

Femoral Neck Fractures in the Elderly

Boot Camp 2013

Phoenix, AZ

Issue 1: Arthroplasty vs ORIF

- Non-displaced or minimally displaced fractures - standard treatment is closed reduction and internal fixation in all ages.
 - Hudson, CORR, 1998. At 8 year f/u
 - Nondisplaced treated with ORIF - no difference in revision rate compared to arthroplasty
 - Displaced treated with ORIF - higher 8 year cumulative revision rate in older patients compared to arthroplasty
 - However, patients with previous symptomatic hip arthritis or those with pathologic fractures may benefit from primary THA.
- Displaced femoral neck fractures in the elderly - Arthroplasty is preferred.
- Argument for ORIF rather than arthroplasty:
 - retaining a patient's femoral head will result in better hip function
 - quicker
 - cheaper
 - less blood loss
 - lower dislocation rate
- Argument for THA rather than ORIF :
 - Faster mobilization, immediate WBAT
 - Less pain
 - Lower revision rate
 - the rate of reoperation following internal fixation of femoral neck fractures is relatively high.
 - A meta-analysis (Bhandari, JBJS, 2003) - rates of osteonecrosis and nonunion in hip fractures treated with fixation as high as 20% and 30%, respectively.
 - The relative risk of revision surgery after arthroplasty was LOWER compared with the risk after internal fixation (RR=0.23, p = 0.0003).

- 35% with displaced femoral neck fractures treated with internal fixation required reoperation. The cost of treating such complications is immense.
 - Concluded that 17 conversion surgeries can be avoided for every 100 pts treated with arthroplasty over ORIF.
- Rogmark, JBJSBr, 2002. RCT ORIF vs arthroplasty in age >70.
 - 2 year f/u, failure rate was 43% in the internal fixation group versus 6% in the arthroplasty group
- Keating, JBJS, 2006 compared ORIF with hemi and THA in pts >60yrs with displaced femoral neck. (They also compared ORIF with hemiarthroplasty alone.)
 - At 2yr f/u, secondary surgery rate of 39% in the ORIF group vs. 5% with hemi and 9% with THA
 - ORIF group had worse functional and quality of life outcome scores compared with the THA group at 24 months.
 - Cost analysis – ORIF significantly MORE expensive.
 - Concluded - Arthroplasty was superior to ORIF for displaced femoral neck fractures for the over-60 patient population.
- Patient factors (age, activity level, cognitive level, and associated comorbidities) and fracture factors (degree of displacement, degree of comminution, age of the fracture, and the quality of bone) matter.
- Age historically is considered major determinant in a treatment plan.
 - Younger patients (<60 years) with high activity levels and good bone quality, the trend is to towards closed or open reduction and internal fixation (ORIF).
 - Older patients (>80 years), significant medical comorbidities, sedentary lifestyle, osteopenic bone - arthroplasty is the preferred treatment.
 - Definitive age cutoff difficult. Often arbitrarily set at physiologic age 65 given differences in physiologic vs chronologic age.
 - Rogmark Scoring System (age, habitat, walking aids, mental status)

Issue 2: Unipolar vs. Bioplar

- No consensus
- Theoretical advantage of bipolar over unipolar:

- Prosthesis-prosthesis articulation theoretically decreases acetabular wear by shifting some hip movement away from the acetabulum to the internal prosthesis-prosthesis articulation.
- Does the articulation move? - Maybe
 - Drinker and Murray, JBJS, 1979 – only minor motion at inner bearing
 - Phillips, JBJSBr, 1987 – Bateman Bipolar Prosthesis, 76 pts with pre-existing OA, 80% had inner bearing motion primarily
- Any better outcomes? – Not convincingly.
 - Cochrane review 2004 – 7 RCTs with 857 pts. Each study suffering from small numbers and only short term f/u.
 - No difference for:
 - dislocation, acetabular cartilage erosion, deep wound sepsis, reoperations, deep vein thrombosis, or mortality.
 - Australian National Joint Replacement Registry, 2011 – higher revision rates in bipolar than bipolar in age <75.
 - Selection bias inherent.
- Disadvantages of bipolar:
 - Cost
 - Potential consequences of polyethylene wear debris
 - Increased chance of a dislocation requiring open reduction
- Factors leading to acetabular cartilage erosion are age, activity level, and length of follow-up.
- Summary: Given the above disadvantages, unipolar hemiarthroplasty may be recommended in older, less active pts with shorter life expectancy.
 - Given this, we are left with question - who to use bipolar on?
 - The other group may be appropriate for THA.

