

Displaced Femoral neck Fractures: ORIF, THA or HA?

Emil H. Schemitsch MD FRCS(C)

**Richard Ivey Professor of Surgery
Chair, Department of Surgery
University of Western Ontario**

**Chief of Surgery, London Health Sciences Centre, St.
Joseph's Health Care, London, Ontario
Editor-in-Chief, OTA International**

I (and/or my co-authors) have something to disclose.

Detailed disclosure information is available via:



“My Academy” app;



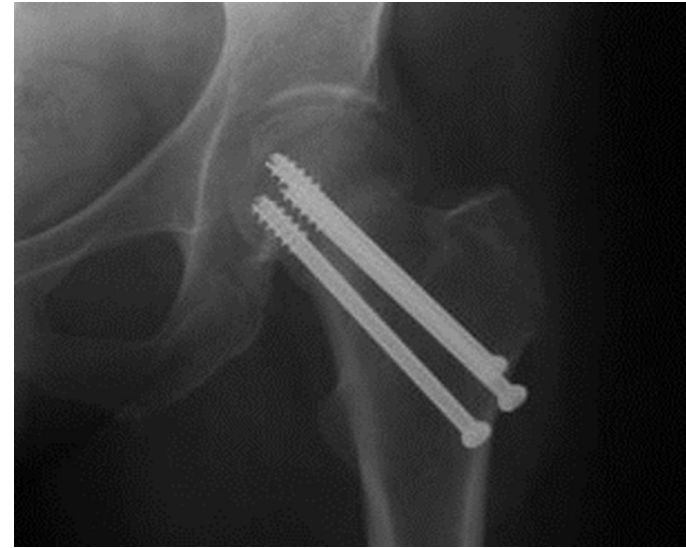
or

AAOS Orthopaedic Disclosure Program on the AAOS website at

<http://www.aaos.org/disclosure>

Burden of Illness

- Increasing prevalence
- Growing elder population
- High mortality rate
- High complication rate
- Some complications related to limited WB with ORIF
- Need to optimize medical and fracture management to allow early weight bearing



The Problem with IF...

- **High revision rates**
 - 30-40% displaced, 20% undisplaced
- **Femoral neck shortening**
 - 30% shortening rates
 - Affects patient function negatively (SF-36)
- **High rate of technical errors**
- **So to limit this....**
 - Typically limited to young patients with displaced fractures



Questions

Arthroplasty and hip fracture

- What is the rationale?
- Who is the ideal patient?
- Hemi vs THA?
- Can the surgery be optimized?

Arthroplasty for femoral neck fracture: What is the rationale?

Eliminates the need for

Revision surgery

-avascular necrosis

-nonunion

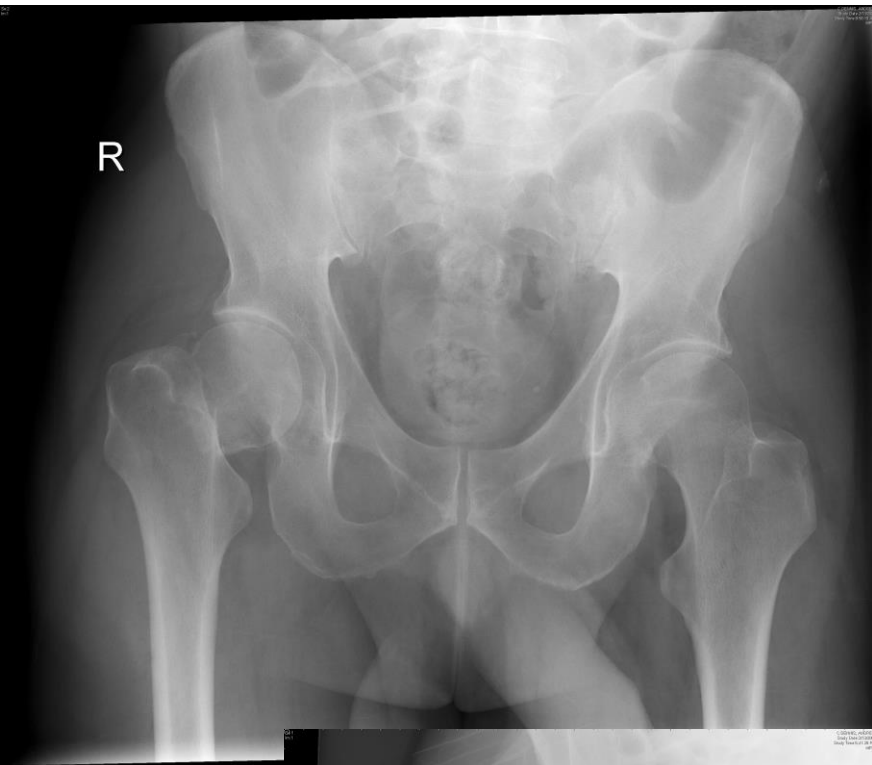


Arthroplasty for femoral neck fracture: What is the rationale?

Improves function
-less shortening

Slobogean et al. OTA 2017: Any femoral neck shortening post fracture fixation negatively impacts functional outcomes





INTERNAL FIXATION COMPARED WITH ARTHROPLASTY FOR DISPLACED FRACTURES OF THE FEMORAL NECK

A META-ANALYSIS

BY MOHIT BHANDARI, MD, MSc, P.J. DEVEREAUX, MD, MARC F. SWIONTKOWSKI, MD,
PAUL TORNETTA III, MD, WILLIAM OBREMSKEY, MD, MPH, KENNETH J. KOVAL, MD, SEAN NORK, MD,
SHEILA SPRAGUE, BSc, EMIL H. SCHEMITSCH, MD, AND GORDON H. GUYATT, MD, MSc

Investigation performed at McMaster University, Hamilton, Ontario, Canada

- Higher re-operation rates and treatment failure in the internal fixation cohort

- Offer arthroplasty (THA or HA) to patients with a displaced intracapsular hip fracture **[2017]**
- Offer THA rather than HA to patients with a displaced intracapsular hip fracture who:
 - were able to walk independently out of doors with no more than a stick **and**
 - are not cognitively impaired **and**
 - are medically fit **[2017]**

So why not arthroplasty?

