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INDIUM-111 LEUCOCYTE SCANNING IN THE EVALUATION OF PAINFUL HIP ARTHROPLASTY

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Thirty patients with a painful hip arthroplasty had an In-111 leucocyte scan before surgical reexploration. In 12 patients, the In-111 leucocyte scan was abnormal and in all of them, microorganisms were found at the culture of the material from their hips at the operation. Among the 18 patients with a normal scan no infection was found in 17. In one patient, a thick-walled abscess growing *Escherichia coli* was found. We conclude that In-111 scanning is sensitive, specific and therefore useful in the differential diagnosis of pain after hip arthroplasty.

Key words: hip arthroplasty; Indium-111; infections; leucocyte; scintigraphy.

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Evaluation of the patient with a painful hip arthroplasty sometimes represents a diagnostic challenge. The differential diagnosis includes peri-articular ossification, loosening and late infection (Amstutz 1970, Charnley 1972, Beckenbaugh & Ilstrup 1978). Scintigraphy with Technetium (Tc-99m) phosphate compounds and Gallium (Ga-67) has been recommended to distinguish between these possibilities (Reing et al. 1979, Horoszowski et al. 1980, Williams et al. 1981, Rushton et al. 1982). Recently Indium (In-111) labelled leucocytes have proven useful to locate infectious lesions (Thakur et al. 1977). This technique may be useful in bone or joint infections (Propst-Proctor et al. 1982).

In-111 leucocyte scanning was performed in 30 patients with hip arthroplasty and who needed surgical reexploration.

PATIENTS AND METHODS

The study included 30 patients (15 F, 15 M) mean age 60 years (range 27–80). Twenty-one patients had had total hip replacement (Charnley 18 hips; McKee-Farrar 3 hips; Moore hemi-arthroplasty 4 patients, and cup arthroplasty 5 patients). The patients were pain-free for between 1 month and 10 years following surgery (mean 11 months). The preoperative evaluation included radiographs, leucocyte scanning and hip aspiration with culture of the synovial fluid. At the time of surgical reexploration, material from the hip was also cultured.

The labelled leucocytes were prepared using the method described by Segal et al. (1976), and modified by us (Ferrant & Leners 1980). Venous blood (60 ml) was aspirated into a syringe containing 500 units of preservative-free heparin. Blood (50 ml) was mixed with 2 ml of 2 per cent methyl cellulose. The red cells were allowed to sediment for a maximum of 45 min. The remaining 10 ml blood was centrifuged at 1500 *g* for 10 min to obtain platelet poor plasma for resuspension of the labelled leucocytes. The leucocyte-rich supernatant from the sedimented blood was centrifuged at 80–90 *g* for 7 min. The cell pellet was then washed with 9 per cent saline and resuspended in saline. The In-111-Oxine (18.5 MBq) was added dropwise to the

