

Incidence of and Risk Factors for Delirium After Cardiac Surgery at a Quaternary Care Center: A Retrospective Cohort Study

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Objective: Delirium after cardiac surgery is associated with persistent cognitive deficits and increased mortality. The authors' objective was to determine the incidence of and risk factors for delirium in a mixed cohort of patients undergoing on-pump and off-pump cardiac surgery and transcatheter aortic valve implantations (TAVI) in a Canadian quaternary care center. This study followed a pilot from the same center on patients treated in 2007.

Design: A retrospective cohort study.

Setting: A quaternary care center in Vancouver, B.C., Canada.

Participants: Patients undergoing cardiopulmonary bypass grafts (CABG), conventional valve replacements, combined CABG-valve replacements, transfemoral TAVI, or transapical TAVI in 2008.

Interventions: Data from 679 charts on demographics, medical history, medications, laboratory results, surgical procedure, and anesthesia were abstracted and analyzed using univariate and multivariate analyses. Nurses screened for delirium using the Confusion Assessment Method, and

the final diagnoses were made clinically by physicians. Risk factors were identified using logistic regression and bootstrapping.

Measurements and Main Results: Delirium occurred in 28% of patients. Delirium was most common in transapical TAVI (47%), and least common in transfemoral TAVI (17%). Delirious patients were older and had greater preoperative cardiac and neurologic burdens than nondelirious patients. Age ≥ 64 years, history of delirium, history of stroke/transient ischemic attack, cognitive impairment, depression, and preoperative use of beta-blocker(s) were associated independently with delirium.

Conclusions: The incidence of delirium varied greatly with the type of procedure. The authors' logistic regression model showed that age and certain pre-existing neurologic conditions could predict delirium after cardiac surgery.

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KEY WORDS: delirium, cardiac surgery, incidence, risk factor

POSTOPERATIVE DELIRIUM is a common sequela of cardiac surgery. It is characterized by acute and fluctuating disturbances in attention, awareness, and cognition.¹ Postoperative delirium usually is transient and can resolve spontaneously; most iatrogenic cases are treated by environmental modification and/or pharmacologic management.² Importantly, delirium after cardiac surgery has been associated with a number of serious long-term neurologic and functional impairments, including cognitive decline,^{3,4} mortality,^{3,5,6} and need for long-term care.⁷ Identifying risk factors for postoperative delirium in cardiac surgery patients is therefore a priority, and a number of these already have been described in the literature.⁸ A systematic review by Koster et al⁹ identified atrial fibrillation, cognitive impairment, depression, history of stroke, older age, and peripheral vascular disease as the most established predisposing risk factors for delirium after cardiac surgery. Identified precipitating factors included the method of sedation,^{10,11} intraoperative ketamine and fentanyl administration,¹² intraoperative volume load, and ventilator time in the intensive care unit.¹³

Postoperative delirium typically affects approximately one-third of cardiac surgery patients, although estimates have ranged from 0% to 73.5%.¹⁴ This large discrepancy in the reported incidence likely reflects, at least in part, differences in the screening and diagnosis of delirium. In a retrospective pilot study¹⁵ from a quaternary cardiac care facility in Vancouver, B.C., Canada, the authors reported that 29% of patients undergoing elective cardiac surgery developed postoperative delirium. This pilot study¹⁵ was conducted to determine the incidence of delirium in a small cohort of 28 patients receiving coronary artery bypass grafts (CABG), valve replacements, and combined CABG and valve replacement procedures.

It has been observed, however, that the incidence of postoperative delirium differed significantly according to the

type of surgery. Valvular procedures, such as aortic valve replacement, as well as combined procedures performed on cardiopulmonary bypass (CPB), have demonstrated higher rates of delirium than CABG alone or procedures performed off-pump.^{16–18} The advent of recent percutaneous transcatheter aortic valve implantation (TAVI) surgical procedures,¹⁹ including those performed at the authors' center (which has helped to pioneer the use of these procedures^{20–22}) provided the opportunity to study comparative delirium rates in aortic valve replacement patients who did not undergo CPB. In an important study published in 2010, the Placement of Aortic Transcatheter Valves (PARTNER) trial, TAVI produced superior outcomes compared to standard therapy with regard to 1-year survival and rehospitalization in patients who received these procedures because they were not surgical candidates.²³ This trial, though, did not investigate the incidence of postoperative delirium associated with these procedures. The authors recently have described the incidence of delirium in transfemoral (TF) versus transapical (TA) TAVI patients.²⁴ However, this study did not include data from on-pump patients; hence, inferences from a direct comparison of the

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incidence of postoperative delirium among the considerable numbers of on-pump versus TAVI procedures at the same clinical site were not possible.

