

An Update on the Management of Meckel's Diverticulum: Review Article

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Abstract: Meckel's diverticulum is a congenital gastrointestinal anomaly commonly seen in the pediatric age group. It can be divided into symptomatic and asymptomatic presentations, with the most common clinical presentation being gastrointestinal bleeding, intestinal obstruction, and perforation. The diagnosis uses imaging modalities like ultrasound or computerized tomography, with the technetium 99 scan and angiography reserved for complicated presentations. Meckel's diverticulum is treated by performing a diverticulectomy or resection, which can be performed as an open or laparoscopic procedure. The treatment of incidental Meckel's diverticulum is an area of controversy due to the absence of any guidelines on management.

Keywords: Meckel's Diverticulum, Diagnosis, Diverticulectomy, Segmental Resection, Laparoscopic Resection, and Complications.

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INTRODUCTION

Meckel's diverticulum is one of the most common congenital gastrointestinal malformations, with a reported incidence of 0.6% -4%. It is most commonly seen in the pediatric age group rather than in adults. The clinical symptoms are non-specific, with some presenting with abdominal pain, but the complications from Meckel's diverticulum include intestinal obstruction, bleeding, inflammation, and perforation. Bleeding is the most common complication that is seen in the pediatric age group, with obstruction being the most common complication in adults (Kuru & Kismet, 2018; Sancar *et al.*, 2015).

The diagnosis of Meckel's diverticulum is obtained by imaging modalities like ultrasound, computerized tomography, and magnetic resonance imaging. Nuclear medicine scans, like a technetium-99 pertechnetate scan (Meckel scan), are used for complications like bleeding Meckel's diverticulum, especially in the pediatric age group. Mesenteric angiography can be used in cases where the nuclear scan could not reveal the site of bleeding Meckel's diverticulum, but it requires a rate of 1ml per hour of

blood loss. Other investigative tools include capsule endoscopy and gastrointestinal contrast studies (Malik *et al.*, 2010; Nissen *et al.*, 2022; Pepper *et al.*, 2012).

The treatment of Meckel's diverticulum involves surgical resection, which can be performed as a segmental resection with anastomosis or a wedge resection with tangential stapling. Open surgery is often the most common type of surgical procedure that is performed, although a laparoscopic exploration and a mini laparotomy to conduct an extra-corporeal anastomosis to remove all ectopic tissue. The surgical treatment of complications like bleeding, obstruction, and perforation will involve laparotomy and bowel resection. The treatment of an incidental Meckel's diverticulum is controversial, with no recommendations on whether a diverticulectomy should be performed in these patients (Erol *et al.*, 2013; Fa-Si-Oen *et al.*, 1999.; Lequet *et al.*, 2017).

As there is no current consensus in the management of Meckel's diverticulum, we have conducted this review article looking into the diagnosis and management of Meckel's diverticulum. The role of laparoscopic surgery in the management of Meckel's

diverticulum and if asymptomatic or incidental, diverticulum should be surgically removed. We conducted a literature review using PUBMED, the Cochrane database of systematic reviews, Google Scholar, and Semantic Scholar, looking for randomized control trials, non-randomized trials, observational and cohort studies, clinical reviews, systematic reviews, and meta-analyses from 1980 to 2024. The following keywords were used: “Meckel’s diverticulum”, “Diagnosis”, “Diverticulectomy”, “Segmental resection”, “laparoscopic resection”, and “complications”. All articles were in English, and all articles were assessed by manual cross-referencing of the literature. Commentaries, case reports, and editorials were excluded from this review. Adult and pediatric patients were included in this study.

DISCUSSION

The Diagnosis of Meckel’s Diverticulum

The clinical presentation of symptomatic Meckel’s diverticulum includes symptoms of intestinal obstruction, gastrointestinal bleeding, and signs of acute peritonitis secondary to perforation of the Meckel’s diverticulum (Fu *et al.*, 2021). These symptoms are commonly seen in pediatric patients and older adults, with the length of the Meckel’s diverticulum being a factor in these complications and the subsequent surgical management (Jarboa *et al.*, 2024).

