Antegrade or retrograde reamed femoral nailing

A PROSPECTIVE, RANDOMISED TRIAL

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Retrograde femoral nailing is gaining in popularity. We report a prospective, randomised comparison of antegrade and retrograde procedures in 68 patients with 69 fractures of the femoral shaft. All nails were inserted after appropriate reaming. There was no difference in operating time, blood loss, technical complications, size of nail or reamer, or transfusion requirements. There were more problems of length and rotation using a retrograde technique on a radiolucent table than with an antegrade approach on a fracture table. All fractures in both groups healed and there was no difference in the time taken to achieve union. Although retrograde nailing is a promising technique the skills required need practice. A longer period of follow-up is necessary to determine whether there are long-term problems in the knee after such surgery.

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Intramedullary nailing is the current treatment for fractures of the femoral shaft in adults. Reports of pain in the lateral hip together with the difficulty of nailing using the antegrade approach in obese patients and those with multiple injuries, have prompted some surgeons to explore the possibility of retrograde nailing. This has been recommended for multiply-injured patients and those with spinal injuries, fractures of the hip, pelvis, acetabulum or tibia, and for bilateral injuries. It may also be suitable for patients with hip disease and obesity. Although the technique has been described, it has not been compared prospectively with antegrade nailing. We have therefore compared antegrade and retrograde reamed femoral nailing with respect to union, early complications and alignment.

Patients and Methods

A consecutive group of 68 patients with 69 fractures of the femoral shaft was entered into a prospective, randomised study of antegrade and retrograde reamed nailing. Randomisation was by medical record number. Only fractures which could be nailed with either an antegrade or a retrograde technique were included, and therefore those within 5 cm of the lesser trochanter or 5 cm of the knee were excluded. Patients with ipsilateral fractures of the pelvis, hip or of the spine were not included but the obese and those with ‘floating knees’ were. Titanium femoral nails (Howmedica Alta Series, Rutherford, New Jersey) were used in all patients.

There were seven open, 21 gun-shot, and 41 closed fractures; 36 had stable and 33 unstable patterns according to the Winquist classification. Antegrade nailing was carried out on a fracture table in the lateral or supine position. A standard piriformis entry was used followed by nailing. Retrograde nailing was undertaken on a radiolucent table using a medial paratendinous approach from the inferior patella to the tibial joint line. The length of this incision became smaller during the period of study. The technique of reaming was the same for both groups. After placement of a guide-wire, the femur was reamed to 1 or 1.5 mm larger than the width at which cortical chatter was achieved. A nail 1 or 1.5 mm narrower than the last reamer was used. Care was taken to avoid injury to the patellar tendon and patella by pushing the reamer to bone before reaming was begun. The knee was irrigated after the nail had been locked. Endcaps were used in the retrograde group after three patients developed haemarthroses requiring arthrocentesis. All nails were statically locked. Attempts were made to lock the retrograde nails at the level of the lesser trochanter.

Data were gathered prospectively, and included the operating time, the set-up time, blood loss, technical complications, the sizes of reamers and the nail and the transfusion requirements. Axial alignment was determined using postoperative full-length radiographs. Postoperative CT of unstable (Winquist 3, 4) fractures was used to determine...
accurately length and rotational deformity. The postoperative management of the two groups was the same and included toe-touch weight-bearing until there was formation of callus. Full weight-bearing was initiated when bridging callus was visible on two orthogonal radiographs.

Follow-up was at four, eight and 12 weeks, and six and 12 months. Assessment of the quality of life by using the SF-36 scoring system was attempted in all patients preoperatively, and at the six- and 12-month follow-up visits. The range of movement of the knee and hip was measured each time. Pain in the knee was graded subjectively by the patients in both groups. Union was defined as a bridging callus on two orthogonal radiological views, with no tenderness to palpation or pain on standing.

Statistical analysis was carried out using unpaired Student t-tests assuming normal distributions.