Issue 3: THA vs Hemiarthroplasty

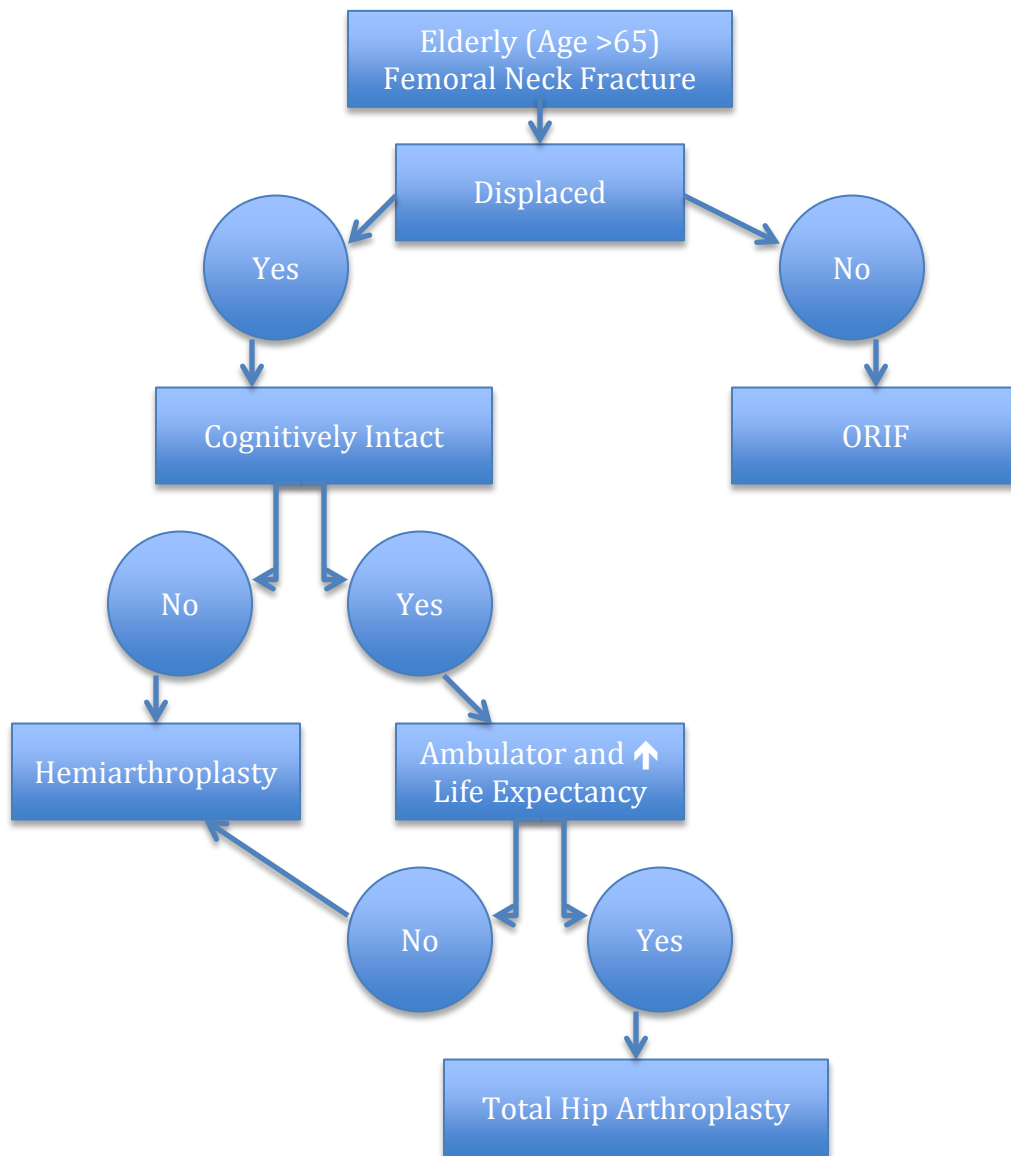
- Historically, hemiarthroplasty has been preferred management for femoral neck fractures not suited for ORIF.
- Advantages of hemiarthroplasty compared to THA
 - quick, relatively simple surgical technique
 - lower risk of dislocation related to the larger head size
- The main disadvantages of hemiarthroplasty
 - potential for wear of acetabular articular cartilage

