TOTAL HIP ARTHROPLASTY AFTER FAILED INTERTROCHANTERIC OSTEOTOMY

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From 1969 through 1982, 305 hips in 290 patients had total hip arthroplasty for failed femoral intertrochanteric osteotomy. Of these, we reviewed 215 hips (70.5%) with a minimum follow-up of five years.

The results were good or excellent in 79%, but there were technical problems at operation in 23% and a total perioperative complication rate of 11.8%. Late complications occurred in 13.1% including seven late infections (3.2%). At a mean follow-up of ten years, 39 hips had been revised (18.1%), there was probable loosening in 19.5% of stems and 12.6% of cups and possible loosening in 11.4% of stems and 7.2% of cups. The cumulative probability of failure at ten years was 20.6%.

We recommend that intertrochanteric osteotomy be advised, planned and executed bearing in mind the possible need for a subsequent total hip arthroplasty, and that screws and plates should be routinely removed soon after union of the osteotomy.

PATIENTS AND METHODS

The joint replacement registry of the Mayo Clinic provided records of all patients with a previous failed osteotomy from 1969 through 1982. From the 420 hips, we excluded 84 with severe congenital deformity of the acetabulum and 15 which had undergone either a Milch subtrochanteric osteotomy (10) or an osteotomy after a previous fusion (5).

We also excluded eight treated by endoprostheses and eight which had had surface replacement arthroplasties. These exclusions left 305 hips in 290 patients; all operative records were available for these cases.

Of these, 215 hips had been followed up for at least five years (mean 10.1). The other 90 hips were in patients who had either died (n = 79), been lost to follow-up, or had inadequate radiographs. We reviewed, however, demographic data, operation, postoperative radiographs and complications in all 305 hips, finding no differences in these respects between those with long-term follow-up and those lost.

The diagnosis before osteotomy had been osteoarthritis in 79%, post-traumatic arthritis in 6.5%, and slipped epiphysis in 5.6%, with small numbers with other diagnoses, such as avascular necrosis, rheumatoid arthritis, Perthes' disease, developmental coxa vara, old septic arthritis, systemic lupus erythematosus, and psoriatic arthritis. Left and right hips were equally represented and 58% of the patients were men. The mean age at osteotomy was 54.5 years and just over half of the osteotomies had been performed at the Mayo Clinic.

All the records and radiographs were reviewed by one of the authors (GMF) after the arthroplasty. A transtrochanteric approach had been used in all cases; no metal-backed acetabuli had been used. All components had been cemented, but femoral canal plugging and cement pressurisation had not been used. The mean age at THA was 61.4 years, giving a mean time after osteotomy of 7.3 years. The preoperative, one-year postoperative, and latest follow-up radiographs were evaluated for loss of bone stock and evidence of loosening, using the Mayo hip score (Kavanagh and Fitzgerald 1985).

We used the same scoring system to evaluate the clinical results, giving up to 80 points for clinical performance (excluding range of motion) and up to 20
points for radiographic appearance. This information was gained by questionnaire in 68%, telephone call in 8.1%, and clinical examination in 23.9%. If a patient could not attend the Mayo Clinic, a radiograph was taken locally and mailed to us.

**Statistics.** Comparisons of continuous variables were made with two-sample t-tests or rank-sum tests when necessary. Comparisons of proportions were with chi-squared tests. The cumulative probability of failure was estimated as a function of time since surgery by the Kaplan-Meier method. Comparisons of failure curves were made with log-rank tests.

**RESULTS**

**Osteotomy.** All 305 hips had had femoral intertrochanteric osteotomies. In 96 (31.5%) the neck was placed in varus, and in 96 in valgus (Fig. 1a). There had been medial displacement in 23.4%, and a combination of medial displacement and valgus in 6.2%. Other hips had valgus derotation (2.6%), medial and varus displacement (2.3%), varus derotation (2.0%), and derotation alone (0.3%). All but four osteotomies had been fixed with a plate or spline (Wainwright, Harris or AO blade plate) and distal cortical screws; four had spica casts with no internal fixation.

The disease progressed after osteotomy in all patients; 10.8% had nonunion and 1.3% became infected. The highest nonunion rate (18%) was in the 17 hips with post-traumatic arthritis, with a 13% rate in the osteoarthritic cases. Varus osteotomy had a 23% nonunion rate; valgus osteotomy produced 4% nonunion. Varus and valgus osteotomies gave similar periods of pain relief, 40 and 47.1 months respectively. Femoral derotation gave a mean 72 months of relief and valgus derotation gave the longest mean relief (93.5 months).

