



Managing perioperative risk in the hip fracture patient

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Hip fracture is a tremendous physiologic insult—nearly one third of patients die within the first year after sustaining one. For a few types of fractures, repair should be accomplished as soon as possible after the injury. For most, however, medical stabilization to prepare patients for a long and often arduous surgical procedure should be a high priority. The entire medical team, including the surgeon, anesthesiologist, and internist, should work together to optimally manage each patient.

This article provides a case-based overview of the different types of hip fracture and their surgical management and discusses methods to prevent and manage common complications.

■ CASE: A 78-YEAR-OLD WOMAN WITH HIP FRACTURE

A 78-year-old woman presents to the emergency department after slipping and falling on the ice. She had no loss of consciousness or head trauma but has severe left hip pain and is unable to bear weight. She has type 2 diabetes mellitus, hypertension, and rheumatoid arthritis, as well as a history of depression and hypothyroidism. Her functional capacity is limited and she lives in a single-floor home. She has no drug allergies.

Medications. Atenolol 50 mg/day, levothyroxine 88 µg/day, sertraline 25 mg/day at bedtime, metho-

trexate 5 mg/week orally, lisinopril 10 mg/day, simvastatin 20 mg/day at bedtime, raloxifene 60 mg/day, hydrochlorothiazide 25 mg/day, and a combined calcium and vitamin D supplement twice daily.

Vital signs. Blood pressure is 154/88 mm Hg, heart rate is 92 beats per minute, temperature is normal, and respiratory rate is normal.

Physical examination. The patient is not in acute distress. Cardiopulmonary and neurologic examinations are normal. She has tenderness in her lateral left hip and has some external rotation but no foreshortening.

Laboratory examination. Complete blood cell count and basic metabolic panel are normal.

Radiography. A radiograph of her left hip is shown in Figure 1.

■ CLASSIFYING AND MANAGING HIP FRACTURES

Femoral neck fractures and intertrochanteric fractures are typical low-energy fractures in elderly patients after a fall from a chair or a slip on the ice. Subtrochanteric fractures, which involve the proximal shaft of the femur, are less common, and usually occur from higher-energy trauma.

Stress fractures can also occur in the proximal femoral region, and are suspected in a patient with intractable pain that does not respond to weight-bearing with walking aides. This situation should be evaluated with sequential plain radiographs and magnetic resonance imaging to avoid propagation and/or completion. When these fractures are recognized, they can be pinned surgically or followed closely in dependable patients.

Nondisplaced (impacted) femoral neck fractures can be repaired with a limited incision and percutaneous pinning. Prognosis with repair of this type of fracture is good, with a quick return to high-level functioning.

Impacted femoral neck fractures must be fixed surgically, preferably within 6 hours. Not only can delay cause further displacement, but pressure in the sur-

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rounding hip capsule can promote devascularization of the femoral head, leading to avascular necrosis. Even if fixation is successful after this point, the femoral head may die and collapse, requiring a second surgery. For this reason, an impacted fracture that appears unstable 24 to 48 hours after the injury should be treated with a total hip replacement to avert the need for a second surgery.

Displaced femoral neck fractures require a bipolar hemiarthroplasty or total hip replacement, depending on the degree of arthritis present before the fracture occurred. Although performed through small incisions, total hip replacement is invasive, and can result in significant fluid shifts and blood loss. These surgical procedures can be complex and extensive, and patients should be optimized and well managed by a multidisciplinary team both preoperatively and postoperatively. Younger patients (< 50 years of age) with displaced femoral neck fractures who have few or no medical problems should proceed to operative repair as soon as possible. Delay can lead to femoral head necrosis, which may necessitate a second surgery later for a hip arthroplasty.

Intertrochanteric hip fractures, if minimally displaced, can be repaired by a number of fixation methods; the screw and sideplate and short proximal intramedullary nails are currently useful options. The more distal the fracture, the more difficult it is to treat. Based on her radiograph, our patient has an intertrochanteric fracture.

Subtrochanteric hip fractures, which involve the proximal shaft of the femur, can be repaired or replaced with a bipolar or total hip replacement based on the bone quality and complexity. These procedures are usually extensive, can be expected to involve significant intraoperative blood loss, and carry a high risk of complications, cardiac arrest, and death. Medical conditions should be critically evaluated and optimized prior to proceeding with this operation.

■ ASSESSING THE RISK OF PROCEDURES

In general, perioperative risk depends on the invasiveness of the procedure, the amount of destruction that occurred during the injury, and the patient's medical status at the start of surgery. Specific concerns are as follows:

- Bone marrow instrumentation and the cement applied put the patient at risk for embolization.
- The larger the incision, the greater the risk. Simple pinning can sometimes be performed with only local anesthetics for very sick patients.



