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Alcohol Misuse is an Independent Risk Factor for Poorer Postoperative Outcomes Following Primary Total Hip and Total Knee Arthroplasty

Matthew J. Best, BS [a], Leonard T. Buller, MD [a], Raul G. Gosthe, MD [a], Alison K. Klika, MS [b], Wael K. Barsoum, MD [b]

[a] Department of Orthopaedic Surgery and Rehabilitation, University of Miami Miller School of Medicine, Miami, Florida
[b] Cleveland Clinic Department of Orthopaedic Surgery, Cleveland, Ohio

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ABSTRACT

The influence of alcohol misuse on outcomes following primary total hip (THA) or knee (TKA) arthroplasty is poorly understood. Using the National Hospital Discharge Survey, a cohort representative of 8,372,232 patients (without cirrhosis) who underwent THA or TKA between 1990 and 2007 was identified and divided into two groups: (1) those who misused alcohol ($n = 50,861$) and (2) those who did not ($n = 8,321,371$). Differences in discharge status, comorbidities and perioperative complications were analyzed. Compared to patients with no diagnosis of alcohol misuse, alcohol misusers were nine times more likely to leave against medical advice and had longer hospital stays ($P < 0.001$). Alcohol misuse was independently associated with higher odds of in hospital complications (OR: 1.334, range: 1.307–1.361), surgery related complications (OR: 1.293, range: 1.218–1.373) and general medical complications (OR: 1.300, range: 1.273–1.327).

Alcohol misuse, including abuse and dependence [1], is a maladaptive pattern of drinking associated with an increased risk of postoperative complications including delirium, cognitive decline, pneumonia and death [2–13]. While worse outcomes have been documented among patients with liver cirrhosis undergoing primary total hip (THA) and knee (TKA) arthroplasty [14,15], the influence of alcohol misuse, without cirrhosis, on perioperative outcomes following total joint arthroplasty is poorly understood. One study by Williams-Russo et al [16] evaluated 60 patients undergoing bilateral TKA and found that pre-operative alcohol use was associated with an increased risk of delirium in geriatric patients. The only other study, by Harris et al [17], retrospectively reviewed 185 patients, 32 of whom were alcohol misusers, undergoing THA or TKA at a Veterans Health Administration hospital and found alcohol misuse to be associated with an increased number of postoperative complications.

Identifying modifiable risk factors associated with complications following total joint arthroplasty may allow surgeons to intervene preoperatively, potentially decreasing complications and improving outcomes. The purpose of this study was to measure the influence of alcohol misuse on inpatient perioperative outcomes following primary THA or TKA using a large national database. The null hypothesis was that there would be no difference in the rate of perioperative complications between patients with and without a history of alcohol misuse.

Materials and Methods

Data Source

The National Hospital Discharge Survey (NHDS) [18], developed by the National Center for Healthcare Statistics division of the Centers for Disease Control and Prevention (CDC), was used in this study. The NHDS is considered the most comprehensive of all inpatient surgical databases in use today and is the principal database used by the U.S. government for monitoring hospital use [19]. Publicly available, the NHDS provides demographic and medical data for inpatients discharged from non-federal, short stay hospitals in the United States [19]. The survey uses International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) [20] codes to classify up to seven discharge diagnoses and up to four procedures. In addition to medical information, the NHDS collects demographic information (age, gender, race), expected source of payment (insurance status), length of care, hospital size, US region, and inpatient outcomes including discharge destination including: (1) routine/discharge home, (2) left against medical advice, (3) discharged/transferred to short-term facility, (4) discharged/transferred to long-term care institution, (5) alive, disposition not stated, and () dead [21]. The NHDS ensures an unbiased national sampling by using a complex three-stage probability design including: inflation by reciprocals of the probabilities of sample selection,

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Reprint requests: Leonard T. Buller, MD, Department of Orthopaedic, Surgery and Rehabilitation, University of Miami, 1400 NW 12th Avenue, Miami, FL 33136.

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adjustment for no response and population weighting ratio adjustments [19]. This study did not require approval by the institutional review board because the NHDS is a publically available database with no patient identifying information.

Patient Selection

All patients admitted to hospitals in the United States who underwent primary THA or TKA between 1990 and 2007 were identified using ICD-9-CM codes. Due to NCHS budgetary limitations starting in 2008, the number of hospital surveys was halved, decreasing the precision of the survey data and nearly doubling the relative standard error [22]. Consequently, we chose 2007 as the endpoint of our study. Using previously described techniques, all discharges with a procedure code (ICD-9-CM) of THA (81.51) or TKA (81.54) were identified [23]. In order to determine the effect of alcohol misuse on outcomes, patients with a diagnosis of cirrhosis (ICD-9-CM 571.5) were excluded from the study ($n = 7258$), bringing the total cohort from 8,379,490 to 8,372,232 patients. Patients were divided into two groups: (1) those with a diagnosis of alcohol misuse (alcohol dependence: 303.90–303.93 or alcohol abuse: 305.00–305.03) and (2) those who did not have a diagnosis of alcohol misuse. Alcohol abuse is defined by the American Psychiatric Association as a maladaptive pattern of drinking, leading to clinically significant impairment or distress, as manifested by at least one of the following occurring within a 12-month period: (1) recurrent use of alcohol resulting in a failure to fulfill major role obligations at work, school, or home (e.g., repeated absences or poor work performance related to alcohol use; alcohol-related absences, suspensions, or expulsions from school; neglect of children or household), (2) recurrent alcohol use in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by alcohol use), (3) recurrent alcohol-related legal problems (e.g., arrests for alcohol-related disorderly conduct), and (4) continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol (e.g., arguments with spouse about consequences of intoxication) and having never met the criteria for alcohol dependence [1]. In contrast, the definition of alcohol dependence is a maladaptive pattern of drinking, leading to clinically significant impairment or distress, as manifested by three or more of the following occurring at any time in the same 12-month period: (1) need for markedly increased amounts of alcohol to achieve intoxication or desired effect; or markedly diminished effect with continued use of the same amount of alcohol, (2) the characteristic withdrawal syndrome for alcohol; or drinking (or using a closely related substance) to relieve or avoid withdrawal symptoms, (3) drinking in larger amounts or over a longer period than intended, (4) persistent desire or one or more unsuccessful efforts to cut down or control drinking, (5) important social, occupational, or recreational activities given up or reduced because of drinking, (6) a great deal of time spent in activities necessary to obtain, to use, or to recover from the effects of drinking, and (7) continued drinking despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to be caused or exacerbated by drinking [1].

