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Does same day surgery for bilateral knee arthroplasty increase major complication rates in selected patients?

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From the Kaiser Permanente National Total Joint Replacement Registry

ABSTRACT

We examined the assumption that patients who undergo same day bilateral knee arthroplasty are at greater risk of major peri-operative complications than patients who stage their procedures over time. Between April 2001 and March 2007, prospective data was collected using a community-based total joint registry. Patients undergoing primary, bilateral, same day, total knee arthroplasties (TKAs) were compared to patients undergoing primary, staged, bilateral TKAs within a one year period. 26840 primary TKA were identified, 2441 (8.2%) TKAs were performed on the same day, while 4231(14.2%) were staged procedures performed within 1 year. The following variables were associated with same day procedures (P<0.05): younger age, male sex, not diabetic, ASA score of <3, and high volume surgeon. There were no significant differences in 90 day mortality, thrombotic events, and infections between the two groups (power of 0.8 to detect a 1% difference). There is a tendency for surgeons to select younger, healthier patients for same day bilateral TKA reflecting accepted clinical practice. Our data suggest that performing bilateral TKA in healthier and younger patients does not predispose them to increased risk over staged arthroplasty. Further study and multivariate analysis is required to identify threshold values below which there is no increased risk of complications.

INTRODUCTION

The relative safety of performing bilateral simultaneous total knee replacements vs. staging the procedures over time has been the subject of extensive debate. Though there have been dissenting voices, the consensus that has emerged over time is that there is a higher risk of complications following same day bilateral knee replacements than with staged procedures.

In this paper, we question the implicit assumption that the cumulative complications following staged bilateral knee replacements is equal to that of isolated knee replacements and less than that of simultaneous surgery. We hypothesize that patients who undergo staged bilateral knee replacement are at lower risk of complications than patients who undergo same day bilateral knee arthroplasty in a large community based practice.

METHODS

We conducted a retrospective review of all patients who had undergone a bilateral TKA between April 2001 and April 2007 in our community based hospital system. Primary bilateral TKAs done in the same day were compared to bilateral TKAs done within an one year period of the first procedure. The patients were identified using the Kaiser Permanente Total Joint Replacement Registry.[6] Demographic and implant information were collected at the time of surgery. Revision rate, mortality, thrombotic events, and infection rates were obtained by registry follow up information and a comprehensive review of all inpatient, outpatient, and emergency encounters of the patient.

Chi-square and Fisher's exact test were used to compare categorical variables. Statistical analyses were performed using the SPSS program (SPSS for Windows Release 14.0.0, SPSS Inc., Chicago, IL, USA).

RESULTS

There were 6672 bilateral primary TKAs were entered in the registry during the study period. This is 22.4% of the primary TKA cases in the registry (N=29840). There were 2441 (37%) bilaterals performed in the same day and 4231 (63%) performed within 1 year of the first surgery.

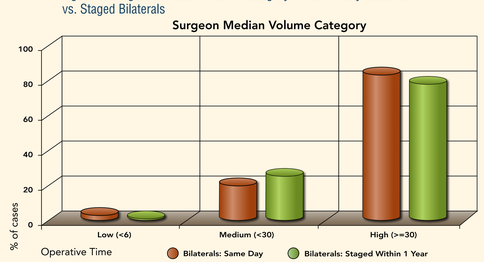
A higher percentage of males had their surgeries on the same day (N=996, 41.6%) than within 1 year (N=1416, 34.2%), P<0.001. Patients with surgeries on the same day also had lower ASA scores (ASA 1 or 2 N=1524, 66.2%) than patients with surgeries within 1 year (ASA 1 or 2 N=2417, 62.9%), P=0.009. Patients with surgeries on the same day tended to be younger, P<0.001. Diabetes rates were lower in patient with surgery on the same day (N=185, 7.6% vs. N=437, 10.3%), P<0.001. The diagnosis for surgery (osteoarthritis, post-traumatic arthritis, inflammatory arthritis, osteonecrosis, and rheumatoid arthritis) was not statistically significantly different between the groups. Other variables that were different between the groups were related to surgeon volume. Surgeons with high volume (>=30 TKAs per year) were more likely to do surgeries on the same day (N=2008, 82.3% vs. N=3157, 74.6%), P<0.001. See Table 1 for all details.

