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Meckel diverticulum with combined pancreatic and gastric heterotopia – Its significance, clinical and pathologic presentations and literature review

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Abstract

Background and objectives: Meckel diverticulum (MD) is a common congenital anomaly, but the presence of combined gastric and pancreatic heterotopia within it is exceedingly rare, reported in less than 2% of cases. This unique presentation is often associated with significant clinical symptoms and complications compared to typical MD. This manuscript aims to highlight the extreme rarity of MD presenting with combined gastric and pancreatic heterotopia, integrate findings from a comprehensive literature review with an institutional case, and delineate optimal diagnostic and management strategies for this condition.

Methods: A systematic literature search was conducted using databases such as PubMed and Google Scholar with keywords including "Meckel diverticulum" and "combined heterotopia" to identify previously reported cases of MD containing both pancreatic and gastric heterotopic tissues. The compiled information from these identified cases was reviewed and integrated with an institutional case. Statistical methods were not applicable for this descriptive review.

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Results: The systematic literature search revealed fewer than twenty documented cases of Meckel diverticulum with combined gastric and pancreatic heterotopia. Findings from the literature and the institutional case indicate that, unlike asymptomatic MD, those with combined heterotopia are typically symptomatic, often presenting with gastrointestinal bleeding or bowel obstructions. Histopathologically, these cases demonstrate distinct gastric oxyntic-type mucosa and pancreatic acini with islets of Langerhans and small ducts. Imaging studies, such as CT scans, were found to be neither sensitive nor specific for diagnosing this combined heterotopia, particularly for diverticula smaller than 3 cm.

Conclusions: Meckel diverticulum with combined gastric and pancreatic heterotopia is an exceptionally rare entity that is more prone to symptomatic presentation and complications compared to other types of MD. Given the increased risk of complications, if incidentally diagnosed through imaging studies or biopsy, a complete resection may be considered the preferred management option when heterotopia is identified.

Keywords: Meckel diverticulum. Gastric heterotopia. Pancreatic heterotopia. Combined heterotopia. Congenital anomaly; Surgical management. Gastrointestinal bleeding.

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Background and etiology

By definition, Meckel diverticulum (MD) is a remnant of the omphalomesenteric duct that normally disappears during embryogenesis (1). It is considered a true diverticulum as it contains all the layers of the bowel wall (1). The most common heterotopic tissue found in MD is gastric, followed by pancreatic tissue (3). The presence of both gastric and pancreatic tissue is extremely rare, occurring in up to 2% of cases in the general population (4), and is mainly identified in the duodenum, rarely in MD (5). This manuscript aims to highlight the extreme rarity of MD presenting with combined gastric and pancreatic heterotopia, integrate findings from a comprehensive literature review with our institutional case, and delineate optimal diagnostic and management strategies.

The definite etiology of MD is not clearly known. The proposed etiologies include congenital abnormalities during embryogenesis and development that affect the rotation of the foregut and the fusion of dorsal and ventral pancreatic buds (6). The primary embryologic theory for the presence of heterotopic tissue in a MD involves the pluripotent cell differentiation theory. The omphalomesenteric duct, from which the diverticulum forms, contains pluripotent cells. These cells can mature into various different cell types, including the ileal tissue that typically lines the diverticulum. However, they can also infrequently mature into heterotopic tissues such as gastric tissue and, less commonly, pancreatic tissue (7).

Another proposed etiology is a metaplastic process, where mature intestinal cells within the diverticulum are replaced by other mature cell types, such as gastric and pancreatic tissue, usually in response to an abnormal stimulus or chronic irritation (8). The pluripotent cell theory

is more widely accepted because it better explains the frequent presence of multiple types of ectopic tissue within a single diverticulum.

Methods

A systematic literature search was performed to identify reported cases of MD containing both pancreatic and gastric heterotopic tissues. The search was conducted using the databases PubMed and Google Scholar, covering the period from their inception up to September 2025. The exact search terms used were: "Meckel diverticulum" AND "combined gastric and pancreatic heterotopia".

This focused search strategy, while systematic, did not follow all the steps outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, as it was designed to be a narrative review of case reports rather than a comprehensive systematic review. The search revealed fewer than twenty such cases in the literature. The compiled information from these identified cases is presented in Table 1.

