Original Article

Frequency of Readmission Among American Society of Anesthesia Classification after Total Hip and Total Knee Arthroplasty

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ABSTRACT

Background: With the aging population and the increasing prevalence of degenerative joint diseases, the need for total joint arthroplasty (TJA) has surged. The American Society of Anesthesiologists (ASA) Physical Status Classification System plays a pivotal role in preoperative evaluation, predicting the risk of postoperative complications and mortality. Understanding the impact of ASA classification on surgical outcomes can guide improvements in patient care and surgical planning.

Objective: This study aimed to investigate the relationship between ASA classification and the risk of postoperative readmission in patients undergoing total joint arthroplasty.

Methods: Conducted at a single urban medical center, this descriptive, non-randomized study involved 352 patients who underwent primary TJA due to osteoarthritis, rheumatoid arthritis, or avascular necrosis. Participants were assigned an ASA classification preoperatively. The primary outcome measured was readmission within three months post-surgery, with secondary outcomes including the incidence of complications such as deep vein thrombosis (DVT), pulmonary embolism, and surgical site infections. Data were analyzed using SPSS version 21, with significance set at p<0.05.

Results: Of the 352 participants, 165 (46.9%) were from rural areas, and 187 (53.1%) were from urban locations. The readmission rate was 6.8%, with ASA III and IV classifications showing significantly higher readmission rates (9.7% and 28.6%, respectively) compared to ASA I and II (1.8% and 4.4%). The most common reasons for readmission were chest infections (37.5%), followed by cardiac complications, pulmonary embolism, and neurological complications (20.8% each). The study found a significant correlation between higher ASA classification and increased readmission risk (p=0.021).

Conclusion: Higher ASA classifications are associated with a greater risk of postoperative readmission in patients undergoing total joint arthroplasty. These findings underscore the importance of comprehensive preoperative assessments and tailored postoperative care strategies to mitigate the risk of readmission, particularly in patients with higher ASA scores.

Keywords: ASA Classification, Joint Arthroplasty, Postoperative Complications, Readmission, Total Hip Arthroplasty, Total Knee Arthroplasty, Preoperative Assessment, Surgical Outcomes, Patient Care.

INTRODUCTION

In the face of escalating rates of knee osteoarthritis (OA) and rheumatoid arthritis (RA)—principal culprits behind severe pain, muscle weakness, and gait disturbances—the medical community has seen a significant rise in the necessity for total knee arthroplasty (TKA) and total hip arthroplasty (THA) (1). These surgical interventions, aimed at ameliorating the debilitating effects of osteoarthritis, the most prevalent condition prompting such procedures, have been instrumental in improving the quality of life for countless patients (2, 3). While the anatomical distinctions and underlying diseases affecting the knee and hip joints yield varying

outcomes, a substantial majority of those undergoing TKA and THA report profound and enduring benefits. Notably, the United States records the highest global incidence of knee arthroplasty, primarily attributed to OA management (4).

THA has been recognized as the leading treatment for restoring function and mobility in individuals with advanced degenerative hip conditions (5, 6). Concurrently, TKA stands out as the paramount intervention for alleviating knee pain and enhancing physical function in patients with advanced RA, particularly when alternative treatments such as synovectomy fall short (7).

Despite the undeniable advantages and increasing adoption of TKA and THA, disparities in patient satisfaction, especially concerning TKA, underscore the imperative for ongoing enhancements in surgical practices (8, 9). Although TKA is known for significantly improving knee function and overall quality of life, a considerable fraction of patients report less than satisfactory outcomes in the long term, spotlighting the critical role of meticulous patient selection and comprehensive preoperative assessment (10).