A systematic review on the epidemiology, presentation, and management of Meckel’s diverticulum was conducted by Hansen *et al.*, A total of ninety-two articles were included, and symptoms were present in 4% to 9% of cases. Meckel’s diverticulum was four times more common in males. Obstruction was the most common complication. Ectopic gastric tissue was the most common histology of Meckel’s diverticulum (C. C. Hansen & Søreide, 2018).

Meckel’s diverticulum is diagnosed with imaging modalities, with ultrasound being the first imaging modality that is usually performed. Ultrasound may demonstrate the Meckel’s diverticulum as a blind

ended tubular structure, but it has a low sensitivity. Computerized tomography is more sensitive in identifying the blind-ended triangular or tubular structure, but it is used in the diagnosis of complicated Meckel’s diverticulum, and it has a 47.5% chance of detecting an asymptomatic Meckel’s diverticulum (Chatterjee *et al.*, 2017; Kawamoto *et al.*, 2015). Scintigraphy in the form of Technetium pertechnetate scan has limited value in the diagnosis of Meckel’s diverticulum, but it can detect diverticula with ectopic gastric mucosa and aid in the diagnosis of complicated Meckel’s diverticulum (Elsayes *et al.*, 2007). The diagnostic accuracy of the technetium pertechnetate scan is at 90% for the diagnosis of Meckel’s diverticulum (Farrell & Zimmerman, 2020).

A systematic review and meta-analysis were conducted by Yan *et al.*, on the role of Technetium 99 scan for pediatric bleeding Meckel diverticulum. A total of sixteen studies with 1115 patients were included in this study, and the combined sensitivity and specificity of this scan were 0.80 and 0.95, respectively. This study showed that Technetium 99 scan was highly specific but moderately sensitive in the diagnosis of bleeding Meckel’s diverticulum (Yan & Jiang, 2023).

Capsule endoscopy has been used as a diagnostic tool to diagnose Meckel’s diverticulum, and the appearance of a double-lumen appearance, the partial disappearance of normal mucosa, and the retention of the capsule endoscopy (Lin *et al.*, 2019). A systematic review was conducted by Hansen *et al.*, on Meckel’s diverticulum discovered by capsule endoscopy. A total of thirty-three studies with forty-three cases were included in this review, and this study concluded that capsule endoscopy can be used to diagnose Meckel’s diverticulum, and the double lumen appearance was the most common sign. But this study did highlight the high number of prior negative investigations that were performed before capsule endoscopy was performed; hence, capsule endoscopy may have a role in the diagnosis of Meckel’s diverticulum, but further studies may be needed to evaluate this (L. Ø. Hansen *et al.*, 2025).

Table 1

Study	Study type	Year	Prevalence Rate (%)
Hansen <i>et al.</i> ,	Systematic Review	2018	0.3-2.9%
Yagnik <i>et al.</i> ,	Systematic Review	2024	1.2%

Table showing the prevalence rate of Meckel’s diverticulum

Treatment of Meckel’s Diverticulum

The surgical management of Meckel’s diverticulum involves performing a diverticulectomy or resection. Diverticulectomy can be performed via a stapler or open method, and the choice between performing a diverticulectomy or resection will depend on the patient’s clinical situation (Mendelson *et al.*, 2001; Mora-Guzmán *et al.*, 2019). The surgical management of complications of Meckel’s diverticulum, like bleeding,

perforation, and obstruction, is by surgical resection rather than a diverticulectomy. Laparoscopic diverticulectomy can be performed with the use of staplers to resect the diverticulum, but the lack of ability to palpate the resected margins for ectopic tissue has limited its use. Laparoscopic-assisted trans umbilical diverticulectomy (LATUM), however, allows for palpation of the diverticulum and assessment of the base and can lead to a better assessment of ectopic tissue

(Alemayehu *et al.*, 2014; Hosn *et al.*, 2015; Palanivelu *et al.*, 2008; Sharma & Jain, 2008).

