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Is There a Difference in Outcomes Between Hemiarthroplasty and Total Hip Arthroplasty for Patients Who Have Displaced Femoral Neck Fractures?

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Is there a difference in outcomes between hemiarthroplasty and total hip arthroplasty for patients who have displaced femoral neck fractures?

Response/Recommendation: The current evidence, with at up to 5 years follow-up, does not show a clinically meaningful difference between hemiarthroplasty and total hip arthroplasty performed for elderly patients who have displaced femoral neck fractures. However, based on expert opinion, the use of total hip arthroplasty may be considered for younger and more active patients.

Voting Results (N = 186): Agree: 93% (N = 173), Disagree: 6% (N = 11), and Abstain: 1% (n = 2).

Level of Evidence: High.

Rationale

Given the preponderance of randomized controlled trial (RCT) studies available, this analysis was limited to published RCTs on the topic, with up to 5 years of follow-up. There were 19 RCTs that were included with a total sample size of 3,414 patients who had a mean age of 78 years [1–18]. The outcomes of interest included all important clinical outcomes that were reported in a sufficient number of studies to allow for quantitative meta-analysis. These outcomes included mortality, revision surgery, periprosthetic fracture, complications, dislocations, operative time, estimated blood loss, function, and health-related quality of life (HRQoL).

In summary, based on quantitative meta-analyses, there was no significant difference between hemiarthroplasty (HA) and total hip arthroplasty (THA) in terms of mortalities, revision surgeries, periprosthetic fractures, total complications, or dislocations. The most robust evidence exists for revision and dislocation, each of which was reported in 14 studies [1–3,5,8,10–15,17,18]. It should be noted that dislocations, which have previously been reported as being more likely with THA, were not significantly different between the groups in this analysis. While the absolute dislocation rate was

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indeed higher in THA patients (4.6%, 59 of 1,270) compared to HA (2.9%, 38 of 1,325), this difference was not significant (odds ratio: 1.48, 95% confidence interval [CI]: 0.60 to 3.65). Mortality rates (11 RCTs) were nearly identical between groups, at 15.3% for THA patients versus 15.8% for HA patients (odds ratio: 0.98, 95% CI: 0.79 to 1.22) [2,3,8−14,18,19].

An option that may be considered to help reduce the risk of dislocation is dual mobility THA. While beyond the scope of this question, a systematic review mostly comprised of nonrandomized studies did find a significantly lower dislocation rate with dual mobility THA compared to HA in patients who have femoral neck fractures [20]. The only RCT included in the present review ($n = 60$) demonstrated a significant reduction in dislocation rates in the dual mobility THA group (0%) compared to the bipolar HA group (16.6%) [19]. However, the role of dual mobility THA remains unclear due to a lack of strong RCT evidence, and in particular, it is unclear if there is a sufficient reduction in dislocation rates to justify the added cost and unique complications associated with dual mobility implants.

There were small and statistically significant differences in favor of THA in terms of function and HRQoL. Based on nine RCTs, and with scores converted to the most common instrument (Harris Hip Score, range 0 to 100, higher scores = better), THA patients had a significantly higher mean score than HA patients (mean difference [MD]: 4.59, 95% CI: 1.65 to 7.53) [2,4−6,11−13,15,17]. However, this is smaller than the previously established minimal clinically important difference for the Harris Hip Score following arthroplasty (eight points) [21]. Similarly, based on five studies, there was a significantly higher HRQoL score based on the EuroQol-5 Dimensions for THA versus HA patients (MD: 0.05, 95% CI: 0.02 to 0.08) [2,11−13,17]. The minimal clinically important difference estimate for EuroQol-5 Dimensions has been determined to be 0.145 based on the best available literature [21], exceeding the mean difference.

