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PARA-ARTICULAR OSSIFICATION FOLLOWING HIP REPLACEMENT

70 Arthroplasties ad modum *Moore using McFarland's Approach*

S. ROSENDAHL, J. KROGH CHRISTOFFERSEN & M. NØRGAARD

Surgical Department 9, The Copenhagen City Hospital, Copenhagen, Denmark.

Seventy patients, representing all the survivors from a group of 117 consecutive Moore arthroplasties, were examined 2 years after the operation. A high incidence of para-articular ossification was observed. The ossification was associated with impaired function of the hip joint. The separation of periost and fascia from the greater trochanter in McFarland's approach may be responsible for the high incidence of bone formation. This theory is compatible with experimental evidence.

Key words: myositis ossificans; femoral neck fracture; Moore prosthesis

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Arthroplastic operations on the hip may be followed by characteristic bone formation in the periarticular tissue. One month after the operation these changes are seen on the X-ray film as a faint shadow which, in a few months, grows more intense and assumes a trabecular structure.

Interest in this problem has been revived by the increasing use of hip replacement, but the cause of the bone formation is not understood. The reported incidence of this complication varies widely, and there is disagreement regarding the significance of the para-articular bone in hip function.

In Department 9 of the Copenhagen Municipal Hospital we have found ossification to be common after hip replacement. Therefore, we have performed a follow-up examination of all the available patients subjected to this operation during a specified 2-year period, in order to elucidate the incidence and classify the calcification. We also studied its influence upon the final result and tried to clarify the aetiology.

PATIENTS AND METHODS

During the 2-year period from 1. 4. 1969 to 31. 3. 1971, a total of 117 hip replacement operations were performed according to Moore (1957).

One hundred and twelve operations were primary treatment of a recent medial fracture of the femoral neck. Sixty-seven patients had the operation within 24 hours of fracture, whereas in 45 patients the operation was deferred, because of associated diseases, for 2–35 days (mean 8 days), and temporary traction was used in the intervening period.

Five operations were performed as a secondary measure, after failure of osteosynthesis or conservative treatment of medial fractures of the femoral neck.

At all the operations the approach was the McFarland-Osborne (1954) anterolateral incision, detaching the insertion of the gluteus medius muscle from the greater trochanter in continuity

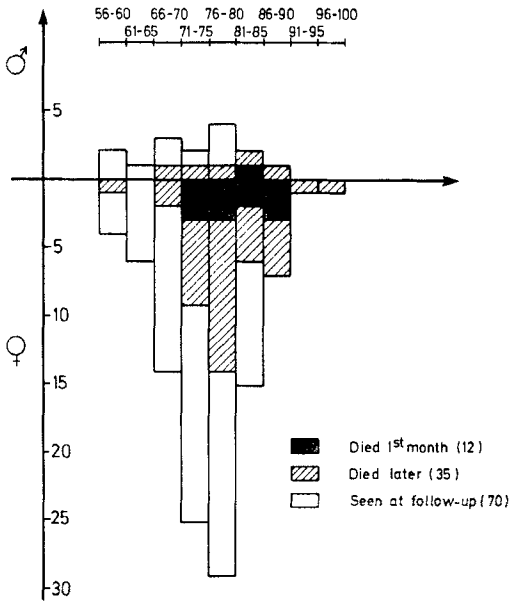

Figure 1. Age and sex distribution of 117 patients.

with the origin of the vastus lateralis muscle. The joint capsule was opened by an L-shaped incision, and the femoral head was dislocated anteriorly during external rotation of the femur. After insertion of the prosthesis and reduction, the gluteus medius muscle was re-inserted using 4 or 5 non-absorbable sutures passed through drill holes in the trochanter. Whenever possible, walking exercises, with full support, were started a day or two after the operation.

Complications

Twelve patients died within the first month after the operation. As shown in Figure 1 these patients were predominantly in the oldest age groups, their mean age being 80.6 years.

Seven patients developed sub-fascial infection due to *Staphylococcus aureus*. Two of them died within the first month and another two after 2 and 4 months, respectively, before the wound had healed. In the remaining three patients with deep infection, healing was obtained, but in one of them not until the prosthesis had been removed. In another three patients the prosthesis was removed, because of hip pain, before the follow-up examination.

Follow-up

At follow-up the patients were questioned regarding pain, walking ability, and working capacity. The gait was observed, and the patients were subjected to a clinical examination of both hip joints, measuring mobility. A Trendelenburg sign, if present, was recorded. Radiographs of the operated hip, both anteroposterior and lateral views, were taken.

RESULTS

In evaluating hip function we used the system of Merle d'Aubigné & Postel (1954).

Periarticular calcification was assessed as follows on the basis of the radiographs (Rosendahl et al. 1972):

\+ Faint shadows of minimal extent.
\+ + Scattered lumps of calcification in the periarticular tissue or small exostoses from the trochanter or acetabulum, of a radiopacity approximately the same as that of normal bony tissue.
\+ + + Widespread calcification with distinctly trabecular structure.

Among 70 patients included in the follow-up, we found no calcification in 7, mild calcification (+) in 20, moderate (+ +) in 26, and severe (+ + +) in 17.

Table 1. Degree of calcification as compared with the clinical result. In the two groups with the poorest results all patients have calcification.

