The impact of frailty on postoperative delirium in cardiac surgery patients

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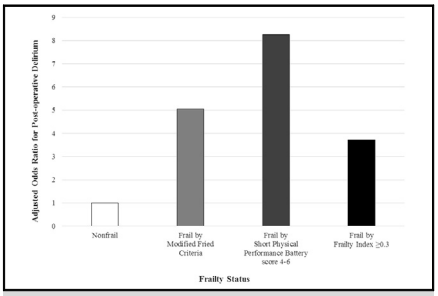
ABSTRACT

Objective: To determine if adding frailty measures to the EuroSCORE II improves model performance in predicting postoperative delirium.

Methods: In a prospective observational study in elective cardiac surgery patients, frailty was defined using the Modified Fried Criteria (MFC), the Short Physical Performance Battery (SPPB) and a 35-item Frailty Index (FI). The primary outcome was postoperative delirium, assessed using the Confusion Assessment Method (CAM).

Results: Seventy-two (54.1%) of the 133 participants met the MFC definition for frailty and 69 (51.9%) met the SPPB definition. Eighty-eight (66.2%) participants had an FI score ≥0.2, and 47 (35.3%) had a score ≥0.3. After adjusting for the EuroSCORE II, frail patients as identified by the MFC were at increased risk of postoperative delirium (adjusted odds ratio [OR], 5.05, 95% confidence interval [CI], 1.58-16.13). Patients in the "high risk frailty" SPPB category had even greater risk (adjusted OR, 8.26, 95% CI, 2.23-30.64). FI scores ≥0.3 were also associated with higher risk of delirium (adjusted OR, 3.72, 95% CI, 1.39-9.92). The inclusion of any of these definitions of frailty improved the discrimination of the EuroSCORE II in predicting postoperative delirium.

Conclusions: Frailty results in a 3- to 8-fold increase in risk of postoperative delirium, independent of the EuroSCORE II. "Frail" and "fit" may be considered 2 ends of a continuum, and the risk of postoperative delirium grows as one becomes increasingly frail. The addition of frailty improves the ability of the EuroSCORE II to predict postoperative delirium, pointing to opportunities for improved prevention and management. (J Thorac Cardiovasc Surg 2015;149:869-75)



Frail individuals are at increased risk of postoperative delirium after cardiac surgery.

Central Message

The link between frailty and delirium after cardiac surgery has not been well elucidated. We conclude that frailty results in a 3- to 8-fold increase in risk of postoperative delirium, independent of the EuroSCORE II. Further, inclusion of frailty improves the discrimination of the EuroSCORE II in predicting postoperative delirium.

Author Perspective

The increased risk of postoperative delirium associated with frailty shows the importance of assessing for frailty in cardiac surgery patients. Given the association of the occurrence of postoperative delirium with morbidity and mortality, the ability to better predict for its occurrence, by incorporating frailty into the EuroSCORE II, is promising. Future studies should seek out accurate yet easily implementable methods of identifying frail individuals who are at higher risk of postoperative delirium. Strategies to reduce frailty, thereby potentially reducing an individual's risk of postoperative delirium, may also be pursued.

See Editorial Commentary pages 875-6.

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Department of Surgery, University of Manitoba; Cardiac Sciences Program, Winnipeg Regional Health Authority; Manitoba Health Research Council; Manitoba Medical Service Foundation; Canadian Institutes of Health Research (grant #KPE-12681). There are no conflicts of interest to report.

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Received for publication Aug 5, 2014; revisions received Oct 3, 2014; accepted for publication Oct 29, 2014; available ahead of print Dec 16, 2014.

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0022-5223/$36.00

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http://dx.doi.org/10.1016/j.jtcvs.2014.10.118

Supplemental material is available online.

Delirium, defined as an acute fluctuating disorder of attention and cognition, is the most common neurologic complication following cardiac surgery.[1] Most current estimates place the incidence of postoperative delirium at 1 in 5 cardiac surgery patients.[2,3] As more than 600,000 cardiac surgery procedures are performed in the United States annually, nearly 120,000 cases of postoperative delirium may be expected. In addition to its high incidence, postoperative delirium is associated with negative outcomes that include

