INTERTROCHANTERIC OSTEOTOMY FOR OSTEOARTHRITIS OF THE HIP

A Review of Fifty-eight Operations

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The name of McMurray (1935, 1939) is firmly associated with intertrochanteric osteotomy for the treatment of osteoarthritis of the hip, although this method was based on the bifurcation operation of Lorenz (1919) and was suggested by several previous authors—Ashley (1923), Galland (1930), Hey Groves (1933) and Lowendorf (1933). There is still, however, no unanimity about the technique of operation and no agreement on its rationale or on the long term results. This paper presents the results in cases of intertrochanteric osteotomy performed for osteoarthritis of the hip at the Royal National Orthopaedic Hospital between the years 1935 and 1955.

CLINICAL MATERIAL

Eighty-seven patients had been treated in this way. Of these, six are known to have died, twenty-four were not traced, and the remaining fifty-seven, roughly two-thirds of the total, were reviewed. One patient had both hips treated, making fifty-eight operations in all. Some of the patients were seen only once at review, but those treated recently were seen several times. Only a few were seen by us before operation.

Sex—Of the fifty-seven patients reviewed, forty were women and seventeen men. As in Gade’s (1947) series, the proportion of women was high; this is in keeping with the statement of Lloyd-Roberts (1955) that osteoarthritis of the hip is twice as common in women as in men.

Presumptive cause—In thirty-eight of the fifty-eight hips no cause of the osteoarthritis was evident and it was recorded as idiopathic. The seeming causes of the remainder were: congenital dysplasia, twelve; old Perthes‘ disease, three; slipped epiphysis, three; protrusio acetabuli, one; old septic arthritis, one. These figures agree closely with those reported by Lloyd-Roberts (1955) in his series of hips operated upon for osteoarthritis.

Bilateral affection—In twenty instances the opposite hip presented osteoarthritis severe enough to cause symptoms; in thirty-eight the opposite hip appeared normal.

Age—The average at operation for all patients was 55·4 years and the range twenty-seven to seventy-two years (Fig. 1). There was little difference in the average age in the different groups.

Methods of fixation—The series has been divided into three groups according to the type of fixation: 1) thirty-three hips treated after operation by external fixation, usually a double plaster spica; 2) eighteen hips treated by osteotomy with internal fixation, usually a modified McKee pin and plate; 3) seven hips treated by combined internal and external fixation.

RESULTS

Duration of observation—The longest duration of observation was eighteen years, and the shortest nine months. The latter was considered to be the shortest period at which any assessment of the result could be made. For patients treated with external fixation alone the average was five years and two months; with internal fixation alone it was thirteen months, varying from twenty-one to nine months. Patients treated by internal fixation were kept under observation for a much shorter time, and this must be remembered in comparing the results. It might be thought, for instance, that after an initial improvement patients would deteriorate after several years. Milch (1947) stated that McMurray’s osteotomy could at best be considered...
as of only temporary value because it could not modify the underlying arthritic process, and that in time the disability would recur. If this were so, internal fixation would have an unfair advantage in this review. Several authors, however, including Osborne and Fahrni (1950) and Wardle (1955), have shown that the benefits of osteotomy last for many years. Only two of our patients complained of deterioration of the hip operated upon, after a period of relief of symptoms, but complaint of increasing pain and disability in the untreated hip was quite common. Though it is clear that the series in which external fixation alone was used and that in which internal fixation was used are not strictly comparable, we believe that a comparison is of value.

Assessment—The patients were assessed according to the table devised by Shepherd (1954) for the study of hip arthroplasty. Since this method takes into account the function of the patient as a whole and not that of the affected hip alone, a poor late result may be due to osteoarthritis in the other hip and not to failure of the operation. Table I shows the analysis of results in accordance with Shepherd's strict criteria, including the assessment of mobility. It will be seen that the number of poor results after external fixation is four times that after internal fixation.

Although a common object of osteotomy is to retain movement in the hip, restoration of movement is not usually expected. The results with exclusion of the mobility index from the calculation have therefore been assessed in Table II. There is now little difference shown between the two techniques.
Complications and causes of failure—A spike formed by the calcar femorale projected from the lower fragment in eight patients; of these, four had excellent or good results, and only one poor. Three patients treated by internal fixation had pulmonary embolism, one patient after osteotomy of each femur and one treated by external fixation; none was fatal. One patient treated by internal fixation developed bilateral phlebothrombosis without embolism.

