Arthroplasty Knee Surgery and Alcohol Use

Risk Factor or Benefit?

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Abstract

Background Excessive alcohol consumption has been associated with adverse measures of health after elective surgery. However, associations of low/moderate consumption remain uncertain.

Question/purposes We determined differences among patients with three different self-reported consumption

levels in (1) preoperative/postoperative patient-perceived outcomes and knee scores, (2) preoperative/postoperative changes in these scores, (3) preoperative demographics and comorbidities, and (4) length of stay (LOS) and inpatient charges.

Methods We retrospectively studied 430 patients (545 TKAs). Based on a self-administered consumption questionnaire, patients were stratified into groups: (1) nondrinkers, (2) occasional drinkers, and (3) moderate drinkers. We compared the following variables between groups: demographics, BMI, American Society of Anesthesiologists score, Charlson Comorbidity Index, preoperative and postoperative Quality of Well-being Index (QWB-7), SF-36 score, WOMAC score, Knee Society (KS) Score, Hospital for Special Surgery (HSS) knee score, LOS, and hospital charges. QWB-7, SF-36, WOMAC, KS, and HSS scores were compared adjusting for patient characteristics. Minimum followup was 1 year (average, 3.4 years; range, 1–6 years).

Results Preoperatively, compared to self-reported nondrinkers, moderate drinkers had better QWB-7, SF-36, and WOMAC scores. At followup, occasional and moderate drinkers had better KS function and HSS scores. However, nondrinkers had greater SF-36 general health improvement. Most nondrinkers were older, female, and Hispanic and had more comorbidities. Nondrinkers had a longer LOS.

Conclusions Self-reported alcohol consumption was more common among men and non-Hispanics. Moderate drinkers had better preoperative QWB-7, SF-36, and WOMAC scores and shorter LOS than nondrinkers. However, after surgery, self-reported abstainers achieved greater improvements in the SF-36 general health score.

Level of Evidence Level III, prognostic study. See the Instructions for Authors for a complete description of levels of evidence.

Each author certifies that he or she, or a member of his or her immediate family, has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

One of the authors (CJL) certifies that he is a board member of the American Association of Hip and Knee Surgeons (Rosemont, IL, USA); is a consultant for and receives royalties from Mako Surgical Corp (Fort Lauderdale, FL, USA); and owns stock in Johnson & Johnson (New Brunswick, NJ, USA), Zimmer Inc (Warsaw, IN, USA), Mako Surgical Corp, Stryker Orthopaedics (Mahwah, NJ, USA), Wright Medical Technology Inc (Arlington, TN, USA), and Symmetry Medical Inc (Warsaw, IN, USA).

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Introduction

Alcohol abuse is unquestionably harmful and represents a major disease burden on the US population. The prevalence of alcohol abuse and alcohol dependence approaches 5% and 4%, respectively [20]. Among patients admitted to surgery, the estimated prevalence of screen-positive alcohol dependence is reportedly about 23% [16].

Acute alcohol exposure reportedly has been associated with antiinflammatory effects [4, 10, 24] while chronic abuse has been associated with immunosuppression and an increased response to pathogenic bacterial products [5, 24], such as lipopolysaccharide, which exacerbate tissue injury in conditions such as hepatitis and pancreatitis. Chronic alcohol abuse negatively impacts the function of antigen-presenting cells and the activation of T cells during the cell-mediated immune response [24]. Additionally, in a study of 7631 patients with documented alcohol use (making use of the National Surgical Quality Improvement Program database from the American College of Surgeons of all elective surgeries), alcohol use independently predicted pneumonia (odds ratio [OR], 1.98), sepsis (OR, 1.19), superficial surgical-site infection (OR, 1.15), wound disruption (OR, 1.41), and prolonged hospital length of stay (LOS) (OR, 1.17) [19]. However, Di Castelnuovo et al. [7] in a meta-analysis of prospective studies found the association between total mortality and alcohol intake was a J-shaped relationship because alcohol consumption, up to four drinks/day in men and two drinks/day in women, was inversely associated with total mortality.