FIGURE 1. Radiograph of the left hip reveals an intertrochanteric fracture without displacement (arrow).

- Risk is increased with the duration of the procedure.
- Procedures that require large incisions and considerable muscle dissection, such as those for intertrochanteric fractures, increase risk due to extensive bleeding and fluid shifts.

■ PREOPERATIVE MANAGEMENT

How should our patient, who has diabetes, hypertension, and rheumatoid arthritis, be managed before undergoing surgery for her intertrochanteric fracture?

- Proceed to surgery as soon as possible regardless of her medical condition*
- Proceed to surgery once her medical condition is optimized*
- Because of her diabetes and limited functional capacity, delay surgery until she has undergone noninvasive stress testing*
- Because of her multiple medical problems, forego operative treatment*

The best answer for this patient is B; however, each case must be treated individually as there are no absolute guidelines for treating hip fractures. For example, a patient with unstable angina should be stabilized before entering the operating room, but if the patient has a long history of unstable angina that is refractory to treatment, the best decision may be to proceed despite the risk.

Team management improves outcome

For each case, the surgical team must carefully consider the risks and the best course of action. Each member of a team has a specific role in assessing patients, and good communication between all members is essential to success.

The orthopedic surgeon rapidly assesses the type and extent of surgery required.

The internal medicine consultant evaluates the patient medically and stabilizes him or her before surgery. Postoperatively, the medical consultant manages complications such as malnutrition, delirium, hyponatremia, and diabetes.

The anesthesiologist assesses preoperative risk, plans for advanced intraoperative monitoring needs, and manages hematologic issues.

Vidan et al¹ randomly assigned 319 elderly patients during the acute phase of hip fracture to receive either multidisciplinary geriatric care or usual care (in which orthopedic surgeons completely handled care). Patients who received the multidisciplinary intervention had a significantly lower risk of in-hospital mortality (0.6% vs 5.8% for the usual care group, $P = .03$) and major medical complications (45.2% vs 61.7%, $P = .003$) and a reduction in the median length of stay that did not quite achieve statistical significance (16 vs 18 days, $P = .06$). Functional recovery was better 3 months postoperatively in the multidisciplinary care group but was not statistically different from the usual care group at 6 and 12 months.

Timing of surgical repair

In nine cohort studies (as reviewed by Morrison et al²), surgical hip fracture repair within 48 hours of medical evaluation and stabilization was associated with fewer perioperative complications and a reduced risk of death within 1 year. Inadequate control of variables in these studies, however, does not permit the issuance of absolute guidelines. More recent studies^{3,4} have found no association between mortality and time to surgery when adjusting for demographic variables and for severity of underlying medical problems. However, these studies did note fewer decubitus ulcers, reduced pain scores, and shorter hospital stays with earlier operation.

In general, delaying surgery hampers the return to weight-bearing and overall functional recovery, but failure to stabilize medical problems increases the risk for perioperative complications.

■ RISK OF POSTOPERATIVE COMPLICATIONS IS HIGH

Complications associated with hip repair are com-

mon, even with the best care. In the study by Vidan et al,¹ postoperative medical complications occurred in 45% of patients receiving multidisciplinary care.

Among studies published from 1990 to 2002 that enrolled at least 100 patients and for which mortality data were cited, the rate of mortality during hospitalization for hip fracture ranged from 7% to 11%, and at 1 year postoperatively it was as high as 43%.⁵

Below we provide an overview of the medical complications most often encountered in patients undergoing surgery for hip fracture, along with a brief overview of strategies for their prevention. Most of these complications and their prevention in general surgical patients are explored in depth in other articles in this supplement, and the prevention and management principles outlined in these articles also apply to the patient undergoing surgery for hip fracture.

Lawrence et al,⁵ in a retrospective cohort study of nearly 9,000 patients who underwent hip fracture repair, found that 19% developed postoperative medical complications. The most common complications were cardiac (8%, including myocardial infarction, congestive heart failure, or arrhythmia) and pulmonary (4%, including pneumonia and respiratory failure). Mortality at 30 days was 14% among patients with a complication and 1.7% among those without a complication; at 1 year, the mortality rates were 34% and 12%, respectively.

