EDITORIAL

ORTHOGERIATRICS AND HIP FRACTURES

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Approximately 14% of women and 6% of men will have a hip fracture during their life time (1). There is large geographical variation in hip fractures with the highest rates occurring in Scandinavian countries (over 500/100,000 annual age-standardized incidence) and the lowest rates in African countries (less than 100/100,000 age-standardized incidence) (2). In the United States, rates of hip fracture vary between 143 to 316/100,000 for Caucasians and 76 to 136/100,000 for persons of African origin.

Death rates after a hip fracture are quite high and are 10% at 10 days and 17 to 36% at 1 year (3). Not only do hip fractures confer high mortality rates, but the morbidity rates are quite staggering as well. One year after a hip fracture, 10% of patients are bedfast, 16% of patients are in a nursing home and 80% of patients require a walking aid that was previously unneeded. These poor outcomes have suggested the need for a focus on improving hip fracture care in older persons.

One approach to improving care of older persons with hip fracture is the collaborative approach of a closely cooperative team of a geriatrician and an orthopedic surgeon—often called orthogeriatrics. The first orthogeriatric unit was developed by Michael Devas (an orthopedist) and Robert Irvine (a geriatrician) in 1963 (4). In 1980, Richard Lefroy published the positive results of a combined unit in Western Australia on management of hip fractures (5). Adunsky et al (6) found lower mortality rates for patients who were admitted to a comprehensive geriatric hip fracture unit compared to standard care. Recently, a large prospective trial showed that these positive benefits extended to well after discharge and that patients with hip fractures had better mobility 4 months after hospitalization when receiving comprehensive care (7). A meta-analysis of 18 studies which included a total of 9094 patients of orthogeriatric collaboration found a significant reduction in mortality in hospital (0.60; 6.42-6.84), long term mortality (0.83; 0.74-0.94) and a reduction in length of stay (8).

Operative Management

Persons who do not have surgery for their hip fracture have four times the risk of death in the first year (9, 10). These deaths stem from complications of immobility and are often the result of deep vein thromboses, pulmonary emboli, pneumonia, and pressure ulcers. Those patients who mobilize out of bed quickly after their fracture despite not receiving operative management do somewhat better (11). It is typically

recommended that patients who are able to undergo surgical intervention, even if of higher cardiac risk, should do so rather than electing for non-operative management. Hip fracture surgery can be viewed as a palliative procedure with the goal of achieving pain control in those patients who are non-ambulatory at baseline.

Intuitively, low surgeon volume is associated with a longer length of stay and higher mortality (12). One key to favorable surgical outcomes is reducing the time it takes for the patient to undergo surgery, with recommendations that surgery should occur within 48 hours of when the fracture occurred (13, 14). Furthermore, recent studies have suggested that surgery within 6 hours of the time of fracture reduces postoperative mortality (15). The HIP ATTACK trial is attempting to confirm that accelerated time to surgery (<6 hours) truly improves outcomes (NCT02027896).

Anemia in hip fracture patients is quite commonplace in the perioperative period because the arteries providing the blood supply to the femoral head are often torn, resulting in significant bleeding. Many patients will require a blood transfusion in the perioperative period. However, one study did show that a liberal blood transfusion strategy post hip fracture did not reduce mortality or 60 day independent walking (16). It may improve long term function in persons with dementia (17).

Pain control in the perioperative period is imperative in order to improve both the quality of life of the patient and to encourage early mobilization. It is recommended that most patients be placed on scheduled pain medication post-operatively. Additionally, there is some evidence that patients who have femoral nerve blocks done on admission and then having a continuous fascia iliac block placed have less pain and better walking and stair climbing ability throughout their hospital stay and at 6 weeks post-hospital discharge (18, 19).

High Risk Populations

Populations at high risk for increased morbidity and mortality following a hip fracture include those with multi-morbidity, frailty and protein energy malnutrition. A correlation between comorbidity at discharge and poor functional outcomes has been demonstrated (20). Persons with the physical frailty phenotype have an increased risk of fractures in general and poor surgical outcomes (21, 22). A rapid screen for the physical phenotype for frailty – the FRAIL scale has been developed (23-27). Gleason et al (28) has shown that those deemed “frail”

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using the FRAIL scale had increased lengths of hospital stay, increased surgical complications, and were more likely to discharge to a nursing home following hip fracture. There are a number of treatable causes of frailty including polypharmacy, depression, sleep apnea, hypothyroidism, and sarcopenia and these should be assessed and screened for in hip fracture patients in the orthogeriatric unit (29).