Patients undergoing HA had significantly lower estimated blood loss (MD: 133.04 mL, 95% CI: 96.39 to 169.69) [3−7,9,15,16] and significantly shorter operative times (MD: 29.7 minutes, 95% CI: 17.95 to 41.49) [2−7,15,17,19]. These findings are not surprising given that acetabular work is not required in HA, whereas it is required in THA. The clinical importance of these findings is difficult to estimate; on the one hand, it is well established that longer operative times increase the risk of infection. However, the weighted mean operative time for the THA patients was only 96 minutes; thus, operative times in all patients were relatively short. As well, total complications (which included infection in some studies) did not differ between groups. In terms of estimated blood loss, the difference is statistically significant, but less than 150 mL, which may not have clinical significance. Transfusion rates, which were not reported in enough studies to allow for quantitative analysis, would be a more clinically important outcome to compare between groups.

Some interesting secondary analyses have been performed using data from the largest RCT on this topic, the Hip Fracture Evaluation with Alternatives of Total Hip Arthroplasty versus Hemiarthroplasty trial. Patients who underwent HA or THA by nonarthroplasty-trained surgeons had significantly higher rates of periprosthetic joint infection and discharge to a facility other than home. There was no significant difference in the reoperation rate [22]. In terms of the functional and HRQoL differences, THA compared to monopolar arthroplasty was associated with a small but clinically unimportant benefit, whereas THA versus bipolar arthroplasty was not. Higher American Society of Anesthesiologists scores and preoperative use of a mobility aid were associated with lower functional and HRQoL scores regardless of treatment [23]. Also, a secondary analysis of the Hip Fracture Evaluation with Alternatives of Total Hip Arthroplasty versus Hemiarthroplasty trial identified a range of factors associated with the risk of revision surgery, including age, body mass index, comorbidities, and length of operation [24].

While not possible to include in our meta-analysis, registry data do provide additional support for the recommendation. Based on data from the Australian Orthopaedic Association National Joint Replacement Registry, there was no significant difference in revision rates at a maximum of 19.7 years follow-up between bipolar HA and THA, although monopolar HA did demonstrate a significantly higher revision rate [25].

Overall, there is no evidence to support recommending THA or HA universally in patients who have femoral neck fractures. Given high mortality rates following hip fractures, and the reduced costs, operative time, and blood loss, HA remains an excellent option in treating patients who have a displaced femoral neck fracture. Given that the arguments regarding THA in this population commonly revolve around potentially improved function, longevity/long-term survival of the implant, and the small, but statistically significant benefits found in these data, THA can be considered in younger, healthier, and more active patients; however, this recommendation cannot be said to be evidence-based as the studies analyzed did not differentiate among patients on these criteria.

CRediT authorship contribution statement

Geert Meermans: Writing − review & editing, Writing − original draft, Methodology, Data curation, Conceptualization. **Darko Talevski:** Writing − review & editing, Writing − original draft, Methodology, Data curation, Conceptualization. **Pēteris Studers:** Writing − review & editing, Writing − original draft, Methodology, Data curation. **Emre Togrul:** Writing − review & editing, Writing − original draft, Methodology, Data curation. **G. Ruslan Nazaruddin Simanjuntak:** Writing − review & editing, Writing − original draft, Methodology, Data curation. **Kamolsak Sukhonthamarn:** Writing − review & editing, Writing − original draft, Methodology, Data curation. **Mark Phillips:** Writing − review & editing, Writing − original draft, Methodology, Data curation, Conceptualization. **Seper Ekhtiari:** Writing − review & editing, Writing − original draft, Visualization, Validation, Supervision, Software, Methodology, Formal analysis, Data curation, Conceptualization.