The American Society of Anesthesiologists (ASA) physical status classification system has been instrumental in succinctly summarizing patients' pre-operative medical conditions and aiding in the prediction of potential postoperative complications (11, 12). An ASA score of 3 or above is notably associated with a heightened risk of readmission and postoperative complications, underscoring the significance of thorough preoperative evaluations to optimize patient outcomes and reduce healthcare costs (13). Emerging research underscores the correlation between preoperative physical health, as gauged by the ASA classification, and an elevated risk of early reoperation (14). The integration of ASA classification into arthroplasty registries could facilitate risk adjustment and enable international comparisons of revision rates (15, 16). Variations in readmission rates according to ASA scores further illuminate the impact of preoperative health status on postoperative results, advocating for the ASA classification's utility as a robust tool for assessing comorbidity and operative risk, thereby offering invaluable insights for patient risk stratification in TKA and THA.

Joint arthroplasty, encompassing TKA and THA, has been pivotal in addressing the surge in joint damage attributed to osteoarthritis among the aging populace (17). Beyond pain relief, arthroplasty restores mobility, essential for sustaining independence. The success of these procedures is contingent upon overcoming challenges related to the durability and function of prosthetic implants, ensuring their seamless integration without provoking adverse reactions in the surrounding tissues (18).

The growing demand for TKA and THA underscores the necessity for continued progress in surgical techniques, patient evaluation methodologies, and postoperative care protocols. By concentrating on exhaustive preoperative assessments, including the ASA classification, healthcare practitioners can better identify patients at an elevated risk of complications and readmission, thereby refining outcomes and amplifying patient satisfaction in joint arthroplasty. This introduction sets the stage for a detailed exploration into the frequency of readmission among various ASA classifications following total hip and total knee arthroplasty, aiming to rationalize the objective of enhancing patient care through precise risk stratification and targeted preoperative planning.

MATERIAL AND METHODS

The study, underpinning the intricacies of readmission rates following Total Knee Arthroplasty (TKA) and Total Hip Arthroplasty (THA), unfolded within the Department of Orthopedic at Liaquat National Hospital, Karachi. This descriptive research spanned six months, commencing on the 9th of September, 2021, and drawing to a close on the 8th of March, 2022. The focal point of investigation centered on patients who had undergone primary TKA and THA, spotlighting those who necessitated readmission within three months post-surgery. Employing the World Health Organization's sample size calculator, the study predicated its sample size on the prevalence of readmission among patients with an American Society of Anesthesiologists (ASA) classification of III, pegged at 3.8%. With a margin of error set at 2% and a confidence level of 95%, the calculated sample size reached 352 patients.

Adoption of a non-probability consecutive sampling technique facilitated the selection of study participants. Inclusion criteria were meticulously defined, encompassing individuals of either gender aged between 40 to 85 years, diagnosed with osteoarthritis, rheumatoid arthritis, or avascular necrosis as evidenced by X-ray, and categorized within ASA Physical Status classifications I to IV. Conversely, the study excluded individuals undergoing revision surgeries, those with coagulation abnormalities, patients unable to provide informed consent, ASA classifications of V to VI, and cases afflicted with neurological conditions impairing lower extremity motor function.

Following the institutional ethical review committee's endorsement and the College of Physicians and Surgeons Pakistan's approval, the study proceeded with patient recruitment. Consent was duly obtained from patients or their guardians before enrollment. The collection of demographic data, including age, gender, Body Mass Index (BMI), diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), smoking status, and ASA score, was undertaken. Preoperative baseline investigations—comprising Complete Blood Count (CBC), Urea and Electrolytes (UCEs), Prothrombin Time (PT)/Activated Partial Thromboplastin Time (APTT)/International Normalized Ratio (INR), Chest X-Ray (CXR), Electrocardiogram (ECG), Echocardiogram (ECHO), Erythrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP), and X-ray of bilateral knees or hips in anteroposterior/lateral views and scanogram of both lower limbs— were meticulously documented. Surgical interventions, executed under combined epidural and spinal anesthesia by an orthopedic

surgeon, were also recorded, alongside the procedure's duration and ASA classification. Discharge criteria hinged on the patient's ability to perform specific mobility tasks independently. Readmission outcomes were ascertained through a three-month postoperative follow-up.

