The Association Between Preoperative 3D Rendering Prior to an Elective Total Knee, Shoulder or Hip Arthroplasty and Postoperative Outcomes: Real World Evidence from the OHDSI Network

Matthew E. Spotnitz, M.D., M.P.H.[1,4], Edward Burn, Ph.D.[2], Thomas W. Hamilton M.D. D.Phil.[2], Jeffrey A. Geller, M.D.[1], Kristin Kostka, M.P.H.[3,4], Karthik Natarajan, Ph.D.[1,4]

[1]Columbia University Medical Center, New York, NY; [2]University of Oxford, Oxford, England; [3]IQVIA, Durham, NC; [4]Observational Health Data Sciences & Informatics, New York, NY

Background

The techniques for reconstructing a 3D image have changed dramatically since the 1980s and continue to evolve. Having a 3D rendering prior to an elective arthroplasty may improve decisions about surgical access for procedures that are not robotic or computer-assisted. Knowing the dimensions of a joint preoperatively may help the surgeon pick the best prosthetic for the procedure. Some surgeons may use a 3D rendering to print patient specific instruments. Additional causes of arthroplasty failure include malalignment, component overhang, and suboptimal component sizing. The magnitude of these issues may be reduced with the use of 3D rendering preoperatively.

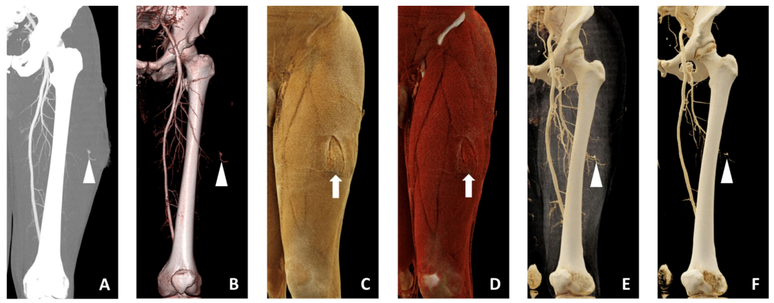

Figure 1: Reconstruction of a lower extremity CT angiogram by a) Maximum Intensity Projection (MIP) b) Volumetric Rendering (VR) c-f) Cinematic Rendering (CR). [Adopted from Rowe SP, Fritz J, Fishman EK Emerg Radiol (2018) 25:93–101].

Methods

We performed comparisons of patients who had a 3D rendering prior to a Total Knee Arthroplasty (TKA), Total Shoulder Arthroplasty (TSA) or Total Hip Arthroplasty (THA) to those who did not. The index event was the arthroplasty procedure which occurred for the first time in the patient's history. All patients were at least 40 years old and underwent the procedure for the first time in the patient's history on or after 01/01/2006. We restricted our analysis to patients who had observation for 365 days prior to the procedure date. Patients with a history of a trauma in the pertinent region within 90 days prior to the procedure were excluded. We excluded robotic or computer assisted procedures. We identified 3D rendering procedures by CPT codes 76376 and 76377, and used them to differentiate the target cohort (T) from the comparator cohort (C) in our comparisons. Propensity score stratification accounted for residual confounding. A revision procedure was the outcome. The time at risk was from 1 day after the procedure to all days after the procedure.

-Comparison 1: 3D TKA (T) vs. No 3D TKA (C), Outcome 1: Revision TKA
-Comparison 2: 3D TSA (T) vs. No 3D TSA (C), Outcome 2: Revision TSA
-Comparison 3: 3D THA (T) vs. No 3D THA (C), Outcome 3: Revision THA

OHDSI Software Package Link: http://www.ohdsi.org/web/atlas/#/estimation/cca/81.

Results

Preliminary results for the TKA, TSA, and THA analyses were acquired on 3 databases.

RR [95% CI]	#target cohort	#comparator cohort	#target outcome	#comparator outcome	p-value	Institution/Data base
0.45 [0.07-1.40]	129	143007	-5	3733	0.29	IQVIA/Hospital
0.86 [0.70-1.05]	3988	99639	106	2536	0.16	IQVIA/Claims
0.37 [N/A-19.20]	-5	1979	0	82	N/A	CUIMC/2018q4

Figure 2: Preliminary results for the TKA analysis. RR = Relative Risk, CI = Confidence Interval, Institution/Data = Institution/Database, N/A = Not Applicable, CUIMC = Columbia University Irving Medical Center.

Analysis	RR [95% CI]	p-value	Institution/Data
Uncalibrated	0.86 [0.70-1.05]	0.16	IQVIA/Claims
Calibrated	0.80 [0.64-0.99]	0.04	IQVIA/Claims

Figure 3: Uncalibrated and calibrated results for the TKA analysis. RR = Relative Risk, CI = Confidence Interval, Institution/Data = Institution/Database.

Conclusions

We have successfully extracted preliminary results from different databases and sites. We anticipate that our study will demonstrate evidence to understand the magnitude of association between 3D rendering prior to a TKA, TSA and THA on subsequent revision rates.

Contact: mes2165@cumc.columbia.edu