From the table in which mobility is excluded from the calculations we see that the result was poor in 20 per cent (twelve patients). These patients were reviewed to see whether any common cause could be found for the failure. The reasons were as follows: two falls since

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>RESULTS INCLUDING MOBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent (per cent)</td>
</tr>
<tr>
<td>All cases</td>
<td>14</td>
</tr>
<tr>
<td>With external fixation</td>
<td>18</td>
</tr>
<tr>
<td>With internal fixation</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>RESULTS EXCLUDING MOBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent (per cent)</td>
</tr>
<tr>
<td>All cases</td>
<td>33</td>
</tr>
<tr>
<td>With external fixation</td>
<td>39</td>
</tr>
<tr>
<td>With internal fixation</td>
<td>33</td>
</tr>
</tbody>
</table>

the operation, with a fracture of the femur on each occasion; fracture of the femur, resulting in shortening and a stiff knee; infective arthritis of the hip; spastic paraplegia from thrombosis of the spinal vessels; avascular necrosis of the head of the femur after a transcervical fracture which occurred before the osteotomy; non-union at the osteotomy site; hysterical paresis; antecedent bilateral protrusio acetabuli; homolateral stiff knee and hip (two patients); bony ankylosis of the hip (two patients). With the exceptions noted, these causes appeared after the osteotomy. No single cause, therefore, contributed greatly to these poor results. Ten of these patients with poor results were treated with external fixation.

Pain—Pain was often the only indication for operation, and the results have accordingly been assessed with regard to pain alone in fifty-seven patients. Before operation forty-three patients had pain of the most severe grade ("crippling"), six had "disabling" pain, five "made concessions" to pain, two had pain which they ignored and one had no pain. After operation twenty-six patients had no pain, twenty had a mild ache, seven "made concessions," one had "disabling" pain and three had "crippling" pain. In other words, forty-six out of fifty-seven, after operation, had no pain, or an occasional ache only, while eleven patients had a significant amount of pain. This may be compared with the series of Osborne and Fahrlin (1950); of seventy-five patients fourteen had no relief of pain. We agree with Osborne and Fahrlin that the relief of pain is long lasting—in our series up to eighteen years after operation. With external fixation only, 78 per cent had pain before operation and 6 per cent after. Of the patients treated with internal fixation alone and observed for a much shorter period, 94 per cent had pain before operation and 6 per cent after.
Patient's assessment—The patients were more easily pleased than the assessment of Shepherd (1954) would suggest; thirty-eight of fifty-eight (66 per cent) were satisfied in every way with the result of the operation; eleven (19 per cent) were satisfied but with some reservation; two (3 per cent) were doubtful; and seven (12 per cent) thought the operation not worth while. Mobility—The assessment of movement was difficult. The range of movement at the hip, as recorded by different examiners before operation, showed great variation. Great care was taken at the follow-up examinations in recording movement, but for the range before operation we had in most cases to rely on the case histories. Taking the series as a whole, there appeared to be a slight gain in the range of movement. In patients for whom information was available twenty-six gained movement, five remained unchanged and fourteen lost movement. Of twenty-eight hips treated by external fixation, twelve (43 per cent) gained movement, whereas fourteen of seventeen (82 per cent) treated by internal fixation alone, gained movement. It may be that internal fixation, which allows early movement of the hip, was superior to external fixation in plaster, but the unequal duration of observation makes fair comparison impossible.

Two patients had been treated after operation by skin traction alone, without immobilisation of the hip. The length of follow-up was eight years and seven years respectively, and in each patient the range of movement had increased greatly. One had made the greatest gain in movement of all the patients in the series, with an increase in the mobility index from 3 to 46·5, and in the other the index had increased from 18 to 46. Considering the degree of stiffness before operation these were two of the best results in the whole series.

In Osborne and Fahrni's series, where external fixation by a plaster spica was employed, there was, taken over all, a slight decrease in flexion movement after operation. Campbell
and Jackson (1955) reported forty-six patients, in whom a simple abduc tion osteotomy was performed without deliberate medial displacement. Some were treated by internal fixation and some by external fixation. They found that the flexion range was decreased in 40 per cent and increased in 17 per cent. Campbell (1955), reporting later thirty-four patients treated by internal fixation, found that movement was decreased in only 6 per cent and increased in 63 per cent.

