
Gallium Detection of Salmonella Costochondritis

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A case of Salmonella costochondritis developed at a traumatic focus in a 37-yr-old Hispanic male without hemoglobinopathy or systemic disease. Bone scans and gallium scans were initially positive and remained abnormal, despite a variable clinical course and repeatedly negative serology and blood cultures. Scintigraphy was valuable for both detection and monitoring of antibiotic treatment, as well as providing localization for subsequent surgical resection.

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Osteomyelitis remains a dilemma for clinicians, frequently presenting with nonspecific symptoms and delayed radiographic findings. Numerous articles have described the efficacy of bone and gallium scintigraphy in the diagnosis and treatment of osteomyelitis. Both are sensitive early in acute osteomyelitis, while a subsequently negative gallium scan provides strong evidence against persistent bacteriologic infection following antibiotic therapy (1–3).

Soft-tissue inflammation also may be detected with radiopharmaceuticals. Gallium-67 (^{67}Ga) has been extensively employed for the diagnosis of a variety of inflammatory lesions. Accumulation at inflammatory foci is apparently multifactorial and involves: an adequate blood supply, increased capillary permeability, direct uptake by leukocytes and bacteria, and binding to lactoferrin and bacterial siderophores (4). Although technetium-99m ($^{99\text{m}}\text{Tc}$) phosphate uptake has also been reported in many different inflammatory disorders, the precise mechanisms of localization remain poorly understood. Hyperemia, altered capillary permeability, adsorption onto soft-tissue calcium, binding by tissue enzyme receptors, tagging to denatured proteins, the presence of soft-tissue iron deposits, and adsorption onto immature collagen all have been postulated, however, no single explanation has gained universal acceptance (5).

The utilization of both radiopharmaceuticals has been reported in Tietze's syndrome or nonpyogenic costochondritis (6,7). This common clinical entity is

presumed to have a viral pathogenesis. In contrast, pyogenic costochondritis is rare, and we are unaware of a previously reported case documented by gallium scintigraphy.

CASE REPORT

A 37-yr-old Hispanic male was briefly seen in the emergency room, after being struck over the right anterior lower

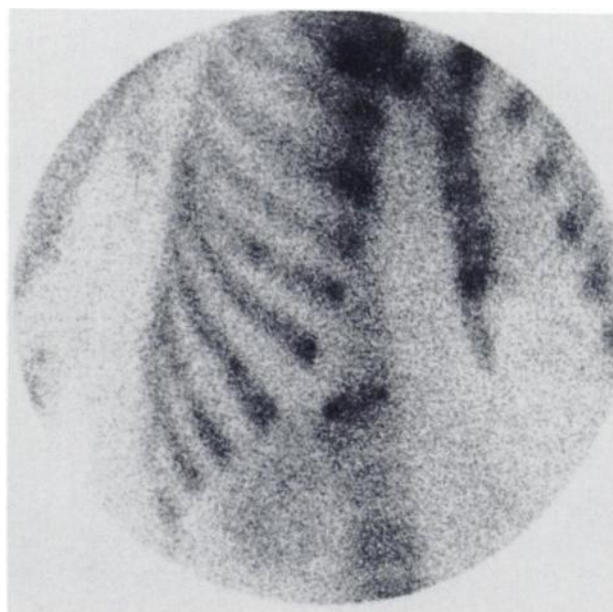


FIGURE 1
A right anterior oblique view from a bone scan demonstrates a focus of increased activity along the anterior costochondral portion of the right 7th rib.

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rib cage by a wooden plank at a construction site. X-rays of the ribs were unremarkable; however, he gradually developed erythema and tenderness in this region over the next several days. Two months later, a local incision and drainage of subcutaneous tissues produced a purulent material which grew *Salmonella typhosa*, sensitive to ampicillin. Following a 15-day oral antibiotic regimen, the patient became asymptomatic. Nine months prior to the trauma, he had been hospitalized for enteric fever, with positive blood cultures for *Salmonella typhosa*, sensitive to chloromycetin. Tests for hemoglobinopathies performed during that admission were negative.

Although the patient remained asymptomatic three months later, further diagnostic evaluation for an occult *Salmonella* infection was instituted. All laboratory data, including serum

Salmonella titers, blood cultures, and stool cultures were normal. Repeat x-rays of the ribs were normal. A bone scan, however, demonstrated a focus of increased activity in the costochondral portion of the right 7th rib (Fig. 1). A gallium scan, performed 72 hr after injection, showed faint increased activity at this site as well, which was confirmed on additional images obtained at 96 and 120 hr postinjection (Fig. 2).

