

## MECKEL'S DIVERTICULUM

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### CASE HISTORY

A 17-year-old male patient presented with recurrent iron deficiency anaemia. Clinical examination was unremarkable, both upper GI endoscopy and a barium enema were normal. The possibility of a Meckel's diverticulum was considered and a <sup>99m</sup>Tc pertechnetate radio-isotope scan was requested. This showed an area of increased uptake in the right iliac fossa consistent with gastric mucosa in a Meckel's diverticulum (Figure 1), this was subsequently confirmed radiologically on a small bowel enema examination (Figures 2 and 3).

### ANATOMY AND EMBRYOLOGY

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract with a reported incidence of 2%.<sup>1</sup> It was first clearly described by Johann Meckel in 1812.<sup>2</sup> It is a true diverticulum arising from the anti-mesenteric border of the small bowel and contains all layers of the ileal wall. The diverticulum on average is located about 50 cm from the ileo-caecal valve and averages 5 cm in length.<sup>3</sup> In the pre-metrication era, the 'rule of two' for Meckel's diverticulum was often quoted as: 2% of the population, two feet from the ileo-caecal valve and two inches long. The diverticulum represents the incomplete obliteration of the vitello-intestinal (or omphalo-mesenteric) duct of the fetus. If it persists it can give rise to a variety of conditions: 1) If the entire duct persists, then there is a fistula between the intestine and the umbilicus; 2) A remnant of the duct may persist as a fibrous cord; 3) The umbilical end of the duct may fail to close with a resulting blind-ending sinus opening into the umbilicus; 4) A Meckel's diverticulum results when the intestinal end fails to close but the rest of the duct disappears. Finally, any combination of the above can occur, with the most common finding being a Meckel's diverticulum linked to the umbilicus by a fibrous cord from the diverticular apex.

Ectopic gastric, duodenal, pancreatic and colonic mucosa may be present within the diverticulum. Heterotopic gastric mucosa is the most common occurrence (62%).<sup>3</sup> The exact embryologic mechanism through which ectopic tissue comes to be present is unclear but it may result from maturation of multipotential cells that remain in the incompletely obliterated vitelline duct.

### CLINICAL PRESENTATION

Most Meckel's diverticula are clinically silent and are discovered incidentally at autopsy, laparotomy and barium studies.<sup>4</sup> About 29% become clinically apparent due to complications. The commonest complication (25-50% of

all complications) is gastro-intestinal haemorrhage, which is especially common in the paediatric age group. The usual source of bleeding is from an ulcer associated with ectopic gastric mucosa within the diverticulum. The second most frequent complication is intestinal obstruction (about 25%), which may be due to a variety of causes: intussusception of the diverticulum followed by ileo-ileal intussusception; volvulus of the small bowel around a residual fibrous cord between the diverticulum and the umbilicus; incarceration of the diverticulum within a hernia, either femoral or inguinal (Littre's hernia). Meckel's diverticulitis (15%) mimics symptoms of acute appendicitis with similar complications of perforation and peritonitis.

Lastly, neoplasia may arise within Meckel's diverticula (3%). These are mostly benign tumours such as leiomyomas, lipomas and angiomas. Malignant neoplasms have also been described: they include sarcomas, carcinoids and adenocarcinomas.<sup>5</sup> The latter usually originate from gastric mucosa and are usually advanced lesions at presentation.<sup>6</sup>

### IMAGING

The diagnosis of Meckel's diverticulum is difficult and a large series of some 600 patients reported a pre-operative diagnosis in only 6%.<sup>3</sup>

#### *Conventional radiographs*

Non-specific signs such as small bowel obstruction and a calcified enterolith within the diverticulum, or an air fluid level may be demonstrated.

#### *Barium studies*

Small bowel enema examination (enteroclysis) is considered the barium technique of choice for diagnosing a Meckel's diverticulum.<sup>7</sup> This technique is more successful than conventional follow-through examinations, as it involves consistent, moderate distension of the bowel loops and allows a better visualisation of the ileum. The diagnosis on barium studies rests on demonstration of a single diverticulum arising from the anti-mesenteric border, this usually has a wide neck but, less commonly, a narrow neck may be seen. A characteristic mucosal pattern can sometimes be identified at the neck with a triangular, or tri-radiate fold, being seen, depending on the degree of bowel distension. Small bowel mucosal folds may be apparent within the diverticulum; a gastric rugal pattern may occasionally be identified, although ulcers are rarely demonstrated. An inverted diverticulum may appear as a polyp and is recognised in these instances as the lead point for potential intussusception.

