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# Cephalomedullary Fixation for Pertrochanteric Femoral Fractures

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**Abstract:** Cephalomedullary fixation has well-recognized indications in reverse obliquity and subtrochanteric femoral fractures, and is now being recommended for use in simple intertrochanteric fractures in osteoporotic patients. There are no published articles examining this subject. We present 271 pertrochanteric fractures managed operatively at the Gold Coast Hospital. A retrospective review was undertaken using DRG codes and ORMIS data specifying "femoral fracture" between January 2002 and December 2004. Nine hundred and fifty charts were identified. All those not identified as having a pertrochanteric fracture were excluded. Other exclusionary grounds were isolated femoral neck fracture and non-operative management. 271 patients were identified as receiving operative management either by a compression hip screw or cephalomedullary fixation. 218 intertrochanteric, 5 basicervical and 48 subtrochanteric fractures were identified. 235 compression hip screws were performed (includes 5 $90^0/95^0$ devices). 35 received cephalomedullary fixation (22 long IMHS, 2 short IMHS, 1 Gamma, 10 recon nails), and one patient received a standard anterograde femoral nail. 233 patients (average age 81) suffered low energy injuries. All reoperations for failure of fixation were in this group. 19 required reoperation, including 7 for failure of fixation. 1.7% (4 of 235) of compression hip screws failed (2 osteoporosis, 1 technical error, 1 inappropriate fixation); 8.3% (2 of 24) IMHS failed (osteoporosis) and the anterograde nail failed (inappropriate fixation). No specific indication for the use of cephalomedullary fixation in simple intertrochanteric fractures was identified. The traditional compression hip screw has a lower revision rate due to osteoporosis.

**Key words:** Subtrochanteric fractures, outcome assessment

## INTRODUCTION

In 2006, the number of hip fractures world-wide is expected to reach approximately 2.6 million, with an annual cost to health care systems of 16 billion US dollars[1,2]. It is expected that this will grow exponentially with the aging population. Approximately 50% of all hip fractures in the elderly are intertrochanteric, and of these 50-60% are unstable.[1] The vast majority of hip fractures in the elderly result from low energy trauma, usually simple falls[2], and osteoporosis is a contributing factor in 75% of cases.[3]
Using the modified Evans classification[4] (Fig 1), an unstable fracture shows comminution of the posteromedial buttress of the calcar femorale, and is usually considered to include the reverse obliquity and subtrochanteric types.[5] The term pertrochanteric is used to describe both intertrochanteric and subtrochanteric fractures.

Following popularization by Jewett in 1941, internal fixation of pertrochanteric fractures is among the most commonly performed orthopaedic procedures. Union rates around 95%[6] using a compression hip screw and plate construct ("pin and plate") have been achieved. The majority are inserted with a plate-screw (neck) angle of $130^0$ or $135^0$. Ninety or ninety-five degree plate/screw devices are generally reserved for reverse obliquity or otherwise unstable fractures.

The unstable group have a higher complication and failure rate (up to 50% in some series)[2], and unfortunately tend to occur in the elderly, patients with low bone mineral density, and those with pre-morbid mobility issues. After the well-documented successes of intramedullary fixation for femoral shaft fractures, a number of cephalomedullary designs combining intramedullary fixation, sliding lag screws and distal locking options were advanced. These combined the perceived advantages of percutaneous fixation (shorter operating time and reduced blood loss); with the mechanical advantages of cephalomedullary fixation, namely a shorter lever arm across the lag screw, better stress transfer, reconstruction of the posteromedial buttress and controlled collapse with compression of subtrochanteric fractures.[6]

Despite the poor results of the Gamma nail (Howmedica, Inc) in Australia, a similar cephalomedullary device (IMHS, Smith and Nephew Inc) has gained widespread acceptance and is being increasingly advocated for simple intertrochanteric fractures in osteoporotic patients as well as unstable pertrochanteric fractures. The international literature, however, while

