

Meckel's Diverticulum: Possible Detection by Combining Pentagastrin with Histamine H₂ Receptor Blocker

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A Meckel's scan was performed on a 7-yr-old boy because of rectal bleeding. He was premedicated with pentagastrin (6 μ g/kg subcutaneously) followed by 259 MBq (7 mCi) [^{99m}Tc]pertechnetate intravenously. The study was essentially negative. Because of persistent rectal bleeding and a strong clinical suspicion of a Meckel's, a repeat study was performed 6 wk later. He received pentagastrin as before, but this time was also given a histamine H₂ receptor blocker (zantac). A Meckel's diverticulum was clearly evident.

Key Words: Meckel's diverticulum; pentagastrin

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Meckel's diverticulum is a vestige of the omphalomesenteric duct, and persists in about 2% of the population. It occurs anywhere in the small bowel from below the ligament of Treitz to the ileocecal valve, but it is usually found 50-75 cm proximal to the terminal ileum. Ectopic tissue (i.e., gastric, duodenal, colonic, or pancreatic) may be present. The incidence of gastric mucosa is estimated to be between 30% and 50%. However, nearly all diverticula responsible for rectal bleeding contain ectopic gastric mucosa, since hemorrhage results from mucosal ulceration in the diverticulum or in the adjacent ileum caused by HCl and pepsin. In children it is the most frequent cause of severe lower gastrointestinal bleeding in all age groups, even though 50% of symptomatic patients present before the age of 2 yr (1).

Harper first suggested that a bleeding Meckel's should be identifiable scintigraphically using ^{99m}Tc pertechnetate, since it is concentrated by gastric mucosa (2). Since the first clinical application of this technique by Jewett (3) it has been widely used diagnostically.

Pharmacologic intervention has been advocated to improve the sensitivity of the study. Pentagastrin given subcutaneously 20 min before the study has been shown to enhance gastric uptake. Cimetidine, a histamine H₂ receptor

antagonist, has a similar effect and possibly inhibits the intraluminal release of pertechnetate (4-7). Glucagon given intravenously 10 min after the pertechnetate inhibits peristalsis (8) and delays the emptying of gastric contents into the small bowel. It may also prevent the washout of activity secreted from the diverticulum into the lumen. Although premedication with these agents is frequently utilized, there has not been a systematic evaluation to determine whether these manouvers enhance the sensitivity in the clinical setting.

CASE REPORT

A 7-yr-old male was completely healthy until he had an episode of abdominal pain associated with the passing of bright red blood per rectum. Investigations included colonoscopy, an upper GI series, endoscopy and stool for microscopy and culture, which were all negative. A Meckel's scan was performed, premedicating the patient with pentagastrin, 6 μ g/Kg subcutaneously. Twenty min later [^{99m}Tc]pertechnetate was injected intravenously and anterior images of the abdomen were obtained for the following 30 min. Analogue images at 5 min intervals showed normal uptake by the stomach and excretion via the urinary system. There was no focal accumulation to suggest the presence of a Meckel's diverticulum (Fig. 1).

The patient continued to have cramping abdominal pain approximately every 2 wk. Six weeks after discharge he was readmitted with another episode of bright red blood per rectum and cramping abdominal pain. On examination he was pale, afebrile and the vital signs were stable. The physical examination was otherwise normal. Colonoscopy and biopsy now suggested a possible AVM above the cecum in the colon. A mesenteric angiogram was normal, without evidence of an AVM or inflammatory bowel disease. At this time he was started on zantac orally (40 mg bd) and a repeat Meckel's scan requested. He was premedicated with pentagastrin as before, and again the study was performed with 259 MBq (7 mCi) [^{99m}Tc]pertechnetate. On this occasion 1 min images were acquired for 30 min in 128 \times 128 word mode. An abnormal focus of activity was clearly seen in the right lower quadrant in the early images, long before bladder activity was evident (Fig. 2). The images at 30 min showed the focus to be anterior as seen in the right lateral projection (Fig. 3). The scan appearance was consistent with a Meckel's. At surgery the diverticulum was identified approximately 25 cm from the ileocecal valve. The patient made an uneventful recovery and was discharged on zantac 40 mg bd and iron sulphate 12 mg tid.

