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Department of Orthopaedics,
Catholic University, Nijmegen, The Netherlands.

PARA-ARTICULAR OSSIFICATIONS AFTER TOTAL HIP REPLACEMENT

A. J. G. NOLLEN & T. J. J. H. SLOOFF

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The preoperative and postoperative complications of alloarthroplasties of the hip are virtually the same with all types of prosthesis (McKee 1951, 1966, 1969, Friedebold 1969, Charnley 1969, Watson-Farrar 1969, Witt 1969, Chapchal-Müller 1970, Weber 1970, Chapchal 1972). In the past three years in particular, para-articular ossifications have been increasingly mentioned in this respect (Boitzy-Zimmerman 1969, Huggler 1969, Willert-Semlitsch 1970, Cotta-Schulitz 1970, Kingma 1971, Owen 1971, Ring 1971, Chapchal 1972, Slooff-Van Berkel 1972, Blaimont 1972, Wilson et al. 1972, Murray 1972, Patterson et al. 1972). On clinical grounds—course, localization and radiological features—these heterotopic ossifications can be brought under the heading of non-septic ectopic ossifications of the locomotor apparatus. These can be divided into ossifications in tendons, particularly those of the hip adductors (McLean-Urist 1961), congenital myositis ossificans progressiva (Noble 1924, Frejka 1929, Maini-Singh 1967), myositis ossificans circumscripta, which is usually posttraumatic (Geschickter 1938, Thorndyke 1940, Levinthal-Kaplan 1962, Urist-McLean 1963, Paterson 1970), and the para-osteoarthropathies observed in association with neurological disorders, especially paralyses (Déjerine-Ceillier 1919, Miller-O'Neill 1949, Brailsford 1941, Irving-Le Brun 1954, Hardy-Dickson 1963, Roberts 1968, Costello-Brown 1951, Gunn-Young 1959). The latter mostly occur around the large joints, and specifically around the hip and elbow. To this list we should like to add the ossification around the hip alloarthroplasty.

The aetiology and pathogenesis of ectopic ossifications are obscure. The oldest theory is probably that of Déjerine & Ceillier (1919),

who assumed that metaplasia of primitive connective tissue should be held responsible. Leriche & Policard (1926) suggested that haemorrhages and inflammations (e. g. rheumatic affections) stimulate the connective tissue to heterotopic ossification. Friedenstein (1966, 1969) and Danis (1970) held that migrating bone marrow cells cause the change of connective tissue elements into osteogenic tissue. A traumatic cause was accepted by Geschickter (1938), Ackermann (1958) and Collins (1965), who believed that lesions of muscles or interstitial haemorrhages can lead to degeneration of muscle, proliferation of perivascular connective tissue and, ultimately, to formation of cartilage, osteoid and bone. Urist & McLean (1963) and Zaccalini & Urist (1964) suggested that a periosteal lesion causes such changes in local cell metabolism that differentiation of osteogenic cells occurs, leading to ossification.

While there are only hypotheses on the cause of these ossifications, their histomorphological features and course are well known. The histological descriptions of myositis ossificans progressiva (Frejka 1929, Maini-Singh 1967) and of other types of ectopic ossification (Urist & McLean 1963) show close similarities. The heterotopically induced bone matures and, via various stages, ultimately begins to resemble normal trabecular bone. Radiologically, too, matured ectopic bone resembles normal bone tissue.

MATERIAL AND METHODS

In a follow-up study of 155 patients submitted to total hip replacement during the period 1969–1971, emphasis was placed on the occurrence of ectopic ossifications (Figure 1).

Efforts were made to classify these cases according to the localization and severity of ossification, and to compare these with the therapeutic results. The clinical course was analysed. Biopsy specimens were used for histological examination. A preliminary impression was gained concerning therapy with phosphonates.

The study encompassed 200 hips in 155 patients, with the following distribution:

males:	31	left-sided:	51
females:	124	right-sided:	59
		bilateral:	45
total:	155 patients	total:	155 patients

The graph in Figure 2 shows the age distribution.

We used two types of prosthesis for hip replacement: the Müller type (63 cases) and the McKee type (137 cases). The operative approach was anterolateral for the

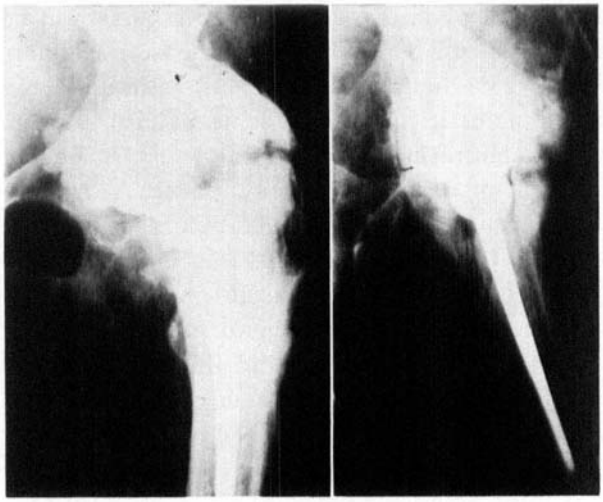


Figure 1. Para-articular ossification.