Traditional thinking:

- Not usually necessary with undisplaced fractures
- Arthroplasty in young patients problematic
 - Dislocation
 - Loosening
 - Infection
 - Revision
- Difficulty defining “young”



Recent literature challenges dogma

- **More failures / reduced mobility with IF vs HA for undisplaced fractures**
 - Garden 1 (42%) and 2 (63%) fractures collapsed more than expected (>1cm) after IF (Cronin et al, JOT 2019)
 - Hemiarthroplasty led to improved mobility and fewer major re-ops compared to IF for nondisplaced femoral neck fractures (Dolatowski JBJS 2019)

Arthroplasty Versus Internal Fixation for the Treatment of Undisplaced Femoral Neck Fractures: A Retrospective Cohort Study

Shaikh Afaq, MD,^a Nathan N. O'Hara, MHA,^a Emil H. Schemitsch, MD, FRCSC,^b Sofia Bzovsky, MSc,^c Sheila Sprague, PhD,^{c,d} Rudolf W. Poolman, MD, PhD,^e Frede Frihagen, MD, PhD, FRCSC,^f Diane Heels-Ansdell, MSc,^d Mohit Bhandari, MD, PhD, FRCSC,^{c,d} Marc Swiontkowski, MD,^g and Gerard P. Slobogean, MD, MPH^a on behalf of the FAITH and HEALTH Investigators

| | Arthroplasty (n = 1441) | Internal Fixation (n = 734) | Crude OR (95% CI) | P | Adjusted OR (95% CI) | P |
|----------------------------|----------------------------|--------------------------------|------------------------------|-------|------------------------------|-------|
| Mortality, n (%) | 198 (13.7%) | 129 (17.6%) | 0.75 (0.59–0.95) | 0.02 | 0.56 (0.44–0.73) | <0.01 |
| Reoperation, n (%) | 117 (8.1%) | 131 (17.9%) | 0.41 (0.31–0.53) | <0.01 | 0.41 (0.32–0.55) | <0.01 |
| | Arthroplasty (n = 1006) | Internal Fixation (n = 490) | Crude Difference (95% CI) | P | Adjusted Difference (95% CI) | P |
| 24-mo SF-12 PCS, mean (SD) | 38.8 (9.9) | 36.1 (9.9) | 2.7 (1.7–3.8) | <0.01 | 2.7 (1.6–3.8) | <0.01 |
| 24-mo SF-12 MCS, mean (SD) | 52.3 (10.6) | 51.2 (14.5) | 1.1 (–0.1–2.3) | 0.07 | 0.9 (–0.3–2.0) | 0.14 |

Mortality and re-op less and function better with arthroplasty

Not All Garden-I and II Femoral Neck Fractures in the Elderly Should Be Fixed

Effect of Posterior Tilt on Rates of Subsequent Arthroplasty

The Journal of Bone and Joint Surgery: [October 16, 2019](#) - Volume 101 - Issue 20 - p 1852-1859

- Posterior tilt $\geq 20^\circ$ at higher risk of arthroplasty vs $<20^\circ$ (22.4% vs 11.9%)



High failure rate after internal fixation and beneficial outcome after arthroplasty in treatment of displaced femoral neck fractures in patients between 55 and 70 years

An observational study of 2,713 patients reported to the Norwegian Hip Fracture Register

Stefan BARTELS ¹, Jan-Erik GJERTSEN ^{2,3}, Frede FRIHAGEN ⁴, Cecilia ROGMARK ⁵, and Stein Erik UTVÅG ^{1,6}

- Major reoperations occurred in 27% after IF, 3.8% after HA and 2.8% after THA.
- **Is 55 the upper limit for internal fixation in displaced fractures?**

Total Hip Arthroplasty Leads to Better Results After Low-Energy Displaced Femoral Neck Fracture in Patients Aged 55 to 70 Years

A Randomized Controlled Multicenter Trial Comparing Internal Fixation and Total Hip Arthroplasty

Stefan Bartels, MD, Torbjørn B. Kristensen, MD, PhD, Jan-Erik Gjertsen, MD, PhD, Frede Frihagen, MD, PhD, Cecilia Rogmark, MD, PhD, Filip C. Dolatowski, MD, PhD, Wender Figved, MD, PhD, Jūratė Šaltytė Benth, PhD, and Stein Erik Utvåg, MD, PhD

Investigation performed at Akershus University Hospital, Lørenskog, and Haukeland University Hospital, Bergen, Norway

- THA patients reported better health-related quality of life
- 51% of the IF group vs 4% in the THA group underwent a major reoperation
- **Is 55 the upper limit for internal fixation in displaced fractures?**

Arthroplasty

- Must consider:
 - THA vs HA
 - Use of cement
 - Approach
 - Head size



Hip Fracture Evaluation with Alternatives of Total Hip Arthroplasty Versus Hemi-Arthroplasty (H.E.A.L.T.H)

HEALTH Investigators

NEJM 2019

Primary Endpoint

Secondary hip procedures within 24 months:

THA group:

57 of 718 patients (7.9%)

HA group:

60 of 723 patients (8.3%)

