

Management of Hip Fractures in Older Adults

Evidence-Based Clinical Practice Guideline

Adopted by:

The American Academy of Orthopaedic Surgeons Board of Directors
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Endorsed by:



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Disclaimer

This clinical practice guideline (CPG) was developed by a physician volunteer clinical practice guideline development group based on a formal systematic review of the available scientific and clinical information and accepted approaches to treatment and/or diagnosis. This clinical practice guideline is not intended to be a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. Clinical patients may not necessarily be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment, given the individual patient's specific clinical circumstances.

Disclosure Requirement

In accordance with AAOS policy, all individuals whose names appear as authors or contributors to the clinical practice guideline filed a disclosure statement as part of the submission process. All panel members provided full disclosure of potential conflicts of interest prior to voting on the recommendations contained within this clinical practice guideline.

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SUMMARY OF RECOMMENDATIONS

Recommendations are formed when there is sufficient evidence by which to create a directional statement. This is defined as evidence from two or more high quality studies (i.e., a strong recommendation), two or more moderate quality studies (i.e., a moderate recommendation), or statements resulting in a strong or moderate strength following Evidence to Decision Framework upgrading and/or downgrading.

PREOPERATIVE TRACTION

Preoperative traction should not routinely be used for patients with a hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

SURGICAL TIMING

Hip fracture surgery within 24-48 hours of admission may be associated with better outcomes.

Quality of Evidence: Low

Strength of Recommendation: Moderate ★★★☆☆ (Upgraded)

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention. Recommendation was upgraded based on EtD framework.

VENOUS THROMBOEMBOLISM PROPHYLAXIS

Venous thromboembolism (VTE) prophylaxis should be used in hip fracture patients.

Quality of Evidence: Moderate

Strength of Recommendation: Strong ★★★★★ (Upgraded)

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention. Recommendation was upgraded based on EtD framework.

ANESTHESIA

Either spinal or general anesthesia is appropriate for patients with a hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.

UNSTABLE FEMORAL NECK FRACTURES – Arthroplasty vs Fixation

In patients with unstable (displaced) femoral neck fractures, arthroplasty is recommended over fixation.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.

UNIPOLAR/BIPOLAR HEMIARTHROPLASTY

In patients with unstable (displaced) femoral neck fractures, unipolar or bipolar hemiarthroplasty can be equally beneficial.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★★★

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

UNSTABLE FEMORAL NECK FRACTURES - Total Arthroplasty vs Hemi Arthroplasty

In properly selected patients with unstable (displaced) femoral neck fractures, there may be a functional benefit to total hip arthroplasty over hemiarthroplasty at the risk of increasing complications.

Quality of Evidence: High

Strength of Recommendation: Moderate ★★★★★ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Recommendation was downgraded based on EtD framework.

CEMENTED FEMORAL STEMS

In patients undergoing arthroplasty for femoral neck fractures, the use of cemented femoral stems is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

SURGICAL APPROACH

In patients undergoing treatment of femoral neck fractures with hip arthroplasty, evidence does not show a favored surgical approach.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★★★

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

CEPHALOMEDULLARY DEVICE – STABLE INTERTROCHANTERIC FRACTURES

In patients with stable intertrochanteric fractures, use of either a sliding hip screw or a cephalomedullary device is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

CEPHALOMEDULLARY DEVICE – SUBTROCHANTERIC/REVERSE OBLIQUITY FRACTURES

In patients with subtrochanteric or reverse obliquity fractures a cephalomedullary device is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

CEPHALOMEDULLARY DEVICE – UNSTABLE INTERTROCHANTERIC FRACTURES

Patients with unstable intertrochanteric fractures should be treated with a cephalomedullary device.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

TRANSFUSION

A blood transfusion threshold of no higher than 8g/dl is suggested in asymptomatic postoperative hip fracture patients.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★★★

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

MULTIMODAL ANALGESIA

Multimodal analgesia incorporating preoperative nerve block is recommended to treat pain after hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

TRANEXAMIC ACID

Tranexamic acid should be administered to reduce blood loss and blood transfusion in patients with hip fractures.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

INTERDISCIPLINARY CARE PROGRAMS

Interdisciplinary care programs should be used in the care of hip fracture patients to decrease complications and improve outcomes.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.

SUMMARY OF OPTIONS

Options are formed when there is little or no evidence on a topic. This is defined as low quality evidence or a single moderate quality study (i.e., a limited strength option), no evidence or only conflicting evidence (i.e., a consensus option), or statements resulting in a limited or consensus strength following Evidence to Decision Framework upgrading and/or downgrading.

STABLE FEMORAL NECK FRACTURES

In patients with stable (impacted/non-displaced) femoral neck fractures, hemiarthroplasty, internal fixation or non-operative care may be considered.

Quality of Evidence: Moderate

Strength of Option: Limited  (Downgraded)

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

CEPHALOMEDULLARY DEVICE – PERTROCHANTERIC FRACTURES

In patients with pertrochanteric femur fractures, short or long cephalomedullary nail may be considered.

Quality of Evidence: Low

Strength of Option: Limited 

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention.

WEIGHT BEARING

Following surgical treatment of hip fractures, immediate, full weight bearing to tolerance may be considered.

Quality of Evidence: Low

Strength of Option: Limited 

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention.

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INTRODUCTION

OVERVIEW

This clinical practice guideline is based on a systematic review of published studies examining the surgical treatment of hip fractures in adults age 55 years and older (older adults). It provides recommendations that will help practitioners to integrate the current evidence and clinical practice, and it highlights gaps in the literature in need of future research. This guideline is intended to be used by appropriately trained physicians and clinicians who manage the treatment of hip fractures in older adults. It also serves as an information resource for developers and applied users of clinical practice guidelines.

GOALS AND RATIONALE

The purpose of this clinical practice guideline is to evaluate the current best evidence associated with treatment. Evidence-based medicine (EBM) standards advocate for use of empirical evidence by physicians in their clinical decision making. To assist with access to the large resources of information, a systematic review of the literature in publication was conducted between March 2020 and July 2021. It highlights where there is good evidence, where evidence is lacking, and what topics future research will need to target in order to help facilitate evidence-based decision making in the treatment of older adult patients with hip fracture. AAOS staff methodologists assisted the physician/clinician work group in evaluating the existing literature so that they could formulate the following recommendations based on a rigorous systematic process. Musculoskeletal care is provided in many different settings and by a variety of providers. We created this guideline as an educational tool to guide qualified physicians and clinicians in making treatment decisions that improve the quality and efficacy of care. This guideline should not be construed as including all possible methods of care or excluding acceptable interventions similarly directed at obtaining favorable outcomes. The final decision to use a specific procedure must be made after assessing all concerns presented by the patient and consideration of locality-specific resources.

INTENDED USERS

This guideline is intended to be used by orthopaedic surgeons and other healthcare providers managing patients with hip fracture in older adults. This includes adult primary care physicians, geriatricians, hospital based adult medicine specialists, physical therapists, occupational therapists, nurse practitioners, physician assistants, emergency physicians, and other healthcare professionals who routinely see this type of patient in various practice settings. It serves as an information resource for medical practitioners. In general, individual practicing physicians and clinicians do not have the resources required to complete a project of comparable scope and duration involving the evaluation of an extensive literature base. In April 2019, the AAOS adopted the use of the GRADE Evidence-to-Decision Framework into its clinical practice guideline development methodology. This Framework enables work group members to incorporate additional factors into the strength of each recommendation and move away from the rigidity of previous AAOS recommendation language stems. The AAOS intends for this guideline to assist treatment providers not only in making shared clinical decisions with their patients, but also in describing to patients and their loved ones why a selected intervention represents the best available course of treatment. This guideline is not intended for use as a benefits determination document. It does not cover allocation of resources, business and ethical considerations, and other factors needed to determine the material value of orthopaedic care. Users of this guideline may also want to consider the appropriate use criteria (AUC) related to the treatment of hip fracture in older adult patients.

PATIENT POPULATION

This guideline is intended for use with adults aged 65 years and older who have been diagnosed by a trained healthcare provider with hip fracture. (The lower limit for our patient population was set at 55 years of age but was also required to have an average age of 65 years).

SCOPE

As defined by the scope of this CPG, prevention of primary or secondary hip fractures or post-hospital rehabilitation are not addressed in this document. These subjects remain critically important to the holistic care of the geriatric patient and those who have sustained a hip fracture. The reader is encouraged to view these external CPGs and references for further information.

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ETIOLOGY

Hip fractures in older adults are most often the result of low energy trauma. These fractures are usually associated with osteoporosis or impaired bone strength. Other conditions, such as history of falls or frailty, may also predispose to hip fracture risk.

INCIDENCE AND PREVALENCE

With increasing life expectancy, the number of older individuals at risk for hip fracture will increase over time.

RISK FACTORS

Risk factors for an older adult sustaining a hip fracture include, but are not limited to, increasing age, low bone density, impaired balance, gait disturbance, poor vision, and hazardous living

environments (such as cluttered spaces, throw rugs, or a lack of grab bars where appropriate). Race and ethnicity are also non-modifiable risk factors that can play an important role in patient outcomes.

BURDEN OF DISEASE

Although the age-standardized incidence of hip fracture is falling in many developed countries, the aging of the world population results in an increased overall number of hip fractures globally. Thus, the number of hip fractures in older adults that occur globally is expected to increase from 1.26 million in 1990 to 4.5 million by the year 2050 (Veronese).

Between 1986 and 2005, the annual mean number of hip fractures in the US was 957.3 per 100 000 (95% confidence interval [CI], 921.7-992.9) for women and 414.4 per 100 000 (95% CI, 401.6-427.3) for men. The majority of fractures in both men and women occurred among those aged 75-84 years. The overall mortality for hip fracture is 24% at one year. However, for some of the most vulnerable hip fracture patients (i.e., nursing home residents), the 6-month mortality is as high as 36% for all, and 46% for men (Brauer).

Older patients who sustain hip fractures are at risk for:

1. Increased rates of mortality (Guzon-Illescas).
2. Increased rates of morbidity (Veronese).
3. Decreased quality of life (Alexiou).
4. Increased rates of depression (Alexiou, Veronese).
5. Decreased levels of mobility and ambulation (Dyer).
6. Increased rates of subsequent fractures (Balasubramanian).
7. Increased need for enhanced level of care and supervision (Konda).

A typical older adult patient who has sustained a hip fracture will incur over \$50,000/year in medical costs (Adeyemi).