Abbreviations and Acronyms

5-GDS	= 5-item Geriatric Depression Scale
ADLs	= activities of daily living
AUC	= area under the receiver operating characteristic curve
BMI	= body mass index
CABG	= coronary artery bypass graft
CAM	= Confusion Assessment Method
CAM-ICU	= Confusion Assessment Method for the Intensive Care Unit
CES-D scale	= Center for Epidemiologic Studies Depression scale
CHF	= congestive heart failure
CI	= confidence interval
COPD	= chronic obstructive pulmonary disease
CPAC	= Cardiac Preoperative Assessment Clinic
CPB	= cardiopulmonary bypass
CRF	= case report form
CVD	= cerebrovascular disease
EuroSCORE II	= European System for Cardiac Operative Risk Evaluation II
FI	= 35-item Frailty Index
GI	= gastrointestinal
HbA1c	= glycosylated hemoglobin
HRQoL	= health-related quality of life
ICU	= intensive care unit
IDI	= integrated discrimination improvement index
LOS	= length of stay
MFC	= Modified Fried Criteria
MI	= myocardial infarction
MMSE	= Mini Mental Status Examination
MoCA	= Montreal Cognitive Assessment
NRI	= net reclassification index
OR	= odds ratio
PVD	= peripheral vascular disease
RASS	= Richmond Agitation-Sedation Scale
REB	= Research Ethics Board
ROC	= receiver operating characteristic
RRC	= Research Review Committee
SPPB	= Short Physical Performance Battery

prolonged hospitalization, increased rates of institutional discharge, persistent functional and cognitive deficits, and increased 30-day and 5-year mortality.[4-6] The resultant costs to the system are substantial.[7]

Frailty is an increasingly recognized concept in cardiac surgery. It is defined as a state of decreased physiologic reserves due to multisystem decline, which leaves patients in a state of increased vulnerability.[4,8,9] Frailty has been shown to be associated with multiple negative outcomes, including cognitive decline, falls, fractures, and progressive disability in activities of daily living.[4,10] Frailty is a risk factor for postoperative complications of cardiac surgery such as in-hospital mortality, institutional discharge, and reduced mid-term survival.[11-13] However, frailty measures have yet to be incorporated into standard preoperative risk prediction models such as the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II).[14]

The interaction between frailty and delirium has not been satisfactorily explored. Frailty generally is viewed as a chronic condition, whereas delirium is thought to be the result of an acute stressor on a "vulnerable" brain. Each results in significant negative health outcomes and share several risk factors. It has been postulated that frailty and delirium may be different manifestations of a shared inability to compensate for stress.[6] We hypothesized that the presence of frailty is associated with an increased occurrence of postoperative delirium. Our primary objective therefore was to determine if an association existed between objective measures of frailty and the occurrence of postoperative delirium using a systematic screening tool in the cardiac surgery patient. Second, we were interested in understanding if the incorporation of an objective frailty assessment to the EuroSCORE II would improve the discrimination of the model with respect to predicting postoperative delirium.

MATERIALS AND METHODS

Study Population

The study was carried out at St Boniface Hospital, a tertiary care center in Winnipeg, Canada, with a patient capture area of approximately 1.1 million people. The study was approved by the University of Manitoba Research Ethics Board (REB) and the St Boniface Hospital Research Review Committee (RRC). Consecutively, consenting patients were recruited from July 2012 to June 2013. Patients over the age of 18 and undergoing elective coronary artery bypass graft and/or valve procedures were eligible to participate. Patients in whom postoperative delirium could not be reliably assessed were excluded (eg, due to previous stroke, cerebral palsy, severe dementia, severe hearing disabilities, inability to understand English).

Measurements and Outcomes

Study participants underwent detailed frailty assessment that included 4 physical tasks and 5 questionnaires. The physical tasks were (1) a 5-m gait speed measurement[15]; (2) a handgrip strength measurement[4]; (3) the side-by-side, semi-tandem and tandem stand balance tests[16]; and (4) the repeated chair stand test.[16] The questionnaires were (1) self-reported weight loss,[4] (2) the modified 2-item Center for Epidemiologic Studies Depression (CES-D) Scale,[17] (3) the 5-item Geriatric Depression Scale (5-GDS),[18,19] (4) the Paffenbarger Physical Activity Index,[20] and (5) the Montreal Cognitive Assessment (MoCA).[21]

The primary exposure variable was frailty. Three definitions of frailty were used: the Modified Fried Criteria (MFC) (Appendix E1), the Short Physical Performance Battery (SPPB) (Appendix E2), and a 35-item Frailty Index (FI) (Appendix E3). Under the Modified Fried definition, a patient was deemed "frail" if he/she met ≥3 of the following 7 criteria: slowness (as determined by the 5-m gait speed measurement), weakness (handgrip strength measurement), weight loss (self-reported weight loss),

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