- 0-26% incidence in bipolar, 2.2-38% incidence in unipolar hemi
 - Kofoed, Injury, 1983 studied 106 consecutive patients who underwent unipolar hemi
 - 37% of the 71 patients followed up at 2 years needed or had undergone THA; of those who were living independently, 55% required THA because of the development of pain.
- THA disadvantages:
 - Technically more challenging.
 - Now 2 components to place with placement of acetabular component and need to restore length and offset.
 - Higher early dislocation rate, especially with older designs and techniques, posterior approach and small head sizes.
 - Papandrea, Am J Orthop, 1996.
 - THA for femoral neck fx higher dislocation rate than elective THA for OA.
 - When patients with a single, early (<4 mos postop) dislocation excluded from dislocation statistics, unipolar and bipolar hemiarthroplasty and THA all have similar long-term dislocation rates
 - Skinner, Injury 1989.
 - Higher dislocation rate may be due to greater preop ROM.
 - Similar Dislocation rates at 1 year.
 - Sierra, CORR, 2005.
 - Posterior approach in pts >80yrs with lower dislocation rate with posterior capsular repair.
 - Role of dual mobility designs?
 - Tarasevicius et al. BMC Musculoskeletal Disorders 2010 – 0/42 dislocation with dual articulation vs 8/56 with conventional THA.
 - More studies ongoing. Promising.
- Mounting literature in favor of THA over hemi. Some limitations to studies, including uni vs. bipolar and older (often nonmodular) designs.
 - Dorr, JOA, 1986 compared cemented THA, cemented hemi, and uncemented hemi.
 - No differences in mortality between groups.

- Rate of dislocation was 18% after THA vs 5% after uncemented hemiarthroplasty.
 - Uncemented hemiarthroplasty did not show functional improvement after surgery. Cemented hemiarthroplasty function deteriorated after 6 months. However, function continued to improve in patients treated with THA.
- Gebhard, CORR, 1992 compared unipolar hemiarthroplasty to THA.
 - 156 patients, mean age of 76
 - Unipolar hemiarthroplasty (122 surgeries; 77 cemented, 45 uncemented) vs THA (44 surgeries; all cemented).
 - Average age, anesthesia risk classification, in-hospital mortality, early complications, and dislocation rates were comparable.
 - Pain, walking, and function scores were higher with THA at avg 56 mos f/u.
 - Revision rates: THA -2.2%; Cemented hemi - 7.9%; Uncemented hemi - 13%.
- Squires, Injury, 1999, compared hemi with THA at mean 4 years f/u.
 - No THA patient required revision vs. 38% of hemiarthroplasties revised to THA.
 - 6% dislocation in THA.
 - 86% THA good to excellent HHS vs 12% hemi
 - 77% THA could walk >1mi vs 27% hemi.
 - Selection bias a concern.
- Ravikumar and Marsh, Injury, 2000. RCT 271 pts with Garden III/IV treated by ORIF, hemi or THA.
 - At 1 year, 27% hemi pts had persistent severe pain vs 0% in THA.
 - At 13 years, 24% of initial 91 hemi pts went on to revision to THA. Only 6.4% of THA pts required reoperation.
 - 20% dislocation rate in THA vs. 13% hemi.
- Baker and Squires, JBJS, 2009, RCT cemented 28mm THA (40 pts) vs cemented unipolar hemi (41 pts) via posterior approach.
 - Mean f/u 3 years
 - THA walked farther (> 2mi vs ~1mi, p = 0.039) and had a lower (better) Oxford hip score (p = 0.033) hemi.
 - 20/32 surviving hemis showed acetabular erosion.

