# Question: Is there a difference in outcomes between hemiarthroplasty and total hip arthroplasty for patients with displaced femoral neck fractures?

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**Response/Recommendation:** Based on randomized controlled trials (RCT), at up to 5 years follow up, there appears to be no important difference between hemiarthroplasty (HA) and total hip arthroplasty (THA) performed for patients with displaced femoral neck fracture. The use of THA is associated with better health-related quality of life (HRQoL) and function. Estimated blood loss and operative time are both significantly lower in hemiarthroplasty compared to THA.

### Level of Evidence: High

#### **Rationale:**

Given the preponderance of RCT studies available, this analysis was limited to published RCTs on the topic, with up to 5 years' follow-up. Nineteen RCTs were included with a total sample size of 3,414 patients with a mean age of 78.1 years old (1–19). The outcomes of interest included all important clinical outcomes which 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 HRQoL.

In summary, based on quantitative meta-analyses, there was no significant difference between HA and THA in terms of mortality, revision surgery, periprosthetic fracture, total complications, or dislocations. The most robust evidence exists for revision and dislocation, each of which were reported in 14 studies (1–3,5,8,10–16,18,19). 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 indeed higher in THA patients (4.6%, 59/1270) compared to HA (2.9%, 38/1325), this difference was not significant (odds ratio [OR]: 1.48, 95% Confidence Interval [CI]: 0.60-3.65). Mortality rates (11 RCTs) were nearly identical between groups, at 15.3% for THA patients versus 15.8% for HA patients (OR: 0.98, 95% CI: 0.79-1.22) (3,8–15,19,20).

One option which 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 comprising of non-randomized studies did find a significantly lower dislocation rate with dual mobility THA compared to HA in patients with femoral neck fracture (21). 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%) (20). 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 favour of THA in terms of function and HRQoL. Based on 9 RCTs, and with scores converted to the most common

instrument (Harris Hip Score, range 0-100, higher scores = better), THA patients had a significantly higher mean score than HA patients (Mean Difference [MD]: 4.59, 95%CI: 1.65-7.53) (4–6,11–14,16,18). However, this is smaller than the previously established minimal clinically important difference (MCID) for the Harris Hip Score following arthroplasty (8 points) (22). Similarly, based on 5 studies, there was a significantly higher HRQoL score based on the EuroQol-5-Dimensions for THA versus HA patients (MD: 0.05, 95%CI: 0.02-0.08) (11–14,18). The MCID estimate for EQ-5D has been determined to be 0.145 based on the best available literature (22), exceeding the mean difference.

Patients undergoing HA had significantly lower estimated blood loss (MD: 133.04 mL, 95%CI: 96.39-169.69) (3–7,9,16,17), and significantly shorter operative times (MD: 29.72 mins, 95%CI: 17.95-41.49) (3–7,13,16,18,20). 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, and 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 150mL, 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 HEALTH trial. Patients who underwent HA or THA by non-arthroplasty trained surgeons had significantly higher rates of peri-prosthetic joint infection and discharge to a facility other than home. There was no significant difference in reoperation rate (23). 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 Anesthesiologist (ASA) score and pre-operative use of a mobility aid were associated with lower functional and HRQoL scores regardless of treatment (24). Finally, a secondary analysis of the HEALTH trial identified a range of factors associated with risk of revision surgery, including age, body mass index, comorbidities, and length of operation (25).

Overall, there is no evidence to support recommending THA or HA universally in elderly patients with 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 these patients. Given that the arguments regarding THA in this population commonly revolve around potentially improved function, 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.

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# <u>APPENDIX – FOREST PLOTS</u>

	Total Hip Arthroplasty		Hemiarthroplasty			Odds Ratio		Odds Ratio		
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		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]		+		
lorio 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: $Tau^2 = 0.0$	00; $Chi^2 = 11.25$ ,	df = 13 (	$P = 0.59$ ; $I^2$	= 0%			0.002		500	
Test for overall effect: Z =	0.47 (P = 0.64)						0.002	Favours THA Favours HA	500	

## Figure 1 – Revision Surgery

	Total Hip	Hemia	rthropi	asty		Mean Difference	Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	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]	- <b>-</b>
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									•
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup>								
Test for overall effect:	Z = 3.21 (F	Favours HA Favours THA							

# Figure 2 – Health-related quality of life

	Total Hip Arthro	Total Hip Arthroplasty				Odds Ratio	Odds Ratio		
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Rand	om, 95% Cl	
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]		<u> </u>	
Dorr 1986	7	39	2	50	12.9%	5.25 [1.02, 26.90]		<b>—</b>	
HEALTH 2019	34	718	17	723	20.3%	2.06 [1.14, 3.73]			
lorio 2019	0	30	5	30	6.6%	0.08 [0.00, 1.44]		F	
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]		<b></b>	
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: $Tau^2 = 0.9$	96; Chi <sup>2</sup> = 19.78,	df = 10 (	$P = 0.03$ ; $I^2$	= 49%			0.001 0.1	10	1000
Test for overall effect: Z =	Favours THA	Favours HA	1000						

Figure 3 – Dislocation rates

	Total Hip Arthroplasty		Hemiarthroplasty		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% Cl
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]	+
lorio 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: $Tau^2 = 0.0$	00; Chi <sup>2</sup> = 5.79, df	= 10 (P	= 0.83); I <sup>2</sup> =	0%			
Test for overall effect: Z =	0.19 (P = 0.85)						Favours THA Favours HA

## **Figure 4** – Mortality rates

	2										
	Total Hip Arthro	Hemiarthrop	lasty		Odds Ratio		Odds Ratio				
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		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]		-#-			
lorio 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 <sup>2</sup> =	= 0.00; Chi <sup>2</sup> = 2.89	, df = 5	$(P = 0.72); I^2$	= 0%			0.01				
Test for overall effect:	Z = 0.40 (P = 0.6)	9)					0.01	Favours THA Favours HA			

## **Figure 5** – Periprosthetic Fracture

0	Total Hig	Arthrop	lasty	Hemiarthroplasty				Mean Difference	Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	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 <sup>2</sup> =	13.71; Chi	$^{2} = 36.81$	, df = 8	(P < 0.0	001); I <sup>2</sup>		-	-20 -10 0 10 20			
Test for overall effect:	Z = 3.06 (P	Favours HA Favours THA									

# Figure 6 – Function

-	Total Hip Arthroplasty			He	miarthroplasty			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	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]	
lorio 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 <sup>2</sup> =	339.72;	Chi <sup>2</sup> = 333.17,	df = 9 (F	P < 0.000	$(001); I^2 = 97\%$				
Test for overall effect: $Z = 4.95$ (P < 0.00001)									Favours THA Favours HA

# Figure 7 – Operative Time

	Total H	ip Arthrop	lasty	Hemi	iarthroplas	ty		Mean Difference	Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	Mean SD Total		Weight	IV, Random, 95% CI	IV, Random, 9	5% 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 <sup>2</sup> =	2666.43	; Chi <sup>2</sup> = 30	7.54, df	= 7 (P <	0.00001);	$l^2 = 98$	3%			140 240
Test for overall effect:	Z = 7.11	Favours THA Fav	ours HA							

Figure 8 – Estimated Blood Loss