Surgical Management of Hip Fractures: An Evidence-based Review of the Literature. II: Intertrochanteric Fractures

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Abstract

Treatment of intertrochanteric hip fracture is based on patient medical condition, preexisting degenerative arthritis, bone quality, and the biomechanics of the fracture configuration. A critical review of the evidence-based literature demonstrates a preference for surgical fixation in patients who are medically stable. Stable fractures can be successfully treated with plate-and-screw implants and with intramedullary devices. Although unstable fractures may theoretically benefit from load-sharing intramedullary implants, this result has not been demonstrated in the current evidence-based literature.

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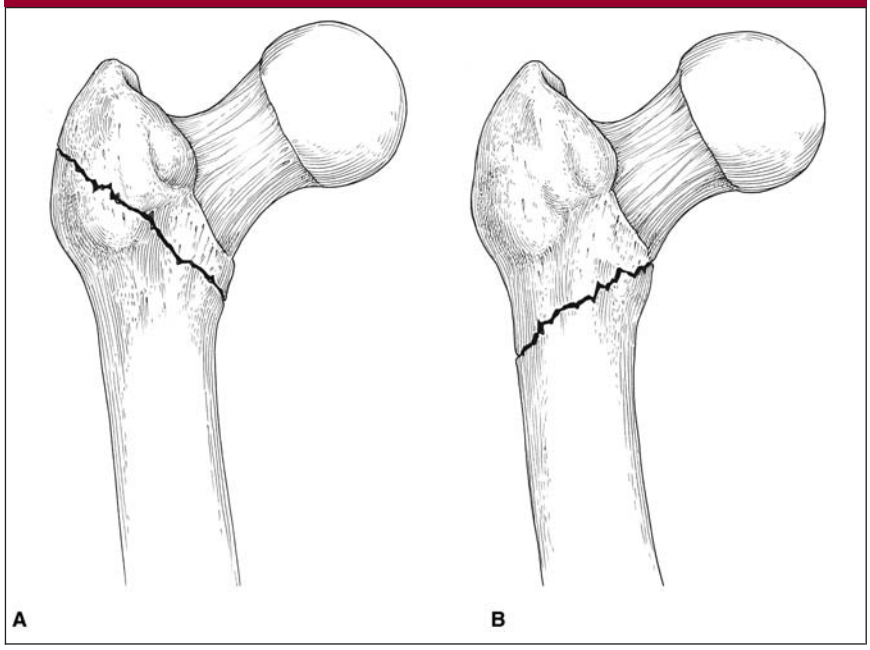
Intertrochanteric hip fractures are extracapsular fractures of the proximal femur involving the area between the greater and lesser trochanter. Such fractures that extend into the area distal to the lesser trochanter are described as having a subtrochanteric component. The intertrochanteric region has an abundant blood supply, which makes fractures in this area much less susceptible to osteonecrosis and nonunion than are femoral neck fractures. Fractures just proximal to the intertrochanteric line, so-called basicervical fractures, are at greater risk for osteonecrosis (secondary to possibly being intracapsular) and malunion (as a result of head rotation during implant insertion). However, they may be treated with the same implants that are used for intertrochanteric fractures.

Internal fixation of intertrochanteric fractures is the mainstay of treatment, although prosthetic replacement is occasionally indicated. The major difficulty stems from the combination of the presence of often osteopenic bone and the adverse biomechanics of many intertrochanteric fracture patterns. Other factors affecting the choice of fixation include preexisting hip symptoms, the presence of osteoarthritis, bone quality, degree of comminution, and the patient's medical condition.

Most of the classification systems for intertrochanteric fractures have poor reliability and reproducibility. A simplified system to aid in evaluating treatment algorithms when assessing the literature is based on fracture stability, which is related to the condition of the posteromedial cortex. Fractures are considered stable in the absence of a comminuted posteromedial cortex, reverse obliquity, and subtrochanteric extension (Figure 1).

Figure 1



Intertrochanteric hip fracture. **A,** Standard oblique fracture (type I). **B,** Reverse oblique fracture (type II).

