

# Meckel's Diverticulum: Wedge Excision vs Segmental Resection Anastomosis

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**Abstract:** *Meckel's Diverticulum (MD) is the commonest congenital anomaly of the GI tract but it is rarely diagnosed in adults. Hence, there is no agreement on what sort of resection to be performed for symptomatic MD and if to resect incidentally discovered MD. Definitive surgery is the treatment for symptomatic MD; it includes diverticulectomy, wedge, and segmental resection. The integrity of diverticulum base and adjacent ileum and the presence and location of ectopic tissue within MD are important factors to determine which surgical procedure to be performed. Due to the rarity of this condition in adults, in this article review we included various presentations of MD and their subsequent surgical management. Generally speaking, we recommend considering the length of the diverticulum (long vs short) and width of the base (narrow vs broad) to determine the appropriate surgical strategy in emergency presentation of MD.*

**Keywords:** Meckel's Diverticulum

## 1. Introduction

It was first described in 1809 by the German anatomist Johann Meckel [1].

Meckel's diverticulum is the remain of the yolk stalk (Vitellointestinal duct). The yolk sac of the developing embryo is connected to the primitive gut by the yolk stalk or vitelline (i.e. omphalomesenteric) duct. This structure ordinarily regresses by the seventh week of fetal life. If this regression fails, various abnormalities can occur. Meckel's diverticulum is the most important of these anomalies. MD is the most common congenital anomaly of the gastrointestinal tract in humans occurring in approximately 2% of the population with equal incidence in males and females [2].

It is often referred to by the rule of 2's; occurs in 2% of the population, presents before the age of two, located within 2 feet of the ileocecal valve, measures 2 inches long and contains two types of ectopic mucosa. It is located on the anti-mesenteric border of the ileum 45 to 60 cm proximal to the ileocecal valve and is usually 3–5 cm long [3]. It is a true diverticulum (possesses all the three layers of the small bowel wall) and has its separate blood supply from the superior mesenteric artery, which makes it prone to obstruction and infection like the appendix [3]. Since cell lining of vitelline duct are pluripotent, the heterotopic mucosa may contain gastric mucosa (50%), pancreatic mucosa (5%) and less commonly colonic mucosa, endometriosis, hepatobiliary tissue, which are responsible for other complications like chronic peptic ulceration, bleeding and perforation [2, 4, 5]. The majority of symptomatic MD are found to contain ectopic mucosa within the diverticulum. Asymptomatic MD are most often lined by normal intestinal epithelium.

A person with Meckel's diverticulum has a 4 – 6% lifetime risk of developing a complication [6, 7].

Common presentations in adult patients are: (a) intestinal obstruction, 36.5%; (b) intussusception, 13.7%; (c) diverticulitis and perforation, 12.7 and 7.3% respectively; (d)

hemorrhage, 11.8%; (e) tumor, 3.2% [5]. Age wise statistics reveals that hemorrhage is the most common presentation in children aged 2 years or younger [3, 8] and intestinal obstruction being the commonest among adults [9], although some studies have found reverse [10]. Overall, the complications have been found more common in males, with the ratios varying in different studies from 1.8:1 to 3:1 [11-13].

Symptomatic MD is found to result in disease that is an indication for surgical intervention, while asymptomatic is recognized during surgical procedures performed for other clinical findings and does not cause symptoms being indications for surgery. Definitive surgery is the treatment for symptomatic MD, it includes diverticulectomy, wedge, and segmental resection.

## 2. Methods

The type of procedure to be performed for resection of symptomatic MD depends on: (a) the integrity of diverticulum base and adjacent ileum; and (b) the presence and location of ectopic tissue. The presence of ectopic tissue cannot be precisely detected intraoperatively by palpation and gross appearance; 62% of MD with ectopic tissue, the ectopic tissue was not palpable neither recognisable based on gross wall thickening intraoperatively [10].

However, when present, ectopic tissues location can be predicted based on height-to-diameter ratio. Long diverticula (height-to-diameter ratio >2) have ectopic tissue located at the body and tip, whereas short diverticula (height-to-diameter ratio <2) have wide distribution of ectopic tissue including the base [14]. Consequently, categorization of MD in long and short, based on height-to-diameter ratio, can aid in decision making.

### Intestinal Obstruction:

Intestinal obstruction due to Meckel's diverticulum is the most common presentation in adult and is the second most common in children [9, 10]. There are various mechanism by which it can cause intestinal obstruction like (a) volvu-

lus of small intestine around the fibrous band extending from MD to umbilicus; (b) ileoileal and ileocolic intussusception; (c) incarceration of MD in an inguinal or femoral hernia known as complicated Littre's hernia; (d) axial torsion of MD with or without a fibrous band extending from MD to the mesentery or the umbilicus; (e) entrapment of small bowel beneath the blood supply of the MD known as a mesodiverticular band; (f) stricture secondary to chronic diverticulitis; (g) MD lithiasis (enterolith, bezoar); (h) entrapment of small bowel beneath a band extending from MD to the base of mesentery; (i) tumors (Lipomas, Carcinoid tumors and others) In cases of intestinal obstruction, the main aim of surgery is still to remove the MD by wedge or segmental resection along with correction of associated pathology, independent of the chosen surgical approach being either open or laparoscopic. If there is a volvulus around a fibrous band, untwisting of bowel along with division of band should be done. In case of intussusception, attempts to reduce such mass may be difficult, warranting resection of intussuscepted mass followed by primary anastomosis. However, in Littre's hernia, Meckel's diverticulum should be resected after reducing it followed by hernial repair [15]. For a mesodiverticular band, the small bowel is reduced, and the diverticulum along with its blood supply should be resected. Enterolith in Meckel's diverticulum should be resected en bloc with primary anastomosis [16].