Results

There were 38 fractures in the antegrade and 31 in the retrograde group. There was no difference between them as regards age (31 ± 33 years), injury severity score (12.4 ± 12.5, 4 to 42), width of the nail (11.6 ± 11.4 mm), blood loss (215 ± 253 ml), stability or location of the fracture or associated injuries. There was a statistical difference between operating time; 116 ± 40 min for antegrade and 147 ± 58 min for retrograde (p < 0.05). When set-up time was included, there was no difference in total time. The postoperative position revealed longitudinal angular deformity greater than 5° in one antegrade and three retrograde nails. A rotational deformity of greater than 10° was seen on CT rotation studies in 3 of 18 (17%) of the antegrade and in 5 of 15 (33%) of retrograde nailings carried out in those patients with unstable patterns. Shortening occurred in five unstable fractures in the retrograde group, but in none of such injuries in the antegrade group. In these five patients shortening averaged 12 mm (5 to 30). Return to the operating room for acute lengthening and relocking was necessary for the patient with 3 cm of shortening.

Complaints of pain in the knee were identified in 25 retrograde and 13 antegrade patients in the immediate perioperative period. In many cases, it was difficult to delineate tightness of the quadriceps or injury from pain in the knee. Three patients in the retrograde group developed haemarthrosis which required percutaneous arthrocentesis in the ward to allow early movement. Complaints of pain in the knee subsided by the time of union in all but four retrograde and five antegrade patients. A total of 64 patients with 65 fractures (35 antegrade and 30 retrograde) was followed to union. The time to union was 98 days for the antegrade group and 92 days for the retrograde group. There was no difference in the final range of movement of the hip or the knee between the groups. No patient in the retrograde group developed heterotopic ossification at the hip in the antegrade group.

Discussion

The aim of our study was to determine whether there were differences between antegrade and retrograde intramedullary nailing for femoral fractures, and whether retrograde nailing caused pain in the knee.

It has been reported that the rate of union after unreamed retrograde nailing was only 89%, but by using a nail with a better canal fill, combined with early dynamisation, this can be increased to 94%. A rate of union of 90% was reported in a heterogeneous group of patients after reamed retrograde nailing, although the technique did not include over-reaming of the canal to achieve a good fit. These reports when combined indicate that retrograde nailing does not achieve the same rate of union as antegrade reamed nailing. In fact, the problems seen in these reports are similar to our findings of slower union after unreamed antegrade nailing. In that series distal fractures treated with unreamed antegrade nails took twice as long to unite than after reamed nailing. We consider that the delay was likely to be due to mechanical factors. In the current study the findings of equal rates of and time to union may be related to the reaming, and the improved mechanics obtained by over-reaming of the canal in all cases, whether retrograde or antegrade. In all our patients the nail which fitted their canal had been placed after over-reaming of 1 or 1.5 mm, and presumably had optimal mechanical efficiency.

The difference in shortening and rotational deformity was due, at least in part, to the different techniques used for placement of the nail. A fracture table was used for the antegrade group and nailing was carried out with the leg in traction, thus avoiding shortening. In the retrograde group a radiolucent table was used and the position of reduction was maintained by an assistant. The leg was often rotated to align the proximal screw hole so that the distal segment could rotate more than the proximal fragment. We found that nailing without a traction table made length and control of rotation more difficult, as evidenced by the superior reductions achieved in the antegrade group. Although a femoral distractor can be used during retrograde nailing to correct for length, rotation in unstable fractures is difficult to judge. One-third of the Winquist type-3 or type-4 fractures in the retrograde group had more than 10° of rotational deformity. To avoid this problem we advise that the distal jig be used to rotate the nail with the leg and cross-locking at the proximal end be carried out first.

The duration of the operation, from incision to closure, was longer for retrograde than for antegrade nailing. This was probably due to several cases of non-comminuted transverse fractures in large men, in whom reduction, even using a femoral distractor, was challenging. As we became
more experienced with the technique the duration of surgery decreased. Pain in the knee was commonly reported by the retrograde group in the period soon after surgery, but resolved in most cases, usually with return of quadriceps strength. At the time of union of the fracture, as we defined it, there was no difference in pain in the knee between the two groups. Three patients in the retrograde group, none of whom had an endcap or drain, required arthrocentesis to remove haemarthroses. There was no other difference in the outcome of the patients.

Although retrograde femoral nailing is useful in certain circumstances it is not better than antegrade nailing for fractures of the diaphysis of the femur. Difficulty in obtaining the correct length and rotation when nailing without a fracture traction table contributed to malreduction. We recommend a distractor for fractures with shortening. A longer period of follow-up is needed to determine the outcome of the intra-articular knee portal. Care in obtaining a good canal fill after 1 to 1.5 mm of over-reaming resulted in a similar time to union for retrograde nailings as that seen in antegrade nailings.

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References