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Original Article

Routine Postoperative Laboratory Tests Are Unnecessary After Partial Knee Arthroplasty

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ABSTRACT

Background: While partial knee arthroplasty (PKA) is increasingly performed on an outpatient basis, many surgeons still admit patients overnight and obtain laboratory studies on the first postoperative day. The purpose of this study was to investigate the utility and cost effectiveness of routine postoperative laboratory studies after PKA.
Methods: This is a retrospective review of 322 consecutive unilateral or bilateral simultaneous PKAs (unicompartmental, patellofemoral, and modular bicompartmental knee arthroplasty) performed by a single surgeon. There were 408 complete blood counts and basic metabolic panels ordered.
Results: Despite a large number of laboratory studies ordered and abnormalities detected, there was a 1.6% rate of laboratory-associated interventions (for either hypokalemia or hyperglycemia in 5 patients) and no red blood cell transfusions. Hospital charges associated with laboratory studies totaled $85,413. There were no 90-day postoperative hospital readmissions or emergency department evaluations related to abnormal postoperative laboratory values.
Conclusion: With an increasing emphasis placed on cost containment, the low rate of laboratory-associated interventions after PKA suggests that routinely obtaining laboratory studies are neither necessary nor cost effective.

Partial knee arthroplasty (PKA) is performed to address isolated unicompartmental, bicompartmental, or patellofemoral knee arthritis, while preserving unaffected chondral surfaces and leaving the cruciate ligaments intact. With the improvement in identification of appropriate surgical candidates and enhanced surgical techniques and implant designs leading to optimized kinematics and better clinical outcomes, the number of PKA continues to grow [1-5].

Cost effectiveness is an increasingly important consideration in the delivery of health care; however, it should not be at the expense of safe medical and surgical management. Orthopedic surgeons are increasingly encouraged to reduce costs by minimizing operative times, limiting utilized resources, decreasing postoperative patient hospitalization, and perhaps most importantly by reducing the incidence of postoperative complications [6]. Compared with total knee arthroplasty, PKA has been shown to have fewer complications, with potential for delivery at a lower overall cost [7-11].

While PKA is increasingly performed on an outpatient basis, many surgeons continue to admit patients to the hospital for an overnight stay after surgery. Whether patients are admitted overnight or discharged within 23 hours to be considered by insurers an "outpatient" procedure, postoperative laboratory studies are often routinely ordered the morning after total and PKA without due consideration of their necessity. However, with improved blood loss prevention protocols, less invasive surgical techniques, and shorter operative times, reflexively obtaining postoperative laboratory studies may not be necessary. In addition, with the growing tendency toward performing PKA on an outpatient basis, it must be determined whether not having postoperative laboratory studies is safe.

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The primary purpose of this study was to determine the incidence of abnormalities in postoperative laboratory studies after PKA and the extent to which these abnormalities required medical evaluations, interventions, or hospital readmissions. A secondary purpose was to calculate the potential healthcare cost savings that would occur if routine postoperative laboratory studies were eliminated after PKA. The authors hypothesized that there would be a low rate of abnormalities in routine postoperative laboratory studies after PKA and, when observed, those abnormalities would rarely require medical intervention, postdischarge emergency department (ED) evaluation or hospital readmission.

Materials and Methods

This is a retrospective study performed with the approval of this institution's human subject review board. All consecutive patients that underwent primary PKA by the senior surgeon (J.H.L.) on an inpatient basis between January 2011 and January 2015 were identified. Those without available preoperative and postoperative laboratory studies, and those who underwent outpatient PKA were excluded from analysis. Patients who underwent simultaneous bilateral PKA were included in the study but analyzed separately. Surgical procedures included unicompartmental, patellofemoral, and combined unicompartmental tibiofemoral and patellofemoral (bicompartmental knee arthroplasty). Hospital records were searched using Current Procedural Terminology codes 27446, 27442, and 27446 and 27438 (unicompartmental, patellofemoral, and bicompartmental arthroplasty, respectively). The following data were collected from the electronic medical records: patient age, gender, surgical procedure, laterality, length of stay, preoperative and postoperative laboratory values, body mass index, Charlson comorbidity index, and American Society of Anesthesia scores [12]. A medical record review of all identified patients was performed to provide information regarding in-hospital interventions, postdischarge ED evaluations, and hospital readmissions within 90 days of PKA. A review of electronic medical records initially identified 471 consecutive primary PKA procedures. Ninety-three patients were excluded for same day discharge, and 56 patients were excluded for incomplete preoperative or postoperative laboratory values. This left 322 PKAs, including 194 unicompartmental knee arthroplasty (UKA), 59 bicompartmental knee arthroplasty (BiKA), and 69 patellofemoral arthroplasty (PFA) procedures available for analysis.