All four infected patients were treated successfully, and there was no relationship between infection of the
osteotomy and later hip infection after arthroplasty. Although no patient was actively infected at the time of arthroplasty, 28 specimens taken at this time were positive to plate culture (the total number of such specimens obtained is not known). Twenty-one cultures grew *Staphylococcus epidermidis*, three *Streptococcus viridans*, and one each α-haemolytic *Streptococcus*, *Corynebacterium*, *Propionibacterium acnes*, and *Neisseria* species. None of these cases developed a deep infection after hip arthroplasty, but one had a superficial wound infection with the same cultured organism which subsequently healed. Fifteen of the hips with positive cultures were treated with a three-week course of prophylactic antibiotics, changed in four according to the sensitivity of the organism.

**Total hip arthroplasty.** The mean operating time in 305 hips in 290 patients for THA was 171 minutes (90 to 320). Blood loss averaged 1340 ml (50 to 4100) and the mean transfusion was 3.3 units of packed cells (0 to 10). The mean hospital stay was 16.9 days (8 to 62).

In the surgeon’s opinion the osteotomy incision compromised the ideal arthroplasty incision in less than 5% of cases, and exposure was described as difficult in 36.4%. There was also difficulty in reaming the femoral canal in 34.1% and in removal of plates and screws in 24.3%. Breakage of these implants occurred in 20.7% (Fig. 1b). Femoral shaft osteotomy was never required to help to fit the prosthesis.

A Charnley cobalt-chrome prosthesis was used in 90 hips (29.5%; Fig. 2), with a variety of other designs, mainly other Charnley patterns, but including the Harris HD-2, Charnley-Müller, Aufranc-Turner, T-28, and the double-curved ‘osteotomy’ prosthesis (Fig. 3). We found no relationship between the type of osteotomy and the choice of prosthesis.

All but three patients received prophylactic antibiotics; none of the three had a postoperative infection. Methicillin was used in 196 (64.3%); other antibiotics included cephalothin (14.1%), cepazolin (8.6%) and lincomycin (6.3%), and more rarely oxacillin, clindamycin, ampicillin, cefamandole, and penicillin. The mean duration of prophylaxis was 4.4 days.

Warfarin was routinely used for prophylaxis against deep venous thrombosis (DVT), except in four patients, none of whom developed DVT or pulmonary embolism. The drug was usually started the evening after operation and continued during the time in hospital.

The osteotomy fixation was removed at the time of THA in 71.8%, or earlier in 26.9%; this made no difference to the clinical outcome as regards hip score, loosening or revision rates. The final follow-up score was not affected by the original type of osteotomy.

Nonunion of the osteotomy (n = 33) did not affect the arthroplasty revision rate, the loosening rate, or the follow-up hip score. Of the five revisions performed after arthroplasty in the presence of osteotomy nonunion, one was done for stem loosening and four for loosening of both components.

The bone stock on the femoral or acetabular side was always adequate to support a prosthesis, and only one patient required corticocancellous grafting to augment the acetabulum: this hip was functioning well at seven years.

For the long-term follow-up group of 215 hips the
mean preoperative Mayo Clinic hip score was 34 of a possible 80 (6 to 73), with 95% below 59. The combined clinical and radiological score at latest follow-up had improved to a mean of 85 of a possible 100 (15 to 100) points: the rating was good to excellent (score greater than 80 points) in 79%, fair (70 to 79) in 7% and poor (< 70) in 14%.

Complications. In all 305 hips (290 patients) there were perioperative complications in 11.8%, and postoperative complications in 13.1%, both including infection. The combined complication rate for the whole series was 24.9%, with 23% having technical problems at operation. Femoral shaft fracture or perforation occurred in only seven. Two patients required screw fixation for fracture; five patients needed no fixation. Two of these patients were lost to follow-up; one underwent revision for infection and one for aseptic loosening of both components 14 years after surgery. The remaining three had good function ten years after operation.

Four superficial wound infections resolved with appropriate treatment. There were no deep infections in hospital.

Seven late deep infections (2.3% of the entire group; 3.2% of the long-term follow-up group) were all confirmed by culture. Five developed 9 to 18 months postoperatively, two 9 and 10 years respectively after surgery. Five were revised to new implants by staged procedures, and two had resection arthroplasties. Seven patients developed urinary tract infection, all treated successfully.

Only six cases of DVT were suspected clinically; one patient had pulmonary embolism which led to perioperative death. Four other patients with pulmonary emboli were successfully treated. There was one case of warfarin-induced stroke, with significant residual deficit, and one of warfarin-induced gastrointestinal haemorrhage, which required transfusion.

