Replacement for hip fracture: THA or Bipolar or Unipolar: Is one better?

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Displaced Femoral Neck Fractures

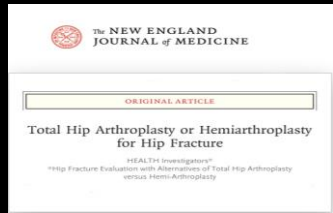
Displaced femoral neck fractures are often treated with arthroplasty

- Total hip arthroplasty (THA)
- Hemiarthroplasty (HA): Bipolar and Unipolar

In elderly patients, there remains uncertainty regarding the optimal arthroplasty option for surgically managing these injuries

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

HEALTH Investigators



Primary Objective

To determine the effect of THA versus HA for displaced femoral neck fractures on the risk of unplanned secondary hip procedures within 24 months

Participants

- Adults 50 years and older
- Displaced femoral neck fracture
- Amenable to arthroplasty
- Operative treatment within 3 days
- Ambulatory prior to fracture
- Low energy fracture
- No other major trauma (ISS<17)
- Availability of expert surgeon for both HA and THA

Thresholds for Surgical Expertise

Participating surgeons required to meet two criteria for expertise for either THA or HA:

- Must have performed at least 50 procedures (either THA or HA) in their career
- Must have continued to perform at least five procedures (either THA or HA) in the year prior to trial start date, and each year for duration of study

Primary Outcome

Unplanned secondary hip procedure within 24 months

Procedures classified as study events included:

- Closed and open reductions of a hip dislocation
- Open reduction of a fracture
- Soft-tissue procedure
- Insertion of an antibiotic spacer
- Full or partial implant exchange
- Implant adjustment (reorientation of stem or acetabular component)
- Implant removal with no replacement
- Excision of heterotopic ossification
- Other event as determined by the adjudication committee

Secondary Outcomes

Mortality

Serious adverse events

Hip-related complications

Functional outcomes and quality of life

- Western Ontario and McMaster Universities Arthritis Index
- EuroQol-5 Dimensions
- Short Form-12 Health Survey
- Timed Up and Go Test

Subgroups

Prior to unblinding, four subgroup analyses were planned:

Primary Model

- Age (50-80 years versus >80 years)
- Pre-fracture living setting
- Pre-fracture functional status
- ASA Class

Eligibility

1441 patients included in final analysis

718 in THA
723 in HA

24 month follow-up **85%** patients

Patients

Typical patient:

- Female (70%)
- 70 years of age or older (80%)
- Independent ambulator (74%)
- Subcapital fracture (61%)

No differences in patient and fracture characteristics between treatment groups

Surgical Expertise

Surgeons meeting thresholds for surgical expertise:

- THA 277 of 283 (97.9%)
- HA 369 of 381 (96.9%)

Primary Endpoint

Secondary hip procedures within 24 months:

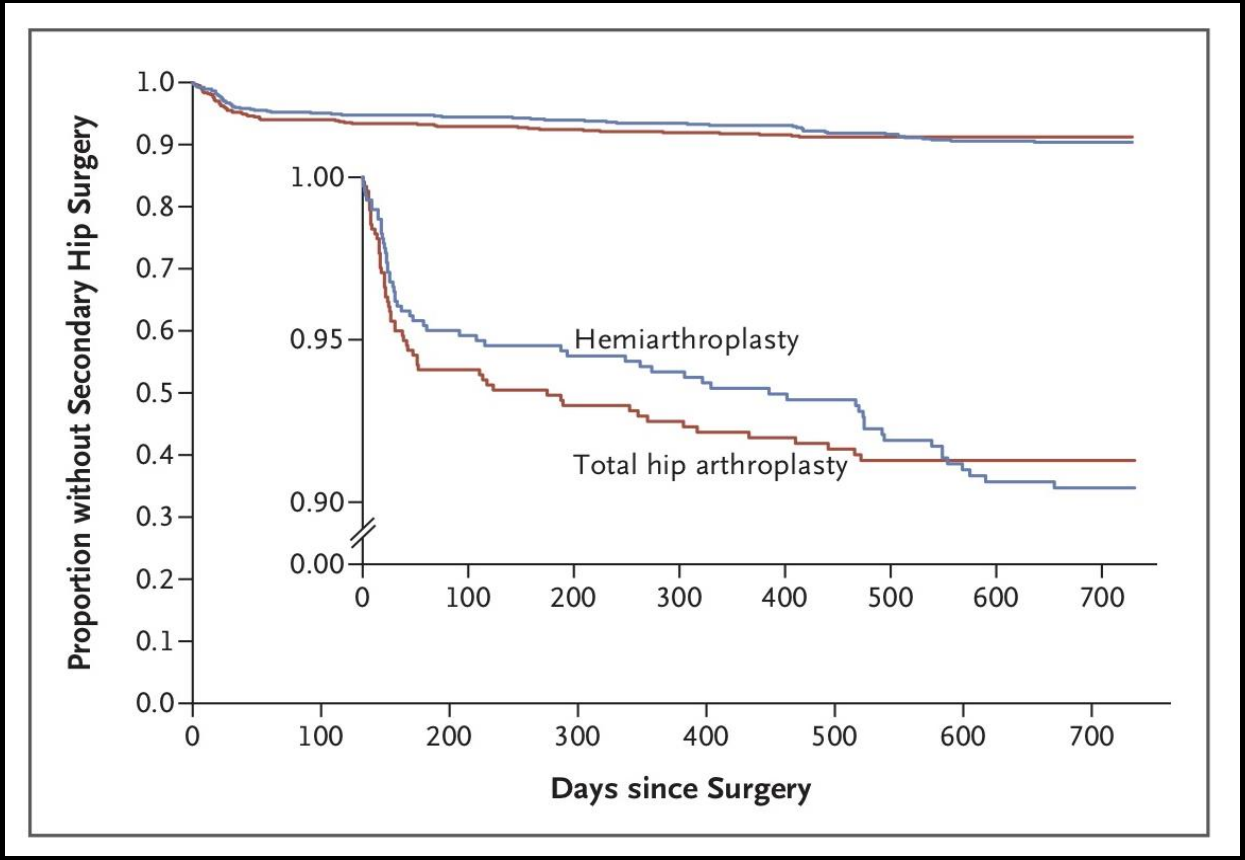
THA group:
57 of 718 patients (7.9%)

HA group:
60 of 723 patients (8.3%)

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

No difference

Primary Endpoint



Secondary Endpoints

No difference in Mortality 14%

Trend towards greater Serious Adverse Events with THA vs HA (300 vs 265, HR: 1.2)

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)

Subgroups

No observed subgroup effects

- Age (50-80 years versus >80 years)
- Pre-fracture living setting
- Pre-fracture functional status
- ASA Class

Interpretation

Among patients with displaced femoral neck fractures, the incidence of secondary procedures over 24 months did not differ between THA or HA

THA resulted in a clinically unimportant improvement in function and quality of life at 24 months

THA had a potentially increased number of serious adverse events

Total Hip Arthroplasty Versus Hemiarthroplasty for Displaced Femoral Neck Fracture

A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Seper Ekhtiari, MD, Jessica Gormley, BSc, Daniel E. Axelrod, MD, Tahira Devji, PhD, Mohit Bhandari, MD, PhD, FRCSC, and Gordon H. Guyatt, MD

Investigation performed at McMaster University, Hamilton, Ontario, Canada

- JBJS(A) 2020
- 3084 patients
- HA and THA likely result in similar revision rate, function, mortality, periprosthetic fracture, and dislocation at up to 5 years, with a small, possibly unimportant benefit in health-related quality of life with THA

Question?

- **Who, if anyone, may benefit from a total hip arthroplasty after a displaced femoral neck fracture?**

Need to consider

- Age
- Medical fitness
- Activity level / function
- Length of follow-up

Is Total Hip Arthroplasty a Cost-Effective Option for Management of Displaced Femoral Neck Fractures? A Trial-Based Analysis of the HEALTH Study