HR 0.95, 95% CI: 0.64-1.40; p=0.79

No difference

Functional Outcomes and Quality of Life

Patients in the THA group had superior function as measured by the WOMAC but differences were below MCID: 9 points

| Endpoint, n (%) | Total N=1,441 | Mean Difference at 24 Months (99% CI) |
|-----------------|------------------|--|
| WOMAC Total | 943 (65.4) | -6.37 (-9.18, -3.56) |
| WOMAC Pain | 990 (68.7) | -0.93 (-1.42, -0.44) |
| WOMAC Stiffness | 987 (68.5) | -0.44 (-0.65, -0.23) |
| WOMAC Function | 947 (65.7) | -4.97 (-7.11, -2.83) |
| EQ-5D Utility | 1,141 (79.2) | 0.04 (-0.03, 0.11) |
| EQ-5D VAS | 1,111 (77.1) | 0.72 (-2.02, 3.46) |
| SF-12 PCS | 1,006 (69.8) | 1.41 (-0.33, 3.14) |
| SF-12 MCS | 1,006 (69.8) | 1.34 (-0.38, 3.05) |
| Endpoint, n (%) | Total N=1,441 | Odds Ratio (99% CI) |
| TUG | 1,268 (88.0) | 0.72 (0.38, 1.36) |

HEALTH Substudy: Fittest Patients

- Fittest participant cohort:
 - Aged ≤ 70 years
 - With an ASA I or II classification
 - Not using assistive devices for ambulation
 - Living independently prior to injury
- None of the differences in the functional outcomes between THA and HA groups of the fittest cohort crossed the threshold for a MCID
- **THA not better even in “fittest” patients**

Unknown

- **Age < 70**
- **Medically fit**
- +
- **High functioning??**

Is the type of HA important?

- **Bipolar vs Unipolar?**

Unipolar vs. Bipolar

- **No difference in:**

- blood loss
- length of hospital stay
- dislocation rates
- post-operative pain
- recovery of ambulatory status
- activities of daily living
- post-operative pain

When using modern implants
Short term outcomes

- Two systematic reviews show no benefit of BH
 - *Yang et al, Eur J Orthop Surg 2015*
 - *Jia et al, J Orthop Surg Res 2015*

- **When using modern implants**
at Short term



Unknown

- What is the ideal HA at long term follow-up?
- Limited prospective data

Is the Use of Bipolar Hemiarthroplasty Over Monopolar Hemiarthroplasty Justified?

A Propensity Score-Weighted Analysis of a Multicenter Randomized Controlled Trial

- **342 patients received UH**
- **404 patients received BH**
- **60 patients who received hemiarthroplasty underwent revision, and were excluded from the analysis**

How often is a BH used over UH?

- Canada, Spain, Norway -> majority of BH
- Netherlands, UK -> majority of UH
- US -> 50/50

Number of hemiarthroplasties (HA) performed per country

| | UH (n=342) | BH (n=404) | Total (n=746) |
|----------------------------------|---------------|---------------|------------------|
| <i>Hemi # per country, n (%)</i> | | | |
| Canada | 57 (16.7) | 129 (31.9) | 186 (24.9) |
| The Netherlands | 104 (30.4) | 4 (1) | 108 (14.5) |
| US | 64 (18.7) | 52 (12.9) | 116 (15.5) |
| Norway | 0 | 86 (21.3) | 86 (11.5) |
| Spain | 9 (2.6) | 101 (25) | 110 (14.7) |
| UK | 50 (14.6) | 16 (4) | 66 (8.8) |
| Other | 61. (17`) | 16. (3.9) | 74. (9.9) |

Functional outcomes & pain / WOMAC

- There was **no difference** in WOMAC scores between UH and BH at 2 years postop ($p>0.05$)

WOMAC scores in patients who received a UH vs BH, at 24 months postop

| End point | AMDs BH vs UH (99% CI) | P-value |
|-----------|---------------------------|---------|
| WOMAC | | |
| Total | 1.77 (-2.61 to 6.16) | 0.30 |
| Pain | 0.03 (-0.75 to 0.08) | 0.91 |
| Stiffness | 0.01 (-0.36 to 0.39) | 0.93 |
| Function | 1.64 (-1.78 to 5.06) | 0.21 |

WOMAC & SF-12 in patients < 70 yrs

- There was **no difference** in WOMAC and SF-12 scores between UH and BH

SF-12 and WOMAC scores in patients <70 years, UH vs BH at 2 years postop

| End point | AMDs BH vs UH (99% CI) | P-value |
|-----------|---------------------------|---------|
| WOMAC | | |
| Total | 1.77 (-2.61 to 6.16) | 0.30 |
| Pain | 0.03 (-0.75 to 0.08) | 0.91 |
| Stiffness | 0.01 (-0.36 to 0.39) | 0.93 |
| Function | 1.64 (-1.78 to 5.06) | 0.21 |
| SF-12 | | |
| PCS | -0.56 (-3.10 to 2.09) | 0.61 |
| MCS | 0.73 (-1.75 to 3.21) | 0.45 |

What about the 60 revision cases?

Reasons for revision surgery in the 60 participants who received a hemiarthroplasty whether unipolar or bipolar.

