LOW-FRICTION ARTHROPLASTY AFTER FRACTURE-DISLOCATIONS OF THE HIP

K. P. BOARDMAN, J. CHARNLEY

From the Centre for Hip Surgery, Wrightington Hospital

Sixty-six patients are presented who have had a total hip replacement by the Charnley low-friction technique after injuries of the hip, the majority of which were fracture-dislocations. The clinical results of the arthroplasties in this relatively young group of patients are shown to be very good. The selection of young patients for total hip replacement arthroplasty is discussed.

Between January 1966 and December 1975 sixty-six patients had a total hip replacement by the Charnley low-friction technique after injuries to the hip, the majority of which were fracture-dislocations. This paper outlines the clinical findings before and after operation in these patients and mentions points of technical interest connected with the operation itself.

The five types of primary injury are shown in Table I. Thirty-two of the arthroplasties (47.1 per cent) followed posterior fracture-dislocations and twenty-one (30.9 per cent) followed central fracture-dislocations. The remaining three groups of injury are too small in number to warrant detailed discussion. Altogether sixty-eight arthroplasties were performed in sixty-six patients of whom forty-four were male and twenty-two female. The right hip was replaced in thirty-eight patients, the left in twenty-six and two patients had bilateral operations.

The mean age of patients at the time of injury was forty years. Most patients had been involved in road traffic accidents. A minority had sustained industrial, sporting or wartime injuries. The mean age of patients at the time of the arthroplasty was fifty-five years, ranging from twenty-four to seventy-seven years. The mean interval between injury and arthroplasty was fifteen years. Patients with central fracture-dislocations had the shortest interval of eight and a half years. The intervals between injury and arthroplasty for the posterior and central fracture-dislocations are shown as a histogram in Figure 1.

When the hip had been severely disorganised by the primary injury, patients presented early for arthroplasty; hence the relatively large number of operations within six years. Even if function returned to normal without operation, secondary osteoarthritis might subsequently require treatment. The symptom-free period and the rate of progression of the ensuing arthritis were very variable, as is shown by the scatter in the later part of the histogram.

**Intermediate operations.** Thirteen of the fracture-dislocations (19.1 per cent) had had open reductions at the time of injury. Five had had screws inserted into an acetabular fragment. For this group the mean interval between the injury and the arthroplasty was ten years.

Eleven patients had had an intermediate operation between the injury and the arthroplasty. Of these, seven

<table>
<thead>
<tr>
<th>Type of hip injury</th>
<th>Number of patients</th>
<th>Number of hips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior fracture-dislocation</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Central fracture-dislocation</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Crack fracture of the acetabulum</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Posterior dislocation</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Anterior fracture-dislocation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>68</td>
</tr>
</tbody>
</table>

Followed posterior fracture-dislocations and twenty-one (30.9 per cent) followed central fracture-dislocations. The remaining three groups of injury are too small in number to warrant detailed discussion. Altogether sixty-eight arthroplasties were performed in sixty-six patients of whom forty-four were male and twenty-two female. The right hip was replaced in thirty-eight patients, the left in twenty-six and two patients had bilateral operations.

The mean age of patients at the time of injury was forty years. Most patients had been involved in road traffic accidents. A minority had sustained industrial, sporting or wartime injuries. The mean age of patients at the time of the arthroplasty was fifty-five years, ranging from twenty-four to seventy-seven years. The mean interval between injury and arthroplasty was fifteen years. Patients with central fracture-dislocations had the shortest interval of eight and a half years. The intervals between injury and arthroplasty for the posterior and central fracture-dislocations are shown as a histogram in Figure 1.

When the hip had been severely disorganised by the primary injury, patients presented early for arthroplasty; hence the relatively large number of operations within six years. Even if function returned to normal without operation, secondary osteoarthritis might subsequently require treatment. The symptom-free period and the rate of progression of the ensuing arthritis were very variable, as is shown by the scatter in the later part of the histogram.

**Intermediate operations.** Thirteen of the fracture-dislocations (19.1 per cent) had had open reductions at the time of injury. Five had had screws inserted into an acetabular fragment. For this group the mean interval between the injury and the arthroplasty was ten years.

