Effect of motor subtypes of delirium in the intensive care unit on fast-track failure after cardiac surgery

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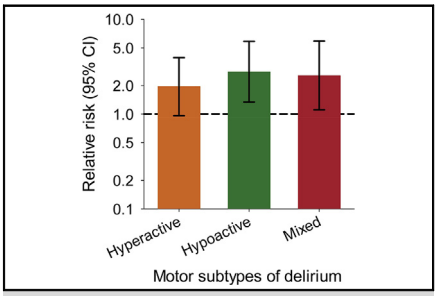
ABSTRACT

Objective: The purpose of the study was to evaluate the association between motor subtypes of postoperative delirium in the intensive care unit and fast-track failure (a composite outcome of prolonged stay in the intensive care unit >48 hours, intensive care unit readmission, and 30-day mortality) after cardiac surgery.

Methods: This was a secondary analysis of a prospective cohort study of 600 consecutive adults undergoing cardiac surgery at a university hospital in Hong Kong (July 2013 to July 2015). The motor subtypes of delirium were classified using the Richmond Agitation Sedation Score and Confusion Assessment Method intensive care unit assessments performed by trained bedside nurses. A generalized estimating equation was used to estimate a common relative risk of fast-track failure associated with motor subtypes.

Results: The incidences of hypoactive, hyperactive, and mixed motor subtypes were 4.3% (n = 26), 4.0% (n = 24), and 5.5% (n = 33), respectively. Fast-track failure occurred in 88 patients (14.7%). There was an association between delirium (all subtypes) and fast-track failure ($P = .048$); hyperactive delirium (relative risk, 1.95; 95% confidence interval, 0.96-3.94); hypoactive delirium (relative risk, 2.79; 95% confidence interval, 1.34-5.84); and mixed delirium (relative risk, 2.55; 95% confidence interval, 1.11-5.88). Hypoactive and mixed subtypes were associated with prolonged intensive care unit stay (both $P = .001$).

Conclusions: Patients with pure hypoactive delirium had a similar risk of developing fast-track failure as other motor subtypes. Differentiation of motor subtypes is unlikely to be clinically important for prognostication of fast-track failure. However, because delirium is associated with poor outcomes, potential treatment strategies should address all subtypes equally. (J Thorac Cardiovasc Surg 2017;■:1-8)



Effect of hyperactive, hypoactive, and mixed ICU delirium on FTF.

Central Message

Compared with patients without delirium, motor subtypes were more likely to fail fast-track cardiac surgery, with the main contributing factor being a prolonged length of stay in ICU.

Perspective

We assessed the association between postoperative motor subtypes of ICU delirium and FTF, a composite outcome of prolonged length of stay in ICU, readmission to ICU, and 30-day mortality. Differentiation of motor subtypes is unlikely to be of clinical importance for prognostication in early recovery after cardiac surgery, but treatment strategies should address individual subtypes equally.

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Fast-track cardiac surgery is a complex intervention involving components of standardized perioperative care, with the ultimate aim of early tracheal extubation after cardiac surgery to reduce length of stay in the intensive care unit (ICU) and the hospital.[1,2] Fast-track failure (FTF) after cardiac surgery varies widely from 11%[3] to 51%[4] depending on the definition used, type of cardiac surgery, and age of the patient population studied. In patients after cardiac surgery, FTF is a validated meaningful

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Abbreviations and Acronyms

AUROC = area under the receiver operating characteristic curve
CABG = coronary artery bypass grafting
CAM = Confusion Assessment Method
CAM-ICU = CAM for the intensive care unit
FTF = fast-track failure
GEE = generalized estimating equation
ICU = intensive care unit
IQR = interquartile range
RASS = Richmond Agitation and Sedation Scale
RR = relative risk

composite end point.[4] It incorporates end points that directly and indirectly measure resource use (length of ICU stay), unexpected serious morbidity (readmission to ICU), and meaningful mortality (30-day). Several published risk prediction models for FTF are available, but none include delirium as a candidate predictor.[4-7]

Delirium is a leading postoperative complication and has greater reported effects on adverse outcomes than other major postoperative complications (population attributable risk of 6%, 95% confidence interval [CI], 5-7).[8] In cardiac surgery, the overall incidence of postoperative delirium ranges from 12% to 56%.[9-14] Patients who develop delirium after cardiac surgery have longer stays in the ICU, higher hospital charges, reduced cognitive and functional recovery, and an increased risk of mortality.[12-14]