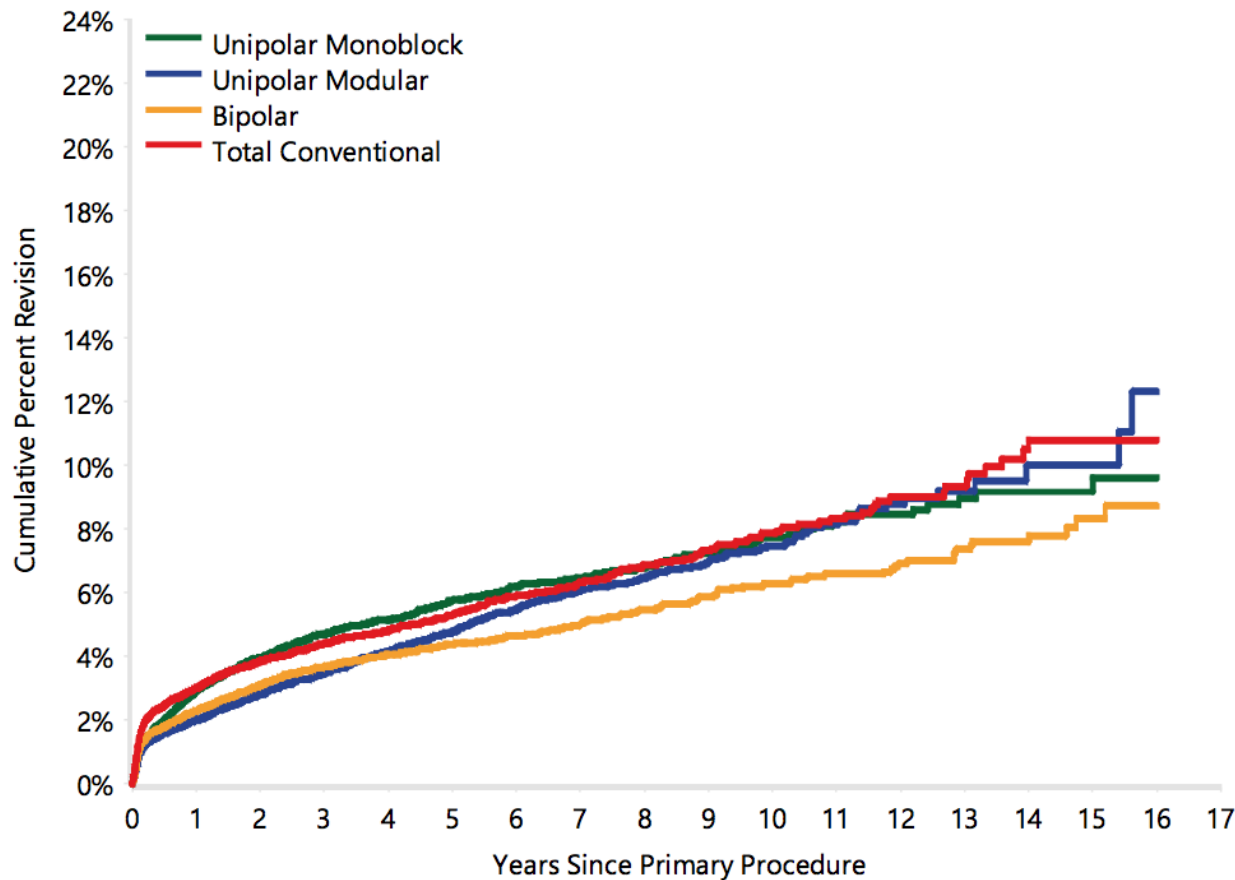
| Reasons for revision* | UH (n=26) | BH (n=31) | Not Specified (n=3) | Total** (n=60) |
|-------------------------------------|--------------|--------------|------------------------|-------------------|
| Dislocation | 7 | 7 | 0 | 14 |
| Fracture | 4 | 5 | 0 | 9 |
| Soft-tissue procedure | 8 | 6 | 1 | 15 |
| Insertion of abx spacer | 2 | 1 | 0 | 3 |
| Full implant exchange | 10 | 8 | 1 | 19 |
| Implant adjustment | 1 | 1 | 0 | 2 |
| Implant removal with no replacement | 2 | 1 | 0 | 3 |
| Supplementary fixation | 0 | 1 | 1 | 2 |
| Other | 2 | 1 | 0 | 3 |

*Multiple reasons for revision surgery could be selected

**Three participants were randomized to the total hip arthroplasty group in the original HEALTH trial, but received a hemiarthroplasty during the original surgery