Loss of muscle mass is a common occurrence in older persons and may contribute to falls and increased risks of hip fracture (30, 31). Sarcopenia is currently defined as poor function (measured by decreased walking speed or grip strength), associated with a low muscle mass (32-35). When screening for sarcopenia, it is important that cutoff points are defined based on ethnicity (36). A rapid screen for sarcopenia – SARC-F – has been developed (37-40) and can be used by primary care physicians to make an ICD-10 diagnosis of sarcopenia (41, 42). Loss of bone mass (osteoporosis) typically occurs concurrently with loss of muscle mass (sarcopenia), resulting in sarco-osteoporosis, and leading to an increase in the rate of hip fracture (43-45). It is important that the presence of sarcopenia be identified so that there can be an emphasized focus on resistance exercise in the acute rehabilitation unit following hip fracture (46).

Diabetic patients have a higher risk of sustaining hip fractures despite having greater bone densities (45). Part of this increase of fracture is due to overall poorer bone quality in diabetic patients, causing increased weakness and decreased integrity in the bone structure (47). In addition, individuals with diabetes mellitus are much more likely to be sarcopenic and have an increase in falls, conferring a higher hip fracture incidence (48, 49).

Protein energy malnutrition is a common problem in older persons and can accelerate the development of sarcopenia and frailty (50). The MiniNutritional Assessment (MNA) is a commonly used assessment tool for undernutrition (51-53). Both the malnutrition and weight loss are associated with severe functional impairment following hip fracture (54-56) because of interference with bone and wound healing and also the ability to regain an ambulatory status. Weight loss from anorexia of aging needs to be distinguished from weight loss due to cachexia because anorexia has treatable components (57-60). Cachexia, however, is more difficult to correct because it stems from a catabolic process, in which the underlying causes are not always apparent or treatable. Anorexia, which is a major predictor of future weight loss, can be identified by the Simplified Nutrition Appetite Questionnaire (SNAQ) (61, 62). This should be done prior to hospital discharge in hip fracture patients so that targeted interventions can be put in place to reverse the weight loss or prevent more weight loss from occurring.

Delirium

Delirium is one of the most common complications following hip fracture and occurs in 10 to 65% of patients (63-65). The diagnosis of delirium can be made using the Confusion Assessment Methodology (CAM) with particular attention of the patient's ability to focus or to maintain attention (66). The hyperactive motor subtype of delirium occurs almost twice as often as the hypoactive, but hypoactive delirium is often underdiagnosed (67). Median duration of delirium is 3 days and those with delirium often require longer hospital stays. Delirium in hip fracture patients without a diagnosis of dementia predicts higher one year mortality (68). Furthermore, a meta-analysis has confirmed that delirium in persons with hip fracture is associated with an increase in mortality and institutionalization (69).

The pathophysiology of delirium following hip fracture is uncertain and likely quite multi-factorial. Persons with protein energy undernutrition are more likely to develop delirium (70) as are those with underlying dementia. It is well-recognized that anticholinergic burden is commonly associated with delirium and medicines with inherently high anticholinergic activity should be stopped wherever possible (70, 71). Similarly, potentially inappropriate drugs delay full functional recovery following hip fracture (72). There is some evidence to suggest that C-reactive protein and inflammatory cytokine levels are elevated in the cerebrospinal fluid of persons who develop delirium following hip fracture surgery, but the significance of this finding is unknown (73). There is reasonable quality evidence that comprehensive geriatric evaluation and orthogeriatric management reduces delirium in persons with hip fracture (74, 75). Of note, antipsychotics should not be used to treat delirium (76) as they only target a small pathway implicated in the pathogenesis of delirium and are dangerous medications to use in the elderly.

Infections

Infections are the most common postoperative complication in persons with hip fracture (77). The most common infections are surgical site, pneumonia and urinary tract infection. To prevent surgical infections where possible patient risk factors should be modified, surgical procedures should be as short as possible and performed under optimal conditions and antimicrobial prophylaxis (cefazolin and vancomycin or clindamycin) given 30 to 60 minutes prior to surgery. Aspiration pneumonia can be prevented by good oral hygiene, not lying the patient flat, limiting gastric reflex, not over-sedating the patient, good respiratory exercises and early mobilization. As urinary tract infections occur in up to 38% of patients admitted to hospital with a hip fracture, all patients require urine analysis on admission and use of indwelling Foley catheters should be limited to a maximum of 24 hours (78).

Neumaier et al (79) suggested the use of a serum

C-reactive protein (CRP) level to monitor persons following surgery to alert physicians to the possibility of post-surgery thromboembolic events, ischemia or infections. On the 2nd postoperative day, levels of CRP should range from 8 mg/dl (if nails or screws were used for surgical fixation of the hip) to 16 mg/dl (if a hip prosthesis was placed). By the 6th post-surgical day, the CRP should have declined by 4 mg/dl.

