Rheumatoid Arthritis vs Osteoarthritis: Comparison of Demographics and Trends of Joint Replacement Data from the Nationwide Inpatient Sample

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Author Affiliation | **Disclosures**

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Take-Home Points

- Patients undergoing THA for OA, when compared to those with RA undergoing THA, had lower risk for postoperative cardiovascular, pulmonary, wound dehiscence, infections, and systemic complications.
- Patients with OA undergoing THA had statistically significant higher risk of cerebrovascular complication compared to RA patients undergoing the same procedure.

- In TKA, OA patients had significantly higher risk for cardiovascular and cerebrovascular complications, and a significant lower risk for mechanical wounds, infection, and systemic complications.
- RA patients are at higher risk for postoperative infection, wound dehiscence, and systemic complications after TKA and THA compared to OA patients.
- These findings highlight the importance of preoperative medical clearance and management to optimize RA patients and improve the postoperative outcomes.

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease that causes joint deterioration, leading to pain, disability, systemic complications, short lifespan, and decline in quality of life.[1-3] The deterioration primarily affects the synovial membranes of joints, causing arthritis and resulting in extra-articular sequelae such as cardiovascular disease,[4] pulmonary disease,[5] and increased infection rates.[3,6] RA is the most prevalent inflammatory arthritis worldwide and affects up to 50 cases per 100,000 in both the US and northern Europe.[2,7-9] Although the gold standard of care for these patients is medical management with immunosuppressant drugs such as disease-modifying anti-rheumatic drugs (DMARDs), total joint arthroplasty (TJA) remains an important tool in the management of joint deterioration in such patients.

Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are common procedures utilized to treat disorders that cause joint pain and hindered joint mobility, including osteoarthritis (OA) and RA. Given the aging population, the amount of TKAs and THAs performed in the US has consistently increased each year, with the vast majority of this increase composed of patients with OA.[10] As a result, previous studies investigated the trends and outcomes of these procedures in patients with OA, but relatively less is known about the outcomes and trends of patients with RA undergoing the same surgeries.

Given that RA is a fundamentally different condition with its own pathological characteristics, an understanding of how these differences may impact postoperative outcomes in patients with RA is important. This study aims to present a comparative analysis of the trends and postoperative outcomes between patients with RA and OA undergoing TKA and THA (**Figure 1, Tables 1 and 2**).

Methods

Exemptions were obtained from the Institutional Review Board. Data from the Nationwide Inpatient Sample (NIS) from 2006 to 2011 were extracted using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes for patients that received primary TKA or THA, as well as their comorbid conditions. No patients or populations were excluded from the sampling process. A list of all independent variables collected for analysis and provision of relevant *ICD-9* codes is included in Figure 1. The NIS is the largest all-payer stratified survey of inpatient care in the US healthcare system. As of 2011, each year provides information on approximately 8 million inpatient stays from about 1000 hospitals in 46 states. All discharges from sampled hospitals are also represented in the database. All patient information is protected, and all methods were conducted in accordance with the highest ethical standards of Human and Animal Rights Research.

Statistical Analysis

SAS 9.2 and PROC FREQ statistics software were used to generate *P* values (chi square result) and analyze the trends (Cochran-Armitage). Results were weighted utilizing standard discharge weights from the NIS to ensure accurate comparison of data from different time points. $P < .05$ was considered statistically significant. Multivariable logistic regression analyses were performed to generate odds ratio and 95% confidence limits to assess outcomes across different demographic variables.

Results

Data on 337,082 and 1,362,241 patients undergoing THA or TKA, respectively, between 2006 and 2011 were analyzed. Patients in both groups were further differentiated by a diagnosis of either OA or RA. OA was the most common diagnosis, constituting 96.8% of all arthritic THA and TKA patients. From 2006 to 2011, a 36% and 34% increase in total number of THAs and TKAs, respectively, were reported. The number of patients with OA undergoing THA and TKA steadily increased from 2006 to 2011 (**Figure 2**). The number of THA and TKA procedures in patients with RA followed a similar trend but at a comparatively slower rate (**Figure 3**). The TKA geographical trends mirrored those observed with THA. The majority of operations were performed at urban hospitals (89% THA, 87% TKA; $P < .0001$). Among patients with RA and OA, the majority of TKAs (47.77%; $P < .0001$) took place in urban non-teaching hospitals than in urban teaching hospitals (39.26%). This pattern was not the same for THA, with 44.94% being performed at urban teaching hospitals and 44.05% at urban non-teaching institutions ($P < .0001$). Rural hospitals accounted for a low percentage of operations for both procedures: 10.46% of THA and 12.36% of TKA ($P < .0001$). Large institutions (based on the number of beds) claimed the majority of cases (59% of THA and TKA).

