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INTERTROCHANTERIC OSTEOTOMY WITH A. O. TECHNIQUE IN ARTHROSIS OF THE HIP

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Osteotomy of the upper end of the femur in treating arthrosis of the hip was first reported by McMurray (1935). He applied osteotomy above the lesser trochanter with medial displacement of the femoral shaft and immobilization for four to six months in hip plaster of Paris.

Since then a number of methods have been described for internal fixation. Blount (1943, 1964) and Kessel (1955) use straight splints, the upper ends of which are tapped into the greater trochanter and the bottom ends of which are fixed to the femur with screws.

Osborne (1969) and Wainwright (1971) supplement this with a screw at right angles to the upper part of the splint, and this allows for applying compression on the site of osteotomy and a more stable fixation. Tillberg (1968) uses collum nails and splint to maintain a large surface of contact in the osteotomy.

The A. O. technique described by Müller et al. (1969), introducing the use of angulated splints fixed under compression, makes allowance both for the demand for stable fixation and the wish for a wide contact surface. Since 1968 we have used this method and found it well suited. The purpose of this post-examination has been to assess the healing of the osteotomy when this method of fixation is used, and to evaluate the primary results of the operation regarding its pain-relieving effect.

MATERIAL AND METHODS

The present analysis comprises the results of 96 intertrochanteric osteotomies performed in the Copenhagen Orthopaedic Hospital, Departments I and II, during the period from May 1, 1968, to May 1, 1970. It contains all intertrochanteric osteotomies performed on patients with arthrosis of the hip. 92 patients were operated on, 56 women and 36 men; 53 patients were operated on the right side, 43 patients on the left side.

Table 1. Age distribution in 92 patients treated with intertrochanteric osteotomy with A.O. technique.

Age (years)	No. of patients
Under 20	2
20–30	2
31–40	5
41–50	9
51–60	32
61–70	36
71–80	6
	92

During the period in question a total of 268 operations were made for arthrosis of the hip. Arthrodesis was carried out in 36 cases, arthroplasty in 84 cases, and other minor operations (inforatio coxae, resectio n. obturatorii) in 52 cases.

In all patients the main symptom was pain. The indication for osteotomy was a fairly well-preserved hip joint on X-rays and a reasonable range of flexion, as a rule more than 70°.

Table 1 shows the age distribution. The youngest patient was 18 years old, the

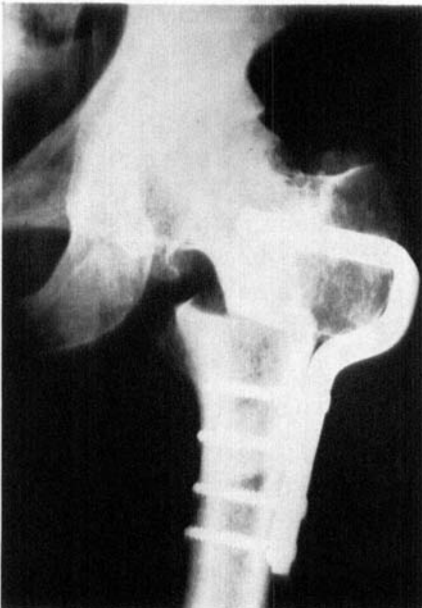

Figure 1. Antero-posterior radiograph of hip immediately following intertrochanteric osteotomy with medial displacement.

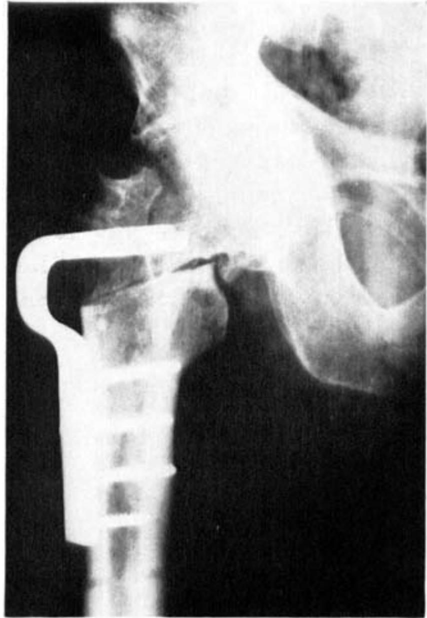

Figure 2. Radiograph showing the result of intertrochanteric osteotomy with angulation in varus and external rotation of femur.