POTENTIAL BENEFITS, HARM, AND CONTRAINDICATIONS

Hip fracture in an older adult patient is typically a life-altering event requiring surgical treatment with the associated risks. Recovery to pre-fracture level of function is often unsuccessful and may occur in less than 50% of patients, regardless of their previous level of function (Tang). The aim of treatment of hip fracture in the older adult is to provide pain relief and restoration of function. For the vast majority of fractures, surgical treatment is indicated and carries greater potential benefit than harm. While there are more hip fractures in women than men, there may be important sex and gender differences in hip fracture and this CPG does not explore or address such potential differences. Future research may result in a better understanding of how a patient's sex and gender alter treatment benefits and harms.

DIFFERENCES BETWEEN THE PRESENT AND PREVIOUS GUIDELINES

This updated clinical practice guideline replaces the first edition that was completed in 2014, "Management of Hip Fractures in the Elderly 1st edition." This update considered the literature that was previously examined as well as the empirical evidence published since the 2014 guideline. Since this last edition, AAOS has updated their study appraisal methodology coinciding with updates to the Cochrane handbook and the ROBINS, QUADAS, and QUIPS tools (full methodology can be found on the AAOS website). Additionally, to align with GRADE methodology, all observational studies are now assigned a base appraisal of low-quality evidence. In April 2019, the AAOS also adopted the use of the GRADE Evidence-to-Decision

Framework into its clinical practice guideline development methodology. This Framework enables work group members to incorporate additional factors into the strength of each recommendation and move away from the rigidity of previous AAOS recommendation language stems. The current guideline also established new parameters for study inclusion, which mandated that in order to be included in our CPG, a study must have included at least 30 patients per comparison group, and that the average age of study participants must be at least 65 years, with the age of individual participants limited to ≥ 55 years. The complete listing of inclusion criteria for this guideline is detailed in the section, “Study Inclusion Criteria,” (eAppendix 1).

METHODS

The methods used to perform this systematic review were employed to minimize bias and enhance transparency in the selection, appraisal, and analysis of the available evidence. These processes are vital to the development of reliable, transparent, and accurate clinical recommendations. To view the full AAOS clinical practice guideline methodology please visit

<https://www.aaos.org/quality/research-resources/methodology/> .

This clinical practice guideline evaluates the management of hip fracture in older adult patient outcomes. The AAOS approach incorporates practicing physicians (clinical experts) and methodologists who are free of potential conflicts of interest relevant to the topic under study, as recommended by clinical practice guideline development experts.¹

This clinical practice guideline was prepared by the AAOS Hip Fracture in Older Adults Guideline physician development group (clinical experts) with the assistance of the AAOS Clinical Quality and Value (CQV) Department (methodologists). To develop this clinical practice guideline, the clinical practice guideline development group held an introductory meeting on November 17, 2019 to establish the scope of the clinical practice guideline. As the physician experts, the clinical practice guideline development group defined the scope of the clinical practice guideline by creating PICO Questions (i.e. population, intervention, comparison, and outcome) that directed the literature search. The AAOS Medical Librarian created and executed the search (see Appendix III for search strategy).

LITERATURE SEARCHES

The systematic review begins with a comprehensive search of the literature. Articles considered were published prior to the start date of the search in a minimum of

three electronic databases; PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials. The medical librarian conducts the search using key terms determined from the guideline development group's PICO questions.

A CQV methodologist will review/include only primary literature but will supplement the electronic search with a manual search of the bibliographies of secondary literature sources, such as systematic reviews, as available. The methodologist will then evaluate all recalled articles for possible inclusion based on the study selection criteria and will summarize the evidence for the guideline work group who assist with reconciling possible errors and omissions. A study attrition diagram is provided in the appendix of each document that details the numbers of identified abstracts, recalled and selected studies, and excluded studies that were evaluated in the CPG. The search strategies used to identify the abstracts is also included in the appendix of each CPG document.

DEFINING THE QUALITY OF EVIDENCE

The quality of evidence for a recommendation is determined by the quality and quantity of included literature for the statement. Statements with evidence from two or more "High" quality studies are considered to have "High Quality Evidence". Statements with evidence from two or more "Moderate" quality studies, or evidence from a single "High" quality study are considered to have "Moderate Quality Evidence". Statements with evidence from two or more "Low" quality studies or evidence from a single "Moderate" quality study are considered to have "Low Quality Evidence". Statements with evidence from one "Low" quality study or no supporting evidence are considered to have "Very Low Quality Evidence" or "Consensus" respectively.

DEFINING THE STRENGTH OF RECOMMENDATION

Judging the quality of evidence is only a steppingstone towards arriving at the strength of a CPG recommendation. The strength of recommendation also takes into account the quality, quantity, and the trade-off between the benefits and harms of a treatment, the magnitude of a treatment's effect, and whether data exists on critical outcomes.

Strength of recommendation expresses the degree of confidence one can have in a recommendation. As such, the strength expresses how possible it is that a recommendation will be overturned by future evidence. It is very difficult for future evidence to overturn a recommendation that is based on many high quality randomized controlled trials that show a large effect. It is much more likely that future evidence will overturn recommendations derived from a few small retrospective comparative studies. Consequently, recommendations based on the former kind of evidence are given a "strong" strength of recommendation and statement based on the latter kind of

evidence are presented as options to the practicing clinician, rather than a directional recommendation, with either a "limited" strength or, in the event of no supporting or only conflicting evidence, a "consensus" strength.

VOTING ON THE RECOMMENDATIONS

The recommendations and their strength were voted on by the guideline development group members during the final meeting. If disagreement between the guideline development group occurred, there was further discussion to see whether the disagreement(s) could be resolved. Recommendations were approved and adopted in instances where a simple majority (60%) of the guideline development group voted to approve; however, the guideline development group had consensus (100% approval) when voting on every recommendation for this guideline. Any recommendation strength upgrade or downgrade based on the Evidence-to-Decision Framework requires a super majority (75%) approval of the work group.

UNDERSTANDING THE QUALITY OF EVIDENCE AND STRENGTH OF STATEMENT

Table I. Level of Evidence Descriptions

Statement Strength	Evidence Quality	Statement Description	Strength Visual
Strong	High*	Evidence from two or more “High” quality studies with consistent findings recommending for or against the intervention. Or Rec is upgraded using the EtD framework.	
Moderate	Moderate*	Evidence from two or more “Moderate” quality studies with consistent findings or evidence from a single “High” quality study recommending for or against the intervention. Or Rec is upgraded or downgraded using the EtD framework.	
Limited	Low*	Evidence from two or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention. Or Rec is downgraded using the EtD framework.	
Consensus*	Very Low, or Consensus*	Evidence from one “Low” quality study, no supporting evidence, or Rec is downgraded using the EtD framework. In the absence of sufficient evidence, the guideline work group is making a statement based on their clinical opinion.	

*Unless statement was upgraded or downgraded in strength, using the EtD Framework

Table II. Interpreting the Strength of a Recommendation or Option

Strength of Recommendation	Patient Counseling (Time)	Decision Aids	Impact of Future Research
Strong	Least	Least Important, unless the evidence supports no difference between two alternative interventions	Not likely to change
Moderate	Less	Less Important	Less likely to change
Limited	More	Important	Change possible/anticipated
Consensus	Most	Most Important	Impact unknown

REVIEW PERIOD

Following the final meeting, the CPG draft undergoes a 3-week review period for additional input from external content experts. Written comments are provided on the structured review form. All reviewers are required to disclose their conflicts of interest.

Specialty societies relevant to the topic are solicited for nominations of individual reviewers approximately six weeks before the final meeting. The review period is announced as it approaches, and others interested are able to volunteer to review the draft. The chairs of the guideline work group review the draft of the guideline prior to dissemination.

Some specialty societies (both orthopaedic and non-orthopaedic) ask their evidence-based practice (EBP) committee to provide review of the guideline. The organization is responsible for coordinating the distribution of our materials and consolidating their comments onto one form. The chair of the external EBP committees provides disclosure of their conflicts of interest (COI) and manages the potential conflicts of their members.

Again, the AAOS asks for comments to be assembled into a single response form by the specialty society and for the individual submitting the review to provide disclosure of potentially conflicting interests. The review stage gives external stakeholders an opportunity to provide evidence-based direction for modifications that they believe have been overlooked. Since the draft is subject to revisions until its approval by the AAOS Board of Directors as the final step in the guideline development process, confidentiality of all working drafts is essential.

The CPG is also provided to members of the AAOS Board of Directors (BOD), members of the Research and Quality Council (RQC), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS) and members of the Committee on Evidence-Based Quality and Value (EBQV) for review and comment. The CPG is automatically forwarded to the AAOS BOD, RQC, and EBQV

so that they may review it and provide comment prior to being asked to approve the document. Based on these bodies, over 200 commentators have the opportunity to provide input into each CPG.

The chairs of the guideline work group, the manager of the AAOS CQV unit, and the Director of AAOS CQV draft the initial responses to comments that address methodology. These responses are then reviewed by the chair and co-chair, who respond to questions concerning clinical practice and techniques. All comments received and the initial drafts of the responses are also reviewed by all members of the guideline development group. All proposed changes to recommendation language as a result of the review period are based on the evidence. Final revisions are summarized in a report that is provided alongside the guideline document throughout the remainder of the approval processes and final publication.

The AAOS believes in the importance of demonstrating responsiveness to input received during the review process and welcomes the critiques of external specialty societies. Following final approval of the guideline, all individual responses are posted on our website <http://www.aaos.org/quality> with a point-by-point reply to each non-editorial comment. Reviewers who wish to remain anonymous notify the AAOS to have their names de-identified; their comments, our responses, and their COI disclosures are still posted.

THE AAOS CPG APPROVAL PROCESS

This final clinical practice guideline draft must be approved by the AAOS Committee on Evidence Based Quality and Value, and subsequently the AAOS Research and Quality Council, and the AAOS Board of Directors. These decision-making bodies are described in the Hip Fracture in Older Adults CPG eAppendix. Their charge is to approve or reject its publication by majority vote.

REVISION PLANS

This clinical practice guideline represents a cross-sectional view of current treatment and may become outdated as new evidence

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becomes available. This clinical practice guideline will be revised in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology. This clinical practice guideline will be updated or withdrawn in five years.