Wound infections

First- and second-generation cephalosporins are recommended for prophylaxis of wound infections, with vancomycin being the choice for patients with penicillin allergy. The optimal time of initial administration is 0 to 2 hours before surgery,⁶ and prophylaxis should be continued for 24 hours. Gillespie and Walenkamp,⁷ in a systematic review of more than 8,000 patients in 22 controlled trials for hip fracture repair, found that prophylactic antibiotics at the time of surgery for hip or other closed long bone fracture reduced the risk of deep wound infections by 60% and also reduced the risk of superficial wound infections, urinary tract infections, and respiratory tract infections.

Venous thromboembolism

Multiple prospective studies using contrast venography found rates of total and proximal deep vein thrombosis of approximately 50% and 27%, respectively, in the absence of prophylaxis.⁸ A delay in operative repair greater than 48 hours from injury increases the risk of venous thromboembolism.^{9,10} In 2004, the Seventh American College of Chest Physicians

Conference on Antithrombotic and Thrombolytic Therapy recommended routine prophylaxis for all patients undergoing hip fracture surgery, continuing until full ambulation is reached.⁸

Patients undergoing hip surgery at The Cleveland Clinic receive a first dose of enoxaparin on admission the evening before morning surgery. Preoperative dosing is essential to minimize the risk of intraoperative pulmonary embolism, an infrequent but devastating complication.

Preoperative anticoagulant dosing has an impact on the choice of anesthesia. According to the 2002 Consensus Conference by the American Society of Regional Anesthesia,¹¹ patients who receive prophylactic dosing of enoxaparin can have a spinal or epidural anesthetic 12 hours after the last dose. Those who are on therapeutic doses (such as 1 mg/kg enoxaparin every 12 hours) need to wait 24 hours after the last dose before receiving a neuraxial anesthetic. These guidelines are due to be updated, but we urge great caution about performing neuraxial anesthesia in patients on low-molecular-weight heparin and similar medications.

Patients on hormone replacement therapy have an increased risk of thromboembolism. Surgery should not be delayed because a patient is on hormone replacement therapy; rather, appropriate thromboembolic prophylaxis should be provided.

Malnutrition

Malnutrition is associated with increased surgical morbidity and mortality.¹² Malnutrition is common in the elderly: up to 20% of older patients with hip fracture are severely malnourished. Protein supplementation during hospitalization for hip fracture improves nitrogen and caloric balance, reduces length of hospital stay, and leads to better 6-month outcomes, with fewer complications and deaths.^{13–15} Bastow et al¹⁶ found that supplemental nocturnal nasogastric tube feeding of patients with hip fracture led to increased weight and, in very thin patients, a shorter time to achieving independent mobility.

Urinary retention and infection

Urinary retention is another common complication of hip surgery and is associated with high mortality.¹⁷ To reduce the risk of infection, indwelling urinary catheters should be removed within 24 hours of surgery whenever possible. Intermittent straight catheterization reduces the incidence of urinary retention and bladder overdistention without increasing the rate of urinary tract infection, and may be used to facilitate the return of spontaneous voiding.^{18,19}

TABLE 1
Tranquilizer regimens for treating delirium

Medication	Dosage
Haloperidol	0.25–0.5 mg orally or intravenously every 6 hours
Risperidone	0.25–0.5 mg orally twice daily
Olanzapine	2.5 mg/day orally

Delirium

Delirium (acute confusional state) is associated with a longer hospital stay, more complications, poorer outcomes after discharge, and an increased mortality rate. An estimated 61% of patients undergoing surgery for hip fracture develop delirium, with baseline risk factors that include old age, history of cognitive impairment or alcohol use, severe illness, and poor functional status.²⁰ Precipitating factors during hospitalization include medications (especially opioids, sedatives, and anticholinergic drugs), electrolyte imbalances, hypotension, infection, and sensory and environmental problems.^{2,20,21}

Approaches to prevent delirium and control it when it develops include:^{20,21}

- Minimizing sedative-hypnotic and anticholinergic drugs
- Assessing for withdrawal from benzodiazepines and alcohol
- Providing supportive reorientation to the patient and facilitating a calm and quiet environment
- Using adequate pain control (meperidine should be avoided because normeperidine, its active metabolite, can accumulate in the central nervous system and lead to seizures and worsened delirium)
- Providing a low-dose tranquilizer (Table 1).

SUMMARY

Patients with hip fracture benefit from a multidisciplinary team approach for preoperative and postoperative care. Team members, consisting of the orthopedic surgeon, internal medicine consultant, and anesthesiologist, should each have a role in determining a patient's readiness for surgery and communicate with one another about appropriate management.

