Hip Fracture Management
Tailoring Care for the Older Patient

William W. Hung, MD, MPH
Kenneth A. Egol, MD
Joseph D. Zuckerman, MD
Albert L. Siu, MD, MSPH

THE PATIENT’S STORY
Mr W, an 89-year-old veteran, arrived in the emergency department after falling. He had a history of congestive heart failure, chronic kidney disease, obstructive sleep apnea, asthma, gastroesophageal reflux disease, benign prostatic hyperplasia with urinary incontinence, sensorineural hearing loss, depression, and mild cognitive impairment. He also had a vitamin D deficiency and chronic low back pain from lumbar spinal stenosis, despite a laminectomy. Prior to his hip fracture, he ambulated with a 4-wheel walker and had no history of falls.

At the occurrence of the hip fracture, Mr W was standing—he twisted suddenly and subsequently lost his balance. He fell onto a hard floor, landing on his left hip and was brought to the hospital by his family. His medications at that time included furosemide, bupropion, citalopram, trazodone, finasteride, terazosin, oxybutynin, albuterol inhaler, loratidine, omeprazole, vitamin D, calcium, senna, acetaminophen, and acidophilus. Prior to the hip fracture, Dr H, his geriatrician, tried on several occasions to reduce the number of medications, but Mr W resisted.

On admission, a radiograph of his left hip revealed a minimally displaced femoral neck fracture. The next morning, following medical optimization, Mr W underwent a pinning, in situ while under spinal anesthesia, with 4 screws placed under fluoroscopic guidance. On postoperative day 1, he had escalating pain in his left hip and was administered morphine intravenously and oxycodone orally. Over the next few hours, he became delirious and was transferred to the intensive care unit for bradycardia and hypotension. Mr W continued to have a fluctuating level of alertness for several days. By postoperative day 4, he was able to participate in physical therapy. On day 6, he was discharged to a skilled nursing facility after medical optimization.

Hip fracture is a potentially devastating condition for older adults. Hip fracture leads to pain and immobilization with complications ranging from delirium to functional loss and death. Although a mainstay of treatment is orthopedic repair, a multidisciplinary comanagement approach, including medical specialists and rehabilitation, may maximize patient recovery. Using the case of Mr W, an older man who sustained a fall and hip fracture, we present evidence-based components of care both in the hospital and outpatient settings. Preoperatively, clinicians should correct medical abnormalities and consider the appropriateness, timing, and type of surgical repair in the context of the patient’s life expectancy and goals of care. Perioperative care should include prophylaxis with antibiotics, chemoprophylaxis for venous thromboembolism, and correction of major clinical abnormalities prior to surgery. Pain control, delirium, and pressure ulcer prevention are important inpatient care elements. Multidisciplinary models incorporating these care elements can decrease complications during inpatient stay. Rehabilitation strategies should be tailored to patient needs; early mobilization followed by rehabilitation exercises in institutional, home, and group settings should be considered to maximize restoration of locomotive abilities. Attention to care transitions is necessary and treatment for osteoporosis should be considered. The road to recovery for hip fracture patients is long and most patients may not regain their prefracture functional status. Understanding and anticipating issues that may arise in the older patient with hip fracture, while delivering evidence-based care components, is necessary to maximize patient recovery.
facility for continued therapy. One month later, he returned home and received several weeks of in-home occupational and physical therapy, twice weekly. Because he still was not fully weight bearing at the conclusion of home rehabilitation, he received another 2 months of outpatient physical therapy.

Approximately 4 months after the hip fracture, Mr W developed severe pain over his left greater trochanter. He was seen the following day in the orthopedics clinic, was diagnosed with trochanteric bursitis, and treated with an injection of triamcinolone into the bursa. Afterwards, his pain quickly abated. Six months following the hip fracture, Mr W was walking well with his 4-wheel walker and had minimal hip pain. He regularly rode a stationary bicycle for exercise. He continued taking oral calcium and vitamin D but was not given zoledronic acid due to renal insufficiency. Dr H felt that he had regained the level of mobility experienced prior to his hip fracture and that his major problems were his chronic diseases. Throughout his course of treatment, Dr H was in close contact with Mr W and his family through hospital visits, weekly phone calls and e-mail messages, and close outpatient follow-up.

A Care of the Aging Patient series editor interviewed Mr W, his wife Mrs W, and Dr H, in the spring of 2011.

Perspectives

Mr W: I don’t know if I’ll ever be [back to my full strength], but I’m pretty good. . . . It took time to do that.

Mrs W: It’s very important to have follow-up come to the home [giving him exercises].

Dr H: He is a very determined person. He has a very good social support system.