Logistic regression analysis and odds ratios of patients with OA vs those with RA with patient outcomes adjusted for age, Charlson Comorbidity Index (CCI) score, and gender revealed that patients with OA undergoing THA had lower risk for cardiovascular (0.674; confidence interval (CI) 0.587-0.774) and pulmonary complications (0.416; CI 0.384-0.450), wound dehiscence (0.647; CI 0.561-0.747), infections (0.258; CI 0.221-0.301), and systemic complications (0.625; CI 0.562-0.695) than patients with RA. Patients with OA exhibited statistically significantly higher odds of experiencing cerebrovascular complications after THA than those with RA (1.946; CI 1.673-2.236) (**Table 3**). In a similar logistic regression analysis of OA vs RA in TKA, which was adjusted for age, CCI score, and gender, patients with OA had significantly higher risk for cardiovascular (1.329; CI 1.069-1.651) and cerebrovascular complications (1.635; CI 1.375-1.943) than patients with RA. Significant decreases in wound dehiscence (0.757; CI 0.639-0.896), infection (0.331; CI 0.286-0.383), and systemic complication (0.641; CI 0.565-0.729) were noted in the patients with OA and TKA (**Table 4**).

Discussion

Our results showed a continuous yearly increase from 2006 to 2011 in THA and TKA procedures at a rate of 36% and 34%, respectively; this result was consistent with existing literature.[11] Despite a substantial increase in the amount of total THA and TKA procedures, the ratio of patients with RA undergoing these operations has decreased or remained nearly the same. Similar effects were found in Japan and the US when examining patients with RA undergoing TJA procedures between 2001 and 2007 and between 1992 and 2005, respectively.[12-14] This observation may be explained by the advances and early initiation of pharmacologic treatment and the widespread use of DMARDs such as methotrexate (MTX), azathioprine, leflunomide, hydroxychloroquine, and biological response modifiers TNF-α and interleukin-1.[15] These medications have drastically improved survival rates of patients with RA with impressive capabilities in symptom relief.[15] With the increasing use of DMARDs and aggressive treatment early on in the disease process, patients with RA are showing markedly slow progression of joint deterioration, leading to a decreased need for orthopedic intervention compared with the general population.[13,15]

When analyzing the complication rates for patients undergoing TKA and THA, we observed that patients with RA exhibited a significant increase in the rates of infections, wound dehiscence, and systemic complications prior to discharge from the hospital compared with the OA population. The increased risk of infections was reported in

previous studies assessing postoperative complication rates in TJA.[16,17] A study utilizing the Norwegian Arthroplasty Registry noted an increased risk of late infection in patients with RA, leading to increased rates of revision TJA in comparison with patients with OA.[16] Another study, which was based on the Canadian Institute for Health Information Discharge Abstract Database, showed that patients with RA are at an increased risk of infection only after THA and interestingly not after TKA.[17] Although our study did not identify the causes of the increased infection rate, the inherent nature of the disease and the immunomodulatory drugs used to treat it may contribute to this increased infectious risk in patients with RA.[6,18] Immunosuppressive DMARDs are some of the widely used medications employed to treat RA and are prime suspects of causing increased infection rates.[15] The perioperative use of MTX has not been shown to cause short-term increases in infection for patients undergoing orthopedic intervention, but leflunomide and TNF-α inhibitors have been shown to cause a significant several-fold increase in risk for surgical wound infections.[19,20]

All patients with RA presented with significant increases for infection, wound dehiscence, and systemic complications, whereas only patients with RA undergoing THA showed increased risk of pulmonary and cardiovascular complications when compared with patients with OA. Surprisingly, in TKA, patients with RA were at a significantly decreased risk of cardiovascular complications. This observation was interesting due to cardiovascular disease being one of RA's most notable extra-articular features.[4,21]