Clinical presentations

If MD remains present after birth, it is mostly non-symptomatic. Overall, 4% of MD appear to become symptomatic [7]. If it becomes symptomatic, common presentations may include abdominal pain and accompanied melena and bloating. The outcome of the symptomatic MD may end in inflammation (diverticulitis), obstruction, hemorrhage or less likely perforation. Perforation could be a complication per se or a complication following acute out inflammation [8]. It has been documented that a perforated Meckel's diverticulum

containing pancreatic and gastric heterotopia can be clinically misdiagnosed as acute appendicitis, leading to a delay in proper treatment [9]. Intussusception resulted from MD appears to be extremely rare. This is consistent with case reports, such as one documenting an infant with combined ileal heterotopic pancreatic and gastric tissues causing ileocolic intussusception [10]. Other uncommon presentations may include peptic ulcer, melena or depending on the size, with mass effect and polypoid presentations [11]. Ulcer, if present, most likely is identified at the junction of gastric and small bowel (ileal) mucosa. The presence of ulcer may depend on the proportional size of gastric versus pancreatic components and their counter producing secretions. Malignant transformation or concomitant neuroendocrine neoplasms may rarely be encountered [12]. Other, rare presentations of MD may include Littre's hernia [13] or entrovesical fistula [14]. Literature says that in contrary to the usual MD, a MD with combined pancreatic and gastric heterotopia is usually symptomatic and causes significant clinical presentations and complications like gastro-intestinal bleeding or bowel obstructions.

Histopathologic findings

Heterotopic gastric and pancreatic tissues are present. Figure 1 shows a combined a pancreatic and gastric heterotopia. The gastric mucosa shows a normal-appearing gastric oxyntic-type mucosa. The pancreatic mucosa shows normal-appearing pancreatic acini including islets of Langerhans and small ducts. The two mucosae are separated with a tiny rim of loose, congested stroma. No significant atypia is noted.

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Anatomical findings

MD is most commonly identified on the anti-mesenteric side of the ileum [15]. Very rare other anatomical findings of MD may also include the mesenteric side [16].

Radiologic and imaging findings

Imaging studies appear to be neither sensitive nor specific for identifying the combined heterotopia. CT-scan may not be an optimal diagnostic modality when the size of the MD is smaller than 3 cm. Described cases in the literature highlights the limitations of modern imaging, as a CT scan with IV contrast was non-diagnostic despite the presence of a ruptured and inflamed MD [2].

Differential diagnosis

Differentiating a MD with combined gastric and pancreatic heterotopia from other intestinal anomalies is challenging and often relies on surgical pathology. Histopathological examination is the definitive diagnostic method, revealing both gastric and pancreatic tissue within the diverticular wall. While technetium-99m pertechnetate scintigraphy can help detect the ectopic gastric mucosa, it cannot identify the pancreatic component, and cross-sectional imaging (CT or MRI) is often non-specific, typically showing a blind-ending pouch, but may suggest a duplication cyst if it's located on the mesenteric border and lacks communication with the ileal lumen.

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Management

Incidental, asymptomatic finding of a MD during imaging studies is suggested to be left alone, as potential post-operative complications may exceed the benefit. Some risk factors are considered high risk factors in patients with MD and may prone the patient for more significant complications if left untreated. These include; age <50 years, male gender, length of MD more than 2 cm and MD with heterotopia. In this circumstance, if incidental MD identified, a resection approach is suggested. The resection approach may range from endoscopic resection to extended approach of distal small bowel resection, wedge resection and diverticulectomy [17].

In summary, generally, surgical resection is the standard treatment for complicated MD, while the management of incidental MD is still debated, though current evidence seems to lean toward resection [18]. While MD is widely resected when symptomatic, the prophylactic removal of an asymptomatic MD remains highly debated. The presence of heterotopic tissue, such as gastric or pancreatic mucosa, is one of the strongest arguments for resection as it's a key risk factor for future complications.

Overall, drawing definitive conclusions about this condition (combined hetrotopia) is challenging. The rarity of combined heterotopic tissue within MD, along with potential publication bias and the wide variety in reported cases, means that current evidence is limited. As a result, any decision to resect an asymptomatic MD must be carefully weighed, considering the individual patient's risk factors and overall health.

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Conclusion

Since MD with combined pancreatic and gastric heterotopia is overall more symptomatic that other types of MD, at also considering any heterotopia causes a MD to be more prone to complications if left untreated, it is suggested if incidentally through imaging studies or biopsy diagnosed, a complete resection approach is the management modality of choice.

