

# Laparoscopic Approach to Symptomatic Meckel Diverticulum in Adults

Maen Abul Hosn, MD, Moustafa Lakis, MD, Walid Faraj, MD, FACS,  
Ghattas Khoury, MD, FACS, FRCS, Samer Diba, MD

## ABSTRACT

**Background:** Meckel diverticulum (MD) is the most common congenital gastrointestinal malformation found in approximately 2% of the general population. MD manifests in adults as gastrointestinal bleeding, bowel obstruction, intussusception, or perforation in <5% of cases. There is no consensus on the ideal management strategy in symptomatic MD. Therefore, we searched the literature to highlight the role of laparoscopy in diagnosing and treating symptomatic MD.

**Method:** We used PubMed, Medline, Google Scholar, Ovid, and Cochrane data search engines looking for articles containing terms such as Meckel diverticulum, ectopic gastric mucosa, laparoscopic, technetium 99m pertechnetate, and acute management. We included articles reporting on case series in the English language on adult patients only and reporting on laparoscopic approach in the management of symptomatic MD.

**Results:** A total of 5 articles reporting on 35 cases were found. We report on the pooled data from these series with emphasis on number of patients, age, male to female ratio, length of stay, conversion to open procedure, method of resection, complications, first presentation, and confirmation of diagnosis preoperatively. We also compare the results of laparoscopic versus open approaches mentioned in the literature.

**Conclusions:** The laparoscopic approach was found to be effective as a diagnostic and therapeutic modality in patients with symptomatic MD; however, its adoption as the gold standard still needs further studies with larger patient numbers.

**Key Words:** Acute abdomen, Laparoscopic, Meckel diverticulum, Stapler, Technetium scan.

## INTRODUCTION

Meckel diverticulum (MD) is the most common congenital malformation of the gastrointestinal tract present in 2% of the population. MD manifests mainly in the pediatric age group as gastrointestinal bleeding, whereas in the adult population, it presents with perforation, obstruction, intussusception, hemorrhage, and to a lesser extent fistulae and tumors. Only 4% of the MD cases become symptomatic; therefore, its diagnosis still poses a challenge to the surgeon. It requires a high index of suspicion and when suspected, the technetium 99m pertechnetate is not often sufficient. Moreover, when it is not suspected, most adult patients are diagnosed intraoperatively during exploration. There is no consensus on the ideal management strategy in symptomatic MD, and our hypothesis was that laparoscopy might play a crucial role in such cases. In our study, we searched the literature for series reporting on the laparoscopic approach in the diagnosis and the management of MD in adult patients.

## METHODS

We used PubMed, Medline, Google Scholar, Ovid, and Cochrane data search engines looking for articles containing terms such as Meckel diverticulum, ectopic gastric mucosa, laparoscopic, technetium 99m pertechnetate, and acute management. We included articles reporting on case series in the English language on adult patients only. All pediatric series and case reports were excluded. We then manually searched the references of the articles found for more manuscripts to be included if they fit the inclusion criteria. This search yielded 5 manuscripts. We report on the pooled data from these series with emphasis on number of patients, age, male to female ratio, length of stay, conversion to open procedure, method of resection, complications, first presentation, and confirmation of diagnosis preoperatively.

General Surgery Division, American University of Beirut Medical Center, Beirut, Lebanon (Dr. Hosn, Lakis, Diba).

Clinical Surgery Department, American University of Beirut Medical Center, Beirut, Lebanon (Drs. Khoury, Faraj).

Address correspondence to: Moustafa Lakis, General Surgery Division, American University of Beirut Medical Center, Beirut Jnah, Adnan Hakeem Street, Sally Bldg 3rd floor, Beirut, Lebanon. Telephone: 00961 3 821415, E-mail: ml16@aub.edu.lb

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## RESULTS

The literature offers scarce published data on laparoscopic approach in symptomatic MD in adults. In our search, we found 5 series reporting on 35 cases with male to female ratio of 2.5 and weighted average age of 32 years. The most common presentation was acute abdomen presenting as either Meckel diverticulitis or volvulus (31 of 35 cases) and the others presenting as anemia and gastrointestinal bleeding (4 of 35 cases). The surgical intervention was either tangential/wedge resection or segmental bowel resection with a ratio of 23:12, respectively. All reported cases had a smooth postoperative course and were discharged home with a length of stay ranging between 3 and 5 days with no reported complications. There were 9 conversions (25.7%) to open surgery in the series.