Mukamal et al. [18] in a prospective cohort study in which the main outcome measure was all-cause mortality found self-reported moderate alcohol consumption in the year before acute myocardial infarction was associated with reduced mortality after infarction. As a consequence of these contradictory reports, in the current study, we investigated whether low or moderate alcohol consumption could be associated with beneficial effects in TKA.

We therefore determined differences among patients with three different levels of self-reported alcohol consumption in (1) preoperative/postoperative patient-perceived outcomes and clinical knee scores, (2) preoperative/postoperative changes in these scores, (3) preoperative demographics (age, sex, race, ethnicity, BMI) and comorbidities (American Society of Anesthesiologists [ASA] score, Charlson Comorbidity Index [CCI]), and (4) length of stay (LOS) and inpatient charges.

Patients and Methods

Using our joint registry database, we studied 430 patients (545 procedures) who underwent primary TKA, performed

by the senior author (CJL) from July 2005 to June 2008. All patients were given a preoperative self-administered questionnaire that asked “Do you drink any alcoholic beverages (including beer, wine, rum, whiskey, etc)?” The patient indicated the frequency of alcohol consumption, both past and present, as never, occasionally, moderately, or heavily. The questionnaires were completed by patients before 295 (57.4%) of the 545 procedures. Complete data were available for 231 of the 295 procedures; at postoperative followup, 193 procedures had complete data. The minimum followup was 1 year (mean, 3.4 years; range, 1–6 years). Data for 38 procedures were not available due to incomplete data collection, loss of contact, patient relocation, or patient mortality. Analyses were made on available data.

Based on the self-reported alcohol consumption, we stratified patients into three groups: (1) nondrinkers (64%, $n = 148$), (2) occasional drinkers (29%, $n = 67$), and (3) moderate drinkers (7%, $n = 16$). No patient reported heavy consumption.

All data were obtained from the database joint registry, the patient’s clinical chart, and the hospital financial department. All patients provided informed consent for this institutional review board-approved study.

Preoperatively and postoperatively, the following patient-perceived outcomes were obtained: Quality of Well-being Index (QWB-7) total score [14]; the physical function, bodily pain, general health, social functioning, and physical component scores of the SF-36 [2]; and the pain, stiffness, physical function, and total scores of the WOMAC [3]. Clinical scores included Knee Society (KS) knee and function scores [12] and Hospital for Special Surgery (HSS) knee score [13, 23]. The database included the following data: age, sex, race (black/white), ethnicity (Hispanic/non-Hispanic), BMI, ASA score [1], CCI [6], and LOS. The hospital financial service provided data on hospitalization charges: gross revenue, net revenue, direct cost, contribution margin, indirect cost, operating cost, and net income.

Most patients were discharged to home within 3 to 4 days in the absence of complications. Patients were then seen by the senior author during the second and sixth postoperative week for staple removal and clinical evaluation. The QWB-7, SF-36, WOMAC, KS knee and function, and HSS knee scores were assessed at 3 months, 6 months, 1 year, and annually thereafter.

We determined differences in the QWB-7, SF-36, WOMAC, KS knee and function, and HSS knee scores before and after surgery using an analysis of covariance controlling for age, sex, race, ethnicity, BMI, ASA score, and CCI to isolate alcohol consumption as a risk factor. We also determined differences among the three levels of alcohol consumption for the change in score (difference between preoperative and postoperative scores) for the aforementioned variables. ANOVA was used to assess differences in

age, BMI, and CCI. In addition, a chi-square analysis using crosstabulation was used to determine whether sex, ethnicity, ASA score, and race were associated with the three different levels of alcohol consumption. To assess for differences in LOS and hospitalization charges among the three levels of alcohol consumption, we used ANOVA. All statistical analyses were performed using SPSS[®] software (Version 16.0; IBM Corp, Armonk, NY, USA).