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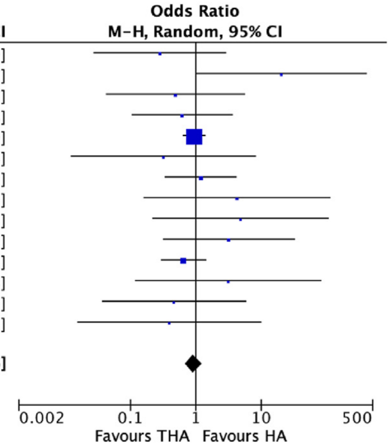
Appendix—Forest Plots

Study or Subgroup	Total Hip Arthroplasty Events	Total Hip Arthroplasty Total	Hemiarthroplasty Events	Hemiarthroplasty Total	Weight	Odds Ratio M-H, Random, 95% CI
Baker 2006	1	36	3	33	1.7%	0.29 [0.03, 2.89]
Cadossi 2013	6	16	0	16	1.0%	20.43 [1.04, 401.67]
Chammout 2019	1	60	2	60	1.6%	0.49 [0.04, 5.57]
Dorr 1986	2	39	4	50	3.0%	0.62 [0.11, 3.58]
HEALTH 2019	57	718	60	723	63.9%	0.95 [0.65, 1.39]
Iorio 2019	0	30	1	30	0.9%	0.32 [0.01, 8.24]
Keating 2006	6	66	5	65	6.0%	1.20 [0.35, 4.15]
Macaulay 2008	1	17	0	23	0.9%	4.27 [0.16, 111.52]
Mouzopoulos 2008	2	33	0	30	1.0%	4.84 [0.22, 105.01]
Parker 2023	3	52	1	53	1.7%	3.18 [0.32, 31.65]
Skinner 1989	13	89	19	91	15.2%	0.65 [0.30, 1.41]
Sonaje 2018	1	24	0	24	0.9%	3.13 [0.12, 80.68]
Uikey 2024	1	15	2	15	1.4%	0.46 [0.04, 5.75]
van den Bekerom 2012	0	99	1	119	0.9%	0.40 [0.02, 9.85]
Total (95% CI)		**1294**		**1332**	**100.0%**	**0.93 [0.69, 1.26]**
Total events	94		98			

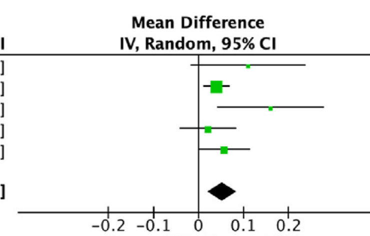
Heterogeneity: Tau² = 0.00; Chi² = 11.25, df = 13 (P = 0.59); I² = 0%
Test for overall effect: Z = 0.47 (P = 0.64)



Appendix Figure 1. Revision surgery.

Study or Subgroup	Total Hip Arthroplasty Mean	Total Hip Arthroplasty SD	Total Hip Arthroplasty Total	Hemiarthroplasty Mean	Hemiarthroplasty SD	Hemiarthroplasty Total	Weight	Mean Difference IV, Random, 95% CI
Chammout 2019	0.66	0.27	52	0.55	0.36	47	5.9%	0.11 [−0.02, 0.24]
HEALTH 2019	0.81	0.19	433	0.77	0.22	411	45.7%	0.04 [0.01, 0.07]
Keating 2006	0.69	0.32	66	0.53	0.36	65	6.8%	0.16 [0.04, 0.28]
Macaulay 2008	0.43	0.08	17	0.409	0.12	23	19.2%	0.02 [−0.04, 0.08]
Mouzopoulos 2008	0.853	0.12	23	0.796	0.06	20	22.4%	0.06 [0.00, 0.11]
Total (95% CI)			**591**			**566**	**100.0%**	**0.05 [0.02, 0.08]**

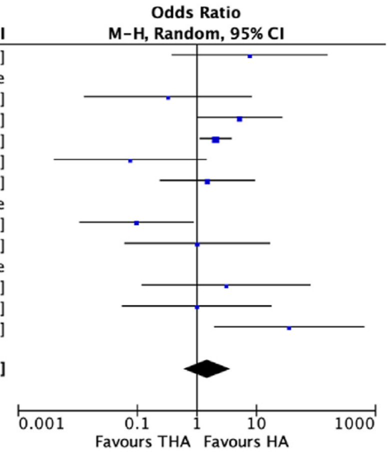
Heterogeneity: Tau² = 0.00; Chi² = 5.60, df = 4 (P = 0.23); I² = 29%
Test for overall effect: Z = 3.21 (P = 0.001)



Appendix Figure 2. Health-related quality of life.