**Improvement in the radiographic appearances**—All patients who showed a significant increase in movement showed also, to a greater or lesser degree, appearances of regression of the osteoarthritis. In four instances an increase in the joint space and more regular joint outlines were seen, although movement appeared to have diminished.

Figures 2 and 3 show the radiographs before operation and at follow-up of the second patient treated by strapping extension, in whom the mobility index increased from 18 to 46. Note the increase in the joint space, the healing of the pseudocysts, and the improvement in the joint outline. In the whole series of fifty-five hips for which radiographs before and after operation were available, thirty-eight showed unmistakable evidence of the changes described, sixteen showed no change or advance of the osteoarthritis, and in one instance there was radiographic deterioration after early improvement. These changes were mentioned by Osborne and Fahrni (1950), who stated that no successful case of osteotomy showed progress of the osteoarthritis. Wardle (1955) also mentioned improvement in the joint space.

**Medial displacement**—McMurray (1935) in his original description of the operation said that the shaft should be displaced medially so that it lay just below the lower border of the acetabulum: “if this displacement is not sufficient there can at best be only a partial relief of symptoms and a disappointing result.” Malkin (1936) showed that simple osteotomy of the femur at or just below the lesser trochanter, with abduction of the lower fragment but no displacement, was able to relieve or abolish pain in the hip in eleven of fourteen patients. McFarland (1954) believed that even when the displacement was not maintained the result might be good. Osborne and Fahrni (1950) showed experimentally on necropsy specimens that the joint pressure was reduced to nil after displacement osteotomy, but were uncertain whether this ever happened clinically. They thought that inadequate displacement gave less lasting relief. They considered that medial displacement should be enough to block all adduction movement, and found that this was so after 95 per cent of successful operations and not so in twelve unsuccessful operations. On the other hand Campbell and Jackson believed that the essentials were to divide the bone and to correct deformity, and they did not deliberately displace the shaft medially. Yet their results compared favourably with those of Osborne and Fahrni.

**TABLE III**

<table>
<thead>
<tr>
<th>Degree of pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under half diameter</td>
<td>21</td>
<td>16</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Over half diameter</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

We found it impossible to measure the medial displacement of the lower fragment in relation to the pelvis; the medial displacement has therefore been expressed as a fraction of the diameter of the femur at the level of section. The relief of pain has been correlated with the amount of displacement in Table III.

Of patients with less than half a diameter of displacement 80·4 per cent had no pain, or pain which was ignored, compared with 81 per cent of those with displacement of over
half the diameter. These figures suggest that the amount of medial displacement is not important. In eleven cases the medial displacement was more than half the diameter, in three it was less than a quarter of the diameter, and in the remaining forty-three hips it lay between a quarter and a half the diameter.

**Position of the upper fragment**—Various writers, including Hoets (1949), Stuck (1949) and Osborne and Fahrni (1950) have ascribed the beneficial results of intertrochanteric osteotomy to contact of the femoral head bearing undamaged articular cartilage with the weight-bearing part of the acetabulum. Whenever possible we measured the relation of the upper fragment to the pelvis before operation, immediately after operation, and in the final radiograph. Only those who had no clinically detectable abduction or adduction movement, before and after operation, were suitable, because movement in this plane would have vitiated the results. It was not possible to measure the changes of position of either flexion or rotation. Under these conditions twenty-six hips were available for measurement. In thirteen of these there was no change of abduction or adduction of the upper fragment, the position of the head in the acetabulum after operation being the same as before. In eight, on the intermediate radiograph, the upper fragment was shown abducted between 7 degrees and 27 degrees as compared with the position before operation, and in each case returned to its previous position. In one patient coxa vara gradually developed, and finally the head fragment was abducted 14 degrees and the shaft adducted. In four instances the head fragment adducted between 8 degrees and 20 degrees and in all four remained in this adducted position. In twenty-one of twenty-six hips (81 per cent) the final position at the hip was the same as before the operation.

