

Bleeding Meckel's Diverticulum

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Abstract: A 27-year-old gentleman presents with haematochezia for investigation. Computed tomography (CT) of the abdomen, nuclear medicine (NM) scintigraphy and balloon enteroscopy revealed a Meckel's diverticulum, for which he underwent a laparoscopic resection. The patho-physiology, presentation, complications, radiological investigations and surgical management of Meckel's diverticulum will be discussed.

1. CASE REPORT

Mr Y is a 27-year-old Chinese male with no significant co-morbidity. He had previously presented to another hospital in 2012 for haematochezia of unknown etiology. Computed tomography (CT) mesenteric angiogram then did not reveal any blush. Colonoscopy showed an entire colon coated with blood and clots, including the distal 15cm of the terminal ileum but there was no diverticular disease or angiodysplasia. Oesophago-gastro-duodenoscopy (OGD) was normal. Subsequent capsule endoscopy showed blood clots at proximal ileum but patient refused plans for balloon enteroscopy and defaulted follow-up.

He re-presented to our institution in June 2014 for multiple episodes of spontaneous haematochezia. Clinically, he was normotensive without tachycardia and without signs of hypovolemic shock. Digital rectal examination showed altered blood with no masses felt. His haemoglobin level was 11.9 g/dL with no coagulopathy. Transfusion was commenced and an urgent CT mesenteric angiogram showed suspicion of a Meckel's diverticulum with mucosa enhancement and surround reactive ileus (Figure 1). There was no contrast extravasation. Subsequently, a retrograde single balloon enteroscopy was performed and revealed a distal ileum ulcer and a proximal ileum diverticulum. Ileal biopsies showed features suggestive of gastric pyloric metaplasia while biopsies sent for tuberculosis polymerase chain reaction (PCR) returned as negative. A nuclear medicine (NM) Meckel's scintigraphy combined with SPECT (single photon emission computed tomography) showed focal uptake in the right hemi pelvis, behind the urinary bladder, hence positive for Meckel's diverticulum (Figure 2).