OVERVIEW

In many ways, hip fracture is a prototypical geriatric illness. Older adults are most commonly affected; patients with hip fracture often have multiple comorbidities and geriatric problems. Because a fall, which is a geriatric syndrome, often precipitates hip fracture, it shares many risk factors with other geriatric syndromes. Treatment course after hip fracture is prolonged and recovery is variable and requires extensive support from multiple disciplines. Because of the patient population affected by hip fracture and its effect on mobility and function, understanding geriatric principles and anticipating issues in the aging patient can further enhance care. In this article, we will discuss care components applicable to the patient with hip fracture based on lessons learned from studies of patients with hip fracture and also aging patients. While drawing on the experience of Mr W, we present these essential care elements by time and setting as the patient with hip fracture transitions through inpatient acute care (including preoperative, perioperative, and postoperative periods), rehabilitation, and recovery.

Methods

We searched MEDLINE and the Cochrane database for peer-reviewed English-language articles from 1980 to April 2012 to identify effective hip fracture treatment elements under the subject heading of hip fracture, limiting types of study to clinical trials, randomized controlled trials (RCTs), comparative studies, or systematic reviews. We also performed specific searches on effective inpatient care models for hip fracture patients; and effective rehabilitation strategies to restore mobility. We synthesized the database on the time and setting of treatment elements pertaining to hip fracture treatment, and our recommendations are based on the evidence and clinical experience caring for patients with hip fracture. Based on authors’ reviews, levels of evidence include classes 1A (for 2 or more RCTs), 1B (for 1 RCT or meta-analysis), 2 (for nonrandomized trials), 3 (for cohort studies), and 4 (for expert opinion).1-2 Details of the specific searches are included in the eAppendix (available at http://www.jama.com). Additional resource websites are also available online (Resources).

Epidemiology

More than 1.6 million older adults worldwide sustain hip fractures annually, with 320,000 of these in the United States; numbers are expected to increase as the population ages.3,4 Three-quarters of all hip fractures occur in women.4 Hip fracture risk increases as people age—adults aged 85 years and older are more than 10 times more likely to sustain hip fracture than are those aged 65 to 69 years.7 Osteoporosis and falls are major risk factors for hip fracture; consequently, risk factors for falls, such as polypharmacy, use of assistive devices, and cognitive impairment, also increase the risk of hip fracture.6 Mr W, as is common with the typical hip fracture patient, had multiple risk factors.

Older adults who experience hip fractures often have poor outcomes, including functional decline, institutionalization, and death. Among older adults who sustain hip fractures, approximately 13.5% die within 6 months and 24% within 1 year.5 The increase in mortality risk persists beyond 10 years after hip fracture, with higher excess mortality risk among men than women.8 Among those who survive 6 months, only 50% recover their prefracture ability to perform activities of daily living (ADLs) and only 25% recover their ability to perform instrumental ADLs.10 Following a hip fracture, older adults are 5 times more likely than age-matched controls without hip fracture to be institutionalized at 1 year.11 Mr W belongs to the minority of hip fracture patients who had an excellent outcome with good recovery of function. Given the potential for devastating consequences of hip fracture, it is important that patients with hip fracture receive care that integrates effective elements of care throughout the course toward recovery.

INPATIENT CARE

Patients with hip fracture are often heterogeneous in their baseline functional and comorbid status12; it is important
to assess prefracture status when considering an overall approach. Because the goal of hip fracture surgery is to return patients to their preinjury level of functioning, the goals of care for patients with life-limiting comorbid illnesses (eg, advanced dementia), poor baseline functional status (eg, being bedridden), or both should be determined. This, in turn, should inform the discussion on the decision for operative vs nonoperative management. Surgical risk should also be considered in determining whether nonoperative management may be more appropriate. For surgical risk stratification, the American Society of Anesthesiologists (ASA) Physical Status Classification System is often applied; the assignment of the categories is based on the presence of comorbid illnesses and their severity.\textsuperscript{13} Patients with significant systemic disease and those in whom the systemic disease is a constant threat to life (ASA classification, 3-4) demonstrated 1-year mortality rates that were 9 times higher than rates in patients classified as ASA 1 to 2 (normal healthy patients to those with mild systemic disease).\textsuperscript{13}

