Heart Murmurs as a Predictor for Post-arthroplasty Complications and Performance

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Introduction

By 2033, demand for total knee arthroplasty is predicted to rise by 174% and total hip arthroplasty by 673%.[1,2] Patients report good satisfaction with these procedures, however adverse event rates as high as 7.4%, and large numbers of patients requiring discharge to rehabilitation centers continue to negatively affect outcomes and add to expense.[2,3,4] With new Medicare and Medicaid pay-for-performance programs rewarding better outcomes, there is pressure to reduce complication rates and rehabilitation requirements without increasing cost.[2] Finding cost-effective, early-detection tools to identify patients at risk of post-arthroplasty complications is therefore an important topic of study.

The post-operative cardiac exam is a low-cost screening method that is often overlooked by orthopedic surgeons.[2] It has been noticed at our institution that a high number of arthroplasty patients have post-operative heart murmurs, but to our knowledge, there is no orthopaedic literature assessing the significance of this. The purpose of this study was to assess the correlation between post-operative heart murmurs and post-operative outcomes in hip and knee arthroplasty patients. We hypothesized that heart murmurs would be associated with increased complications, decreased physical therapy capacity, and increased need for discharge to rehabilitation facilities following primary joint arthroplasty.

Materials and methods

This was a single institution prospective cohort study. Inclusion criteria were patients who underwent a primary hip or knee replacement surgery between 4/1/14 and 5/30/14, were over the age of eighteen, did not have a planned ICU admission, spoke English, and gave informed consent. Exclusion criteria were patients who were pregnant or incarcerated. Data was recorded from time of surgery to time of discharge. Every patient received a physical and cardiac exam by a resident and a hospitalist attending within 24 hours of surgery to detect the presence of a heart murmur.

Patient characteristics included age, sex, body mass index (BMI), past medical history, and procedure type. Post-operative complications included myocardial infarction, atrial fibrillation, stroke, DVT, pulmonary embolism, acute kidney injury, and blood transfusion. Other measured post-operative variables included distance walked with physical therapy and whether a patient was discharged to home versus a rehabilitation facility. All patients had a CBC and BMP checked each morning for at least 48 hours following surgery. Acute kidney injury was defined as an increase in creatinine of 50 percent or of 0.3 mg/dL within 24 hours.[5] Heart murmurs were recorded whether or not the patient had a murmur preoperatively.

Chi-square tests and T-tests were used to compare group demographics and to test for correlation.

Results

151 of 181 (89.5%) patients who underwent a primary hip or knee arthroplasty met inclusion requirements. Fifty-five (36.4%) of procedures were hip arthroplasties. Fifty three (35%) of patients were male and the average BMI was 32.5. Twenty eight (18.5%) of patients had murmurs post-operatively. All murmurs were systolic. Thirty (19.9%) patients had a total of 32 complications. Acute kidney injury and need for blood transfusion comprised the majority of complications. (Table 1) Other complications included hypotension and partial small bowel obstruction.

The murmur and non-murmur groups were comparable in age, BMI, and type of procedure. Past medical history between groups were comparable except for cardiac history (32.1% versus 13%, $p = 0.014$). There was a significantly lower proportion of males compared to females with post-operative murmurs (10.7% versus 40.7% $p = 0.003$).

Patients with post-operative murmurs had a significantly higher rate of acute kidney injury (22% versus 5.7%, $p = 0.03$). The groups did not have a significantly different rate of blood transfusion (7% versus 8.9% $p = 0.3$). The number of other measured complications was

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Table 1: Patient demographics.

Total	151
Hip Athroplasty	55 (36.4%)
Age	61.2 ± 10.5
Male sex	53 (35%)
BMI	32.5 ± 7.8
PMH	
Diabetes	17 (11.3%)
Cardiac	25 (16.6%)
Renal	6 (3.9%)
Pulmonary (Asthma/COPD)	28 (18.5%)
Vascular	9 (6.0%)
Other	61 (40%)
Complications	32
AKI	12 (7.9%)
Blood transfusion	13 (8.6%)
DVT/PE	0
Afib/Stroke/MI	0
Infection	1 (0.66%)
Other	6 (4.0%)
Murmur	28 (18.5%)

not high enough to compare the two groups. Patients with murmurs walked 21.1 feet less than those without (67 versus 45.9, p = 0.12), and they were half as likely to be discharged home (14.3% versus 29.3%, p = 0.1). (Table 2)

Discussion

In this prospective cohort of hip and knee arthroplasty patients, 18% of patients had a post-operative heart murmur, and patients with post-operative murmurs were over three times as likely to develop acute kidney injury. Decreased ability to participate with physical therapy and increased rate of discharge to a rehabilitation facility trended towards significance.

Current orthopaedic literature is vague about the significance of post-operative murmurs. The American Heart Association and American College of Cardiology (AHA/ACC) recommend echocardiography if there is 'moderate probability' for structural heart disease associated with a murmur.[6,7] However, because concern for acute structural changes of the heart is usually low, and post-operative workup for murmurs can be expensive, post-operative murmurs are usually ignored as no workup is indicated.[6]

This study lends evidence that auscultating for heart-murmurs post-operatively may represent a cost effective strategy for identifying patients at risk of developing post-operative acute kidney injury and may identify those with

Table 2. Comparison of patients with and without murmurs.

	With post-operative Murmur	Without post-operative murmur	P-Value
Total	28	123	n/a
Age	63.8 ± 9.9	60.57 ± 10.6	p = 0.15
Male sex	3 (10.7%)	50 (40.7%)	p = 0.003
BMI	33.1 ± 7.4	32.4 ± 7.9	p = 0.66
Procedure (Hip arthroplasty)	7(25%)	48(39%)	P = 0.16
PMH			
Diabetes	3 (10.7%)	14 (11.4%)	p = 0.9
Cardiac	9(32.1%)	16 (13%)	p = 0.014
Renal	1(3.5%)	6 (4.9%)	p = 0.7
Pulmonary (Asthma/COPD)	5(17.9%)	23 (18.7%)	p = 0.9
Vascular	1(3.5%)	8 (6.5%)	p = 0.56
Other	15(53.6%)	46 (37.4%)	p = 0.11
Complications			
AKI	5(17.9%)	7 (5.7%)	p = 0.03
Blood transfusion	2(7.1%)	11 (8.9%)	p = 0.3
MI/Afib/Stroke/DVT/PE	1(3.6%)	0 (0%)	n/a
Distance walked (feet)	45.9	67	p = 0.12
Discharged Home	4 (14.3%)	36 (29.3%)	p = 0.1

decreased ability to perform with physical therapy. Heart murmurs have been associated with increased cardiac output, increased strain of the heart, and decreased physiologic reserve.[2,6,7,8,9] Arthroplasty patients, who are often older with multiple comorbidities, may have a lower tolerance for increased heart strain. This could explain the relationship between a post-operative murmur, increased acute kidney injury, and a reduced ability to participate with physical therapy.

Weaknesses of this study included a relatively small sample size which barred analysis of many complications. A larger sample size would be needed to examine correlations between heart murmurs and other complications. Ten and one-half percent of arthroplasty patients did not meet requirements or chose not to participate in the study. We do not believe that there was a pattern to which patients were not included and do not believe that these omissions significantly affected analysis.

Conclusion

In summary, we have found evidence that auscultating for heart murmurs within 24 hours of hip and knee arthroplasty surgery may represent a cost-effective strategy for identifying those at higher risk of developing acute kidney injury. There is limited evidence that murmurs may also predict those at risk of acute decreased performance with physical therapy and increased need for discharge to a rehabilitation facility.

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