Müller type and posterolateral for the McKee type. Both types of prosthesis were cemented with Palacos R. The joint-capsule was excised in toto.

Postoperative treatment and after-care were the same for both types of prosthesis

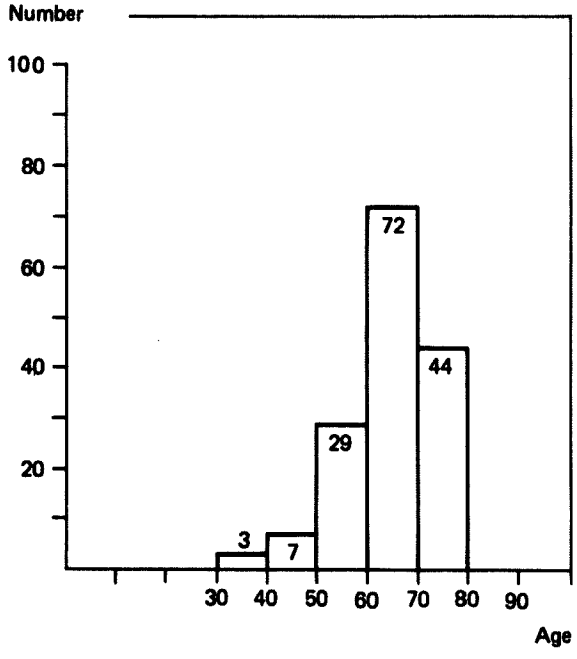


Figure 2. Age distribution.

and encompassed: (1) wound drainage during 48 hours; (2) a hip spica during 5 days; (3) traction in abduction and extension during 5 days.

From the first postoperative day: (1) anticoagulant medication; (2) isometric static exercise of the limb involved.

Wound dressing on the 5th postoperative day and walking with two English canes, without weight-bearing.

From the 10th postoperative day: active hip exercises and exercises with weight-bearing.

The indications for the arthroplasties were the following:

progressive coxarthrosis:	149		
secondary head necrosis:	10		
rheumatism:	10		
Bechterew's disease:	1		
unsuccessful preceding hip operation	30:	osteotomy:	17
		Moore prosthesis:	7
		Smith-Petersen cup:	3
		total hip:	2
		arthrodesis:	1
	200		30

Grading of Ossifications

For greater convenience, four grades of ossification were distinguished (Figure 3) on the basis of the following parameters: (1) localization and extent of ossifications; (2) intensity and structure in radiographs.

The grades can be defined as follows:

Grade 0: no ossifications.

Grade I: only in the gluteal area, not clearly defined in radiographs and without distinct bone structure.

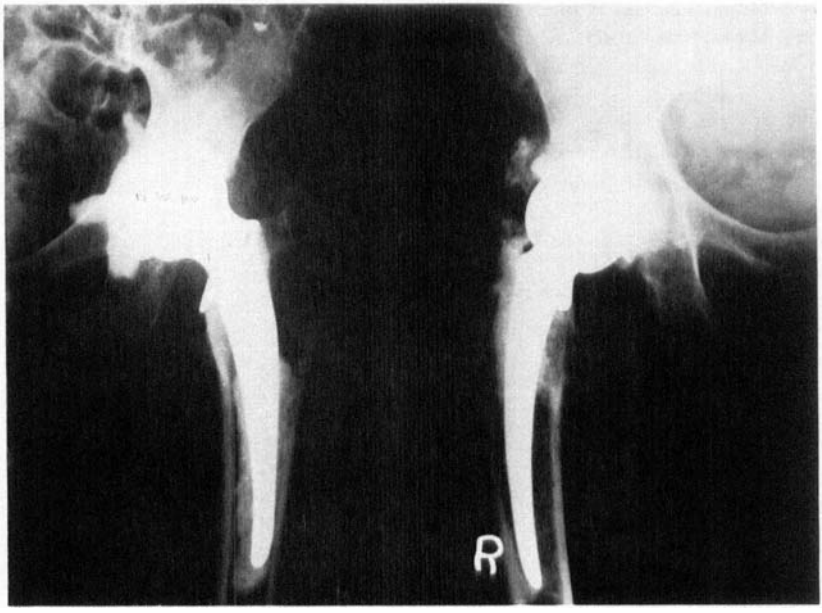
Grade II: in gluteal and psoas areas, again ill-defined but with a more distinct structure.