**Surgical Management**

Surgery should proceed as soon as the patient’s clinical status is deemed medically optimized. Major clinical abnormalities including coagulopathy, respiratory failure, electrolyte disturbances, and heart failure should be addressed prior to surgery.\textsuperscript{14} Beneficial effects of early surgery include decreased pain, shorter length of stay, and fewer major postoperative complications.\textsuperscript{15} In a cohort study of 367 hip fracture patients, a surgical delay of more than 2 days from admission approximately doubled the risk of 1-year mortality; however, the mortality excess is no longer present after controlling for comorbid conditions delaying surgery.\textsuperscript{16} Thus, most excess in-hospital mortality risk associated with surgical delays is partially related to the medical reasons for the delays rather than the delays alone.\textsuperscript{17}

Mr W sustained an impacted femoral neck fracture, which placed his fracture in the minimally displaced category. For nondisplaced or minimally displaced fractures of the femoral neck, operative management most commonly consists of placement of screw alone or plate and screw fixation. If a nondisplaced or impacted femoral neck fracture is treated without fixation, there is a 12% to 33% risk of fracture displacement prior to healing.\textsuperscript{18,19} To prevent the complications associated with fracture displacement and to allow the patient to mobilize early and prevent the complications of prolonged recumbency, fixation with screws is the standard of care (class 3). Conversely, patients with intertrochanteric fractures should be treated with fixation using a sliding hip screw or intramedullary screw depending on stability of the fracture, and there is insufficient evidence to recommend replacement arthroplasty over internal fixation.\textsuperscript{21}

The treatment of choice for displaced femoral neck fractures includes either a partial hip replacement or a total hip arthroplasty. Most of these patients (85%) can expect 9-year survivorship of the hemiarthroplasty or partial replacement implant before requiring revision surgery.\textsuperscript{22} Some studies have demonstrated improved functional outcomes for those who receive a total hip arthroplasty compared with a hemiarthroplasty.\textsuperscript{23} Therefore, patients who are expected to live longer and are healthy and active may benefit from total hip arthroplasty. Hemiarthroplasty is still reserved for less active patients with shorter life expectancy.\textsuperscript{24}

Comparisons of regional (spinal/epidural) and general anesthetic techniques have not demonstrated any significant differences in mortality and functional outcomes following hip fracture.\textsuperscript{25} A Cochrane review suggested that regional anesthesia may be associated with a reduction in postoperative confusion from 19.2% to 9.4%, which represents a 50% decrease in risk (class 1B).\textsuperscript{26}

Other evidence-based elements include perioperative administration of first-generation cephalosporin for 24 hours (single or multiple dose), which reduces risk of surgical wound infection by 60% (class 1A);\textsuperscript{27,28} and venous thromboembolic prophylaxis using fondaparinux, low-molecular-weight heparin, low-dose unfractionated heparin, or adjusted-dose vitamin K antagonist, which reduces incidence of venous thromboembolism by 40% or more (class 1A).\textsuperscript{27,28} When compared with indwelling urinary catheter for 48 hours postsurgery, intermittent urinary catheterization for urinary retention reduced the time of return to satisfactory voiding by 4 days (class 1B).\textsuperscript{29} Regarding the use of nutritional supplementation, no benefits on survival or functional recovery have been demonstrated.\textsuperscript{30} Nevertheless, small studies have demonstrated a 29% reduction in medical complications, particularly with the use of protein supplementation, which should therefore be considered in patients with malnutrition (class 1B).\textsuperscript{31} Regarding transfusion strategies to manage anemia, there is little evidence that liberal transfusion to maintain a hemoglobin level of more than 10 g/dL has additional benefit beyond a more restrictive strategy of maintaining a hemoglobin level of more than 8 g/dL in the absence of symptoms of anemia (class 1B).\textsuperscript{31} The Table and Box summarize specific interventions and the evidence supporting their use throughout the course of hip fracture care.

**Pain Control**

Mr W: I was in quite a bit of pain. They gave me medicine to ease the pain.

Patients with hip fracture often have undertreated pain during their hospitalization. In a cohort study of 411 patients in the postoperative inpatient setting, 50% experienced moderate to severe pain at rest, 83% when getting out of bed, and 91% when receiving physical therapy. Only 13% of these patients received standing orders for analgesics during their hospitalization.\textsuperscript{32} Undertreated pain in patients with hip fracture is associated with longer length of stay in the hospital, missed physical therapy sessions, delayed ambulation, and poorer locomotion at 6 months.\textsuperscript{40} A common concern is that analgesics, opioids in particular, may increase the risk of delirium; however, a large cohort study of 541