#### Bleeding:

The most common presentation in children with a symptomatic MD is lower GI bleeding with occurrence rates as high as 50% [17], the mean age of presentation is 2 years, but bleeding may occur in older children and adults.

Bleeding is related to the presence of ectopic gastric and pancreatic mucosa which secretes HCL and pancreatic alkaline secretions causing ulceration of the adjacent mucosa of ileum. Colonization of *Helicobacter pylori* in this ectopic gastric mucosa has been reported but its role in pathogenesis of complication is yet to be established [18]. In adults other rare causes have been reported such as tumors [19]. The bleeding is usually painless and it may be brisk or massive resulting in bright red, brick red or black stool. This is perhaps attributable to slower colonic transit time in adults [20]. Technetium -99m pertechnetate radioisotope scintigraphy has been utilized universally for the diagnosis of bleeding MD and is at present the investigation of choice in a suspected Meckel diverticulum bleed [21]. Angiography is also useful for localization of the site of bleeding and specific diagnosis [12].

The aim of the surgery is to resect the MD all ectopic gastric mucosa, and any ulcerated adjacent ileum to prevent recurrent bleeding. During surgery if a narrow base without any mass in the lumen is found, then a wedge resection of the diverticulum with transverse closure of the ileum is the ideal method to prevent future stenosis. This can be also achieved by linear stapler close the ileum. But when the base is wide or mass of ectopic tissue is palpable or when there is inflammation, it is preferable to perform segmental resection of involved bowel followed by end-to-end anastomosis [4]. The reason behind this procedure is

from the observation that in short Meckel's diverticulum, ectopic mucosa can be seen even in the proximal part, as compared to long diverticulum where the mucosa has been found mostly in the apical area [22]. At the point when residual ectopic tissue is histologically affirmed after diverticulectomy for bleeding MD, reoperation for segmental resection is essential exclusively after bleeding remission as diverticulectomy does not increase the risk of post-operative bleeding [23,24].

#### Diverticulitis:

Diverticulitis represents 12.7% of the symptomatic MD and is common in adult patients [5]. Clinical manifestation similar to acute appendicitis and ought to be considered in the differential diagnosis of a patient with right lower quadrant pain. Therefore, when the appendix looks grossly normal during operation for acute appendicitis, exploration of distal ileum is essential to rule out complicated MD. Preoperative diagnosis is rare (4%); MD is a rare intraoperative finding during surgery for appendicitis with an incidence of 2.4% and a ratio of diverticulectomy to appendectomy of 1:55 [25]. Diverticulitis and perforation occur at a combined rate of ~7.3%; additional complications include abscess and fistula formation [26].

When indication of surgery is simple diverticulitis, diverticulectomy should be performed for long and wedge resection for short MD. When indication of surgery is complicated diverticulitis with perforated base, wedge, or segmental resection should be performed. And if perforation has occurred, thorough peritoneal toileting is done after resection [10, 14, 22].

#### Tumour:

Tumors in MD are very rare; occur in 3.2% of complicated MD [5]. Lipoma, Neuromuscular and vascular hamartoma are among the benign group [28-30]. In the malignant group, carcinoids are the most common tumor occurring with 44% of incidence [31, 27]. Others are mesenchymal-tumors (including gastro intestinal stromal tumors, leiomyosarcomas and peripheral nerve sheath tumors 35%), adenocarcinomas (16%) [27] and Desmoplastic small round cell tumor [32-34, 31, 35]. Lipoma can be dealt with simple diverticulectomy. Since Carcinoid tends to spread early (in 25% of cases), single, localized, asymptomatic nodules less than 1 cm are generally managed with diverticulectomy or segmental resection. Larger or multiple lesions require segmental resection of the bowel and its mesentery, and hepatic resection may be required for metastatic disease [36, 37].

#### Asymptomatic MD:

In incidentally discovered MD, routine resection is not indicated. The decision making should be based on risk factors for developing future complications, such as: (1) patient age younger than 50 years; (2) male sex; (3) diverticulum length >2 cm; and (4) ectopic or abnormal features within a diverticulum [10]. It is recommended to resect all incidental MD that fulfil any of these 4 criteria as when 1 criterion was met, the overall proportion of symptomatic

MD was 17% and when 2, 3, and all 4 criteria were met, the proportion increased to 25, 42, and 70%, respectively [10]. In this case, diverticulectomy should be performed for long and wedge resection for short MD [10]. Moreover, resection of incidentally discovered MD is not associated with increased operative morbidity and mortality [38].

### 3. Conclusion

MD is the most common congenital anomaly of the gastrointestinal tract but the life time risk of developing complications in this vestigial organ is 4 – 6%. Clinical manifestations arise from complications which require emergency treatment includes bleeding, obstruction, diverticulitis and perforation and the appropriate knowledge of various pathophysiologies by which a MD can cause complication should be kept in mind for the better management and to prevent recurrences. The diagnosis of symptomatic MD needs a high degree of suspicion as the preoperative clinical and investigational diagnosis is difficult to be made with accuracy. The type of procedure to be performed depends on: (a) the integrity of diverticulum base and adjacent ileum; (b) the presence and location of ectopic tissue within MD. For incidentally discovered MD, routine resection is not indicated. The decision making should be based on risk factors for developing future complications.

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