It has been suggested that the 3 motor subtypes of postoperative delirium (hyperactive, hypoactive, and mixed) may have differences in underlying pathophysiology, adverse outcomes profile, and prognosis, and may require different pharmacologic management.[15-17] In a mixed group of surgical patients, those with hypoactive delirium were older and had a higher risk of 6-month mortality than those with mixed delirium (32% vs 9%, $P = .04$).[16] Previous studies of motor subtypes of delirium after cardiac surgery suggest that hypoactive delirium is associated with longer duration of mechanical ventilation and length of stay in ICU.[17,18] However, neither study adequately adjusted for potential confounding bias and mediating effects, or assessed the response to treatment of different subtypes. By understanding the differences in the effect of motor subtypes of delirium on FTF, the underlying predisposing and precipitating factors may be highlighted, a more informative prognosis can be made, and appropriate management strategies considered and tested to potentially achieve positive treatment responses.

The primary objective of this study was to determine the association between motor subtypes of postoperative delirium and FTF after cardiac surgery. A secondary objective was to describe the distribution of delirium subtypes over different sedation levels. We tested the hypothesis that hypoactive delirium was most strongly associated with FTF after cardiac surgery because it is associated with worse prognosis and more adverse events compared with other motor subtypes.[16-18]

MATERIALS AND METHODS

Study Participants

This was a planned secondary analysis of data from a prospective cohort study designed to externally validate and assess the performance of published validated risk prediction models of delirium after cardiac surgery.[19] The Clinical Research Ethics Committee reviewed and approved the research protocol for the cohort study conducted from July 2013 and July 2015 (CRE-2012.564). All patients gave their written informed consent and were followed up to 30 days after surgery. We recruited 600 consecutive patients undergoing urgent and elective cardiac surgery at The Prince of Wales Hospital in Hong Kong, a 1650-bed university hospital. We excluded patients if they had a sustained Richmond Agitation and Sedation Scale (RASS) score[20] of −4 or −5 throughout the ICU admission, had major auditory or visual disorders, had mental disabilities, had no CAM-ICU assessment recorded, or were unable to understand Chinese or English.[19] All patients received standardized perioperative care under existing protocols for anesthesia, surgery, postoperative ICU sedation, analgesia, and weaning from mechanical ventilation. The intraoperative propofol infusion was continued to facilitate transport to the ICU from the operating room and was stopped in the ICU within 3 hours after admission.

Exposure

We used the Confusion Assessment Method (CAM)-ICU screening tool for detecting delirium.[21] Trained bedside nurses routinely performed CAM-ICU assessments 3 times per day (once per 8-hour shift) until the patient's discharge from the ICU or up to 7 days during their stay in the ICU, whichever was shorter. Although haloperidol, dexmedetomidine, and quetiapine were prescribed at the discretion of the attending specialist intensivist for the treatment of delirium, all delirium episodes were detected by a positive CAM-ICU tool result.

Motor subtypes of postoperative delirium were classified for CAM-ICU positive results using the corresponding RASS score.[20] When RASS was scored −5 or −4, we did not perform CAM-ICU delirium screenings.[20] Hypoactive delirium was defined if the RASS score was from −3 to 0, hyperactive if the RASS score was from +1 to +4, and mixed-type delirium if both hypoactive and hyperactive delirium episodes were present during the observation period.[22] To reflect the intensity and duration of motor subtypes, we estimated the cumulative delirium severity index[23] from the CAM-ICU and RASS score assessments recorded in the patient's medical records. The number of delirium exposure days and delirium events was calculated for each patient using the methodology described recently.[24]

Primary Outcome

The primary outcome was FTF. This is a meaningful patient-centered, objective composite outcome composed of prolonged stay in the ICU more than 48 hours, ICU readmission, and 30-day mortality after cardiac surgery.[3,25] The outcome data were extracted from the Hospital Authority Clinical Management System electronic database.

Other Study Variables

We collected age, gender, American Society of Anesthesiologists' Physical Status, logistic European System for Cardiac Operative Risk