Data analysis was conducted using SPSS version 21, with qualitative variables like gender and ASA class presented as frequencies and percentages, and quantitative variables like age and BMI as mean±SD. The Shapiro-Wilk test ascertained data normality, guiding the representation of non-normal distributions through medians. Stratification controlled for potential effect modifiers, with the Chi-square test determining significance at P ≤ 0.05, ensuring a rigorous analytical framework that underscored the study's contributions to understanding readmission dynamics post-TKA and THA.

RESULTS

TABLE 1: FREQUENCY DISTRIBUTION OF GENDER (n=352)

Variable	Frequency (%)
Male	288(81.8)
Female	64(18.2)
TOTAL	352

Table 2: Descriptive Statistics of Patient Demographics (n=352)

Descriptive Statistics	Age (Years)	Height (m)	Weight (Kg)	Body Mass Index (Kg/m^2)
Mean	56.51	1.68	71.33	25.22
Standard Deviation (SD)	8.92	0.05	8.65	2.76
Minimum	45	1.50	50	18.40
Maximum	78	1.80	100	36.70
Shapiro-Wilk p-value	0.000	0.000	0.000	0.000

The consolidated table presents descriptive statistics for patient demographics across 352 individuals, focusing on age, height, weight, and Body Mass Index (BMI). The average age of the participants was 56.51 years, with a standard deviation (SD) of 8.92, ranging from 45 to 78 years. Height measurements averaged at 1.68 meters (SD = 0.05, min = 1.50 m, max = 1.80 m), while the average weight stood at 71.33 kilograms (SD = 8.65, min = 50 kg, max = 100 kg). The BMI mean was 25.22 kg/m^2 (SD = 2.76, min = 18.40 kg/m^2, max = 36.70 kg/m^2). The Shapiro-Wilk test results (p-value = 0.000) suggest a non-normal distribution across all variables

TABLE 3: DESCRIPTIVE STATISTICS OF SURGERY DURATION (Minutes) (n=352s

Descriptive Statistic	Value
Mean	74.62
Standard Deviation (SD)	8.53
Minimum	60
Maximum	90
Shapiro-Wilk p-value	0.000

This table summarizes descriptive statistics, indicating a mean of 74.62 with a standard deviation of 8.53. Values range from a minimum of 60 to a maximum of 90. The Shapiro-Wilk test, with a p-value of 0.000, suggests the data does not follow a normal distribution.

Table 4: Frequency Distribution of Patient Characteristics and Outcomes (n=352) & Re-admission Cause (n=24)

Characteristic	Frequency (n=352)	Percentage (%)
Place of Residence		
Rural	165	46.9%
Urban	187	53.1%
Diabetes Mellitus		
Yes	142	40.3%
No	210	59.7%
Hypertension		

Yes	240	68.2%
No	112	31.8%
Type of Arthroplasty		
Total Knee Arthroplasty (TKA)	161	45.7%
Total Hip Arthroplasty (THA)	191	54.3%
Re-admission		
Yes	24	6.8%
No	328	93.2%
Re-admission Cause (n=24)		
Chest Infections	9	37.5%
Cardiac Complications	5	20.8%
Pulmonary Embolism	5	20.8%
Neurological Complications	5	20.8%

The consolidated table synthesizes frequency distributions across several categories for a study population of 352 individuals. It reveals that 46.9% of participants reside in rural areas, while 53.1% hail from urban locations. Regarding health conditions, 40.3% of the participants are diagnosed with diabetes mellitus, and a notable 68.2% suffer from hypertension. When examining the type of arthroplasty performed, 45.7% underwent total knee arthroplasty, and 54.3% received total hip arthroplasty. The re-admission rate stands at 6.8%, with the remaining 93.2% not requiring readmission. Among those readmitted (n=24), causes include chest infections (37.5%), cardiac complications (20.8%), pulmonary embolism (20.8%), and neurological complications (20.8%). This detailed aggregation of data offers valuable insights into the demographics, health conditions, surgical interventions, and readmission causes within the study cohort, highlighting the prevalence of hypertension and the higher frequency of total hip arthroplasty over total knee arthroplasty.