#### *Ultrasonography*

A complicated Meckel's diverticulum can be visualised on ultrasound as a fluid-filled structure that may or may not be connected to the umbilicus.<sup>8</sup> Its position and appearances on ultrasound examination may help to distinguish a Meckel's diverticulum from appendicitis.

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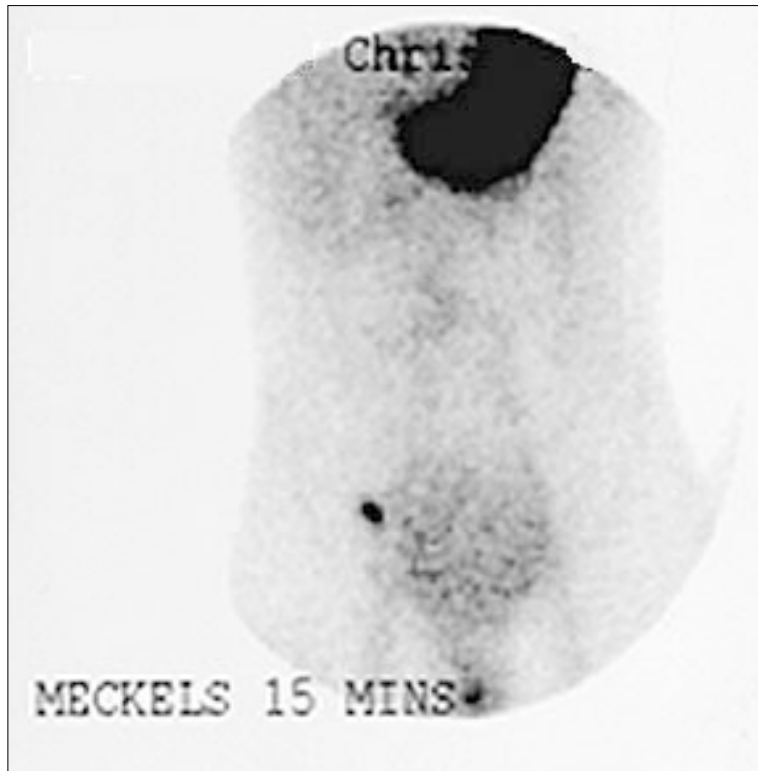


FIGURE 1  
A  $^{99m}\text{Tc}$  pertechnetate scan 15 minutes after injection. Gastric mucosa is seen superiorly, with activity in the Meckel's diverticulum visible in the lower abdomen, just to the right of the iliac vessels and bladder.



FIGURE 2  
A small bowel enema examination, showing the Meckel's diverticulum in the right iliac fossa, medial to the terminal ileum and caecum.

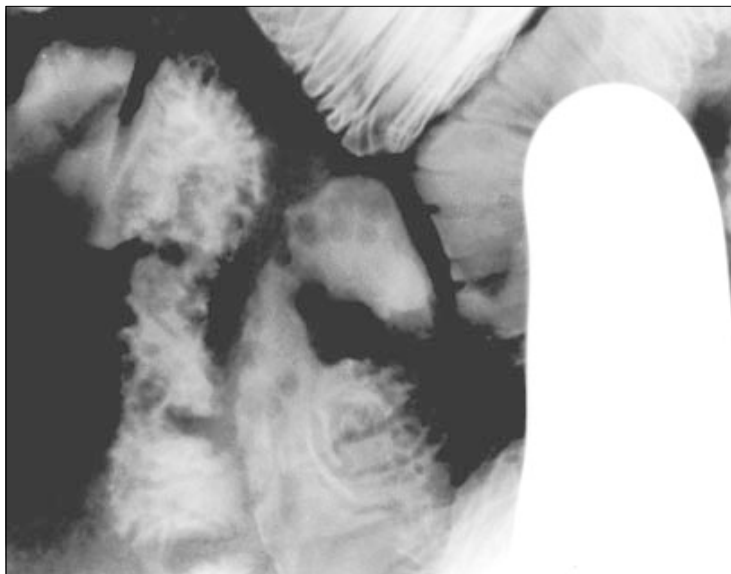


FIGURE 3  
A close up of the Meckel's diverticulum (with a lead glove on the right of the image).

