

AUTHORS

Paul Toogood¹

AFFILIATIONS

¹Department of
Orthopedics,
University of
California San
Francisco, USA

CORRESPONDENCE

Paul Toogood
Associate Professor,
University of California
San Francisco, USA;
Email:
paul.toogood@ucsf.edu

REVIEW ARTICLE

Femoral Neck Fractures:
Replacement

Abstract

<https://doi.org/10.59173/noaj.20251104h>

As the population continues to live longer and be in better health low energy neck of femur fractures continue to rise annually in incidence. Such injuries are common enough that many orthopedic surgeons doubtlessly feel confident in their management. Despite this the topic retains importance to the practicing surgeon and the health system because these injuries require rapid and judicious management and are still plagued with complications and consequences for patients and their families. Optimizing indications and excellence in technical execution remain the surgeons' best tools to maximize outcomes. The current review provides an update on four technical considerations during replacement (arthroplasty) for these injuries: Approach, fixation, head type (hemiarthroplasty), and hemiarthroplasty versus total hip arthroplasty.

KEYWORDS

Neck of femur fracture; replacement; indications; technique

Introduction

Fractures of the femoral neck are commonplace, with rates increasing as the population ages worldwide. Despite their routine nature, the topic continues to be of critical importance both to orthopedic surgeons and their patients because these customary injuries require urgent management, have a persistently high complication rate, and often lead to functional decline.

Significant insight has been gained even within the last 15 years regarding the importance of time to surgery. While patients with neck of femur fractures often present with medical complexities and overt frailty, it has become clear that delaying surgery for "medical optimization" is unnecessary and even harmful. Meta-analysis of prior prospective observational studies clearly demonstrated a benefit to surgery within 24 hours of injury with a 1-year mortality relative risk reduction of 45% and

similar improvements in the rates of the consequences of prolonged recumbency, such as pneumonia and pressure sore development.¹ While the HIP ATTACK study, a large multi-center randomized controlled trial, failed to demonstrate a mortality or composite complication reduction when evaluating an even more accelerated time to surgery of less than 6 hours, rates of delirium, urinary tract infection, time to mobilization, and time to hospital discharge all benefitted from rapid surgical intervention.² Such robust data at a minimum strongly supports the need for urgent (within 24 hour) intervention, requiring a robust healthcare delivery system. Adding to the importance of this topic are the persistently high complication rates and frequently observed functional decline after neck of femur fractures in the elderly. While these cases often feel technically

routine to the experienced surgeon, dislocation (2.1-7.2%),^{3,4} transfusion rates (16-33%),^{5,6} infection (0-5.1%),⁷ and medical complications and mortality (22%)² remain frequent and consequential. Even when such reportable complications are avoided, most patients never regain their pre-fracture mobility.⁸

While numerous aspects of surgical care for neck of femur fractures influence outcomes, this article will focus on indications and review and emphasize four critical technical considerations when performing replacement for neck of femur fractures.

Indications

The surgical management of neck of femur fractures in the geriatric population can be broadly divided into fixation and arthroplasty and the Garden Classification has long been the tool relied upon to help make this fundamental decision. Simplified into two categories, instead of the traditional four, neck of femur fractures can either be non-displaced (usually valgus impacted) or displaced. Non-displaced injuries, as judged by the AP view per the Garden Classification, have traditionally been managed with in situ fixation while displaced injuries have repeatedly proven to be better managed with arthroplasty given the high failure rates seen with attempts at reduction and fixation.⁹

While this simple algorithm continues to dominate contemporary management of neck of femur fractures in the elderly, additional considerations beyond fracture displacement on the AP radiograph have more recently surfaced. Specifically, consideration of the lateral view at presentation and of the patient's age, have proven to be impactful variables. The FAITH trials demonstrated the importance of considering posterior tilt on the lateral view, rather than just the appearance on the AP radiograph, when considering indicating patients for fixation; patients with > 20 degrees of posterior tilt had significantly higher rates of failure compared to those with

