Total Hip Arthroplasty Navigation Not Shown to have Reduced 90-Day Adverse Events or Five-Year Revisions in a Large National Cohort

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INTRODUCTION:

Computer navigation is increasingly considered for use with total hip arthroplasty (THA). However, the evidence to support this practice is mixed. The current study leveraged a large national administrative database to compare 90-day adverse events and five-year all-cause revision and dislocation rates of THAs performed without versus with navigation.

METHODS:

A 2010 to Q3 2020 national ortho database was queried for THA cases performed for osteoarthritis. Cases were subcategorized as those without or with imageless navigation and matched 4:1 based on age, sex, and Elixhauser Comorbidity Index (ECI). Ninety-day adverse events were assessed and compared with univariate and multivariate analyses. Five-year incidences of revision and dislocation were also assessed and compared.

RESULTS:

Navigation was increasingly utilized for THAs from 2010 (3.2% of THA cases) to 2020 (7.6% of THA cases; p<0.001). After matching, 47,948 THA patients without navigation and 11,990 with navigation were identified. Overall 90-day adverse events were observed in 6.96% of the population.

Multivariate analysis controlling for age, sex, and ECI demonstrated that the only difference in 90-day adverse events was wound dehiscence, which had higher odds in the navigation group (odds ratio [OR] 1.60, p<0.001). At five years, revisions for the navigated group were higher (4.4% vs. 3.6%: p=0.006) while dislocations were not significantly different.

DISCUSSION AND CONCLUSION:

THA navigation was not found to be associated with improved 90-day postoperative adverse events or five-year freedom from revision or dislocation. The current data were unable to identify advantages of this evolving technology.

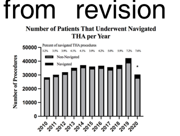
Number of Patients That Underwent Navigated THA per Year
Percent of navigated THA procedures
3.2% 3.5% 3.9% 4.1% 4.1% 3.9% 4.2% 5.0% 5.9% 7.2% 7.6%
Non-Navigated
Navigated
Number of Procedures
0
10000
20000
30000
40000
50000
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year
*

Figure 1: Stacked bar graph of number of navigated and non-navigated THA procdures for osteoarthritis between 2010 and Q3 2020 with percent of navigated THA relative to total THA per year. Chi-squared test, p < 0.001

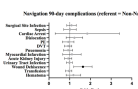
Navigation 90-day complications (referent = Non-Navigated)
Surgical Site Infection
Sepsis
Cardiac Arrest
Dislocation
PE
DVT
Pnuemonia
Myocardial Infarction
Acute Kidney Injury
Urinary Tract Infection
Wound Dehiscence
Transfusion
Hematoma
0 1 2 3 4
Odds Ratio

Figure 2: Forest plot of 90-day complications adjusted odds ratios for navigated THA, with non-navigated THA as the reference population. Select adverse events shown.

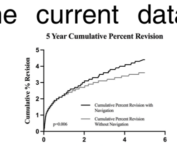

Figure 3: Five-year Kaplan-Meier survival plot of revision procedures following Navigated versus Non-Navigated procedures. Log-rank test, p = 0.006.

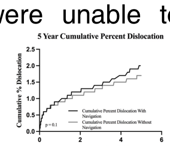

Figure 4: Five-year Kaplan-Meier survival plot of subsequent dislocation following Navigated versus Non-Navigated procedures. Log-rank test, p = 0.1.

Table 1: Matched patient characteristics

	All Patients (Prior to Matching)		Non-Navigated		Navigated		
	Value	%	Value	%	Value	%	p-value
Total	337,011		47,948		11,990		
Age, year, mean (SD)	64.71 ± 9.89		64.46 ± 9.77		64.43 ± 9.76		0.799
Sex							1
Female	189,588	56.26	27,330	57.0	6,834	57.0	
Male	147,423	43.74	20,618	57.0	5,156	43.0	
ECI, mean (SD)	3.96 ± 3.15		4.42 ± 3.29				0.970
Insurance							**<0.001**
Commercial	225,060	66.78	31,632	65.97	7,967	66.45	
Medicaid	9,061	2.69	1,371	2.86	238	1.98	
Medicare	103,015	30.57	13,685	28.54	3,381	28.2	

4:1 Matching based on age, sex, and ECI
Bold p-value = Statistical Significance at p<0.05
Abbreviation:
ECI = Elixhauser Comorbidity Index
SD = Standard Deviation

Table 2: Univariate and multivariate analyses of 90-day complications

	Total		Non-Navigated		Navigated		Multivariate Navigated relative to Non-Navigated		
	Value	%	Value	%	Value	%	OR[a]	95% CI	p-value
Total	59,938	100	47,948	80	11,990	20			
Surgical Site Infection	357	0.6	145	0.3	212	1.77	1.07	0.867-1.33	0.51
Sepsis	177	0.3	77	0.16	100	0.83	0.99	0.73-1.33	0.93
Cardiac Arrest	13	0.02	*	*	13	0.11	1.42	0.56-3.57	0.46
Dislocation	151	0.25	59	0.12	92	0.77	1.19	0.85-1.65	0.31
PE	209	0.35	91	0.19	118	0.98	0.84	0.71-1.24	0.66
DVT	439	0.73	190	0.4	249	2.08	0.91	0.76-1.11	0.38
Pneumonia	295	0.49	132	0.28	163	1.36	0.91	0.72-1.15	0.41
Myocardial Infarction	98	0.16	40	0.08	58	0.48	1.05	0.70-1.58	0.81
Acute Kidney Injury	444	0.74	201	0.42	243	2.03	0.92	0.76-1.11	0.39
UTI	883	1.47	364	0.76	519	4.33	0.98	0.85-1.13	0.77
Wound Dehiscence	248	0.41	81	0.17	167	1.39	1.60	1.22-2.10	**<0.001***
Transfusion	676	1.13	288	0.6	388	3.24	0.95	0.81-1.11	0.502
Hematoma	182	0.3	71	0.15	111	0.93	1.14	0.85-1.55	0.37

*Censored if one or more cohorts had <10 patients with a complication
[a]Odds ratio for Navigated adjusted for age, sex, and ECI. Referent = Non-Navigated
Bold p-value = Statistical Significance at p<0.05
Abbreviation:
DVT = Deep vein thrombosis
ECI = Elixhauser Comorbidity Index
OR = Odds Ratio
PE = Pulmonary embolism
UTI = Urinary tract infection