Best Practices for Elderly Hip Fracture Patients

A Systematic Overview of the Evidence

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OBJECTIVES: To determine evidence-based best practices for elderly hip fracture patients from the time of hospital admission to 6 months postfracture.

DATA SOURCES: MEDLINE, Cochrane Library, CINAHL, Embase, PEDro, Ageline, NARIC, and CIRRIE databases were searched for potentially eligible articles published between 1985 and 2004.

REVIEW METHODS: Two independent reviewers determined studies appropriate for inclusion using standardized selection criteria, extracted data, evaluated internal validity, and then rated studies according to levels of evidence. Only Level 1 or 2 evidence was included in our summary of clinical recommendations.

RESULTS: Spinal anesthesia, pressure-relieving mattresses, perioperative antibiotics, and deep vein thromboses prophylaxes had consistent evidence of benefit. Routine preoperative traction was not associated with any benefits and should be abandoned. Types of surgical management, postoperative wound drainage, and even "multidisciplinary" care, lacked sufficient evidence to determine either benefit or harm. There was little evidence to either determine best subacute rehabilitation practices or to direct ongoing medical issues (e.g., nutrition). Studies conducted during the subacute recovery period were heterogeneous in terms of treatment settings, interventions, and outcomes studied and had no clear evidence for best treatment practices.

CONCLUSIONS: The evidence for perioperative practices is relatively robust and evidence-based perioperative treatment guidelines can be easily established. Conversely, more evidence is required to better guide the care of elderly patients with hip fracture during the subacute recovery period and convalescence.

KEY WORDS: systematic review; geriatrics; hip fracture; postoperative care.
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Hip fracture represents the second leading cause of hospitalization for elderly people.[1] Incidence increases substantially with age, rising from 22.5 and 23.9 per 100,000 population at age 50 to 630.2 and 1289.3 per 100,000 population by age 80, for men and women, respectively.[2–5] Following a hip fracture, patients have increased health service utilization for at least 1 year, with much of health care costs attributable to subsequent long-term care.[2,6–8] Identifying best practices for elderly hip fracture patients while using available health resources effectively and efficiently is relevant to both clinicians and policymakers.

Standardized care, based upon current "best evidence," constitutes 1 approach to facilitate optimal outcomes and resource use. We conducted a systematic literature review of management of this patient population, examining all practices throughout the care continuum from preoperative assessment through surgical management and subsequent rehabilitation. Because our systematic review examined a broad array of treatment practices, we included not only individual studies, but also systematic reviews of specific treatment practices where available. Some of the clinical areas investigated apply to elderly patients in general, but are still important aspects of care for hip fracture patients (e.g., pressure sore prevention); thus these components were also included in our review. Our intent was to identify those evidence-based practices that should be considered a part of routine high quality care for all hip fracture patients.

METHODS

Data Sources

A detailed literature search strategy was implemented to identify potential articles published between 1985 and 2004 using MEDLINE, Cochrane Library, CINAHL, Embase, PEDro, Ageline, NARIC, and CIRRIE databases (Appendix 1). Clinical practice guideline websites and reference lists of key articles were searched, and content experts questioned to capture further literature. The search strategy yielded 1,419 abstracts for review; 277 abstracts were excluded from indepth review because they did not address our study question (Figure 1).

Eligibility Criteria

Specific eligibility criteria are described in Figure 1. Our inclusion criteria necessarily spanned a wide range of study designs, interventions, and outcomes. The target population was patients over age 65 years. For surgical interventions, only randomized study designs were considered acceptable. All studies required a comparison group or detailed and appropriately risk-adjusted analyses.

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Study Selection

For potentially eligible abstracts ($n=1,142$), 2 reviewers, blinded to authorship and journal, independently assessed studies for inclusion/exclusion using standardized criteria regarding study design, interventions, and outcomes (Figure 1). Noninterventional studies describing factors affecting outcomes were evaluated to look for potentially modifiable risk factors (e.g., surgical delay). Observational studies examining only nonmodifiable risk factors (e.g., age) were excluded. The κ statistic, a test of interrater reliability, was "substantial" ($\kappa=0.68$) for abstract selection.[9]

Following abstract evaluation, the full text article was retrieved for potentially eligible studies ($n=290$) and evaluated by the same 2 reviewers. When the reviewers did not agree on article selection, they undertook a third review of the article together. Consensus was attained in all cases on the combined review. The κ statistic for the full text review was "moderate" ($\kappa=0.52$).[9]

Data Extraction

Following study selection, the 2 reviewers independently extracted information regarding study population, design, interventions, and outcomes onto standardized data collection sheets.