Grade III: complete bony bridge between femur and pelvis, both in the gluteal and in the psoas area; structure like that of normal bone.

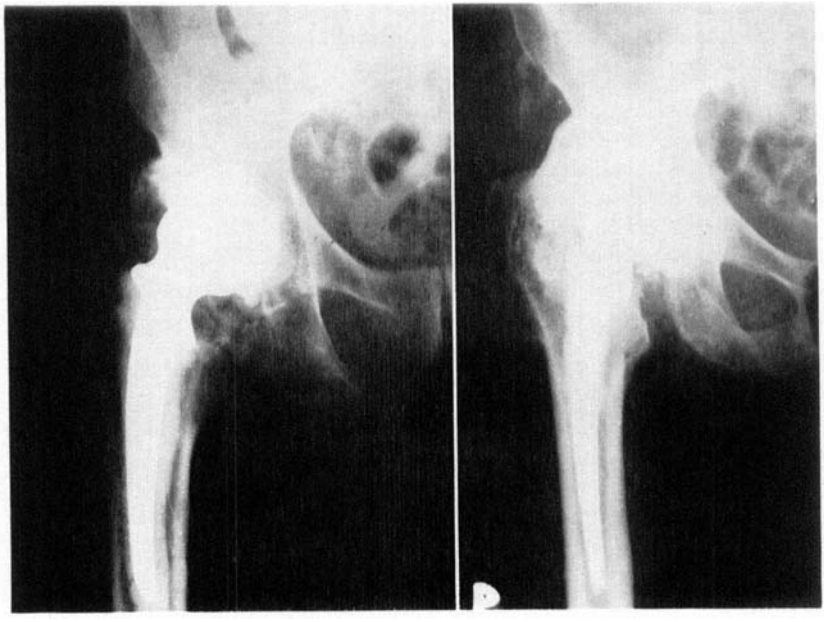
RESULTS OF FOLLOW-UP

The 200 arthroplasties are arranged, below, according to the above grading of ossifications.

Ossification grade	No. of hips
0	95
I	49
II	42
III	14
	200



Grade 0 Grade I



Grade II Grade III

Figure 3. Grading of ossifications.

The 14 cases of severe para-articular ossification were evenly distributed over the two types of prosthesis. In all patients treated by bilateral operations, bilateral ossifications were found; but this does not mean that the grade of ossification was the same on both sides. The relation between operative indication and occurrence of ossifications is shown in Table 1.

Table 1.

Indications	*Ossifications* preoperative	postoperative 0	I	II	III
coxarthrosis	0	71	37	32	9
secondary head necrosis	0	2	2	3	3
rheumatoid arthrotis	0	10	0	0	0
Bechterew's disease	0	1	0	0	0
osteotomy	0	0	8	7	2
Moore prosthesis	0	6	1	0	0
Smith-Petersen	0	3	0	0	0
total hip	0	2	0	0	0
Bracket arthroplasty	0	0	1	0	0
		95	49	42	14

Table 2 indicates the correlation between grade of ossification and postoperative hip function as compared with the preoperative condition.

Table 2.

Function	Improved	Unchanged	Reduced
Grade 0	85	8	2
Grade I	33	14	2
Grade II	20	18	4
Grade III	2	3	9
	140	43	17

The Grade III ossifications lead to further reduction of the hip function after operation. Grade I and Grade II ossifications hardly affect postoperative function. However, Grade III ossification need not necessarily preclude movement. This is demonstrated in Figure 4, showing radiographs of a hip in abduction and adduction.

The following *clinical* and *radiological* findings support a diagnosis of Grade III para-articular ossification.

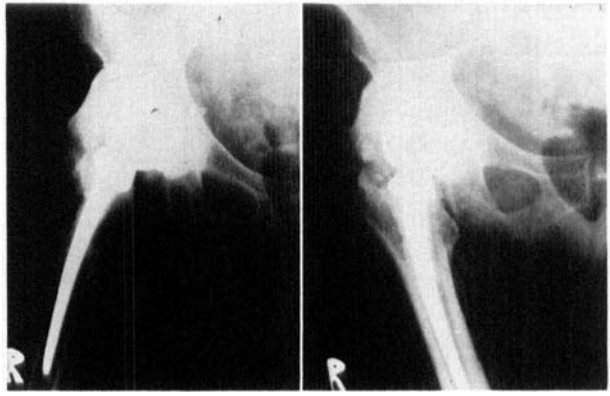


Figure 4a. Abduction and adduction radiographs.