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**Table. Evidence for Interventions on the Checklist of Important Care Elements for the Treatment of Hip Fracture**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comparison</th>
<th>Estimated Effect</th>
<th>Level of Evidence</th>
<th>Source</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative</td>
<td>Nonoperative management (traction and bed rest)</td>
<td>Reduced hospital length of stay, fracture healing without leg shortening; less risk of independence loss</td>
<td>1B</td>
<td>Systematic review of 5 RCTs</td>
<td>Small trials; surgical or anesthesia practices not current</td>
</tr>
<tr>
<td>Uncorrected major clinical abnormalities prior to surgery</td>
<td>Corrected major clinical abnormalities</td>
<td>Postoperative complications (reference group had no clinical abnormalities; odds ratio, 2.8 vs 0.8)</td>
<td>3</td>
<td>Observational cohort (n = 571)</td>
<td>No long-term outcomes</td>
</tr>
<tr>
<td>Early surgery</td>
<td>Delayed surgery</td>
<td>No difference in mortality or medical complications unless delayed for more than 120 h; reduced pain; reduced hospital length of stay by the number of days of the delay in surgery</td>
<td>3</td>
<td>Observational cohort (n = 2250)</td>
<td>No long-term outcomes</td>
</tr>
<tr>
<td>Regional anesthesia</td>
<td>General anesthesia</td>
<td>50% Risk reduction in postoperative confusion; insufficient evidence for mortality or other outcomes</td>
<td>1B</td>
<td>Systematic review of 31 trials</td>
<td>Studies may not reflect current anesthesia practices</td>
</tr>
<tr>
<td>Venous thromboembolism prophylaxis</td>
<td>No prophylaxis</td>
<td>Reduced incidence of lower limb deep vein thrombosis by &gt;40%</td>
<td>1A</td>
<td>Systematic review of 22 RCTs</td>
<td></td>
</tr>
<tr>
<td>Antibiotic prophylaxis</td>
<td>No prophylaxis</td>
<td>Risk reduction of 60% for deep surgical site infection</td>
<td>1A</td>
<td>Systematic review of 23 RCTs</td>
<td></td>
</tr>
<tr>
<td>Pain managed with opioid protocol</td>
<td>Usual care</td>
<td>9% Absolute risk reduction of chronic pain incidence; improved function at 6 mo</td>
<td>2</td>
<td>Propensity score matched-controlled trial (n = 249)</td>
<td>Single study</td>
</tr>
<tr>
<td>Delirium prevention using structured protocol</td>
<td>Usual care</td>
<td>36% Risk reduction in delirium incidence</td>
<td>1A</td>
<td>RCT (n = 126)</td>
<td>No long-term outcomes</td>
</tr>
<tr>
<td>Transfusion to maintain hemoglobin level of 10 g/dL (restrictive)</td>
<td>Transfusion to maintain hemoglobin level of 8 g/dL (liberal)</td>
<td>No reduction in cardiovascular complications and mortality in intervention group; no difference in functional mobility</td>
<td>1B</td>
<td>RCT (n = 2016)</td>
<td>Single large RCT</td>
</tr>
<tr>
<td>Early ambulation</td>
<td>Longer duration of immobility</td>
<td>Improved survival at 6 mo, and better functional recovery at 2 mo</td>
<td>3</td>
<td>Observational cohort (n = 532)</td>
<td>Observational</td>
</tr>
<tr>
<td>Nutrition supplementation</td>
<td>No supplementation</td>
<td>No difference in mortality; 29% reduction in medical complications</td>
<td>1B</td>
<td>Systematic review of 24 RCTs</td>
<td>Weak evidence with heterogeneous trials</td>
</tr>
<tr>
<td>Postoperative intermittent urinary catheter</td>
<td>Continuous urinary catheter</td>
<td>Reduced return to satisfactory voiding by 4.3 d</td>
<td>1B</td>
<td>RCT (n = 67)</td>
<td>Single study</td>
</tr>
<tr>
<td>Discharge planning</td>
<td>No intervention</td>
<td>Reduced readmission at 3 mo; decreased hospital length of stay</td>
<td>1B</td>
<td>RCT (n = 126)</td>
<td>Care transitions intervention not specific for patients with hip fracture</td>
</tr>
<tr>
<td>Care transitions intervention</td>
<td>No intervention</td>
<td>30% Reduction in 30-d readmission rates</td>
<td>1B</td>
<td>RCT (n = 750)</td>
<td></td>
</tr>
<tr>
<td>Bisphosphonates after hip fracture</td>
<td>Placebo</td>
<td>28% Risk reduction in mortality rate and 35% risk reduction in clinical fractures</td>
<td>1A</td>
<td>RCT (n = 2127)</td>
<td>Unclear mechanism of mortality reduction</td>
</tr>
<tr>
<td>Alendronate, etidronate, and risedronate</td>
<td>Placebo</td>
<td>Reduced vertebral and nonvertebral fractures</td>
<td>1A</td>
<td>Systematic review of 11, 11, and 7 trials</td>
<td>Not specific for patients with hip fracture</td>
</tr>
<tr>
<td>Fall prevention Multifactorial risk assessment and intervention</td>
<td>Reduced fall incidence</td>
<td>Systematic review of 25 trials</td>
<td>1A</td>
<td>Systematic review of 13 RCTs</td>
<td>Not specific for patients with hip fracture</td>
</tr>
<tr>
<td>Hip protector</td>
<td>No protector</td>
<td>19% Reduction in hip fracture risk in nursing or residential care settings</td>
<td>1B</td>
<td>Systematic review of 13 RCTs</td>
<td>Poor adherence to its use</td>
</tr>
</tbody>
</table>