Seven months after the trauma, the patient was readmitted, complaining of increased pain and swelling over the prior incision and drainage site. Admission laboratory data, cultures, and *Salmonella* titers were once again normal. A bone scan revealed increased radionuclide activity in the anterior costochondral portion of the right 7th rib. A gallium scan, obtained 48 hr postinjection (Fig. 3), once again demonstrated

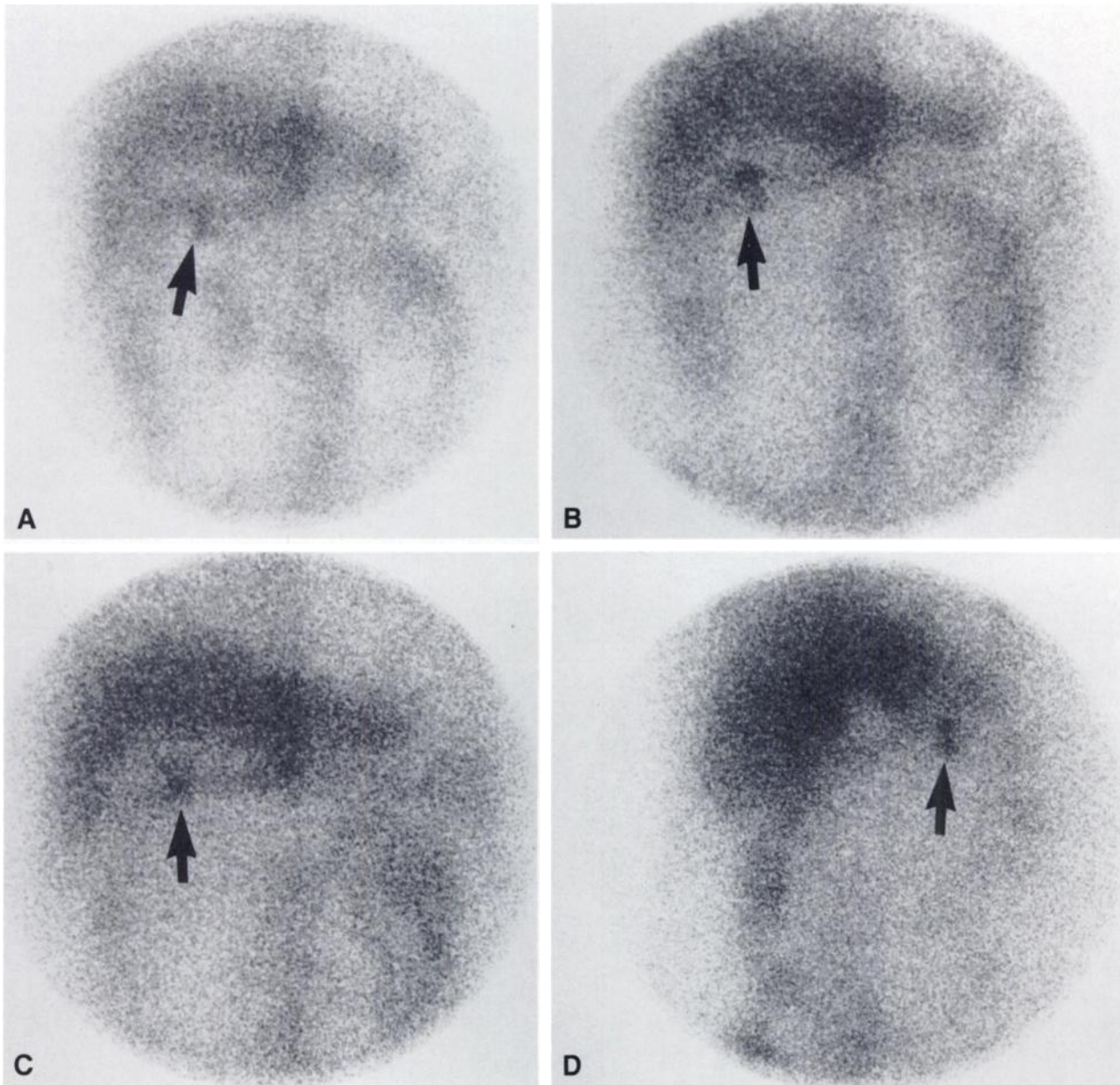


FIGURE 2

Anterior views from a gallium scan obtained at 72 (A), 96 (B), and 120 (C) hr postinjection again demonstrate a faint focus of increased activity (arrows) in the right upper abdomen. A right anterior oblique view at 120 hr (D) shows that the focus was located anteriorly in the region of the anterior costochondral portion of the right 7th rib.

