CASE REPORT

Meckel's diverticulum: new solutions for an old problem?

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Received 13 June 2015

Revised 18 September 2015

Accepted 29 September 2015

Published Online First

21 October 2015

ABSTRACT

Meckel's diverticulum (MD) is the most commonly encountered true diverticulum in the small bowel. Although overall a rare cause of gastrointestinal bleeding, it remains an important differential in a child/young adult presenting with lower gastrointestinal bleeding. We present two MD cases, one associated with brisk bleeding resulting in haemodynamic instability and the other in insidious blood loss causing symptoms of chronic iron deficiency. These cases illustrate the heterogeneous nature of the clinical picture associated with Meckel's diverticulae, a condition most gastroenterological and surgical units will encounter. We subsequently discuss the diagnostic and management dilemma Meckel's diverticulae pose and appraise the latest evidence and management strategies in this regard.

CASE HISTORIES

A 21-year-old previously well man presented with a 24 h history of melaena and pre-syncope. He was haemodynamically stable on admission with the clinical examination revealing conjunctival pallor and melaena on digital rectal examination. The patient specifically denied taking any medication including non-steroidal anti-inflammatory drugs.

Admission haemoglobin was documented as 11.3 g/dL. Admission blood tests including a coagulation profile were within normal limits. Emergent oesophago-gastroduodenoscopy was normal.

The patient continued to bleed overnight passing fresh melaena, eventually developing hypovolaemic shock. Four units of packed red blood cells and intravenous fluids were administered; both CT angiography and colonoscopy were non-diagnostic at this point. A Meckel's diverticulum (MD) was suspected and a diagnostic radionuclide SPECT/CT (single photon emission CT/CT) using technetium-99 m pertechnetate was

performed (figure 1). This is a relatively new type of imaging procedure where the patient undergoes a CT scan and an isotope scan on the same gantry without moving between scans. This allowed the functional abnormality seen on the isotope study to be precisely localised using the CT anatomy.

A MD was thus diagnosed. The patient underwent a limited small bowel (3 cm) surgical resection (excised bowel-figure 2), made a good recovery and was discharged 2 days later.

The second case involves a 17-year-old boy who presented to our emergency department with symptoms of extreme fatigue, exertional dyspnoea and malaise. Initially insidious, these symptoms had markedly worsened in the 2 weeks prior to admission. Admission observations were normal but admission haemoglobin was documented at 6.6 g/dL (microcytic, hypochromic), with a marked hypoferritinaemia (ferritin 3 µg/L); the remaining blood tests (including a coeliac screen) were normal. Nothing significant was noted in the past medical, family or drug history. The patient denied alcohol consumption. Clinical examination revealed conjunctival pallor and digital rectal examination ruled out melaena or fresh rectal bleeding.

The patient was transfused due to symptomatic anaemia and a CT scan of the chest, abdomen and pelvis was conducted. This was normal except for a 2 cm soft tissue swelling at the distal end of the terminal ileum (figure 3). A subsequent composite scan (figures 4 and 5) confirmed this to be a MD, this was surgically removed and the patient is doing well on routine outpatient review.

DISCUSSION

The first case highlights the importance of including MD as a differential

To cite: Chauhan A, Suggett N, Guest P, et al. *Frontline Gastroenterology* 2016;**7**:118–121.

Figure 1 Coronal image. Composite single photon emission CT/CT scan. Blue arrow shows normal isotope uptake in gastric mucosa, orange arrow shows uptake in ileal mucosa and white arrow highlights urinary isotope excretion.

diagnosis in a young male with major gastrointestinal bleeding. A patient with a normal gastroscopy, ongoing melaena and haemodynamic instability poses an important and commonly faced gastroenterological problem. Colonoscopy is often suboptimal due to presence of intra-colonic melaena and therapeutic opportunity is predictably limited.¹ With improving interventional radiology services, there is greater availability of CT-guided arterial embolisation, but this intervention is limited to bleeds brisk enough to

Figure 2 Resected small bowel sections with abnormal gastric mucosa (arrow) seen.

Figure 3 Transverse section from CT scan suggests Meckel's diverticulum (arrow).

actually be viewed radiologically. In the first patient, neither procedure was helpful nor diagnostic. A Meckel's isotope scan is often done but the yield is low despite reported prevalence^{2 3} and this is particularly the case with increasing age. The first case highlights the fact that life-threatening haemorrhage from a MD can occur and must be investigated in a timely manner. This is in contrast to the second case where the blood loss was rather insidious, and the diagnostic process therefore more protracted. Although there was no suggestion of overt blood loss, we suggest that in the absence of other causes of severe iron deficiency anaemia in a young male, occult bleeding from an MD be considered.

MD is a true intestinal congenital diverticulum. Initially mentioned by Fabricius Hiladanus in 1598,⁴ it was actually first described in a paper published in 1809 by the German anatomist, Johann Friedrich Meckel, the younger (1781–1833), who described it as a remnant of the omphalomesenteric duct.^{5 6} Although overall a rare condition it remains the most frequently encountered small bowel diverticulum. The condition was thought to affect 2% of the population, with 2% developing complications, the vast majority

Figure 4 Subsequent transverse section composite scan (single photon emission CT/CT) localises and, therefore, confirms Meckel's diverticulum (arrow).

