International Orthopaedics (SICOT) (2002) 26:238–242
DOI 10.1007/s00264-002-0343-7

ORIGINAL PAPER

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# Intertrochanteric osteotomy for osteonecrosis of the femoral head

Accepted: 3 January 2002 / Published online: 4 May 2002


**Abstract** We studied 32 hips (in 27 patients) treated by intertrochanteric osteotomy for osteonecrosis of the femoral head. Average follow-up was 17 (range 9–26) years. There were 22 men and 5 women with an average age of 39 (range 25–55) years. Eleven hips were classified as Ficat stage II, 19 as stage III and two as early stage IV. Nine hips showed collapse of the femoral head within 3 years after operation and in six hips collapse occurred after 3–8 years. In 13 hips slow progression with incipient signs of arthrosis was noted 8 years after surgery. Four hips with a moderate degree of necrosis at the time of surgery showed no radiological progression 9–26 years after operation. We recommend intertrochanteric osteotomy for patients with Ficat stage II and early stage III, provided that they still have a good range of motion in the hip.

**Résumé** Nous avons suivi 32 hanches (27 malades) avec une ostéonécrose de la tête fémorale traité par ostéotomie intertrochanterienne pendant un temps moyen de 17 (9–26) années. Il y avait 22 hommes et 5 femmes, avec un âge moyen de 39 (25 à 55) années. Onze hanches ont été classées comme Stade II de Ficat, 19 comme Stade III et deux comme Stade IV précoce. Neuf hanches ont montré un collapsus de la tête fémorale dans les trois années postopératoires et six hanches ont eu un collapsus plus tardif, après trois à huit années. Dans 13 hanches des signes naissants d'arthrose avec progression lente ont été notés huit années après la chirurgie. Quatre hanches avec une nécrose limitée au moment de la chirurgie n'ont pas montré d'aggravation radiologique au cours des 9 à 26 des années postopératoires. Nous recommandons l'ostéotomie intertrochanterienne pour les malades avec une nécrose de stade II ou III précoce et une bonne mobilité de la hanche.

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## Introduction

Intertrochanteric osteotomy for femoral head necrosis has been used for more than 30 years. It is mostly indicated when there is only partial necrosis of the femoral head. The aim of the operation is to move the necrotic segment away from the main weight-bearing area. Since 1972 we have used intertrochanteric osteotomy in the treatment of femoral head necrosis.

The purpose of the study was to assess the influence of intertrochanteric osteotomy on the progression of necrosis, on the presence or absence of any 'final' collapse of the femoral head and on the possible development of osteoarthritis in the hip joint.

## Materials and methods

Thirty-two hips in 27 patients operated on between 1972 and 1991 were studied. Thirteen patients had bilateral involvement of the femoral head, and five of these underwent bilateral intertrochanteric osteotomy. The Ficat radiological system was used for staging [2].

Selection criteria included partial necrotic involvement of the femoral head in Ficat stages II and III with a well-preserved range of hip motion (flexion of at least 115° and adduction and abduction of at least 20°). There were 22 men and five women and their average age was 39 (range 25–55) years. Eleven patients had developed idiopathic necrosis of the femoral head. Necrosis in 14 patients was induced by alcohol abuse, and in two by long-term steroid therapy. There were 11 hips with stage II radiological involvement, 19 with stage III, and two with early stage IV. Duration of symptoms before the osteotomy was an average of 14 (range 6–23) months.

The extent of necrosis was assessed by measuring the arc of the necrotic surface area on anteroposterior and lateral radiographs and by combining the angles as proposed by Kerboul et al. [4]. The lesion was considered medium when the angle was between 160° and 200° and large when it was greater than 2,000°. Five patients had moderate lesions and the rest had large lesions.

