

EVALUATION OF PAINFUL HIP ARTHROPLASTY

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The evaluation of chronic pain after hip arthroplasty has always been a difficult problem and recently scintigraphy has been recommended as a suitable method of examination for this purpose. On the basis of radiographic and laboratory studies, scintigraphy, allergy tests, cultures and histological examinations, in 16 patients with chronic pain in the hip after arthroplasty, it is concluded that radiography and scintigraphy together give valuable information about the cause of pain, especially if the prosthesis is infected. Fenestration of the femoral cortex may verify the diagnosis before replacement of the prosthesis.

Key words: painful hip arthroplasty; radiography; scintigraphy; allergy tests; fenestration of femoral cortex

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Following hip arthroplasty osseous inflammation occurs with a frequency ranging from 8 per cent (Amstutz 1970) to 0.5 per cent (Charnley 1972). In many cases, this inflammation is due to infection (Arnoldi & Buhl 1973, Charnley 1972), but mechanical irritation (i.e., loosening and uneven pressure), allergy and toxic reactions may also give rise to inflammation.

The inflammation often runs an insidious course, independent of the aetiology (Amstutz 1970, Feith et al. 1976, Salvati et al. 1971, 1974, Sjöstrand 1974). Accordingly it may be difficult to recognize the inflammation, and even more difficult to disclose its cause, in particular, whether it is due to mechanical loosening of the prosthesis or to infection (Amstutz 1970, Charnley 1972, Feith et al. 1976, Sjöstrand 1974).

Many authors have recommended bone scintigraphy in the evaluation of pain after hip arthroplasty (Bauer et al. 1973, Bergström

et al. 1973, Feith et al. 1976, Sjöstrand 1974).

The purpose of the study reported below is to throw light on the possibility of finding the cause of pain by means of radiography, sero-reactions and bone scintigraphy.

PATIENTS AND METHODS

The series studied comprises 16 patients who in the period from October 1974 to March 1976 were examined because of persistent pain after hip arthroplasty performed during the years 1969-1975. A Moore prosthesis had been implanted in 13 of these patients after a fracture of the femoral neck, and a Ring prosthesis in three because of osteoarthritis of the hip joint. No bone cement was used, and none of the patients were given prophylactic antibiotics.

The patients were subjected to radiography every 2nd month after implantation of the prosthesis. The classification of X-ray findings is based on the principles described by Sjöstrand (1974). A successfully implanted prosthesis will show a radiogram with a zone of radiolucency

around the prosthesis not exceeding 2 mm (*Normal*).

The first radiological signs of loosening of the prosthesis are discrete, more than 2 mm wide, areas of radiolucency at the sites of maximal weight-bearing (collum and tip of femoral stem). Acetabular wear will show radiolucency in the acetabular roof and eventually osteophyte formation (*Discrete radiolucency*).

A more than 2 mm wide, irregular zone of radiolucency around a large part of the femoral stem is indicative of advanced loosening or infection (*Diffuse, irregular radiolucency*).

Some patients show typical ostitis lesions with broad diffuse, irregular radiolucency around the prosthesis and periosteal reaction (*Ostitis*).

ESR was determined regularly. An ESR exceeding 25 mm/hour more than 3 months after implantation was regarded as indicative of infection (Sjöstrand 1974).

A ^{99m}Tc -pyrophosphate scintigraphy was performed, in patients D and N 6½ months after implantation of the prosthesis, while the others were examined more than 10 months after surgery. One patient (O) was reoperated on less than half a year after implantation of the first prosthesis, thus no scintigraphy was performed.

The scintigram will either show *heavy, diffuse accumulation* surrounding the prosthesis (indicative of infection), *discrete but heavy accumulation* around a small part of the prosthesis (indicative of a mechanical problem) or very weak accumulation (*normal*).

By means of patch tests, allergy to chromium, cobalt and nickel was investigated (Evans et al. 1974).

Of the 16 patients, 13 were reoperated on:

In 11 patients the prosthesis was replaced, including five after previous fenestration of the femoral cortex. In two patients only fenestration of the femoral cortex was performed. During reoperation, swabs for aerobic, anaerobic and hypertonic sacchrose – broth cultures (Kamme et al. 1974, Nolan et al. 1975) and biopsy specimens were obtained from the medullary cavity.

RESULTS

Each of the 16 patients is denoted by a letter.

