

### Gallium-67 Citrate Scintigraphy in *Salmonella* Infected Thrombus of a Left Ventricular Aneurysm

**TO THE EDITOR:** Although the most common bacterial infection involving the heart is endocarditis, infection associated with ventricular aneurysm and mural thrombus may occur and prove difficult to diagnose. Gallium-67 ( $^{67}\text{Ga}$ ) citrate has been widely used for the detection of infections (1,2). We have encountered a patient with infection of a left ventricular aneurysm and pericarditis by *Salmonella* organisms, where  $^{67}\text{Ga}$  scan was useful in confirming the diagnosis.

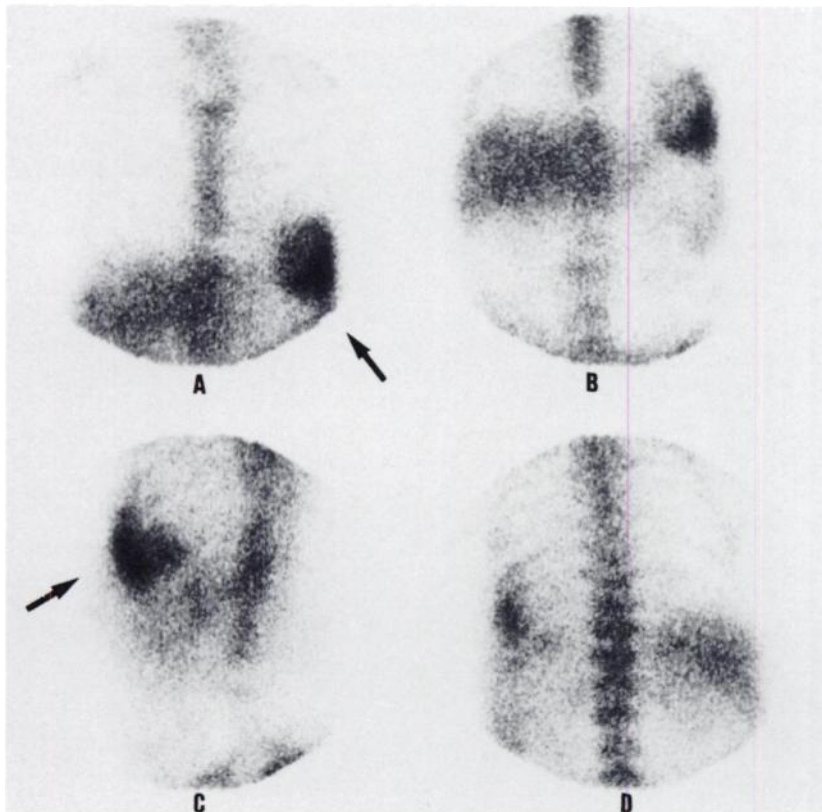
A 55-yr-old man was admitted with a 5-day history of asthenia, anorexia, myalgia, and fever. He had had an anterolateral myocardial wall infarction 2 yr before, and had done well on a regimen of digoxina and amiodarone.

On admission, he had pyrexia (40°C). The white blood cell count was 5900/mm<sup>3</sup> with 92% neutrophils. Physical examination was unremarkable. Two consecutive blood cultures were positive for *Salmonella* *Wirchoff*. Echocardiography showed a left ventricular aneurysm.

He was treated initially with chloramphenicol intravenously, however, an intermittent pyrexia persisted and blood culture, again proved positive for *Salmonella*. Ampicillin was then administered.

After 15 days of antibiotic therapy the patient continued to have fever and it was decided to carry out a whole-body  $^{67}\text{Ga}$  scan to localize the source of the infection. Imaging was performed with a large field of view gamma camera with a medium energy parallel hole collimator 48 hr after intravenous injection of 185 MBq of [ $^{67}\text{Ga}$ ]citrate. Anterior (Fig. 1, A-B), left lateral (Fig. 1C) and posterior (Fig. 1D) thoracic views were taken. Images showed increased uptake in the left ventricular wall, with a higher intensity in the region of apex. No other abnormal uptake was seen. Echocardiogram was performed 10 days later and revealed the previous left ventricular aneurysm, a left ventricular pseudoaneurysm with a thrombus, and pericardial effusion. Computed tomography of the thorax, showed pericardial effusion and left ventricular aneurysm with thrombus. Left ventricular angiography was carried out and confirmed left ventricular aneurysm and a thin wall apical pseudoaneurysm, with a mobile pedunculated thrombus inside.