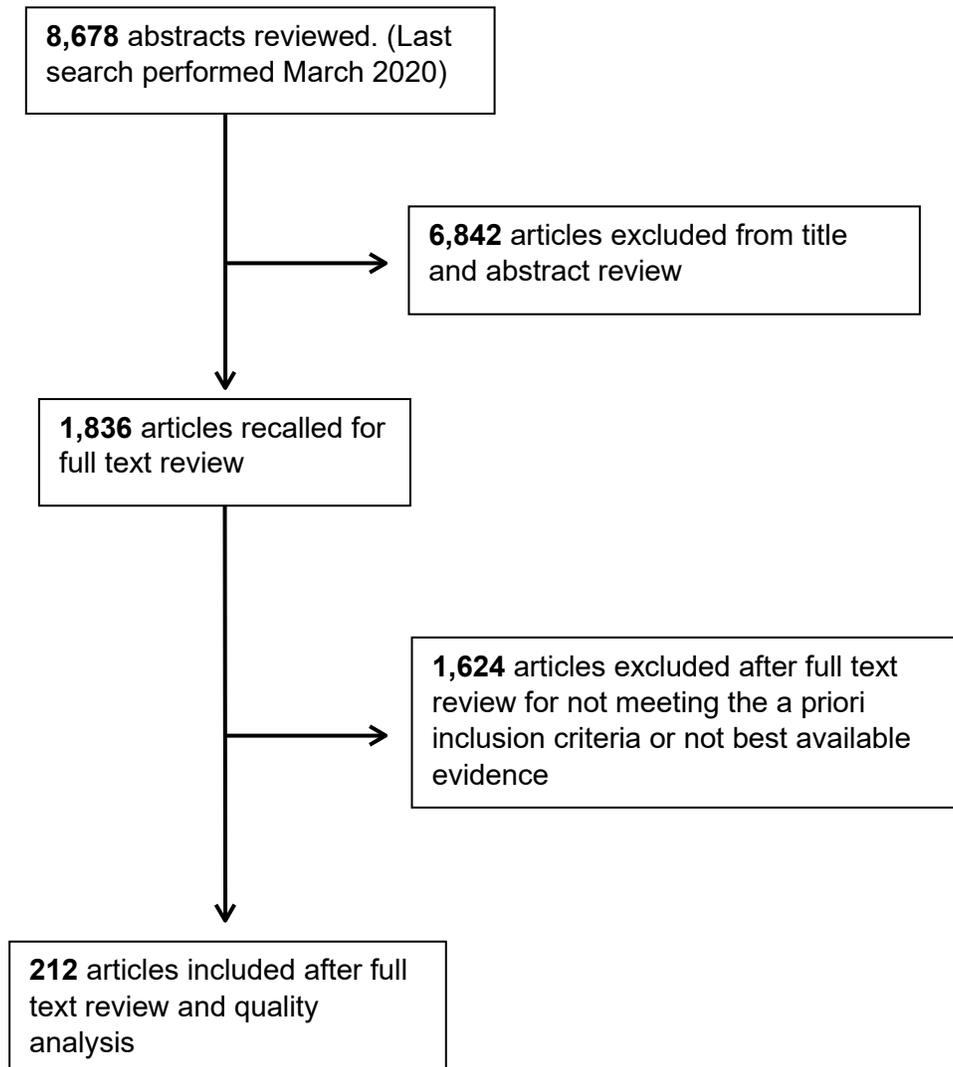
CPG DISSEMINATION PLANS

The primary purpose of the present document is to provide interested readers with full documentation of the best available evidence for various procedures associated with the topic of this review. Publication of most clinical practice guidelines is announced by an Academy press release, articles authored by the clinical practice

guideline development group and published in the *Journal of the American Academy of Orthopaedic Surgeons*, and articles published in *AAOS Now*. Most clinical practice guidelines are also distributed at the AAOS Annual Meeting in the Resource Center. The final guideline recommendations and their supporting rationales will be hosted on www.OртоGuidelines.org.

Selected clinical practice guidelines are disseminated by webinar, the AAOS Learning Management Systems (LMS), Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

STUDY ATTRITION FLOWCHART



RECOMMENDATIONS

Recommendations are formed when there is sufficient evidence by which to create a directional statement. This is defined as evidence from two or more high quality studies (i.e., a strong recommendation), two or more moderate quality studies (i.e., a moderate recommendation), or statements resulting in a strong or moderate strength following Evidence to Decision Framework upgrading and/or downgrading.

PREOPERATIVE TRACTION

Preoperative traction should not routinely be used for patients with a hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Overall, there were two high quality (Endo 2013, Rosen 2001) and six moderate studies (Needoff 1993, Resch 1998, Resch 2005, Saygi 2010, Tosun 2018, Yip 2002) addressing preoperative traction. Since 2012, one high (Endo 2013) and one moderate quality study (Tosun 2018) investigated preoperative traction. Tosun (2018) found that a position splint resulted in significant difference in immobilization comfort score (30.1/100) and pain compared to traction, whereas Endo found no differences in pain. Tosun (2018) also found that preoperative traction resulted in more pre-operative complications (constipation, pressure ulcers, adhesive plaster allergy, urinary tract infections, pulmonary complications, bleeding in the fractured joint) than a position splint applied for 1 day preoperatively, whereas Endo found no significant differences in complications between traction and no traction. These results are consistent with prior evidence and strengthen the body of evidence indicating that there are no benefits of preoperative traction. The recommendation reflects that there are some instances in which traction may be required (e.g., specific cases with peri-trochanteric fractures), however, in most cases pre-operative traction should not be used.

Benefits/Harms of Implementation

There are no known harms of implementing this recommendation. However, research is lacking regarding the potential harm of pre-operative traction as a form of tethering, which could trigger delirium, particularly in patients with dementia.

Outcome Importance

Complications, comfort, and pain are important outcomes related to hip fracture.

Cost Effectiveness/Resource Utilization

Not using preoperative traction may decrease cost/resource utilization compared to bedrest with positioning for comfort using pillows.

Acceptability

Use of alternatives to preoperative traction appeared to be acceptable to patients (Endo 2013, Tosun 2018).

Feasibility

Positioning with pillows is feasible.

Future Research

Future research regarding preoperative modalities to minimize patient pain should be continued to be investigated, including use of a position splint. Research should address possibility of delirium as a complication of pre-operative traction use.

SURGICAL TIMING

Hip fracture surgery within 24-48 hours of admission may be associated with better outcomes.

Quality of Evidence: Low

Strength of Recommendation: Moderate  (Upgraded)

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention. Recommendation was upgraded based on EtD framework.

Rationale

Eight low strength studies (Elliot 2003, Moran 2005, Parker 1992, Siegmeth 2005, Orosz 2004, McGuire 2004, Novack 2007, Radcliff 2008) evaluated patient outcomes in relation to timing of hip fracture surgery. Potential confounding effects of patients with increased comorbidities also having delays to surgery was accounted for with statistical techniques (instrumental variable analysis, regression) and excluding patients delayed due to medical reasons.

The majority of studies favored improved outcomes in regard to pain, complications, and length of stay with decreased time to surgery. After controlling for patent comorbidities, the influence of delay to surgery on mortality was mixed but increased delay was in general associated with increased mortality. The studies varied on the optimal time frame from admission to surgery (24 hours to 4 days); however, the majority favored surgery within 24-48 hours.

Benefits/Harms of Implementation

Benefits from numerous studies have been outlined. There is minimal harm in adopting early surgical timing of hip fractures. The evidence is limited partly due to the difficulty and potential ethical issues with performing a randomized controlled trial on this topic. The committee felt that the cited evidence, along with other lower quality studies supports this recommendation as there is potential patient harm with delay in surgery. Further, the potential benefit to patients is large enough that the committee voted it to be a moderate strength recommendation despite the limited level of evidence.

Cost Effectiveness/Resource Utilization

Decreasing time to surgery decreases cost and health care resources.

Feasibility

Intervention has been used extensively and has been proven feasible. However, it should be noted that these studies were performed predominantly at high volume, well-resourced, academic centers. While decreased time to surgery from admission should always be the goal, in some cases this target may not be met due to patient comorbidities, or factors related to the medical center (staffing, OR availability, surgeon availability, medical sub-specialist availability).

Future Research

Future research improving controls for bias relating to increased medical severity of patients delayed for surgery is needed to better identify critical timing related issues regarding patient specific populations. Understanding which perioperative medical issues and co-morbidities are modifiable and can impact patient outcomes would help in optimizing surgical timing. Further, exploring whether race has an impact on timing to surgery could help decrease health disparities.

VENOUS THROMBOEMBOLISM PROPHYLAXIS

Venous thromboembolism (VTE) prophylaxis should be used in hip fracture patients.

Quality of Evidence: Moderate

Strength of Recommendation: Strong ★★★★★ (Upgraded)

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention. Recommendation was upgraded based on EtD framework.

Rationale

Six moderate quality studies (Eskeland 1966, Jorgensen 1992, Jorgensen 1998, Morris 1976, PEP Study 2000, Sasaki 2009) and four low quality studies (Cha Y H 2019, Goh E L 2020, Kulachote N 2015, Zhang C 2018) were identified comparing various pharmacological prophylaxis interventions in the setting of hip fracture. One moderate strength study (Stranks 1992) compared mechanical prophylaxis to a group that received no mechanical prophylaxis. These studies were an update of those utilized in the 2014 CPG guideline on the same topic, and excluded some previous studies judged to not meet current criteria for inclusion. Of these included studies, evidence shows the risk of DVT/VTE/PE complication is significantly less with VTE prophylaxis than control. Most general complications were not significantly different between treatment groups and there is some evidence that mortality is less with prophylaxis.

Given the significant established risk factors for VTE present in this patient population including age, presence of hip fracture, major surgery, delays to surgery, and the potential serious consequences of failure to provide prophylaxis in the hip fracture population, it is the recommendation of the workgroup that VTE prophylaxis be used.

With regard to mechanical prophylaxis, in the absence of a contraindication, this mechanical intervention can be applied with good efficacy for decreasing VTE, reasonable cost, and little risk to patient safety.

With regard to chemical prophylaxis, moderate quality evidence suggests that this may decrease patient risk of VTE/PE, with minimal risk of increased hemorrhagic consequences. There is however insufficient evidence to recommend a specific pharmacologic agent or duration of treatment. Patient specific factors should be considered when choosing an anticoagulated agent such as patient immobility, comorbidities, or bleeding risks.

Benefits/Harms of Implementation

Patients with hip fracture are at high risk for deep venous thrombosis and pulmonary embolism. The consequences of symptomatic VTE are significant and include both increased morbidity and mortality. The harms associated with this recommendation include those associated with over or under treatment in the prevention of VTE/PE. Potential patient risks include thrombotic event, patient burden for administration route as well as risk of over treatment including hemorrhagic event. Given the potentially dire consequences of a VTE, and the relatively low risk of VTE prophylaxis, the committee voted to upgrade this to a strong recommendation despite the moderate evidence.

Cost Effectiveness/Resource Utilization

Mechanical prophylaxis is available at most medical institutions in the United States and is typically an available adjunct without major cost or need for additional resources. Aspirin may be a cost-effective agent for appropriately selected patients and is able to be administered in an oral route, with little education, and low cost. Low Molecular Weight Heparin may also prove cost effective for appropriate patients, however, requires education on administration and patient compliance. This chemoprophylactic agent has no typical monitoring costs. Coumadin is a cost-effective means of

anticoagulation for appropriately selected patients and is able to be administered in an oral route. This however requires post discharge monitoring which may require system resources and additional patient education. NOAC/DOAC medication are an effective but more costly means of VTE prophylaxis for appropriately selected patients and are able to be administered in an oral route, with little education and no post discharge monitoring.