Table 1 shows the results of the non-operative studies. The patients fall into two groups:

Group 1: This consists of nine patients (B, G, I, J, K, L, N, P [and O]) in whom at least two of the three examinations were suggestive of *infection*, and in whom there was good agreement between the radiographic and scintigraphic findings (i.e., the patients in the right upper corner of the table). The diagnosis of infection was

Table 1. The results of radiographic, serological and scintigraphic examinations and their interrelation

Scintigraphy	X-ray				ESR (mm/hour)
	Normal	Discrete radiolucency	Diffuse, irregular radiolucency	Ostitis	
Heavy, diffuse accumulation			P	IBGK	> 25
	M	C	L	N	< 25
Heavy, localized accumulation		F	J		> 25
					< 25
Normal	H				> 25
	A E	D			< 25

Patient O (with infection) was not subjected to scintigraphy and is therefore not included in the table.

afterwards confirmed in all cases except patient P, in whom re-operation revealed complete loosening of the prosthesis without bacteriological or histological signs of infection. This patient had for a short time been given lincomycin without any change in symptoms or findings (including ESR).

Group 2: This group consists of seven patients (A, C, D, E, F, H and M) in whom none or at most one of the results of the examinations was compatible with the presence of infection. The results in this group are more variable. None of the patients in group 2 has subsequently been found to suffer from infection.

No patient in group 2 had X-ray findings indicative of infection. However, scintigraphy of patients C and M showed heavy, diffuse accumulation around the prosthesis. In patient M the scintigraphic accumulation was caused by allergy but in patient C no reason was found. In only one of the patients with positive findings (F) was there agreement between radiography and scintigraphy and in this patient scintigraphy disclosed the cause of pain: heavy accumulation in the roof of the acetabulum. Correspondingly, reoperation disclosed abundant granulation tissue presumably

because of too large a prosthesis head. X-ray only revealed slight radiolucency in the acetabular roof and osteophyte formation.

Table 2 shows the most likely cause of the inflammation around the prosthesis based on bacteriological and histological findings as well as on radiography, sero-reactions and scintigraphy. Decisive diagnostic importance was ascribed to the bacteriological and histological findings.

The patients were re-examined more than 22 months after treatment of their painful hip arthroplasty. The results are shown in Table 3. Only three patients were pain-free. The patients denoted "improved" had slight pain on weight-bearing, mostly using one cane when walking outdoors and one patient (B) had a persisting fistula. The three patients whose condition had deteriorated all had severe pain at rest and very poor ambulatory function. In patient L a Girdlestone arthroplasty was performed 1½ years after replacement of an infected hip prosthesis and the same procedure is planned for patient N. The table shows that only three of the eight infected patients felt better after treatment, which in all cases included antibiotics. Likewise two of the three patients whose discomfort increased unacceptably had an infected prosthesis.

Table 2. The aetiology of the ostitis around the hip prosthesis. The diagnosis was based on as many findings as possible, but if a given patient had undergone re-operation, it was based particularly on the bacteriological and histological findings

Aetiology	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Infection		■					■		■	■	■	■		■	■	
Mechanical irritation*	■				■	■										■
Allergy													■			
Unknown			■	■				■								
Re-operated	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

* Loosening or uneven mechanical pressure.

A black rectangle indicates the most probable aetiology and that the patient had undergone re-operation.

Table 3. The results of treatment of failed hip arthroplasty based on interviews with the patients more than 22 months after treatment

Symptoms after treatment	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Well				■		■										■
Improved	■	■	■								■					
Unaltered				■		■		■	■	■			■			■
Worse								■				■		■	■	

DISCUSSION

Osseous inflammation around a prosthesis may give only very weak X-ray changes within the first year after implantation of the prosthesis (Bergström et al. 1973, Charnley 1972), partly because of a slow course and partly because some destruction of the surrounding osseous tissue is required before pathological radiolucency can be distinguished radiographically from normal radiolucency. Accumulation on a scintigram is caused by increased metabolism and vascularity (Jones et al. 1976). Any noxious stimulus (e.g., infection, allergy and loosening) will very soon cause these principal elements of inflammation. Scintigraphy thus gives a picture of inflammation and does not demand morphological destruction before a positive finding can be registered. A successfully implanted prosthesis will show a normal scintigram after half a year (Bauer et al. 1973).

Sjöstrand (1974) performed both scintigraphy and scintimetry, and he found that these investigations together gave indications of whether the prosthesis was infected or loosened. Scintigraphy, as performed in this study, reveals the presence of inflammation and where it is situated, but it is not possible to differentiate infection from loosening by the intensity of inflammation.

We find scintigraphy valuable in two situations: When a patient experiences pain

despite an almost normal radiogram (e.g., patients C, F and M); and when X-ray shows radiolucency, to determine whether it is caused by an active or an inert process (e.g., patient D).

In the case of infection, radiography and scintigraphy show identical and diffuse abnormalities. The diagnosis of infection can be confirmed by fenestration of the femoral cortex. This operation may also give material for histological studies (Charosky et al. 1973) and cultures (Kamme et al. 1974) thus helping to choose the best antibiotic. Further fenestration might relieve pain (Arnoldi & Buhl 1973, Wilson & Scales 1970).

Before reoperation allergy should be looked for.

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