Clinical results	Calcification				
	—	+	++	+++	Total
Very good	4	3	7	2	16
Good	1	4	1	2	8
Medium	1	6	6	4	17
Fair	–	2	4	2	8
Poor	–	2	6	5	13
Total	6	17	24	15	62

Table 1 lists the calcification compared with the clinical result. Five patients had to be excluded from this evaluation, as their walking was inhibited by other causes: hemiparesis in two, disseminated sclerosis in one, and severe senility in two. A further three

patients were excluded in whom the poor result was due to removal of the prosthesis because of pain. A relationship between increasing calcifications and poor function is seen.

The calcifications usually occurred in the gluteus medius muscle. The relationship between insufficiency of this muscle, indicated by the presence of Trendelenburg's sign, and the degree of calcification is shown in Table 2. In this table increasing calcification seems to be associated with poorer function.

Table 2. Degree of calcification as compared with the occurrence of Trendelenburg's sign. Increasing calcification is seen to be associated with insufficiency of the abductor function.

Trendelenburg's sign	Calcification				
	—	+	++	+++	Total
Negative	6	8	15	4	33
Positive	0	9	9	11	29
Total	6	17	24	15	62

Table 3. Calcification in eight patients excluded because of functional impairment due to other causes.

Reason for exclusion	Degree of calcification
1. Hemiplegia	—
2. Hemiplegia	+++
3. Senile dementia	++
4. Senile dementia	+++
5. Disseminated sclerosis	+
6. Implant removed	+
7. Implant removed	+
8. Implant removed	++

Table 3 shows the calcification in the eight patients excluded because of functional impairment due to other causes.

Deep or superficial infection had no influence upon the occurrence of calcifications, and there was also no difference between the groups of patients having acute and elective surgery.

DISCUSSION

Periarticular ossification after hip replacement is a kind of posttraumatic myositis ossificans. This is a misnomer, as it is not an inflammatory condition, but the disease entity is well-known and has been well described, clinically and histologically. It is known that the calcification arises through metaplasia of connective-tissue cells in the peri- and endomysium. The process progresses rapidly. As early as 3 or 4 weeks after the trauma the calcific shadow may be discerned on the X-ray film, and biopsy at this time may be misinterpreted as osteosarcoma owing to the numerous mitoses. The true cause of calcification following hip replacement has not been definitely established. In the opinion of Boitzy & Zimmermann (1969) the growth is elicited by bony splints and bone marrow from the operation. However, careful flushing with saline before seating the prosthesis cannot prevent the calcification. Sarmiento & Grimes (1963) assumed that injury to the acetabular rim was the eliciting factor and tried to prevent calcification by sparing this area during the dissection. However, the great majority of calcifications observed by us have clearly arisen from the trochanteric area. Also the Moore operation, using modest dissection, and the McKee total replacement, with comprehensive dissection at the acetabulum, appear to be followed by the same rate of calcification.

Blunt injury to muscle tissue is the main factor in classical posttraumatic myositis ossificans. This factor presumably contributes to the development of calcification following hip replacement, as all approaches to the hip joint involve some injury to muscles by the retractors.

Periarticular calcification has occurred in practically all major series of hip replacement. The incidence is usually stated to be about 10 per cent (Eftekhar 1971, Patterson & Brown 1972), but

many authors have reported divergent rates, with a range as wide as from a few up to about 50 per cent. The explanation is possibly that minor degrees of calcification are apt to be overlooked on the X-ray film.

Nollen & Slooff (1973), using a classification almost identical to ours, found calcifications in 53 per cent, which is considerably below our 90 per cent. We employed McFarland & Osborne's incision (1954) which differs from most other approaches to the hip joint in the extensive dissection of the periosteal muscle insertion on the greater trochanter.

Zacchalini & Urist (1964) have demonstrated that detachment of the periosteum is the most reliable method for inducing experimental calcifications, in particular if a distance of a few millimetres is established between the bone and the detached periosteum. In this way they could induce severe calcification in 36 out of 36 rabbits. On the other hand, injury to the muscle and periosteum caused no calcification in any rabbit.

In the McFarland approach to the hip joint the strong gluteus medius muscle is re-inserted by non-absorbable sutures through drill holes to the greater trochanter. When walking exercises are started a short time after the operation, diastasis is apt to occur between the muscle-periosteal flap and the bone, and it is from this space that the calcification arises. Insufficiency of the re-insertion of the gluteus medius may explain the relationship demonstrated by us between Trendelenburg's sign and bone formation. In this connection, however, it must be pointed out that the dissection in McFarland's approach is performed close to the nerve fibres from the superior gluteal nerve which innervate the tensor muscle of the fascia lata. Together with the gluteus medius muscle, this is the most important abductor of the hip joint.

There is disagreement about the functional significance of the periarticular calcification following hip replacement. Examples of a poor result in the presence of severe calcification are often mentioned, but it is well-known that even a very severe calcification is not incompatible with a satisfactory functional result.

From the present study there is indication that calcification around the hip joint following hip replacement is associated with impaired function. The marked impairment of abductor function is of particular importance.

In order to prevent postoperative calcification, one should avoid extensive dissection of the periosteum from the bone and abstain from approaches which demand this. Flushing off bony splints and gentle retraction of the muscles must also be assumed to be of importance.

If periarticular ossification develops after a hip replacement operation, treatment should be attempted according to the lines of Böhler (1936) for dealing with classical posttraumatic myositis ossificans.

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Correspondence to: S. Rosendahl, M.D., Department of Orthopaedic Surgery, Hvidovre Hospital, DK-2650 Hvidovre, Denmark.