Results

Preoperatively and compared to nondrinkers, individuals who considered themselves moderate drinkers had better QWB-7 total scores, SF-36 general health and bodily pain scores, and WOMAC physical function, stiffness, and total scores. Further, those who considered themselves occasional drinkers also had better QWB-7 total scores and SF-36 physical function scores compared to individuals who classified themselves as nondrinkers (Table 1).

At followup and compared to nondrinkers, individuals who reported being occasional or moderate drinkers had better KS function scores and HSS knee scores (Table 2). Nondrinkers had greater improvement ($p = 0.009$) in the SF-36 general health score than moderate drinkers (Fig. 1).

Addressing demographics, moderate drinkers (mean age, 65.5 years) were younger than occasional drinkers (mean age, 71.4 years) ($p = 0.006$) or nondrinkers (mean age, 72.6 years) ($p < 0.0001$). Most women were nondrinkers (69.3%) while approximately 73% of men were occasional or moderate drinkers ($p < 0.0001$). Regarding

ethnicity, 66.5% of Hispanics reported being nondrinkers compared to only 32.2% of non-Hispanics ($p < 0.0001$). Consumption groups were not different regarding BMI ($p = 0.725$) or race ($p = 0.55$). Addressing comorbidities, nondrinkers had a higher ($p = 0.007$) proportion of patients classified as ASA Grade 3 (72.8%) compared to the other groups (22.3% in occasional drinkers and 4.9% in moderate drinkers). Abstainers had a worse mean CCI (1.89) compared to occasional (1.32) ($p = 0.001$) or moderate (1.04) ($p = 0.01$) drinkers.

Moderate drinkers had a hospital LOS (4.38 days) more than 1 day less ($p = 0.03$) than the LOS of abstainers (5.63 days). There were no differences ($p = 0.06$ to 0.37) among the three levels of alcohol consumption in inpatient gross revenue, net revenue, direct cost, contribution margin, indirect cost, operating cost, and net income.

Discussion

Excessive alcohol consumption has been associated with adverse measures of health status [25] or negative clinical and surgical outcomes such as complications and/or prolonged LOS [11, 19, 21]. However, low and moderate consumption has been associated with beneficial effects such as decreased total mortality [7, 18] or stroke risk [22], coronary cardioprotection [18], and traumatic brain injury neuroprotection [4]. Consumption and health measure associations have been described as J-shaped relationships [7, 25]. Strong interest exists today about the possibility that at certain doses alcohol can have a beneficial effect in TKA.

Table 1. Comparisons among self-reported alcohol consumption groups of preoperative patient-perceived outcomes and clinical knee scores after adjustments

Score (points)	Nondrinkers (n = 152)	Occasional drinkers (n = 73)	p value	Moderate drinkers (n = 19)	p value
QWB-7 total	0.51 ± 0.04	0.54 ± 0.05	0.009	0.56 ± 0.04	0.003
SF-36 physical functioning	11.49 ± 12.5	21.34 ± 17.99	0.04	25.63 ± 21.43	0.07
SF-36 bodily pain	32.35 ± 17.27	40.09 ± 23.04	0.33	49.88 ± 16.36	0.01
SF-36 general health	68.45 ± 21.55	78.12 ± 17.99	0.08	86.63 ± 9.93	0.003
SF-36 social functioning	43.57 ± 33.30	46.51 ± 35.77	1.0	60.19 ± 29.33	0.98
SF-36 physical component summary	24.86 ± 6.56	27.57 ± 7.89	0.36	29.38 ± 7.06	0.19
WOMAC function	43.24 ± 10.27	38.36 ± 11.28	0.17	33.87 ± 12.87	0.02
WOMAC pain	12.09 ± 3.54	11.25 ± 3.14	0.66	10.63 ± 2.55	0.38
WOMAC stiffness	4.02 ± 2.09	3.40 ± 2.11	0.14	3.00 ± 2.19	0.04
WOMAC total	59.34 ± 13.71	53.01 ± 14.32	0.11	47.50 ± 16.12	0.01
HSS knee	58.53 ± 8.91	61.40 ± 9.65	0.83	63.56 ± 10.58	0.37
KS knee	45.36 ± 21.02	49.30 ± 20.18	0.83	49.12 ± 20.30	1.0
KS function	32.16 ± 18.10	39.85 ± 16.80	1.0	50.31 ± 13.84	0.05

Values are expressed as mean ± SD; QWB-7 = Quality of Well-being Index; HSS = Hospital for Special Surgery; KS = Knee Society.