Patients with RA undergoing TJA also showed significantly lower cerebrovascular complications than patients with OA. The significant reduction in risk for these complications has not been previously reported in the current literature, and it was an unexpected finding as past studies have found an increased risk in cerebrovascular disease in patients with RA. RA is an inflammatory disease exhibiting the upregulation of procoagulation factors,[22] so we expected patients with RA to be at an increased risk for cerebrovascular and cardiovascular complications over patients with OA. Although we are unsure why these results were observed, we postulate that pharmaceutical interventions may confer some protection to patients with RA. For example, aspirin is commonly utilized in RA for its protective anti-platelet effect[23] and may be a contributing factor to why we found low postoperative complication rates in cerebrovascular disease. However, the reason why aspirin may be protective against cerebrovascular and not cardiovascular complications remains unclear. Moreover, most guidelines suggest that aspirin be stopped prior to surgery.[24] Although patients with RA were younger than those with OA, age was accounted for when analyzing the data.

A major strength of the study was the large sample size and the adjustment of potential confounding variables when examining the difference in complications between RA and OA. It is also a national US study that utilizes a validated database. Given that the patient samples in the NIS are reported in a uniform and de-identified manner, the database is considered ideal and has been extensively used for retrospective large observational cohort studies.[25] However, the study also had some limitations due to the retrospective and administrative nature of the NIS database. Only data concerning patient complications during their inpatient stay at the hospital were available. Patients who may develop complications following discharge were not included in the data, providing a very small window of time for analysis. Another limitation with the database was its lack of ability to identify the severity of each patient's disease process or the medical treatment they received perioperatively. Finally, no patient-reported outcomes were determined, which would provide information on whether these complications affect the patients' postoperational satisfaction in regard to their pain and disability.

Conclusion

As RA patients continue to utilize joint arthroplasty to repair deteriorated joints, understanding of how the disease process and its medical management may impact patient outcomes is important. This article reports significantly

higher postoperational infection rates in RA than in patients with OA, which may be due to the medical management of the disease. Although new medications have been introduced and are being used to treat patients with RA, they have not altered the complication rate following TJA in this patient population. Thus, surgeons and other members of the management team should be familiar with the common medical conditions, co-morbidities, and medical treatments/side effects that are encountered in patients with RA. Future studies should delve into possible differences in long-term outcomes of patients with RA undergoing TKA and THA, as well as whether certain perioperative strategies and therapies (medical or physical) may decrease complications and improve outcomes.

This paper will be judged for the Resident Writer's Award.

Key Info

Figures/Tables

Figures / Tables:

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Independent Variables

Age
≤64
65-69
≥80

Sex
Male
Female

Race
White
Black
Hispanic
Other

Payer Type
Medicare
Medicaid
Private
All Others[c]

Hospital Size (in Beds)
Small
Medium
Large

Weekend Admission

Diagnosis
Osteoarthritis
Rheumatoid Arthritis

Comorbidities
Diabetes
Obesity
Obstructive Sleep Apnea
[a]Charlson Index Score
0
1 or 2
≥3

[d]Median Household Income
≤38,999
39,000 to 47,999
48,000 to 62,999
≥63,000

Hospital Region
Northeast
Midwest
South
West

Hospital Type
Rural
Urban Non-teaching
Urban Teaching

Interventions
Primary THA
Primary TKA

[b]Inpatient Complications
Cardiovascular
Cerebrovascular
Pulmonary
Wound Dehiscence
Infection
Systemic

Hospital Length of Stay

Discharge Status
Home
Another Facility

Discharge Disposition
Expired
Lived

Figure 1. A list of all independent variables collected for analysis and provision of relevant *International Classification of Diseases, Ninth Revision* (*ICD-9*) codes.