Future Research

The issue of VTE prophylaxis in patients who have sustained a hip fracture is complex. There are many unanswered questions that have the potential to have a significant impact on clinical outcomes for this patient population. A multi-armed randomized controlled study would be optimal. Such a study would potentially need to evaluate the comparative effectiveness of a multitude of chemical agents, at different dosages, with multiple time points (such as pre- and post-op), and include assorted durations of therapy, while utilizing contemporary diagnostic methodologies. Barriers to such a study include the low incidence of the complication implicating a requirement for a substantially large sample size. Furthermore, such a study carries ethical concerns given the potential risks associated with under-treatment. Potentially, well organized patient outcome registries may ultimately help improve our knowledge in this area and advances in large data-set machine learning algorithms may also help sort through the complexity of these mixed patient groups and their treatment needs.

ANESTHESIA

Either spinal or general anesthesia is appropriate for patients with a hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Two high quality studies (Shin 2020, Tzimas 2018) and five moderate strength studies (Haghighi 2017, Parker 2015, McKenzie 1984, Davis 1981, Valentin 1986) compared mortality and complications among patients undergoing hip fracture surgery with spinal versus general anesthesia. One high quality study included in the prior guideline version was excluded due to low sample size (Casati); one study graded as high quality (Davis 1981) in the prior version was classified as moderate quality in the present guideline.

One high quality study (Shin 2020) and two moderate quality studies (Davis 1981, Valentin 1986) found no difference in mortality at up to 120 days for spinal versus general anesthesia. One moderate quality study (McKenzie 1984) found a decreased mortality rate at two weeks postoperatively in the spinal anesthesia group; however, this difference did not persist at two months. One moderate quality study (Parker 2015) found increased mortality with spinal versus general anesthesia at 1 year. One high quality study (Shin 2020) and one moderate quality study (Parker 2015) found no difference in in-hospital complications with spinal versus general anesthesia. One high quality study (Tzimas 2018) and two moderate quality studies (Parker 2015, McKenzie 1984) found no difference in length of stay by anesthesia type. One moderate quality study (Haghighi 2017) found lower postoperative pain scores with spinal versus general anesthesia.

Benefits/Harms of Implementation

Spinal anesthesia and general anesthesia each have a longstanding record of use with established safety in appropriately selected patients. In patients undergoing anticoagulation, available external guidance should be consulted regarding the timing of block placement relative to anticoagulant dosing to limit potential harms for patients undergoing spinal anesthesia.

Outcome Importance

Mortality and complications occur commonly after hip fracture surgery; therefore, identifying interventions to improve these outcomes represents an important public health priority.

Cost Effectiveness/Resource Utilization

No data were identified to characterize the relative cost-effectiveness of spinal versus general anesthesia.

Acceptability

Both spinal and general anesthesia may be acceptable to patients and providers. Acceptability of spinal versus general anesthesia for a given case may vary depending on patient preferences, provider experience, and case characteristics.

Feasibility

Both spinal and general anesthesia are in widespread use in the United States.

Future Research

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Most identified randomized trials were small and may have lacked power to detect important differences between groups. Future research including appropriately randomized patients may provide more information on risks and benefits of spinal anesthesia versus general anesthesia with regard to mortality, complications, and other important patient-centered outcomes such as delirium, functional outcomes, and discharge location.

UNSTABLE FEMORAL NECK FRACTURES – ARTHROPLASTY VS FIXATION

In patients with unstable (displaced) femoral neck fractures, arthroplasty is recommended over fixation.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Six high quality (Frihagen 2007, Johansson 2001, Keating 2005, Lu 2017, Parker 2010, Stoen 2014) and 21 moderate quality studies (Bachrach-Lindstrom 2000, Calder 1995, Cao 2014, Chammout 2012, Davison 2001, Desteli 2015, Dolatowski 2019, El-Abed 2005, Johansson 2014, Johansson 2006, Johansson 2000, Jolly 2019, Mouzopoulos 2008, Parker 2002, Ravikumar 2000, Roden 2003, Shi 2018, Sikorski 1981, Skinner 1989, Tidermark 2003, Waaler 2012) directly compared arthroplasty (hemi- and/or total hip arthroplasty) to internal fixation for the treatment of unstable/displaced (Garden III and IV) femoral neck fractures. These studies consistently reported better outcomes (reoperation rate, pain scores, functional status, and/or complication rate) for patients in who were treated with arthroplasty. A decreased rate of reoperation among patients treated with arthroplasty was the most consistent finding across the studies. Composite analysis of these studies shows no statistically significant difference in mortality between arthroplasty and internal fixation.

Benefits/Harms of Implementation

Implementing this recommendation does not result in additional harm to the patient beyond that conferred by usual surgical risk. Arthroplasty may be associated with somewhat higher initial charges compared with internal fixation due to more costly implants and higher procedural and professional fees, however this is likely offset by the decrease in reoperations expenses avoided by arthroplasty versus internal fixation.

Future Research

Future studies should help to identify patient populations who may benefit from less invasive treatment.

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UNIPOLAR/BIPOLAR HEMIARTHROPLASTY

In patients with unstable (displaced) femoral neck fractures, unipolar or bipolar hemiarthroplasty can be equally beneficial.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

Rationale

Ten moderate quality studies (Calder 1995, Calder 1996, Davison 2001, Hedbeck 2011, Inngul 2013, Kanto 2014, Khan 2015, Parker 2020, Raia 2003, Stoffel 2013) and one low quality study (Kenzora 1998) included comparing outcomes of unipolar and bipolar hemiarthroplasty for treatment of displaced femoral neck fractures reported no significant differences in most of the outcome measures between the two groups. A meta-analysis of mortality at all time points showed no significant differences between these two groups.

Benefits/Harms of Implementation

Unipolar and bipolar hemiarthroplasty pose similar risk of adverse events. Composite Quality of Life (QoL) and functional outcome measures are overall not significantly between the two groups, although isolated statistically significant outcome differences were noted in some outcome measures that favored the bipolar group.

Outcome Importance

All outcome measures including QoL, function, adverse events, mortality, and pain are relevant to patients.

Cost Effectiveness/Resource Utilization

Most studies acknowledge lower cost of unipolar heads (Note: cost of implant is dependent on implant pricing at institutions and may not be lower at a specific institution).

Acceptability

No variation in acceptability between the two groups anticipated.

Feasibility

Surgical centers may not have equal access/availability to both unipolar and bipolar heads.

Future Research

Specific cost/resource utilization studies may be useful to compare these two groups.

UNSTABLE FEMORAL NECK FRACTURES – TOTAL ARTHROPLASTY vs HEMI ARTHROPLASTY

In properly selected patients with unstable (displaced) femoral neck fractures, there may be a functional benefit to total hip arthroplasty over hemi arthroplasty at the risk of increasing complications.

Quality of Evidence: High

Strength of Recommendation: Moderate  (Downgraded)

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention. Recommendation was downgraded based on EtD framework.

Rationale

Four high strength (Chammout 2019, Hedbeck 2011, Keating 2005, van den Bekerom 2010) and ten moderate strength studies (Blomfeldt 2005, Cadossi 2013, Health Investigators 2019, Iorio 2019, Li 2017, Parker 2019, Ren 2017, Sharma 2016, Ukaj 2019, Xu 2017) examined this question. The evidence demonstrates a small functional outcome benefit to patients who received total hip arthroplasty. Hemi arthroplasty was associated with a small decrease in dislocation and instability. Mortality rates were largely unaffected within the first 4 years after treatment.

The strength of the evidence is strong. However, the effect size is small, which led the expert panel to unanimously downgrade this recommendation to moderate. Patient exclusion criteria in some of these studies reflect the general bias amongst surgeons towards performing total hip arthroplasty in patients who are higher functioning and more likely to be independent community ambulators. Cautious decision making for lower functioning patients may be justified considering the bias and risk for complications.

Benefits/Harms of Implementation

Implementing this recommendation does not result in additional harm to the patient beyond that conferred by usual surgical risk. The choice of appropriate treatment requires discussion of risk and benefit with patients and families (shared decision making). This may help determine which patients might benefit more from functional improvement or avoiding complications including those patients whose preoperative function does not justify a surgical procedure involving greater risks.

Implementing this recommendation is likely to lead to greater expenditure. Total hip arthroplasty implants are priced higher than implants for hemi arthroplasty. Procedural and professional fees are higher for total hip arthroplasty than for hemi arthroplasty. The slight increase in complications with total hip arthroplasty may also generate additional charges.

Future Research

Further areas of investigation include whether potential delays in surgery occur when total hip arthroplasty is the chosen treatment, and whether this influences postoperative morbidity. Another important but unanswered question is whether the demand for total hip arthroplasty following fracture can be met by surgeons who currently employ hemi arthroplasty, or if the increasing use of total hip arthroplasty by less experienced surgeons will offset potential benefits seen in previous studies.

CEMENTED FEMORAL STEMS

In patients undergoing arthroplasty for femoral neck fractures, the use of cemented femoral stems is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.

Rationale

Two high quality studies (Figved 2009, Taylor 2012) and eleven moderate quality studies (Movrin 2020, Parker 2020, Inngul 2015, Langslet 2014, Deangelis 2012, Santini 2005, Moerman 2017, Chammout 2016, Talsnes 2013, Vidovic 2013, Vidovic 2015) address the question of cemented or uncemented femoral stem arthroplasty for femoral neck fractures, many of them randomized controlled trials. Six studies comprised of one high quality (Taylor 2012) and five moderate quality (Vidovic 2013, Vidovic 2015, Moerman 2017, Inngul 2015, Santini 2005) support cemented femoral stems for short term improved patient reported outcomes. Two studies (Inngul 2015, Taylor 2012) suggested a higher periprosthetic fracture risk in cementless implants. Few studies have demonstrated clear superiority in regard to mortality or medical complications (Parker 2020, Deangelis 2012). Seven studies (Figved 2009, Morvin 2020, Langslet 2014, Chammout 2016, Talsnes 2013, Vidovic 2013, Vodovic 2015) reported higher surgical time and blood loss in cemented implants.

Benefits/Harms of Implementation

Patients who undergo cemented femoral stems may benefit from lower periprosthetic fracture risk and improved short time outcomes while being at risk for increased surgical time and blood loss.

