

## DIMINISHED UPTAKE OF $^{67}\text{Ga}$ -CITRATE IN A CASE OF PSEUDARTHROSIS

Sheldon R. Hurwitz\* and Ray R. Quinto

University of California, San Diego, School of Medicine, La Jolla,  
and Veterans Administration Hospital, San Diego, California

**A 22-year-old man with pseudarthrosis and infection of the right hip was referred for a  $^{67}\text{Ga}$ -citrate scan. A striking decrease was seen in normal bone and soft-tissue uptake in the entire right leg compared with the normal limb. Aortic injection of  $^{99\text{m}}\text{Tc}$ -labeled microspheres showed increased trapping in the region of the hip but contrast angiography was unremarkable. Despite clinical improvement,  $^{67}\text{Ga}$  uptake by the right leg on a repeat scan did not return to normal. This case represents the first report of a "photon-deficient" body part on  $^{67}\text{Ga}$  scanning.**

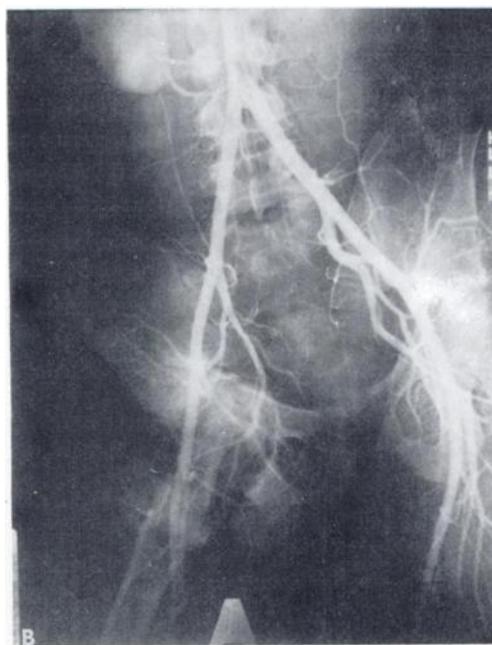
Gallium-67 citrate is widely used to detect and stage neoplastic and inflammatory processes (1,2). Normally, there is accumulation in the liver, spleen, and axial skeleton with occasional variants (3). Abnormal lesions present as foci of relatively increased activity. We report here the phenomenon of decreased isotopic uptake in a case of pseudarthrosis.

### CASE REPORT

A 22-year-old man came to the Veterans Administration Hospital, San Diego, with right hip pain. He had previously incurred a fracture dislocation of the right hip in an auto accident in 1965. Treated with traction, he recovered uneventfully. In 1968, the patient developed severe right hip pain and required a right cup arthroplasty. The cup became infected and was taken out in 1972. In hopes of obtaining fusion of the hip, he was placed in a spica cast for 4 months. A pseudarthrosis developed, however, and the cast was removed. Aspirations of the right hip in May and August of 1973 showed no growth on culture.

On admission examination in September 1973, the patient held the right hip in 90 deg of external rotation. He had limited range of motion: 80 deg flexion, 70 deg abduction, 0 deg adduction, 0 deg internal rotation, and 90 deg external rotation. The right leg was 2 in. shorter than the left. Femoral, popliteal, and dorsalis pedis pulses were equal in both legs. There was a positive Branham's sign (decreased apical pulse rate with compression of the

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For reprints contact: Ray R. Quinto, Nuclear Medicine Service, VA Hospital, 3350 La Jolla Village Dr., San Diego, Calif. 92161.  
\* Present address: Dept. of Nuclear Medicine, Naval Regional Medical Center, Oakland, Calif. 94627.



**FIG. 1.** (A) Radiograph of pelvis demonstrates pseudarthrosis of right hip. (B) Arterial phase of normal angiogram (incidentally noted is accessory right renal artery).

femoral artery) but no thrill or bruit. There were no varicosities or edema noted.

Radiograph of the right hip (Fig. 1A) showed demineralization of the proximal femur with loss of normal cortex of the femoral head. The joint space was narrowed and acetabular protrusion was present. Leukocyte count was 8,700, serum calcium and alkaline phosphatase were normal, and the erythrocyte sedimentation rate was 24. Because of persistent pain, a scan with  $^{67}\text{Ga}$ -citrate was ordered (Fig. 2A) "to rule out infection." Imaging was performed on Sept. 13, 1973, 72 hr after intravenous injection of 5 mCi of  $^{67}\text{Ga}$ -citrate (New England Nuclear). All scans were performed with a dual-probe 5-in. NaI(Tl) Ohio-Nuclear whole-body scanner with 5:1 minification. For  $^{67}\text{Ga}$ , a 100-keV window (90–190 keV) with no enhancement and 5:1 minification was used.

