Acta orthop. scand. *50*, 555–561, 1979

OSTEOTOMY IN OSTEOARTHRITIS OF THE HIP

A Prospective Study

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Ninety-two patients (94 hips), who in 1971–1972 underwent intertrochanteric osteotomy for painful osteoarthritis of the hip, were assessed and graded according to a well-defined rating system immediately before operation and 1 and 5 years postoperatively. At the 1-year follow-up pain was absent or only slight in 73.5 per cent of the patients. Five years postoperatively this figure had decreased to 45.5 per cent; 41.5 per cent of the patients deteriorated between the two investigations. Nineteen patients had been reoperated upon and total hip replacement performed. It was not possible to predict the effect of the osteotomy from the preoperative clinical and roentgenological picture. Nor was the operative procedure (amount of medial displacement, varus angulation, tenotomy of the iliopsoas) found to have any influence on the results. Though the effect of the osteotomy is not as long-lasting as previously believed, it is concluded that it still has a place in the operative treatment of painful osteoarthritis of the hip in younger patients.

Key words: gait; hip; osteoarthritis; osteotomy; results

Accepted 31.x.78

The pain-relieving effect of intertrochanteric osteotomy in osteoarthritis of the hip has been demonstrated by many authors (Adam & Spence 1958, Nicoll & Holden 1961, King & Dooley 1962, Ottolenghi & Frigerio 1962, Lucht & Tarp 1967, Tillberg 1968, Hirsch & Goldie 1968, Gudmundsson 1970, Morscher et al. 1971, Salenius et al. 1971, Hansen et al. 1973, Goldie et al. 1973). It is often claimed that this effect is long-lasting, but this assumption would seem to be less well substantiated.

In 1971 a prospective study was initiated to evaluate the effect of intertrochanteric osteotomy in osteoarthritis of the hip. In an attempt to assess its long-term effect, a comparison was made between the results of two follow-up examinations, performed 1 and 5 years after operation.

PATIENTS AND METHODS

The original series in the present study includes 97 patients who between January 1971 and March 1972 underwent intertrochanteric osteotomy for osteoarthritis of the hip at the Department of Orthopaedic Surgery, Karolinska Hospital, Stockholm. Two of the patients had bilateral operations at intervals of 6 and 12 months, respectively, making 99 operated hips in all.

The investigation was designed as a prospective study. The patients were examined on three different occasions:

1. On admission to hospital one or a few days preoperatively.

0001–6470/79/050555–07$02.50/0

Table 1. Method of assessment and classification of pain

Pain on starting to walk	No	0 point
	Yes	1 point
Pain on weight-bearing	No	0 point
	Slight	1 point
	Severe	2 points
Pain at rest	No	0 point
	After exertion	1 point
	Spontaneous	2 points

Group I: 0–1 points
Group II: 2–3 points
Group III: 4–5 points

2. One year after operation.
3. Five years after operation.

The first and second examinations included a clinical assessment, roentgenographic examination of both hips in standard projections, and a gait investigation on an electronic walkway. The third examination included only clinical assessment and roentgenographic investigation.

Clincial assessment was performed by means of a grading system developed by Andersson & Möller-Nielsen (1972) with some modifications (Collert 1974). The method provides a rating scale, permitting classification of the series into three groups according to degree of pain, loss of mobility, and functional impairment. Table 1 shows the method of classification of pain.

Roentgenological classification. On the basis of the preoperative AP roentgenograms, the cases were classified with respect to roentgenological type and stage of osteoarthritis, according to the following definitions. *Lateral type.* The destruction of the cartilage (evident in narrowing of the joint space) initially appears and becomes most marked in the lateral-proximal part of the joint, leading to a lateral and proximal displacement of the head of the femur. *Medial type.* The destruction of the cartilage initially appears and becomes most marked in the medial part of the joint, leading to medial displacement of the head. *Stage I.* Partial or total obliteration of the joint space along at least part of the joint. Secondary deformation of the bony surface of the femoral head absent or only slightly. *Stage II.* Marked secondary deformation of the bony surface of the head.