Figure 5 Composite (single photon emission CT/CT) scan showing (arrow) enhanced isotope uptake in ileum.

present before the age of 2, and the actual diverticulum is normally within 2 feet (0.6 meters) of the ileo-caecal valve; hence the ‘rule of 2s’.⁷

Persistence of the vitelline or omphalomesenteric duct results in a number of embryological abnormalities including fistulae, umbilical sinuses and even abdominal cysts called enterocystomas. Failure however of the intestinal portion of the vitelline duct to close is the abnormality credited with development of a MD.⁸ A common misconception is that these diverticulae are thought to universally contain ectopic gastric mucosa, and that the most common complication of a MD is painless lower gastrointestinal tract bleeding (secondary to ulceration of the gastric mucosa). In reality, majority of these diverticulae actually contain ileal mucosa,⁹ a case series spanning 30 years places the incidence of ectopic gastric mucosa containing MD at only 20% with incidence reducing with age.¹⁰ Ectopic duodenal and colonic mucosa, pancreatic tissue, Brunner’s glands, hepatobiliary tissue and endometrial mucosa account for the remaining minority.¹¹

Despite the ‘rule of twos’, the actual incidence is reported between 0.3% and 2%,⁸ with almost 16% becoming symptomatic.¹² Up to 60% of all symptomatic MD will present before the age of 10.¹³ The condition equally affects both sexes; males are however four times more likely to develop complications.⁷ The type of complication encountered varies with age, adults for instance tend to present with obstruction due to intussusception or adhesive band (14%–53%); ulceration (<4%); diverticulitis (10%–20%); and perforation.¹² In children on the other hand, symptomatic MD present under the age of 2, and painless ‘maroon’ coloured gastrointestinal bleeding is the most common presentation.¹³ Other reported complications include MD tuberculosis, malignant tumours

(leiomyosarcoma and carcinoid) and MD Crohn’s. Perforation, torsion and volvulus of MD have also been described.^{14 15}

Conventional barium studies can be used to diagnose a MD, they have however been shown to be of limited diagnostic value in acute presentations of condition.¹⁶ The nuclear medicine ‘namesake’ scan for viewing a MD was introduced by Harper in 1962,¹² with Jewett *et al*,¹⁷ being the first to apply it clinically in 1970. The Meckel’s scan involves planar, scintigraphic detection of Tc-99m pertechnetate, an anion, which is intravenously infused and selectively taken up by the mucous secreting cells present in the gastric (and importantly ectopic gastric) mucosa. This is the most common and accurate non-invasive scan performed for a MD.¹² In children it is a fairly reliable scan with a sensitivity of 80%–90%, specificity of 95% and an accuracy of 90%.^{12 18} The scan is predictably less reliable in adults; where sensitivity falls to 62.5%, specificity to only 9% with an accuracy of 46%.^{12 19} Better imaging modalities are therefore necessary in adults especially to diagnose more complicated MD presentations.²⁰

Composite imaging techniques fusing CT with a nuclear medicine uptake scan (SPECT) reduces the false positives associated with a traditional Meckel’s scan.²⁰ This is demonstrated in the imaging used in the first patient described above, who underwent a CT scan and an isotope scan on the same machine without moving between scans, thus allowing the functional abnormality seen on the isotope study to be precisely localised using CT. We appreciate that SPECT scanning may not be available at all centres, but do suggest that in order to increase the sensitivity of functional isotope scanning, hybrid cross sectional imaging be used. This will help clearly define the anatomy of suspected MD and may also yield further clinically pertinent information.

The treatment of choice in a symptomatic MD is surgical excision.²¹ This can be a laparoscopic diverticulectomy or segmental bowel resection.^{21 22} The importance of complete resection of ectopic mucosa cannot be overstated, especially in cases where resection is undertaken due to bleeding.

The management of asymptomatic and incidental MD found at laparotomy remains contentious. Surgeons vary in their recommendations and practices in these cases, Stallion and Shuck place the lifelong risk of complications due to a MD at 5%–6%, compared with a postoperative complication risk of 1%,²¹ and therefore imply that it is reasonable to remove all asymptomatic MD. Soltero and Bill²³ mention a 4.2% lifetime complication risk of MD versus 9% morbidity after incidental resection and favour a conservative approach.²³ Other suggestions range from asymptomatic and symptomatic MD resection in all children under 8,²⁴ to restricting removal to males under the age of 40²⁵ to more convoluted recommendations

such as ‘in cases of gangrenous or perforated appendicitis, an incidentally discovered MD should be left in place, whereas in an only mildly inflamed appendix it should be removed’.²⁶ A more pragmatic approach may be to assess each case on an individual basis, taking into account the poignant risk factors in different patient cohorts; the increased risk of complications in young males for instance.

CONCLUSION

Meckel’s diverticulae remain an important differential diagnosis in patients presenting with both haemodynamically significant bleeding, especially in situations where endoscopic evaluation has been non-diagnostic and also as a cause of occult blood loss. Once commoner causes of the above presentations including AV malformations, ulceration and small bowel tumours have been ruled out, a MD should be on the differential list. Given the spectrum of presentations such diverticulae can present with, a reasonable degree of suspicion is undoubtedly necessary.

Charles Mayo in 1933 summed up the frustration surrounding diagnosing a MD with the statement ‘Meckel’s diverticulum is frequently suspected, often looked for and seldom found’. While, hybrid composite imaging techniques coupled with advanced surgical techniques for diagnosis and resection have helped us ‘find’ these diverticulae, the next challenge is to figure out what to do with the asymptomatic ones.

Contributors AC and JG wrote the manuscript. NS provided information about optimum surgical management and pathology images. PG provided radiological images and all related information.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

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