Data Evaluation

These same reviewers independently assessed studies for internal validity using standard published criteria (Figure 1).[10] Studies were rated as "Excellent" if they met all criteria, "Good" if they met at least 75%, and "Fair" if they met between 60% and 74% of validity criteria.

To be included in our final summary of clinical recommendations, studies had to rate as Level 1 or 2 evidence. Level 1 evidence was one or more high quality randomized clinical trials (RCT) or systematic reviews, while Level 2 evidence was one or more high quality observational studies.[11]

Data Syntheses

For clinical areas, where a systematic review of sound methodological quality had previously been undertaken, only studies subsequent to the review were included. To prevent duplication, we did not include individual studies contained in the systematic review, unless there was additional information not included in the review. Eighty-two RCTs were excluded because their results were encapsulated within a systematic review (Figure 1). Fifty articles were included in the syntheses.

RESULTS

We present our main results along the temporal continuum from time of hospital admission through final rehabilitation. Data are listed as relative risks (RR), hazard ratios (HR), or odds ratios (OR) with their respective 95% confidence intervals (CI) to allow for comparisons between studies and across interventions. Finally, we summarized and tabulated our recommendations for clinical practice according to the interventions examined and the level of evidence provided (Table 1). Web tables are available for more complete data review.

Preoperative Care

Three components of preoperative care were identified that had sufficient published evidence to determine best practice: use of preoperative traction, pressure sore prevention, and the effect of surgical delay (Table 1).

Preoperative Traction. Preoperative skin or skeletal traction, standard care in this patient population, consists of 5 to 10 pounds applied to the lower leg, and is intended to decrease preoperative pain and assist with fracture reduction. However, we found a systematic review of 7 high-quality studies (1,271 participants) that reported no benefits for traction use.[12] There were no differences in pain with or without the use of traction on either the first (RR=1.14 (0.89, 1.46)) or second (RR=1.02 (0.74, 1.41)) postoperative day.[12] One trial indicated that analgesic use increased with preoperative traction use (RR=1.78 (1.16, 2.7)).[13] Further, traction did not improve the ease of fracture reduction (RR=1.02 (0.34, 3.00)).[12]

Pressure Sore Prevention. Pressure sores are common following hip fracture, with reported postfracture incidence rates ranging from 10% to 40%.[14–16] Pressure sores represent a major burden of illness as patients who develop pressure sores have increased risk of nosocomial infection and prolonged hospitalization.[14,17]

Within a systematic review (16 RCTs) of patients requiring prolonged hospitalization, 2 trials (214 participants) examined pressure sore prevention compared with standard care in elderly orthopaedic patients.[17] These 2 trials reported that foam and alternating pressure mattresses reduced the incidence of pressure sore development (RR=0.34 (0.14, 0.85)) and (RR=0.20 (0.09, 0.45)), respectively) compared with usual care.[17]

Minimizing Surgical Delay. Time to surgical fixation has been examined in several studies, some reporting adverse effects of surgical delay while others reported minimal negative consequences.[18–27] Determining the effect of time to surgery on patient outcomes is difficult, because RCTs have not been considered feasible or ethical, and only Level 2 evidence is available.

In cohort studies utilizing appropriate risk adjustment, surgical delay was associated with an increase in adverse outcomes.[20–23] Hamlet et al.[21] reported increased mortality at 3 years if surgery was delayed beyond 24 hours, even after adjusting for preoperative severity of illness. In contrast, in a much larger and methodologically rigorous study, Grimes et al.[20] found no increased mortality in patients who waited more than 96 hours for surgery compared with those who had surgery within 48 hours after adjustment for comorbidities (HR=1.07 (0.95, 1.21)), suggesting that patients who had delayed surgery were sicker than those not experiencing surgical delay.