oldest 76. The majority of the patients were between 51 and 70 years old (74 per cent). Of the 96 operated hips, the arthrosis was secondary in 33 cases, which means that a causative factor could be proved, as e.g. prior fracture or epiphysiolysis with caput necrosis, sequealae of mb. Calve-Perthés or prior coxitis. In the 63 cases such predisposing factors could not be proved.

Thirty-two of the patients had two-sided arthrosis, whereas in 60 cases the changes were predominantly or completely one-sided.

In all patients the mobility of the hip was limited prior to the operation. The range of flexion movement was used as a criterion for mobility, and in 52 of the cases preoperative hip flexion of 90° or more was found. In 43 patients the hip flexion was less than 90°. In one case the preoperative mobility was not examined, as the osteotomy was performed simultaneously with acute operation for fractured femoral neck.

In all of the patients femoral osteotomy had been performed transversally above the lesser trochanter, accompanied by medial displacement (Figure 1), changed collum angle or rotation, possibly a combination of these variations (Figure 2). All the osteotomies are fixed with angulated A.O. splints with compression according to the technique described by Müller et al. (1969).

In 46 patients the position of collum was changed. In 50 cases only medial dislocation on the site of osteotomy was performed. Of the 50 osteotomies comprising medial displacement exclusively, dislocation of less than 5 mm was found in 17 cases. Only in 8 cases did the dislocation exceed 10 mm.

Postoperatively pool exercises were started when the wound had healed, and three weeks postoperatively the patient was allowed to stand gently on his leg.

RESULTS

The period of observation varied from six months to three years (Table 2). All the osteotomies were radiologically healed during the time of observation.

Delayed healing included radiological failures, i.e. no fuzzy line of osteotomy and no continuous columns of bone, after four months. Delayed healing was observed in 7 patients. In 3 of these cases the clinical course was normal. Radiological obliteration of the line of osteotomy only occurred seven, eight and twelve months after the operation.

Three patients were re-operated, 2 of them after three months and the third one after five months, all due to increasing clearing along the line of osteotomy. At the re-operation, another angulated splint was applied, and then the osteotomies healed normally.

Table 2. Time of observation of 95 intertrochanteric osteotomies with A.O. technique.

Observation time	No. of cases
6–12 months	40
12–18 months	34
18 months–2 years	13
2–2½ years	7
2½–3 years	1
Total	95

Table 3. Complications in 96 intertrochanteric osteotomies with A.O. technique.

Type of complication	No. of cases
Pseudarthrosis	0
Delayed healing	7
Angulation in varus position	4
Fractured collum or trochanter	4
Wound infection	4
Postoperative bleeding	1
Bronchopneumonia	3
Lung infarction	4
Coronary occlusion	1
Thrombophlebitis	5

The last case of delayed healing occurred in connection with fracture of the femoral neck during the convalescence period.

One month after the operation, a 67-year-old man had pains in the operated hip. No recognized trauma was recorded. Radiography showed a vertical fracture, laterally in the collum. While the patient was bed-ridden the fracture healed in normal time, whereas the line of osteotomy had only vanished after eight months.

In four patients unintended angulation in varus appeared post-operatively. In 3 of the cases the angulation occurred simultaneously with and probably caused by fracture in the collum or the greater trochanter. In the fourth patient the osteotomy was fixed with a 110° angulation splint instead of the correct 90° splint, and already during the application varization set in. Two of the above-mentioned patients were treated with plaster of Paris for two months. In the remaining 2 cases, the time of weight bearing was delayed two and two and a half months after the operation. All 4 osteotomies healed by the end of three months after surgery.

Postoperative wound infection occurred in 4 patients, in all cases a minor infection which did not affect healing of the bone. In one case the splint was removed two months after the operation and the osteotomy had then healed. In none of the 4 infected cases did the time of healing exceed three months.