Figure1. Meckel's diverticulum on CT abdomen

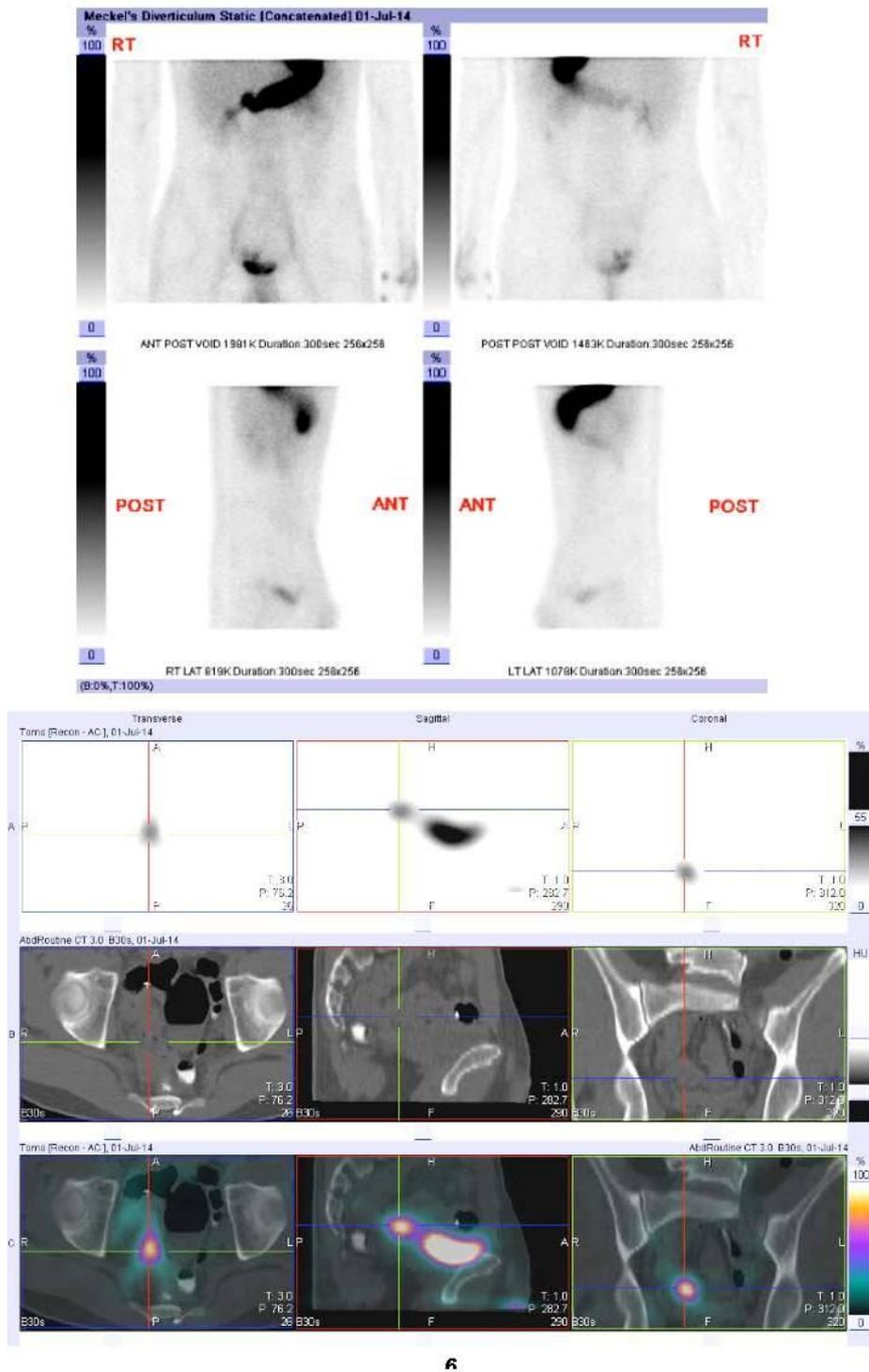


Figure 2. NM scintigraphy (below) with SPECT (bottom) showing focal uptake in the right hemi-pelvis, behind the urinary bladder

Patient was counseled and he consented for an elective totally-laparoscopic resection of Meckel's diverticulum. Intra-operatively, running of the small bowel from ileo-caecal valve to duodenal-jejunal flexure was performed and the Meckel's diverticulum was identified at 62cm from the ileal-caecal valve (Figure 3). An ileal ulcer with mild surrounding hypertrophy was also identified at 20cm from ileal-caecal valve. This ulcer was previously seen at the pre-operative retrograde balloon enteroscopy. Hence, a total small bowel length of 48cm was resected, incorporating both the ileal ulcer with Meckel's diverticulum (Figure 4). Subsequently, an intra-corporeal functional end-to-end stapled anastomosis of the remaining jejunum to ileum was performed. Post-operative recovery was uneventful and the patient was discharged well postoperative day 2. Specimen histology was that of a Meckel's diverticulum which contained both ectopic gastric and pancreatic tissue, with no evidence of inflammation, dysplasia or malignancy.



Figure3. *Laparoscopic view of Meckel's diverticulum*

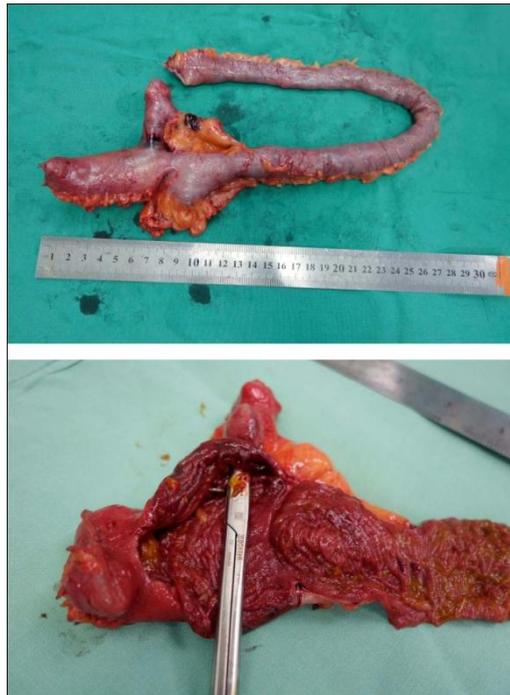


Figure4. *Resected specimen (below) and a view of the specimen cut open (bottom)*

2. DISCUSSION

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract and is found in about 2% of the general population [1-2]. It was first described in 1809 by Johann Friedrich Meckel and is affectionately taught early in medical school as the "Rule of Twos": it is usually found within 2 feet of the ileal-caecal valve, in 2% of the population, with 2 possible heterotopic mucosae (gastric or pancreatic), 2 times as prevalent in men compared with women, wherein only 2% become symptomatic, usually within the first 2 years of life.

3. PATHO-PHYSIOLOGY

Meckel's diverticulum contains all three layers of the intestinal wall and is a true diverticulum. It originates from the anti-mesenteric border of the distal ileum and arises due to incomplete closure of omphalo-mesenteric duct. In majority of such cases, the diverticulum is seen within 100cm from the ileal-caecal valve and it can be of variable lengths and widths, with lengths as long as 10cm. Meckel's diverticulum can contain heterotopic mucosa, commonly of gastric or pancreatic origin. Duodenal and jejunal mucosa are less commonly seen. Vascular supply to the diverticulum is mostly from the omphalo-mesenteric artery, which arises from one of the ileal branches of the superior mesenteric artery.