Delay in surgery was, however, associated with increased risk of decubitus ulcer (OR=2.2 (1.6, 3.1)).[20] Early surgical intervention also significantly reduced major medical complications, compared with delays beyond 48 hours in the patients who were rated as most ill on hospital admission.[22] Orosz et al.[23] reported surgery performed within 24 hours of admission decreased time with severe or very severe preoperative pain (-0.22 days (-0.41, -0.03)), decreased average hospital length of stay (LOS) by almost 2 days (1.94

Table 1. Clinical Recommendations

Intervention	Outcome(s) Assessed	Recommendation	Level of Evidence*
Preoperative			
Preoperative traction	Analgesic use Ease of fracture reduction	Preoperative traction demonstrates no benefit	1[12–13]
Pressure sore prevention	Incidence of pressure sores	Pressure-reducing mattresses appear to be beneficial in reducing pressure sore development	1[17]
Surgical delay	Mortality Major complications Decubitus ulcer Preoperative pain	Surgery should be performed once patient is medically stable, within 24 h if possible	2[20–23]
Perioperative			
Conservative management	Nonunion, leg shortening and deformity	Operative treatment is better than conservative treatment	1[31]
Surgical management			
Intertrochanteric	Operative details (length of surgery, blood loss, transfusion requirements) Fixation complications (nonunion, reoperations) Anatomical restoration (limb shortening, deformity) Function, pain, mortality	Sliding hip screw fixation should be considered standard of treatment Short femoral nails (i.e., short Gamma) should not be used (increased risk of postoperative fracture around implant) Long femoral nails may be superior to sliding screw fixation for treatment of reverse obliquity and subtrochanteric fractures Ender's nails should not be used	1[28, 32–34, 38]
Subcapital	Operative details (length of surgery, blood loss, transfusion requirements) Fixation complications (nonunion, reoperations) Anatomical restoration (limb shortening, deformity) function, pain, mortality	Screws are better than pins for nondisplaced fractures Cemented arthroplasties are superior to noncemented Bipolar implants have no advantages over unipolar implants Choice of hemiarthroplasty versus internal fixation is dependent upon patient factors/surgeon preference, but displaced fractures should be treated with hemiarthroplasty or total hip arthroplasty	1[29–30, 35–37, 39]
Anesthetic	Mortality Morbidity	Regional anesthesia should be used whenever possible	1[40–41]
Deep vein thromboses (DVT) prophylaxis	Mortality Morbidity (DVT, pulmonary embolus)	DVT prophylaxis in the form of any heparin or fondiparinux for 10 days postoperatively, or mechanical pumping should be used	1[43–45]
		Vitamin K antagonists may be used for 10 days postoperatively with a target international normalized ratio of 2.5 (2.0 to 3.0 acceptable)	1[45]
		DVT prophylaxis should be commenced preoperatively if surgery is delayed	1[45]
Antibiotic prophylaxis	Morbidity (wound infection, urinary and respiratory tract infections)	Antibiotics should be used preoperatively for all patients	1[46]
Postoperative wound drainage	Morbidity (Wound infection, wound healing, transfusions, dressing changes, reoperation)	Postoperative drains may not be required	1[47]
Urinary tract management	Urinary retention	Intermittent catheterization is superior to indwelling catheterization	1[50†]
Perioperative pain control	Pain Analgesic use	Epidural pain management may reduce myocardial ischemia in addition to reducing perioperative and postoperative pain	1[52–53]
Early postoperative (up to 7 to 10 days)			
Nutritional assessment and treatment	Mortality Morbidity Function Maintenance of lean body mass	Nutrition should be assessed Protein supplementation should be considered for malnourished patients	1[57–59]
Multidisciplinary care	Function Morbidity Length of stay Mortality	Effectiveness of multidisciplinary care compared with usual care is unclear Presence of mild or moderate dementia should not preclude inclusion in a rehabilitation program	1 and 2[60–69] 1[70,78]
Rehabilitation/discharge planning			
Rehabilitation setting Homecare Subacute Rural versus urban Outpatient	Function Length of stay Institutionalization Activity of daily living mobility Ambulation	No clear benefit has been demonstrated between different settings for the specified outcomes Patients can respond positively to exercise programs following hip fracture	1 and 2[60,62,64,68,72–75,77] 1[71,76]

*Level 1, at least one good quality Randomized Clinical Trial (RCT); Level 2, at least one good quality observational study.
†Only 1 randomized trial to support that recommendation.