Eleven patients had had an intermediate operation between the injury and the arthroplasty. Of these, seven

<table>
<thead>
<tr>
<th>Type of hip injury</th>
<th>Number of patients</th>
<th>Number of hips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior fracture-dislocation</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Central fracture-dislocation</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Crack fracture of the acetabulum</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Posterior dislocation</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Anterior fracture-dislocation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>68</td>
</tr>
</tbody>
</table>

Followed posterior fracture-dislocations and twenty-one (30.9 per cent) followed central fracture-dislocations. The remaining three groups of injury are too small in number to warrant detailed discussion. Altogether sixty-eight arthroplasties were performed in sixty-six patients of whom forty-four were male and twenty-two female. The right hip was replaced in thirty-eight patients, the left in twenty-six and two patients had bilateral operations.

The mean age of patients at the time of injury was forty years. Most patients had been involved in road traffic accidents. A minority had sustained industrial, sporting or wartime injuries. The mean age of patients at the time of the arthroplasty was fifty-five years, ranging from twenty-four to seventy-seven years. The mean interval between injury and arthroplasty was fifteen years. Patients with central fracture-dislocations had the shortest interval of eight and a half years. The intervals between injury and arthroplasty for the posterior and central fracture-dislocations are shown as a histogram in Figure 1.

When the hip had been severely disorganised by the primary injury, patients presented early for arthroplasty; hence the relatively large number of operations within six years. Even if function returned to normal without operation, secondary osteoarthritis might subsequently require treatment. The symptom-free period and the rate of progression of the ensuing arthritis were very variable, as is shown by the scatter in the later part of the histogram.

**Intermediate operations.** Thirteen of the fracture-dislocations (19.1 per cent) had had open reductions at the time of injury. Five had had screws inserted into an acetabular fragment. For this group the mean interval between the injury and the arthroplasty was ten years.

Eleven patients had had an intermediate operation between the injury and the arthroplasty. Of these, seven
had had intertrochanteric osteotomies, two had had Smith–Petersen cup arthroplasties, one an Austin Moore hemiarthroplasty and one a pseudarthrosis. The mean interval between the injury and the intermediate operation was eight years. The mean interval between the intermediate operation and the arthroplasty was seven and a half years.

**Grades before operation**
The mean gradings before operation for pain, function and movement were 3.41, 2.91 and 2.78 respectively on the six-point scale used in this clinic in which 6 represents normality and 1 total disability (Merle d'Aubigné and Postel 1954).

Fifty-two of the patients (78.8 per cent) were in clinical category A (unilateral hip disease); three (4.5 per cent) in category B (bilateral hip disease); and eleven (16.7 per cent) in category C (unilateral or bilateral hip disease in patients with additional abnormalities which could impair postoperative function) (Charnley 1968). Two of the patients in category B had primary osteoarthritis of the opposite hip and the third had an old fracture of the opposite femoral neck. Nine of the patients in category C had sustained multiple injuries to the lower limbs at the time of injury, of whom two had had bilateral arthroplasties after bilateral fracture-dislocations of the hip. The two remaining patients in category C had primary osteoarthritis of the knees.

**Operative findings**
The following special technical details were recorded in the notes of the operations. Thirty-five hips (51.5 per cent) were difficult to dislocate; in fourteen hips (20.6 per cent) there was a defect in the acetabular rim and in six (8.8 per cent) a defect in the acetabular floor; the acetabulum was large and irregular in nine hips (13.2 per cent); fibrous union of the acetabular fracture was found in eight hips (11.8 per cent); in eighteen hips (26.5 per cent) the bone in the acetabulum was notably soft but in six (8.8 per cent) it was hard; difficulty in reaming the medullary cavity of the femur was encountered in nine hips (13.2 per cent) of which six had had a previous intertrochanteric osteotomy. Despite defects in the acetabular wall circumferential support for the cup was achieved by deepening and reaming the acetabulum. Caution was necessary to ensure that ununited acetabular fragments were not displaced or avulsed. Full expansion of the expanding reamer was prevented in one of the patients by a screw in an acetabular fragment. The screws in four other cases were not seen. The screws were retained in all five cases. An extra volume of cement was used in some of the patients with very capacious acetabula and also sometimes to provide extra support for the cup when there was a defect in the acetabulum.

The incidence of operative tenotomies indicated the frequency with which muscle contractures were encountered. The external rotators were divided in forty-four hips (64.7 per cent) and the psoas tendon in thirty-eight (50.0 per cent). The adductors were divided during thirteen (19.1 per cent) operations, and after it was completed in eight (11.8 per cent).