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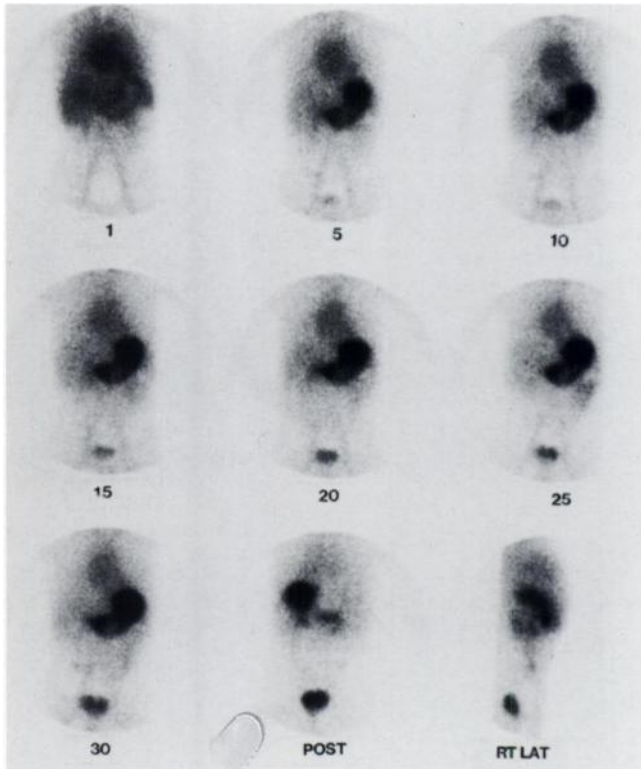


FIGURE 1. After premedication with pentagastrin, there is early uptake of the radiopharmaceutical by the gastric mucosa but no evidence of a Meckel's diverticulum.

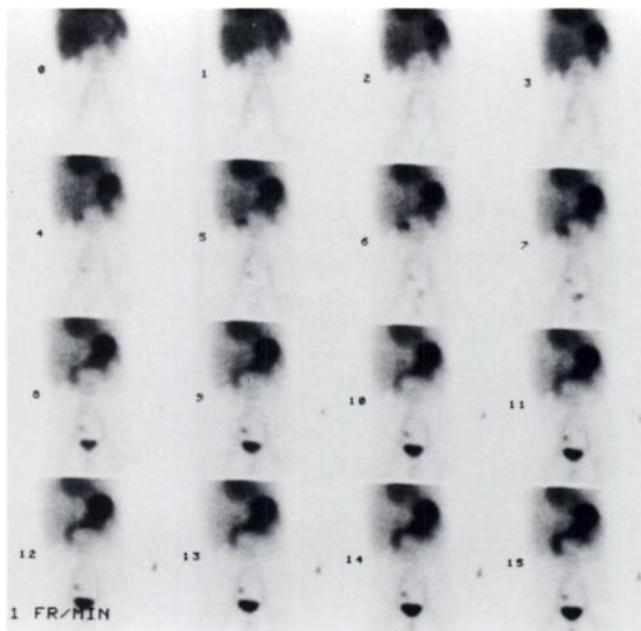


FIGURE 2. In the repeat study, the patient was premedicated with pentagastrin and zantac. There is early visualization of an abnormal focus in the right lower quadrant, the appearance being simultaneous with gastric uptake.

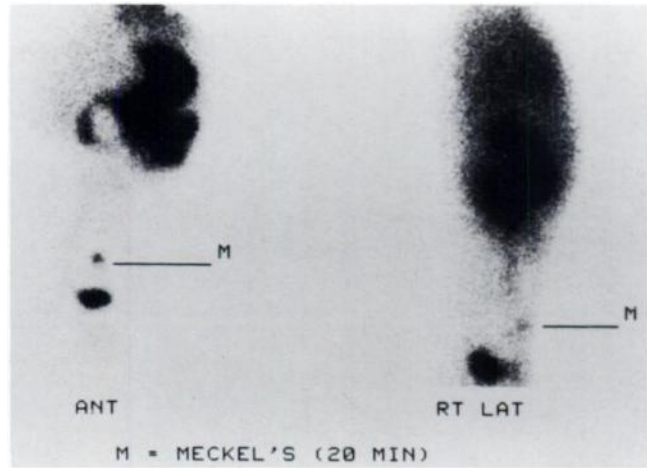


FIGURE 3. Anterior and right lateral views at 20 min clearly show the abnormal focus to be anterior. The findings are consistent with a Meckel's diverticulum. Diagnosis was confirmed at surgery.