Table 1.
Comparison of Demographics, Procedure Diagnosis, and Surgeon Volume between Bilateral TKAs Performed on the Same Day vs. Bilateral TKAs Performed Within 1 Year

		Bilaterals: Same Day		Bilaterals: Staged Within 1 Year		
		N	%	N	%	P-Value
Gender	Male	996	41.6	1416	34.2	<0.001***
	Female	1397	58.4	2721	65.8	
ASA Category	1 or 2	1524	66.2	2517	62.9	0.009**
	>=3	778	33.8	1483	37.1	
Age Group	<20	0	0	0	0	<0.001***
	20-29	2	0.1	0	0	
	30-39	4	0.2	14	0.3	
	40-49	75	3.1	65	1.6	
	50-59	512	21.4	740	17.8	
	60-69	941	39.4	1653	39.7	
	70-79	721	30.2	1318	31.6	
	80-89	130	5.4	373	9	
	90 and >	2	0.1	3	0.1	
Age Category	<55 Yrs Old	250	10.5	290	7	<0.001***
	>=55 Yrs Old	2137	89.5	3876	93	
BMI Category	<30	613	46.1	919	38.2	<0.001***
	>=30 and <35	376	28.3	699	29.1	
	>=35	341	25.6	785	32.7	
Diabetes		185	7.6	437	10.3	<0.001***
Diagnosis	Osteoarthritis	2266	92.8	3926	92.8	0.952 (ns)
	Rheumatoid Arthritis	62	2.5	105	2.5	0.883 (ns)
	Inflammatory Arthritis	12	0.5	15	0.4	0.396 (ns)
	Post Traumatic Arthritis	9	0.4	12	0.3	0.550 (ns)
	Osteonecrosis	8	0.3	10	0.2	0.488 (ns)
	Other	19	0.8	36	0.9	0.752 (ns)
Surgeon Median Volume Category	Low (<6)	50	2	69	1.6	<0.001***
	Medium (<30)	383	15.7	1005	23.8	
	High (>=30)	2008	82.3	3157	74.6	

ASA= American Society of Anesthesiologists. BMI= Body Mass Index.
Missing information: 2.1% gender, 5.5% ASA, 1.8% Age, 44% BMI, 21% operative time.
Stars indicate the level of significance for each variable in the model (P Values): (*) 0.01<P<0.05; (**) 0.001<P=<0.01; (***) P=<0.001; (ns) P>0.05.

Figure 1. Surgeons Median Volume Category for Same Day Bilaterals vs. Staged Bilaterals



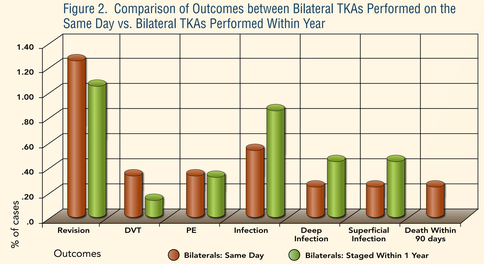
None of the measured outcomes were found to be statistically significantly different between the same day bilateral TKAs vs. within 1 year procedures. The rate of revision in same day procedures was 1.2% (N=29 out of 2441) and 1.0% (N=41 out of 4231) for staged procedures, P=0.398. Revision and infection rates were reported per procedure while PE, DVT, and mortality are reported by patients. See all registry reported outcomes on Table 2.