**RESULTS**
Sixty-three patients with sixty-five hips were reviewed. The mean period of follow-up was three and a half years.

**Grades after operation**
**Pain.** The mean postoperative grade for pain was 5.92. Sixty of the arthroplasties (92.3 per cent) were graded as 6 for pain and five (7.7 per cent) as grade 5.

**Function.** The mean postoperative grade for function was 5.60. Forty-five of the arthroplasties (69.2 per cent) were graded 6 for function, fifteen (23.1 per cent) were grade 5, four (6.2 per cent) grade 4 and one (1.5 per cent) was grade 3. Those cases which were graded 4 or 3 for function all had additional abnormalities in the lower limbs and the hip arthroplasty was not solely responsible for the impairment.

Analysis of the follow-up of forty-nine patients in clinical category A showed that thirty-eight (77.6 per cent) were graded 6 for function and eleven (22.4 per
Low-friction arthroplasty after fracture-dislocations of the hip

<table>
<thead>
<tr>
<th>Shortening</th>
<th>More than 2cms</th>
<th>0 - 2 cms</th>
<th>0</th>
</tr>
</thead>
</table>

The numbers of patients with shortening of the leg before and after the arthroplasty.

The mean grades for function after operation for patients in clinical categories B and C, whose function was already impaired for reasons unrelated to the arthroplasties, were 5.0 and 5.1 respectively.

**Movement.** The mean grade after operation was 5.45. Thirty-four of the arthroplasties (52.3 per cent) were graded 6, twenty-six (40 per cent) grade 5, and five (7.7 per cent) grade 4. Two of the five arthroplasties which were graded 4 were conversions from a pseudarthrosis and a Smith-Petersen cup arthroplasty respectively.

**Walking aids.** Fifty-nine patients (93.7 per cent) did not require aid after the arthroplasty though fifty-six (88.9 per cent) had used aids before this operation (Fig. 2).

**Radiological assessment.** Fifteen hips (22.1 per cent) had extensive new bone formation around the joint before operation. In the group of posterior fracture-dislocations nineteen hips (59.4 per cent) had an "upper pole" osteoarthritis. Five (15.6 per cent) had extensive necrosis of the femoral head. In the group of central fracture-dislocations sixteen hips (76.2 per cent) had a "concentric" arthritis and twelve (57.2 per cent) had an associated protrusio acetabuli. Three hips (14.3 per cent) had extensive destructive changes of the lining of the acetabulum.

**Leg length.** True shortening was measured on the radiographs before and after operation. Forty-six patients (73.0 per cent) had a discrepancy in leg length before operation: the mean shortening was 1.32 centimetres for the posterior fracture-dislocations and 1.21 centimetres for the central fracture-dislocations. After the arthroplasties fifty-five (87.3 per cent) patients had legs of equal length (Fig. 3).

**Complications**
Three patients died in hospital: two from massive pulmonary embolism and one from myocardial infarction. Three patients had small pulmonary emboli and one a deep venous thrombosis. One patient developed postoperative pneumonia, another a superficial wound infection and one patient had an asymptomatic fibrous union of the trochanter.

**DISCUSSION**
Total hip replacement arthroplasty must be advised with caution in young patients such as are encountered in this study (mean age 54.7 years). Severe disability associated with severe pain which would be improved by pseudarthrosis provides a useful guideline and is the basis of what in this unit is called the "pseudarthrosis test" for suitability of the young person for arthroplasty. Additional pathological changes, which will restrict activity after the operation and hence lessen wear of the prosthesis, are other factors to be considered—the so-called "built-in restraint". Nineteen arthroplasties (27.9 per cent) were on patients under fifty years of age (mean 36.9 years; range 24–49 years) but the hips in this young group were on average more painful and had worse function than those of the older patients. Forty-seven per cent of the young group were categorised B or C indicating that the other hip was also diseased or that they suffered from multiple abnormalities which would restrict activity after operation. By contrast 85.7 per cent of the patients who were over fifty years old at the time of the arthroplasty were in category A which indicated that they were accepted for surgical treatment with isolated unilateral hip disease.

The proportion of patients who require an arthroplasty after sustaining a fracture-dislocation of the hip cannot be evaluated from this study. What is clear, however, is that a low-friction arthroplasty gives an excellent result in this group of patients.

**REFERENCES**