The literature regarding intertrochanteric fractures points to the difficulty in applying evidence-based treatment algorithms. The current evidence is conflicting and does not always support the treatment modalities that are widely used in practice. Techniques and implants continue to be modified, making the older literature less relevant to current practice. Varying fracture patterns may not be distinguished in clinical studies. The ability to make absolute recommendations based on clear evidence is limited by these problems.

The Centre for Evidence-Based Medicine created criteria for assigning levels of evidence (Table 1). We performed a thorough literature review to determine the most pertinent and highest-level studies related to the treatment of intertrochanteric hip fracture. Although level IV case studies contribute general recommendations for the management of these fractures, we have focused on level I, II, and III studies.

Nonsurgical Versus Surgical Treatment

Nonsurgical treatment of intertrochanteric hip fractures is usually reserved for patients with comorbidities that place these patients at unacceptable risk from anesthesia, the surgical procedure, or both. Mortality from surgical treatment typically results from cardiopulmonary complications, thromboembolism, and sepsis.[1]

There is a paucity of level I evidence concerning whether nonsurgical treatment can provide a comparable outcome to that of surgical fixation for intertrochanteric hip fractures (Table 2). In 1989, Hornby et al[2] performed a randomized prospective study comparing nonsurgical treatment (ie, traction) with a sliding hip screw (SHS) in 106 patients with intertrochanteric hip fracture. Complications were low in both groups, with no significant difference in 6-month mortality, pain, leg swelling, or pressure sores. Anatomic reduction was achieved more commonly with surgical treatment, and these patients had shorter hospital stays. Patients treated with traction had greater loss of independence at 6-month follow-up. The authors recommended surgical treatment for medically stable patients.

A 1981 prospective (level II) trial of 150 patients compared nonsurgical treatment (ie, skeletal traction with a tibial pin) with surgical treatment (eg, medial displacement osteotomy, valgus osteotomy).[3] The authors concluded that excellent results were feasible with traction alone provided that a high standard of nursing care was maintained. Careful attention to bedside physical therapy, respiratory care, deep vein thrombosis prophylaxis, and prevention of ulcers were vital to satisfactory outcomes in nonsurgically treated patients.

A 2003 retrospective level III study reviewed a population database to compare mortality rates in patients with severe comorbidities who were treated either nonsurgically or surgically for intertrochanteric hip fracture.[4] The 30-day mortality rate was lower in patients treated surgically.

Dr. Egol or a member of his immediate family has participated in a speakers bureau or given paid presentations for Biomet; is an unpaid consultant for Biomet; has received research or institutional support from Biomet, Smith & Nephew, Stryker, and Synthes; and holds stock or stock options in Johnson & Johnson. Dr. Zuckerman or a member of his immediate family is affiliated with Neostem and Starmed as a board member, owner, officer, or committee member; has received royalties from Exactech; and has received research or institutional support from Exactech and Stryker. None of the following authors or a member of their immediate families has received anything of value from or owns stock in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Kaplan, Dr. Miyamoto, and Dr. Levine.

Table 1

Levels of Evidence for Primary Research Question*

	Type of Study			
Level	Therapeutic Studies—Investigating the results of treatment	Prognostic Studies—Investigating the effect of a patient characteristic on the outcome of disease	Diagnostic Studies—Investigating a diagnostic test	Economic and Decision Analyses—Developing an economic or decision model
I	High-quality RCT with statistically significant difference or no statistically significant difference but narrow confidence intervals Systematic review† of level I RCTs (and study results were homogeneous‡)	High-quality prospective study§ (all patients were enrolled at the same point in their disease with ≥80% follow-up of enrolled patients) Systematic review† of level I studies	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold standard") Systematic review† of level I studies	Sensible costs and alternatives; values obtained from many studies; with multiway sensitivity analyses Systematic review† of level I studies
II	Lesser quality RCT (eg, <80% follow-up, no blinding, or improper randomization) Prospective§ comparative study¶ Systematic review† of level II studies or level I studies with inconsistent results	Retrospective# study Untreated controls from an RCT Lesser quality prospective study (eg, patients enrolled at different points in their disease or <80% follow-up) Systematic review† of level II studies	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold standard") Systematic review† of level II studies	Sensible costs and alternatives; values obtained from limited studies; with multiway sensitivity analyses Systematic review† of level II studies
III	Case-control study** Retrospective# comparative study¶ Systematic review† of level III studies	Case-control study**	Study of nonconsecutive patients (without consistently applied reference "gold standard") Systematic review† of level III studies	Analyses based on limited alternatives and costs; and poor estimates Systematic review† of level III studies
IV	Case series††	Case series	Case-control study Poor reference standard	Analyses with no sensitivity analyses
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion

RCT = randomized clinical trial

*A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design

†A combination of results from two or more prior studies

‡Studies provided consistent results

§The study was started before the first patient enrolled

¶Patients treated one way (eg, cemented hip arthroplasty) compared with a group of patients treated in another way (eg, uncemented hip arthroplasty) at the same institution

#The study was started after the first patient enrolled

**Patients identified for the study based on their outcome, called "cases" (eg, failed total arthroplasty), are compared to those who did not have that outcome, called "controls" (eg, successful total hip arthroplasty)

††Patients treated one way with no comparison group of patients treated in another way

Data for this table are from http://www.ejbjs.org/misc/public/instrux.shtml and http://www.cebm.net/levels_of_evidence.asp

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Table 2

Nonsurgical Versus Surgical Treatment of Intertrochanteric Hip Fracture

Evidence	Treatment	Results/Recommendations
Level I[2]	Traction vs sliding hip screw	No significant difference in 6-month mortality With surgical treatment, better anatomic reduction, decreased hospital stay, increased independence
Level II[3] and III[4]	Traction with tibial pin vs medial displacement osteotomy or valgus osteotomy	Nonsurgical treatment can be as successful as surgical treatment, provided a high standard of nursing care is maintained
Authors' experience	Tibial traction with early mobilization vs surgical treatment (dependent on evaluation of the fracture)	Surgical treatment results in earlier mobilization and lower perioperative morbidity Nonsurgical treatment is preferred for the patient whose medical condition is not stable

Table 3

Intramedullary Versus Extramedullary Fixation for Intertrochanteric Hip Fracture

Evidence	Treatment	Results/Recommendations
Level I, II, and III[6-23]	Gamma nail (Stryker, Mahwah, NJ) vs DHS;[6,17] IM nail vs SHS;[7,8,18] IM nail vs DHS and side plate;[9] Gamma nail vs compression hip screw;[10-12] DHS vs PFN;[13,19] IM hip screw vs SHS;[14] IM device vs fixed-angle screw-plate;[15] SHS, Gamma nail, PFN;[16] SHS vs short trochanteric nail[23]	No significant difference in wound complications, fracture union, mortality, or functional outcomes
Authors' experience	DHS or IM implant (stable fracture), IM device (unstable fracture)	DHS or IM implant for stable fractures (based on clinical experience and financial considerations) IM device (unstable fractures) aids in early mobilization and results in decreased blood loss and reduced surgical time

DHS = dynamic hip screw, IM = intramedullary, PFN = proximal femoral nail, SHS = sliding hip screw

However, when the authors compared surgical fixation with nonsurgical treatment with early mobilization (ie, out of bed to chair), they found no significant difference in mortality rate. Thus, when feasible, the authors recommend early mobilization out of bed to chair in patients with nonsurgically managed hip fracture.

The evidence-based literature supports surgical fixation[2] while also providing valuable information in regard to medically unstable patients who must be treated nonsurgically.[3,4]

Intramedullary Versus Extramedullary Fixation

The mechanical environment and blood supply to the peritrochanteric region of the hip is more robust, making surgical treatment of intertrochanteric hip fractures different from that of femoral neck fractures. Because the risk of osteonecrosis is minimal, the need for prosthetic replacement is reduced. Experience with fixed-angle screw-plate constructs indicates that uncontrolled fracture impaction is a problem, with complications including implant joint penetration and implant failure.[5]

Two types of implant are used in the treatment of patients with intertrochanteric hip fracture: an SHS with a side plate, and an intramedullary (IM) nail with an SHS component. The latter may have several advantages over the SHS and side plate. The IM component helps to buttress against fracture collapse and medialization of the distal fracture fragment, particularly in unstable (ie, reverse obliquity) intertrochanteric fractures. Furthermore, the percutaneous insertion of the IM device may reduce the amount of surgical trauma. Numerous studies have compared these types of implant.[5-14] The correct interpretation of these data to guide current practice is one of the major controversies in the treatment of intertrochanteric fractures (Table 3).