Table 2. Comparison of Outcomes between Bilateral TKAs Performed on the Same Day vs. Bilateral TKAs Performed Within 1 Year

	Bilaterals: Same Day		Bilaterals: Staged Within 1 Year		
	N	%	N	%	P-Value
Revision	29	1.2	41	1	0.398 (ns)
DVT *	2	0.3	1	0.1	0.258 (ns)
PE*	2	0.3	4	0.3	1.000 (ns)
Infection	11	0.5	35	0.8	0.073 (ns)
Deep Infection	6	0.2	17	0.4	0.295 (ns)
Superficial Infection	5	0.2	18	0.4	0.139 (ns)
Death within 90 days**	2	0.2	0	0	0.142 (ns)

DVT= Deep Vein Thrombosis.
PE= Pulmonary Embolism.
ns= P-Value>0.05, non-significant.
DVT, PE, and Death within 90 days are shown per patient. Revision and Infection are per procedure.
* Data available from 2005 onward, sample size smaller.
**Data available for a slightly smaller sample size.

Figure 2. Comparison of Outcomes between Bilateral TKAs Performed on the Same Day vs. Bilateral TKAs Performed Within Year



DISCUSSION

Total knee arthroplasty is a common procedure with excellent overall results. However, unlike total hip replacement surgery, recovery is longer and frequently lasts for more than three months. For patients with bilateral disease, the prospect of staging a knee replacement can mean six or more months of difficulty ambulating, increased direct and indirect costs of a prolonged convalescence, and two separate anesthetics and hospitalizations. The allure of bilateral knee surgery is convenience for the patient and cost for the health care provider.

Several authors have written in favor of bilateral knee replacement[4,9] citing the increased convenience for the patient with low increased risk, and others have noted the favorable cost comparison of same day vs. staged arthroplasty.[8]

However, other authors have written that the risks of same day bilateral surgery are significantly greater than same day surgery3. This perspective was summarized by Restrepo et al in their recent and exhaustive meta-analysis of the literature. They found that "simultaneous bilateral total knee replacement carries a higher risk of serious cardiac complications, pulmonary complications, and mortality than staged bilateral or unilateral knee arthroplasties."[7] In their very large review encompassing over 27,000 patients, only 458 patients had undergone staged bilateral knee arthroplasties. These patients' complication rates were equivalent to unilateral replacements and were not discussed separately. Since the bulk of their data compared outcomes between isolated unilateral knee replacement and simultaneous bilateral knee replacement, it is difficult to extend their conclusions to staged bilateral knee replacements.

Our paper is in agreement with that published by several authors[2,4,9] in that we found no increase in the ninety day mortality in either cohort, a commonly cited risk of bilateral procedures.[3,5,7] Parvizi et al noted that ninety day mortality is affected by age, history of cardiopulmonary diseases, and bilateral procedures. Our data would suggest that when selecting for younger, healthier patients, high volume surgeons have no increased risk of peri-operative mortality. Age and ASA scores were not independent variables associated with increased mortality.

Several authors have also noted an increased risk of pulmonary embolism[7] and thrombophlebitis.[9] However, as with some authors[1,2], we found a very low number of events in our population and no increased risk of pulmonary embolism in our study. Barrett et al reviewed a large Medicare population and concluded that "the sum of the risks associated with a staged procedure may equal or exceed that of a simultaneous procedure."[1]

Some of the limitations of our study are the retrospective nature of some of the data sources used in this study and the use of administrative databases to identify some of the outcomes presented. Validation processes are used by the registry to maximize data accuracy and integrity but inherent problems exist in this type of data source. Also, what might be perceived as a bias in the study, that patients with bilateral surgery tended to be better surgical candidates being treated by higher volume surgeons, is present in many papers.[1-3,9,10] We feel that this "bias" in the study makes it more, not less, relevant to the experience of community surgeons.

CONCLUSION

Reflecting accepted clinical practice, there is a tendency for high volume surgeons to select younger, healthier patients for same day bilateral TKA. Our data suggest that with appropriate patient selection, performing same day bilateral TKA does not materially increase the risk of major peri-operative complications when compared to the cumulative risk of staging the procedures over one year. In these selected patients we conclude that the convenience and cost advantages of bilateral same day surgery are worthwhile.

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