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Comprehensive Rehabilitation Approach to Improve Outcomes after Hip Fracture

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Clinical Vignette

A 79-year-old, right-handed female tripped over a throw rug and landed on her right hip. Prior to this injury, she had been living independently at home. She managed her own finances and medications and used a standard cane intermittently when her arthritic knees were painful. Her medical history included coronary artery disease with episodes of congestive heart failure, diabetes mellitus with sensory neuropathy, degenerative joint disease affecting her knees, and osteoporosis. In the hospital, she was found to have a displaced fracture of the femoral neck (see Figure 1) and was admitted for surgical management of her fracture. She asked whether or not she would be able to walk again. More important, she wanted to return home as soon as possible, since she was fearful about long-term institutionalization because of her injury.

Figure 1. Femoral neck

Definition of Problem

In 2000, the Centers for Disease Control and Prevention estimated that 340,000 hospitalizations per year were related to acute hip fracture, with an incidence of 525 per 100,000 men and 1,198 per 100,000 women over the age of 65[1]. The one-year mortality rate is 20 percent, and approximately 25 percent of individuals who had been independent community dwellers prior to hip fracture require long-term nursing home care[2]. For individuals suffering a hip fracture, many had been living alone before their injury; unfortunately, only half of all patients regain premorbid functional mobility[3]. A comprehensive rehabilitation approach has the potential to improve function, return individuals to community living, and minimize long-term disability.

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Initial Management

Hip fractures are treated surgically to provide pain relief and to restore functional mobility. Even nonambulatory patients benefit from relief of pain after surgical fixation. Leg traction before surgery is unnecessary, since this immobilization neither reduces the need for analgesia nor results in easier fracture reduction during surgery[4].

The wait time for surgery should be kept to a minimum in order to avoid the detrimental effect of bed rest, including atelectasis, disuse atrophy, venous stasis and thromboembolism, skin breakdown, and infection. Operative delay of more than two days is a predictor of increased mortality within a year after hip fracture[5].

Hip fractures are classified as intracapsular or extracapsular. Intracapsular fractures involve the femoral neck and are associated with high risk for osteonecrosis because the vascular supply coursing along the femoral neck is often compromised during the fracture. Extracapsular fractures include intertrochanteric and subtrochanteric fractures. Intertrochanteric fractures are located in an area of abundant blood supply and are less likely to develop osteonecrosis. Because of muscle forces across the hip, intertrochanteric fractures are prone to developing shortening as well as valgus rotation. Subtrochanteric fractures are in an area with less blood supply and are susceptible to nonhealing.

There is no consensus as to which anesthetic technique is best for elderly patients undergoing hip fracture repair. Regional anesthesia using peripheral nerve blocks is associated with lower rates of deep venous thrombosis[6]. Spinal and general anesthesias yield similar long-term functional outcomes[7]. The combined use of peripheral nerve blocks with either spinal or general anesthesia has resulted in lower pain levels, which may aid rehabilitation[8].

Hemiarthroplasty has been the preferred treatment for displaced intracapsular femoral neck fractures. Internal fixation — using intramedullary nailing, percutaneous screws, or plates — is the treatment of choice for extracapsular femur fractures or minimally displaced intracapsular fractures. See figures 2 through 4 for x-ray representations of each stabilization technique.

Figure 2. Bipolar hemi-arthroplasty

Figure 3. Screw fixation

Figure 4. Intertrochanteric fracture, open reduction with internal fixation (ORIF)

Unrestricted weight bearing after uncomplicated hip surgery is safe and does not result in increased mechanical complications or adverse surgical outcomes[9]. Elderly patients are generally unable to maintain weight-bearing restrictions such as "touch-down" weight bearing (TDWB). With current implants for extracapsular fractures, it is possible to allow full weight bearing regardless of the fracture pattern or degree of osteoporosis. Those treated with hemiarthroplasty can also be allowed to bear weight as tolerated. If restricted weight-bearing is indicated because of an unstable fracture or because of increased risk for fixation failure, partial weight bearing (PWB) — defined as 50 percent body weight — is preferred to TDWB or non-weight bearing. Using an in-shoe biofeedback device, one can objectively measure PWB[10].

Medical Complications

Hip fracture surgery is associated with high rates of postoperative venous thromboembolism (VTE) — due to venous stasis, vessel trauma, and immobility — with reported incidence of 36 percent to 60 percent[11]. VTE prophylaxis greatly reduces this risk. Options for prophylaxis include warfarin, low molecular weight heparin, and synthetic factor Xa inhibitor. Aspirin is currently not recommended for primary VTE prevention. The risk for VTE persists longer than 11 days after hip surgery[12]. Extended prophylaxis, lasting four weeks, with fondaparinux can reduce the risk of deep vein thrombosis (DVT) by 96 percent, compared to 89-percent risk reduction for prophylaxis lasting just one week[13]. However, some patients suffer postoperative VTE[11] despite optimal prophylaxis.