Study or Subgroup	Total Hip Arthroplasty Events	Total Hip Arthroplasty Total	Hemiarthroplasty Events	Hemiarthroplasty Total	Weight	Odds Ratio M-H, Random, 95% CI
Baker 2006	3	40	0	41	6.5%	7.75 [0.39, 154.96]
Blomfeldt 2007	0	60	0	60		Not estimable
Chammout 2019	0	60	1	60	5.8%	0.33 [0.01, 8.21]
Dorr 1986	7	39	2	50	12.9%	5.25 [1.02, 26.90]
HEALTH 2019	34	718	17	723	20.3%	2.06 [1.14, 3.73]
Iorio 2019	0	30	5	30	6.6%	0.08 [0.00, 1.44]
Keating 2006	3	66	2	65	11.7%	1.50 [0.24, 9.29]
Li X 2023	0	66	0	66		Not estimable
Macaulay 2008	1	17	9	23	9.7%	0.10 [0.01, 0.87]
Parker 2023	1	52	1	53	7.1%	1.02 [0.06, 16.74]
Sharma 2016	0	39	0	39		Not estimable
Sonaje 2018	1	24	0	24	5.7%	3.13 [0.12, 80.68]
Uikey 2024	1	15	1	15	6.9%	1.00 [0.06, 17.62]
van den Bekerom 2012	8	44	0	76	6.8%	35.63 [2.00, 634.27]
Total (95% CI)		**1270**		**1325**	**100.0%**	**1.48 [0.60, 3.65]**
Total events	59		38			

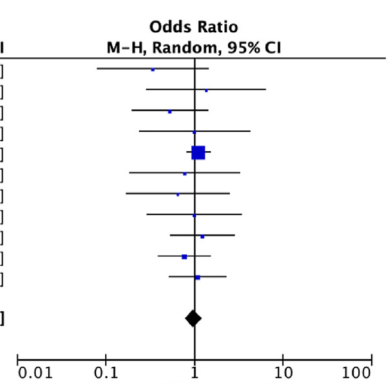
Heterogeneity: $Tau^2 = 0.96$; $Chi^2 = 19.78$, df = 10 (P = 0.03); $I^2 = 49\%$
Test for overall effect: Z = 0.84 (P = 0.40)



Appendix Figure 3. Dislocation rates.

Study or Subgroup	Total Hip Arthroplasty Events	Total Hip Arthroplasty Total	Hemiarthroplasty Events	Hemiarthroplasty Total	Weight	Odds Ratio M-H, Random, 95% CI
Baker 2006	3	36	7	33	2.3%	0.34 [0.08, 1.43]
Blomfeldt 2007	4	60	3	60	2.0%	1.36 [0.29, 6.34]
Cadossi 2013	9	42	14	41	5.0%	0.53 [0.20, 1.40]
Chammout 2019	4	60	4	60	2.3%	1.00 [0.24, 4.20]
HEALTH 2019	103	718	95	723	53.5%	1.11 [0.82, 1.49]
Iorio 2019	4	30	5	30	2.4%	0.77 [0.19, 3.20]
Macaulay 2008	5	17	9	23	2.7%	0.65 [0.17, 2.47]
Mouzopoulos 2008	6	43	6	43	3.2%	1.00 [0.30, 3.39]
Parker 2023	17	52	15	53	7.0%	1.23 [0.54, 2.83]
Skinner 1989	20	89	25	91	10.5%	0.77 [0.39, 1.51]
van den Bekerom 2012	16	99	18	119	9.0%	1.08 [0.52, 2.25]
Total (95% CI)		**1246**		**1276**	**100.0%**	**0.98 [0.79, 1.22]**
Total events	191		201			