Abbreviation: RCT, randomized controlled trial.

*Level of evidence based on authors’ reviews using the following grading definitions: class 1A, evidence from 2 or more RCTs; class 1B, evidence from 1 RCT or meta-analysis of RCTs; class 2, evidence from nonrandomized trial or quasi-experimental study; class 3, evidence from cohort studies; class 4, based on expert committee opinion or clinical experience in absence of other evidence. Adapted from Tinetti et al.1 and Shekelle et al.2*
patients with hip fracture showed that severe pain increases the risk of delirium among patients with hip fracture. Those receiving a very low dose of opioids (<10 mg/d of parenteral morphine equivalents) were 5.4 times more likely to develop delirium compared with those receiving a higher dose (>30 mg/d of morphine equivalents). Therefore, the concern for risk of delirium should not be a deterrent to adequate pain treatment. In addition to systemic opioids, preliminary data support the use of femoral nerve block, however, more definitive trials are needed.

A sensible approach would be to adopt a regimen of standing, as needed, and preemptive (prior to physical therapy) opioid administration (class 2). As an example, for an 89-year-old patient like Mr W, the starting regimen would have been a standing order of 3 mg of oxycodone administered orally every 4 hours, 1.5 mg of oxycodone every hour as needed, 1.5 mg of oxycodone 1 hour prior to physical therapy sessions, and subsequent administration titrating to effect.

Delirium

Delirium occurs frequently in patients with hip fracture while hospitalized—incidence estimates from prospective cohorts range from 10% to 65%. As many as one-third of delirium episodes persist after hospital discharge. Delirium upon hospital admission is associated with poorer physical and cognitive functioning at 6 months after hip fracture. Delirium during hospitalization for hip fracture is associated with mobility and functional decline, death, and nursing home placement 1 month after discharge.

Two RCTs have demonstrated that a significant proportion of delirium episodes can be prevented by using geriatric consultation or ward teams delivering targeted interventions (class 1A). In one trial, proactive geriatric consultation using targeted recommendations such as fluid and electrolyte balance, pain management, elimination of unnecessary medications, early removal of urinary catheters, and early mobilization reduced delirium episodes from 50% to 28% (risk reduction, 0.64). In another trial, a specialized geriatric ward with staff applying comprehensive geriatric assessment led to a 20% absolute risk reduction in delirium incidence and a 5-day reduction in duration of delirium episodes compared with usual care.

Mr W had several risk factors for developing delirium including advanced age, cognitive impairment, hearing loss, and polypharmacy including psychoactive medications. He would benefit from a multicomponent intervention while in the hospital including reduction of unnecessary medications; provision of hearing assistance, frequent orientation, and adequate pain control; and assistance with early mobilization.

Pressure Ulcer Prevention

Due to long periods of immobility, patients with hip fracture are at high risk of developing pressure ulcers. Pressure ulcer formation is associated with poor patient outcomes. In a cohort of 658 patients with hip fracture, 16% developed a new pressure ulcer (stage 2) at 7 days after initial hospitalization, 28% at 14 days, and 36% at 32 days. To prevent pressure ulcers, current guidelines suggest pressure ulcer risk assessment, frequent repositioning, and the use of pressure redistributing support surfaces. A recent review from the Cochrane collaboration supports the use of pressure-relieving overlays in the operating room and the use of foam alternatives rather than standard hospital foam mattresses, which can reduce pressure ulcer incidence by 60% (class 1A).

Early Ambulation

To return patients to their preinjury level of function, patients should be mobilized soon after surgery, often during the next morning following surgery. Early ambulation improves patient outcomes, including functional recovery and mortality rate. Delayed ambulation is associated with the development of new-onset delirium, postoperative pneumonia, and increased length of stay. Depending on fracture stability achieved by surgery, rehabilitation may commence with unrestricted weight bearing. This should progress each day, ideally leading to stair climbing by postoperative day 4. These goals are to be taken as general guidelines; each rehabilitation program must be tailored to the individual's physical, psychological, and social situation. Poor pain control is associated with delayed ambulation, making attentive pain control a priority both for the patient's comfort as well as to improve locomotion during hospitalization.