Postoperative bleeding causing revision of the hemostasis on the same day occurred in one patient. Defect in coagulation has not been proved.

There were 3 cases of postoperative bronchopneumonia and 4 lung infarctions, all minor cases. These 4 patients together with 4 patients with deep thrombophlebitis were given anticoagulation therapy. Preoperative anticoagulation therapy has not been applied.

One patient died five months after the operation as a result of hemolytic anemia with splenomegaly, possibly caused by myeloid leukemia.

In 22 cases the A. O. device was later removed, partly because of pain which could be ascribed to the splint, partly because of clearing around the splint or screws on the radiographs. In one patient the splint caused coxa saltans.

The time from the operation to the onset of radiological healing appears from Table 4. In 68 cases, i.e. 70 per cent of the total, the osteotomy healed in less than three months. In 6 patients the time of healing cannot be included in this report, as radiographs from the period of healing are not available. These 6 patients had a normal

clinical course, and subsequent radiographs showed healing of the osteotomies.

Table 4. Roentgenologic time of healing for 96 intertrochanteric osteotomies with A.O. technique.

Healing time	No. of cases
Less than 2 months	40
Less than 3 months	28
Less than 4 months	15
Over 4 months	7
Unknown	6
Total	96

Table 5. Statements of 95 patients concerning the pain-relieving effect on the hip pain in intertrochanteric osteotomy with A.O. technique.

Results	No. of patients
No pains	61
Slight pains	21
Unchanged pains	7
Other pains	6
Total	95

The primary effect of the operation on pain was assessed according to the patients' statements at the post-examination (Table 5). 82 patients stated that the preoperative pains had vanished or considerably decreased, and only 7 patients reported that the pains were unchanged or worse. In 6 patients other pains occurred which could be ascribed to the apparatus, to a simultaneous spondylosis or to arthrosis of the knee joint. Altogether 90 per cent of the patients reported improvement of the preoperative pain.

If the patients' statements concerning the effect of the operation are compared to the type of operation (Table 6), no difference can be shown. Thus the immediate effect of the operation seems to be related to the osteotomy rather than to the changed conditions of load.

Whether the further course of the arthrosis is influenced cannot be decided on the present basis.

In the majority of the patients the mobility range was unchanged after the operation (Table 7). In 30 patients, however, the mobility was improved by more than 10°, possibly due to reduction of the muscle spasm caused by pain.

Previously it has been found that in cases of strongly reduced mobility of the hip, osteotomy certainly has an almost equally good pain-relieving effect, but also a considerable tendency towards further reduced hip mobility.

Table 6. The distribution of the pain-relieving effect on osteotomies with exclusively medial displacement and other combined osteotomies.

	Osteotomies with exclusively medial displacement	Combined osteotomies
No pains	33	28
Slight pains	9	12
Unchanged pains	4	3
Other pains	3	3
Total	49	46

Table 7. Hip mobility following intertrochanteric osteotomy with A.O. technique compared with the preoperative mobility and stated by range of flexion movement.

Results	No. of cases
Improved mobility	30
Unchanged mobility	45
Less mobility	19
Not reported	1

If the mobility is examined after the operation in the patients with the most considerably reduced mobility preoperatively, it will appear that in these 43 patients the mobility was only further reduced in 6 cases, while in the remaining 37 cases it was unchanged in 16 and improved in 21 cases.

DISCUSSION

In intertrochanteric osteotomy the greatest problem connected with the methods of operation has been sufficiently stable fixation. Osborne (1969) and Wainwright (1971) used compression for obtaining this. With the A. O. technique both rigid fixation and a large area of contact at the osteotomy site is obtained.

The purpose of this work was to evaluate whether the A. O. technique has brought about a method of fixation, which in spite of early weight bearing is sufficiently stable to provide safe healing.

The evaluation of the radiological healing is made difficult by the fact that periosteal callus appears sparsely in connection with a compression that is satisfactorily applied. Jerri & Tilling (1969) found callus in 15 out of 35 osteotomies without compression after two months and in all 35 cases after four months, but complete obliteration of the line of osteotomy was only seen after six months in one-third and after nine months in two-thirds of the cases.