Abbreviations

MD: Meckel's diverticulum.

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Summary of Meckel's Diverticulum Diagnosed Cases with Combined Pancreatic and Gastric Heterotopia

Source, Year	Number of Reported Cases	Age	Gender	Clinical presentations	Imaging findings	Management
Beck CW et al, 1957	1	55 years	Not reported	Abdominal pain	Not reported	Surgical removal
Jiang K, 2015	1	65 years	Male	Obstructive tumor of ileum	CT: 7-cm obstructive tumor; Double balloon enteroscopy: submucosal mass	Resection with double balloon enteroscopy
Abizeid GA, 2017	1	Not reported	Not reported	Perforation	Preoperatively diagnosed (imaging not detailed)	Surgical intervention (implied by perforation)
Shemer A, 2018	1	42 years	Female	Abdominal pain, signs of peritonitis	CT: Inflamed Meckel's diverticulum	Surgical resection of Meckel's

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						diverticulum

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						Surgical resection of Meckel's diverticulum
Rosado M, 2021	1	Not reported	Not reported	Ruptured Meckel's diverticulum	CT: Negative for diverticulum but showed signs of free fluid	Surgical intervention (implied by rupture)
Singh T, 2021	1	18 months	Female	Intussusception	Ultrasonography: Target sign suggesting intussusception	Surgical reduction and resection
Locurto P, 2023	1	Not reported	Not reported	Bowel obstruction	Not specified in detail for this specific case	Surgical excision (laparoscopic)
Pahlavan PS 2025 (current case)	1	< 2-year-old	Not specified	Acute onset of lower gastrointestinal bleeding	Ultrasound: Suggested potential intussusception	Laparoscopy and mini-laparotomy with diverticulum resection

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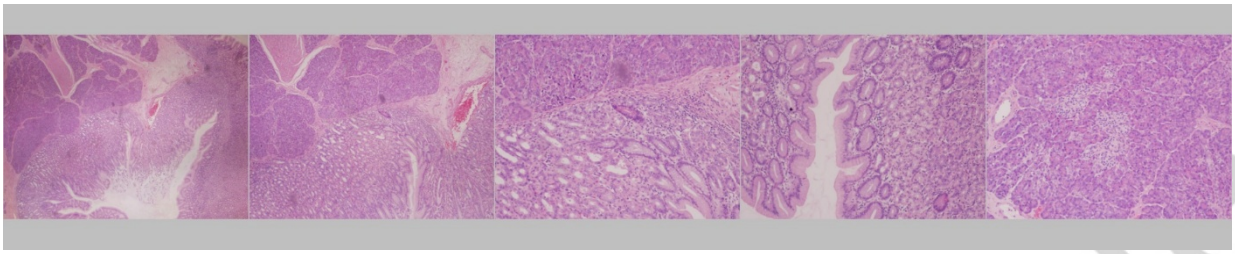

A pediatric patient, less than 2 years of age, presented with an acute onset of lower gastrointestinal bleeding. Initial imaging studies suggested a potential intussusception. The patient's preoperative lab results were notable for low hemoglobin (9.1 g/dL), low hematocrit (27.8%), and a low red blood cell count (3.39×106/mcL), as well as a high white blood cell count (18.6×103/mcL) and low total protein (5.9 g/dL). A diverticulectomy was performed, revealing a diverticulum in the mid-ileum. Intraoperatively, the diverticulum was found to be adherent to the bladder and the right pelvic sidewall, suggesting prior or current Meckel's diverticulitis. Follow-up a few months after the operation revealed no significant side effects.

Gross examination of the resected specimen showed an outpouching of the small bowel with an inflamed external surface, a thickened wall, and a narrow opening. The internal lining appeared erythematous. Microscopic examination confirmed a combined pancreatic and

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gastric heterotopia. The pancreatic tissue contained characteristic acini and islets, while the gastric mucosa was of the oxyntic-type, lined with foveolar cells on its surface. These two mucosal types were separated by an edematous, congested stroma. No significant atypia was noted.

The series of five images, presented from left to right, depict the pathological findings at varying magnifications: 2X, 4X, 10X, 10X, and 10X, with the fourth image showing the gastric component and the fifth image highlighting the pancreatic component of the heterotopia.