< 20 degrees of posterior tilt (22% vs 12%).¹⁰ [Figure 1] Increasing posterior tilt both reduces the inherent stability of the injury and also the ability of fixation to gain adequate purchase in the head fragment ultimately reducing the success rate of fixation in these cases. Similarly, higher failure rates of internal fixation and the need for conversion to arthroplasty have been repeatedly documented in the very elderly,¹¹ leading some to suggest primary arthroplasty regardless of Garden Classification. This may again be due to poor inherent stability and fixation, this time from declining bone quality. Evaluation of posterior tilt and consideration of age have thus expanded the indications for arthroplasty beyond the dichotomy presented by the Garden Classification.

Technical considerations:

While indicating the correct patient for the correct procedure may be the most critical step in achieving good outcomes, correct technical execution is a close second. When considering arthroplasty for neck of femur fractures four technical variables have evidence worth reviewing.

Approach

The most common approaches for accessing the hip during arthroplasty are the posterior (Southern/Moore/Kocher-Langenbeck), the lateral (Hardinge), the anterior-lateral (Watson-Jones) and the direct anterior (Smith-Peterson/Hueter). While surgeon comfort will always play a role in choice of approach, at a population level there are differences in outcomes and complication rates that should be influencing surgeons' choices also.

Dislocation is a devastating and challenging problem after hemiarthroplasty and it appears clear that choice of approach influences the rates of this complication. Rates of dislocation are undoubtedly lower with a lateral, anterior-lateral, and direct anterior approaches (0-3%) as compared to a posterior approach with (8%) or without (13%) posterior repair.¹²⁻¹⁴ While

surgeon comfort with the posterior approach remains a persistent factor in approach selection, it seems clear that the posterior approach should be avoided for this reason in most cases. While the direct anterior approach has a well documented learning curve both for hemiarthroplasty and total hip replacement, the Hardinge, in particular, is a simple approach most surgeons can quickly master and incorporate into their practice. It is also worth noting that other potential complications, such as mortality, reoperation, fracture, infection, blood loss, and operative time also appear to be equivalent amongst the approaches.^{13,14}

Fixation

When inserting a femoral stem surgeons must select fixation using either a press-fit or cemented stem. While it is true that both have their advantages and disadvantages and are technique dependent, it is also true that considerable evidence now supports the routine use of cement fixation for arthroplasty for femoral neck fractures in the elderly. While cementation adds a small amount of time to the operation and risks the very rare complication of intra-operative cardiac collapse, its benefits seem to far outweigh these shortcomings. Specifically, the risk of intra-operative fracture and post-operative pain and mobility appear to substantially benefit from cement fixation.¹⁵ Intra-operative fracture is rare with cemented stems, as a tight, geometric fit is not required when planning for a cement mantle. Rates of fracture when performing press-fit fixation are measurably higher (5-6%), as surgeons using this technique aim for a stable initial fit in osteoporotic bone. Less dramatically, but just as importantly, there appears to be reduced mobility and increased pain with press-fit stems in the elderly population as compared to cement fixation. This is likely due to an occult lack of in-growth/on-growth in press-fit stems which generates micromotion and pain. Given these shortcomings, the American

Academy of Orthopedic Surgeons, which has often struggled to come out with strong practice guidelines in this regard, has stated plainly that cementation is the preferred method of fixation during replacement for elderly neck of femur fractures.