Table 2. Comparisons among self-reported alcohol consumption groups of postoperative patient-perceived outcomes and clinical knee scores after adjustments

Score (points)	Nondrinkers (n = 129)	Occasional drinkers (n = 55)	p value	Moderate drinkers (n = 13)	p value
QWB-7 total	0.58 ± 0.10	0.62 ± 0.15	1.0	0.65 ± 0.12	1.0
SF-36 physical functioning	46.84 ± 21.63	57.26 ± 21.09	0.77	60.42 ± 19.82	1.0
SF-36 bodily pain	66.63 ± 21.20	70.87 ± 20.78	1.0	77.17 ± 22.10	0.89
SF-36 general health	71.66 ± 8.30	74.79 ± 8.84	1.0	70.25 ± 9.24	0.38
SF-36 social functioning	73.34 ± 18.25	77.45 ± 21.04	1.0	82.42 ± 14.45	1.0
SF-36 physical component summary	40.63 ± 8.61	44.21 ± 8.66	0.74	45.25 ± 7.26	1.0
WOMAC function	5.02 ± 8.44	2.91 ± 4.09	0.41	1.58 ± 0.79	0.49
WOMAC pain	0.72 ± 2.10	0.49 ± 1.25	1.0	0.08 ± 0.28	0.96
WOMAC stiffness	0.14 ± 0.66	0.04 ± 0.19	0.96	0.08 ± 0.28	1.0
WOMAC total	5.87 ± 10.70	3.43 ± 5.25	0.48	1.75 ± 0.86	0.57
HSS knee	86.19 ± 7.06	89.75 ± 6.17	0.03	92.75 ± 2.09	0.01
KS knee	93.14 ± 11.21	94.30 ± 8.31	0.59	96.58 ± 5.28	1.0
KS function	53.87 ± 20.49	68.96 ± 22.08	0.02	79.17 ± 11.64	0.008

Values are expressed as mean ± SD; QWB-7 = Quality of Well-being Index; HSS = Hospital for Special Surgery; KS = Knee Society.

Fig. 1 A graph shows the change in SF-36 general health scores from preoperative to postoperative for each self-reported alcohol consumption group. Nondrinkers had greater ($p = 0.009$) improvement in the SF-36 general health score than moderate drinkers.

As a consequence, among individuals who self-reported being nondrinkers, occasional drinkers, or moderate drinkers, we determined differences in (1) preoperative/postoperative patient-perceived outcomes and knee scores, (2) preoperative/postoperative changes in these scores, (3) preoperative demographics and comorbidities, and (4) LOS and hospitalization charges.

Our results should be interpreted in light of several limitations. First, groups were different in age and CCI at baseline. In view of this, we statistically controlled for these differences and other patient characteristics in an attempt to isolate alcohol consumption as a factor. Second, the questionnaire was completed preoperatively by patients before 57% of the procedures. It is possible some patients with high intake levels opted to not complete it or to report a lower level. Analysis was based solely on the answers selected by patients. Thus, the patient consumption classification could be biased. Third, the questionnaire has not been validated and exact quantitative levels of alcohol consumption were absent. However, the questionnaire was similar to many validated instruments intended to determine pain, activity, and function level making use of the 1 = none, 2 = mild, 3 = moderate, and 4 = severe options. In most validated instruments, the same general categories are utilized for pain. Another limitation was the modest sample size of moderate drinkers. Finally, we limited ethnicity definitions to Hispanics or non-Hispanics because of the high proportion of Hispanics in our sample. Inferences about ethnicity may not apply to other parts of the United States. Consumption generalizations to the overall population cannot be made expeditiously.

