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Incidence of Above Knee Amputations Due to Total Knee Arthroplasty Complications: A Comprehensive Analysis from a Midwest Metropolitan Hospital System

Robert Garner, DO, Collin Erickson, DO, Evan Johnson, DO, Brandalynn Holland, DO, Jacob Frisbie, DO, David Dye, DO, Jason Webb, BA, Robert Paul, DO, David Dugan, DO, Charles Orth, DO FAOAO

HCA Rocky Mountain Healthcare Symposium – Medical Center of Auora, CO

March 29th 2024

HCA-Research/KCU Consortium Orthopaedic Surgery Residency

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Introduction

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- Conflicts of Interest: None
- Funding: None

- Arthroplasty surgery has increased steadily over the recent years
  - 800,000 total knee arthroplasties (TKA) are performed annually in the United States, increased from the 600,000 amount that occurred in 2010. [1]
  - Shichman projected TKA to increase to over 1.2 million yearly by 2040. [2]
- Kurtz found the rate of infected knee arthroplasties 0.92% in 2008 [6]

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Introduction

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- Above Knee Amputations (AKA) Indications according to George [8]
  - Trauma, malignancy, vascular disease, gangrene, periprosthetic joint infections (PJI) failing treatment, and others.
- Sierra reported rate of Primary TKA requiring AKA 1970-2000: 0.36%, 67/18,443 [7]
- The incidence of AKAs resulting from knee prosthetic joint infections (PJI) increased by 263% from 1998 to 2013 [8]
- Question: With the increase in joint replacements from an aging population, is there a correlation of increasing AKA trend from failed TKA and what comorbidities are assoicated?
- Hypothesis: There is an increase of AKA due to failed TKA given increased number of procedure.

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Methods

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- Retrospective study utilizing HCA Database for Midwest Division Fall/Winter 2023
  - 7 Hospitals
  - Patients aged 17+ from 1/1/2016-12/31/2022 were included
- Used CPT code related to AKA for any indication to identify patients
  - CPT: 27590-8
- Used ICD-10 codes for comorbidities
  - Vascular disease, DM, smoking, chronic steriod use, tobacco use, alcohol use, etc.
- Demographic information, BMI, and Microbiology were reviewed
- Used CPT code 27447 to identify primary TKA

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Methods

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- The operative reports were obtained with the CPT codes and deidentified by HCA data analysts
  - Orthopedic surgery resident categorized indication for AKA from Indication for procedure and operative diagnosis in the operative reports
- Exclusion criteria
  - Prior BKA/AKA (revision amputation)
  - Contralateral AKA/BKA
- Statistical analysis using T-test for the numeric outcomes and chi-square test the categorical comorbidities.

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Results

- 360 Cases Identified (256 when adjusted for exclusion criteria and non-AKA)
  - 96 Excluded due to revision amputation, prior amputation, or contralateral amputation
  - 8 cases not AKA
  - 136 due to infection (Not PJI)
  - 58 due to vascular disease
  - 20 due to trauma
  - 2 due to cancer

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Results

- 35/256 AKA assoicated with TKA
  - Knee PJI: 33
  - Arthrofibrosis s/p TKA: 1
  - Vascular Indication with AKA present: 1
- % of AKA due to PJI: 12.89%
- % of AKA assoicated with failed TKA: 13.67%
- No comorbidities were statically significant

- Total number of Primary TKA in Midwest during same time period
  - ~9900
- Rate of amputation per primary TKA in Midwest
  - 0.35%

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Results

		Other		Failed TKA	
		Count	Column %	Count	Column N %
Sex	F	85	45.0%	19	63.3%
	M	104	55.0%	11	36.7%
Race	Black	41	21.7%	1	3.3%
	Other	7	3.7%	1	3.3%
	White	141	74.6%	28	93.3%
Mortality	0	157	83.1%	30	100.0%
	1	32	16.9%	0	0.0%
Diabetes	0	87	46.0%	18	60.0%
	1	102	54.0%	12	40.0%
Vascular Disease	0	159	84.1%	29	96.7%
	1	30	15.9%	1	3.3%

		Other		Failed TKA	
		Count	Column %	Count	Column %
CHF	0	130	68.8%	23	76.7%
	1	59	31.2%	7	23.3%
Hypertension	0	33	17.5%	4	13.3%
	1	156	82.5%	26	86.7%
Sleep Apnea	0	172	91.0%	24	80.0%
	1	17	9.0%	6	20.0%
Hyperlipidemia	0	80	42.3%	10	33.3%
	1	109	57.7%	20	66.7%
CoronaryArtery	0	113	59.8%	25	83.3%
	1	76	40.2%	5	16.7%
CKD	0	80	42.3%	26	86.7%
	1	109	57.7%	4	13.3%

0 = PT does not have diagnosis

1 = Patient has Diagnosis

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Results

0 = PT does not have diagnosis

1 = Patient has Diagnosis

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		Other		Failed TKA	
		Count	Column %	Count	Column %
COPD	0	146	77.2%	26	86.7%
	1	43	22.8%	4	13.3%
Liver Disease	0	179	94.7%	28	93.3%
	1	10	5.3%	2	6.7%
Rheumatoid Arthritis	0	189	100.0%	30	100.0%
Metastatic Cancer	0	185	97.9%	30	100.0%
	1	4	2.1%	0	0.0%
Chronic Steroid	0	183	96.8%	29	96.7%
	1	6	3.2%	1	3.3%
Immuo-suppressed	0	189	100.0%	30	100.0%
Alcohol	0	178	94.2%	29	96.7%
	1	11	5.8%	1	3.3%