Unipolar vs Bipolar vs THA

Figure HT63 Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

Unipolar Monoblock vs Total Conventional

0 - 3Mth: HR=1.02 (0.88, 1.19), $p=0.784$

3Mth+: HR=1.74 (1.54, 1.96), $p<0.001$

Unipolar Modular vs Total Conventional

0 - 3Mth: HR=0.80 (0.70, 0.93), $p=0.002$

3Mth - 1.5Yr: HR=0.92 (0.79, 1.08), $p=0.323$

1.5Yr+: HR=1.65 (1.43, 1.89), $p<0.001$

Bipolar vs Total Conventional

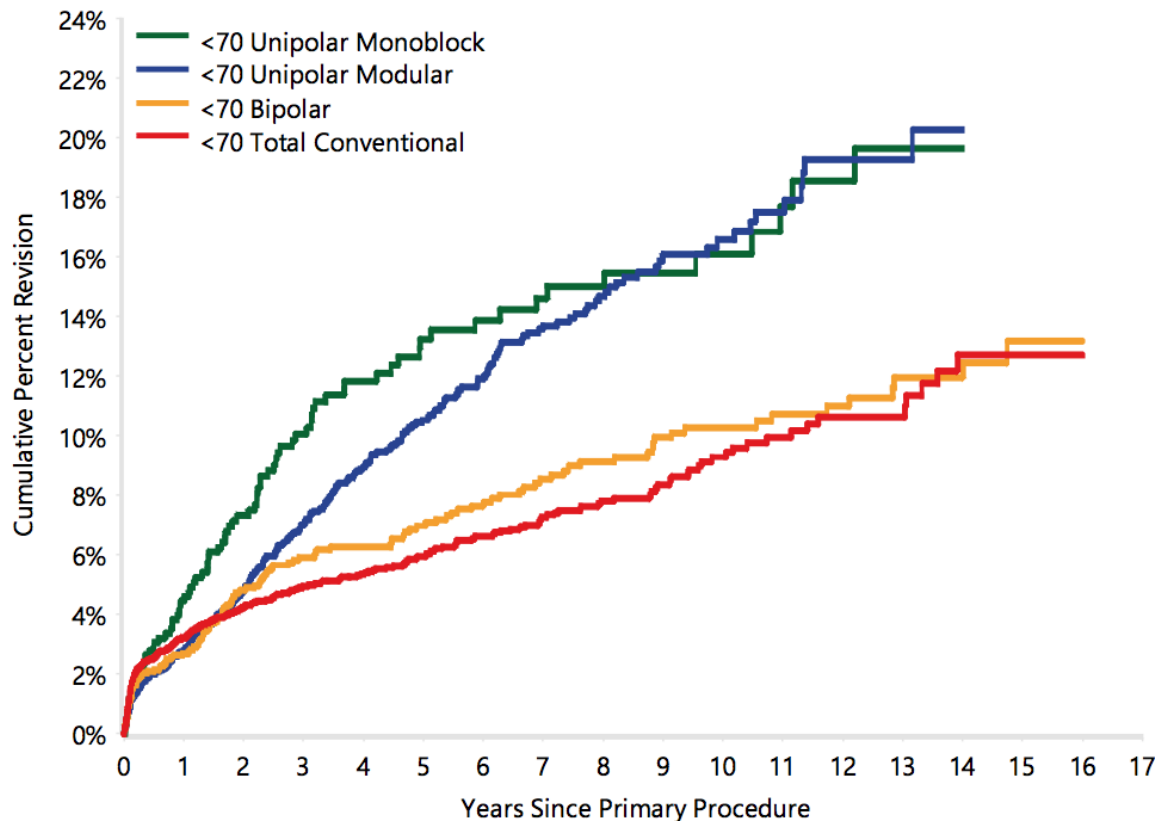
0 - 3Mth: HR=0.91 (0.78, 1.07), $p=0.245$

3Mth - 1.5Yr: HR=0.93 (0.78, 1.12), $p=0.469$

1.5Yr+: HR=1.13 (0.95, 1.33), $p=0.158$

Unipolar vs Bipolar vs THA

Figure HT64 Cumulative Percent Revision of Primary Hip Replacement in Patients Aged <70 Years by Class (Primary Diagnosis Fractured NOF)