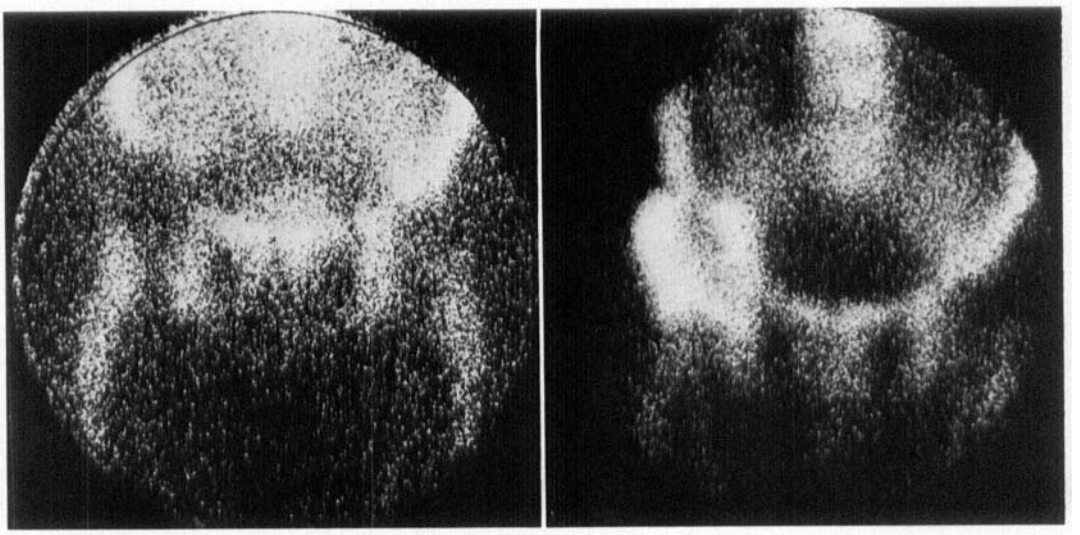

Figure 1. Scintigraphy for diagnosis of an infected arthroplasty. The patient had pain after prosthetic arthroplasty of the right hip. A: The Tc-99m sulphur colloid scan showed no uptake in the acetabulum. B: There was marked uptake of In-111 leucocytes in the regions of the greater and lesser trochanter and in the acetabulum of the right hip.

cell suspension followed by 15 min incubation at room temperature. Half of the volume of the platelet poor plasma was then added to the labelled cell suspension. The cells were centrifuged at 80–90 *g* for 7 min, and the cell pellet was suspended in 10 ml saline with the remaining cell poor plasma. The cells were then ready for injection.

At the time of the labelling of the leucocytes, Tc-99m sulphurcolloid imaging of the reticuloendothelial system (RE-system) of the pelvis and femora was performed. Twenty-four hours after injection of the labelled leucocytes, imaging was performed using the 247 keV photopeak. The leucocyte scan was considered abnormal when activity in addition to RE activity was seen. All the tests were performed within the month before surgical exploration.

RESULTS

In 12 patients the In-111 leucocyte scan was abnormal, and in all of them the culture of material from hip at the time of surgery grew microorganisms. The microorganisms involved were *Staphylococcus epidermidis* (5 patients), *Staphylococcus aureus* (3 patients), *Streptococcus pyogenes* (2 patients), and *Klebsiella pneumoniae, Escherichia coli, Serratia marcescens* (1 patient each). Preoperative hip aspiration did not grow any microorganism in 4 of these 12 patients.

The abnormal leucocyte uptake was present in the region of the false capsule and the top of the femoral shaft (6 patients), around the greater trochanter (4 patients), or in the lower shaft (2 patients).

In 18 patients, the In-111 leucocyte scan was normal. The culture of material sampled at the time of surgical reexploration remained sterile in 17 of them. In one patient with a normal leucocyte scan, a thick-walled abscess, the content of which grew *E. coli,* was found.

DISCUSSION

Radiographs and bone scanning are of limited help in the diagnosis of hip sepsis (Gelman et al. 1978, Weiss et al. 1979). Hip aspiration is highly specific but poorly sensitive (Murray & Rodrigo 1975). In our series, a third (4/12) of the hip aspirations were falsely negative.

Ga-67 citrate is also useful for diagnosing an infected hip arthroplasty, despite both false and negative results (Lisbona & Rosenthall 1977, Wagner et al. 1978, Reing et al. 1979, Horoszowski et al. 1980, Williams et al. 1981, Rushton et al. 1982). However, Ga-67 imaging may

necessitate a 48–72-h delay before conclusions can be drawn. Ga-67 uptake is not specific for infection (Hoffer 1978) and can occur in areas of increased bone turnover without evidence of sepsis (Lisbona & Rosenthall 1979, Rosenthall et al. 1979).

When examining an In-111 leucocyte scan, it must be known that destruction of a part of the labelled leucocytes occurs in the macrophages of the bone marrow. The distribution of the macrophages in the pelvis and the femora may be modified by the arthroplasty and this may cause difficulties in interpretation. These are easily overcome if a marrow scan with Tc-99m sulphur colloid is performed before the leucocyte scan.

For the leucocyte scan to show an abnormal image in the presence of infection, the lesion must be active enough and vascularized so as to attract a sufficient amount of labelled leucocytes to be detected. Chronicity and a poor vascularization were presumably the reasons why no increased activity was observed at the site of an old thickwalled abscess. Conceivably, diseases affecting the chemotaxis of the neutrophils might also hinder their concentration at the site of sepsis. Furthermore, it might be objected that labelled neutrophils might be taken up in aseptic inflammatory lesions (Ferrant & Leners, 1980). Nevertheless, we did not observe any abnormal uptake not due to infection in this series of patients with hip arthroplasty.

As scanning with In-111 labelled leucocytes is both highly specific and sensitive for detecting infection in hip arthroplasty, we recommend this diagnostic procedure in patients evaluated for pain after hip arthroplasty.

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