Two patients had peroneal nerve deficits, one sensory and one motor and sensory; both resolved. One case of perioperative myocardial infarction led to death, but four other minor postoperative cardiac problems all settled fully.

Trochanteric nonunion occurred in 6.7% of the hips, one requiring reoperation. One other hip required reoperation for anterolateral impingement during activity.

There was at least one dislocation in five hips (2.3%); three were successfully treated closed and two required open operation, one needing implant revision.

Loosening and revision. In the long-term follow-up group of 215 hips, 7.2% of the cups and 11.4% of the stems showed possible loosening, defined as progression in the cement-bone radiolucent lines (Kavanagh and Fitzgerald 1985).

Probable loosening was defined as component migration, cement fracture, prosthesis-cement lucent lines, or a complete cement-bone lucency greater than 1 mm in any zone (Kavanagh and Fitzgerald 1985). These changes were shown by 19.5% of stems and 12.6% of cups.

In the long-term group 12.1% of stems and 7.9% of cups required revision. The total revision rate was 18.1% (39 of 215). The indications included pain, probable loosening with or without loss of bone stock and deep sepsis. The aseptic revision rate was 14.9%. Eight patients had moderate or severe pain at follow-up but had not been revised. Defining failure as the presence of moderate or severe pain or the need for revision, the total cumulative probability of failure (by the Kaplan-Meier method) was 20.6% at ten years, and 33% at 15 years but with wide confidence intervals (Fig. 4). The ten-year cumulative failure rate was 29.7% after varus osteotomy and 15.8% after a valgus osteotomy (Fig. 5).

Seven revisions were required for stem fracture, which was of the pattern and location previously recorded.
DISCUSSION

The effect of previous intertrochanteric osteotomy on the outcome of THA has been analysed by others. Dupont and Charnley (1972) reported a one-year follow-up of 121 cases of osteotomy converted to THA: 87% had no pain and the range of motion was significantly improved. No numbers were given for complications, or for long-term loosening and revision. Benke, Baker and Dounis (1982) reviewed 105 patients who had osteotomy conversions with a minimum follow-up of one year (mean 4.7): 82% had little or no pain and 75% could walk long distances. Their infection rate was 8.6% with technical difficulties in 17.1%.

Our clinical success rate for conversion after failed intertrochanteric osteotomy, with mean improvement of Mayo hip score from 34 of 80 points to 85 of 100 points is similar to the success rates reported for primary THA in comparable patients. Beckenbaugh and Ilstrup (1978), from our institution, and using the same cement-fixation techniques, found 24% loose stems and 6.5% loose cups at five years although relatively few needed revision.
To the patient with failed intertrochanteric osteotomy:

Stauffer (1982) described a stem-loosening rate of 29.9% and a cup-loosening rate of 11.3% at ten years, although only 4.3% of loose stems and 3.1% of loose cups required revision. In our series, more loose components required revision: 7.9% of the 11.6% with loose cups, and 12.1% of the 19.5% with loose stems. The reason may be the younger mean age of our patients. Our deep infection rate of 3.2% also increased the revision rate. We obtained positive cultures in 28 patients, only one of whom developed an infection, although not all patients were so examined. Perhaps all hips with previous osteotomies should have routine aspiration for culture before conversion to THA.

The role of residual cortical defects in causing loosening is uncertain, but they seemed to be implicated in four of our 39 revisions. The presence of cortical holes must decrease the quality of cement-bone interdigitation, and small penetrations of cement through screw holes may act as stress risers in the mantle.

The incidence of positive tissue cultures from the osteotomy site, of broken plates and screws (20.7%) and of difficulty in removing metal implants (24.3%) at the time of THA all argue in favour of the routine removal of such implants soon after an osteotomy has healed, and at least six months before any conversion to THA.

The long-term clinical results of cemented THA after intertrochanteric osteotomy have been reported to be similar in quality to those after primary THA (Salvati et al 1981; Stauffer 1982; Sutherland et al 1982), but we experienced a complication rate of 24.9%, technical problems in 23% and an aseptic revision rate of 14.9%. They warrant careful counselling when considering conversion to THA (Poss 1984) and very careful planning and execution of any primary femoral osteotomies. Indications must be strictly applied, and perhaps only patients who are close to the ideal candidate (Morscher, cited by Poss 1984) should be considered.

The planned osteotomy should preserve the mechanical axis of the limb with minimal distortion of the proximal femoral canal and patients should be told that plates and screws will need to be removed.

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REFERENCES


