
Inflammatory Pseudotumor: A Gallium-Avid Mobile Mesenteric Mass

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An 8-yr-old boy with a 1-mo history of culture-negative fever and anemia underwent gallium, ultrasound, and computed tomography studies as part of the evaluation of a fever of unknown origin. These studies revealed a mobile gallium-avid solid abdominal mass subsequently proven to be an inflammatory pseudotumor of the mesentery, a rare benign mass. This report documents the gallium-avid nature of this rare lesion and discusses associated characteristic clinical, pathologic, and radiographic features.

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Inflammatory pseudotumor is a rare pediatric abdominal mass with a characteristic clinical presentation (1). We discuss the pertinent clinical, pathologic, and radiologic features of inflammatory pseudotumor and establish its position among the gallium-avid abdominal masses.

CASE REPORT

An 8-yr-old white boy presented with a 1-mo history of low-grade fever, chills, pallor, and night sweats. Physical examination was remarkable only for a temperature of 101.5°F and a chronically ill appearance. Laboratory evaluation revealed an elevated modified Westergren sedimentation rate of 144 mm/hr (normal: 0-20 mm/hr), a microcytic normochromic anemia, and thrombocytosis. Other laboratory values were hemoglobin, 7.9 g/dl; hematocrit, 24.5%; red blood cell count, 32.9×10^6 ; mean corpuscular volume index, 74.5; and platelets, 803,000. The white blood cell count was 10,600 with 61% segmented neutrophils, 0% bands, 27% lymphocytes, 7% monocytes, 3% eosinophils, and 2% basophils. Serum iron was below normal at 24 µg/dl. Bone marrow examination revealed slight general hypoplasia with no evidence of tumor or granuloma. Results of multiple blood, fecal, and urine cultures were negative, as was a tuberculin test.

Radiologic investigation began with abdominal ultrasound (US), which demonstrated a solid, well-circumscribed mass in the right upper quadrant. The mass was of mixed echogenicity and was clearly separate from adjacent viscera (Fig. 1). Given the possibility that this finding represented a fecal mass, follow-up examinations were performed at 24 and 48 hr. These tests revealed migration of the mass to the left upper quadrant.

On the same day as the final ultrasound, anterior gamma camera images were acquired with a medium-energy collimator 24 hr after intravenous injection of 1.56 mCi (57.72 MBq) of gallium citrate Ga 67. Surprisingly, a focal area of increased activity was detected in the right upper quadrant. Images acquired at 48 and 96 hr subsequently revealed migration of the focal uptake to the left upper quadrant (Fig. 2). Decubitus positioning of the patient at that time did not change the relative location of the focal uptake. Finally, CT examination of the abdomen performed on the same day that the 96-hr gallium images were acquired revealed a solid enhancing mass now located in the right upper quadrant (Fig. 3). The surprisingly mobile nature of this mass during its radiologic evaluation is summarized in Table 1.

Given the likelihood of an inflammatory or lymphomatous mass, exploratory laparotomy was performed. This procedure revealed a solid mass arising in the transverse mesocolon, firmly attached to the serosa of the transverse colon. The redundancy of the colon and its mesenteric attachment accounted for the observed mobility of the lesion. Pathologic examination revealed a spindle cell tumor associated with an inflammatory proliferation of lymphocytes and plasma cells consistent with an inflammatory pseudotumor of the mesentery.

DISCUSSION

Though a rare etiology for a pediatric abdominal mass, inflammatory pseudotumors are recognized with increasing frequency (2). Originally labeled post-inflammatory tumor by Umiker and Iverson in 1954, this lesion is also commonly known as plasma cell granuloma and less frequently as plasma cell pseudotumor, fibroxanthoma, xanthogranuloma, and histiocytoma (3). While most often encountered in the lungs of young adults, this entity has now been reported in a multiplicity of sites below the diaphragm, including the stomach, liver, spleen, pancreas, kidney, mesentery, ovary, uterus, and bladder. Most reports stress the clinical and radiographic similarity to malignant disease but emphasize minimal resection as treatment of choice, given the benign histology (4,5).