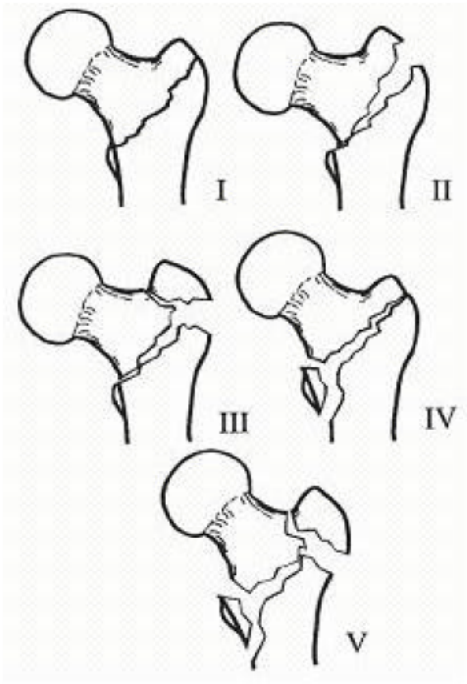


Fig. 1: Type 1 two-fragment fracture without displacement; type 2 a two-fragment fracture with displacement; type 3 is a three-fragment fracture with displacement of the greater trochanter (lacks lateral support); type 4 is a three-fragment fracture with displacement of the lesser trochanter or the medial cortex (lacks media support); and type 5 is a four-fragment fracture including the greater and the lesser trochanter or the medial cortex (lacking lateral and medial support)

being centered around the Gamma nail, reports there is no significant difference between cephalomedullary fixation and pin and plate devices regarding postoperative transfusion requirement, mortality, wound infection or medical complications[1]. Valverde et al[7] found that the perioperative complication rate for insertion of the Gamma nail was 10.3%, the majority being attributable to technical error. The same study found a 14.1% postoperative complication rate.

Due to the much higher cost of the IMHS compared to any pin and plate device (eg Ambi, Smith and Nephew Inc or DHS, Synthes Inc) or generic reconstruction nail (eg Russel-Taylor, Smith and Nephew), and the well-documented success rate of the pin and plate devices, we conducted a retrospective analysis of pertrochanteric fractures managed operatively at the Gold Coast Hospital since the availability of the IMHS (early 2002). In this series, selection of fixation device was based solely on fracture configuration; no consideration was given to potential nonunion or failure due to osteoporosis.

Our hypothesis was that cephalomedullary fixation devices have a higher rate of re-operation, and while there may be limited indications, the majority of pertrochanteric fractures should be managed with a pin and plate-type device.

## METRIALS AND METHODS

Medical records were examined using DRG codes and ORMIS data specifying femoral fracture between January 2002 and December 2004. Nine hundred and fifty charts were identified. All those not identified as having some type of pertrochanteric fracture were excluded. Other grounds for exclusion were all isolated femoral neck fractures and non-operative management. A total of 271 patients were identified, receiving operative management either by a pin and plate device or cephalomedullary fixation.

This group was analysed by fracture type, mechanism of injury ie high or low energy, fixation received, and reoperation for any reason.

As comminution of intertrochanteric fractures was not a factor in fixation selection, the group was divided into intertrochanteric fractures, basicervical fractures and subtrochanteric fractures.

## RESULTS

A total of 218 (80.4%) IT, five (0.9%) basicervical and 48 (17.7%) subtrochanteric fractures were identified during the two year period. The age range was 12 to 98 years. Seven (14.6%) of the subtrochanteric group and 12 (5.5%) of the intertrochanteric group required reoperation, while one patient was changed from a Russel-Taylor reconstruction nail to a pin and plate on the table after a femoral neck fracture was noted during piriformis fossa entry.

Overall, 235 pin and plates were performed, including all of the basicervical and intertrochanteric group and 12 of the subtrochanteric fracture group. Twelve required reoperation (four for failure of fixation), none of which were subtrochanteric fractures.