A bone scan using  $^{99\text{m}}\text{Tc}$ -polyphosphate showed increased uptake in the affected hip (Fig. 2B). Contrast angiography demonstrated normal vessels including runoff (Fig. 1B). A mainstream aortic injection of  $^{99\text{m}}\text{Tc}$ -microspheres (4) showed an intense mottled flush of activity over the right hip (Fig. 2C). Skin blood flow in the legs both by the radionuclidic technique described by Moore (5) and by Doppler ultrasound examination was normal.

In January 1974, the patient underwent a Girdlestone arthroplasty to correct the pseudarthrosis. The surgically removed right femoral head showed no histologic evidence of osteomyelitis, but postoperative culture grew *Enterobacteriaceae*. Despite intravenous Cleocin, a draining infection persisted. In March 1974, debridement was carried out down to

the acetabulum. The base granulated in well and recovery was uneventful. Within 2 months, weight-bearing was permitted and the patient returned to school. Followup  $^{67}\text{Ga}$  scan June 1, 1974 showed diminished uptake in the right leg identical to the first study.

#### DISCUSSION

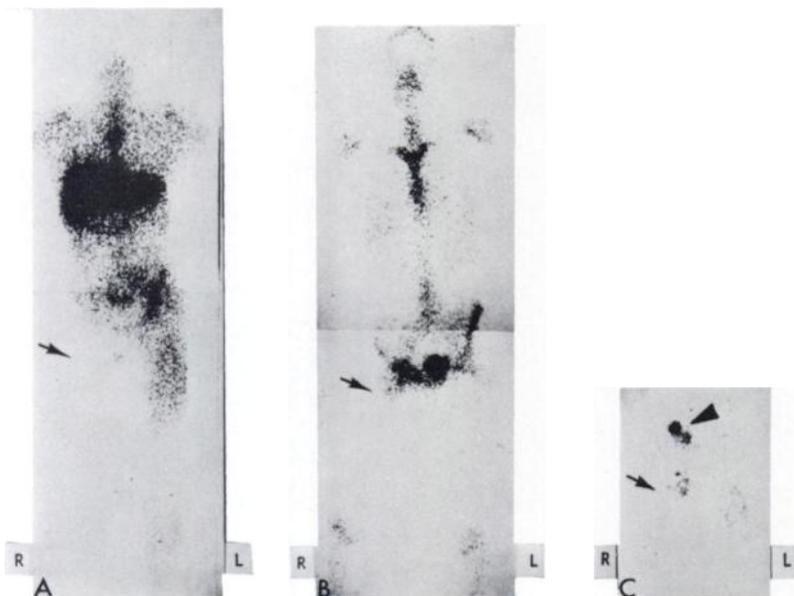
In a patient with pseudarthrosis of the hip,  $^{67}\text{Ga}$ -citrate scan showed a dramatic decrease in isotope activity of the entire affected leg compared with the normal limb. The first hypothesis to explain this finding was a traumatic arteriovenous malformation shunting isotope from the affected leg. Although no shunts were seen on radiographic contrast studies, aortic injection of  $^{99\text{m}}\text{Tc}$ -microspheres showed increased blood flow to the right hip of uncertain significance. Arteriovenous communications following femoral fracture or hip surgery have not been reported (6).

The patient's leg had not been used for some time before the scan. Following surgery and increased use of the limb, there was only a partial return to normal  $^{67}\text{Ga}$  activity in the leg. We have never before observed diminished gallium uptake in patients with trauma, ischemia, or infection of a limb.

Recently, the concept of the "photon-deficient" lesion on bone scanning was introduced (7). The present case represents a patient with a "photon-deficient" limb on  $^{67}\text{Ga}$  scan. Its significance and cause are, at present, unknown.

#### ACKNOWLEDGMENTS

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**FIG. 2.** (A) Gallium-67 citrate scan Sept. 13, 1973 shows decreased uptake in both bony skeleton and soft tissues of right leg. (B) Bone scan Sept. 17, 1973 with  $^{99\text{m}}\text{Tc}$ -polyphosphate shows increased uptake in right hip as would be expected in arthritis. (C) Rectilinear scan at 20 min following aortic injection of  $^{99\text{m}}\text{Tc}$ -labeled microspheres on Sept. 28, 1973. Large arrow points to normal renal bed filled from accessory renal artery. There was no pulmonary uptake.

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