How urgently a hip fracture needs repair depends on the type of injury. In general, most injuries should be repaired as soon as the patient can be medically optimized (preferably 24 to 48 hours), keeping in mind that procedures are often lengthy and maximally

invasive, and frequently involve complications. Nondisplaced (impacted) femoral neck fractures, however, should be repaired within 6 hours if possible to avert avascular necrosis of the femoral head and the need for total hip replacement.

The following interventions are helpful for preventing complications following hip fracture repair:

- Perioperative prophylaxis against infection

and thromboembolism

- Daily protein supplementation for malnourished patients
- Removal of indwelling urinary catheters within 24 hours (intermittent straight catheterization may be used as needed)
- Monitoring for acute onset of delirium, and prompt treatment if it occurs.

REFERENCES

1. Vidan M, Serra JA, Moreno C, Riquelme G, Ortiz J. Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial. *J Am Geriatr Soc* 2005; 53:1476–1482.
2. Morrison RS, Chassin MR, Siu AL. The medical consultant's role in caring for patients with hip fracture. *Ann Intern Med* 1998; 128(12 Pt 1):1010–1020. Erratum in: *Ann Intern Med* 1998; 129:755.
3. Grimes JP, Gregory PM, Noveck H, Butler MS, Carson JL. The effects of time-to-surgery on mortality and morbidity in patients following hip fracture. *Am J Med* 2002; 112:702–709.
4. Orosz GM, Magaziner J, Hannan EL, et al. Association of timing of surgery for hip fracture and patient outcomes. *JAMA* 2004; 291:1738–1743.
5. Lawrence VA, Hilsenbeck SG, Noveck H, Poses RM, Carson JL. Medical complications and outcomes after hip fracture repair. *Arch Intern Med* 2002; 162:2053–2057.
6. Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N Engl J Med* 1992; 326:281–286.
7. Gillespie WJ, Walenkamp G. Antibiotic prophylaxis for surgery for proximal femoral and other closed long bone fractures. *Cochrane Database Syst Rev* 2001; 1:CD000244.
8. Geerts WH, Pineo GF, Heit JA, et al. Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest* 2004; 126(3 Suppl):338S–400S.
9. Hefley WE, Nelson CL, Puskarich-May CL. Effect of delayed admission to the hospital on the preoperative prevalence of deep-vein thrombosis associated with fractures about the hip. *J Bone Joint Surg Am* 1996; 78:581–583.
10. Zahn HR, Skinner JA, Porteous MJ. The preoperative prevalence of deep vein thrombosis in patients with femoral neck fractures and delayed operation. *Injury* 1999; 30:605–607.
11. Second Consensus Conference on Neuraxial Anesthesia and Anticoagulation, April 25–28, 2002. American Society of Regional Anesthesia and Pain Medicine Web page. Available at: www.asra.com.
12. Bastow MD, Rawlings J, Allison SP. Undernutrition, hypothermia, and injury in elderly women with fractured femur: an injury response to altered metabolism? *Lancet* 1983; 1:143–146.
13. Tkatch L, Rapin CH, Rizzoli R, et al. Benefits of oral protein supplementation in elderly patients with fracture of the proximal femur. *J Am Coll Nutr* 1992; 11:519–525.
14. Delmi M, Rapin CH, Bengoa JM, Delmas PD, Vasey H, Bonjour JP. Dietary supplementation in elderly patients with fractured neck of the femur. *Lancet* 1990; 335:1013–1016.
15. Stableforth PG. Supplement feeds and nitrogen and calorie balance following femoral neck fracture. *Br J Surg* 1986; 73:651–655.
16. Bastow MD, Rawlings J, Allison SP. Benefits of supplementary tube feeding after fractured neck of femur: a randomised controlled trial. *Br Med J (Clin Res Ed)* 1983; 287:1589–1592.
17. Smith NK, Albazzaz MK. A prospective study of urinary retention and risk of death after proximal femoral fracture. *Age Ageing* 1996; 25:150–154.
18. Skelly JM, Guyatt GH, Kalbfleisch R, Singer J, Winter L. Management of urinary retention after surgical repair of hip fracture. *CMAJ* 1992; 146:1185–1189.
19. Michelson JD, Lotke PA, Steinberg ME. Urinary-bladder management after total joint-replacement surgery. *N Engl J Med* 1988; 319:321–326.
20. Gustafson Y, Berggren D, Brannstrom B, et al. Acute confusional states in elderly patients treated for femoral neck fracture. *J Am Geriatr Soc* 1988; 36:525–530.
21. Williams MA, Campbell EB, Raynor WJ, Mlynarczyk SM, Ward SE. Reducing acute confusional states in elderly patients with hip fractures. *Res Nurs Health* 1985; 8:329–337.