[a]Comorbidity quantified using the 9 disease conditions used in Charlson Comorbidity Index. [b]Cardiovascular included acute myocardial infarctions (*ICD-9* codes 410.00-410.92), osteoarthritis (*ICD-9* code 715.9), and rheumatoid arthritis (*ICD-9* code 714.0); primary total hip arthroplasty/primary total knee arthroplasty (*ICD-9* code 81.51); cerebrovascular included occlusion and stenosis of precerebral arteries (*ICD-9* codes 433.00-433.91); pulmonary include pneumonia (*ICD-9* codes 480.00-486.00, 997.31-997.39), acute respiratory failure following trauma or surgery (*ICD-9* codes 518.51-518.53), and pulmonary embolus (*ICD-9* codes 415.11-415.19); wound dehiscence included hematoma complicating a procedure and disruption of operation wound (*ICD-9* codes 998.12-998.13, 998.30-998.33); infection included postoperative infection (*ICD-9* codes 998.51-998.59, 999.31-999.39, 996.66); and systemic included septic shock and hemorrhage (*ICD-9* codes 998.00-998.09, 998.11). [c]Included self-pay, no charge and others. [d]Determined by patient zip code.

Abbreviations: THA, total hip arthroplasty; TKA, total knee arthroplasty.

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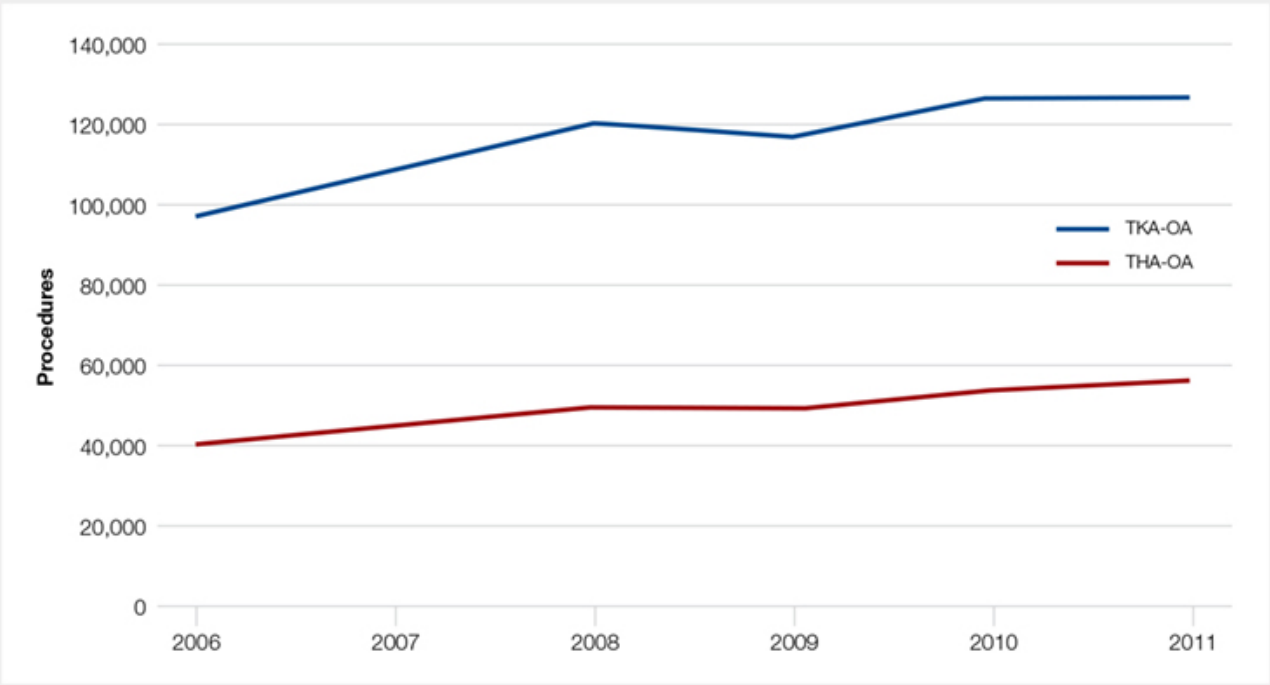

Figure 2. Trends of total knee arthroplasty (TKA) and total hip arthroplasty (THA) in osteoarthritis (OA) patients between 2006 and 2011.