Outcome Importance

Patients undergoing cemented femoral stems will have the benefits of higher short-term patient reported outcomes and lower periprosthetic fracture risk, but with increased surgical time and blood loss during the operation. Postoperative periprosthetic fracture is a serious complication often requiring additional surgery with attendant risks. Surgeon's familiarity with surgical technique may guide which implant they choose which contributes to the overall variability.

Cost Effectiveness/Resource Utilization

Implant cost varies widely depending on healthcare contracts and geographic location. In general, cemented implants cost less, but utilization may require more resources such as bone cement and cement preparation supplies, as well as operating room staff training.

Acceptability

Acceptability may be variable. However, since 2012, and after the first guidelines of femoral stem fixation were released in 2014, cement fixation for femoral stems has been increasing in the US.

Future Research

High quality, double blinded randomized controlled trials are needed comparing stem fixation in arthroplasty for femoral neck fractures to definitively determine risk of fracture, blood loss and patient outcomes.

SURGICAL APPROACH

In patients undergoing treatment of femoral neck fractures with hip arthroplasty, evidence does not show a favored surgical approach.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

Rationale

One high quality study (Ugland 2018), seven moderate quality studies (Jianbo 2019, Li 2017, Parker 2015, Repantis 2015, Saxer 2018, Ugland 2019, Verzellotti 2019) and two low quality studies (Biber 2012, Skoldenberg 2010) were included in the evidence for this recommendation.

The high quality study (Ugland 2019) compared hemiarthroplasty with the anterolateral approach to hemiarthroplasty with the direct lateral approach and reported that while there were elevated levels of serum creatine kinase (CK) observed in the anterolateral approach group, no correlation between CK levels and the Timed Up and Go test or the Trendelenburg sign at 3 months were found.

There were also 8 citations on the subject of surgical approach in the surgical treatment of femoral neck fractures with moderate evidence strength. Jianbo (2019) reported on a prospective, randomized study of 100 patients. They specifically compared the clinical outcomes and complications of using either the conventional posterior approach, or with using a minimally invasive (MIS) and muscle preserving approach (the Suprapath approach). There was less blood loss, and low transfusion rate in the MIS group. There was less pain, and better function within the first week in the minimally invasive group, but no differences between the groups at the 3-month interval. Repantis (2015) reported on the comparative results of a prospective, randomized study in 80 patients using either a MIS approach or in using the posterior approach. It was a single-surgeon series. There was less pain in the MIS group in the short term. There was no difference in any of the other outcomes or complications up to 4 years of follow up. In another comparative study, Saxer (2018) reported on the results of 190 patients using either a MIS or using the lateral approach. There was less pain, and faster ambulation in the first 3 weeks in the MIS group. There was no difference in any of the other outcomes, or in the complications between the groups. Verzellotti (2019) reported on the comparative results of using the direct anterior (DA) which is muscle preserving, or in using the posterior approach in 100 patients. There was less pain in the DA group in the first month after surgery. There was no difference in the other outcomes or complications between the groups. The operative time was longer in the DA group. Parker (2015) reported the comparative results of a multi-center, prospective, randomized study in 216 patients using either the posterior or the lateral approach. There was no difference in any of the outcome measures analyzed between the groups. In a prospective, randomized study in 150 patients, Ugland (2018) reported higher risk of post-surgery Trendelenburg gait when the arthroplasty was done using the lateral approach in contrast to using the anterolateral approach (more abductor muscle preserving). Two low strength articles (Biber 2012, Skoldenberg 2010) compared the posterior approach to the direct lateral approach for performing arthroplasty in the patients with femoral neck fractures. While neither of the included studies specifically addressed any functional outcomes, they both demonstrated statistically significant differences in dislocation rates, favoring the direct lateral approach.

The data in these newer studies show no difference in the dislocation rates between the different surgical approaches, including the posterior approach. This is in contrast to the earlier data in older publications which showed higher dislocation rate with the posterior approach in comparison to the lateral approach in particular.

Benefits/Harms of Implementation

While some studies showed less pain in the early postoperative period for less invasive surgical approaches, operative time may be longer with a less invasive approach and there was no clear difference in functional outcomes. This information should be considered in the context of both patient and surgeon specific factors when deciding on a surgical approach.

Future Research

The existing evidence does not support superiority of one surgical approach. Future well designed RCTs should include a comparison of the anterior approach with the posterior and the lateral approach. Any future studies related to surgical approach should also include pain and functional data associated with the approaches. This may have important implications for patient selection and recovery needs such as assistive devices or therapy needs.

CEPHALOMEDULLARY DEVICE – STABLE INTERTROCHANTERIC FRACTURES

In patients with stable intertrochanteric fractures, use of either a sliding hip screw or a cephalomedullary device is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Two high quality (Cai 2016, Varela 2009) and 6 moderate strength (Carulli 2017, Li 2018, Sanders 2017, Utrilla 2005, Wang 2019, Xu 2018) studies compared the use of an extramedullary sliding hip screw device with a cephalomedullary device for stable intertrochanteric fractures. Fixation with either an extramedullary or intramedullary implant show similar clinical outcomes. One moderate strength study (Utrilla 2005) found no difference in walking ability with either a sliding hip screw or cephalomedullary nail for the stable intertrochanteric fractures. While one study (Sanders 2017) did show improved walking ability in the cephalomedullary group, the high strength study (Varela 2009) found no difference in functional outcome, hospital stay, fracture collapse, or mortality between a cephalomedullary nail and an extramedullary sliding hip screw and plate device that offers two points of fixation into the femoral head. This recommendation includes stable peritrochanteric fractures, 31.A1 and 31.A2, that are stable after anatomical reduction.

Benefits/Harms of Implementation

There are no known harms associated with implementing this recommendation.

Cost Effectiveness/Resource Utilization

The cost of cephalomedullary devices is generally more than sliding hip screw fixation in most institutions. Cephalomedullary nail fixation had reduced length of hospital stay and fewer complications (Xu 2018) which can lead to overall decreased costs with cephalomedullary devices.

Future Research

Randomized, prospective trials comparing modern cephalomedullary nails with extramedullary devices in a large cohort of patients with only stable intertrochanteric fractures (OTA 31.A1) should specifically assess pain, functional outcomes, radiographic parameters, complications, and cost. These studies should control for patient demographics as well as quality of fracture reduction and placement of fixation (tip-to-apex distance). The potential difficulty with conversion to total hip arthroplasty for failed fracture treatment also should be considered when comparing fixation methods.

CEPHALOMEDULLARY DEVICE – SUBTROCHANTERIC/REVERSE OBLIQUITY FRACTURES

In patients with subtrochanteric or reverse obliquity fractures a cephalomedullary device is recommended.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Reverse obliquity fractures are a subset of intertrochanteric/peritrochanteric fractures that are an unstable pattern. Though subtrochanteric fractures are more of a proximal femur fractures, they can be a component of an intertrochanteric fracture as well. There were 3 high (Miedel 2005, Schipper 2004, Zehir 2015), and 6 moderate quality (Aktselis 2014, Fernandez 2017, Griffin 2016, Hardy 1998, Reindl 2015, Tao 2013) studies evaluating the use of cephalomedullary devices in the treatment of unstable intertrochanteric and subtrochanteric fractures. Although many comparative studies have been done, the variability of fracture classification systems and implants used makes interpretation of the literature challenging; many orthopaedic surgeons use the terms intertrochanteric and peritrochanteric interchangeably. Evaluation of these studies shows an apparent treatment benefit with cephalomedullary devices for unstable peritrochanteric fractures compared to extramedullary devices.

One high strength comparative study (Schipper 2004) showed similar results and outcomes between different cephalomedullary devices in unstable fractures.

Another high strength study (Miedel 2005) demonstrated a lower complication rate with use of a cephalomedullary versus an extramedullary device in treatment of unstable intertrochanteric and subtrochanteric fractures. Another moderate strength study (Hardy 1998) showed improved mobility and decreased limb shortening in unstable intertrochanteric fractures treated with a cephalomedullary device versus a sliding hip screw.

Benefits/Harms of Implementation

There are no known harms associated with implementing this recommendation.

Future Research

Continued comparative studies between modern cephalomedullary and extramedullary devices in unstable subtrochanteric and reverse obliquity fractures (OTA 31.A3) which control for fracture reduction and implant position (specifically tip-to-apex distance) may further clarify the utility of cephalomedullary devices for this fracture cohort. TAD is important in all peritrochanteric and intertrochanteric fractures. Many use it in A3 fractures as well clinically.

CEPHALOMEDULLARY DEVICE – UNSTABLE INTERTROCHANTERIC FRACTURES

Patients with unstable intertrochanteric fractures should be treated with a cephalomedullary device.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

Two high (Adams 2001, Zehir 2015) and 9 moderate quality studies, (Papasimos 2005, Utrilla 2005, Leung 1992, Aktseis 2014, Fernandez 2017, Griffin 2016, Reindl 2015, Tao 2013, Verettas 2010) evaluated the use of cephalomedullary devices in unstable intertrochanteric fractures with a separate lesser trochanteric fragment but no subtrochanteric involvement (OTA 31.A2). Although many studies have been done, the variability of the fracture classification systems and the diverse designs of the implants used makes interpretation of the literature challenging. Many orthopaedic surgeons use the terms intertrochanteric and peritrochanteric interchangeably. Evaluation of these studies shows strong evidence strength supporting the treatment benefit of using the cephalomedullary devices for unstable intertrochanteric fractures.

Two moderate strength studies (Utrilla 2005, Leung 1992) recommended a cephalomedullary device over sliding hip screw. Utrilla (2005) found improved postoperative walking ability and fewer blood transfusions in the cephalomedullary group. Leung (1992) showed no difference in the mortality or in the ultimate hip function but did show a shorter convalescence period in the cephalomedullary cohort. A moderate strength study (Verettas 2010) found no difference in pain and in the systemic physiologic responses (O₂ requirement, mental status, hematocrit) between the treatment groups with using either a sliding hip screw or using a cephalomedullary device. Papasimos (2005) conducted a moderate strength study evaluating treatment with using a sliding hip screw and using two different cephalomedullary devices. Their data showed no difference between the devices with respect to the ultimate fracture consolidation and the return to the pre-fracture level of function. Adams (2001) conducted a comparative study evaluating using a cephalomedullary device to using an extramedullary plate and screw in the treatment of 31.A1, 31.A2 and 31.A3 fractures. They found the use of an intramedullary device in the treatment of intertrochanteric hip fractures was associated with a higher but nonsignificant risk of postoperative complications. By controlling for tip-to-apex distance, there was no statistical difference between the types of the implants with regard to fracture reduction and the fracture stability during the healing phase.

