



Literature Reviews

Cognitive and cardiac outcomes 5 years after off-pump vs on-pump coronary artery bypass graft surgery.

van Dijk D, Spoor M, Hijman R, Nathoe HM, Borst C, Jansen EW, Grobbee DE, de Jaegere PP, Kalkman CJ; Octopus Study Group. JAMA. 2007 Feb 21;297(7):701-8

Reviewer

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Background and objectives

Conventional coronary artery bypass graft surgery with use of cardiopulmonary bypass (on-pump CABG) is associated with excellent long-term cardiac outcomes but also with a high incidence of cognitive decline. The effect of avoiding cardiopulmonary bypass (off-pump CABG) on long-term cognitive and cardiac outcomes is unknown. To compare the effect of off-pump CABG and on-pump CABG surgery on long-term cognitive and cardiac outcomes.

Methods: The Octopus Study, a multicenter randomized controlled trial conducted in the Netherlands, which enrolled 281 low-risk CABG patients between 1998 and 2000. Five years after their surgery, surviving patients were invited for a follow-up assessment. **INTERVENTION:** Patients were randomly assigned to receive either off-pump (n = 142) or on-pump (n = 139) CABG surgery. The primary measure was cognitive status 5 years after surgery, which was determined by a psychologist blinded to treatment allocation who administered 10 standardized validated neuropsychological tests. Secondary measures were occurrence of cardiovascular events (all-cause mortality, stroke, myocardial infarction, and coronary reintervention), anginal status, and quality of life.

Results: After 5 years, 130 patients were alive in each group. Cognitive outcomes could be determined in 123 and 117 patients in the off-pump and on-pump groups, respectively. When using a standard definition of cognitive decline (20% decline in performance in 20% of the neuropsychological test variables), 62 (50.4%) of 123 in the off-pump group and 59 (50.4%) of 117 in the on-pump group had cognitive decline (absolute difference, 0%; 95% confidence interval [CI], -12.7% to 12.6%; $P > .99$). When a more conservative definition of cognitive decline was used, 41 (33.3%) in the off-pump group and 41 (35.0%) in the on-pump group had cognitive decline (absolute difference, -1.7%; 95% CI, -13.7% to 10.3%; $P = .79$). Thirty off-pump patients (21.1%) and 25 on-pump patients (18.0%) experienced a cardiovascular event (absolute difference, 3.1%; 95% CI, -6.1% to 12.4%; $P = .55$). No differences were observed in anginal status or quality of life.

Conclusion: In low-risk patients undergoing CABG surgery, avoiding the use of cardiopulmonary bypass had no effect on 5-year cognitive or cardiac outcomes.

Comments

Coronary-artery bypass grafting (CABG) performed with cardiopulmonary bypass and cardiac arrest (“on pump”) provides a motionless, bloodless surgical field, allowing optimal conditions for the construction of coronary anastomoses and has become a well-established treatment modality for patient with coronary artery disease. However, the systematic inflammatory reaction initiated by cardiopulmonary bypass (CPB) circuit has been implied for impairing neurological and cognitive functions.

In this study, the authors conducted the first large randomized trial reporting long-term cognitive outcomes after off-pump vs on-pump CABG surgery. They found that half of their patients had cognitive decline after both surgical strategies. The study was unable to demonstrate any benefit from avoiding cardiopulmonary bypass on long-term cognitive outcomes. Concurrently, there were no differences in cardiovascular event rate, angina, and quality of life.

To date, no adequately powered randomized study has demonstrated a benefit of off-pump surgery on cognitive outcome. Although the authors found a trend toward better cognitive outcome 3 months after surgery, this difference disappeared at 12 months and now appears to remain absent at 5 years. This is remarkable because several studies have demonstrated that off-pump CABG surgery is associated with less cerebral embolization than on-pump CABG surgery.

The present results suggest that factors other than cardiopulmonary bypass may be responsible for cognitive decline, such as anesthesia and the generalized inflammatory response that is associated with major surgical procedures. It is also possible that the cognitive decline observed at 5-year follow-up is not caused by the operation but reflects natural aging. Two trials comparing patients undergoing CABG surgery or angioplasty failed to show a difference in postprocedural cognitive decline. These trials underscore the possibility that patient characteristics might be more relevant than the type of intervention for risk of developing cognitive decline. The authors concluded that in low-risk patients undergoing CABG surgery, avoiding the use of cardiopulmonary bypass had no effect on cognitive or cardiac outcome 5 years after the procedure.