The gait study was conducted with the aid of a 5 m long double force-plate electronic walkway, which registered the vertical and anteroposterior horizontal forces exerted by the foot on the ground during walking. The recorded curves permitted analysis of certain temporal and kinetic factors. Special emphasis was placed on the weight-bearing capacity of the operated leg. This was defined as the sum of the vertical forces exerted during the stance phase.

Final series. Of the 97 patients who were included in the first examination and underwent operation, five patients were not available for examination 1 year postoperatively (one had died, three were suffering from some other serious disorder, and one had moved to a distant part of the country), leaving 92 patients and 94 hips. At the 5-year follow-up another 17 patients were excluded for the following reasons: nine patients were dead, two were senile and unable to cooperate and six could not be traced. Thus 75 patients and 77 hips were included in the 5-year follow-up. For reasons of convenience, each operated hip is in the following counted as a separate case.

Age and sex. The series includes 48 women and 46 men. The mean age at the time of operation was 59.6 years, ranging from 32 to 77 years (Table 2).

Operative procedure and postoperative course. In 39 cases intertrochanteric osteotomy was combined with a varus angulation of 10 degrees or more, and in 43 cases with at least 1 cm medial displacement of the shaft. In 48 cases tenotomy of the iliopsoas was performed. Internal fixation with an AO nail-plate following compression was used in all cases.

One postoperative death due to pulmonary embolism occurred. Nine patients had symptoms suggestive of thrombosis following operation,

Table 2. Age and sex distribution

Age	Male	Female	Total
30–39	1	1	2
40–49	5	6	11
50–59	15	11	26
60–69	17	26	43
70–79	8	4	12
Total	46	48	94

while four patients had a superficial wound infection. Healing time, i.e. the interval between operation and the first roentgenographic examination to show consolidation of the osteotomy, was less than 3 months for 55.5 per cent, and less than 6 months for 80 per cent of the series. One case of non-union was found at the 1-year follow-up.

RESULTS

At the 5-year follow-up 19 patients had been reoperated on with total hip replacement and for that reason were excluded from the assessment of mobility and functional capacity. As it was assumed that they all had had pain at rest as well as weight-bearing pain, they were classified in pain group III.

Pain

Since the main indication for osteotomy was pain, all patients at the preoperative examination belonged to group II (22 per cent) or group III (78 per cent) with respect to pain (Table 3). One year postoperatively 73.5 per cent (69 patients) had no pain or it was only slight and they were classified in group I. Five years postoperatively this figure had decreased to 45.5 per cent (35 patients).

A closer analysis of the type of pain shows that preoperatively only 3 per cent (3 patients) never had pain at rest (spontaneous or after exertion). One year after operation 78 per cent (73 patients) were free from pain at rest and after 5 years 47 per cent (36 patients). With respect to weight-bearing pain, all patients except one (1 per cent) had complaints preoperatively. One year postoperatively 55 per cent (52 patients) were free from weight-bearing pain and 5 years after operation 35 per cent (27 patients).

The result was somewhat better for cases of lateral osteoarthritis than for the medial type (47 per cent pain-free as against 40 per cent at the 5-year follow-up) but the difference is statistically not significant. The roentgenological stage of osteoarthritis had no influence on the effect of the operation in providing relief of pain.

The operative procedure (amount of medial displacement of the shaft fragment, varus angulation, tenotomy of the iliopsoas) was found to have no influence on the results.

Mobility

The operation produced an increase in mobility 1 year postoperatively in a number of cases (Table 4). Four years later hip mobility had decreased in some cases, but it was still better than preoperatively. There was on the whole a good correlation between increased pain and impaired mobility between 1 year and 5 years postoperatively.

