Medical Clearance Risk Rating as a Predictor of Perioperative Complications After Total Hip Arthroplasty

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Abstract: Hip arthroplasty has become the standard treatment of end-stage osteoarthritis. However, postoperative complications are the risks associated with joint arthroplasty, which most significantly impact patient results and the total cost of care. Currently, no predictive system has been developed for categorizing levels of risk for the development of postoperative complications in patients undergoing total hip arthroplasty. We examined the association between the medical clearance risk rating by the physician performing the preoperative clearance examination and postoperative complications after total hip arthroplasty. We have demonstrated a significant association between the medical clearance risk rating and postoperative urinary track infection, and the American Society of Anesthesiologist score but no significant association to other complications. This study presents a predictive patient characteristic that may help us identify among our patients the ones that may benefit from a personally tailored preoperative planning and evaluation but demonstrates further work is necessary to better predict the risk of complications after total hip arthroplasty. **Keywords:** American Society of Anesthesiologists score (ASA), medical clearance risk rating, total hip arthroplasty (THA), perioperative complications.
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Total hip arthroplasty (THA) has become the standard treatment for patients with end-stage osteoarthritis (OA) [1]. The benefits of total joint arthroplasty as a treatment of OA have been well characterized. Multiple studies have demonstrated that, after total joint arthroplasty, patients experience significant quantitative and qualitative improvement in both their physical function and quality of life [2-4]. Current projections in the United States predict an increase of 174% to nearly 600 000 THA procedures by 2030 [5,6]. The job-related costs of OA have been estimated to be between $3.4 and $13.2 billion each year [7], making it a significant contribution to the overall health care cost.

However, numerous studies have demonstrated that postoperative complications are risks associated with total joint arthroplasty [8,9], and complications are the major factors that impact the success of the procedure, as well as the total cost of care [10-13]. Thus, as more and more patients undergo total joint arthroplasty for the treatment of OA, it is imperative to minimize the incidence of complications to decrease the risk of poor outcomes for the patients as well as the high economic costs that are associated with them. Because of the cost of treating complications, changes in comorbidities may direct a change in allocation of resources for preoperative testing and perioperative consultations from anesthesiologists, cardiologists, and endocrinologists. Physicians and hospitals will need to devote resources and attention to improve documentation of preoperative medical conditions to alter and tailor reimbursement rates for more complicated cases and patients [14,15], and direct research at optimizing outcomes through improvement of perioperative procedures and pathways is necessary.

Evaluation of the risk of complications after surgery is of primary importance with regard to both stratifying patient's risk and for preoperative and postoperative decision making. As far as we are aware, no system has yet been developed for categorizing levels of risk for the development of postoperative complications in patients undergoing total joint arthroplasty. The American Society of Anesthesiologists Score (ASA) [16] has not been found to be predictive of the quality of surgical

outcomes in total hip arthroplasty for treatment of OA [17]. The purpose of this investigation was to assess the association between the preoperative general medical evaluation as measured by the medical clearance risk assessment grade and the risk of perioperative complications after THA.

Methods and Materials
Study Design and Selection Criteria

This retrospective study was performed after institutional review board approval. The authors reviewed the charts of all patients who had undergone primary THA at a single institution between 1997 and 2001. All the patients who had one of the following perioperative complications, while in house after surgery, were included in the study: pneumonia, myocardial infarction, deep venous thrombosis (DVT)/pulmonary embolism (PE), acute surgical site infection, prolonged wound drainage, or urinary tract infection (UTI). Of 6200 charts that were reviewed, 93 charts were found who matched our selection criteria.

Data Collection

Demographic and patient data were collected for all patients including body mass index (BMI), age, and sex. Perioperative complications were recorded from the patients' charts.

The overall preoperative medical status of the patients was evaluated by 2 measures: the American Society of Anesthesiologists rating of operative risk [5] and the patient's preoperative clearance risk assessment provided by the general medical doctor. An anesthesiologist recorded the ASA during the patient's preoperative assessment visit. The ASA categories are as follows: 1, normal, healthy; 2, mild systemic disease; 3, severe systemic disease, not incapacitating; 4, severe incapacitating systemic condition, constant threat to life; and 5, moribund patient. There were no patients in ASA category 5 in this study. The patient's medical clearance risk assessment was obtained during the patients' preoperative evaluation visit from the patients' primary care physician or internist medical clearance note. Medical clearance risk assessment was rated as low, low-moderate, moderate, moderate-high, or high. The medical clearance risk assessment rating was represented in a numerical score, from 1 to 5 where a risk rating of low was represented by 1 and the highest risk rating was represented by 5.

Data Analysis

Associations between perioperative complications and the medical clearance assessment rating were analyzed using logistic regression. We first measured the bivariate associations between the different perioperative complications and each risk factor alone using the odds ratios computed from simple logistic regression models. We subsequently used multiple logistic regression models to compute the adjusted odds ratio for perioperative complications as controlled for the other risk factors. Only the adjusted odds ratios from the full models are presented below.

Results

The study group included 93 patients: 56 of the patients were women and 37 were men. The ages of the patients ranged from 12 to 87, with an average age of 64.5. The BMI of our subjects ranged from 17.8 to 51.2 with an average BMI of 28. Thirty-five of the patients were of normal weight with a BMI of less than 25, 34 of the patients were overweight with BMI between 25 and 30, and 24 of the patients were classified as obese, with a BMI greater than 30. Each of the patients had sustained at least one of the following postoperative complications: pneumonia, myocardial infarction, DVT/PE, wound infection, wound drainage, or UTI (Table 1).

Of the 93 patients, 5 had an ASA score of 1, 53 had a score of 2, 28 had a score of 3, 7 had a score marked as 2 to 3, and there were no patients with a score of 4 or 5 in this study (Table 1). There were 26 patients with a medical clearance risk rating of 1, 1 had a rating of 2, 49 had a rating of 3, 4 had a rating of 4, and 13 had a rating of 5 (Table 1).

A statistically significant association was found between the medical clearance risk rating and the ASA score ($P < .001$) in our patient group (Table 2). We found that there was a statistically significant increase in the medical clearance risk rating for women when compared to men ($P = .023$) and with increased age ($P =$

Table 1. Summary of Study Cohort: Patient Demographics, Medical Clearance Risk Rating, ASA Score, and Perioperative Complications Among Study Group

Demographics	No. of Patients	Average	Range
Age	93	64.49	12-87
Sex	93	37 male	56 female
BMI	93	28.01	17.8-51.2
ASA score	93	2.28	1-3
I	5		
II	53		
II-III	7		
III	28		
IV	0		
V	0		
Medical clearance risk rating	93	2.75	1-5
I	26		
II	1		
III	49		
IV	4		
V	13		
Complications			
Pneumonia	6		
Myocardial infarction	37		
DVT/PE	21		
Wound infection	8		
Wound drainage	14		
UTI	18		