- 0 dislocations hemi, 3 dislocations THA
 - 2 revisions hemi to THA, 3 more indicated. 1 revision in THA for femoral stem subsidence.
 - Swedish and Norwegian Registers have looked at cemented THA and shown higher revision rate in this group vs. THA for OA.
 - Main reasons for revision were dislocation and periprosthetic fracture.
 - Adequate implant survival rate of 95% at 5 years
 - Concluded that THA in fracture patients is a good option but there was an increased risk of early dislocations and periprosthetic fractures but larger head sizes with cross linked poly have made THA a better option.
- Cost:
 - Iorio, CORR, 2001 – Procedure Total Costs for Two Years
 - Internal Fixation \$24606
 - Bipolar Hemiarthroplasty \$22043
 - Unipolar Hemiarthroplasty \$21597
 - Hybrid Total Hip Arthroplasty \$21066
 - Cemented Total Hip Arthroplasty \$20670
- Summary:
 - Important factors: Surgical approach, recreation of appropriate hip biomechanics (length and offset), application of large head-to-neck ratios, cross-linked poly, quality of capsular closure, surgical experience and improvements in prosthesis technology
 - Due to the risk of dislocation, approaches which preserve the posterior capsule may reduce the risk of dislocation. However, use approach of comfort.
 - Strong repair of the posterior capsule is important for via posterior approach.
 - Preservation of the medial capsule will minimize the risk of dislocation or the risk of leg lengthening.
 - Larger head sizes minimizes the risk of dislocation.
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 - See algorithm
- Pearls:

- Offset gives stability (over length)
- Metal-on-Metal is out. Beware of new technologies, but... Dual Mobility?
- In the elderly, metal heads adequate (higher cost with ceramic)
- Combined anteversion is the key. Ranawat test. Consider start with femur first.
- Preserve calcar bone.
- Template off the good hip to help determine neck cut length.
- Acetabular positioning to meet combined anteversion needs. Look at anatomic landmarks and use the TAL.



Issue 4: Cemented vs Uncemented

- Many current papers on arthroplasty for hip fracture include comparisons older designs of uncemented prosthesis (eg. Austin-Moore).
 - Not surprising that the current evidence has been in favor of cemented femoral stem fixation.
- Disadvantages of uncemented implants in elderly:
 - potential for retarded osteointegration
 - osteopenia and concern for fracture
 - wide femoral canal and/or mismatch of proximal/distal diameters.
- Advantages of uncemented femoral components
 - including faster implantation
 - potential lower risk of fat and marrow embolism compared to cemented implants.
- Supporting literature can be found in favor of both methods
 - Parvizi, JBJS, 2004. Review of 7774 patients with hip fractures treated with arthroplasty,
 - mortality was HIGHER in cemented group (3.5% versus 1.5%)
 - Selection bias.
 - Parker, Cochrane Review, 2010.
 - Twenty-three trials involving 2861 older and mainly female patients
 - Cemented prostheses, when compared with uncemented prostheses (6 trials, 899 participants) were associated with a less pain at a year or later and improved mobility.
 - No significant difference in surgical complications was found.
 - One trial of 220 participants compared a HA coated hemi with a cemented prosthesis and reported no differences
 - Conclusion: There is good evidence that cementing the prostheses in place will reduce post-operative pain and lead to better mobility
 - Ahn, CORR, 2008 – Meta-analysis of 11 studies cemented vs uncemented hemiarthroplasty for femoral neck
 - 80 mins uncemented vs 95 minutes cemented and 338 vs. 467 mL blood loss
 - Postoperative mortality rates, overall complications, and pain were similar between the two cohorts.