Twenty-two of the subtrochanteric group received a long IMHS (Smith and Nephew, Inc), of which 3 required reoperation (two for failure of fixation); three received a short cephalomedullary fixation device (1 Gamma, Howmedica Inc; 1 IMHS and 1 TAN, Smith and Nephew Inc), neither of which required reoperation; and 10 received a recon nail, of which 3 required reoperation (none for failure of fixation). Seven received a $135^0$ pin

Fig. 2a: Left, Three-part subtrochanteric fracture. Right, postoperative AP radiograph of an anterograde femoral nail

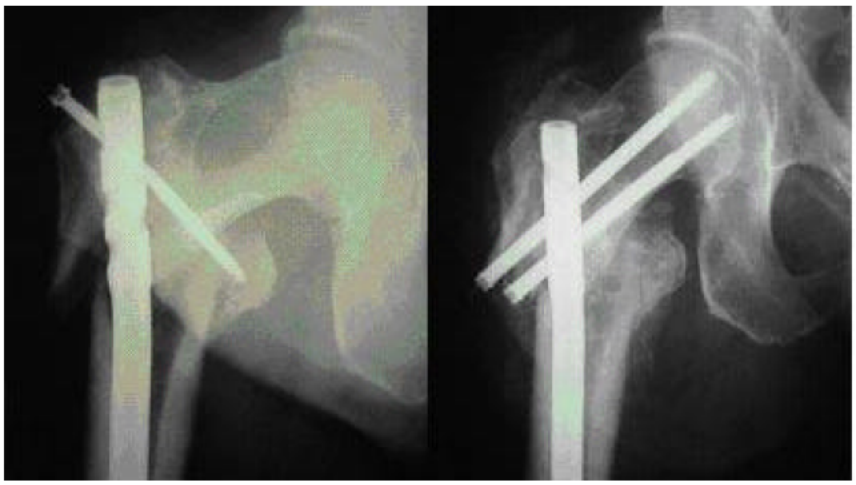

Fig. 2b: Left, AP radiograph at five weeks showing varus deformity at the fracture. Right, post revision to reconstruction femoral nail

and plate and 5 received a $90^0$ or $95^0$ pin and plate (none required reoperation); and one patient received a standard anterograde femoral nail which was revised to a reconstruction nail due to failure of fixation (Fig. 2).

The remainder of the reoperations (12 of 19) were for evacuation of hematoma, washout of infections and the sequelae thereof, or removal of distal locking screws.

233 patients were injured in low energy trauma eg simple falls. 206 patients with an average age of 81 received a pin and plate; 27 patients with an average of 79 received cephalomedullary fixation. All reoperations for failure of fixation remained in this group, as did all subtrochanteric fractures treated with a pin and plate (none of which required revision).

The remaining 38 patients received high energy injuries eg falls from a height or motor vehicle accidents. No reoperations for failure of fixation occurred in this group.

Of the four pin and plates requiring reoperation for failure of fixation, one failed due to inappropriate fixation (actually femoral neck fracture; revised to total hip replacement); one failed due to a technical error of insertion (lag screw placement not conforming to a tip-apex distance of <25mm; Fig. 3a-c); and two were presumed to fail due to osteoporosis. No infection was identified in these two patients, and immediate postoperative radiographs showed appropriate placement of the lag screw. These three were revised to $95^0$ pin and plates.