Patients were followed up on a yearly basis for an average of 17 (range 9–26) years and the outcome was assessed using the following criteria: (1) Poor results – collapse of the femoral head occurring within 3 years after operation and requiring total hip replacement; (2) fair results – collapse of the femoral head occurring 3–8 years after operation; (3) good results – no progression of the disease for 8 years after operation but followed later by slow,


**Fig. 1a–f** Preoperative radiographs of a 26-year-old woman with Ficat stage III lesion of the left hip. **a** AP view. **b** Ventrocranial. **c** Dorsocranial segment of the femoral head. **d** Adduction view. **e** Two years after valgus osteotomy. **f** Fourteen years after primary surgery; complete regression of necrosis

radiologically documented progression of necrosis associated with discomfort after walking long distances; (4) excellent results – no radiological progression of necrosis for 9–26 years post-operatively, and no signs of osteoarthritis.

## Surgical technique

Pre-operative planning included measuring the necessary degree of correction and determining the position for and size of a 90° AO right-angle blade-plate fixation device. The hip joint was exposed through an anterolateral approach. Thirteen patients underwent flexion osteotomy, four valgus osteotomy, ten flexion-varus osteotomy, and five flexion-valgus osteotomy. The angles of correction for flexion ranged from 20° to 30°, and for varus or valgus from 15° to 20°.

In 16 hips the osteotomy was combined with core decompression and cancellous bone grafting. In these patients the hip joint was exposed through an anterior capsulotomy. The necrotic segment of the femoral head was excised through a cortical window in the femoral neck, and the cavity was packed with autologous cancellous bone.

Passive hip movement was started 3–4 days post-operatively and when pain allowed. Walking with crutches with ‘touch weight bearing’ on the affected side was started on the second post-operative day. Full weight bearing was allowed 3 months after the operation.