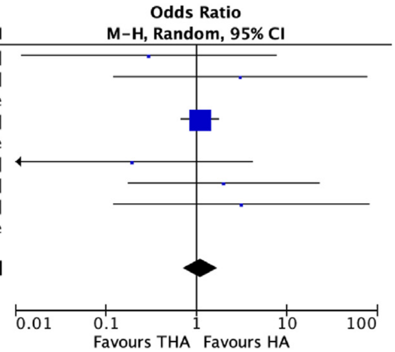
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 5.79$, df = 10 (P = 0.83); $I^2 = 0\%$
Test for overall effect: Z = 0.19 (P = 0.85)



Appendix Figure 4. Mortality rates.

Study or Subgroup	Total Hip Arthroplasty Events	Total	Hemiarthroplasty Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baker 2006	0	36	1	33	1.9%	0.30 [0.01, 7.54]
Blomfeldt 2007	1	58	0	58	1.9%	3.05 [0.12, 76.48]
Chammout 2019	0	60	0	60		Not estimable
HEALTH 2019	38	718	35	723	88.9%	1.10 [0.69, 1.76]
Iorio 2019	0	30	0	30		Not estimable
Li X 2023	0	66	2	66	2.1%	0.19 [0.01, 4.12]
Parker 2023	2	53	1	52	3.3%	2.00 [0.18, 22.75]
Sonaje 2018	1	24	0	24	1.9%	3.13 [0.12, 80.68]
Uikey 2024	0	15	0	15		Not estimable
Total (95% CI)		**1060**		**1061**	**100.0%**	**1.10 [0.70, 1.71]**
Total events	42		39			

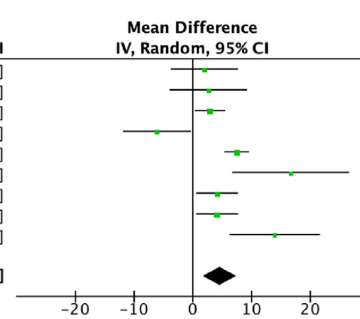
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.89$, df = 5 (P = 0.72); $I^2 = 0\%$
Test for overall effect: Z = 0.40 (P = 0.69)



Appendix Figure 5. Periprosthetic fracture.

Study or Subgroup	Total Hip Arthroplasty Mean	SD	Total	Hemiarthroplasty Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Chammout 2019	76	15	56	74	14	47	10.3%	2.00 [−3.61, 7.61]
Chatterji 2022	78.19	10.56	20	75.5	10.37	20	9.1%	2.69 [−3.80, 9.18]
HEALTH 2019	85.7115	15.6	349	82.78	17	320	14.7%	2.93 [0.45, 5.41]
Keating 2006	73.8	16	65	79.9	17	66	10.2%	−6.10 [−11.75, −0.45]
Li X 2023	89.45	5.81	66	81.94	5.58	66	15.3%	7.51 [5.57, 9.45]
Macaulay 2008	34.9	18	17	18.2	10.2	17	5.8%	16.70 [6.87, 26.53]
Mouzopoulos 2008	83.7	4.8	23	79.5	6.5	20	13.4%	4.20 [0.74, 7.66]
Sonaje 2018	88	5.76	24	83.85	6.62	24	13.3%	4.15 [0.64, 7.66]
Uikey 2024	82.53	9.32	15	68.53	11.64	15	7.9%	14.00 [6.45, 21.55]
Total (95% CI)			**635**			**595**	**100.0%**	**4.59 [1.65, 7.53]**

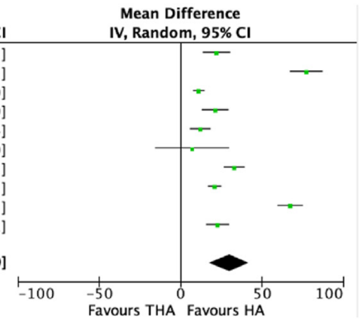
Heterogeneity: $Tau^2 = 13.71$; $Chi^2 = 36.81$, df = 8 (P < 0.0001); $I^2 = 78\%$
Test for overall effect: Z = 3.06 (P = 0.002)



Appendix Figure 6. Function.