Fig. 3a: AP radiograph of a 3-part intertrochanteric fracture

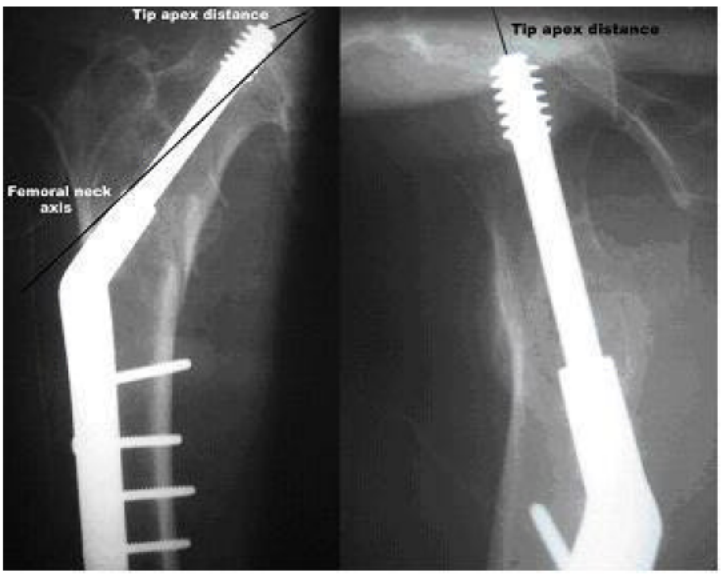


Fig. 3b: Postoperative AP (left) and lateral (right) radiographs of $135^0$ sliding hip screw fixation of the same fracture. The long black line represents the femoral neck axis and terminates on the margin of the femoral head. The short black lines in both films represents the tip-apex distance (tip of lag screw to apex of femoral head; TAD). In the AP film it measured 1.25cm and 2.7cm in the lateral. The combined TAD was 3.95cm

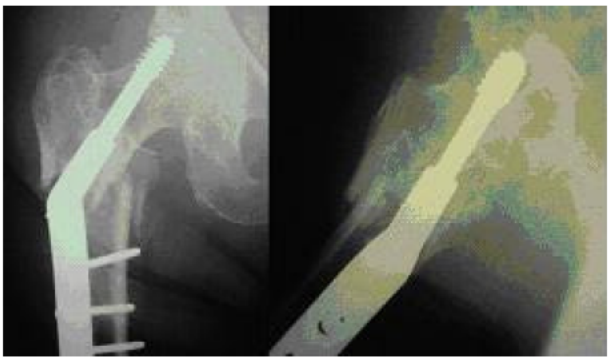

Fig. 3c: The same patient three weeks later showing a new subtrochanteric fracture and partial cutout of the lag screw (with no history of trauma)

Of the two cephalomedullary devices reoperated on for failure of fixation, both were presumed to be caused by osteoporosis, as no infection was identified and immediate postoperative radiographs showed appropriate placement of the lag screw.

Looking purely at osteoporosis as a cause of failure and revision in the low energy trauma group, 1% (2 of 206) of the pin and plates (all types), and 7.4% (2 of 27) of the cephalomedullary devices, fell into this category.

## DISCUSSION

Cephalomedullary fixation is advocated for a number of reasons, including shorter operating time, decreased blood loss and a more advantageous biomechanical construct[6]. These considerations have led to its indications being broadened to include simple intertrochanteric fractures in osteoporotic patients who otherwise would have received a pin and plate.

No recent prospective research clearly demonstrates the superiority of cephalomedullary fixation in these situations. In fact, a number of studies comparing the Gamma nail (Howmedica, Inc) and IMHS (Smith and Nephew, Inc) to the Dynamic Hip Screw (Synthes, Inc) found no difference in time to union, rehabilitation and return to premorbid activities or failure rate.[1,2,8]

Looking at those patients injured by low energy trauma, in our study the average ages of the pin and plate group and the cephalomedullary fixation group was essentially identical (81 vs 79yo), but the failure rate due to osteoporosis was much greater in the cephalomedullary group (1% vs 7.4%). Revision due to technical errors was greater in the pin and plate group (1% vs 0%), but a much greater number of pin and plates were performed (206 vs 27) and this wasn't felt to be significant.

A major limitation in the study was our inability to examine operating time and intraoperative blood loss, both noted to be advantages of cephalomedullary fixation. No significant difference was found between technical failures in the two groups, but operating time and intraoperative blood loss would have given some indication of ease of use when matched for fracture type. The sample size lacked the power to demonstrate statistical significance, but was consistent with the number of patients presenting with similar injuries and mechanisms at international centres.[1]

A confounding factor in the higher failure rate in the cephalomedullary group is the nature of subtrochanteric fractures, in that they are more likely to occur in osteoporotic patients[3] and hence more likely to fail. However, of the 12 subtrochanteric fractures treated with any type of pin and plate, none failed.

## CONCLUSIONS

Cephalomedullary fixation has well-documented indications in subtrochanteric and reverse obliquity femoral fractures, but no evidence was found to support its routine use in simple intertrochanteric fractures or indeed any other. Traditional fixation methods (pin and plate) were shown to have lower revision rate due to osteoporosis, and we found no reason to use cephalomedullary fixation prophylactically against failure in osteoporotic patients.

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