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Clinical Investigation

CLINICAL INVESTIGATION

Postoperative delirium in total knee and hip arthroplasty patients: a study of perioperative modifiable risk factors

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Abstract

Background: Postoperative delirium continues to pose major clinical difficulties. While unmodifiable factors (e.g. age and comorbidity burden) are commonly studied risk factors for delirium, the role of modifiable factors, such as anaesthesia type and commonly used perioperative medications, remains understudied. This study aims to evaluate the role of modifiable factors for delirium after hip and knee arthroplasties.

Methods: We performed a retrospective study of 41 766 patients who underwent hip or knee arthroplasties between 2005 and 2014 at a single institution. Data were collected as part of routine patient care. Multivariable logistic regression models assessed associations between anaesthesia type and commonly used perioperative medications (opioids, benzodiazepines, and ketamine) and postoperative delirium. Odds ratios (OR) and 95% confidence intervals (CI) are reported. Various sensitivity analyses are also considered, including multiple imputation methods to address missing data.

Results: Postoperative delirium occurred in 2.21% (n=922) of all patients. While patients who received neuraxial anaesthesia were at lower risk for postoperative delirium (compared with general anaesthesia; epidural OR 0.59 CI 0.38–0.93; spinal OR 0.55 CI 0.37–0.83; combined spinal/epidural OR 0.56 CI 0.40–0.80), those given intraoperative ketamine (OR 1.27 CI 1.01–1.59), opioids (OR 1.25 CI 1.09–1.44), postoperative benzodiazepines (OR 2.47 CI 2.04–2.97), and ketamine infusion (OR 10.59 CI 5.26–19.91) were at a higher risk.

Conclusions: In this cohort of hip and knee arthroplasty patients, anaesthesia type and perioperative medications were associated with increased odds for postoperative delirium. Our results support the notion that modifiable risk factors may exacerbate or attenuate risk for postoperative delirium.

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Editor's key points

- Delirium is common among elderly patients, particularly those undergoing major arthroplasties.
- The authors interrogated a database containing the records of >40 000 patients who underwent hip or knee arthroplasty at a single centre.
- It contained details of drug medications, anaesthetic technique, and pre- and postoperative ICD-9 codes.
- Modifiable factors associated with delirium were general anaesthesia, ketamine use, opioids, and postoperative benzodiazepines.

Postoperative delirium remains a major problem for perioperative clinicians and their patients, especially given its association with significant short- and long-term adverse outcomes.[1–3] While there is a general consensus regarding the role of unmodifiable risk factors for delirium, including older age and higher comorbidity burden (especially psychiatric), the role of modifiable risk factors, such as type of anaesthesia and perioperatively administered medications, is still disputed.[4–7]

In a number of population-based studies, neuraxial anaesthesia has been associated with reduced perioperative complications when compared with general anaesthesia.[8–12] The question of whether this type of regional anaesthetic technique compared with a general anaesthetic approach can influence risk for delirium remains largely understudied.[6,7] Further, the impact of commonly used perioperative medications on this outcome remains debated.[13]

In the present study, we evaluated whether these factors may be associated with postoperative delirium among total hip and knee arthroplasty patients while controlling for a range of covariates. We hypothesised that postoperative delirium would occur at a higher rate among patients who received general anaesthesia, compared with those who underwent their procedures under neuraxial anaesthetics. We also considered the hypothesis that the use of medications perioperatively, namely opioids, ketamine, and benzodiazepines, would increase risk for delirium.

Methods

We conducted a retrospective study of patients who underwent elective total hip arthroplasties (THA) or total knee arthroplasties (TKA) at Hospital for Special Surgery between 2005 and 2014. This study was approved by the hospital institutional review board and was exempt from the requirement to obtain informed consent from patients, given the retrospective and observational nature of this analysis (IRB # 2016-436). All data utilised for this study were collected as part of routine patient care.

Data sources

Patient characteristics and medical history were obtained from hospital billing datasets, which contained information such as age, sex, dates of admission and discharge, and International Classification of Diseases, 9th Revision (ICD-9) codes. The ICD-9 codes provided information about each patient's presenting diagnoses (i.e. their reason for surgery), their medical history, and any complications that developed during admission.

ICD-9 procedure codes referring to THA (81.51) and TKA (81.54) were used to identify patients for the period 2005–2014. Patients who appeared more than once in the database (i.e. those who had more than one THA, TKA, or both) were included only for the first procedure. Thus, no patient was counted more than once in the analysis. Exclusion criteria are outlined in Fig. 1. After applying these criteria, the study cohort consisted of 41 766 unique patients (21 022 THA and 20 744 TKA).

Study variables

For ICD-9 diagnosis codes, a present on admission (POA) indicator was used to distinguish diagnoses referring to prior conditions from those that emerged during their hospital stay. Postoperative delirium was defined using the following non-POA ICD-9 diagnosis codes: 292.81, 293.0, 293.1, 293.9, 780.09, and 780.97. These diagnosis codes were selected based on codes described in previous publications, which we considered relevant to the current study population.[14–16] Initially, the following additional ICD-9 codes were included in our definition for postoperative delirium, but were found to have a frequency of zero in the current study cohort: 293.8, 293.81, 293.82, 293.83, 293.84, 293.89, and 797. Although our dataset lacked information regarding the timing of the delirium diagnosis, we could assume that the diagnosis took place after operation. Due to the elective nature of the THA and TKA procedures considered in this study, as per hospital practice, the surgery would have been cancelled had the symptoms of delirium emerged before operation.

ICD-9 diagnosis codes marked either with a POA indicator of 'Y' (Yes) or that were classified as exempt from POA reporting were used for assessing each patient's comorbidity burden. Each patient's comorbidity status was evaluated for each of the following diagnoses: hypothyroidism; renal disease; diabetes; obesity; sleep apnoea; valvular disease; hypertension; congestive heart failure; tobacco abuse; pulmonary disease; depression/anxiety; and psychoses.

A hospital anaesthesia billing database was used to identify the primary type of anaesthesia for each patient as one of the following: general; combined spinal epidural (CSE); epidural; or spinal. Patients whose anaesthesia type was missing were excluded.

Use of intraoperative medications commonly suggested to potentially affect the risk of delirium, such as benzodiazepines,