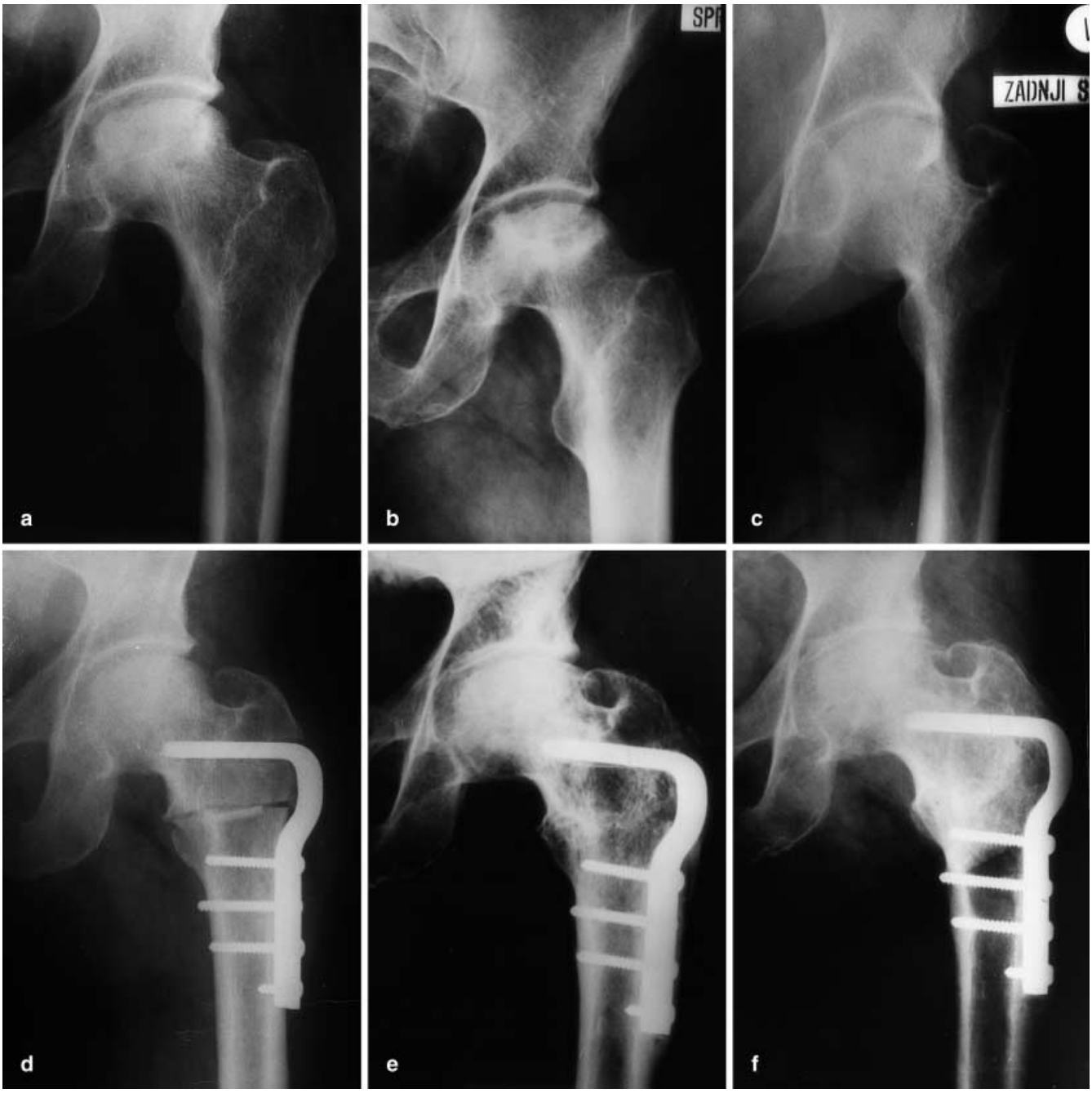


**Fig. 2a–f** Preoperative radiographs of a 42-year-old man with Ficat stage III lesion of the left hip. **a** AP view. **b** Ventrocranial. **c** Dorsocranial segment of the femoral head. **d** AP radiograph after flexion osteotomy. **e** Nine years after primary surgery. **f** Fifteen years after primary surgery; slowly progressing

## Results

At the last follow-up examination, nine hips showed poor results, six fair, 13 good and four excellent. The most convincing factor predicting the final outcome was the stage of hip involvement at the time of surgery. Patients with Ficat stage II had significantly better survival rates of their affected femoral head ($P$=0.004) than those in stage III.

In the group with excellent results two hips (in one patient) pre-operatively had been classified as stage II and two hips as stage III. They all showed a medium necrotic lesion before the operation. Post-operatively there was radiological regression and at follow-up the patients were also pain free (Fig. 1).

Thirteen patients with good results were free of symptoms for 8 years but then began to experience pain. At this stage radiography demonstrated slight progression of the necrosis and signs of osteoarthritis. Seven hips (seven patients) were in stage II and six hips (five patients) in stage III. In all hips the necrotic lesions were

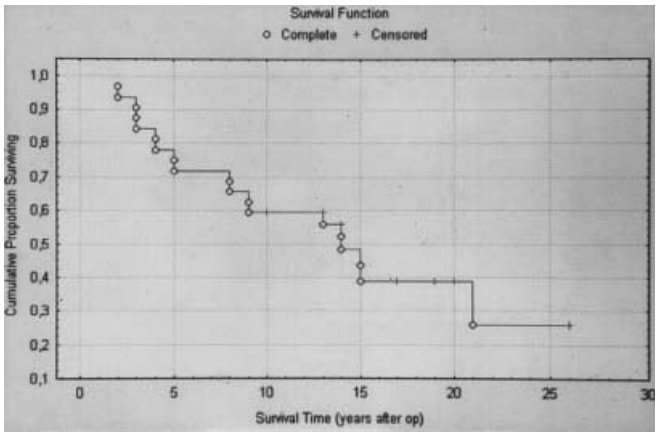


**Fig. 3** Kaplan-Meier survival curve; percentage of surviving hips

large. In this group eight hips had had supplementary core decompression and cancellous bone grafting added to the osteotomy (Fig. 2).