- No significant differences in outcome measurements
 - Lack of standardization
 - Swedish Register data suggests that the long term outcomes, including mortality, are better in the cemented group, mostly because of a higher re-operation rate in the uncemented group.
 - Klein and Parvizi et al., JOA, 2006 - 85 patients, mean age 78yrs, with an acute femoral neck fracture treated with THA using a tapered, proximally coated femoral stem.
 - Avg f/u 3.8 yrs, all femoral components were stable with evidence of bone growth in all but one hip, which was felt to have stable fibrous in growth.
 - 3 dislocations, 2 intraop fx, 1 postop periprosthetic fx. 1 fracture required revision of the stem.
 - AAOS 2012 Abstracts
 - Paper 760: Cemented versus Uncemented Hemiarthroplasty for Intracapsular Neck of Femur Fracture - A National Analysis. Jameson et al.
 - 70-90 year olds undergoing hemiarthroplasty in English NHS
 - 9533 uncemented and 15996 cemented. Significantly higher (2.3% vs 0.9%) revision rate in cemented.
 - Higher 90 mortality and lower respiratory tract infection in uncemented – thought to be due to higher pain and less early mobility.
 - Paper 754: Increased Reoperation Risk for Bipolar and Uncemented Implants; National Registration 25,913 Hemiarthroplasties. Leonardsson et al.
 - 25913 hemiarthroplasties in Swedish Hip Arthroplasty Register.
 - Uncemented stems and bipolar arthroplasties had highest revision rates.
 - Anterolateral had lower revision due to dislocation.
- Summary: Although theoretical advantages exist to support the use of uncemented stems (faster operative time, decreased pressurization and potential less fat emboli), the current literature supports the use of cemented stems when performing arthroplasty for the treatment of displaced femoral neck fractures.

- Current studies suffer from a lack of standardization of implants, the use of dated designs and registry data with inherent selection biases.

References:

- Macaulay W, Pagnotto MR, Iorio R, Mont MA, Saleh KJ. Displaced Femoral Neck Fractures in the Elderly: Hemiarthroplasty Versus Total Hip Arthroplasty. *JAAOS* 14(5): 287, 2006
- Bhandari M, Devereaux PJ, Swiontkowski MF, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. A meta-analysis. *J Bone Joint Surg Am.* 2003;85:1673-1681.
- Iorio R, Healy WL, Lemos DW, et al. Displaced femoral neck fractures in the elderly. Outcomes and cost-effectiveness. *Clin Orthop.* 2001;383:229- 242.
- Ravikumar KJ, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of the femur - 13 year results of a prospective randomized study. *Injury.* 2000;31:793-797.
- Sim FH, Stauffer RN. Management of hip fractures by total hip arthroplasty. *Clin Orthop.* 1980;152:191-197.
- Lee BPH, Berry DJ, Harmsen WS, et al. Total hip arthroplasty for the treatment of an acute fracture of the femoral neck. Long-term results. *J Bone Joint Surg Am.* 1998;80:70-75.
- Coates RL, Armour P. Treatment of subcapital femoral fractures by primary total hip replacement. *Injury.* 1979;11:132-135.
- Cartlidge IJ. Primary total hip replacement for displaced subcapital femoral fractures. *Injury.* 1981;13:249-253.
- Delamarter R, Moreland JR. Treatment of acute femoral neck fractures with total hip arthroplasty. *Clin Orthop.* 1987;218:68-74.
- Taine WH, Armour PC. Primary total hip replacement for displaced subcapital fractures of the femur. *J Bone Joint Surg Br.* 1985;67:214-217.
- Gjertsen J-E, Lie SA, Fevang JM, et al. Total hip replacement after femoral neck fractures in elderly patients. Results of 8,577 fractures reported to the Norwegian Arthroplasty Register. *Acta Orthop Scand.* 2007;78:491-497.
- Parvizi J, Ereth MH, Lewallen DG. Thirty-day mortality following hip arthroplasty for acute fracture. *J Bone Joint Surg Am.* 2004;86:1983-1988.