Head: Unipolar versus Bipolar

When performing a hemiarthroplasty two head types may be available to the surgeon, unipolar and bipolar. Unipolar is a simple solid head, with all motion at the articulation occurring between the metallic head and the native cartilage. Bipolar heads consist of an outer, large diameter metallic ball with an internal polyethylene surface which articulates with an inner, smaller diameter metallic ball. The bipolar head thus has two surfaces for articular motion, one within the implant and one between the larger, outer head and the native cartilage surface of the acetabulum. The rationale for the development of the bipolar head was largely to try and reduce some of the shear forces, and so possible wear, between the implant and the native cartilage of the acetabulum. While the bipolar design had merit at its inception, subsequent evaluation has not demonstrated any of the anticipated benefits. Numerous studies, combined in a meta-analysis,

have failed to detect any difference between the two head types.¹⁶ Rates of erosion, function status, and dislocation all appear to be equivalent. Given the increased cost of production of bipolar heads, the author of this review favors simple unipolar heads when performing hemiarthroplasty for neck of femur fractures.

Hemiarthroplasty versus Total Hip Arthroplasty

Both hemiarthroplasty and total hip arthroplasty have long been used to address displaced neck of femur fractures in the elderly. Numerous authors have attempted to compare these two options, often with the explicit goal of determining which intervention is “superior”. While extensive, high-quality data has been developed and demonstrated notable differences between the two, neither is truly superior in every case. Rather, the data supports the use of both procedure in two separate sub-categories of patients based on function, aligning the benefits of each procedure with the needs of the subpopulation. [Figure 2]

Because of the larger head diameter and reduced dissection required to perform hemiarthroplasty, data has repeatedly shown a reduced rate of dislocation after hemiarthroplasty as compared to total hip arthroplasty.¹⁷Due to

complete replacement of both sides of the joint during total hip arthroplasty, eliminating a metallic bearing surface articulating against native cartilage, total hip arthroplasty has repeatedly showed improved function and reduced revision rates compared to hemiarthroplasty.¹⁷ As such, for those patients with low functional demands and an elevated risk of dislocation, such as from cognitive decline, hemiarthroplasty remains the procedure of choice for displaced neck of femur fractures. However, for those patients who are relatively higher demand functionally, ambulating out of the home with little or no assistance, and who are cognitively normal, total hip arthroplasty provides improved function with an acceptably higher risk of dislocation. “Bhandari’s paradox”¹⁸ is an observation where a vast majority (>93%) of patients at high risk for a hip fracture seem to prefer a THA in the event of a fracture, in sharp contrast to reality where a mere 8% to 13% actually obtain a THA as reported in most hip fracture registries. While trials suggest superior function of THA over hemiarthroplasty, it must be emphasized that the patients enrolled were independent community ambulators without any cognitive impairment.^{19,20}In patients with limited ambulatory potential, cognitive impairment, or significant co-morbidities, the benefits of a THA must be seriously weighed against the potential for serious complications. Neither procedure is truly superior in all ways; a straightforward discussion of the advantages and disadvantages of each with the patient and family remains the best way to match the procedure and patient correctly.

Conclusion

Displaced neck of femur fractures in the elderly, while common, continues to be a critical topic of review for the practicing orthopedic surgeon. Such injuries require urgent management and continue to be plagued with significant complication rates. As such, understanding indications

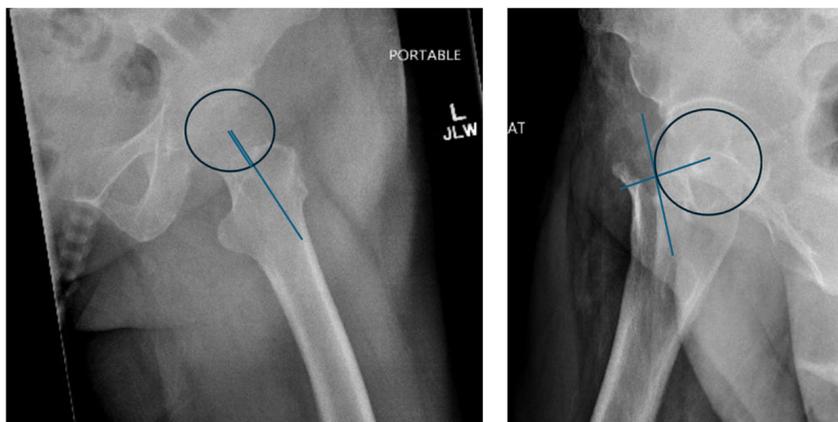


Figure 1 Two patients who both presented with neck of femur fracture who on the AP radiograph would have been labeled at Garden 1. However, on the lateral views show below one patient has essentially no posterior tilt while the other has almost 90 degrees. The patient with little or no tilt remains a candidate for in situ fixation while the patient with significant tilt requires replacements