Benefits/Harms of Implementation

There are no known harms associated with implementing this recommendation

Future Research

The current trend is for increasing use of cephalomedullary devices in the treatment of intertrochanteric fractures (Yli-Kyyry, 2012; Jeffery, Anglen 2008). Concerns regarding increased complication rates with conversion of failed cephalomedullary implants to total hip arthroplasty (Pui 2013) warrants caution and further investigation. High level trials comparing modern cephalomedullary devices with sliding hip screws in a large cohort of patients with intertrochanteric fractures classified as OTA 31.A2 should specifically assess pain, functional outcomes, radiographic outcomes, complications, and cost. These

studies should control for patient demographics, quality of fracture reduction, hardware placement (specifically tip-to-apex distance) and the changing experience of practicing surgeons.

Additional References:

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TRANSFUSION

A blood transfusion threshold of no higher than 8g/dl is suggested in asymptomatic postoperative hip fracture patients.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

Rationale

Several moderate strength studies (Carson 2015, Carson 2011, Gregersen 2015, Gruber-Baldini, 2013, Parker 2013) support this recommendation. Carson (2011) FOCUS trial is the largest (n=2016) and most robust study to address transfusion threshold in hip fracture patients. FOCUS considered patient-centered and clinically important outcomes in a prospective, randomized, multicenter, controlled trial. This study showed that a restrictive transfusion threshold of hemoglobin 8g/dl in asymptomatic hip fracture patients with cardiovascular disease or risk factors resulted in no significant difference in primary or secondary outcomes at 30- or 60-days including mortality, independent walking ability, residence, other functional outcomes, cardiovascular events, or length of stay. Symptoms or signs that were considered indicative of anemia appropriate for transfusion were chest pain that was deemed to be cardiac in origin, congestive heart failure, and unexplained tachycardia or hypotension unresponsive to fluid replacement. Gregersen’s (2015) study comparing 9.7g/dl vs. 11.3 g/dl also showed no significant difference in most of the primary or secondary outcomes.

Of note, in the Carson (2011) study, for patients in the restrictive-strategy group (8g/dl) and for patients in both groups in the Gregerson (2015) study, blood was transfused 1 unit at a time and the patient reassessed for presence of symptoms or signs after each transfusion.

Benefits/Harms of Implementation

Implementation of this recommendation is likely to result in lower transfusion associated complications and cost. There is risk that cognitively impaired patients cannot report symptoms, so special attention to these individuals may be warranted; FOCUS automatically transfused significantly demented patients below hemoglobin 8mg/dl.

Future Research

Confirmatory studies by other authors would strengthen evidence. Additional studies could further risk stratify and refine transfusion thresholds in subpopulations.

MULTIMODAL ANALGESIA

Multimodal analgesia incorporating preoperative nerve block is recommended to treat pain after hip fracture.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

This recommendation combines and updates information contained in 2014 CPG recommendations on Preoperative Regional Anesthesia and Postoperative Multimodal Analgesia. We identified a total of 28 high- or moderate-quality studies (Aprato 2018, Clemmesen 2018, Ergenoglu 2015, Godoy-Monzon 2010, Gorodetskyi 2007, Kang 2013, Ma 2018, Moppett 2015, Morrison 2016, Parras 2016, Phruetthiphat 2021, Unneby 2017, Unneby 2020, Wennberg 2019, Wennberg 2019, Zhang 2020, Zhou 2019, Cooper 2019, Newman 2013, Nie 2015, Rowlands 2018, Temelkovska 2014, Uysal 2020, Unneby 2020, Xu 2020, Matot 2003, Mouzopoulos 2009, Zhang 2019) addressing diverse aspects of perioperative multimodal analgesia for hip fracture patients. Analgesic approaches, dosing regimens, comparators, and outcomes assessed varied markedly across available studies.

Ten high-quality studies (Wennberg 2019, Ma 2018, Wennberg 2019, Unneby 2017, Unneby 2020, Morrison 2016, Aprato 2018, Monzon 2010, Zhou 2019, Ergenoglu 2015) and nine moderate-quality studies (Mouzopoulos 2009, Xu 2020, Rowlands 2018, Zhang 2019, Unneby 2020, Uysal 2020, Cooper 2019, Newman 2013, Matot 2003) specifically assessed use of regional anesthesia before surgery as a component of a perioperative multimodal analgesic approach. 17 of 19 identified studies assessed either fascia iliaca compartment block (FICB) or femoral nerve block (FNB), with or without obturator nerve block; 1 moderate-quality study (Matot 2003) assessed continuous epidural analgesia. 1 high-quality study (Zhou 2019) and 2 moderate-quality studies compared preoperative FICB to preoperative FNB with or without obturator nerve block (Zhou 2019, Cooper 2019, Newman 2013); 1 high-quality study compared FICB to intra-articular hip injection (Aprato 2018). All other identified studies compared a preoperative regional block to routine opioid- and non-opioid based pain management, with or without performance of a sham nerve block procedure in the control arm.

Among studies comparing preoperative regional anesthesia (including FNB, FICB, or epidural) to non-regional anesthesia control, regional anesthesia was associated with decreased pain severity compared to control in 5 high-quality studies (Monzon 2010, Ma 2018, Wennberg 2019, Unneby 2017, Morrison 2016) and 4 moderate-quality studies (Rowlands 2018, Zhang 2019, Uysal 2020, Xu 2020). Regional anesthesia was associated with decreased requirements for parenteral analgesia versus control in one high-quality study (Morrison 2016). Results varied with regard to the association between regional anesthesia receipt and adverse outcomes; while some studies reported lower rates of delirium (Mouzopoulos 2009), cardiovascular events (Matot 2003), postoperative complications (Ma 2018) and severe opioid-related adverse events (Morrison 2016) with regional anesthesia, findings were inconsistent across studies reviewed, with some reporting no difference or worsened outcomes with regional anesthesia observed for these endpoints. One high-quality study (Morrison 2016) observed improved recovery of ambulation at post-operative day 3 and at 6 weeks with regional anesthesia. Among studies comparing FICB to FNB, one high-quality study (Zhou 2019) and one moderate-quality study (Newman 2013) found improved pain VAS score with preoperative FNB vs FICB. In one high-quality study (Zhou 2019), analgesic requirements and rates of nausea were lower with FNB vs FICB. One high-quality study (Aprato 2018) found better pain control and lower systemic analgesic requirements with intra-articular hip injection vs preoperative FICB.

Five high-quality studies (Kang 2013, Gorodetskyi 2007, Zhang 2020, Clemmesen 2018, Phruetthiphat 2021) and five moderate quality studies (Mouzopoulos 2009, Matot 2003, Temelkovska-Stevanovska

2014, Nie 2015, Ogilvie-Harris 1993) assessed aspects of multimodal analgesia for hip fracture patients other than preoperative regional anesthesia. Identified studies examined a range of approaches including: standardized pain treatment protocols; neurostimulation; pre- or intra-operative dexmedetomidine infusion; preoperative methylprednisolone; intra-operative or postoperative regional anesthetics; and postoperative periarticular anesthetic injections. Improved pain outcomes were observed for postoperative periarticular injections (Phruetthiphat 2021, Kang 2013), postoperative FNB (Temelkowska-Stevanovska 2014); and neurostimulation (Gorodetskyi 2007). Neither intraoperative dexmedetomidine (Zhang 2020) nor preoperative methylprednisolone (Clemmesen 2018) were associated with improved pain scores versus control. Association between adjunctive pain therapies and postoperative outcomes varied across modalities evaluated.

Benefits/Harms of Implementation

Risks associated with pain treatment approaches are likely to vary across modalities and should be interpreted with regard to the risks of alternative treatments, such as opioids. Certain techniques, such as epidural anesthesia, may be contraindicated in the presence of anticoagulant therapy or coagulopathy. Appropriate provider training in pain management techniques, adequate monitoring for potential procedure-related complications, and availability of rescue medications and other resources is essential to ensuring patient safety.

Outcome Importance

Treatment of pain represents a major priority for many hip fracture patients and their families; additional outcomes assessed in studies reviewed here, such as delirium and functional recovery, may also carry substantial importance to patients.

Cost Effectiveness/Resource Utilization

Identified studies did not assess cost-effectiveness or resource utilization; these are likely to vary according to the specific pain treatment modality under consideration.

Acceptability

Preoperative FNB and FICB both appear to be broadly acceptable to patients; limited information is available on the acceptability of other pain treatment modalities reviewed here.

Feasibility

FNB and FICB can be performed feasibly in emergency departments, perioperative care settings, and other hospital areas with appropriate provider training and access to necessary monitors and rescue treatments. Feasibility of other multimodal analgesic approaches may vary according to the modality evaluated.

Future Research

Future research on preoperative regional anesthesia for hip fracture patients may focus on impacts on complications and patient-centered end-outcomes, such as functional recovery after fracture. Additional research is needed to define optimal or preferred strategies for multimodal analgesia. Such research may examine outcomes for regimens that incorporate agents not evaluated in identified studies, such as gabapentin, and should evaluate impacts on complications and patient-centered end outcomes in addition to pain outcomes.

TRANEXAMIC ACID

Tranexamic acid should be administered to reduce blood loss and blood transfusion in patients with hip fractures.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.

Rationale

16 studies address the question of use of tranexamic acid in older adult patients with hip fractures (Chen 2019, Tengberg 2016, Tian 2018, Watts 2017, Zufferey 2010, Drakos 2016, Lei 2017, Ma 2021, Zhou 2019, Ashkenazi 2020, Kwak 2019, Lee 2015, Maalouly 2020, Schiavone 2018, Virani 2016, Xie 2019). 5 high quality studies (Chen 2019, Watts 2017, Tian 2018, Tengberg 2016, Zufferey 2010) and 6 lower quality studies (Zhou 2019, Drakos 2016, Lei 2017, Schiavone 2018, Xie 2019, Ashkenazi 2020) reported significantly lower blood loss and 3 high quality studies (Chen 2019, Watts 2017, Tian 2018) and 7 lower quality studies (Drakos 2016, Lei 2017, Kwak 2019, Xie 2019, Lee 2015, Ashkenazi 2020, Maalouly 2020) reported trends towards lower blood transfusions with TXA. Tranexamic acid was not associated with higher incidence of mortality or symptomatic thromboembolic events.

Benefits/Harms of Implementation

Use of tranexamic acid in hip fracture patients may result in lower blood loss and transfusion rates compared to placebo in a number of high quality studies. Studies were unable to detect any difference in adverse events with use of tranexamic acid such as infection, wound complication, DVT, CVA, PE or MI (Chen 2019). One study (Zuffrey 2010) noted slightly increased asymptomatic VTE events as noted in the mandatory ultrasound. Caution may be exercised in patients with strong thrombotic risk factors as many of the studies excluded patients with previous thrombotic events.