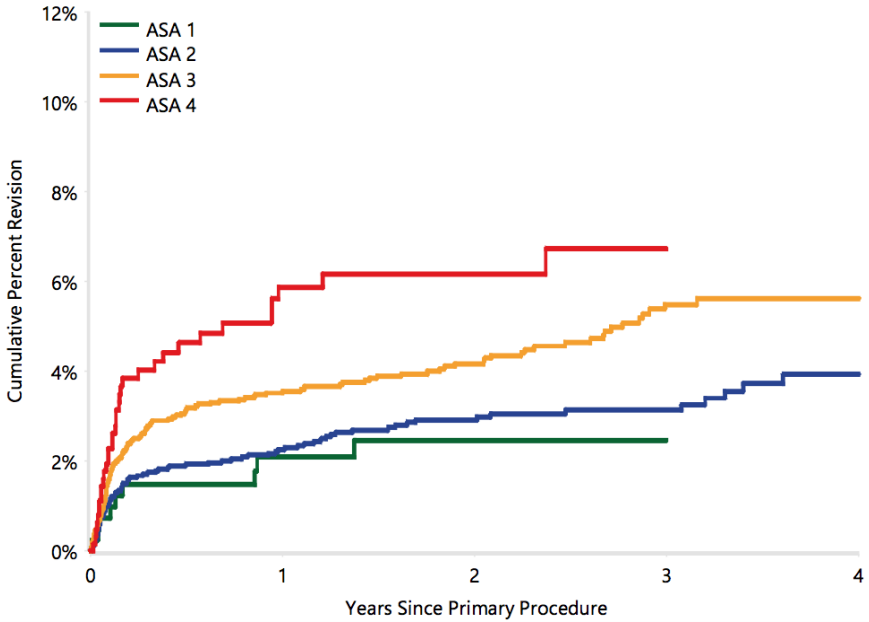
Daniel Axelrod, MD, MSc (Cand),[a] Jean-Éric Tarride, PhD,[b,c,d] Seper Ekhtiari, MD,[a] Gordon Blackhouse, MBA, MSc,[b,c] Herman Johal, MD, MPH, FRCSC,[a] Sofia Bzovsky, MSc,[a] Emil H. Schemitsch, MD, FRCSC,[e] Diane Heels-Ansdell, MSc,[a] Mohit Bhandari, MD, PhD, FRCSC,[a,b] and Sheila Sprague, PhD[a,b] on behalf of the HEALTH Investigators

TABLE 3. Subgroup Analysis of Cost Effectiveness by Age Quartile

	Cost Mean			QALYs Mean		
	THA	HA	Δ Cost	THA	HA	Δ QALYs
Age <73	$24,156	$27,849	-$3693	1.54	1.44	0.10
Age 73–79	$42,441	$26,500	$15,941	1.48	1.45	0.03
Age 80–84	$32,709	$21,947	$10,762	1.31	1.32	−0.01
Age 85 and older	$31,918	$31,978	$-60	1.28	1.22	0.06

How important is medical fitness?

Figure HT53 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=1.50 (0.75, 2.99),p=0.248

ASA 3 vs ASA 1

Entire Period: HR=2.29 (1.16, 4.53),p=0.017

ASA 4 vs ASA 1

Entire Period: HR=3.42 (1.62, 7.22),p=0.001

Best results in ASA 1 and 2

HEALTH Substudy of Fittest Patients

- Is health-related quality of life (HRQL) and functional outcomes better following THA in a subset of the fittest patients (n=143)?
- 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 the THA and HA groups of the fittest cohort crossed the threshold for a MCID

Unknown

- Age < 70
- Medically fit

+

- High functioning

Is the type of HA important?

- **Bipolar vs Unipolar?**

Hemiarthroplasty: Bipolar vs Unipolar

- Arguments for BH include:
  - *[± Surgeon's preference]*
  - ↓ acetabular erosion, supported by several meta-analyses[1-4]
  - Theorical ↓ shear force at the prosthetic-joint interface
  - ↑ range of motion, mixed results from several RCTs[5-10]

Do we really know if this will affect functional outcomes?

Does it make a difference specifically for younger pts (< 70yrs), presumed to be more active ?

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

- A meta-analysis (N=7 trials, 857 participants) suggested similar outcomes *(Parker, Cochrane Review, 2005, 2010).*
- Two 2015 systematic reviews show no benefit of BH
  - *Yang et al, Eur J Orthop Surg 2015*
  - *Jia et al, J Orthop Surg Res 2015*

Is the Use of Bipolar Hemiarthroplasty Over Monopolar Hemiarthroplasty Justified? A Propensity Score-Weighted Analysis of a Multicenter Randomized Controlled Trial

Comeau-Gauthier M, Bzovsky S, Axelrod D, Poolman RW, Frihagen F, Bhandari M, **Schemitsch EH**, Sprague S., and **The HEALTH Investigators**

How often is a BH used over UH?

- 746 hemis, 54% BH and 46% UH

Number of hemiarthroplasties (HA) performed per country

	UH (n=342)	BH (n=404)	Total (n=746)
Hemi # per country, n (%)			
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 Adjusted Mean Differences (AMDs) 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

Health-Related Quality of Life / SF-12

- There was **no difference** in Adjusted Mean Differences (AMDs) in SF-12 scores between UH and BH at 2 years postop (p>0.05)

SF-12 subscores in patients who received a UH vs BH, at 24 months postop

End point	AMDs BH vs UH (99% CI)	P-value
SF-12		
Physical Component Subscore (PCS)	-0.56 (-3.10 to 2.09)	0.61
Mental Component Subscore (MCS)	0.73 (-1.75 to 3.21)	0.45