## CT

CT is of limited value as it is often not possible to accurately separate the diverticulum from normal bowel loops. Inflamed diverticula and neoplastic lesions can be demonstrated on CT examination.<sup>9</sup>

## Nuclear medicine

Radionuclide imaging is useful in the diagnosis of Meckel's diverticulum either by demonstrating the presence of ectopic gastric mucosa on a pertechnetate scan, or by identifying the site of gastro-intestinal haemorrhage using labelled red cells or colloid. <sup>99m</sup>Tc pertechnetate is taken up preferentially by gastric mucosa, and this includes any ectopic gastric tissue within the diverticulum. Diagnosis relies on the demonstration of a localised area of uptake that appears at the same time as the stomach during dynamic scanning. The diagnostic sensitivity is of the order of 75% with a specificity of 95% in the paediatric age group.<sup>10</sup> Sensitivity is reduced to about 63% when only adult patients are considered, as ectopic gastric mucosa is less prevalent in the over 30s.<sup>11</sup> False positive cases are also more common in adults due to the presence of other abdominal disorders.<sup>12,13</sup>

In cases of GI haemorrhage radionuclide studies using labelled red cells or colloid scans may be more sensitive than angiography, as they require a bleeding rate of 0.1 ml/min. compared to a rate of 0.5 ml/min. for angiography, in order to demonstrate reliably the point of haemorrhage. Although sensitive, scintigraphy is non-specific, as the source of bleeding may not be from a Meckel's diverticulum.

## Angiography

A Meckel's diverticulum may be diagnosed as the source of acute GI haemorrhage at arteriography. The angiographic diagnosis is based on the demonstration of an anomalous feeding artery leading to the diverticulum. Usually this is a branch of the superior mesenteric artery, which characteristically has a long, non-branching course to the right iliac fossa and shows no ileal anastomoses.<sup>14</sup> Occasionally branches from the ileo-colic artery supply a Meckel's diverticulum and in these cases differentiating bleeding from other sources within the ascending colon

and caecum is more difficult.<sup>15</sup> Super-selective catheterisation of the artery in question may help in confirming the diagnosis.

## REFERENCES

- Ludtke FE, Mende V, Kohler H, Lepzien G. Incidence and frequency of complications and management of Meckel's diverticulum. *Surg Gynae Obst* 1989; **169**:537-42.
- Meckel JF. *Handbuch der Pathologischen Anatomie, Volume 1*. Leipzig, Germany: Reclam, 1812.
- Yamaguchi M, Takechui S, Awazu S. Meckel's diverticulum: investigation of 600 patients in Japanese literature. *Am J Surg* 1978; **136**:247-9.
- Mackey WC, Dineen P. A fifty year experience with Meckel's diverticulum. *Surg Gynae Obst* 1978; **156**:56-64.
- Sukalo VM *et al.* Sepsis due to leiomyosarcoma of Meckel's diverticulum. *J Emerg Surg Int Care* 1994; **17**:30-3.
- Yamaguchi M, Maeda S, Kitamura K. Adenocarcinoma in Meckel's diverticulum: case report and literature review. *Aust NZ J Surg* 1989; **59**:811-3.
- Maglinte DDT, Elmore MF, Esenberg M, Dolan PA. Meckel's diverticulum: radiologic demonstration by enteroclysis. *AJR* 1980; **134**:925-32.
- Larsen J, Ellinger D. Sonographic findings in torsion of a Meckel's diverticulum. *AJR* 1989; **152**:1130.
- Antes G, Bassermann R, Lessel W. Sarcomas originating in small bowel diverticula. *Abdom Imaging* 1994; **19**:339-41.
- Sfakianakis GN, Conway JJ. Detection of ectopic gastric mucosa in Meckel's diverticulum and in other aberrations by scintigraphy. *J Nucl Med* 1981; **22**:647-54.
- Schwartz MJ, Lewis JH. Meckel's diverticulum: pitfalls in scintigraphic detection in the adult. *Am J Gastroenterol* 1984; **79**:611-8.
- Dunn EK, Farman J, Teitcher J, Smith T. Ileal leiomyosarcoma, false positive scintiscans for Meckel's diverticulum. *Clin Nucl Med* 1987; **12**:440-4.
- Polga JP, Sargent J, Dickinson P. Positive intestinal scan caused by carcinoid tumour. *J Nucl Med* 1974; **15**:365-6.
- Okasaki M, Higashihara H, Saida Y *et al.* Angiographic findings in Meckel's diverticulum: the characteristic appearance of the vitelline artery. *Abdom Imaging* 1993; **18**:15-19.
- Oglevie SV, Smith DC, Gardner GA. Angiographic demonstration of bleeding in an unusually located Meckel's diverticulum simulating colonic bleeding. *Cardiovasc Intervent Radiol* 1989; **12**:210-12.