		Other		Failed TKA	
		Count	Column %	Count	Column %
Indication	Arthrofibrosis s/p TKA	0	0.0%	1	3.3%
	Bilateral AKA - Infection	1	0.5%	0	0.0%
	Bilateral AKA - Vascular	4	2.1%	0	0.0%
	Cancer	2	1.1%	0	0.0%
	Infection - Not PJI	114	60.3%	0	0.0%
	Knee PJI	0	0.0%	28	93.3%
	Not AKA	6	3.2%	0	0.0%
	Trauma	12	6.3%	0	0.0%
	Vascular	50	26.5%	0	0.0%
	Vascular with TKA present, no infection	0	0.0%	1	3.3%
Smoker	Unknown	22	11.8%	2	6.7%
	Never smoked	57	30.5%	16	53.3%
	Former Smoker	58	31.0%	11	36.7%
	Smoker	50	26.7%	1	3.3%

Results

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	Other					Failed TKA				
	Mean	Median	Standard Deviation	Minimum	Maximum	Mean	Median	Standard Deviation	Minimum	Maximum
Age	67.55	68.00	13.91	23.00	90.00	68.50	70.50	7.33	54.00	85.00
LOS	15.20	12.00	12.81	.00	107.00	7.37	6.00	5.34	2.00	22.00
BMI	27.67	26.58	7.87	14.66	66.45	32.53	30.31	7.99	21.07	52.20

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Discussion

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- AKA for PJI are increasing with increased of primary TKA being performed [8]
- Revision TKA is complex and sometimes require multiple surgeries
  - Removal of TKA
  - Antibiotic spacers
  - Extended duration of IV and PO antibiotics
  - AKA is a treatment option with persistent infection after revision TKA

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Discussion

- Our study demonstrated majority of AKAs are due to:
  1. Non-PJI Infection: Gangrene, SSI, necrotizing fascitis, etc.
  2. Vascular disease
  3. TKA complications

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- Bias
  - Retrospective
  - Small sample size
    - Considered using multiple divisions
    - Too much data to deidentify

- Limitations
  - Unable to obtain microbiology data assoicated with the knee
  - Using only HCA system to extract data
    - Some surgeons use separate EMR which has pertinent information such as Micro, labs, prior surgeries, and more extensive history
  - Data was only able to be collected from 2016 to 2022
  - Possible missed cases from data extraction
    - Incorrectly coded procedures/comorbidities
    - Incorrectly labeling of cases from case reports
  - Unable to determines statistical significance due to small sample size

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Discussion

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- Recommendations for future studies
  - Include Type of implant/manufacture
  - Date of primary TKA
  - Number of prior surgeries on knee
  - Post-operative complications
  - ASA Classification
- Use of National Inpatient Sample
  - Largest publicly available all-payer inpatient healthcare database [9]
  - Part of Healthcare Cost and Utilization Project [9]
  - Assoicated with department of health and human services [9]

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Conclusion

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- AKA is the ultimate treatment for PJI refractory to revision surgery and medical treat
- Rate of AKA due to PJI in HCA Midwest is 12.89%
- Rate of AKA assoicated with failed TKA: 13.67%
- Rate of Primary TKA requiring AKA in Midwest 2016-2022: 0.35%
  - Similar to rates of Primary TKA AKA in 1970-2000: 0.36%[7]
- Unable to associate comorbidities, BMI, smoking as risk factors to AKA due to small sample size
- Looking into complications after increased in frequency of procedures, new technique, and new style of implants is vital to ensure care continues to improve

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References

1. UpToDate. Accessed October 23, 2023. https://www.uptodate.com/contents/total-knee-arthroplasty/print

2. Shichman I, Roof M, Askew N, et al. Projections and Epidemiology of Primary Hip and Knee Arthroplasty in Medicare Patients to 2040-2060. JB JS Open Access. 2023;8(1). doi:10.2106/JBJS.OA.22.00112

3. Hamood R, Tirosh M, Fallach N, Chodick G, Eisenberg E, Lubovsky O. Prevalence and Incidence of Osteoarthritis: A Population-Based Retrospective Cohort Study. J Clin Med Res. 2021;10(18). doi:10.3390/jcm10184282

4. UpToDate. Accessed October 23, 2023. https://www.uptodate.com/contents/complications-of-total-knee-arthroplasty

5. Mousavian A, Sabzevari S, Ghiasi S, et al. Amputation as a Complication after Total Knee Replacement, is it a Real Concern to be Discussed?: A Systematic Review. Arch Bone Jt Surg. 2021;9(1):9-21.

6. Kurtz SM, Lau E, Schmier J, Ong KL, Zhao K, Parvizi J. Infection burden for hip and knee arthroplasty in the United States. J Arthroplasty. 2008 Oct;23(7):984-91. doi: 10.1016/j.arth.2007.10.017. Epub 2008 Apr 10. PMID: 18534466.

7. Sierra RJ, Trousdale RT, Pagnano MW. Above-the-knee amputation after a total knee replacement: prevalence, etiology, and functional outcome. J Bone Joint Surg Am. 2003 Jun;85(6):1000-4. doi: 10.2106/00004623-200306000-00003. PMID: 12783994.

8. George, J., Navale, S. M., Nageeb, E. M., Curtis, G. L., Klika, A. K., Barsoum, W. K., Mont, M. A., & Higuera, C. A. (2018). Etiology of Above-knee Amputations in the United States: Is Periprosthetic Joint Infection an Emerging Cause? Clinical Orthopaedics and Related Research, 476(10), 1951-1960. https://doi.org/10.1007/s11999.0000000000000166

9. HCUP-US NIS Overview. hcup-us.ahrq.gov. https://hcup-us.ahrq.gov/nisoverview.jsp

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