DISCUSSION

The sensitivity of [^{99m}Tc]pertechnetate for detecting a Meckel's diverticulum has been found to be 85%, with a specificity of 95% and an overall accuracy of 90%, in a review of 226 cases with surgically proven diagnoses. If the absence of recurrent bleeding or the finding of an alternative source for the bleeding is indicative of a true negative study, then the accuracy increases to 98% (9), although the diagnostic rate is higher in children (92%) than in adults (54%) (10). In another study of 270 children, it was felt that the technetium scan should detect 80%–90% of Meckel's diverticula, while a negative study excludes the diagnosis in over 90% of patients. False-negative studies were attributed to proximity to the bladder in one instance, and to the small amount of gastric mucosa in the other cases (11).

There seems to be no doubt that pharmacologic intervention with pentagastrin or a histamine H_2 receptor blocker can significantly enhance the detection of a Meckel's diverticula. The question is, however, is there an advantage to using one rather than the other? We have routinely used pentagastrin for several years with the efficacious demonstration of ectopic gastric mucosa. The case reported here, however, raises the question whether a false negative with one agent may be corrected by using an alternative. In this instance the patient was on oral Zantac, unknown to the nuclear medicine staff at the time of the radionuclide scan. Zantac (ranitidine hydrochloride) is a competitive, reversible, inhibitor of the action of histamine at the histamine H_2 receptors, including receptors on the gastric cells. Among its many effects is the inhibition of basal gastric secretion as well as gastric acid secretion stimulated by pentagastrin. While it is possible that the effect in this case was due to the Zantac alone, inhibiting the secretion of pertechnetate from the gastric cells, it is possible that there was a synergistic effect. Pentagastrin enhances the uptake of the pertechnetate into the cell,

while Zantac promotes its retention. The value of combining these agents remains to be elucidated.

REFERENCES

1. Boyle JT. Gastrointestinal bleeding. In: Fleischer G, Ludwig S, eds. *Textbook of pediatric emergencies in medicine*. Baltimore: Williams and Williams; 1983:159-169.
2. Harper PV, Andros G, Lathop K. Semiannual reports Argonne Cancer Research Hospital. 1962;18:76.
3. Jewitt TC, Duszynski DO, Allen JE. The visualization of a Meckel's diverticulum with ^{99m}Tc pertechnetate. *Surgery* 1970;68:567-570.
4. Treves S, Grand RJ, Eraklis AJ. Pentagastrin stimulation of technetium 99m uptake by ectopic gastric mucosa in a Meckel's diverticulum. *Radiology* 1978;128:711-712.
5. Petrokubi RJ, Baum S, Rohrer GV. Cimetidine administration resulting in improved pertechnetate imaging of Meckel's diverticulum. *Clin Nucl Med* 1978;3:385-388.
6. Datz FL, Christian PE, Hutson WR, Moore JG, Morton KA. Physiological and pharmacological interventions in radionuclide imaging of the tubular gastrointestinal tract. *Semin Nucl Med* 1991;21:140-152.
7. Diamond RH, Rothstein RD, Alavi A. The role of cimetidine enhanced technetium 99m pertechnetate imaging for visualising Meckel's diverticulum (clinical conference). *J Nucl Med* 1991;16:1422-1424.
8. Sfakianakis GN, Anderson GF, King DR, Boles ET. The effect of intestinal hormones on the Tc-99m-pertechnetate (TcO₄) imaging of ectopic gastric mucosa in experimental Meckel's diverticulum. *J Nucl Med* 1981;22:678-683.
9. Sfakianakis GN, Conway JJ. Detection of ectopic gastric mucosa in Meckel's diverticulum and in other aberrations by scintigraphy. II. Indications and methods—a 10 yr experience. *J Nucl Med* 1981;732-738.
10. Kusumoto H, Yoshida M, Takahashi I, Anai H, Maehara Y, Sugimachi K. Complications and diagnosis of Meckel's diverticulum in 776 patients. *Am J Surg* 1992;164:382-383.
11. Cooney DR, Duszynski DO, Camboa E, Karp MP, Jewitt TC. The abdominal technetium scan (a decade of experience). *J Pediatr Surg* 1982;17:611-619.