Table 3. Pain preoperatively and 1 and 5 years postoperatively

	Group I	Group II	Group III	Total
Preoperatively	0 0%	21 22%	73 78%	94 100%
1 year postop.	69 73.5%	19 20%	6 6.5%	94 100%
5 years postop.	35 45.5%	9 11.5%	33 43%	77 100%

Table 4. Mobility

	Group I	Group II	Group III	Total
Preoperatively	36 62%	22 38%	0 0%	58 100%
1 year postop.	49 84.5%	8 14%	1 0.5%	58 100%
5 years postop.	42 72.5%	13 22.5%	3 5%	58 100%

Table 5. Function

	Group I	Group II	Group III	Total
Preoperatively	42 72.5%	14 24%	2 3.5%	58 100%
1 year postop.	51 88%	6 10%	1 2%	58 100%
5 years postop.	42 72.5%	12 20.5%	4 7%	58 100%

Function

With respect to functional capacity, evaluated according to the assessment table for the 58 patients followed up for 5 years, 72.5 per cent (42 cases) belonged to group I preoperatively. One year after operation this figure had increased to 88 per cent and 5 years postoperatively it was again 72.5 per cent (Table 5).

Twenty-three of the 58 patients followed up did not use walking aids for outdoor walking before operation. One year after operation this applied to 24 patients and 5 years postoperatively to 32 patients.

Gait

The effect of the operation on gait pattern was assessed by comparing the values obtained 1 year after operation with the preoperative values. *Weight-bearing capacity* of the osteotomy leg increased in 40 cases (45 per cent), was unchanged in 30 (34 per cent) and decreased in 19 cases (21 per cent). The effect of the operation on weight-bearing capacity 1 year postoperatively is statistically significant ($P < 0.01$). There was a statistically highly significant relationship ($P < 0.001$) between improved weight-bearing capacity and relief of weight-bearing pain.

The operation also had a statistically significant effect ($P < 0.01$) on *stride length*, i.e. the distance between two consecutive heel-strikes with the same leg when walking with the same cadence (number of steps/min). Stride length increased in 46 per cent of cases, was unchanged in 38 per cent, and decreased in 16 per cent. There was a statistically significant relationship ($P < 0.01$) between increase of stride length and relief of weight-bearing pain.

Roentgenological appearance of the osteoarthritis

A comparison was made between the roentgenograms (AP views) taken im-

Table 6. Roentgenological appearance of the osteoarthritis in relation to pain 5 years postoperatively

Roentgenological appearance	Pain			
	Group I	Group II	Group III	Total
Regression	13	1	0	14
No change	18	5	8	31
Progression	4	3	6	13
Total	35	9	14	58

mediately prior to operation and those taken at the 5-year follow-up with a view to assessing any changes in the roentgenographic appearance of the osteoarthritis. This assessment was based on the shape of the bony surface of the femoral head, the degree of sclerosis, and the amount and size of cysts in the head and acetabulum.

Of the 58 cases investigated, the appearance of the osteoarthritis was unchanged in 31 cases, while regression was noted in 14 cases and progression of osteoarthritic changes in 13 cases. There was a good correlation between regression of osteoarthritic changes and pain relief (Table 6).

Patient's assessment

At the 1-year and 5-year follow-up the patients were asked to state whether they were satisfied with the result of the operation and if they felt that it had been worthwhile. Patients reoperated upon with total hip replacement were assumed to be dissatisfied with the result of the osteotomy. Thus, 1 year after osteotomy 52 per cent (49 patients) were wholly satisfied with the result, 33 per cent (31 patients) were satisfied with some reservation, and 15 per cent (14 patients) were dissatisfied. The corresponding figures 5 years postoperatively were 47 per cent (36 cases), 14 per cent (11 patients) and 39 per cent (30 patients). The patient's own assessment shows good agreement with the figures for pain relief.