Chan *et al* looked at the role of laparoscopic excision of Meckel's diverticulum in children, and it was reported to be safe and effective. Extracorporeal diverticulectomy was favored rather than intracorporeal diverticulectomy due to its reduced cost and ease of performing it (Chan *et al.*, 2014). A systematic review was conducted by Redman *et al.*, comparing laparoscopic diverticulectomy or laparoscopic-assisted resection of symptomatic Meckel diverticulum in children. Eleven studies with 248 patients were included in this study, and they concluded that there was no significant difference between the two procedures, but diverticula that are larger than 2cm and with a broad base would benefit from a laparoscopic-assisted resection (Redman *et al.*, 2020).

Papparella *et al.*, retrospectively assessed the laparoscopically assisted Meckel's diverticulectomy in children. A total of thirteen patients were included in this study. There were no major complications, and the length of hospital stay was five to seven days. This study showed that trans umbilical laparoscopic-assisted Meckel's diverticulectomy was safe and effective in the treatment of Meckel's diverticulum (Papparella *et al.*, 2014).

Asymptomatic Meckel's Diverticulum

The treatment of an incidentally identified Meckel's diverticulum is an area of controversy, with surgical resection being encouraged in male patients who are below the age of fifty, a diverticulum that is larger than 2cm, has a narrow neck, and the tip of which is connected to the umbilicus, and the macroscopic appearance of ectopic tissue (Bani-Hani & Shatnawi, 2004; Hernández *et al.*, 2023; Lindeman & Søreide, 2020; Önen *et al.*, 2003; Tauro *et al.*, 2010; Zulfikaroglu *et al.*, 2008; Zyluk, 2019). Rahmat *et al.*, conducted a review to see if an incidental Meckel's diverticulum warrants resection. A total of thirty-one studies were included, and they concluded that an incidental Meckel's diverticulectomy should be performed in high-risk patients (Rahmat *et al.*, 2020).

A systematic review was conducted by Zani *et al.*, on the treatment of an incidentally detected Meckel's diverticulum. A total of 244 studies were included, and the prevalence of Meckel's diverticulum was 1.2%, and the mortality was 0.01%, hence leaving an incidental Meckel's diverticulum reduces the risk of late complications. This study concluded that an incidental diverticulectomy should not be performed (Zani *et al.*, 2008). Another systematic review was conducted by Yagnik *et al.*, on should an incidental Meckel's diverticulum should be resected. Forty-two studies with 2934 cases were included in this study. The morbidity rate was 5.69%, and there were no mortalities due to the surgical resection of the Meckel's diverticulum. This

Study recommended resection, but after evaluating the patient's characteristics and primary disease (Yagnik *et al.*, 2024).

The largest case series on Meckel's diverticulum was conducted by the Mayo Clinic by Park *et al.*, A total of 1476 patients were included, and 16% were symptomatic, and the asymptomatic group was predominantly seen in male patients. This study could not recommend whether an incidental Meckel's diverticulum should be removed or not. A diverticulectomy was recommended if the patient was younger than 50 years, a male patient, a diverticulum that is larger than 2cm, and the histological presence of ectopic tissue (Park *et al.*, 2005).

A systematic literature review on malignancy and Meckel's diverticulum was conducted by Van Malderen *et al.*, A total of four hundred and two patients were included in this study, and 5% of all resected Meckel's diverticulum specimens were associated with malignancy, with neuroendocrine tumors being the most common histological type and seen in 84.6% followed by stromal tumors at 8.2% and adenocarcinoma at 6% (van Malderen *et al.*, 2018).

CONCLUSION

Meckel's diverticulum is one of the most common congenital anomalies that affect the gastrointestinal tract, and it is commonly seen in the pediatric age group rather than adults. Symptomatic Meckel's diverticulum is associated with complications like bleeding, perforation, and obstruction. The management of Meckel's diverticulum is either by performing a diverticulectomy or resection, and they can be performed as an open or laparoscopic procedure. There is no consensus on the management of asymptomatic or incidental Meckel's diverticulum, with surgical resection being decided by the treating surgeon.

Conflict of Interest: There is no conflict of interest.

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