Suboptimal pain control during the first three days after hip fracture surgery is associated with longer hospital stays and greater complication rates[14]. Moreover, inadequate pain control after surgery increases the risk for delirium[15], while the judicious use of opioid analgesia does not increase the risk of delirium[16]. For some elderly patients who cannot tolerate opioids, scheduled dosing of a nonsteroidal anti-inflammatory drug (NSAID) or acetaminophen should be considered before therapy sessions. Pain severity associated with movement is a strong predictor of negative functional outcome[17] leading to longer rehabilitation treatment duration[18].

In hip-fracture patients, the incidence of delirium has been reported as high as 41 percent[19]. In many patients, delirium is short-lived and can be improved with post-fracture rehabilitation programs. Delirium may be more likely to persist in patients with dementia at baseline[20].

Blood loss after surgery can be significant. Anemia, defined as Hb < 10 g/dL, in the early postoperative period is associated with decreased functional mobility and is a risk factor for nonambulatory status by the third day after surgery, according to a study of 487 elderly patients with hip fracture[21]. This study does not address whether or not deficits are corrected by transfusion. Hypoalbuminemia, defined as albumin < 3.5g/dL, is associated with prolonged length of stay, increased mortality, and decreased activities of daily living after fracture[22].

Immediate Rehabilitation Strategies

Early mobilization after surgery requires intensive resources and is more easily accomplished if tethers such as urinary catheters and IV catheters are eliminated. Physical therapy (PT) should be started on the first postoperative day with focus on attaining upright posture, increasing weight-bearing tolerance, and mastering transfers.

If the peripheral nerve block is still in place, the knee will require support from an orthosis to prevent buckling during stance phase of gait. Ambulation can start, using parallel bars for support.

As tolerance improves, a wheeled walker is able to support 50 percent of the patient's weight[23] and is easier to advance, creating a smoother gait. A cane improves stability by increasing the patient's base of support and can be added as the fracture heals. The patient should place the cane in the hand contralateral to the affected hip, to decrease forces required by the hip abductor muscles to support the pelvis[24]. The cane should be close to the body, no greater than 6 inches away, in order to support 25 percent of body weight. Multiple-legged canes provide increased support, but are heavier and more cumbersome to use.

Endurance and strength training should complement the focus on mobility and ambulation. Exercises should include active assisted hip flexion, active hip extension and abduction, heel slides, ankle pumps, and quadriceps sets. Independent ambulation and transfers are correlated with improvements in hip abductor and quadriceps strength, respectively[25]. Occupational therapy (OT) should also be involved early to foster adaptive skills for grooming, toileting, and transferring from the bed.

Optimal Site for Postacute Rehabilitation

The introduction of prospective payment systems based on diagnosis-related groups (DRGs) in acute-care hospitals has resulted in earlier hospital discharges[26]. Patients with hip fractures who are not prepared to function independently at home require postacute rehabilitation services that may be provided within inpatient rehabilitation facilities (IRF) or skilled nursing facilities (SNF). Recovery to prefracture status is often difficult to attain and 22 percent are reported as nonambulatory 12 months after fracture[27]. The majority of patients with hip fracture will need postacute rehabilitation to regain mobility and functional independence.

Munin and colleagues demonstrated that community-dwelling hip-fracture subjects treated in IRF are more likely to attain 95 percent or more of prefracture functional status by six months. Even when controlling for important baseline covariates, only the IRF setting was associated with recovery to baseline functional status, with a significant odds ratio of 5.44. IRF patients improved sooner, and this functional gain was associated with significantly shorter mean length of stay (LOS) compared to the mean LOS for patients treated in SNF[28,29]. Larger-scale prospective trials or randomized controlled trials are required to allow analysis of different mechanisms for superior outcomes so that more efficacious rehabilitation strategies could be implemented for hip fracture survivors regardless of setting.

Depression can be seen after hip fracture with a reported incidence of 21 percent[30]. Patients with depression and apathy who received rehabilitation in an IRF had better functional outcomes than similarly impaired patients treated at an SNF[31].

Prevention

Falls after a hip fracture can lead to greater disability and loss of self-efficacy[32]. The risk of falling again is increased in the very old, the incontinent, and those who use a rollator walker[33]. Etiologies of falling can include hypotension, arrhythmia, and vasovagal events. Assessment should also include medication review, to avoid poly-pharmacy, as well as modification of hazards at home such as throw rugs.

Osteoporosis, leading to decreased bone mass and increased bone fragility, is common. Of patients with nontraumatic hip fracture, only 13 percent were receiving adequate treatment for osteoporosis, 47 percent reported partial treatment, and 40 percent were receiving no

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treatment[34]. Increased awareness of osteoporosis results in improved treatment[35] using a variety of medications including calcium and vitamin D, oral bisphosphonates (risedronate, alendronate, ibandronate), intravenous bisphosphonates (pamidronate, zoledronate), calcitonin (second line, analgesic effect), selective estrogen-receptor modulators (raloxifene), and the anabolic agent teriparatide.

Once-yearly intravenous infusion of the bisphosphonate zoledronate initiated within 90 days after traumatic hip fracture has been shown to reduce the rate of new fractures and improve survival[36]. Resistive exercises can also help prevent disuse-related bone loss[37].