Demographic variables were collected including age, sex and prevalence of comorbidities. Length of stay and discharge destination were also evaluated. The incidence of complications was determined using the complication screening package [24]. The variable "complication" was created based upon the following variables (ICD-9-CM): acute postoperative infection (998.5), other operative complication (998.89), cardiac complication (997.1), acute myocardial infarction (410), acute renal failure (584), pulmonary embolism (415.1), induced mental disorder (293), pneumonia (480–486), pulmonary insufficiency (518.5), deep venous thrombosis (453.4), osteomyelitis (730), gastrointestinal bleeding (578.0), convulsion (780.39), complication of internal joint prosthesis (996.77), intubation (96.xx), and transfusion of blood (99.x).

Statistical Analysis

Because of the large sample size, a normal distribution of the data was assumed. Differences between continuous variables were compared using the independent-samples t-test, while the Pearson chi-square test was used to compare differences between categorical variables. To determine whether alcohol misuse was an independent predictor of a negative in-hospital outcome, variables present in at least 2% of the population [25] were included in a multivariable binary logistic regression model. The dichotomous variables were (1) presence of any complication, (2) presence of a surgical complication and (3) presence of a general medical complication. Potential confounders were controlled for using a multivariable regression model, to isolate the effect of alcohol misuse on inpatient outcomes. Covariates accounted for in the regression model included: gender, age, race, length of stay, and preexisting comorbidities (diabetes mellitus, hypertension, congestive heart failure, coronary artery disease, atrial fibrillation, osteoporosis, and rheumatoid arthritis). Odds ratios and confidence intervals were calculated to assess the association between alcohol misuse and inpatient adverse events. Correcting for multiple comparisons, a P-value <0.001 was used to define statistical significance, as previously described [26]. All data were analyzed using the software-statistical package for social sciences [SPSS] version 20 (Chicago, IL, USA).

Source of Funding

No external funding source was used for the conduct of this study.

Results

Overall Cohort

A cohort representative of 8,372,232 patients without cirrhosis who underwent primary THA or TKA between 1990 and 2007 was identified (Table 1). Of the total cohort, 50,861 patients had a diagnosis of alcohol misuse, while 8,321,371 patients had no diagnosis of alcohol misuse. The alcohol misuse group was younger (61.2 ± 12.1 years compared to 67.3 ± 11.7 years; $P < 0.001$), had longer hospital stays (5.2 ± 3.2 days compared to 5.1 ± 4.2 days; $P < 0.001$), and had a higher rate of patients who left against medical advice (0.40% compared to 0.04%, $P < 0.001$) when compared with the group of patients with no diagnosis of alcohol misuse (Table 1). The alcohol misuse group had lower rates of diabetes mellitus (8.5% compared to 13.0%), hypertensive disease (45.4% compared to 46.9%), and coronary artery disease (3.9% compared to 4.9%) when compared with the group with no diagnosis of alcohol misuse ($P < 0.001$ for all; Table 2). Table 1 illustrates the demographics stratified by THA and TKA among patients with a diagnosis of alcohol misuse compared to those with no diagnosis of alcohol misuse undergoing primary THA or TKA, respectively while Table 2 shows comorbidities divided by joint type.

Alcohol misusers had a higher rate ($P < 0.001$) of total complications (33.5% compared to 22.6%), surgery related complications (2.2% compared to 1.7%), and general medical complications (31.6% compared to 21.4%) when compared with the group with no diagnosis of alcohol misuse (Table 3). Notably, alcohol misusers had significantly higher rates ($P < 0.001$) for all complications evaluated, with the exception of UTI/urinary complication ($P = 0.032$), pulmonary embolism ($P < 0.001$), and deep venous thrombosis ($P = 0.046$) (Table 3).

Table 4 depicts odds ratios for complications after THA and TKA for alcohol misusers. Of note, alcohol misuse was a risk factor for acute postoperative infection (OR 15.314 range: 14.662 to 15.966, $P < 0.001$), thrombocytopenia (OR 10.910 range: 10.502 to 11.334, $P < 0.001$), convulsion (OR 5.752 range: 5.422 to 6.102, $P < 0.001$), and pulmonary insufficiency (OR 5.239 range: 4.773 to 5.750, $P < 0.001$). Patients who misused alcohol had increased odds of leaving against medical advice (OR 9.132 range: 7.923 to 10.525, $P < 0.001$) (Table 4).