## DISCUSSION

MD is the most common congenital malformation of the gastrointestinal tract secondary to persistence of the congenital Vitello-intestinal duct.<sup>1</sup> Management of incidental asymptomatic MD is controversial as it often depends on weighing the lifetime complication risk of MD versus the morbidity after incidental resection. Current literature supports MD resection in younger individuals, in cases when the diverticulum is longer than 2 cm and contains ectopic mucosa, and in the presence of an omphalomesenteric band at the tip posing a risk of torsion.<sup>2</sup>

As for symptomatic MD, bleeding due to ectopic gastric mucosa is the most common presentation seen in younger age groups, whereas in adults, the presentation is more acute and can be complicated by inflammation, obstruction, perforation, ulceration, and hemorrhage.<sup>3</sup> Meckel diverticulitis is postulated to begin with obstruction at the base of the diverticulum leading to distal inflammation and perforation with possible subsequent peritonitis and abscess formation.<sup>4</sup> This makes preoperative diagnosis of MD a challenging task. Upper and lower endoscopy play minimal roles because the MD is inaccessible for proper evaluation. Computed tomographic scan and ultrasonography have low sensitivity due to the appearance of the MD as a bowel loop, and inflammation of the MD may be easily mistaken for terminal ileitis or appendicitis.<sup>5</sup> The early prodrome of symptomatic MD is usually identical to appendicitis because both are midgut structures with inflammation provoking similar autonomic pain. As the disease progresses, localized peritonitis will be located at the site of inflamed MD, suggesting a pathologic process other than appendicitis.<sup>1</sup> Technetium 99m pertechnetate scan is currently of value and has a reported sensitivity and spec-

ificity of 85% and 95%, respectively, in children. In adults, however, a sensitivity and positive predictive value of only 60% have been reported, with a negative predictive value of 75%.<sup>6</sup> Furthermore, the presentation in adults is usually of an acute abdomen and that usually gives little time for preoperative imaging and diagnosis. As such, when the diagnosis of MD is suspected or the pathologic process is not clear, laparoscopic exploration is warranted to provide a definitive diagnosis and to avoid negative laparotomies. Ding et al<sup>7</sup> reported a series of 15 patients who presented acutely with perforated MD in which only 2 patients had a positive technetium scan preoperatively. The remaining patients were all explored laparoscopically based on the clinical suspicion of acute appendicitis. Rivas et al<sup>8</sup> also reported 4 adult patients who were operated on for symptomatic MD, only 1 of which had a positive technetium scan preoperatively. The remaining 3 patients were explored based on the clinical suspicion of MD despite negative workup.

Because obstruction at the base of the diverticulum is assumed to be the instigating event leading to Meckel diverticulitis, it is postulated that long, narrow base MD are more likely to be symptomatic than short, wide base ones are. This makes their clinical presentation almost indistinguishable from that of complicated appendicitis. In such instances, when laparoscopic exploration reveals a normal-looking appendix, Meckel diverticulitis should be suspected, and the small bowels should be examined starting from the ileocecal valve. Treatment of symptomatic MD revolves around resection of the affected area, including all hypertrophic gastric mucosa and any adjacent peptic ulcers. With the advent of endostaplers, laparoscopic resection of the diverticulum using linear staplers has been reported to be safe as long as the resected specimen is inspected to ensure all ectopic mucosa are removed.<sup>9</sup> An intraoperative frozen section can also be used for that intent.<sup>10</sup> An alternative would be wedge resection of the diverticulum with transverse suturing to avoid narrowing of the lumen. In their series, Palanivelu et al<sup>11</sup> reported 12 cases of MD, all of which were diagnosed intraoperatively and all were treated using endostaplers. Wedge resection was used only in cases when the base of the diverticulum was inflamed, taking part of the normal ileum without compromising its lumen. They reported no complications on long-term follow-up.<sup>11</sup> Laparoscopic exploration with tangential stapling was also used successfully in the 2 cases reported by Sarli et al<sup>12</sup> with 1 of the patients presenting with bowel obstruction secondary to a fibrous band attaching the diverticulum to the abdominal wall.