4. PRESENTATION AND COMPLICATIONS

Most Meckel's diverticula remain asymptomatic over the course of a patient's lifetime but may be discovered incidentally at operation or with an imaging study. When symptomatic, it is the result of bleeding, bowel obstruction, diverticulitis and very rarely, neoplasia. Gastrointestinal hemorrhage is a

serious presentation and is more common and more severe in children. The bleeding is due to presence of heterotopic gastric mucosa with resultant ulceration. Another common complication is acute diverticulitis of varying degrees. The orifice of the diverticulum may get blocked by an enterolith or foreign body and may result in stasis and infection. The diverticulum may also undergo torsion, resulting in inflammation or ischemia. Acute inflammation of the Meckel's diverticulum is a well-known mimic of acute appendicitis. Many other conditions involving the lower abdomen and pelvis can present with similar complaints, making the diagnosis extremely difficult on the basis of clinical examination. Severe cases of inflammation may result in perforation and is a life-threatening complication. Small bowel obstruction is also a well-known complication and can occur due to twisting of the bowel, at the site of the diverticulum. Larger-size diverticula have a higher chance of causing obstruction and may also be associated with intussusception. Rarely, a Meckel's diverticulum becomes incarcerated in an inguinal hernia, known as Littre's hernia. Although rarely seen, a large Meckel's diverticulum may invert within the distal ileum and cause obstruction. Carcinoid tumour arising within a Meckel's diverticulum is rare, although it is the most commonly associated neoplasm. Malignant neoplasms arising from the diverticulum are extremely rare [2].

5. RADIOLOGICAL INVESTIGATIONS

Imaging plays an extremely important role in evaluating patients with a suspected Meckel's diverticulum. Plain radiographs of the abdomen are usually unremarkable, unless there are features of intestinal obstruction. This is however, uncommon. Ultrasound evaluation is often performed in children as the first imaging modality but diagnosis is extremely difficult. A Meckel's diverticulum has appearances similar to the appendix, although in a different location. It is identified as a blind-ending, tubular echogenic structure, having clear communication with a small bowel loop. Contrast-enhanced CT of the abdomen plays a very important role in diagnosis and can also identify associated complications in a majority of the cases. The diverticulum is identified as a blind-ending tubular structure arising from the anti-mesenteric border of the ileum, a short distance proximal from the ileo-caecal junction. The diverticulum may show intraluminal fluid, air or enteroliths. Increased mucosal enhancement and wall thickening are signs of inflammation. Poor mucosal enhancement is seen in ischemia. Acute diverticulitis is identified by increased mucosal enhancement, wall-thickening, surrounding soft tissue stranding and fluid. Severe inflammation or ischemia can result in perforation with evidence of localized or generalized free air in the peritoneal cavity. If there is associated small bowel obstruction, careful evaluation of the transition zone is important to identify presence of a diverticulum. CT mesenteric angiogram may be performed to identify any active contrast extravasation, in cases presenting with gastrointestinal hemorrhage. Tumours of the Meckel's diverticulum have non-specific imaging features and are identified as intra-luminal or intra-mural enhancing soft tissue. It is important to identify any involvement of the adjacent small bowel loops, as a marker for malignant change. Angiographic studies may also be performed in cases of severe gastrointestinal bleeding and it may identify the omphalo-mesenteric artery. This is however, difficult due to the need for selective catheterization of the distal ileal arteries, as the omphalo-mesenteric artery most commonly originates from the mid-distal branches of the superior mesenteric artery.

Nuclear medicine (NM) scintigraphy studies also play an important role in identifying Meckel's diverticulum. However their role is limited to cases with heterotopic gastric mucosa. The overall diagnostic accuracy in these cases may be up to 90% [1]. The overall sensitivity of a technetium 99m pertechnetate scan is about 60% in cases of Meckel's diverticulum. There is uptake of pertechnetate by the gastric mucosal cells and by the ectopic gastric mucosa, in the diverticulum and this uptake gradually increases on subsequent phases of imaging. It is important to correlate the findings of the NM scintigraphy study with CT imaging, as many of these cases are a diagnostic challenge.

6. SURGICAL MANAGEMENT

Consensus within literature is to resect asymptomatic Meckel's diverticulum in children but not in adults [3] and most children who undergo resection are under 4 years of age [4]. All symptomatic Meckel's diverticulum in both children and adults should be resected. While simple diverticulectomy is safe and has a low morbidity, it may be inadequate because ectopic tissue may reach beyond the base of the diverticulum. Therefore an en-bloc resection of the diverticulum with an adequate adjacent length of small bowel is recommended. The aim of surgical resection is to resect the Meckel's diverticulum, ectopic mucosa contained within and other sequelae such as ulcerated ileum, bowel strictures or fibrous bands. Laparoscopic Meckel's resection has been increasingly reported with

techniques including intra-abdominal wedge resection or extracorporeal or intra-corporeal bowel segment resection and anastomosis.

7. CONCLUSION

Meckel's diverticulum is an uncommon cause of gastrointestinal bleeding. Although most Meckel's diverticula remain asymptomatic over the course of a patient's lifetime, presentations may also include inflammation with pain, bowel obstruction or very rarely, neoplasia. CT of the abdomen and NM scintigraphy studies play important diagnostic roles. Consensus within the literature is to resect asymptomatic Meckel's diverticulum in children but not in adults whilest all symptomatic Meckel's diverticulum in both children and adults should be resected and this commonly involves diverticulectomy with a partial resection of surrounding ileum. (Word Count: 1489) 14

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