In 1991, Bridle et al[6] reported on 100 patients with 41 stable intertrochanteric fractures who were randomized to receive either a Gamma nail (Stryker, Mahwah, NJ) or a dynamic hip screw (DHS). In this level I study, no differences were demonstrated in surgical time, blood loss, wound complications, length of stay, or patient mobility at a minimum follow-up of 6 months. Loss of reduction (lag screw, nail cutout) was

similar between the two groups; of the patients treated with the Gamma nail, four experienced femoral shaft fracture requiring revision surgery. For both groups, union occurred at an average of 6 months. Radford et al[7] and Saudan et al[8] found nearly identical results in their level I studies of 200 and 206 patients, respectively, who were randomized to receive either an IM nail or SHS fixation.

In 2001, Adams et al[9] published a prospective, randomized controlled trial assessing IM nailing versus a DHS and side plate in 400 patients. Revision rates, femoral shaft fractures, and lag screw cutout were slightly higher in patients treated with IM nailing but did not differ significantly from the cohort treated with a DHS. There was no difference in early or 1-year functional outcomes.

Ahrengart et al[10] randomized 426 intertrochanteric fractures to treatment with either the Gamma nail or a compression hip screw. The latter cohort required significantly less surgical time, and patients experienced less blood loss ($P < 0.05$). However, in unstable intertrochanteric fractures, surgical time was not significantly different between the two groups. In patients treated with the Gamma nail, difficulty was encountered with the distal locking technique. There was also a higher incidence of cephalic position of the compression screw within the femoral head, screw cutout, and intraoperative fracture in the Gamma nail group. Walking ability was the same in both groups. The authors recommended compression hip screws for less comminuted fractures, reserving Gamma nails for comminuted patterns. In 1995, O'Brien et al[11] found no significant difference between Gamma nail and compression hip screw fixation in terms of blood loss, days in the hospital, time to union, and functional outcome.

Utrilla et al[12] found no difference in total surgical time in their level I study comparing the Gamma nail with a compression hip screw in 210 stable and unstable fractures. However, the Gamma nail group had a significantly lower postoperative transfusion requirement ($P = 0.013$). Mortality, fracture healing, and intra- and postoperative complication rates were not significantly different between the two groups. In patients with unstable fracture patterns, postoperative ambulation was significantly improved in the Gamma nail group ($P = 0.017$).

Recovery of ambulation was a focus of the study by Pajarinen et al,[13] who compared a DHS with a proximal femoral nail (PFN) (Synthes, Oberdorf, Switzerland) in 108 patients. Although the immediate postoperative outcomes did not differ between the two groups, patients treated with IM devices had a significantly faster return to preoperative ambulation levels ($P = 0.04$). Fracture healing was similar between the two groups at 4 months, with two patients in each group requiring revision. This study also suggested that the PFN provided faster restoration of walking ability than did the DHS in patients with unstable fracture patterns.

Baumgaertner et al[14] randomized 135 unstable intertrochanteric fractures to either an IM hip screw (Intramedullary Hip Screw [IMHS]; Smith & Nephew, Memphis, TN) or an SHS. Patients with unstable fractures treated with the IMHS required 23% less time in the operating room and experienced 44% less blood loss than did the SHS cohort. Functional outcome was not significantly different between the two groups.

Sadowski et al[15] reported the results of 39 unstable reverse obliquity intertrochanteric fractures managed with either an IM device or a fixed-angle screw-plate device (Dynamic Condylar Screw; Synthes). Clinical and radiographic follow-up demonstrated a shorter mean surgical time for patients treated with IM nailing and a significantly higher rate of implant failure and nonunion in the group treated with the Dynamic Condylar Screw ($P = 0.008$ and $P = 0.007$, respectively). Excluding patients with nonunion or failure, there was no significant difference in postoperative walking ability or level of independence.

In 2005, Papasimos et al[16] performed a randomized, prospective study of 120 patients with unstable intertrochanteric fractures comparing an SHS, Gamma nail, and PFN. Mean blood loss, length of hospital stay, screw cutout, and fracture reduction were not statistically different between the three groups. Patients treated with PFN had a significantly longer surgical time ($P < 0.05$), which the investigators suggested was due to lack of surgeon experience with that device.