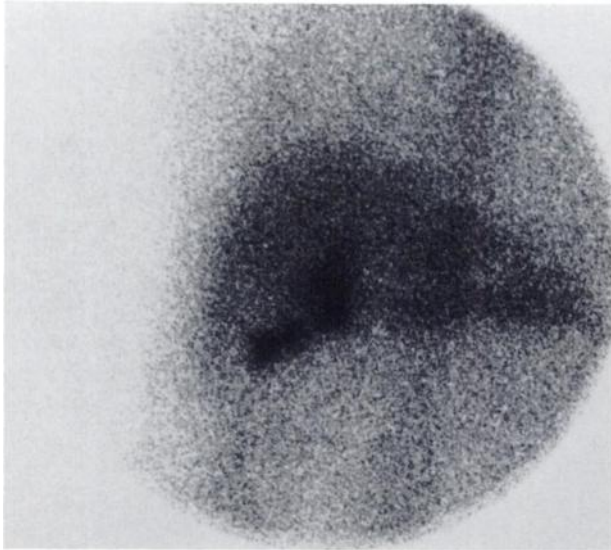


FIGURE 3
A follow-up gallium scan demonstrated significantly increased uptake in the anterior costochondral region, as compared with the previous scan.

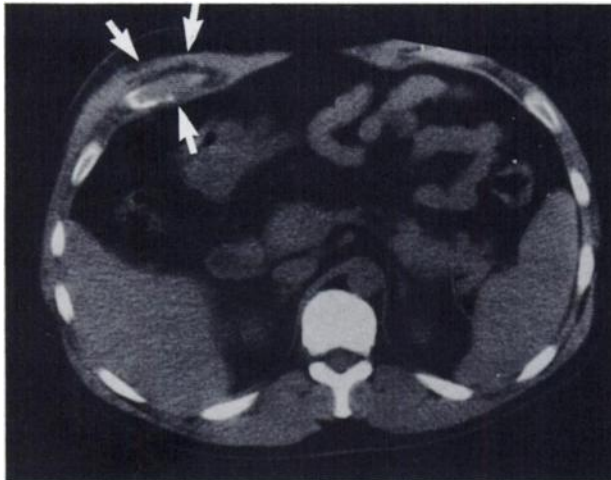


FIGURE 4
An abdominal CT scan at the level of the lower costal margin demonstrated an expansile destructive lesion of the anterior costochondral portion of the right 7th rib with associated soft-tissue inflammation (arrows).

uptake at this site, although significantly increased in comparison to the previous study. A sinogram, performed through a small skin fistula, demonstrated a recurrent subcutaneous abscess cavity, without direct extension; however, a CT scan showed destructive changes in the underlying costochondral portion of the right 7th rib (Fig. 4).

The patient subsequently underwent surgical resection of the subcutaneous abscess cavity and adjacent portions of the right anterior 7th and 8th ribs and costal cartilages. Pathologic examination of the surgical specimen demonstrated a right lower costal margin abscess with osteomyelitis and pyogenic chondritis of the underlying ribs. Specimen cultures grew *Salmonella typhosa*, sensitive to chloramphenicol. After i.v.

chloramphenicol therapy and wound care, the patient improved and remained well at a one-year clinical follow-up.

DISCUSSION

The extraintestinal manifestations of *Salmonella* infections have been discussed in an excellent review article by Cohen et al. (8). Bacterial seeding frequently occurs during septicemia, but may also follow enteric fever or gastroenteritis. Thrombosed vascularity of the gastrointestinal tract in association with decreased liver function (diminished reticuloendothelial clearance of bacterial pathogens) has been postulated to render these patients more susceptible to spread outside the gastrointestinal tract (8). *Salmonella typhimurium* is the most commonly reported serotype, appearing in extraintestinal infections (8,9).

Salmonella osteomyelitis is relatively unusual, accounting for <1% of all cases of chronic osteomyelitis. Extraintestinal spread to bone may follow acute enteric fever by months or even years (10) and has a distinct tendency to chronicity. The majority of cases occur in patients with sickle cell anemia, although cases have also been reported in association with several other systemic diseases, including: other hemoglobinopathies, leukemia, lymphoma, diabetes, systemic lupus erythematosus, and cirrhosis (10). The *Salmonella* bacteria has a tendency to invade sites of pre-existing osseous lesions such as, cysts, hematomas, neoplasms, and osteomyelitis due to other bacteria (10). Sites of predilection include: the long bones, metatarsals, metacarpals, with a low incidence of rib involvement (8,9).

Salmonella costochondritis previously has not been reported, with the exception of a single culture-negative case of reactive arthritis (8). Interesting features of our case included: seeding of a traumatic site nine months after apparent successful antibiotic treatment of enteric fever in a patient without hemoglobinopathy or systemic disease, repeatedly negative serology and blood cultures, and progressive involvement of the subcutaneous tissues and adjacent costocartilage and rib. Serial gallium scans exhibited a persistent focus of increased activity which intensified as the underlying infection flared up. While antibiotic therapy is often successful in acute *Salmonella* osteomyelitis, a favorable outcome is much less common in chronic cases. Effective therapy for extensive soft-tissue infections, such as in our patient, frequently requires both antibiotic therapy and surgical excision (11).

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