Figure 2 A 68-year-old male, a high-functioning community ambulator, with displaced subcapital fracture, was treated with a THA

for replacement and being able to maximize outcomes with the correct selection of approach, fixation strategy, and articular bearing type remains critical. Virtually all hospital systems require a robust system for caring for these patients and orthopedic surgeons who feel confident in the technical execution of these procedures.

Conflict of Interest

None

References

1. Simunovic N, Devereaux PJ, Sprague S, Guyatt GH, Schemitsch E, DeBeer J, Bhandari M. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. *Cmaj*. 2010 Oct 19;182(15):1609-16. <https://doi.org/10.1503/cmaj.092220>
2. Borges FK, Bhandari M, Guerra-Farfan E, Patel A, Sigamani A, Umer M, Tiboni ME, del Mar Villar-Casares M, Tandon V, Tomas-Hernandez J, Teixidor-Serra J. Accelerated surgery versus standard care in hip fracture (HIP ATTACK): an international, randomised, controlled trial. *The Lancet*. 2020 Feb 29;395(10225):698-708.
3. Jobory A, Kärrholm J, Hansson S, Åkesson K, Rogmark C. Dislocation of hemiarthroplasty after hip fracture is common and the risk is increased with posterior approach: result from a national cohort of 25,678 individuals in the Swedish Hip Arthroplasty Register. *Acta orthopaedica*. 2021 Jul 4;92(4):413-8. <https://doi.org/10.1080/17453674.2021.1906517>
4. Skotidis E, Bekas K, Kechagias I, Tsakonas-Ntervakos I, Galanakos SP, Kateros K, Bekas KN. Dislocation of Total Hip Arthroplasty of Femoral Neck Fracture in the Elderly: A Narrative Review. *Cureus*. 2023 Oct 1;15(10). <https://doi.org/10.7759/cureus.46307>
5. Liodakis E, Antoniou J, Zukor DJ, Huk OL, Epure LM, Bergeron SG. Major complications and transfusion rates after hemiarthroplasty and total hip arthroplasty for femoral neck fractures. *The Journal of arthroplasty*. 2016 Sep 1;31(9):2008-12. <https://doi.org/10.1016/j.arth.2016.02.019>
6. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty: treatment of displaced intracapsular hip fractures in healthy older patients. *JBJS*. 2006 Feb 1;88(2):249-60. <https://doi.org/10.2106/JBJS.E.00215>
7. Savage P, McCormick M, Al-Dadah O. Arthroplasty infection rates in fractured neck of femur: single vs dual antibiotic cement. *The Annals of The Royal College of Surgeons of England*. 2019 Sep;101(7):514-8. <https://doi.org/10.1308/rcsann.2019.0054>
8. Ho JP, Wong AY, Ong LH, Rutel A, Abdullah S, Jaffar MS, Bong CH, Tan KT, Rao RP, Kamaruddin F. Mobility and hip function among geriatric patients with displaced neck of femur fractures treated with arthroplasty. *Geriatric Orthopaedic Surgery & Rehabilitation*. 2023 Mar 8;14:21514593231164245. <https://doi.org/10.1177/21514593231164245>
9. Johansson T. Internal fixation compared with total hip replacement for displaced femoral neck fractures: a minimum fifteen-year follow-up study of a previously reported randomized trial. *JBJS*. 2014 Mar 19;96(6):e46. <https://doi.org/10.2106/JBJS.K.00244>
10. Okike K, Udogwu UN, Isaac M, Sprague S, Swiontkowski MF, Bhandari M, Slobogean GP. Not all Garden-I and II femoral neck fractures in the elderly should be fixed: effect of posterior tilt on rates of subsequent arthroplasty. *JBJS*. 2019 Oct 16;101(20):1852-9. <https://doi.org/10.2106/JBJS.18.01256>
11. Ma HH, Chou TF, Tsai SW, Chen CF, Wu PK, Chen WM. Outcomes