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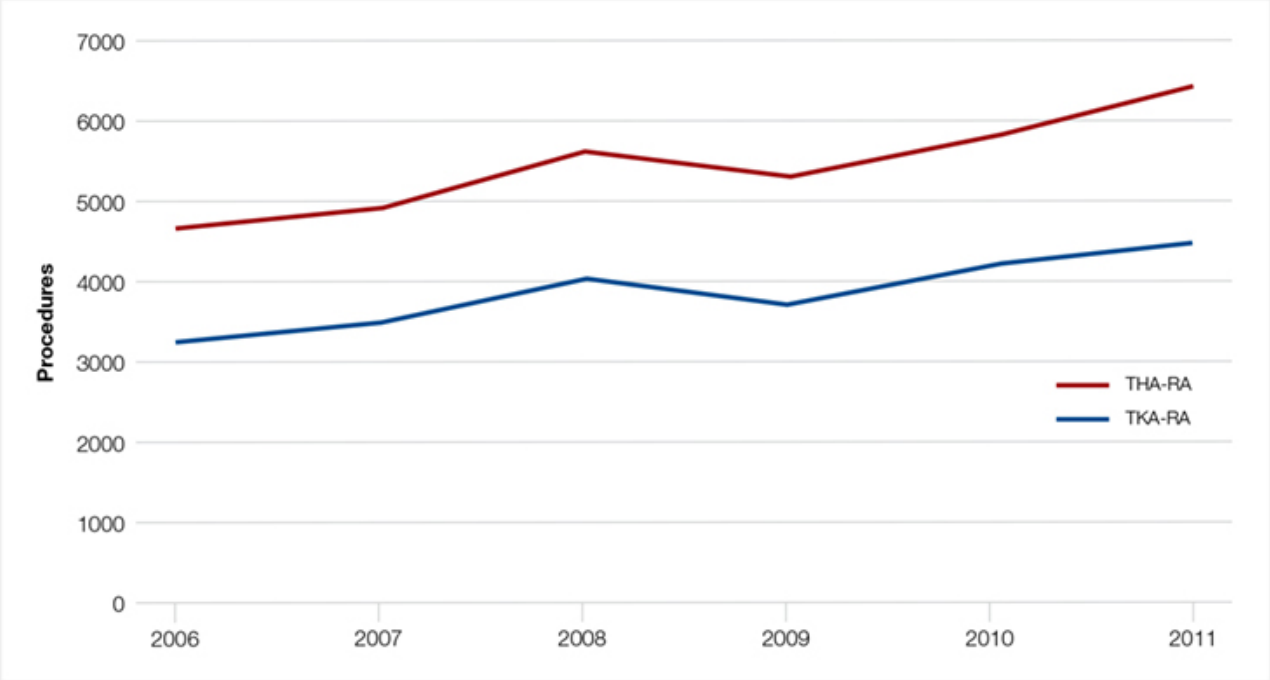

Figure3. Trends of total knee arthroplasty (TKA) and total hip arthroplasty (THA) in rheumatoid arthritis (RA) patients between 2006 and 2011.

Table 1. Demographics of Total Knee Arthroplasty Patients Based on Primary Diagnosis of Osteoarthritis

	OA		RA		Total		*P* Value
	No.	Percent	No.	Percent	No.	Percent	(RA vs OA)
Age group							<.0001
<64 years	295,637	42.42	11,325	48.90	306,962	42.63	
65 to 79 years	329,034	47.22	10,055	43.42	339,089	47.09	
≥80 years	72,197	10.36	1780	7.69	73,977	10.27	
Gender							<.0001
Male	259,192	37.19	4887	21.12	264,079	36.68	
Female	435,855	62.54	18,248	78.88	454,103	63.07	
Race							<.0001
White	468,632	67.25	14,532	77.18	483,164	67.10	
Black	39,691	5.7	2119	11.25	41,810	5.81	
Hispanic	28,573	4.1	1395	7.41	29,968	4.16	
Other	21,306	3.06	783	4.16	22,089	3.07	
Region of hospital							<.0001
Northeast	112,031	16.08	3417	14.75	115,448	16.03	
Midwest	192,595	27.64	5975	25.80	198,570	27.58	
South	257,855	37	9422	40.68	267,277	37.12	
West	134,387	19.28	4346	18.77	138,733	19.27	
Location/teaching status of hospital							<.0001
Rural	86,321	12.39	2709	11.79	89,030	12.36	

Urban non-teaching	333,043	47.79	10,905	47.46	343,948	47.77	
Urban teaching	273,326	39.22	9363	40.75	282,689	39.26	
Hospital location							.0024
Rural	86,321	12.39	2709	11.79	89,030	12.36	
Urban	606,369	87.01	20,268	88.21	626,637	87.03	
Hospital teaching status							<.0001
Teaching	409,465	58.76	13,275	57.78	422,740	58.71	
Non-teaching	283,225	40.64	9702	42.22	292,927	40.68	
Comorbidities							
Obstructive sleep apnea	65,342	9.38	1946	8.40	67,288	9.35	<.0001
Diabetes	147,292	21.14	4289	18.52	151,581	21.05	<.0001
Obesity	129,277	18.55	3730	16.11	133,007	18.47	<.0001

Abbreviations: OA, osteoarthritis; RA, rheumatoid arthritis.

