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Surgical Procedure and Postoperative Delirium in Geriatric Hip Fracture Patients

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The geriatric orthopedic population has a high prevalence of postoperative delirium with hip fracture repair having the highest incidence. The aim of this study was to identify whether surgical procedure is a risk factor for postoperative delirium in the elderly hip fracture population.

Ethical approval for this study (IRB-X) was provided by the Institutional Review Board of Johns Hopkins Medical Institutions, Baltimore, Maryland, USA (Chairperson Susan Bassett, PhD) on 15 September 2013. The dataset used for this analysis was our IRB-approved hip fracture database, which includes patients at least 65 years of age, as described previously.¹ This dataset used Mini-mental status exam (MMSE) and the confusion assessment method (CAM) to test delirium preoperatively and mid-morning on postoperative day 2. Patients diagnosed with preoperative delirium were excluded.

Surgical procedure was categorized as arthroplasty (with or without cement), plate/screw or intramedullary nail (long or short). Perioperative predisposing factors for postoperative delirium were compared by surgical procedure using Chi-square analysis for categorical variables and analysis of variance for continuous variables. The univariate results were then used to guide the selection of logistic regression models to estimate the odds ratios (ORs) of postoperative delirium associated with surgical procedure and their corresponding 95% confidence interval (CI), while adjusting for perioperative risk factors. A P value of 0.05 or less was considered statistically significant.

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Conflicts of interest: none.

Data from 409 patients included arthroplasty (n=177, 145 with cement and 32 without), plate/screw (n=127), and intramedullary nail (n=105). In logistic regression previously identified perioperative risk factors for postoperative delirium remain highly significant (Table 1). These include male gender, age, preoperative cognitive impairment, and perioperative blood transfusion. Arthroplasty with cement and screw/plate procedures were associated with significant higher odds of postoperative delirium than Intramedullary nail procedure (both $p < 0.028$), while cement-less arthroplasty was not ($OR=1.78$, $p=0.28$).

The new potential postoperative delirium risk factor identified in this analysis is use of cement with arthroplasty. Arthroplasty carries a high rate of postoperative delirium, which has been associated with intraoperative cerebral fat embolism.² Embolic events occur with both cement-less and cemented arthroplasty procedures, although the incidence is lower with cement-less arthroplasty.³ Bone cement implantation syndrome with its associated hypoxia and hypotension occurs in 20% of patients during arthroplasty for femoral neck fracture, and could also provide a mechanism for postoperative delirium.⁴

Cemented prostheses carry multiple benefits including reduced postoperative pain, and better mobility. Recent studies show a decreased need for revision arthroplasty with cemented implants when compared to cement-less arthroplasty.⁵ This is due to decreased implant loosening and a lower risk of peri-prosthetic re-fracture.⁶

Study limitations include CAM assessment on the second postoperative day only, which may have under detected mild, transient delirium that occurred only on first postoperative day. Previous studies in hip fracture patients report that delirium severity peaks on day one postoperatively.⁷ Nonetheless, delirium episodes missed would have been mild. In addition, traditional risk factors such as preoperative depression, pain and duration of surgery were not assessed or not reported.^{7,8}

In summary, this study is consistent with previous reports that identify male gender, age, preoperative cognitive impairment, and perioperative blood transfusion, as important risk factors for postoperative delirium. In addition, we have identified use of cement as a potential surgical postoperative delirium risk factor. Future studies focused on detecting and limiting embolic events in arthroplasty + cement procedures for hip fracture repair may be important in decreasing postoperative delirium incidence.

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Table

Model based results from logistic regression

variable	OR (95% CI)	p
Age, per year	1.058 (1.018 to 1.099)	0.0037
Nonwhite race	0.735 (0.229 to 2.364)	0.6059
Male gender	2.476 (1.408 to 4.355)	0.0017
Preoperative cognitive impairment *	6.346 (3.541 to 11.373)	<0.0001
Charlson comorbidity index, per point	0.992 (0.901 to 1.093)	0.8778
Preoperative hematocrit, per %	1.022 (0.971 to 1.075)	0.4029
Days to surgery, per day	0.930 (0.817 to 1.060)	0.2793
Anesthesia, general vs. regional	1.186 (0.721 to 1.951)	0.5023
RBC transfusion, per unit	1.195 (1.008 to 1.416)	0.0404
ICU	0.978 (0.878 to 1.090)	0.6910
Length of stay, per day	1.117 (1.028 to 1.213)	0.0088
Arthroplasty with cement vs nail	3.432 (1.766 to 6.670)	0.0003
Arthroplasty cement-less vs nail	1.778 (0.629 to 5.021)	0.2775
Plate/screw vs nail	2.114 (1.081 to 4.132)	0.0278

OR, odds ratio; CI, confidence interval; RBC, red blood cell; ICU, Intensive Care Unit.

* Preoperative cognitive impairment was diagnosed if the participant had no delirium according to the CAM and a MMSE score less than 24 or a clinical diagnosis of dementia from a geriatrician during the preoperative evaluation.