The authors' primary objective for the present study therefore was to determine the incidence of and risk factors for delirium in a mixed cohort of patients undergoing cardiac surgery and TAVI in a Canadian quaternary care center, expanding their analysis from their previous pilot study¹⁵ and subsequent dedicated TAVI report²⁴ by assessing delirium in both on-pump and off-pump procedures. Second, the authors sought to analyze the results from this substantially larger cohort of cardiac surgery patients to identify key risk factors that can predict postoperative delirium in cardiac surgery patients undergoing a range of different surgical procedures, including TAVI.

METHODS

The Institutional Research Ethics Board's approval was obtained, and the requirement for informed consent was waived. A retrospective chart review was performed on consecutive patients undergoing cardiac surgery at St. Paul's Hospital in Vancouver, B.C., Canada, between January 1, 2008 and December 31, 2008. Inclusion criteria included patients undergoing any of the following procedures: CABG, conventional valve replacements, combined CABG plus conventional valve replacements (combined), TF-TAVI, or TA-TAVI. In both TAVI procedures, a balloon-expandable bioprosthetic aortic valve is implanted in the native diseased valve by way of a catheter. In the TF-TAVI technique, the catheter is inserted in a retrograde direction via the femoral artery, whereas a mini-thoracotomy is performed in the TA-TAVI technique to allow for anterograde insertion. For more information on TF-TAVI,

the authors refer the reader to Leon et al.²³ Exclusion criteria included heart transplant procedures and patients who died during or within 24 hours of surgery; reoperations were included in the analysis.

Information on demographics, medical history, preoperative medications, cardiac surgery details, anesthetic drug doses, postoperative care, pharmacologic management, and laboratory investigation results were abstracted from medical charts by 4 abstractors. The observed agreement among raters was 0.96. Medical chart data were accessed on Sunrise Clinical Manager (Eclipsys Corp., Boca Raton, FL).

The primary outcome was postoperative delirium as diagnosed by an attending physician. This physician was either the attending anesthesiologist in the cardiac surgery intensive care unit or the psychiatrist from the consult liaison service. Nurses in the cardiac surgery intensive care unit and on the cardiac surgery wards screened patients for symptoms of delirium using the Confusion Assessment Method, which requires that a patient's mental status demonstrates an acute onset and fluctuating course, inattention, and cognitive disturbances and/or altered level of consciousness. Physicians' diagnoses were clinical diagnoses, and most assessments were made based on DSM-IV-TR criteria. Data abstractors recorded the diagnosis of delirium as a dichotomous variable based on review of the discharge summary, interdisciplinary notes, and physicians' notes.

Group differences between patients who developed delirium and those who did not were analyzed in SPSS version 22 (SPSS Inc., IBM Corp., Armonk, NY). Categorical variables were analyzed using Pearson chi-square statistics, while continuous variables were analyzed with independent samples *t* tests (these results are reported as mean [standard deviation]). Missing data for these variables were excluded from analyses.

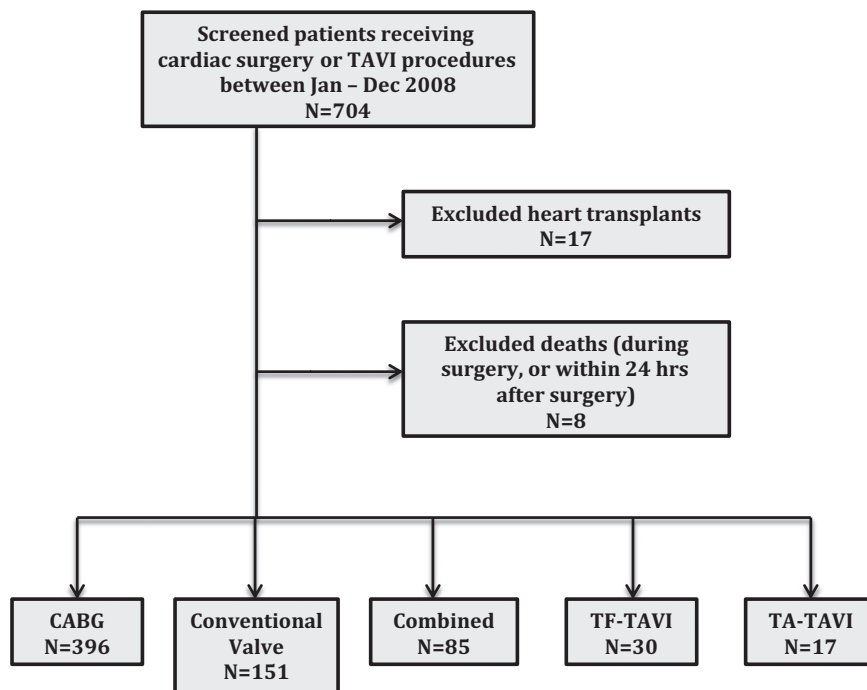


Fig 1. Flow diagram of sample selection.

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