Table 2. Demographics of Total Hip Arthroplasty Patients Based on Primary Diagnosis of Osteoarthritis or Rheumatoid Arthritis

	OA		**RA**		**Total**		***P* Value**
	No.	**Percent**	**No.**	**Percent**	**No.**	**Percent**	**(RA vs OA)**
Age group							<.0001
<64 years	133,645	45.18	4679	48.02	138,324	45.27	
65 to 79 years	123,628	41.8	3992	40.97	127,620	41.77	
≥80 years	38,513	13.02	1073	11.01	39,586	12.96	
Gender							<.0001
Male	129,708	43.85	2457	25.24	132,165	43.26	
Female	165,010	55.79	7278	74.76	172,288	56.39	
Race							<.0001
White	207,005	69.98	6322	80.08	213,327	69.82	
Black	15,505	5.24	771	9.77	16,276	5.33	
Hispanic	6784	2.29	522	6.61	7306	2.39	
Other	7209	2.44	280	3.55	7489	2.45	
Region of hospital							<.0001
Northeast	58,525	19.79	1683	17.27	60,208	19.71	
Midwest	79,040	26.72	2446	25.10	81,486	26.67	
South	95,337	32.23	3716	38.14	99,053	32.42	
West	62,884	21.26	1899	19.49	64,783	21.20	
Location/teaching status of hospital							.0065
Rural	30,954	10.46	993	10.26	31,947	10.46	
Urban non-teaching	133,061	44.99	4245	43.87	137,306	44.94	
Urban teaching	130,150	44	4439	45.87	134,589	44.05	
Hospital location							.4098
Rural	30,954	10.46	993	10.26	31,947	10.46	
Urban	263,211	88.99	8684	89.74	271,895	88.99	
Hospital teaching status							.0077
Teaching	159,313	53.86	5108	52.78	164,421	53.82	
Non-teaching	134,852	45.59	4569	47.22	139,421	45.63	

Comorbidities							
Obstructive sleep apnea	19,760	6.68	573	5.88	20,333	6.65	.0028
Diabetes	41,929	14.18	1325	13.60	43,254	14.16	.1077
Obesity	38,808	13.12	1100	11.29	39,908	13.06	<.0001

Abbreviations: OA, osteoarthritis; RA, rheumatoid arthritis.

Table 3. Odds Ratio for In-Hospital Complications Following THA for OA Patients vs RA Patients

	Odds Ratio	Confidence Limits
Cardiovascular complication	.674	.587-.744
Cerebrovascular complication	1.946	1.673-2.236
Pulmonary complication	.416	.384-.450
Wound dehiscence	.647	.561-.747
Infection	.258	.221-.301
Systemic complication	.625	.562-.695

Abbreviations: OA, osteoarthritis; RA, rheumatoid arthritis; THA, total hip arthroplasty.

Table 4. Odds Ratio for In-Hospital Complications Following TKA for OA Patients vs RA Patients

	Odds Ratio	Confidence Limits
Cardiovascular complication	1.329	1.069-1.651
Cerebrovascular complication	1.635	1.375-1.943
Pulmonary complication	1.03	.995-1.223
Wound dehiscence	.757	.639-.896
Infection	.331	.286-.383
Systemic complication	.641	.565-.729

Abbreviations: OA, osteoarthritis; RA, rheumatoid arthritis; TKA, total knee arthroplasty.

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Multimedia

Product Guide

Product Guide

- STRATAFIX™ Symmetric PDS™ Plus Knotless Tissue Control Device
- STRATAFIX™ Spiral Knotless Tissue Control Device
- BioComposite SwiveLock Anchor
- BioComposite SwiveLock C, with White/Black TigerTape™ Loop

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Citation

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