Interval between initial follow-up and change in condition

Thirty-two patients (including those reoperated upon with total hip replacement) reported a deterioration of their condition between the 1-year and the 5-year follow-up. In 12 cases this had occurred during the second year after operation, in 7 cases during the third, in 7 cases during the fourth, and in 6 cases during the fifth post-operative year. All 6 patients classified in pain group III at the 1-year follow-up, implying deterioration during the first year or a total lack of improvement postoperatively, subsequently had a total hip replacement.

Ten patients, all classified in pain group I at the 1-year follow-up, reported a subsequent improvement in their condition at the 5-year follow-up. This improvement consisted mainly in increased strength and walking ability, which meant that some of these patients were able to discard their walking aids even out of doors.

DISCUSSION

The present investigation would seem to be the only prospective study of an osteotomy series in which the patients were assessed and graded according to the same well defined criteria both before operation and on two occasions at definite intervals after operation. The results 1 year postoperatively confirm the findings of earlier studies indicating that intertrochanteric osteotomy has

a good effect in providing relief of pain; 73.5 per cent of the patients had no pain or it was only slight. The effect of the operation is most marked with regard to pain at rest, which disappeared in 78 per cent of cases, while relief of weight-bearing pain was obtained in 55 per cent. The positive effect on the subjective symptoms is substantiated by the results of the gait analysis. At the 1-year follow-up, 45 per cent of the patients put more weight on the osteotomy leg than they did before operation, and a very good correlation was found between improved weight-bearing capacity and relief of weight-bearing pain. This gait study, which has been reported in detail elsewhere (Collert 1974), appears to be the only investigation to demonstrate the effect of osteotomy in osteoarthritis of the hip by objective methods.

Our study shows that the initially favourable effect of intertrochanteric osteotomy is not as long-lasting as previously believed. Between the first and fifth postoperative year, 41.5 per cent of the patients deteriorated. At the 5-year follow-up only 45.5 per cent showed an acceptable result (absent or only slight pain). Nineteen of the patients in the original series had been treated with a total hip replacement.

Through the years various theories have been advanced concerning the mechanism underlying the effect of osteotomy. Pauwels (1950, 1961) and Blount (1964) are among those who stress changed biomechanical conditions as an important factor, while others (Phillips et al. 1967, Arnoldi et al. 1971, 1972) have pointed out that osteotomy has an effect on the intraosseous pressure and the venous drainage from the femoral head. Although the present study was not intended to elucidate the mechanism underlying the effect of the operation, it clearly shows that biomechanical factors are not of crucial importance. Neither medial displacement of the shaft fragment, varus angulation, or tenotomy of the iliopsoas muscle are of any consequence for the long-term results. Similarly, none of the other factors analyzed in relation to the effect of pain, i.e. roentgenological type and stage of osteoarthritis, age, sex, preoperative range of flexion, and preoperative contractures made any difference to the results.

It is impossible, therefore, to predict the effect of an osteotomy on the basis of clinical or roentgenological features. Since the type of osteotomy does not seem to be of decisive importance either, it is advisable to avoid procedures such as medial displacement of the shaft, which may complicate subsequent total hip replacement or other surgical procedures at a later date.

Our study shows that a patient who fails to obtain relief of pain in the initial postoperative stage cannot expect any appreciable improvements during the next few years.

Even though relief of pain in osteoarthritis of the hip in some cases may occur spontaneously in due time (Danielsson 1964), our study shows that osteotomy provides immediate and good relief of pain in about two-thirds of the cases and that this effect lasts for at least 5 years in almost half of the total number. Although this is a modest result when compared with more than 90 per cent relief of pain following total hip replacement, we should keep in mind that failure with this latter procedure may have disastrous consequences and that so far relatively little experience has been gained regarding the long-term durability of total hip prostheses. In view of this, we feel that intertrochanteric osteotomy still represents a practical alternative treatment for osteoarthritis of the hip in younger persons.

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