 2008;12(1):66-70.
6. Chan KW, Lee KH, Mou JW, et al. Laparoscopic management of complicated Meckel's diverticulum in children: a 10 year review. *Surg Endosc* 2008;22(6):1509-1512. DOI: 10.1007/s00464-008-9832-0.
7. Rangel SJ, Henry MC, Brindle M, et al. Small evidence for small incisions: pediatric laparoscopy and the need for more rigorous evaluation of novel surgical therapies. *J Pediatr Surg* 2003;38(10):1429-1433. DOI: 10.1016/S0022-3468(03)00491-3.
8. Ure BM, Bax NM, van der Zee DC. Laparoscopy in infants and children: a prospective study on feasibility and the impact on routine surgery. *J Pediatr Surg* 2000;35(8):1170-1173. DOI: 10.1053/jpsu.2000.8720.
9. Park JJ, Wolff BG, Tollefson MK, et al. Meckel diverticulum: the mayo clinic experience with 1476 patients (1950-2002). *Ann Surg* 2005;241(3):529-533. DOI: 10.1097/01.sla.0000154270.14308.5f.
10. Rho JH, Kim JS, Kim SY, et al. Clinical features of symptomatic Meckel's diverticulum in children: comparison of Scintigraphic and Non-scintigraphic diagnosis. *Pediatr Gastroenterol Hepatol Nutr* 2013;16(1):41-48. DOI: 10.5223/pghn.2013.16.1.41 [PMID: 24010105].
11. Menezes M, Tareen F, Saeed A, et al. Symptomatic Meckel's diverticulum in children: a 16 year review. *Pediatr Surg Int* 2008;24(5):575-577. DOI: 10.1007/s00383-007-2094-4 [PMID: 18322689].
12. Shalaby RY, Soliman SM, Fawzy M, et al. Laparoscopic management of Meckel's diverticulum in children. *J Pediatr Surg* 2005;40(3):562-567. DOI: 10.1016/j.jpedsurg.2004.11.032 [PMID: 15793736].
13. Attwood SE, McGrath J, Hill AD, et al. Laparoscopic approach to Meckel's diverticulectomy. *Br J Surg* 1992;79(3):211. DOI: 10.1002/bjs.1800790306 [PMID: 1532525].
14. Cobellis G, Cruccetti A, Mastroianni L, et al. One-trocar transumbilical laparoscopic-assisted management of Meckel's diverticulum in children. *J Laparoendosc Adv Surg Tech A* 2007;17(2):238-241. DOI: 10.1089/lap.2006.0036 [PMID: 17484657].
15. Sai Prasad TR, Chui CH, Singaporewalla FR, et al. Meckel's diverticular complications in children: is laparoscopy the order of the day? *Pediatr Surg Int* 2007;23(2):141-147. DOI: 10.1007/s00383-006-1844-z [PMID: 17171378].
16. Prasad TR, Chui CH, Jacobsen AS. Laparoscopic-assisted resection of Meckel's diverticulum in children. *JSLs* 2006;10(3):310-316.