Outcome Importance

Patients with hip fractures may benefit from TXA to reduce blood loss and subsequent transfusion.

Cost Effectiveness/Resource Utilization

Additional use of tranexamic acid in orthopaedic surgery has been demonstrated to be very cost effective in other areas of orthopaedic surgery, especially hip and knee replacement. Several studies additionally cite the better cost-effective nature of TXA when compared to transfusion. This intervention of TXA may offer potential cost savings for institutions as a health care system as a whole.

Future Research

Future research should determine which factors may place patients at higher risk for VTE or CVA, what is the optimal dose for tranexamic acid, and which mode of administration is best.

INTERDISCIPLINARY CARE PROGRAMS

Interdisciplinary care programs should be used in the care of hip fracture patients to decrease complications and improve outcomes.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★★

Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention.

Rationale

While the 2014 AAOS CPG on Interdisciplinary Care focused on patients with mild to moderate dementia, four high quality studies (Berggren 2008, Duncan 2006, Marcantonio 2001, Naglie 2002) and 15 moderate quality studies (Crotty 2019, Heltne 2017, Huusko 2000, Huusko 2002, Majumdar 2007, Olsson 2007, Prestmo 2015, Shyu 2008, Shyu 2010, Shyu 2013, Shyu 2013, Shyu 2013, Shyu 2016, Stenvall 2007, Vidan 2005) now provide strong evidence that interdisciplinary management of geriatric hip fractures improves overall outcomes in all geriatric fracture patients.

Interdisciplinary care refers to programs that involve providers from multiple disciplines working together to co-manage individuals with hip fracture. This may include geriatric and orthopaedic providers, and nursing, dietary, and rehabilitation providers such as occupational and physical therapists. Co-management often includes workup and initiation of therapy for osteoporosis, pain, functional, nutritional and medication management, and prevention of complications (e.g. falls, delirium, and constipation).

Although the outcomes delineated in the studies do not allow for head-to-head comparisons, certain critical themes have emerged from our updated analysis.

Decreased mortality and complications: One high quality study (Duncan 2006) and three moderate studies (Vidan 2005, Olsson 2006, Shyu 2016) found that early multidisciplinary daily geriatric care reduces in-hospital mortality and medical complications in older adult patients with hip fractures. One high quality study (Nagle 2002) and two moderate quality studies (Huusko 2000, Majumdar 2007) found no difference in mortality for intensive geriatric rehabilitation and case management respectively. However, the findings from these studies all trended toward benefit of intervention.

Functional outcomes, reduction of falls, quality of life, and return to the community: Two high quality studies (Berggren 2008, Naglie 2002) found no significant difference in falls, fractures and functional outcomes for interdisciplinary care. One moderate study (Vidan 2005) found no difference in functional recovery. However, the findings from these studies all trended toward benefit of intervention. While most authors reported a trend toward increased mobility, decreased falls and/or failure to lose mobility, significant improvements were noted in eight moderate studies (Crotty 2019, Prestmo 2015, Huusko 2002, Olsson 2007, Huusko 2000, Shyu 2016, Stenvall 2007, both a and b). There was evidence of benefits for reduction in falls and improved quality of life and return to the community. Three studies, Naglie (2002) Huusko (2000) and Stenvall (2007) found improvements in functional outcomes for subgroups with mild to moderate cognitive impairment or dementia.

Initiation of Osteoporosis Management: Only Majumdar (2007) compared case management focused on evidence-based osteoporosis treatment with usual care. They found that the intervention group had substantially higher proportion of appropriate care (bone mineral density testing, bisphosphonate therapy). The average intervention cost was \$50.00 per patient.

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Nutritional outcomes: Duncan (2006) noted that Dietetic assistant supported patients had higher energy intake and decreased in-hospital and 4-month post-operative mortalities. Stenvall (2007) found fewer nutritional problems for postoperative geriatric assessment and rehabilitation intervention compared to conventional care.

Delirium: Marcantonio (2001) found that cumulative incidence was significantly lower for delirium and severe delirium in the group who had geriatric consultation compared to the usual care group. Both groups experienced a similar drop in prevalence so that there was no significant difference by discharge. Stenvall (2007a) found significantly better outcomes for postoperative delirium and number of days of delirium for the postoperative geriatric assessment and rehabilitation intervention compared to conventional care. There was also no difference between groups in the number days of delirium per episode. Crotty (2019) found that the control group was favored at 4 weeks, but at 12 weeks there was no difference.

Cognitive status: Whereas one high quality study (Berggren 2008) found no difference in Mini-Mental State Exam (MMSE) between intervention and control groups, two high quality studies found significant differences in favor of interdisciplinary care. Prestmo (2015) found significant improvement in MMSE and Clinical Dementia Rating scale for comprehensive geriatric care compared to orthopaedic trauma ward care. Shyu (2013) found a non-significant outcome for general mental health as measured by the SF-36 Mental Component Summary score for interdisciplinary comprehensive compared to usual care.

Depression: Berggren (2008) found that the Geriatric Depression scale scores favored conventional orthopaedic care group compared to multi-disciplinary multi-factorial care at 4 and 12 months after hospitalization. Prestmo (2015) found significant difference in depression symptoms in favor for comprehensive geriatric care. Shyu and colleagues (2008, 2010, 2013, 2013, 2013, 2016) followed 2 cohorts of hip fracture patients recruited in 2001-2003 and 2005-2010, respectively. The team tracked interdisciplinary versus usual care in the first cohort and noted reduction of depression in those treated with interdisciplinary care. They then added comprehensive care for their second cohort which included depression management and reduced depression even further.

Improved medical care: This issue was particularly addressed by Heltne (2017) who conducted a secondary analysis of the Trondheim Hip Fracture Trial, which compared acute inpatient comprehensive geriatric care (CGC) with traditional orthopaedic care. They found that at discharge the group had more prescribed medications, related to the treatment of conditions related to the fracture (e.g., pain, constipation, osteoporosis). In addition, the CGC group had more drugs withdrawn, such as cardiovascular and CNS-active drugs.

Length of stay: Results on hospital length of stay varied. Whereas Vidan (2005) found that early multidisciplinary daily geriatric care reduces in-hospital mortality and medical complications in older adult patients with hip fractures, there was no significant effect on length of hospital stay or functional recovery. Two studies also found no significant difference in length of stay between intervention and control groups (Marcantonio 2001, Duncan 2006). Moreover, while Prestmo (2015) found improved mobility, activities of daily living, and more frequent direct discharge home at 12 months for comprehensive geriatric care compared with usual orthopaedic care, they also found increased hospital length of stay. However, between 4 and 12 months, the comprehensive care group required fewer short-term nursing home stays. There was no difference between groups in hospital readmissions or permanent nursing home stay during the 4-12-month period. Similarly, Stenvall (2007 a and b) found shorter length of stay for the intervention group. Huusko (2000) conducted a secondary analysis of a RCT of intensive geriatric rehabilitation compared to usual care for 2 groups of patients with mild and

moderate dementia. For both groups, the intervention resulted in substantially shorter length of hospital stay and a higher percent of patients returning to living in the community.

Benefits/Harms of Implementation

Interdisciplinary care programs for patients with hip fracture have a longstanding record of use with few identified safety risks. Relative benefits and harms of specific program elements should be considered individually to guide design and implementation.

Cost Effectiveness/Resource Utilization

Available studies provide limited information on the cost-effectiveness of interdisciplinary care programs overall or aspects of specific programs that may increase or decrease their cost effectiveness.

Acceptability

Dedicated care programs are likely to be acceptable to patients and providers, although acceptability may vary depending on specific components.

Feasibility

Available studies demonstrate feasibility of program implementation overall across diverse settings; feasibility of implementation/use is likely to vary depending on program eligibility criteria and the specific components.

Future Research

Future research should compare the relative advantages of different intervention components and their timing, intensity, frequency, and duration. Additional research is needed to characterize the cost-effectiveness of interdisciplinary hip fracture programs from the perspective of different stakeholders (e.g., patient/family, hospital, payer, society).

OPTIONS

Low quality evidence, no evidence, or conflicting supporting evidence have resulted in the following statements for patient interventions to be listed as options for the specified condition. Future research may eventually cause these statements to be upgraded to strong or moderate recommendations for treatment.

STABLE FEMORAL NECK FRACTURES

In patients with stable (impacted/non-displaced) femoral neck fractures, hemiarthroplasty, internal fixation or non-operative care may be considered.

Quality of Evidence: Moderate

Strength of Option: Limited ★★☆☆

Evidence from two or more “Moderate” quality studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

Rationale

Strong evidence from one prospective clinical trial comparing 3 groups of patients randomized to non-operative care, internal fixation and hemiarthroplasty. Strong evidence is in favor of hemiarthroplasty group for composite QoL/Function outcome measures-Harris Hip Score (1m,3m and 6m) and EQ-5D (1m and 3m) but not at other time points, or other outcome measures including adverse events, length of stay or mortality.

There is strong evidence of equipoise between the non-operative care, internal fixation and hemiarthroplasty groups in the Wei (2020) study on all outcomes. However, there were significant differences in a few individual outcomes. For example, patients in the hemiarthroplasty group had better functional outcomes compared to the non-surgical group, whereas the outcomes between non-surgical and internal fixation groups were similar. Therefore, the overall strength of evidence was downgraded using EtDF to Limited.

Wei (2020) showed statistically significant and clinically meaningful short-term and intermediate-term pain, function and QoL outcome differences favoring the hemiarthroplasty group over the non-surgical group. However, these outcomes were similar in the long-term. All other outcome measures including pain, function, QoL as well as adverse events, complications, hospital stay, and mortality were similar between the 3 groups at all other time points. Therefore, hemiarthroplasty may be considered for short term improvement of function, QOL and mortality. Individual patient factors should be considered when determining appropriate intervention.

Benefits/Harms of Implementation

No differences in adverse events in two groups (hemiarthroplasty vs. non-operative), but better outcomes in hemiarthroplasty group at least in short and intermediate terms.

Outcome Importance

Composite QoL and Function outcomes are important and relevant (patient reported) to patient.

Acceptability

Patients may have variable acceptability of operative vs. non-operative recommendations.

Feasibility

Hemiarthroplasty may not be available in all centers.

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Future Research

Replication of Wei's study in other populations and health care systems is important.

CEPHALOMEDULLARY DEVICE – PERTROCHANTERIC FRACTURES

In patients with pertrochanteric femur fractures, short or long cephalomedullary nail may be considered.

Quality of Evidence: Low

Strength of Option: Limited ★★☆☆

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention.