**Table 1.**  
Summary of the Pooled Cases

Series	Number	M/F	Ave Age, yrs	LOS	Conv	Type Wedge: Resection	Compl	Pres	Dx C
Ding <sup>7</sup>	15	11:4	38	4	6	9:6	none	acute	2
Palanivelu <sup>11</sup>	12	2:1	25	NA	NA	NA	NA	12 acute	1
Rivas <sup>8</sup>	4	3:1	39	3	1	0:4	None	3 anemia 1 acute	1
Sarli <sup>12</sup>	2	0:2	25	4	0	2:0	none	2 acute	0
Schmid <sup>13</sup>	2	1:1	20	5	2	0:2	none	1 acute 1 bleed	1

Abbreviations: Ave, average; Conv, conversion; Compl, complication; Dx C, diagnosis completed preoperatively; F, female; LOS, length of stay; M, male; NA, not applicable; Pres, presentation.

If, on the other hand, the base of the diverticulum is broad and wedge resection may cause significant luminal narrowing, or if the base is perforated or inflamed or in cases of bleeding ulcers, segmental bowel resection is warranted. In their series of 15 patients, Ding et al<sup>7</sup> used laparoscopically assisted extracorporeal bowel segment resection on 4 patients with broad base MD ( $\geq 2$  cm) and 2 patients with narrow base MD (<2 cm) whose perforation was near the base, whereas the other 9 patients with a narrow base MD underwent laparoscopic wedge resection of the diverticulum. Both groups had no reported intraoperative or postoperative complications with a comparable hospital stay.<sup>7</sup> Small-bowel resection with primary anastomosis has also been advocated in some series as the primary treatment option for MD with no apparent increase in morbidity. In the series by Rivas et al<sup>8</sup>, the small-bowel segment with the diverticulum was exteriorized through 1 of the ports or a minilaparotomy and segmental bowel resection with primary anastomosis was performed with no reported complications. Schmid et al<sup>13</sup> also reported 2 cases of MD where extraperitoneal resection of the small-bowel segment with primary anastomosis was done after exteriorizing it through the umbilical port.

Laparoscopic approach for symptomatic MD has been proven safe and feasible in pediatric population with a shorter length of stay as compared with an open approach (4.3 vs 5.7).<sup>14</sup> These results are comparable to the length of stay presented in **Table 1**.

The literature is scarce in respect to data about the superiority of the open versus laparoscopic approaches when treating symptomatic MD. However, laparoscopic exploration, when feasible and when no absolute contraindication is present, remains a valid surgical option. The available data on complicated appendicitis and diverticulitis show clear superiority of laparoscopy in the adult population.<sup>15</sup> These results may be extrapolated to include

symptomatic MD because the rarity of MD presentation in the adult population precludes prospective randomized multicenter trials to confirm similar superiority.

## CONCLUSIONS

The diagnosis of MD remains a challenge despite the advancement of imaging modalities. Traditional diagnostic tools including technetium scan seem to be unreliable in diagnosing complicated MD in the acute setting in adults and may even delay definitive management in certain instances. Laparoscopy appears to play a pivotal diagnostic role particularly when an intra-abdominal process is suspected and the diagnosis is doubtful. It also provides a minimally invasive approach for excision of the diverticulum either by using intra-abdominal linear staplers or by performing extracorporeal resection and anastomosis, both of which appear to carry minimal intraoperative or postoperative complications.

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