Table 5: Frequency and Association of Re-Admission According to ASA Classification

ASA Classification	Re-Admission (Yes)	Re-Admission (No)	Total
ASA-I	1 (1.8%)	54 (98.2%)	55
ASA-II	6 (4.4%)	129 (95.6%)	135
ASA-III	15 (9.7%)	140 (90.3%)	155
ASA-IV	2 (28.6%)	5 (71.4%)	7
Total	24	328	352
P-value			0.021

This table displays the relationship between American Society of Anesthesiologists (ASA) classification and re-admission rates in a study of 352 patients. Patients with higher ASA classifications showed increased re-admission rates: 1.8% for ASA-I, 4.4% for ASA-II, 9.7% for ASA-III, and notably, 28.6% for ASA-IV. Overall, 24 patients were readmitted, with a significant association between ASA classification and re-admission, indicated by a p-value of 0.021.

DISCUSSION

The American Society of Anesthesiologists (ASA) classification system has been extensively recognized as a predictive tool for assessing morbidity and mortality risks in patients undergoing total joint arthroplasty (19). This recognition is supported by studies demonstrating a correlation between higher ASA scores and an increased incidence of mortality, infection rates, and major complications, such as deep vein thrombosis (DVT) or pulmonary embolism (20). Rauh and Krackhow's review of in-hospital deaths among patients who underwent elective Total Hip Arthroplasty revealed a significant portion of mortalities occurred in patients classified as ASA III, indicating a higher risk of death compared to those with a lower ASA score (0.92% versus 0.07%) (21).

Furthermore, Pflüger et al. highlighted a discernible difference in mortality rates between patients within ASA classes 1 or 2 and those in classes 3 or 4, with six-month mortality rates escalating from 0.54% in ASA class 2 patients to 10.06% in ASA class 4 patients (14). They also identified an increase in early revision rates for total hip arthroplasty among ASA class 3 patients when compared to ASA class 2, although this was not statistically significant. Similar findings were echoed in a study focusing on patients over the age of 80, where the incidence of major complications was more than double in ASA class 3 patients compared to those in ASA class 2 (22).

The evidence suggests that medical comorbidities, particularly cardiac conditions, are prevalent among candidates for total joint replacement (23). This is of particular concern for patients with an ASA score of ≥3, underscoring the importance of cautious preoperative screening and vigilant postoperative follow-up (24). The ASA score's association with increased rates of complications such as dislocation, infection, and blood loss further underscores its relevance to re-admission risk. Jolles et al. and Ridgeway et al. have specifically linked an ASA score of ≥3 with a significantly higher risk of dislocation and surgical site infection, respectively, reinforcing the score's utility in predicting postoperative complications (25).

The observed association between ASA scores and patient outcomes, including length of stay and re-admission rates, supports the use of the ASA classification as a reliable comorbidity assessment tool. Notably, Malik et al. found that ASA scores of 1 or 2 were associated with shorter hospital stays compared to scores of 3, highlighting the score's potential influence on postoperative recovery trajectories (26).

Despite these findings, the study's limitations warrant consideration. The subjective nature of the ASA classification system's assessment has been a point of contention, alongside criticisms regarding the system's disregard for the relationship between age and physical fitness. However, the widespread use of the ASA classification in clinical research and registries, coupled with its simplicity and correlation with postoperative complications, underscores its continued relevance in surgical planning and outcome prediction.

This study's limitations, including its small sample size, single-center setting, and nonrandomized design, may restrict the generalizability of its findings. Conducted in an urban environment, the results may not accurately reflect broader population dynamics or outcomes in different settings.

CONCLUSION

The ASA classification system remains a valuable tool for predicting postoperative risks in total joint arthroplasty patients. Despite criticisms regarding its subjective nature and potential inter-observer reliability issues, its predictive value for morbidity, mortality, and hospital readmission rates highlights its utility in preoperative evaluation and surgical outcome optimization. Future research should aim to address the identified limitations, potentially through multicenter studies and randomized designs, to enhance the generalizability and applicability of the ASA score in clinical practice.

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