Transitions of Care

Patients with hip fracture often experience multiple handoffs during care transitions across settings, such as from hospital to rehabilitation facility, rehabilitation facility to home, and rehospitalization; the average number of transitions for a patient with hip fracture is 3.5. Transitions of care represent vulnerable points in the trajectory toward recovery, because medication errors and adverse events are prone to occur. As clinicians, it is important to ensure that handoffs are accurate and complete and services are adequate when patients are transitioned to a less intensive level of care. Approximately one-third of patients with hip fracture are re-admitted to the hospital within 6 months. Most rehospitalizations (89%) are for nonsurgical causes—infec-tious and cardiac causes being most common. Readmissions are associated with increased risk of mobility dependence (total assistance with ambulation) and death at 6 months. Although not studied directly in patients with hip fracture, interventions targeted at improving care transitions among older patients can reduce hospital readmissions.
Mr W experienced transitions from the hospital to a skilled nursing facility to receive rehabilitation, and subsequently home. Ensuring that he received correct medications at every transition, follow-up appointments and means to attend them (including negotiating stairs at the house or physician's office), and information about indications that his medical conditions were worsening were all keys to successful transitions. The National Transitions of Care Coalition provides information to help address transitions of care (see Resources).

Models of Care for Inpatient Management

Incorporating the elements of care described in this article requires the involvement of multiple disciplines including, but not limited to, orthopedics (for surgical and perioperative management), geriatrics or internal medicine (for delirium, pain, and medical management), rehabilitation, social work, and nursing. Models of inpatient care, such as orthogeriatric units, have been developed to meet patient needs. We reviewed studies of these inpatient models of care (eTable 1, eTable 2, and eTable 3) and found that the studies vary in design, setting, and outcomes. By organizing these studies by outcomes—long-term, short-term, process, or administrative outcomes, we were able to draw certain conclusions.

First, there is a lack of evidence that inpatient multidisciplinary models by themselves improve long-term clinical outcomes such as function,69 studies that have found improvement in long-term outcomes have included coupled rehabilitation interventions in rehabilitation units or after hospital discharge.60,61

Second, the incidence of medical complications during hospital stay, including delirium, is reduced with multidisciplinary care, mostly when a geriatrician or internist is involved. Two studies reported a reduction in hospital mortality.62,63

Third, multidisciplinary models have variable effects on length of stay (6 shortened, 2 with no effect, 1 prolonged). With the limited evidence, the strongest benefit of multidisciplinary care is the reduction of hospital complications including delirium, urinary retention, infection, and pneumonia.39,62 Including these elements of care into the protocol may improve adherence to evidence-based practices.39,62 Future studies should focus on adherence to evidence-based elements of care and include clinically relevant short- and long-term outcomes.

POSTHOSPITAL DISCHARGE CARE

Rehabilitation After Repair

Mrs W: They started him out gradually and then they had him walking in [with the help of the parallel] bars.

A mainstay of posthospital care for the patient with hip fracture is rehabilitation to restore mobility. Although multiple RCTs have evaluated rehabilitation strategies after hip fracture, rehabilitation in clinical settings is often guided by the trajectory of rehabilitation, patient's capability and motivation, and the availability of social support. Also, similar to the evidence on multidisciplinary models of care, studies on rehabilitation strategies vary in design, length, setting, and outcomes, limiting our ability to determine the best single strategy, an observation also noted in a recent Cochrane review.64

Examining the evidence by setting and intensity of treatment (eTable 4) showed that home-based rehabilitation programs may improve locomotive and functional performance at 1 to 12 months,65-67 but 1 program only improved gait performance at 6 months but not at 12 months.68 For patients who can tolerate physical therapy at an outpatient clinic, facility-based (in outpatient rehabilitation gyms or clinics) higher-intensity treatment may lead to improved physical performance, functional status, and quality of life when compared with home-based programs.69,70 Including other modalities of rehabilitation, such as occupational therapy, may lead to improved quality of life and ability to perform instrumental ADLs at 2 months.71 Optimal duration of rehabilitation programs is unclear—1 study reported improvement in function in a 6-month program,69, but a 12-month program only yielded increased physical activity level but no effect on functional performance.72

Mr W underwent rehabilitation in a skilled nursing facility followed by continued physical and occupational therapy at home after discharge. As Mr W was motivated in his rehabilitation efforts, he received additional physical therapy in the outpatient rehabilitation facility. The higher-intensity treatment may have contributed to his good recovery.