In this work the criterion of healing was the occurrence of continuous columns of bone and obliterated line of osteotomy. Using this we found 68 out of 96 osteotomies (= 70 per cent) healed after three months, and 83 (= 86 per cent) by the end of four months. Lucht & Tarp (1967), using the Bosworth splint, found healing in 72 per cent of 57 osteotomies after three months.

In the cases with no signs of healing after four months, 5 out of 7 cases concerned combined osteotomies (dislocation + angulation, etc.), where optimal contact on the site of osteotomy is difficult to obtain. This was also the case in the 4 patients where secondary angulation in varus occurred. Lowe (1969), using a modification of the Müller technique, found that delayed healing mainly occurred in cases of varus osteotomy. Stainsby & Mukarjee (1969), who used the same technique, found that increased angulation in varus occurred in 23 of 58 osteotomies, and varus angulation occurred when the dislocation was more than half the bone width.

The pain-relieving effect of the osteotomy has been investigated earlier. Jerri & Tilling (1969) found reduced pains in 100 per cent, Adam & Spence (1958) in 81 per cent and Lucht & Tarp (1967) in 95 per cent. This examination showed that in 88 patients or 90 per cent of the cases the osteotomy brought about relief or considerable reduction of pain. The time of observation was short, so the results can only be preliminary, but they do not seem to differ from what has previously been found.

Earlier investigators have had differing opinions concerning the meaning of changed collum axis and the degree of medial dislocation in the osteotomy. In connection with the original McMurray osteotomy, medial dislocation is combined with valgus position of collum. Blount (1964) stated that simple transversal osteotomy does not reverse the degenerative processes, whereas Lucht & Tarp (1967) and Adam & Spence (1958) found that the pain-relieving effect of the osteotomy was independent of the medial dislocation. Kallio & Klossner (1967) stated that the result of the osteotomy is better if the medial dislocation exceeds half the width of the bone and simultaneous varus or valgus angulation is performed, whereas Scott (1967) found that dislocation exceeding half the width of the bone and varus angulation caused increased risk of pseudarthrosis.

As stated in Table 6, the pain-relieving effect of the osteotomy seems to be the same, whether simple osteotomy is performed or the axis of collum is changed simultaneously. In most cases the medial displacement was less than 1 cm. Due to the shape of the apparatus it is possible to make minor dislocations on the site of osteotomy and thus maintain the largest possible contact.

The early mobilization does not seem to have delayed healing. No cases of pseudarthrosis were observed, whereas other investigations, as reported by Jerri & Tilling (1969), showed pseudarthrosis frequencies between 3 and 28 per cent.

As previously stated, the A.O. device was eventually removed from 22 patients, often due to pain originating from the splint. Also Lowe (1969) found that the inserted material may cause discomfort in the form of pain. In one-third of the patients he noted complaints about the inserted splint, and, likewise, Stainsby (1969) found such symptoms in 24 of 58 patients.

SUMMARY

In the Orthopaedic Hospital, Copenhagen, Departments I and II, intertrochanteric osteotomy for osteoarthritis of the hip was performed in 92 patients (a total of 96 intertrochanteric osteotomies) with the A.O. technique during the period from May 1, 1968, until May 1, 1970. The osteotomy was performed above the lesser trochanter and accompained by medial displacement on the site of osteotomy or change of the collum angle. None of the patients died in relation to the operation. All the osteotomies healed. Delayed healing occurred in 7 cases.

In 3 of the cases the clinical course was not influenced by the slow healing. Three patients were re-operated and the splint exchanged after which there was normal healing. Unintended angulation in varus occurred in 4 patients, in 3 of the cases accompanied and probably caused by fracture in the femoral neck or greater trochanter. The device was later removed in 22 patients due to discomfort or clearing around the splint or screws.

Post-examination showed that the preoperative hip pains had completely disappeared in 61 patients; considerable relief was noticed in 27. In 7 cases the pains were unchanged.

With a sufficiently simple technique, the A.O. method in trochanteric osteotomies brings about rigid fixation which allows for rapid mobilizing of the patients. Disturbed healing occurs only seldom, and the pain-relieving effect seems to correspond to the results obtained by other methods.

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