Rehabilitation

Post hip fracture patients have an increase in disabilities at three months and 80% have not returned to baseline at one year (80). There is emerging evidence that an aggressive long term program including resistance exercise can markedly improve outcomes in older persons following hip fracture (81, 82). Importantly it appears that progressive strength training should be started in hospital (83) and carried out into the rehab setting. A 6-week strength training program started after surgery was associated with decreased pain and an increase in 6-minute walk test speed (84). A 12-week resistance program resulted in improvements in gait speed, gait distance and self-rated health (85). A 3-month study of exercise combined with vitamin D improved mortality at 12 months and 4 years following hip fracture (86). Singh et al (87) conducted a 12-month geriatrician-supervised high intensity weight-lifting exercise program following surgical repair of hip fractures. They found a reduction in mortality of 81% and an 84% reduction in nursing home admission. In the resistance exercise group, there was an improvement in the performance of basic ADLs and less use of assistive devices. A meta-analysis found that progressive resistance exercise after hip fracture surgery improved mobility, activities of daily living, balance, and lower limb strength and power (88). There is increasing evidence that with appropriately designed programs, an interdisciplinary home rehabilitation program may be as successful as admission to long-term care in a nursing facility (89).

Malafarina et al (90) found that a hydroxymethylbutyrate supplement protected appendicular lean mass. A meta-analysis of oral protein supplements following hip fracture found those taking the supplement had fewer complications, but the evidence was of low quality (91). Additionally, there was no evidence for a reduction in overall mortality. In general, trials evaluating oral nutritional supplements have been poorly designed and of small numbers and few yield clinically significant results.

Patients with hip fracture are highly likely to have dementia (19.2%) and cognitive impairment (41.8%) (92). Cognitive impairment is associated with increased mortality following hip fracture (93). There is little information in the literature in regards to how best to rehabilitate persons with dementia and hip fracture (94). At a minimum, physicians need to look for reversible causes of cognitive impairment (95, 96) and, where appropriate, enter these patients into cognitive stimulation therapy (97, 98). All patients with hip fracture

should be screened for cognitive dysfunction using either using the Rapid Cognitive Screen (99), the Saint Louis University Mental Status (SLUMS) examination (100) or the Montreal Cognitive Assessment (101) at some point during their hospital or rehabilitation stay. This is imperative in order to achieve better outcomes because persons with cognitive dysfunction will need help with taking their medicines and adhering to an exercise regimen post-hip fracture.

Prevention of a Second Hip Fracture

Persons who have had a first hip fracture are at high risk of developing a second hip fracture (102). Prevention requires a focus on reducing fall risk and improving bone health. Approximately a third of falls in older persons are due to syncope caused by either orthostasis, postprandial hypotension or arrhythmias (103-106). These should be individually worked up and excluded. Arrhythmias are frequently undetected and underdiagnosed and the patient may benefit from an implantable arrhythmia monitor (107) in order to improve diagnosis. Involvement in a program of resistance and balance exercises can augment both bone health and fall risk (108). Vision should be improved where possible to minimize falls (108). Similarly, polypharmacy and inappropriate medications should be addressed (109) and drugs that increase hip fracture such as antipsychotics (110) or selective serotonin reuptake inhibitors (111) should be avoided.

For bone health all patients should receive calcium and vitamin D (approximately 1000 IU/day). Total (including dietary) calcium intake should not be greater than 1200 mg per day as higher doses may be associated with myocardial infarction and/or dementia (112, 113). Optimal calcium should be taken at night before going to sleep. Yogurt, either fortified or not with supplemental calcium and vitamin D, may be a reasonable alternative (112). Measurement of total 25-hydroxyvitamin D should be avoided as the presence of its binding protein makes its value difficult to determine in different ethnic populations and is not a cost-effective laboratory test (114). Older persons with hip fractures will most likely have osteoporosis and should be treated with bisphosphonates (alendronate or zoledronic acid) or the more expensive denosumab. Bisphosphonates have been shown to decrease the risk of a second hip fracture (115). There is no evidence that bisphosphonates delay bone healing, so they should be started prior to discharge from the hospital. After five years of treatment, a bone mineral density test should be obtained and a decision of whether or not to continue the drug should be made, taking into account the low risk of atypical fractures. Romosozumab is a monoclonal antibody that inhibits sclerostin. A 12 month treatment with this antibody is 38% more effective at preventing hip fracture than alendronate. However, it does have an increase in cardiovascular events (116, 117).

In summary, elderly hip fracture patients receiving care by

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a collaborative team of geriatricians and orthopedic surgeons have better overall outcomes. Geriatricians can screen patients for conditions, such as dementia, delirium, sarcopenia, polypharmacy, weight loss, and frailty that are likely to confer poorer outcomes and targeted interventions can be put in place to maximize potential recovery and functional status following hip fractures.

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