Two hundred and ninety-two patients of the PKA were unilateral, and thirty patients were bilateral. Bilateral procedures included 24 patellofemoral arthroplasties, 5 unicompartmental arthroplasties, and 1 bicompartmental arthroplasty. There were 176 medial compartment arthroplasties, 18 lateral compartment arthroplasties, 56 combined medial compartment and patellofemoral arthroplasties, 3 combined lateral compartment and patellofemoral arthroplasties, and 69 patellofemoral arthroplasties. Patient demographics and length of stay are presented in detail in Table 1.

Laboratory values collected included preoperative and postoperative complete blood count (CBC) (hemoglobin [Hgb] and hematocrit [Hct]) and components of the postoperative basic metabolic panels (BMPs) including potassium (K), creatinine (Cr), and glucose (Glu). Laboratory results on postoperative day 1 were compared with preoperative values. The number of laboratory studies ordered over the course of patient admissions was also collected. Interventions were considered those that occurred as a direct response to an abnormal laboratory value performed during the patients' immediate postoperative hospital admission. They included transfusion of packed red blood cells (PRBCs) for postoperative anemia, administration of oral potassium for hypokalemia, sliding scale insulin for hyperglycemia in nondiabetic patients, and intravenous fluid boluses for elevated creatinine.

Table 1
Baseline Demographic Characteristics and Laboratory-Related Values for All PKA.

Characteristics	PKA (n = 322)	UKA (n = 194)	BiKA (n = 59)	PFA (n = 69)
Age (y)[a]	59.3 ± 11.2	62.6 ± 10.2	58.2 ± 9.1	50.7 ± 11.0
LOS (d)[a]	1.3 ± 0.6	1.2 ± 0.5	1.4 ± 0.7	1.5 ± 0.9
Preop Hgb (g/dL)[a]	13.9 ± 1.1	13.9 ± 1.2	14.0 ± 0.7	13.9 ± 0.9
Postop Hgb (g/dL)[a]	11.8 ± 1.2	12 ± 1.2	11.2 ± 1.1	11.7 ± 1.2
Delta Hgb (g/dL)[a]	2.1 ± 0.8	1.9 ± 0.7	2.7 ± 0.8	2.2 ± 0.8
Male[b]	147 (46%)	97 (50%)	22 (37%)	28 (41%)
Female[b]	175 (54%)	97 (50%)	37 (63%)	41 (59%)
Medial[b]	233 (72%)	176 (91%)	57 (97%)	n/a
Lateral[b]	20 (6%)	18 (9%)	2 (3%)	n/a
Unilateral[b]	292 (91%)	189 (97%)	58 (98%)	45 (65%)
Bilateral[b]	30 (9%)	5 (3%)	1 (2%)	24 (35%)

PKA, partial knee arthroplasty; UKA, unicompartmental knee arthroplasty; BiKA, bicompartmental knee arthroplasty; PFA, patellofemoral arthroplasty; LOS, length of stay; Hgb, hemoglobin; n/a, not applicable.
[a] Values given as mean, standard deviation.
[b] Value given as number of patients and percentage.

Pneumatic tourniquets were used in all patients unless significant peripheral vascular disease existed. Intravenous tranexemic acid (TXA) was routinely used as of 2012 except in patients with known thromboembolic disease, ischemic heart disease, or peripheral vascular disease. No alternative means of TXA administration was used in patients with contraindications to intravenous TXA administration. The numbers of cases in which a tourniquet was not used or TXA was not administered were too low to be analyzed separately. During the study period, transfusion of PRBC was considered when postoperative Hgb was <8 g/dL, or when postoperative Hgb was <10 g/dL and associated with symptoms of acute anemia, based on the discretion of the medical consultant [13].

Cumulative costs for a CBC and BMP were determined, based on hospital diagnostic-related group associated charges of $63 and $150, respectively, using Medicare payments as a surrogate for the study costs. Calculations were performed as if all patients had Medicare, which provides 100% reimbursement for these laboratory studies at the established rates. To determine the potential health care system savings by eliminating routine laboratory evaluations, the charges for laboratory studies in individuals requiring interventions were subtracted from the total cost of laboratory studies ordered for all patients over the course of the study period. In addition to calculating laboratory-related charges, the incidence of in-hospital interventions, postdischarge ED evaluations, and hospital readmissions within 90 days of PKA that were related to abnormalities in postoperative laboratory results were also determined.

Descriptive statistics were used to summarize patient data. All variables with a normal distribution were analyzed using a 2-tailed *t* test, or analysis of variance. The Fisher extract test was used to compare all categorical variables. Statistically significant differences were defined as those with a P value <.05.

Results

Only 5 in-hospital interventions (1.6%) were performed for abnormal postoperative laboratory values. Two patients without history of diuretic use received oral potassium for postoperative hypokalemia, and 3 patients without a known history of diabetes received sliding scale insulin for postoperative hyperglycemia. Five patients (2%) were readmitted to the hospital within 90 days of surgery. Two (0.6%) were found to have symptomatic deep vein