**Position at the osteotomy site**—The relation of the fragments at the osteotomy site was also measured. Of the twenty-two patients treated by external fixation thirteen remained as they were placed at operation; in nine patients the distal fragment adducted 10 to 30 degrees. In all but one patient of twelve treated by internal fixation the position remained as at operation (Fig. 4). In the one exceptional case a very short nail had been used, and radiographs showed this to have moved as the distal fragment adducted.

**Deformity**—How successful was the operation in correcting deformity? Unless flexion deformity is severe, no attempt is usually made to correct it, and in fact on clinical examination there was little difference in this deformity before and after operation. The correction of adduction or abduction deformity was measured in forty-two patients and the results are seen in Table IV. The average adduction deformity before operation was 11.5 degrees, and after operation 5 degrees. In this series there was improvement, but the figures are disappointing because nineteen of the forty-two patients still had significant adduction deformity. This is not the whole story, however, for a number of patients were able to correct what would have been an adduction deformity by recovering movement.

Osborne and Fahrni (1950) ascribed the relief of pain to a block to adduction at the neutral position. The results in our series do not support this view. Eight patients had fixed
abduction, ten could not adduct the limb, and in thirty-six some adduction was either fixed or possible. In a comparison of these three groups with the relief of pain obtained in each, no difference was found.

**TABLE IV**

**DEFORMITY**

<table>
<thead>
<tr>
<th>Adduction</th>
<th>0°</th>
<th>5-10°</th>
<th>11-20°</th>
<th>21-40°</th>
<th>Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before operation</td>
<td>13</td>
<td>10</td>
<td>15</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>After operation</td>
<td>20</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Age**—Rather surprisingly there was no variation with age. Excellent or good results were obtained in 65·4 per cent of patients over sixty years of age and in 65·6 per cent of patients under sixty. These results are seen in Table V.

**TABLE V**

**RESULTS ACCORDING TO AGE**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 60</td>
<td>12</td>
<td>9</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Over 60</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Knee movement**—The significant results in the present series are shown in Table VI. These figures show that with external fixation there were five times as many patients with more than 30 degrees' limitation of flexion compared with those treated by internal fixation. Osborne and Fahrni found that of seventy-five patients all but six regained the range present before operation, within six months. Those patients were treated in plaster. Wardle (1955) in his series of forty, found that the average range of knee movement was 100 degrees.

**Backache**—Before operation fifteen patients had backache. After operation seven had lost the pain, three had improved and five remained unchanged. No patient, previously free, developed backache after operation.

**TABLE VI**

**KNEE MOVEMENT AFTER OSTEOTOMY**

<table>
<thead>
<tr>
<th></th>
<th>Full knee movement</th>
<th>Limited by 30°</th>
<th>Limited by more than 30°</th>
</tr>
</thead>
<tbody>
<tr>
<td>With external fixation</td>
<td>23 (70%)</td>
<td>2 (6%)</td>
<td>8 (24%)</td>
</tr>
<tr>
<td>With internal fixation</td>
<td>14 (78%)</td>
<td>3 (17%)</td>
<td>1 (5%)</td>
</tr>
</tbody>
</table>
CONCLUSIONS

1. Intertrochanteric osteotomy is valuable in the treatment of patients with osteoarthritis of the hip, giving a high percentage of satisfactory results. It often relieves the pain immediately, is long-lasting in its effects, and may even increase the range of movement.

2. There is no evidence from our figures that the extent of medial displacement of the lower fragment influences the result as judged from relief of pain, performance, and the patient's assessment. Movement, however, is less improved if displacement exceeds half the diameter of the divided bone.

3. Our observations did not support the view that improvement is caused by a changed relationship between the upper fragment and the acetabulum. When measurements were possible the position of the upper fragment usually remained virtually unaltered.

4. Our figures confirm that in most patients relief of pain is immediate; that is to say, the patient is aware on regaining consciousness that his pain has gone, even though he formerly had pain at rest. Whatever may be the mechanism that relieves the pain, it acts immediately.

We readily acknowledge our thanks to Mr K. J. Nissen, at whose suggestion this investigation was undertaken, and to Mr H. Jackson Burrows for their advice, encouragement and help in preparing the paper, and to the Consultant Staff of the Royal National Orthopaedic Hospital who allowed us to examine their patients. We should like also to record our appreciation of the ready aid of the Medical Records Department of the Royal National Orthopaedic Hospital and the Department of Medical Photography of the Institute of Orthopaedics.

REFERENCES