HR - adjusted for gender

<70 Unipolar Monoblock vs
<70 Total Conventional

0 - 3Mth: HR=0.99 (0.60, 1.65), $p=0.982$

3Mth+: HR=2.31 (1.78, 3.01), $p<0.001$

<70 Unipolar Modular vs <70 Total Conventional

0 - 3Mth: HR=0.73 (0.52, 1.02), $p=0.066$

3Mth - 3Yr: HR=1.71 (1.36, 2.17), $p<0.001$

3Yr+: HR=2.75 (2.12, 3.57), $p<0.001$

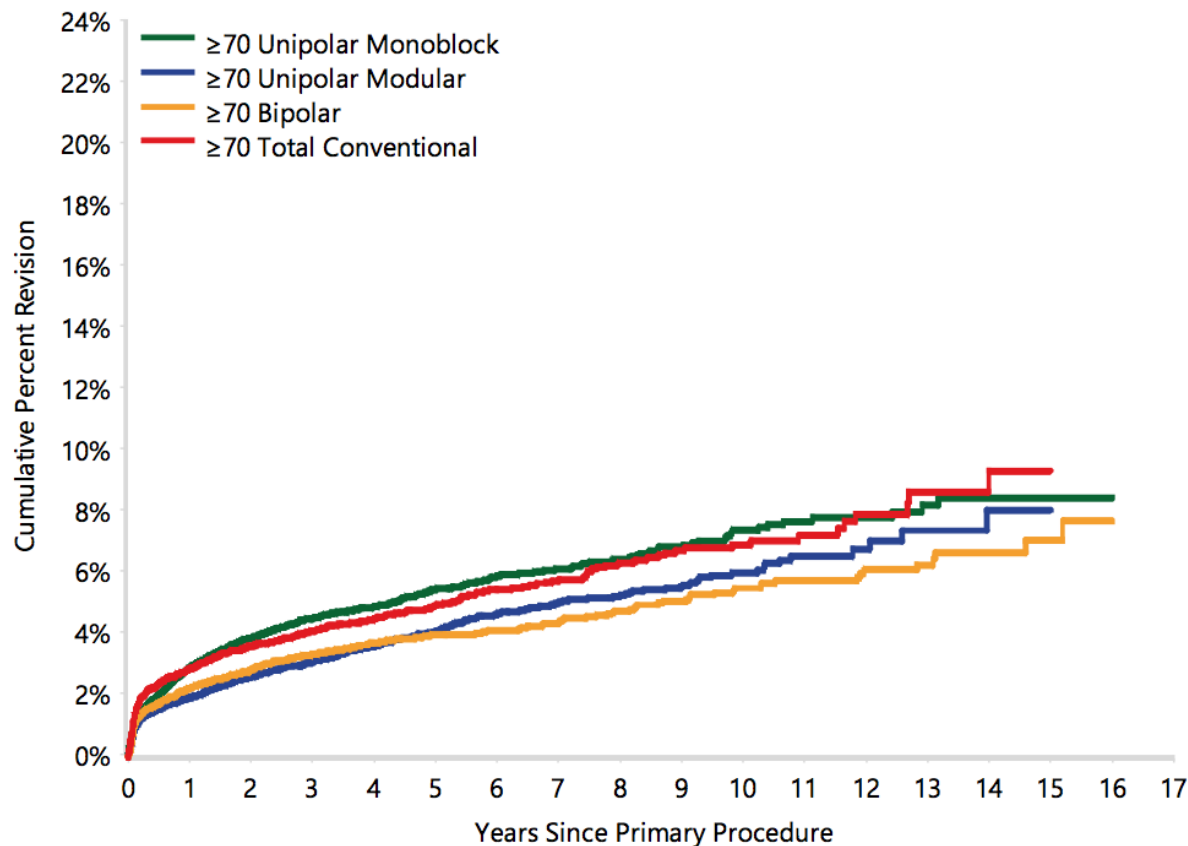
<70 Bipolar vs <70 Total Conventional

Entire Period: HR=1.10 (0.90, 1.34), $p=0.353$

Unipolar less optimal in the young patient <70

Unipolar vs Bipolar vs THA

Figure HT65 Cumulative Percent Revision of Primary Hip Replacement in Patients Aged ≥ 70 Years by Class (Primary Diagnosis Fractured NOF)



HR - adjusted for gender

≥70 Unipolar Monoblock vs

≥70 Total Conventional

0 - 2Wk: HR=1.08 (0.82, 1.42), $p=0.596$

2Wk - 3Mth: HR=0.69 (0.58, 0.81), $p<0.001$

3Mth - 6Mth: HR=1.30 (1.00, 1.70), $p=0.051$

6Mth - 1.5Yr: HR=1.48 (1.23, 1.77), $p<0.001$

1.5Yr+: HR=1.09 (0.92, 1.30), $p=0.324$

≥70 Unipolar Modular vs ≥70 Total Conventional

0 - 1Mth: HR=0.59 (0.49, 0.71), $p<0.001$

1Mth - 1.5Yr: HR=0.72 (0.63, 0.83), $p<0.001$

1.5Yr+: HR=1.01 (0.85, 1.19), $p=0.951$

≥70 Bipolar vs ≥70 Total Conventional

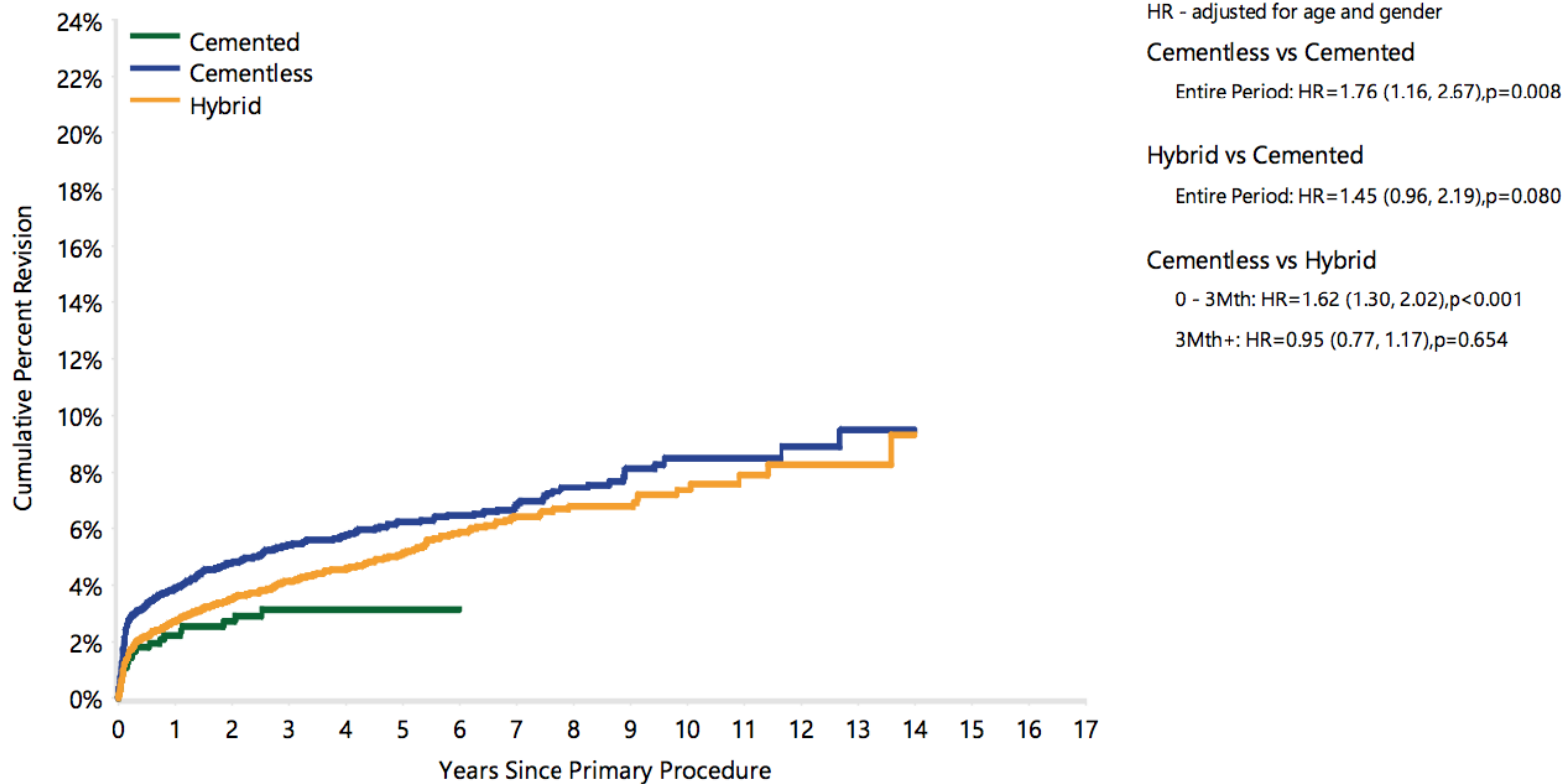
Entire Period: HR=0.77 (0.68, 0.87), $p<0.001$