Moderate drinkers were found to have better preoperative QWB-7, SF-36, and WOMAC scores than abstainers in addition to better postoperative KS function and HSS scores. Our results regarding preintervention alcohol consumption and health status measures confirm previous investigations [7–9, 18, 25]. Di Castelnuovo et al. [7] found in a meta-analysis high-level alcohol consumption was

associated with increased mortality in a J-shaped relationship because consumption, up to four drinks/day in men and two drinks/day in women, was inversely associated with total mortality. Gmel et al. [9] also found the curve depicting the alcohol consumption relationship with mortality was influenced by a combination of beneficial and harmful effects. Mukamal et al. [18], trying to determine prior alcohol consumption effects on long-term mortality among early survivors of acute myocardial infarction, found patients who consumed fewer than one drink/day (3.4 versus 6.3 deaths/100 person-years; hazard ratio [HR], 0.55) and patients who consumed one or more drinks/day (2.4 versus 6.3 deaths/100 person-years; HR, 0.38) had a lower all-cause mortality rate than abstainers. Results remained predictive of lower mortality after adjusting for propensity to drink and other potential confounders. Espehaug et al. [8] determined patient-related factors and early risk of revision after THA performing a matched case-control study with 674 revised hips as cases and 1343 hips as controls (primary). The intake association with revision risk was found to be J-shaped; the lowest risk was among moderate drinkers and the highest among patients who consumed more than four units/week. Williams et al. [25] used the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) questionnaire (higher scores signify greater and more frequent consumption) to evaluate the concurrent association between alcohol screening scores and patient perception of health among male veterans and found after adjustments an inverted U-shaped relationship between AUDIT-C categories and all SF-36 scores; patients with scores of 4 to 5 or 6 to 7 reported the highest health status while patients with scores of 0, 8 to 9, and 10 or more reported the lowest. Across all health status measures, patients with severe alcohol misuse had poorer statuses than those with mild or moderate levels of severity.

We found nondrinkers had a greater change in score than moderate drinkers on the SF-36 general health score. In other words, after surgery, abstainers obtained greater general health improvement. It is possible consumption through effects mediated on inflammation or host tissue responses could have hampered functional recovery and overall health status. We can only speculate on the real reasons for this and found no previous description of this particular finding. This finding warrants further investigation, making use of longitudinal studies.

Abstainers were mostly older, women, and Hispanics. These results are in agreement with a previous report from the National Institute of Alcohol Abuse and Alcoholism on the 12-month prevalence and population estimates of Diagnostic and Statistical Manual-IV alcohol abuse by age, sex, and race-ethnicity in the United States [20]. In that report, overall prevalence of abuse was 4.65%. The lowest

prevalence (1.21%) was among patients older than 65 years while the highest (6.95%) was among patients aged 18 to 29 years. The overall prevalence was 2.55% in women and 6.93% in men. Similar to our findings, Hispanics (3.97%) had a lower prevalence than whites (5.10%). Regarding comorbidities, we found abstainers had higher proportions of patients classified as ASA Grade 3 (72.8%) and worse mean CCI (1.89). We cannot establish a causal relationship between moderate alcohol consumption and a lower prevalence of comorbidities even though our results are in agreement with previous reports that found associations between certain intake levels and beneficial effects such as coronary cardioprotection [15, 17, 18], lower relative risk of total and ischemic stroke [22], or even total mortality [7].

We also found moderate drinkers had a shorter mean LOS than abstainers. Our results are not in agreement with a previous report based on a large nationwide sample that found longer LOS among alcohol users [19]. We had no patients reporting themselves as heavy drinkers and this could explain this discrepancy. Even with LOS differences, we did not find differences in hospital charges.

In conclusion, self-reported alcohol consumption was fairly common among men and non-Hispanics. Moderate drinkers had better patient-perceived outcomes and knee scores and shorter LOS. However, after surgery, self-reported abstainers obtained greater general health improvement. This particular finding warrants further investigation.

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