

Prolonged Cognitive Impairment After Delirium Among Patients Who Had Cardiac Surgery

Sacynski JS, Marcantonio ER, Quach L, et al. Cognitive trajectories after postoperative delirium. *N Engl J Med* 2012;367:30–9.

Study Overview

Objective. To examine the 12-month trajectories of cognitive and functional abilities among patients who underwent cardiac surgery.

Design. Prospective observational cohort study.

Setting and participants. Patients were eligible for the study if they were 60 years or older and planning to undergo coronary artery bypass grafting (CABG) or valve replacement at 1 of 3 hospitals in the Boston area. Among 461 eligible patients, 200 patients declined to participate and 26 were not enrolled for other reasons, yielding a sample of 235 patients. Ten patients were excluded because they had no follow-up data or no cognitive assessment after surgery. The final sample was 225 patients, with an average age of 73 years (standard deviation 6.7); 96% were white and 51% had a college education or higher.

Main outcome measure. Cognitive function during the first year following cardiac surgery. Cognitive function was assessed daily during hospitalization and at 1, 6, and 12 months after surgery using the Mini-Mental State Exam

(MMSE). The MMSE is a validated scale for the measurement of cognition with a score range of 0 to 30, with higher scores indicating better performance. Other measures at follow-up included functional status assessed using the Katz Index of Independence in Activities of Daily Living, which ranks adequacy of performance in 6 functions: bathing, dressing, toileting, transferring, continence, and feeding.

Delirium was assessed using the Confusion Assessment Method (CAM), a diagnostic algorithm that uses a 4-item screen (acute change with a fluctuating course, inattention, disorganized thinking and altered level of consciousness). Delirium was measured daily while the patient was in the hospital postoperatively. The duration of delirium was calculated in number of days when delirium was present.

Statistical analysis included a hierarchical linear regression model to characterize the trajectory of MMSE scores over time, in the entire cohort and stratified by delirium status. The effect of duration of delirium was also examined in this model.

Main results. 78% of patients underwent CABG only, whereas 22% had valve surgery with or without CABG.

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Among the 225 patients, 103 developed postoperative delirium (46%). Delirium lasted 1 to 2 days in 65% of these patients, and 35% had 3 or more days of delirium. Those who had delirium were older, less educated, more likely to be women, less likely to be white, and had more comorbid conditions and preoperative cognitive function.

Among all patients, there was a decline of 4.6 points in MMSE scores from baseline to postoperative day 2, with subsequent recovery of 1 point per day from days 3 to 5. The rate of recovery slowed from days 6 to 183 with no further improvement from day 184 onwards.

Patients who developed delirium had a greater decline in MMSE scores postoperatively than those who did not have delirium (7.2-point decline vs. 2.1-point decline, $P < 0.001$). For recovery of cognitive function, those with delirium had a more rapid rate of recovery than those who did not have delirium from 3 to 5 days but the same rate from 6 to 30 days. From days 31 to 183, patients who had delirium had continued recovery whereas those who did not have delirium had stable cognitive function. The mean MMSE scores at 6 months and 12 months did not differ by whether patients developed delirium ($P = 0.06$). For level of function, those who had delirium were more likely to not have returned to preoperative level of function than those without delirium at 6 months (40% and 24% respectively, $P = 0.01$), but not significantly different at 12 months (31% and 20% respectively, $P = 0.06$). For duration of delirium, a longer duration of postoperative delirium (at or more than 3 days) was associated with a greater drop in MMSE scores postoperatively and a slower recovery afterwards when compared to patients with shorter duration of delirium.

Conclusions. Cardiac surgery was associated with initial cognitive decline followed by recovery after surgery. Patients with delirium had more decline during the initial postoperative period followed by a prolonged period of recovery. Those with delirium postoperatively also were less likely to recover their baseline level of function by 6 months.

Commentary

Postoperative delirium is a common complication after cardiac surgical procedures and is generally considered to be an acute, transient condition. However, emerging evidence suggests that delirium may have long-term functional and cognitive consequences. The current study,

which examined the cognitive and functional trajectories in cardiac surgery patients, found that although all patients may develop cognitive decline immediately postoperatively, those with delirium had more decline in cognition that was followed by a more prolonged course to recovery. This finding suggests that reducing the incidence of delirium in this population might promote faster recovery in cognitive and functional status after surgery.

Studies in non-cardiac surgery patients have found that multicomponent interventions are effective in preventing delirium. Among hospitalized older medical patients, Inouye et al found that an intervention consisting of cognitive orientation, early mobilization, volume repletion, sleep protocol to promote sufficient sleep, and hearing and vision protocols led to a 40% reduction in delirium incidence [1]. For patients with hip fracture, a randomized controlled trial found that proactive daily geriatric consultation using targeted recommendations such as fluid and electrolyte balance, pain management, elimination of unnecessary medications, early removal of urinary catheters, transfusion management, and early mobilization reduced delirium episodes by one third [2]. These interventions may benefit patients who undergo cardiac surgery as well, but further studies are needed to examine the potential effects of delirium prevention strategies in this population.

In addition, investigating the potential mechanisms of delirium in this population may point to which interventions may be most beneficial. Specifically, cardiac surgery may cause microvascular changes in the brain, which may be a potential mechanism for cognitive change [3]. New techniques in improving microvascular reperfusion such as minimal extracorporeal circulation may need to be considered as a part of multicomponent delirium prevention programs for cardiac surgery patients [4,5].

Applications for Clinical Practice

This study elucidated the cognitive trajectories for patients who undergo cardiac surgery, finding that delirium may have long-term effects and require a prolonged recovery period. Clinicians need to be aware of the potential cognitive and functional consequences of cardiac surgery and the long recovery period, as it may necessitate extending rehabilitation services to assist patients in performing the activities of daily living. Identifying patients at risk for delirium prior to surgery and implementing effective interventions may

attenuate the adverse consequences of delirium in this population. Future studies should shed light on that question.

—*William Hung, MD, MPH*

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