- Klein GR, Parvizi J, Vegari DN, et al. Total hip arthroplasty for acute femoral neck fractures using a cementless tapered femoral stem. *J Arthroplasty*. 2006;21:1134-1140.
- Dorr LD, Glousman R, Hoy ALS, et al. Treatment of femoral neck fractures with total hip replacement versus cemented and noncemented hemiarthroplasty. *J Arthroplasty* 1986;1:21-28.
- Skinner P, Riley D, Ellery J, et al. Displaced subcapital fractures of the femur: a prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. *Injury*. 1989;20:291-293.
- Johansson T, Jacobsson S-A, Ivarsson I, et al. Internal fixation versus total hip arthroplasty in the treatment of displaced femoral neck fractures. A prospective randomized study of 100 hips. *Acta Orthop Scand*. 2000;71:597-602.
- Rogmark C, Carlsson Å, Johnell O, et al. A prospective randomised trial of internal fixation versus arthroplasty for displaced fractures of the neck of the femur. Functional outcome for 450 patients at two years. *J Bone Joint Surg Br*. 2002;84:183-188.
- Tidermark J, Ponzer S, Svensson O, et al. Internal fixation compared with total hip replacement for displaced femoral neck fractures in the elderly. A randomised, controlled trial. *J Bone Joint Surg Br*. 2003;85:380-388.
- Keating JF, Grant A, Masson M, et al. Displaced intracapsular hip fractures in fit, older people: a randomized comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. *Health Technol Assess*. 2005;9(41). (available online at <http://www.nccta.org>)
- Johanson NA, Charlson ME, Szatrowski TP, et al. A self-administered Hip- Rating Questionnaire for the assessment of outcome after total hip replacement. *J Bone Joint Surg Am*. 1992;74:587-597.
- Blomfeldt R, Törnkvist H, Eriksson K, et al. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. *J Bone Joint Surg Br*. 2007;89:160-165.
- Berry DJ, von Knoch M, Schleck CD, et al. Effect of femoral head diameter and operative approach on risk of dislocation after primary total hip arthroplasty. *J Bone Joint Surg Am*. 2005;87:2456-2463.
- Matta JM, Shahrddar C, Ferguson T. Single-incision anterior approach for total hip arthroplasty on an orthopaedic table. *Clin Orthop*. 2005;441:115- 124.

- Sierra RJ, Raposo JM, Trousdale RT, et al. Dislocation of primary THA done through a posterolateral approach in the elderly. *Clin Orthop*. 2005;441:262-267.
- Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc*. 1975;23:433- 441.
- Abboud JA, Patel RV, Booth RE, et al. Outcomes of total hip arthroplasty are similar for patients with displaced femoral neck fractures and osteoarthritis. *Clin Orthop*. 2004;421:151-154
- Ahn, J., Man, L.-X., Park, S., Sodl, J. F., & Esterhai, J. L. (2008). Systematic review of cemented and uncemented hemiarthroplasty outcomes for femoral neck fractures. *CORR* 466(10), 2513–2518.
- Parker, M. J., Gurusamy, K. S., & Azegami, S. (2010). Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. *Cochrane database of systematic reviews (Online)*, (6), CD001706.
- Kofoed H, Kofod J. Moore prosthesis in the treatment of fresh femoral neck fractures. A critical review with special attention to secondary acetabular degeneration. *Injury*. 1983;14:531-40.
- Tarasevicius, S., Busevicius, M., Robertsson, O., & Wingstrand, H. (2010). Dual mobility cup reduces dislocation rate after arthroplasty for femoral neck fracture. *BMC musculoskeletal disorders*, 11, 175.