At operation, a large aneurysm was found with an apical pseudoaneurysm with a mobile pedunculated clot that separated the contents of pseudoaneurysm from left aneurysm. Both left aneurysm and pseudoaneurysm were surgically removed, and microscopic examination showed leukocytic infiltration. Cultures from the thrombus were negative. Following resection, the patient had a right femoral thrombus, that



**FIGURE 1**

Gallium-67 scan, anterior (A,B), left lateral (C), and posterior (D) thoracic views. Arrows indicate a generalized pathologic uptake in left ventricle wall, with a higher intensity in the apex.

was successfully treated by the Fogarty technique (3). Post-operatively the patient remained afebrile, while on antibiotics. He was discharged 27 days after operation in good condition. Follow-up blood cultures were negative.

The most relevant complications of left ventricular aneurysm are cardiac failure, thromboembolism, and arrhythmias. Infection of mural thrombus associated with an aneurysm is rare. To our knowledge eight cases have been reported in the literature (4-11).

The pathogenesis of these infections is hematogenous, either seeding of a ventricular mural thrombus immediately following myocardial infarction or becoming infected months to years after their formation. Venezio et al. (10) believe that new thrombi are more predisposed to bacterial attachment with resulting infection than older, endothelialized clots.

The organisms most commonly responsible for this intracardiac infection are gram-negative bacilli. The avidity of *Salmonella* for abnormal endothelialized surfaces has been emphasized (5,7,11-14). *Salmonella* arteritis may also produce inflammatory destruction of the arterial wall leading to pseudoaneurysm formation or arterial rupture (14).

The high mortality of these kinds of infections may partly be a result of difficulty in diagnosis. Cross-sectional echocardiography and [<sup>67</sup>Ga]citrate scintigraphy have been suggested for early diagnosis (10,11).

Out of the eight cases of mural thrombus infection reported in the literature, only three (8,10,11) survived after surgical resection, and in only one (11) was the infection resulting from *Salmonella*. In the latter case the value of echocardiogram for early detection of the thrombus was demonstrated but the infection was not localized preoperatively by indium-111 labeled white blood cell scan.

Venezio et al. (10) reported a case where the thrombus was demonstrated by two-dimensional echocardiography and on the basis of this finding, <sup>67</sup>Ga scan was carried out and showed uptake in the apex. In this case the infecting organism was *Proteus Mirabilis*.

In the case presented here, resection of the left ventricular aneurysm, pseudoaneurysm and associated thrombus, resulted in complete resolution of the pyrexia with progressive clinical improvement. As in the cases previously reported (9-11), culture of the removed thrombus was negative, presumably due to the previous antibiotic therapy.

In conclusion, a patient with a history of myocardial infarction in whom persistent fever and *Salmonella* bacteremia developed, proved to have an infected mural thrombus. Gallium-67 citrate scanning contributed to the detection allowing curative surgical therapy.

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#### Technetium-99m DISIDA Hepatobiliary Agent in Diagnosis of Hepatocellular Carcinoma, Adenoma, and Focal Nodular Hyperplasia

**TO THE EDITOR** In a recent paper in the *Journal of Nuclear Medicine*, Calvet et al. (1) reported on the value of cholescintigraphy for diagnosing hepatocellular carcinoma (HCC) and distinguishing it from other lesions of the liver. A correlation between the amount of DISIDA uptake and the degree of differentiation of the tumor is demonstrated and late images for the detection of distant metastases are recommended. In an earlier study (2) only three of 80 (4%) HCCs accumulated DISIDA, therefore this report is very interesting.

Unfortunately, the time at which images were obtained (20 min and 3 hr) is not well chosen, because at 20 min the peak of liver uptake has already passed (3). Hasegawa et al. (4) have shown a case of HCC accumulating less than the surrounding liver at 5 min, equal at 1 hr and more at 2 hr postinjection. It should also be considered that the histologic distinction between a highly differentiated HCC and focal nodular hyperplasia (FNH) can be very difficult and both lesions can appear in the same organ (5). Calvet et al. remark that FNH, adenoma, and metastases can demonstrate the same uptake pattern as HCC. This has been shown only in case reports (6).

We compared the uptake pattern in 72 patients with FNH, five patients with adenoma and 67 patients with HCC (7). Subgroups were defined (Table 1) with regard to perfusion,