(1.06, 2.82)) and was associated with reduced major medical complications (OR=0.26 (0.07, 0.95). Further, early surgical repair was associated with earlier ambulation compared with delayed surgical repair.[22]

Perioperative Care

Perioperative care was defined as the immediate preoperative time through initial postoperative days to attainment of medical stability. Evidence-based perioperative interventions included surgical and anesthetic management (Table 2), deep vein thrombosis (DVT) and antibiotic prophylaxes, and other general medical care (e.g., wound drainage and pain control) (Table 3).

Surgical Management. Despite numerous clinical trials regarding specific surgical techniques, best practices remain unclear, particularly for femoral neck fractures.[28–39] A compression screw plate device is considered to be the standard of care for intertrochanteric or extracapsular fractures.[28,32–34,38] Surgical management of femoral neck or intracapsular fractures is dependent upon patient age, activity level, health status, and surgeon preference.[29,30,35–37,39] Few studies have examined conservative treatment because operative management is considered superior if patients are medically fit for surgery.[31]

Type of Anesthesia. Use of general anesthetics in elderly patient populations has been associated with increased postoperative delirium.[40] A systematic review of 22 trials (2,567 participants) demonstrated reduced risk of mortality at 1 month postfracture (RR=0.69 (0.50, 0.95)) and DVT (RR=0.64 (0.49, 0.95)) with use of regional anesthesia.[41] Another recent systematic review of 141 studies (9,559 participants), demonstrated a clear benefit for regional anesthesia in terms of mortality (OR=0.68 (0.53, 0.88)).[40] Although the review included several surgical procedures, 44 (31%) of 141 study populations were elderly orthopedic patients. This review also reported a reduction in DVT (OR=0.56 (0.43, 0.72)), pulmonary embolism (PE) (OR=0.45 (0.29, 0.69)), transfusion requirements (OR=0.50 (0.39, 0.66)), and pneumonia (OR=0.61 (0.48, 0.76)) with regional compared with general anesthesia.

DVT Prophylaxis. Following hip fracture surgery, patients are at increased risk of DVT with incidence rates of 27% for proximal DVT.[26,42] Incidence rates for fatal PE range from 1.4% to 7.5% in the first 3 months following hip fracture surgery.[26]

Thirty-two studies (3,614 participants) of adult hip fracture patients consistently demonstrated that DVT prophylaxis reduced the incidence of DVT and PE.[43,44] The use of any heparin treatment versus no treatment (13 trials; 1,199 participants; RR=0.60 (0.50, 0.71)) or a mechanical pumping device versus no treatment (5 trials; 451 participants; RR=0.31 (0.19, 0.51)) significantly reduced the risk of DVT.[44] No significant differences were detected between unfractionated or fractionated heparins in this review.[44] The Seventh American College of Chest Physicians Conference on Antithrombotic and Thrombolytic Therapy currently recommends the routine use of fondiparinux, or heparin of any type for at least 10 days.[45] They also suggest that a vitamin K antagonist may be used for 10 days with a target international normalized ratio of 2.5 (minimum–maximum 2.0 to 3.0).[45] If surgery is to be significantly delayed, any type of heparin treatment is recommended between hospital admission and surgery.[45]

Antibiotic Prophylaxis. In 22 RCTs (8,307 participants) of adult patients with closed long bone fracture fixation, of which 16 trials were hip fracture patients, antibiotic prophylaxis decreased the incidence of deep wound infections (RR=0.36 (0.21, 0.65)) and urinary tract infections (RR=0.66 (0.43, 1.0)).[46] A single antibiotic dose with tissue effects lasting greater than 12 hours (e.g., cefazolin 1 g intravenously) or multiple doses of antibiotics with shorter half-lives were seemingly equivalent.[46]

Postoperative Wound Drainage. Suction wound drainage, routine practice in many hospitals, is implemented to promote postoperative wound healing by preventing large hematoma formation.[47] This technique, however, has an inherent risk of increasing postoperative infection through the creation of a portal to deep tissues.