WOMAC & SF-12 in patients < 70 yrs

- There was **no difference** in Adjusted Mean Differences (AMDs) 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

Conclusions: BH vs UH

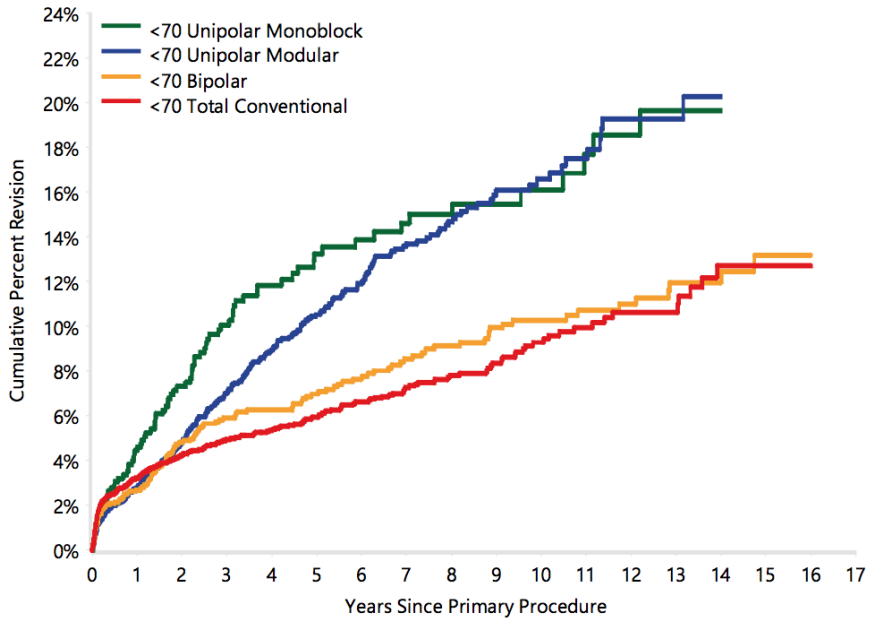
- Despite the lack of evidence, more than half of participants included in this study were given a BH
- This study provides substantial evidence that BH does not provide superior function compared to UH
- Considering the increased cost of BH, surgeons *should consider this in adopting a cost-responsible practice*

Unknown

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

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

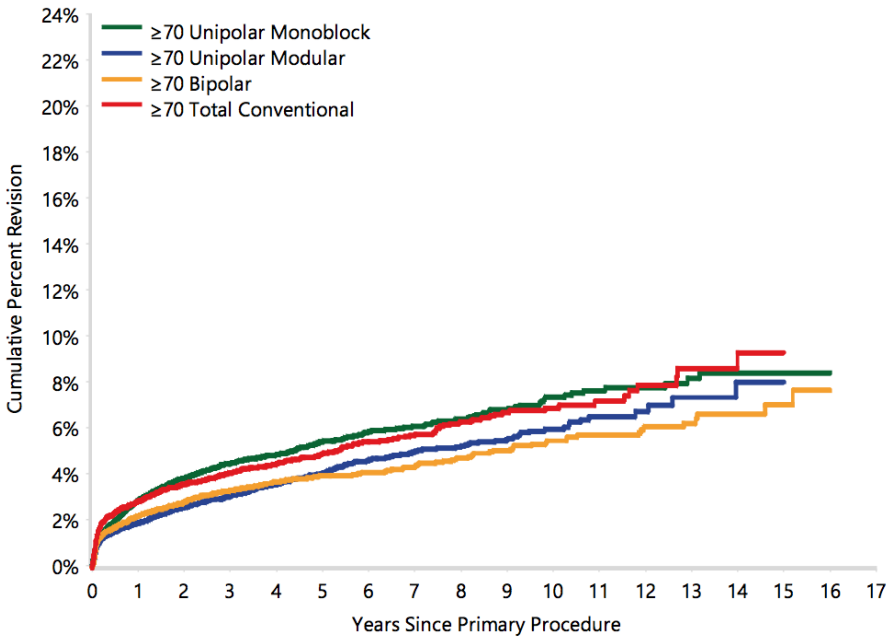
<70 Bipolar vs <70 Total Conventional

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

All arthroplasty options similar in the older patient

Conclusions

Findings suggest that the advantages of THA may not be compelling overall

One uncertainty is whether high-functioning patients expected to lead an active life beyond five years post fracture will benefit from a THA

Bipolar HA is potentially advantageous with longer f/u especially in younger patients

Thank you!