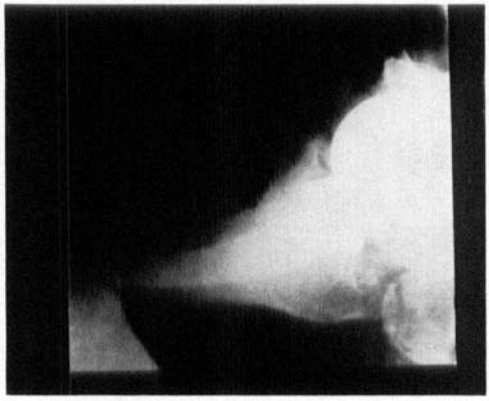


Figure 4b. Collateral radiograph.

Clinical Findings

1. Persistent pain in the hip involved, of a nature different from that of wound pain.
2. Slight swelling of the hip.
3. Progressive limitation of passive and active hip movements.
4. No fever, redness or signs of infection.

Radiological Findings

After 2–3 weeks, the gluteal area shows an irregularly defined densification, of somewhat mottled appearance, which later becomes homogeneous.

The total bridging takes about 12 weeks, the structure becoming more and more that of normal bone.

Histological Aspects

In a few cases, biopsy material from the ossification was submitted to histomorphological examination. The process of ossification proved to resemble that also seen in myositis ossificans and in para-osteoarthropathies. Mainly through desmal ossification the osteoblasts produce osteoid, which is normally mineralized. A woven bone structure results which is later changed to trabecular bone. The features observed closely resemble those of desmal ossification in callus formation. The biopsy specimens contained no muscle cell remnants, and we observed no sarcomatoid features of the type so often described in myositis ossificans.

Serum Determinations

In the group of severe para-articular ossifications we observed a distinct increase in serum alkaline phosphatase. The increase occurred 3 weeks after the operation—at a time corresponding with the first radiological evidence of ossifications. Serum calcium and serum phosphate concentrations did not change when ossifications occurred; nor were the CPK (creatine phosphokinase) and LDH (lactodehydrogenase) levels increased in association with ossifications. There was no correlation between the ESR (erythrocyte sedimentation rate) and the occurrence of ossifications.

THERAPY

There is no known therapy of para-articular ossifications, and the literature has so far failed to present even acceptable suggestions in this context. It seems that the ossification will have to be accepted as an inevitability, which sometimes (in about 7 per cent of cases) leads to loss of function.

As has been described for para-osteoarthropathies, early radiotherapy might be considered in these cases also. Again as in para-osteoarthropathies, surgical resection might be contemplated after maturation. This is in contrast with the results in myositis ossificans progressiva, where resection is useless even in a stationary stage because a relapse nearly always occurs.

Our experience has so far been limited to early physiotherapy which, although it cannot prevent ossifications, can at least ensure continued mobility, because what might be described as a pseudarthrosis develops in the ossifications.

Clinical reports on the use of EHDP in myositis ossificans (Bassett et al. 1969, Russell et al. 1972) and in Paget's disease (Smith et al. 1971, Bijvoet 1972), based on findings reported by such authors as Fleisch (1966, 1969, 1970) and Francis (1969, 1971) prompted us to try EHDP (ethylhydroxydiphosphonate) in these cases also. Its administration proved futile when ossifications were already present; we therefore decided to use EHDP preventively. We have already observed that preventive administration from the day of the operation cannot prevent ossifications. In collaboration with Dr. Bijvoet (Department of Internal Medicine) we have recently given a number of patients awaiting total hip replacement EHDP during 6 preoperative weeks, while an equal number received a placebo. Medication was continued through 2 postoperative months. The results of this procedure are not yet ready for a definite conclusion. It is to be noted, however, that patients who had already developed unmistakable ossifications after a unilateral operation without EHDP, did not develop an ossification when the contralateral hip was replaced with EHDP protection. The results of this study await further evaluation.

Our understanding of the aetiology of these ossifications should also be improved, but it is not within the scope of this report to discuss experimental work in this context.

SUMMARY

This paper discusses the para-articular ossifications after total replacement. This led to serious loss of function in 7 per cent of cases. The ossifications are radiologically visible from the 3rd week after the operation, and give rise to clinical symptoms. Ossification on one side implies the occurrence of ossification after contralateral hip replacement. The aetiology is obscure. The histological features are those of desmal ossification of the type also observed in myositis ossificans, in paraosteoarthropathies and in fracture healing. Therapy should be preventive, and there are indications that EHDP may yield favourable results in this respect.

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Correspondence to:

Dr. A. J. G. Nollen,
St. Josef Zickenhuis,
Eindhoven,
The Netherlands.

and

Dr. T. J. J. H. Slooff,
Katholieke Universitet,
Radboud Zickenhuis,
Dept. of Orthopaedics,
Nijmegen,
The Netherlands.