Role of Cement

- Fewer complications
 - Moerman et al, BMC MSK Disord 2017 (RCT 201 pts)
- Less re-ops
- Less fractures (THA and HA)
 - Lindberg-Larsen et al, Acta Orthop 2017
 - Chammout et al, Acta Orthop 2017
- Less pain and improved function
- Better long term survival

Role of Cement

Figure HT57 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis Fractured NOF)



Cement plays an increasing role with age >70

ORIGINAL ARTICLE

Cemented or Uncemented Hemiarthroplasty for Intracapsular Hip Fracture

Miguel A. Fernandez, Ph.D., Juul Achten, Ph.D., Nicholas Parsons, Ph.D.,
Xavier L. Griffin, Ph.D., May-Ee Png, Ph.D., Jenny Gould, Alwin McGibbon, B.A.,
and Matthew L. Costa, Ph.D., for the WHiTE 5 Investigators*

ABSTRACT

- 1225 patients > age 60
- Cemented HA resulted in a modestly but significantly better quality of life
- Periprosthetic fractures in 0.5% vs 2.1% (odds ratio [uncemented vs. cemented], 4.37; 95% CI, 1.19 to 24.00)

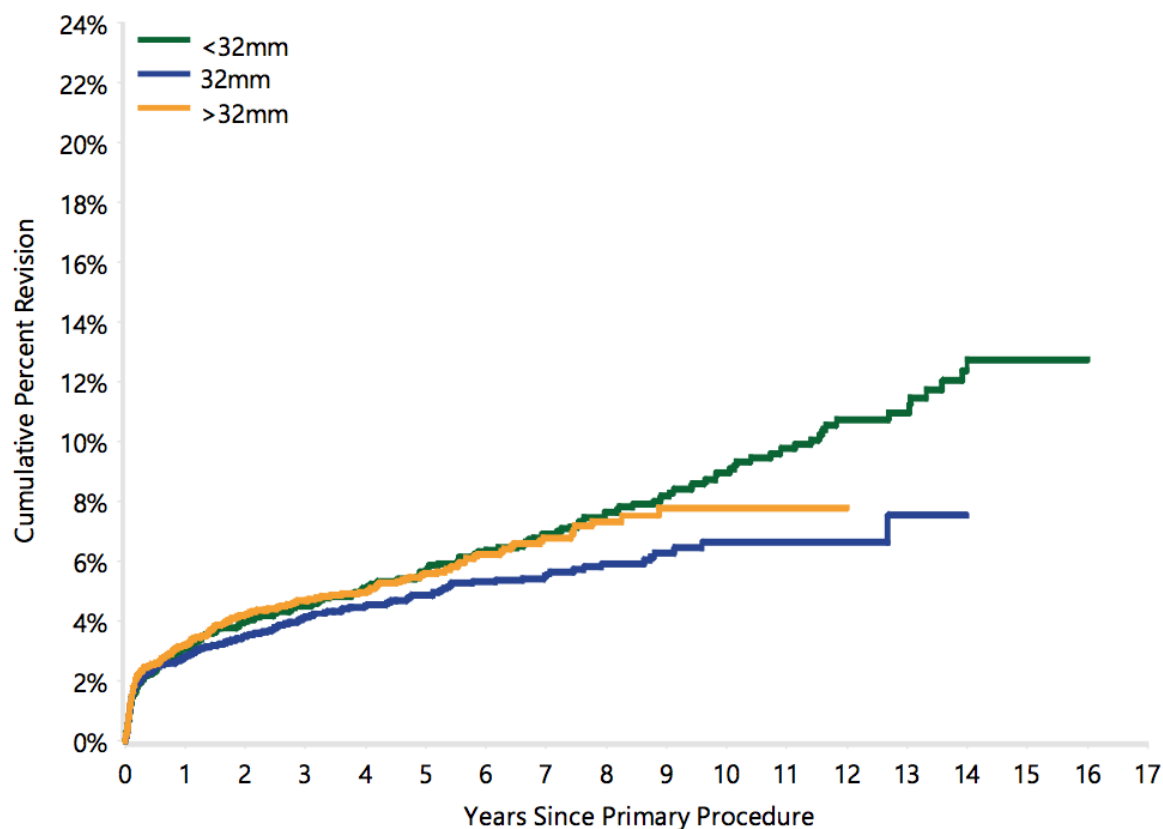
Role of surgical approach

Controversial

- Direct lateral may be less optimal
 - Worse function, more pain
 - Kristenson et al, Acta Orthop 2017
 - Hongisto et al, Scan J Surg 2018
- Posterior
 - Instability still a problem
 - Hongisto et al Scan J Surg 2018
- DAA
 - Increased interest
 - No advantage in function vs posterior and increased complications
 - Argenson et al, IHS 2023