Trajectory of Functional Recovery and Follow-up

Mr W: [On things that were most instrumental to making a terrific recovery] First of all, time. It took time.

All patients with hip fracture should be followed up at standard intervals to assess fracture healing. Expert opinion on optimal care includes follow-up with hip radiographs at 6 weeks if fixation was performed and every 6 weeks thereafter, until bony union occurs. For patients who received arthroplasty, follow-up with radiograph occurs at 3 months and then yearly to assess the integrity of the implant. Patients who have undergone arthroplasty are cautioned to limit certain physical positions for 3 months, such as flexion with internal rotation, to prevent hip dislocation. At each follow-up, the extent of functional recovery, including mobility and ADL performance, should be assessed.

Understanding the time course of expected functional recovery helps clinicians to advise patients. Patients with hip fracture represent heterogeneous groups of individuals with variable baseline status, including some with ongoing physical decline that has culminated in hip fracture.12 Data from a cohort of 674 patients with hip fracture who were followed up for 24 months showed that function in 8 areas re-
covered progressively over the first postfracture year, with different levels of recovery and time to maximum levels of function observed. Recuperation times to maximal recovery were specific to area of function, ranging from 4 months for depressive symptoms, upper extremity function, and cognition, to 9 months for gait and balance, and to 11 months for lower extremity function. New dependency in specific areas includes 20% with difficulty putting on pants, 66% getting on or off the toilet, 83% getting in or out of the bath or shower, and 90% for climbing 5 stairs.

**Risk Reduction of Subsequent Fracture**

Dr H: He has a lot of [comorbid conditions]... It r yt oman-age those without making him fall.

Approximately 10% to 20% of patients with hip fracture have a subsequent hip fracture, representing a 2.5-fold increase in risk; thus, secondary prevention of subsequent fracture is an important aspect of care. This is often overlooked because it is not part of the acute care management of hip fracture. Current guidelines suggest assessment of osteoporosis if not previously diagnosed, calcium and vitamin D supplementation, and bisphosphate use. Vitamin D supplementation, with calcium supplementation, increases bone mineral density and reduces falls. Bisphosphonates, including zoledronic acid, can reduce rates of clinical fractures among patients who have had a hip fracture (class 1A). Bisphosphonate treatment should be initiated within 90 days postsurgery for patients without contraindications, and should be on the checklist of all physicians providing follow-up care. Fall-prevention strategies may consist of risk factor assessment and multifactorial targeted intervention, as discussed in a prior article in the Care of the Aging Patient series. Mr W’s renal insufficiency limited bisphosphonate use; instead, he was prescribed calcium and vitamin D supplementation.

For fall prevention, Mr W would benefit from a comprehensive fall-risk assessment, which may result in elimination of unnecessary medications, especially psychoactive and anticholinergic medications, continued physical therapy for gait and balance training, and a home safety assessment.

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**Box. Checklist of Important Care Elements Throughout Treatment Course of Patients With Hip Fracture**

### Preoperative and Perioperative Care
- Surgical team (with support of geriatric consultant, medical consultant, and primary care physician)
  - Consideration of operative vs nonoperative management
- Emergency and surgical team (with support of geriatric and medical consultants)
  - Adequate pain control: femoral nerve block, scheduled pain regimen, and as-needed pain regimen
  - Correction of medical abnormalities prior to surgery
  - Timing of surgery: early surgery, but treat medical problems first
- Surgical team and anesthesia
  - Regional vs general anesthesia
- Surgical team and nursing
  - Prophylaxis against venous thromboembolism
  - Perioperative antibiotic prophylaxis
  - Pressure ulcer prevention using pressure-redistributing support surfaces, and heel elevation device

### Inpatient Postoperative Care
- Inpatient primary team (with support of geriatric and medical consultants)
  - Adequate pain control: scheduled pain regimen, preemptive pain medications
  - Delirium prevention: structured protocols
  - Anemia management
  - Oxygen support
  - Multidisciplinary inpatient care

### Rehabilitation Services
- Early ambulation
- Nutrition and primary team
  - Consideration for nutrition support, particularly for patients with malnutrition
- Nursing
  - Urinary catheter management
  - Pressure ulcer prevention
- Discharging team
  - Transitions management

### Rehabilitation Postdischarge Care
- Rehabilitation exercises in facilities, home, and outpatient settings
- Primary care clinicians and surgical team
  - Secondary fracture prevention: bisphosphonates and fall prevention
  - Monitor recovery of function
  - Pain monitoring
- Primary care
  - Depression monitoring and treatment
  - Consideration for other modalities of care eg. palliative care
  - Communication: review trajectory of recovery and caregiver expectations

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Pain and Psychological Issues

Dr H: [I make] sure that he has support at home. His caregiver is a big part of why he’s doing well.