	Total Hip Arthroplasty			Hemiarthroplasty				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Chammout 2019	99	25	60	77	19	60	10.1%	22.00 [14.05, 29.95]
Chatterji 2022	133.19	21.02	20	55.95	7.01	20	9.9%	77.24 [67.53, 86.95]
Iorio 2019	59	7.25	30	48	5.25	30	10.5%	11.00 [7.80, 14.20]
Keating 2006	79.7	21	69	58.5	26	69	10.1%	21.20 [13.31, 29.09]
Li X 2023	124.28	17.92	66	112.29	16.92	66	10.3%	11.99 [6.04, 17.94]
Macaulay 2008	89	36	17	82	35	23	7.7%	7.00 [−15.30, 29.30]
Parker 2023	84	16.5785714	52	51	14.81571429	53	10.3%	33.00 [26.98, 39.02]
Ren 2017	89.26	10.05	50	68.49	9.76	50	10.5%	20.77 [16.89, 24.65]
Sonaje 2018	119.1	16.75	24	51.8	8.7	24	10.2%	67.30 [59.75, 74.85]
Uikey 2024	94.8	7.35	15	72.2	11.04	15	10.3%	22.60 [15.89, 29.31]
Total (95% CI)			**403**			**410**	**100.0%**	**29.72 [17.95, 41.49]**

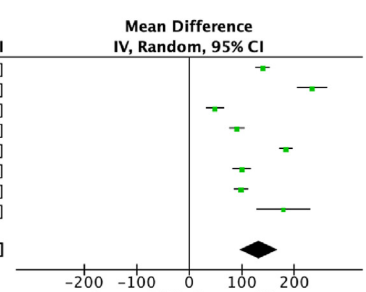
Heterogeneity: Tau^2 = 339.72; Chi^2 = 333.17, df = 9 (P < 0.00001); I^2 = 97%
Test for overall effect: Z = 4.95 (P < 0.00001)



Appendix Figure 7. Operative time.

	Total Hip Arthroplasty			Hemiarthroplasty				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Blomfeldt 2007	460	38.145	60	320	33.0125	60	12.9%	140.00 [127.24, 152.76]
Chatterji 2022	569.06	49.13	20	334.75	38.91	20	12.2%	234.31 [206.84, 261.78]
Li X 2023	381.38	48.73	66	332.29	44.28	66	12.8%	49.09 [33.20, 64.98]
Parker 2023	335	38.145	52	244	33.0125	53	12.9%	91.00 [77.34, 104.66]
Ren 2017	402.61	31.16	50	218.26	28.43	50	12.9%	184.35 [172.66, 196.04]
Sharma 2016	300	38.145	39	200	33.0125	39	12.8%	100.00 [84.17, 115.83]
Sonaje 2018	336.85	23.56	24	238.15	20.43	24	12.9%	98.70 [86.22, 111.18]
Uikey 2024	518.67	85.76	15	339	48.85	15	10.5%	179.67 [129.72, 229.62]
Total (95% CI)			**326**			**327**	**100.0%**	**133.04 [96.39, 169.69]**

Heterogeneity: Tau^2 = 2666.43; Chi^2 = 307.54, df = 7 (P < 0.00001); I^2 = 98%
Test for overall effect: Z = 7.11 (P < 0.00001)



Appendix Figure 8. Estimated blood loss.