- of internal fixation versus hemiarthroplasty for elderly patients with an undisplaced femoral neck fracture: a systematic review and meta-analysis. *Journal of orthopaedic surgery and research*. 2019 Dec;14:1-8. <https://doi.org/10.1186/s13018-019-1377-5>
12. Enocson A, Tidermark J, Törnkvist H, Lapidus LJ. Dislocation of hemiarthroplasty after femoral neck fracture: better outcome after the anterolateral approach in a prospective cohort study on 739 consecutive hips. *Acta orthopaedica*. 2008 Jan 1;79(2):211-7. <https://doi.org/10.1080/17453670710014996>
13. Kunkel ST, Sabatino MJ, Kang R, Jevsevar DS, Moschetti WE. A systematic review and meta-analysis of the direct anterior approach for hemiarthroplasty for femoral neck fracture. *European Journal of Orthopaedic Surgery & Traumatology*. 2018 Feb;28:217-32. <https://doi.org/10.1007/s00590-017-2033-6>
14. Manzo MA, Hali K, Koucheki R, Wolfstadt JI, Edwards TC, Lex JR. Complications and early recovery following hip hemiarthroplasty through the direct anterior approach: a systematic review and meta-analysis. *European Journal of Orthopaedic Surgery & Traumatology*. 2023 Dec;33(8):3267-86. <https://doi.org/10.1007/s00590-023-03603-0>
15. Taylor F, Wright M, Zhu M. Hemiarthroplasty of the hip with and without cement: a randomized clinical trial. *JBJS*. 2012 Apr 4;94(7):577-83. <https://doi.org/10.2106/JBJS.K.00006>
16. Liu Y, Tao X, Wang P, Zhang Z, Zhang W, Qi Q. Meta-analysis of randomised controlled trials comparing unipolar with bipolar hemiarthroplasty for displaced femoral-neck fractures. *International orthopaedics*. 2014 Aug;38:1691-6. <https://doi.org/10.1007/s00264-014-2355-5>
17. Lewis DP, Wæver D, Thorninger R, Donnelly WJ. Hemiarthroplasty vs total hip arthroplasty for the management of displaced neck of femur fractures: a systematic review and meta-analysis. *The Journal of arthroplasty*. 2019 Aug 1;34(8):1837-43. <https://doi.org/10.1016/j.arth.2019.03.070>
18. Alolabi N, Alolabi B, Mundi R, Karanicolas PJ, Adachi JD, Bhandari M. Surgical preferences of patients at risk of hip fractures: Hemiarthroplasty versus total hip arthroplasty. *BMC Musculoskeletal Disord*. 2011;12:289. <https://doi.org/10.1186/1471-2474-12-289>
19. Baker RP, Squires B, Gargan ME, Bannister GC. Total hip arthroplasty and hemiarthroplasty in mobile independent patients with a displaced intracapsular fracture of the femoral neck. *J Bone Joint Surg Am*. 2006;88:2583-2589. <https://doi.org/10.2106/JBJS.E.01373>
20. Goh SK, Samuel M, Su DH, Chan ES, Yeo SJ. Meta-analysis comparing total hip arthroplasty with hemiarthroplasty in the treatment of displaced neck of femur fracture. *J Arthroplasty*. 2009;24:400-406. <https://doi.org/10.1016/j.arth.2007.12.009>