



## Stroke after Coronary Artery Bypass Grafting: Where do we Stand?

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### Abstract

Stroke is a devastating complication of coronary artery bypass grafting (CABG), because its consequences are decreased quality of life and excess mortality. Although several authors have studied potential predictors of stroke after CABG, there is no definitive answer regarding the etiology and the risk factors related to this complication. The main reason is that postoperative stroke after CABG seems to have a multifactorial etiology. Preoperative screening and intraoperative measures that ensure adequate cerebral perfusion, minimize embolization and improve systemic inflammatory response and hemodynamic performance appear mandatory in these patients. Future efforts will be necessary to strongly validate surrogate markers of early neurologic damage to predict neuropsychological dysfunction after cardiac surgery. Knowledge of those patients at the highest risk of stroke after CABG could help to determine the most appropriate preoperative evaluation, adopt therapeutic measures to reduce postoperative stroke rate and improve postoperative management.

### Editorial

Stroke is a devastating complication of coronary artery bypass grafting (CABG), because its consequences are decreased quality of life and excess mortality [1]. Moreover, the number of elderly patients requiring cardiac surgery is raising: they often present comorbid diseases and thus they represent a category of patients at high-risk of cerebrovascular disease accident after CABG. Although several authors have studied potential predictors of stroke after CABG, there is no definitive answer regarding the etiology and the risk factors related to this complication [2-4].

Recently we reported and studied the incidence of early neurological complications after heart surgery at our institution, in order to identify preoperative and procedural risk factors for these complications and to assess their influence on postoperative outcome [5]. Early cerebral complications occurred in 9.85% of patients, and 1.1% had permanent cerebral deficits. Risk factors for early neurological complications were older age, chronic obstructive pulmonary disease, open cardiac chambers procedures, higher end-cardiopulmonary bypass lactate levels, blood transfusion, and the use of insulin in ICU. The results of this study suggest a relationship between metabolic and technical aspects of cardiopulmonary bypass management and early occurrence of neurological injury, but no relationship between stroke and CABG was found.

It is noteworthy that atherosclerosis of the ascending aorta has some evidence of association with stroke after CABG. As a consequence, new surgical techniques have been introduced to eliminate the risk of atheroembolism related to aorta manipulation and cross-clamping, such as off-pump, or minimal extracorporeal circulation CABG [6]. In fact, some authors suggested that high-risk patients, such as patients with severe atherosclerotic aorta or peripheral arterial disease, show a significant reduction in stroke rate after off-pump CABG [7]. On the other hand, a number of randomized studies comparing off-pump CABG with on-pump CABG procedures have not confirmed an advantage with off-pump CABG regarding stroke [8-10].

We recently published a study comparing 5-year rates of overall death, cardiac related death, myocardial infarction, repeat revascularization, stroke, and new occurrence of postoperative renal failure in a large cohort of patients with coronary disease, treated with on-pump or off-pump CABG. Interestingly, we found no differences between strategies in terms of stroke in the follow-up. Moreover our results, like those obtained from other large scale clinical trials, confirmed that the benefits of avoiding extracorporeal circulation with off-pump CABG are lost at long-term follow-up [11].

Advanced age, prior cerebrovascular disease/stroke, peripheral vascular disease are also

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predictors of stroke following other cardiac surgery procedures (e.g. transcatheter aortic valve implantation), [12]. These risk factors probably increase susceptibility to perioperative stroke because widespread cerebrovascular disease, cerebral inflammation, impaired cerebral blood flow, and atheroembolism or thromboembolism play a fundamental role in these high-risk patients [13]. Thus, the use of embolic protection devices may be of particular importance in patients with prolonged cardiopulmonary bypass.

Finally, the new onset of atrial fibrillation (AF) is a frequent complication of cardiac surgery [14]. A strong interaction has been observed between postoperative AF, low cardiac output syndrome and postoperative stroke [3]. The new onset of post-operative AF may be an early marker of subsequent postoperative stroke. There is a general agreement to recommend that preoperative beta blocker therapy must be continued through the perioperative period, and that amiodarone could be used in high-risk patients [15].

Postoperative stroke after CABG seems to have a multifactorial etiology. Preoperative screening and intraoperative measures that ensure adequate cerebral perfusion, minimize embolization and improve systemic inflammatory response and hemodynamic performance appear mandatory in these patients. Future efforts will be necessary to strongly validate surrogate markers of early neurologic damage to predict neuropsychological dysfunction after cardiac surgery. Knowledge of those patients at the highest risk of stroke after CABG could help to determine the most appropriate preoperative evaluation, adopt therapeutic measures to reduce postoperative stroke rate and improve postoperative management.

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