Several level II studies have been published on this topic. In 1992, Leung et al[17] reported the results of a prospective trial comparing Gamma nails with DHSs and found that patients treated with Gamma nails had smaller incisions, less intraoperative blood loss, and earlier full weight bearing. No significant difference was found in mortality and postoperative mobility (both groups lost one level of mobility). Of note, the investigators cited a higher incidence of fractures of the lateral cortex (three in the nail group and two in the DHS group) during insertion and noted two femoral shaft fractures within 3 months of surgery in the Gamma nail group.

Guyer et al[18] reviewed 100 patients treated with either an IM device or an SHS. There was no significant difference in intraoperative blood loss or perioperative complications between the two devices. The authors suggested that the Gamma nail was preferable to DHSs for unstable fracture patterns because three patients in the DHS group experienced proximal screw perforation during attempted mobilization.

Nuber et al[19] evaluated 129 patients with unstable intertrochanteric fractures treated with either a DHS or a PFN. Revision rates were similar between the two groups. However, there was a significantly shorter surgical time (44.3 versus 57.3 min) and hospital stay (18.6 versus 21.3 days) in the PFN cohort. Full weight bearing was possible immediately postoperatively in 97% of the proximal nail cohort, compared with 88% of the patients treated with a DHS. At 6-month follow-up, considerably lower pain intensity scores were found in the PFN cohort.

In several level II trials comparing extramedullary and IM devices, the use of a nail was shown to have an increased risk of intraoperative and postoperative fracture, with an increased rate of revision.[14,20-22] No significant differences were reported in regard to wound infection, medical complications, mortality, functional outcomes, postoperative complications, hip function, quality of life, and activities of daily living at 1 year postoperatively. Complications associated with the Gamma nail, particularly the intraoperative fracture rate, resulted in specific design and technique modifications. These changes, combined with increased surgeon experience, contributed to a lower rate of intraoperative complications in subsequent studies.

One retrospective (level III) study reviewed 93 patients who were treated with either an SHS or a short trochanteric nail.[23] Fracture healing was uneventful in 94% of the patients treated with SHS and in 89% of the patients treated with trochanteric nailing. Complications included one lag screw cutout in the SHS cohort compared with three in the trochanteric nail cohort. Other outcome measures were similar between the two groups, and the authors concluded that both methods resulted in successful treatment of intertrochanteric fractures.

Analysis of level I studies provides insight regarding the two most commonly used methods of intertrochanteric fracture fixation: IM nailing and DHS fixation. Most level I studies indicate that there are no significant differences in operating room time, blood loss, wound complications, length of stay, mobility, functional outcomes, loss of reduction, union rate, mortality, and complication rates when comparing IM devices with SHS constructs. However, several studies report a faster return to preoperative ambulation, reduced operating room time, and less blood loss when an IM device is used, especially in patients with unstable fracture patterns.[6-16] Analysis of level II studies demonstrates a preference for IM devices.

Surgical Outcomes

Unfortunately, the 18 studies discussed herein provide inconsistent evidence for treatment recommendations. A well-defined outcome measure such as surgical time is a good example. Two level I studies indicated no significant difference in surgical time between IM and extramedullary implants.[6,12] However, two level I studies and one level II study found a significantly higher surgical time when an SHS is used ($P < 0.05$), with longer times being associated with unstable patterns.[14,15,19] Two level I studies demonstrated a longer surgical time with the use of an IM implant.[10,16]

Femoral Shaft Fracture

Three level I studies and one level II study found an increased incidence of femoral shaft fracture at the tip of the implant when using IM nails.[9,10,12,17] Most authors concluded that this increase was in part due to a lack of experience and to suboptimal hardware design. Newer-generation nails have a radius of curvature that better conforms to the anatomic shape of the femur. Although this statement is not supported by evidence-based literature, this feature may potentially reduce the rate of intraoperative fracture.[9,10,12,17] In contrast to earlier reports, recent studies show no significant difference in complications or revision rates between the two types of implants, which may be attributed to improved nail design and increasing surgeon experience.[5,24]