Role of Head Size

Figure HT60 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

<32mm vs 32mm

0 - 1Mth: HR=0.92 (0.66, 1.30),p=0.650

1Mth - 6Mth: HR=1.08 (0.79, 1.46),p=0.628

6Mth+: HR=1.47 (1.19, 1.82),p<0.001

>32mm vs 32mm

Entire Period: HR=1.08 (0.92, 1.28),p=0.350

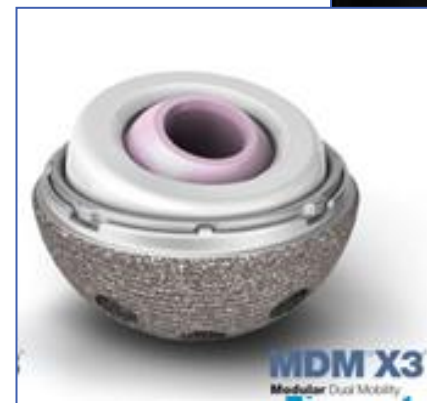
>32mm vs <32mm

Entire Period: HR=0.88 (0.74, 1.05),p=0.161

Head size at least
32 mm

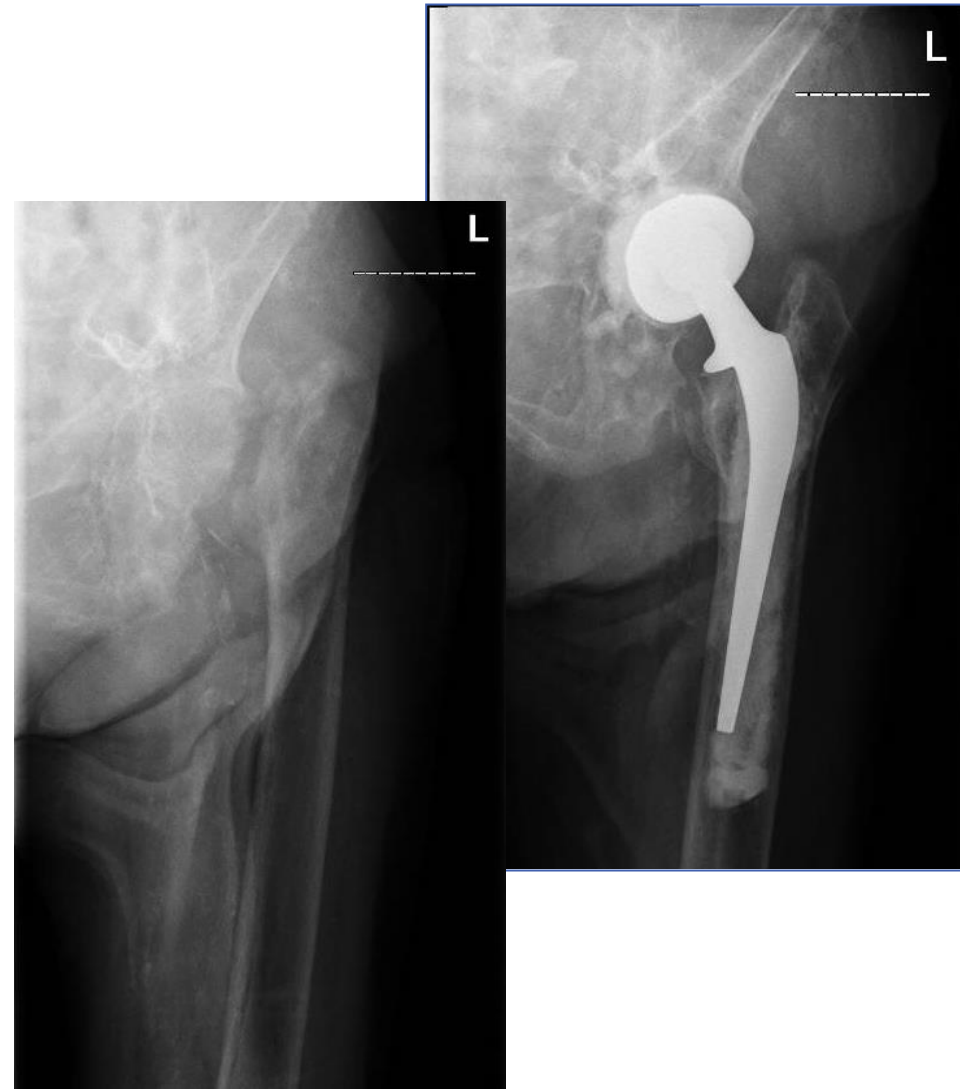
Dual Mobility Cup for femoral neck fracture

- Significant reduction in rates of dislocation
 - *Bensen et al, Int Orthop 2014*
 - *Adam et al, Orthop Trauma Surg Res 2012*
 - *Tarasevicius et al, Hip Int 2013*
 - *Graverson et al, SICOT J, 2017*
- *Cemented vs uncemented options*



Dual Mobility Cup vs Bipolar for femoral neck fracture

- Significant advantage in the frail patient
 - *Boukebous et al, 2017*
 - *Kim et al, 2018*
- *Better clinical outcomes without disadvantages for mortality or dislocation*



Rationale for Acute Arthroplasty

- Eliminates the need to deal with:
 - The presence of failed internal fixation devices
 - Potential infection
 - Bone deformity
 - Bone loss
 - Poor bone quality
 - Poor femoral canal anatomy

Salvage THA after Hip Fx

- Not a straight forward procedure
- Not equivalent to primary THA for OA
 - Qin et al, J Arthroplasty 2017
 - Schwarzkopf et al, J Arthroplasty 2017
 - Lee et al, J Arthroplasty 2017
- Increased risk of dislocation
 - McKinley et al, JBJS(A) 2002
 - Sah et al, JBJS(A) 2008
 - **Careful attention should be paid to the complete and thorough capsular repair**
 - **Large femoral heads**
 - **?Dual mobility**
- Increased risk of periprosthetic #



Evidence based conclusions

- **IF results in more reoperations and likely worse function than Arthroplasty**
- **There is no short term difference between Unipolar and Bipolar HA; Bipolar may be advantageous vs Unipolar in younger patients and at longer f/u**
- **Cemented outperforms uncemented arthroplasty**
- **Advantage of THA uncertain at short term follow-up in lower demand patients**
- **Dislocation may be an issue after THA; Increasing role for Dual Mobility**

Thank you