Persistent, residual pain after hip fracture is common—40% to 50% of patients report moderate to severe pain at 3 to 6 months.44,77 Thus, continuing assessment of pain at follow-up is necessary. Chronic pain management may include a regimen of opioid or nonopioid analgesics titrated to maintain mobility and ability to participate in rehabilitation exercises. Sudden-onset or worsening pain should prompt evaluation because it may indicate associated hip problems such as trochanteric bursitis or loss of fixation, dislocation, infection, or osteonecrosis (a late complication) of the hip.

Clinically significant depression develops in 14% to 20% of patients with hip fracture78,79 and postoperative pain and anxiety symptoms are potentially modifiable factors associated with depression. Clinicians should continue to monitor for signs of depression during follow-up.

Also, 50% or more of patients with hip fracture experience fear of falling, which is associated with poor rehabilitation outcomes, mobility loss, and institutionalization.80 Although educational programs such as coaching to improve self-efficacy expectations show promise, current evidence is insufficient to support practice changes.81

Caregivers often experience frustration with communication in health care delivery and in caregiving-related activities.82 Clinicians should proactively and sensitively communicate with patients’ caregivers. Dr H communicated frequently to support the patient and his family, which may have helped ease patient and caregiver frustration during this prolonged recovery process. Patients both with and without caregivers may be referred for additional nursing and homemaking services depending on individual needs; alternative living arrangements such as assisted living may be explored.

Role of Palliative Care

Dr H: When I heard [Mr W] had a hip fracture, I thought this was going to be it.

Discussion of management goals and choices with patients and proxies should be initiated early in the course of treatment of patients with hip fracture.83 In patients with life-limiting diseases such as advanced dementia,84 it is particularly important that alternatives to surgical treatment, including palliative management, are explored. Aspects of palliative care applicable to the hip fracture include symptom management and assisting patients and caregivers in coping with this difficult condition. For patients with poor functional recovery, significant worsening of comorbid conditions, and multiple readmissions, discussion of goals of care should include consideration of alternative models of care both in institutions and at home, to best serve their needs.85 Palliative care consultation both in the hospital and after discharge may be helpful for patients with significant symptoms and difficulty coping with illness.

CONCLUSIONS

Hip fracture has a prolonged treatment course with potentially devastating consequences. The patient’s overall status and goals should be used to tailor care and optimize patient outcomes. Patients with hip fracture require care that integrates surgical, geriatric, rehabilitative, and psychosocial principles throughout its course. This condition also requires physicians to anticipate problems that may arise during recovery, whether the complications are from hip fracture and immobility, exacerbations of chronic diseases, or problems with social and psychological support. As illustrated in Mr W’s case, it takes a team of dedicated professionals working together seamlessly to deliver care appropriate for patient goals and to maximize recovery.

REFERENCES


eResources

General Resources

Centers for Disease Control and Prevention
http://www.cdc.gov/HomeandRecreationalSafety/Falls/adulthipfx.html#r
erence

This website contains general information about hip fracture with recent data and statistics.

Agency for Healthcare Research and Quality
http://www.effectivehealthcare.ahrq.gov

This website contains reviews of evidence for effectiveness and comparative effectiveness research for clinicians, consumers, and policy makers with a searchable index for information related to falls and hip fracture.

National Rehabilitation Information Center (NARIC)

This website contains links to resources related to disability and rehabilitation-oriented information, including information on aging and on choosing rehabilitation facilities.

American Academy of Orthopaedic Surgeons
http://orthoinfo.aaos.org/topic.cfm?topic=A00392

This website contains information about orthopedic treatment for hip fracture including radiographic depictions of hip fracture repair.
Care Transitions
National Transitions of Care Coalition
http://www.ntocc.org

This website provides information to address problems associated with transitions of care. It is a non-profit organization that provides tools to help health care professionals, patients, and caregivers establish safer transitions; and resources for practitioners and policy makers to improve transitions throughout the health care system.

Delirium Prevention
Hospital Elder Life Program (HELP)
http://www.hospitalelderlifeprogram.org

This website provides information about recognition and prevention of delirium in hospitalized older adults.

Osteoporosis Treatment
National Osteoporosis Foundation
http://www.nof.org

The National Osteoporosis Foundation is dedicated to the prevention of osteoporosis and broken bones, the promotion of strong bones for life, and the reduction of human suffering through programs of public and clinician awareness, education, advocacy, and research.