Blood Loss

Six level I studies and one level II study found no significant difference in blood loss or transfusion rates between IM and extramedullary implants.[6-8,11,16,18] However, two level I studies ($P < 0.05$,[12] $P < 0.013$[14]) and one level II study ($P < 0.05$)[17] found significantly less blood loss with IM implants, while one level I study states that there was significantly less blood loss with the use of a DHS ($P < 0.05$).[10]

Patient Ambulation and Complications

Five level I studies suggested that patients regain equal ambulatory status regardless of fixation type.[6-8,10,15] However, two level I and two level II studies concluded that IM devices expedite return to pretreatment ambulatory function.[12,13,17,19] It is important to note that many current studies have not separated stable from unstable patterns when assessing ambulatory status. The literature is consistent, however, in regard to wound complications, fracture nonunion, mortality rates, and functional outcomes and overall incidence of complications, with no significant difference between IM and extramedullary implants.[6-24]

Authors' Recommendation

There is no consensus regarding the ideal implant for treating intertrochanteric fractures. However, based on the available evidence-based data, we recommend either a DHS or an IM device for stable intertrochanteric fractures. For unstable fractures, we recommend an IM device. Although this has not been proved in the current evidence-based literature, we believe that an IM device is a biome-

chanically stronger construct and is better suited to preventing increased fracture collapse in unstable fractures. In addition, evidence suggests that IM devices aid in early mobilization, return of ambulatory function, decreased blood loss, and less surgical time.[12,13,17,19] However, there seems to be a higher cost associated with the use of IM devices.[5]

Open Reduction and Internal Fixation Versus Arthroplasty

Prosthetic hip replacement generally has not been considered a primary treatment option for intertrochanteric fractures. Unlike femoral neck fractures, which retain some of the femoral neck in addition to the abductor mechanism, intertrochanteric fractures involve more distal femoral bone, and often the greater trochanter and the abductor are not attached to the proximal femur. In this setting, prosthetic replacement for intertrochanteric fractures typically requires a more complex surgical procedure with potentially higher morbidity. In the patient with preexisting symptomatic degenerative arthritis, primary prosthetic replacement may be the best option. It can also be considered for intertrochanteric fractures with extreme comminution in severely osteoporotic bone in which internal fixation methods are unlikely to be successful.[25]

In 2005, Kim et al[26] performed a prospective randomized (level I) study of unstable intertrochanteric fractures in elderly patients in which long-stem cementless calcar-replacement hemiarthroplasty was compared with a PFN. No significant differences were found between the two groups in terms of functional outcomes, hospital stay, time to weight bearing, and risk of complications. However, surgical time ($P < 0.001$), blood loss ($P < 0.001$), need for blood transfusions ($P < 0.001$), and mortality rates ($P < 0.006$) were all significantly lower in the PFN group.

In another level I study, Stappaerts et al[27] treated 47 patients with compression hip screws and 43 with hemiarthroplasty. No significant difference was found between surgical time, wound complications, or mortality rates. However, the hemiarthroplasty group was reported to have higher transfusion rates.

Haentjens et al[28] reported on a prospective (level II) study comparing the results of 79 consecutive patients aged 75 years and older who were treated with either bipolar hemiarthroplasty (37 patients) or internal fixation (42 patients). The bipolar group experienced easier and faster rehabilitation, with a lower incidence of decubiti and pulmonary complications. The decrease in complications was attributed to an earlier return to full weight bearing.

The remainder of evidence regarding arthroplasty to treat intertrochanteric fractures comes from level III and IV studies. These studies suggest that a cemented hemiarthroplasty with standard implants is a reasonable alternative to open reduction and internal fixation. In addition, they indicate that arthroplasty has the advantage of early weight bearing and avoids the potential of fixation failure and the need for subsequent revision.[29-33]

There is no overwhelming evidence from randomized clinical trials to indicate that arthroplasty is more effective than IM and extramedullary fixation of intertrochanteric hip fractures (Table 4). No significant differences in complications have been reported between hemiarthroplasty or THA versus IM fixation.[26,28] However, the incidence of decubiti and pulmonary complications may be higher with internal fixation.[27] Two level I studies found a significantly lower transfusion rate when a PFN was used ($P < 0.001$,[26] $P < 0.05$[27]). No significant difference in functional outcomes or rehabilitation was shown between unstable fractures treated with hemiarthroplasty or with a PFN.[26] However, one level II study concluded that patients treated with bipolar instrumentation had a faster rate of rehabilitation, although the time differences were not statistically significant.[28]

Based on the available evidence on, and our clinical experience with, intertrochanteric hip fractures, arthroplasty should be reserved for patients with preexisting symptomatic degenerative arthritis, those in whom internal fixation is not expected to be successful because of fracture comminution or bone quality, and in patients who require salvage for failed internal fixation.