A systematic review of 3 RCTs (333 participants) found no significant differences reported in rates of infection (RR=0.53 (0.21, 1.35)), reoperation for wound healing problems (RR=4.1 (0.47, 36.1)), or transfusions (RR=1.16 (0.84, 1.61)) with the use of wound drains in hip fracture patients.[47]

Urinary Tract Catheterization. Following hip fracture, the incidence rate of urinary tract infection is 23% to 25%.[48,49] Despite this high rate, very few studies have examined catheterization methods used in this patient population. The 1 RCT performed, reported that normal voiding pattern was resumed on average 4.3 (0.7, 8.0) days earlier with intermittent rather than indwelling catheterization for patients with postoperative urinary retention (P=.01).[50]

Perioperative Pain Control. Patients with poorly controlled perioperative pain have reported increased hospital LOS, delayed ambulation, and decreased 6-month mobility.[51] Little evidence exists regarding appropriate analgesia for patients with a hip fracture.

Two RCTs (145 participants) reported epidural pain management reduced perioperative cardiac complications; one reported decreased intraoperative myocardial ischemia (RR=0.13 (0.02, 0.97)) [52] and the other decreased preoperative cardiac events (cardiac death, myocardial infarction, unstable angina, heart failure, or new onset atrial fibrillation) (P=.01).[53] Both trials reported decreased perioperative and/or postoperative pain compared with usual analgesia. No evidence was found regarding specific narcotic agents, other than an expert-based consensus statement recommending avoidance of codeine and meperidine.[54]

Early Postoperative Care (up to 7 to 10 days Postoperative)

Following medical stabilization, the primary treatment goals focus on rehabilitation. Studies performed during this period were extremely heterogeneous in terms of interventions undertaken and outcomes measured, making it difficult to define best practices.

Optimizing Nutrition. Poor nutritional status is common in the hip fracture population and appears to be independently associated with increased morbidity and mortality.[55,56] Interventions to address malnutrition following a hip fracture have focused primarily on initial recovery in hospital settings.

Protein/vitamin supplements or nasogastric feeding have been examined in 15 trials (1,054 participants) and reduced long-term complications (RR=0.52 (0.32, 0.84)) but did not affect mortality (RR=0.92 (0.56, 1.50)).[57] One RCT (62 participants) reported patients receiving oral nutritional supplementation had a reduced hospital LOS and were less likely to experience major complications.[58] Continuation of an intervention (oral protein supplementation plus nandrolone decanoate) for 6 months following fracture increased albumin levels and maintained lean body mass better than oral protein supplementation only or usual care.[59]

Multidisciplinary Care. Multidisciplinary care involves team-based management, and typically consists of a medical practitioner and multiple other health professionals (e.g., at least Nursing and Physical Therapy) who plan treatment to meet patients' complex care needs. Despite numerous studies, no clear Level 1 evidence exists that multidisciplinary care with early mobilization affords better outcomes in terms of mortality, morbidity, function, or service utilization than usual care. Metaanalysis of such studies is difficult because of heterogeneity caused by diverse interventions, patient outcomes, and measures used to assess the intervention effect.[60–68] Some studies suggest standardized multidisciplinary care reduced LOS in hospital, while others suggested it increased LOS (Table 4).[61–70]

Subacute Rehabilitation and Discharge Planning

Following the initial postoperative period, once the patient is medically stable, treatment focuses on discharge planning and subacute rehabilitation. Few studies have demonstrated a clear benefit among different rehabilitation settings or timing of rehabilitation in terms of patients' functional outcomes and service utilization, despite the surfeit of studies.[22,60–64,67,68,71–77]