Pathologically, the mesenteric pseudotumor is often well-circumscribed without a well-formed capsule. Hemorrhage, necrosis, and cyst formation are uncommon. Histologically, the lesion consists primarily of spindle cells and mononuclear inflammatory cells. Calcifications may be present. Mitotic figures, anaplasia, multinucleated giant cells, and granulomatous inflammatory changes are absent. The etiology of inflammatory pseudotumor remains

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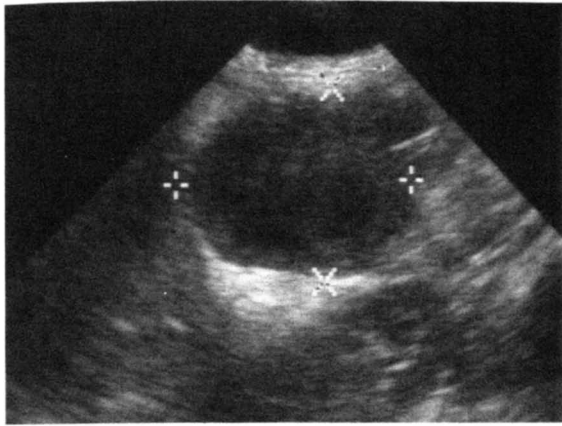


FIGURE 1. Abdominal ultrasound demonstrates a solid right upper quadrant mass.

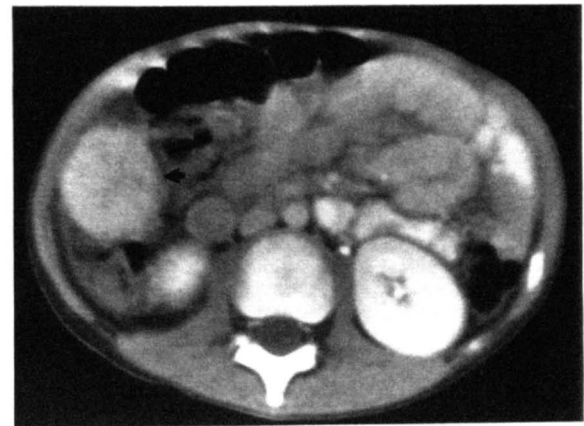


FIGURE 3. Enhanced CT reveals an enhancing solid mass in the right upper quadrant (arrow).

unclear, although this lesion has been associated with prior surgery, trauma, infection, malignancy, and ischemia (1,2,5,6). Dehner has shown that the spindle cell ultrastructure is that of the myofibroblast, the cell found in granulation and scar tissue, as well as in other fibrous lesions (7). Although individual clinical and laboratory findings of themselves might be considered nonspecific, many patients with inflammatory pseudotumor exhibit similar systemic manifestations and laboratory abnormalities (4). These abnormalities include fever of unknown origin, impaired growth, hypochromic microcytic iron refractory anemia, thrombocytosis, hypergammaglobulinemia, and elevated sedimentation rate (1,8). Postoperatively, these inflammatory manifestations usually resolve after excision, although incomplete resection can lead to potentially fatal local recurrence (5,9).

Preoperative differential diagnosis to include inflammatory pseudotumor of the mesentery becomes possible when imaging evaluation is performed with a knowledge of the aforementioned clinicopathologic abnormalities. Gallium studies are frequently requested to evaluate fevers of unknown origin, and the present case demonstrates that inflammatory pseudotumor is gallium-avid. This charac-

teristic of inflammatory pseudotumors has been reported outside the radiologic literature in cases involving the mesentery and liver (9,10). Extrasosseous bone tracer uptake in a 5-yr-old girl with a densely calcified pulmonary plasma cell granuloma has also been reported (11). With respect to mesenteric lesions, ultrasonography is useful for detection and confirmation of a solid abdominal mass of mixed echogenicity. CT echoes the gross pathology most often demonstrating a homogenous, well-circumscribed mass with occasional calcifications and homogenous contrast enhancement.

Of interest in the case presented is the mobile nature of the mass, which provides a clue to its mesenteric origin. Differential considerations when faced with a gallium-avid mobile abdominal mass in a child might include (1) fecal mass-intestinal activity, (2) lymphoma, (3) infected cyst of the mesenteric, duplication, or even urachal varieties, (4) tuberculous or infectious mesenteric adenitis, (5) periappendiceal abscess or inflammatory bowel disease, (6) intermittently intussuscepting inflammatory mass, and (7) inflammatory pseudotumor of the mesentery.

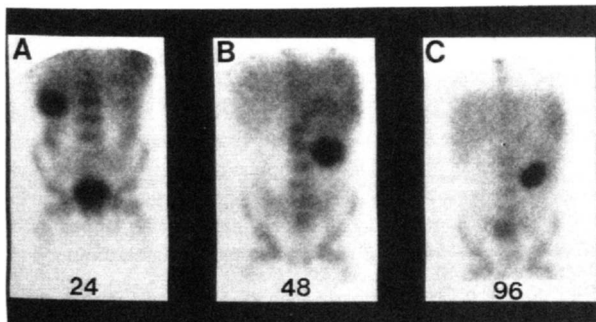


FIGURE 2. (A–C) Twenty-four-, 48-, and 96-hr gallium scintiphotos demonstrate the mobile gallium-avid mass.