Summary

Our patient's hospital course was complicated by significant hip pain after her peripheral nerve blocks were removed. As a result, she could not participate in therapy and was not sleeping well. She was placed on scheduled acetaminophen and celecoxib with hydrocodone–acetaminophen used on an as-needed basis. This regimen did not provide effective pain relief and medications were then changed to sustained-release oxycodone 10mg every 12 hours with immediate-release oxycodone 5–10mg every 4 hours as needed for breakthrough pain with better pain control.

She was placed on fondaparinux 2.5mg subcutaneous daily for DVT prophylaxis with a planned duration of four weeks. On postoperative day three, she was noted to have increased lower extremity swelling in both legs, but duplex ultrasound performed on both legs was negative for DVT. She was seen by her primary care physician, who managed mild congestive heart failure with diuretics and corrected blood sugars by adjusting her insulin and oral medications.

She was admitted to an inpatient rehabilitation facility because she met the medical-necessity criteria and she required three hours of inter-disciplinary care each day. Her care was directed by a physiatrist, who adjusted her pain medications and ensured that her CHF and diabetes were under control. She had urinary retention and constipation requiring a bowel program consisting of docusate, 100mg twice a day, and senna, 2 tablets daily. She was diagnosed with urinary tract infection and treated with double-strength trimethoprim-sulfamethoxazole, 1 tablet twice a day. Once her constipation resolved, she began spontaneously voiding. She was provided with timely access to the toilet although she remained incontinent episodically.

She received twice-daily PT and OT, continuing the program initiated in the acute-care setting. Her therapy program was continued at bedside with nursing staff that walked her after formal sessions ended each day. The nursing staff also provided education on how to properly manage her pain medications, and how to administer fondaparinux. She was also started on alendronate for treatment of osteoporosis.

She became continent and her delirium cleared. She required low-dose trazodone 25mg at night to sleep regularly. On her ninth day in the IRF, she was ambulating community distances, including curbs and ramps, using a wheeled walker at a modified independent level. She was able to do a flight of steps at a modified independent level. She was able to administer her medications and was discharged home with arrangements made for home therapy to assess safety.

Nine months after her fall and fracture, she was living independently at home. She was walking with a slight limp, but did not use a cane unless her knee arthritis was acting up. She was taking her osteoporosis medication and denied further falls.

Conclusion

It is well documented that full recovery after hip fracture is difficult to achieve. However, with a coordinated rehabilitation program, functional recovery can be enhanced, especially for individuals who were living in the community at the time of fracture.

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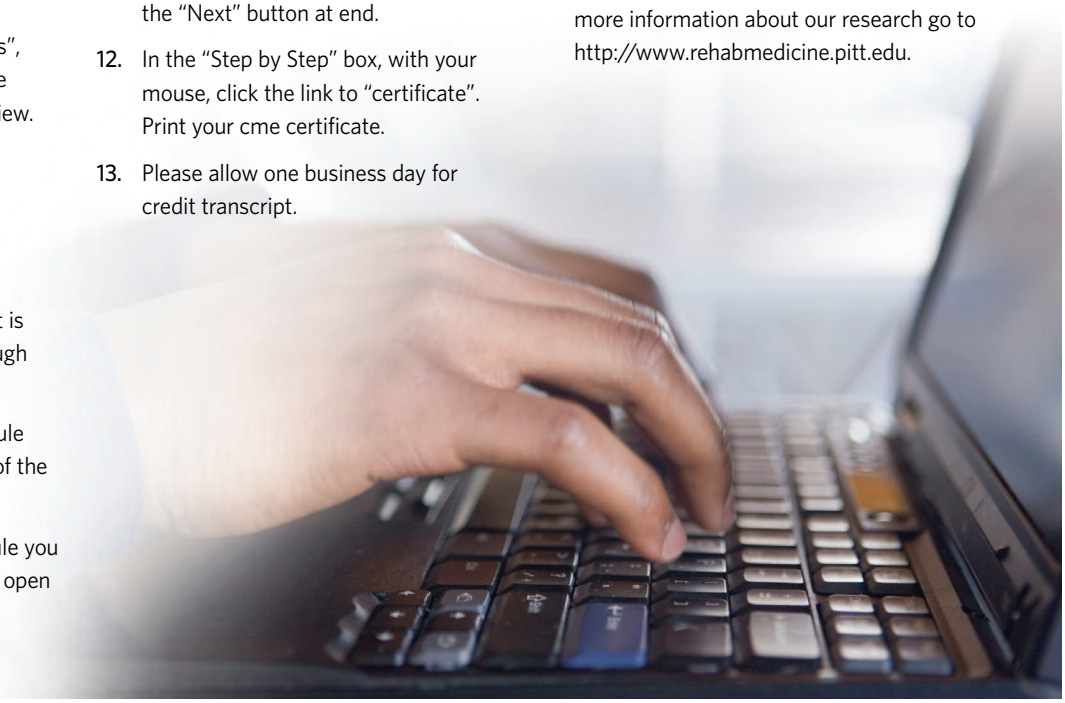

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