The group with fair results was comprised of six hips, all with idiopathic necrosis. Pre-operatively one hip was in stage II, the others in stage III. Clinical results remained acceptable for 3 years, but during the ensuing years the necrosis progressed, necessitating prosthetic hip replacement within 8 years.

The group with poor results was comprised of seven hips with alcohol-induced necrosis, one with idiopathic necrosis and one with steroid-induced necrosis. One hip had a stage II lesion, six had stage III lesions and two had early stage IV lesions. In three hips the flexion angle after osteotomy was less than had been planned.

Our results were used to generate a Kaplan-Meier survivorship curve (Fig. 3). The end point of progression was regarded as stage IV, requiring total hip arthroplasty. Chances of a satisfactory result at 5 years seemed to be 70% and 60% at 10 years. The percentage of hips surviving 15 years or longer after osteotomy was approximately 40%.

There were two major orthopaedic complications; one was delayed union and one was superficial wound infection. Both were successfully treated conservatively and they had no effect on the final functional outcome.

## Discussion

Despite extensive studies of avascular necrosis of the femoral head, its pathogenesis and optimal treatment still remain to be identified. In our patients a varus flexion intertrochanteric osteotomy has proved a safe and effective salvage procedure in hips with advanced disease.

For the operation to be successful the necrotic involvement of the femoral head should not be too extensive. We believe that the common necrotic angle [4] is an important prognostic factor in determining the final outcome of the procedure, as all our patients with excellent results had a pre-operative necrotic angle of approximately 180°. Another important factor is the location of the necrotic segment, which should be determined by accurate pre-operative radiology. This will then allow the appropriate intertrochanteric osteotomy to be performed. However, in spite of using all these prognostic factors the results of the treatment of avascular necrosis with an intertrochanteric osteotomy still has a measure of unpredictability [8].

Our results suggest that a long-term follow-up study is needed for proper assessment of surgery results for aseptic femoral head necrosis, although in our series the risk of failure due to progression of the disease was greatest in the first 5 years after surgery. Later failures were mostly due to osteoarthritis appearing in the operated hips, and this resulted in a peak failure rate 13–15 years after operation. Our results at long-term follow-up revealed a good or excellent outcome in 53% of patients, and these favourable results match those previously reported for intertrochanteric osteotomy for stages II and III avascular hip necrosis. As early as 1965 Merle d'Aubigne et al. [6] reported good and excellent results in approximately 80% of the 59 treated hips. However, their patients were only followed for between 1 and 10 years. Kerboul et al. [4] reviewed the clinical results of 47 osteotomies performed in 39 patients and 60% remained practically free from pain for 5 years after osteotomy. Maistrelli et al. [5] reviewed the outcomes of 106 intertrochanteric osteotomies and found that at 2 years after operation 71% of the hips showed a clinically satisfactory result. At an average of 8.2 years after operation 58% continued as excellent or good and only 23% needed a total hip arthroplasty. Jacobs et al. [3] obtained good results in73% of 22 patients who were followed for an average of slightly more than 5 years. Scher et al. [9] reported surprisingly good results in 45 intertrochanteric osteotomies, with an analysis demonstrating a cumulative survival of 87% at 5 years that remained essentially unchanged at 10 years. Mont et al. [7] reported good and excellent long-term results in 76% of 37 osteotomies at an average of 11.5 years.

The transtrochanteric procedure described in 1992 by Sugioka et al. [10, 11] gave a variable success rate but with greater post-operative morbidity and a higher incidence of post-operative complications [1]. This procedure is not used in our department.

In summary, our results and those of other studies [8] indicate that the clinically satisfactory results of intertrochanteric osteotomy for advanced avascular necrosis of the femoral head may not be permanent, although we recommend it as a hip salvage procedure in properly selected cases. This is because of the relatively long hip survival that it can provide.

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