TABLE 1
Location of Mass on Radiologic Studies

Date of examination	Modality		
	Ultrasound	⁶⁷ G	Computed tomography
11/15	Right upper quadrant		
11/16	Left upper quadrant		
11/17	Left upper quadrant	Right upper quadrant	
11/18		Left upper quadrant	
11/20		Left upper quadrant	Right upper quadrant

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SELF-STUDY TEST

Gastrointestinal Nuclear Medicine

ANSWERS

ITEMS 19-25: Radiopharmaceuticals for Gastric Emptying Studies

ANSWERS 19, T, 20, F, 21 T, 22, T, 23 F, 24, T, 25, F

Meyer et al developed a truly stable label for solid food by injecting live chickens with ^{99m}Tc -sulfur colloid. The sulfur colloid, which is taken up by the Kupffer's cells of the chicken's liver, remains associated with the liver particles in gastric contents for several hours, independent of the method of cooking.

In vitro labeled solid foods also can be prepared that are of sufficiently high stability in gastric juice to be used for measurements of gastric emptying. One meal that has been found to be as stable as in vivo labeled chicken liver is ^{131}I -labeled fiber (α -cellulose), served as a mixture with cheese spread.

Among the ^{99m}Tc -labeled meals, several have been found to be slightly less stable in gastric juice than in vivo labeled chicken liver, but have stability adequate for gastric emptying studies. These include ^{99m}Tc -sulfur colloid mixed with beaten raw egg and cooked until firm; ^{99m}Tc -sulfur colloid added to egg white and cooked until firm; ^{99m}Tc -sulfur colloid injected into cubes of raw chicken liver, which then are cooked thoroughly, and ^{99m}Tc -sulfur colloid mixed with canned liver pate, which is then fried until the particles stick together.

Addition of water-soluble radioactive tracers to foods before cooking them often results in labels that elute from the solids in gastric juice. For example, ^{51}Cr -sodium chromate added to eggs and porridge before cooking shows 90% elution of label within the first hour of incubation in acid and pepsin. When ^{99m}Tc -pertechnetate is added to pancake mix and cooked on a griddle, there also is considerable elution of radioactivity from the solids. Indium-111-DTPA is often used as a marker for the liquid phase in a mixed solid-liquid meal, because it exhibits such low binding to most solids.

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ITEMS 26-29: Gastric Emptying in Diabetic Gastroparesis

Answers: 26, F; 27, T; 28, F; 29, T

Although the most common symptoms of gastroparesis include nausea and vomiting, milder symptoms may include early satiety, bloating, and abdominal pain. Loo et al have demonstrated that a lag phase abnormality of gastric emptying may be present in diabetic patients even before symptoms of gastroparesis have occurred. In Figure 19 the solid foods remain in the fundus and there is no significant movement toward the antrum up to the 30-min image. This is compared with Figure 20 after the patient has been placed on metoclopramide, where one sees that initiation of movement of solids from the fundus to the antrum has begun by 15 min. This patient, therefore, initially had an increase in the duration of the lag phase (> 45 min). Following treatment with metoclopramide, one can see that the lag phase has been shortened. Loo et al have shown that the major effect of metoclopramide on gastric emptying of solids in diabetics is the correction in the delay in the onset of gastric emptying (eg., shortening of the "lag" phase). In this case, therefore, treatment with metoclopramide has improved gastric emptying by shortening a prolonged lag phase. Several studies have shown that the gastric emptying rate of fluids may be normal even in the presence of symptoms of diabetic gastroparesis until very late in the course of the disease, when there is a much more severe and generalized motor disorder of the stomach. Therefore, one could eliminate the use of a liquid label and concentrate on detecting abnormalities in the solid phase of gastric emptying. Studies also have shown that metoclopramide not only increases gastric motility, but also acts centrally as an antiemetic, and both effects may improve the patient's symptoms.

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ITEMS 30-33: Imaging of Gastrointestinal Ulcerations

Answers: 30, F; 31, T; 32, T; 33, F

The diagnosis of Barrett's esophagus is made when columnar-appearing mucosa extends from the proximal margin of the stomach into the esophagus, usually confirmed at endoscopy. In Figure 21, the activity seen at 60 min in the distal esophagus is most likely due to sucralfate

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