Summary

With ongoing improvements in endoprostheses and total hip replacements, increased surgeon experience, and the need to separate stable from unstable fractures, it is difficult to recommend one optimum treatment of intertrochanteric fractures from a purely evidence-based perspective. Even so, we believe that combining current evidence-based literature with clinical experience can guide clinical decision making.

Surgical intervention is preferable to nonsurgical treatment of intertrochanteric fractures in the medically stable patient. This is the case despite evidence demonstrating that patients can have equivalent outcomes with nonsurgical treatment when nursing care is excellent. Patients treated nonsurgically may have a higher mortality rate if they are not mobilized early. Although there is no evidence-based literature to support these findings, nonsurgically treated patients appear to be at higher risk for complications such as decubiti, pneumonia, and deep vein thrombosis.

When considering surgical intervention, it is important to consider the character of each fracture pattern, surgeon clinical experience, and the reported evidence regarding the various internal fixation implants. Pa-

Table 4

ORIF Versus Hemiarthroplasty and THA for Intertrochanteric Hip Fracture

Evidence	Treatment	Results/Recommendations
Level I[26,27] and II[28]	Hemiarthroplasty vs PFN,[26] compression hip screws vs hemiarthroplasty,[27] hemiarthroplasty vs ORIF[28]	Shorter surgical time with PFN compared with hemiarthroplasty, shorter surgical time with THA versus IM and extramedullary implants No significant differences in complications Higher incidence of decubiti and pulmonary complications with bipolar hemiarthroplasty Significantly lower transfusion rate with PFN No significant differences in functional outcomes Faster rehabilitation in patients treated with bipolar instrumentation
Level III and IV[29-33]	Hemiarthroplasty vs ORIF	Cemented hemiarthroplasty a reasonable alternative to ORIF With arthroplasty, earlier weight bearing and lack of fixation failure, so no need for revision
Authors' experience	Hemiarthroplasty vs ORIF	Arthroplasty reserved for patients with preexisting symptomatic degenerative arthritis and those in whom internal fixation is not expected to be successful because of comminution or bone quality, and as a salvage procedure for failed internal fixation

IM = intramedullary, ORIF = open reduction and internal fixation, PFN = proximal femoral nail, THA = total hip arthroplasty

tient outcome has not been shown to differ significantly between fixation of stable intertrochanteric fractures with plate-and-screw implants versus IM devices. Thus, factors in the decision-making process should include surgeon experience with the devices and cost-effectiveness of the procedure. Unstable intertrochanteric fractures are a distinct subset that biomechanically should benefit from an IM device; however, there is no overwhelming evidence to prove this recommendation. Studies on functional outcome have not yet been performed in sufficient detail to demonstrate significant differences between devices. Comparisons between specific types of IM implants have not been reported in sufficient numbers or detail to determine whether nail design has an effect on outcome.

Patients with severe degenerative disease or with comminuted fracture in osteoporotic bone can be successfully treated with an endoprosthetic replacement or a THA. This surgery is more complex than internal fixation and is associated with a higher rate of postoperative complications. The evidence-based literature does not show a significant difference in terms of time to ambulation and length of hospital stay between arthroplasty and internal fixation. However, given the variety of clinical presentations and fracture patterns, such treatment may be considered in select patients.

"Surgical Management of Hip Fractures: An Evidence-based Review of the Literature. I: Femoral Neck Fractures" appeared in the October 2008 issue of the *Journal of the American Academy of Orthopaedic Surgeons*.

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Evidence-based Medicine: References 1-3, 5-22, and 26-28 are level I/II prospective, randomized studies or systematic reviews of level I studies. The remainder are level III/IV case reports and case-control cohort studies.

Citation numbers printed in **bold type** indicate references published within the past 5 years.

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