Rationale

One moderate quality study (Shannon 2019) and multiple low quality studies reported lower surgical OR time, lower intraoperative blood loss (Frisch 2017, Horner 2017, Liu 2018), lower transfusion rate (Guo 2015), and less fluoroscopy (Frisch 2017, Horner 2017, Liu 2018) with short nail use. Multiple comparison studies reported no difference in adverse events (Bovbjerg 2020, Frisch 2017, Guo 2015, Horner 2017, Liu 2018, Rai 2020) nor patient reported outcomes (Rai 2020) in short versus long cephalomedullary nails. One low quality study (Frisch 2017) reported a higher incidence of periprosthetic fractures with short nails, but other studies did not find such findings (Guo 2015). Overall, both short or long cephalomedullary nails are acceptable options in pertrochanteric femur fractures.

Benefits/ Harms of Implementation

Benefits of implementation include shorter patient operative time and lower blood loss. There is risk that patients may suffer periprosthetic femur fractures with short nails.

Outcome Importance

The consequences of using a short versus long cephalomedullary nail is unaffected for adverse events such as implant cut out, infection or implant failure. A short nail may result in less operative time and lower blood loss, and possibly lower transfusion rate.

Cost Effectiveness/Resource Utilization

Shorter cephalomedullary nails generally have lower implant costs compared to long cephalomedullary nails. Additionally, shorter operative time and lower blood loss may have intangible healthcare related savings.

Acceptability

There are likely a large number of surgeons who are dogmatic about the use of long cephalomedullary nails, especially in the use of unstable fracture patterns such as reverse obliquity or subtrochanteric extension fractures. Additionally, studies have not looked specifically at use of short cephalomedullary nails in these fracture patterns.

Feasibility

No feasibility nor barriers foreseen

Future Research

Future research with high quality studies should help elucidate short versus long in unstable intertrochanteric fracture patterns and periprosthetic fracture risk factors.

WEIGHT BEARING

Following surgical treatment of hip fractures, immediate, full weight bearing to tolerance may be considered.

Quality of Evidence: Low

Strength of Option: Limited ★★☆☆

Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention.

Rationale

Two low level retrospective studies (Atzmon 2021, Otteson 2018) compared weight-bearing as tolerated to weight bearing restrictions (partial or non-weight bearing) following intra and extra-capsular hip fractures. Both studies found higher mortality in the non-weight bearing group. Otteson (2018) performed a review of 4918 patients through the NSQIP database of over 600 US centers and found that 75% of patients were allowed to weight-bear as tolerated. They reported that 30-day mortality, length of stay, post-operative delirium, infection, transfusion rates, pneumonia, and adverse events were lower in the weight bearing as tolerated cohort with no difference between groups with return to the operating room within 30 days. However, in the study by Atzmon (2021) weight-bearing restrictions were applied based on the surgeon or therapist’s judgement of patient inability to fully bear weight due to prior functional or cognitive limitations, inadequate fixation or bone quality, or high pain level. Otteson (2018) lacked information on the surgeon’s reason for imposing restrictions, the duration for which these restrictions were imposed, or the surgeon’s criteria that were used to lift the restrictions later in the recovery. Therefore, the results are subject to substantial risk of bias by indication.

Benefits/ Harms of Implementation

No studies reported adverse events and this recommendation has been adopted by ~75% of US orthopedic surgeons based on 2018 NSQIP report. Potential benefits include improved functioning and independence and reduced adverse outcomes.

Outcome Importance

Patient functioning, cost of care, adverse outcomes, and mortality may be improved by further adoption of early, unrestricted weight bearing.

Cost Effectiveness/Resource Utilization

Weight-bearing as tolerated does not require increased resources or costs.

Acceptability

Approximately 25% of patients receive weight-bearing restrictions, indicating lack of acceptability for a substantial proportion of providers and/or patients.

Feasibility

Evidence that 75% of patients are allowed to weight-bear as tolerated supports feasibility.

Future Research

Inconsistent adoption highlights the need for larger, prospective, multi-institutional longitudinal studies. Future research should endeavor to specify the reasons for weight-bearing restrictions, and investigate patients’ ability to comply, as well as the relationship between restrictions and lower extremity strength, power, functional mobility.

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APPENDICES

Appendix I: References

Introduction References

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View background material via the HipFx CPG eAppendix 1

View data summaries via the HipFx CPG eAppendix 2

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Appendix II: PICO Questions and Inclusion Criteria Used to Define Literature Search

1. In elderly patients who are treated for hip fracture, does the use of pre-operative traction result in beneficial patient outcomes? (Updated search limited to RCTs)
2. In elderly patients with hips fracture, what surgical timing results in optimal patient outcomes. (Updated search limited to RCTs)
3. In elderly patients with hip fracture, what is the recommended post-operative VTE prophylaxis and duration? (PICO maintained 2014 comparison format; mechanical vs pharmacological vs none vs both)
4. In elderly patients being treated for hip fracture, what operative anesthesia administration results in better patient outcomes?
5. In elderly patients being treated for stable hip fracture of the femoral neck, is surgery indicated?
6. In elderly patients with unstable femoral neck fracture, which surgical procedure results in better patient outcomes? (Updated search limited to RCTs)
7. In elderly patients with unstable (displaced) femoral neck fractures undergoing hemiarthroplasty, does unipolar or bipolar hemiarthroplasty result in better patient outcomes? (Updated search limited to RCTs)
8. In elderly patients with femoral neck fractures undergoing arthroplasty, what surgical procedure results in better patient outcomes?
9. In elderly patients with femoral neck fractures, what type of stem fixation results in better patient outcomes?
10. In elderly patients with femoral neck fractures, is there a specific surgical approach result in better patient outcomes?
11. In elderly patients do sliding hip screws or cephalomedullary devices result in better patient outcomes? (Updated search limited to RCTs)
12. In elderly patients with unstable intertrochanteric/pertrochanteric/subtrochanteric/basicervical fractures does the use of cephalomedullary devices result in better patient outcomes?(Updated search limited to RCTs)
13. In elderly patients with low-energy proximal femur fractures receiving a cephalomedullary device does the use of long or short cephalomedullary devices result in better patient outcomes? *
14. In elderly patients with hip fracture, what hemoglobin level should trigger administering a transfusion? (Updated search limited to RCTs)
15. In elderly patients with hip fracture, what pain management modalities are most effective? *
16. In patients with hip fracture, does administering fibrinolysis inhibitors improve patients' outcomes? *
17. Is a hip fracture service beneficial in changing outcomes for geriatric hip fractures? *
18. Does immediate weight bearing to tolerance following operative treatment for hip fracture impact outcomes? *Denotes a PICO question new to the 2021 CPG

Study Inclusion Criteria

- Study must be of **elderly patients with hip fractures**
- Article must be a full article report of a clinical study.
 - Retrospective non-comparative case series, medical records review, meeting abstracts, historical articles, editorials, letters, and commentaries are **excluded**.
 - Case series studies that give patients the treatment of interest AND another treatment are **excluded**.
 - Case series studies that have non-consecutive enrollment of patients are **excluded**.
 - Controlled trials in which patients were not stochastically assigned to groups AND in which there was either a difference in patient characteristics or outcomes at baseline AND where the authors did not statistically adjust for these differences when analyzing the results are **excluded**.
 - All studies of “Very Weak” strength of evidence are **excluded**.
 - All studies evaluated as Level V will be **excluded**.
 - **Unvalidated** Composite measures or outcomes are **excluded** even if they are patient-oriented.
- Study must appear in a peer-reviewed publication
- Study should have **30 or more patients per group**
- Study must be of humans
- Study must be published in English
- Study must be published in or after **2013 (last search from previous CPG), new PICOs - 1995**
- Study results must be quantitatively presented
- All study follow up durations are included
- For any given follow-up time point in any included study, there **must be ≥ 50% patient follow-up** (*if the follow-up is >50% but <80%, the study quality will be downgraded by one Level*)
- For any included study that uses “paper-and-pencil” outcome measures (e.g., SF-36), only those outcome measures that have been validated will be included
- Study must not be an in vitro study
- Study must not be a biomechanical study
- Study must not have been performed on cadavers

Patient population: Elderly ≥ 65

- Inclusion: Enrolled patients ≥ 50 and mean ≥ 65
- low-energy proximal femur fractures (subcapital fractures, subtrochanteric fractures, peritrochanteric fractures, intertrochanteric fractures, femoral neck fractures (fractured neck of femur), basicervical fractures, midcervical fractures)

Exclude: >10%: Acetabular/pelvic fractures, oncological fractures (malignancies and tumor processes) atypical fractures, periprosthetic fractures, high-energy fractures (low-energy=equivalent to fall from standing height), avascular necrosis

We will only evaluate surrogate outcomes when no patient-oriented outcomes are available.

Best Available Evidence

When examining primary studies, we will analyze the best available evidence regardless of study design. We will first consider randomized controlled trials identified by the search strategy. In the absence of two or more RCTs, we will sequentially search for prospective controlled trials, prospective comparative studies, retrospective comparative studies, and prospective case-series studies. Only studies of the highest level of available evidence are included, assuming that there were 2 or more studies of that higher level. For example, if there are two Level II studies that address the recommendation, Level III and IV studies are not included.

Appendix III: Guideline Development Group Disclosures

Julie A Switzer, MD, FAAOS

Submitted on: 02/02/2021

AAOS: Board or committee member (\$0) Workgroup AAOS Clinical Practice Guideline on Hip Fxs in Elderly Patients (Self)

American Orthopaedic Association: Board or committee member (\$0) Own the Bone Steering Committee (Self)

DePuy Synthes: Other financial or material support (\$18,000) Support to institution for Geriatric Trauma Symposium,

Dr. Switzer was course chairman (Self)

GOS&R: Editorial or governing board (\$0) Editorial Board member (Self)

IGFS International Geriatric Fracture Society: Board or committee member (\$0) Board Member (Self)

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Submitted on: 08/06/2021

BoneSupport, Inc.: Paid consultant (\$24,000) BoneSupport, Inc. (Self)

Cohere Health: Paid consultant (\$3,000) Cohere Health (Self)

Cohere Health: Stock or stock Options Number of Shares: 2,000 Cohere Health (Self)

Mayo Clinic Press: Publishing royalties, financial or material support (\$2,500) Mayo Clinic Press (Self)

Vori Health: Employee (\$250,000) Vori Health (Self)

Vori Health: Stock or stock Options Number of Shares: 20,000 Vori Health (Self)

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American Geriatrics Society: Board or committee member (\$0) Quality Performance and Measures Committee;

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International Geriatrics Fracture Society: Board or committee member (\$0) President Elect (Self)

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American Journal of Physical Medicine & Rehabilitation: Editorial or governing board (\$0) Associate Editor-Editorial Board Member (Self)

Avazzia: Research support (\$0) Institution receives research funding (Self)

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(This individual reported nothing to disclose); Submitted on: 10/12/2021

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