Although evidence is sparse, presence of dementia should not preclude inclusion in a rehabilitation program.[70,78] In a subgroup analysis of patients with dementia, 1 RCT (141 participants) reported the median LOS for patients with mild and moderate dementia in a group receiving multidisciplinary inpatient rehabilitation was significantly reduced compared with controls (Table 4).[70]

Rehabilitation Setting. Cameron et al.[60] in a systematic review of 9 RCTs (1,887 participants) comparing different formats of inpatient rehabilitation reported heterogeneous effects on costs and LOS. Using a combined index of death or dependency, no difference was seen between intensive rehabilitation and usual care (RR=0.93 (0.83, 1.05)) (Table 4). Kiusma et al.[74] reported patients discharged home with physical therapy had better ambulation at 1 year than patients who underwent inpatient rehabilitation (P=.01) (Table 4).

Tinetti et al.[77] reported that multidisciplinary homecare (structured physical and occupational therapy) did not result in improved outcomes compared with usual homecare (physical therapy as determined by individual therapists). Similar proportions of patients regained prefracture levels in activities of daily living by 6 months postfracture, although the increased homecare group showed a trend towards better gait assessed qualitatively (P=.08) (Table 4). Patient characteristics (e.g., age, social support and prefracture function) determine the type of rehabilitation.[72,73,75] Patients with greater dysfunction were more likely to receive some form of institutional care for prolonged periods.

PostHospitalization Rehabilitation. Binder et al.[71] and Sherrington et al.[76] demonstrated that strengthening programs are effective following hip fracture. Patients in the intervention groups, which consisted of strength training of various types, showed modest gains in strength and function compared with patients following usual care (Table 4).

DISCUSSION

We found that a number of practices in the management of hip fracture patients have a strong evidentiary basis and should be considered part of routine high quality care (Table 1). Although some findings may seem fairly self-evident, we also found that many routine practices were not supported by published literature. For example, high-quality evidence demonstrated that use of preoperative traction, while common, was associated with harms and no net clinical benefits—this is clearly a practice that ought to be abandoned. Conversely, the intuitively sensible offering of multidisciplinary care with early mobilization was not definitively associated with better outcomes than usual care. As usual care in most surgical hospitals may already be "multidisciplinary" to some degree (Medicine, Nursing, and Physical Therapy at a minimum), the incremental benefit of any studied multidisciplinary intervention, over and above usual care, may be prohibitively difficult to ascertain. Further, LOS, which is a commonly assessed outcome of effectiveness of multidisciplinary care, is highly dependent upon how rehabilitation services are organized and located, making crossstudy comparisons difficult.

For the most part, evidence-based care for the hip fracture population in the perioperative period is reasonably well defined. We, unlike others,[79–81] included in our summary of practice recommendations only those practices for which Level 1 or 2 evidence is available. Gaps in knowledge regarding delivery of perioperative care still exist (e.g., urinary tract management) despite the many studies performed. We believe, however, that standardized evidence-based perioperative treatment guidelines can be established for many treatment areas for the typical elderly patient with a hip fracture (Table 1).

Standardization of care (medical and rehabilitation) would also be expected to streamline practice and improve the quality of care, although we acknowledge this hypothesis ought to be more rigorously tested. Nonetheless, several clinical areas require much further investigation. Of particular note is the lack of evidence available in the subacute recovery period, commencing after postoperative day 7 to 10, where very little research has been conducted. Summarizing the limited available evidence is further hindered by heterogeneity in study settings and interventions assessed.[71–77] Investigation as to type and extent of rehabilitation and nutritional services is needed in subacute settings (e.g., long-term care, regional hospitals, homecare) as is greater consideration of secondary prevention measures for recurrent fracture (e.g., falls management, osteoporosis treatment).

In summary, our systematic review found evidence to support many facets of preoperative and perioperative care for elderly hip fracture patients. These treatment practices could likely be applied in most acute care settings. Standardization of these practices could be expected to improve quality of care and outcomes. Nevertheless, much work remains to

define all of the best practices for hip fracture care and determine how best to deliver them within a seamless health care continuum.

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Supplementary Material

The following supplementary material is available for this article online:

Appendix 1. Literature Search Strategies.

Figure 1. Flowchart of Review Process.

Table 1. Preoperative Medical Management.