Influencing Factors for Early Acute Cerebrovascular Accidents in Patients with Stroke History following Off-pump Coronary Artery Bypass Grafting

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Purpose	To analyse risk factors for early acute cerebrovascular accidents following off-pump coronary artery bypass grafting (OPCAB) in patients with stroke history, and to propose preventive measures to reduce the incidence of these events.
Methods	A total of 468 patients with a history of stroke underwent OPCAB surgery in Beijing Anzhen Hospital of China from January 2010 to September 2012. They were retrospectively divided into two groups according to the occurrence of early acute cerebrovascular accidents within 48 hours following OPCAB. Multivariate logistic regression analysis was used to find risk or protective factors for early acute cerebrovascular accidents following the OPCAB.
Results	Fifty-two patients (11.1%) suffered from early acute cerebrovascular accidents in 468 patients, including 39 cases of cerebral infarction, two cases of cerebral haemorrhage, 11 cases of transient ischaemic attack (TIA). There were significant differences between the two groups in preoperative left ventricular ejection fraction $\leq 35\%$, severe bilateral carotid artery stenosis, poorly controlled hypertension, intraoperative application of Enclose® II proximal anastomotic device, postoperative acute myocardial infarction, atrial fibrillation, hypotension, ventilation time > 48 h, ICU duration >48 h and mortality. Multivariate logistic regression analysis showed that preoperative severe bilateral carotid stenosis (OR = 6.378, 95%CI: 2.278-20.987) and preoperative left ventricular ejection fraction $\leq 35\%$ (OR = 2.737, 95%CI: 1.267-6.389), postoperative acute myocardial infarction (OR = 3.644, 95%CI: 1.928-6.876), postoperative atrial fibrillation (OR = 3.104, 95%CI:1.135~8.016) and postoperative hypotension (OR = 4.173, 95%CI: 1.836~9.701) were independent risk factors for early acute cerebrovascular accidents in patients with a history of stroke following OPCAB procedures, while intraoperative application of Enclose® II proximal anastomotic device was protective factor (OR = 0.556, 95%CI: 0.337-0.925).
Conclusions	This study indicated that patients with severe bilateral carotid stenosis, the left ventricular ejection fraction $\leq 35\%$, the postoperative acute myocardial infarction, postoperative atrial fibrillation and postoperative hypotension were more likely to suffer from early acute cerebrovascular accidents when they received OPCAB. Application of Enclose® II proximal anastomotic device may decrease the incidence of early acute cerebrovascular accidents during OPCAB.
Keywords	Off-pump coronary artery bypass grafting • Complication • stroke • Early acute cerebrovascular accident • Risk factors • Protective factors

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Introduction

Stroke following coronary artery bypass grafting (CABG) is still a serious complication, and the incidence is approximately 2% to 5%. Although the incidence of postoperative stroke after cardiac surgery was reduced due to the application of non-pump coronary artery bypass surgery (OPCAB) in recent years, nervous system damage is still regarded as one of the most serious complications in the post-operative stage, especially for those patients with risk factors [1]. The incidence of cerebrovascular accidents in patients with risk factors was much higher than those patients without risk factors [2]. In patients having surgery on cardiopulmonary bypass, patients with preoperative stroke history were at high risk for postoperative cerebral vascular incidents. In these patients, cerebral vascular accidents (CVA) had a high incidence, high morbidity and high mortality, including cerebral infarction, cerebral haemorrhage, subarachnoid haemorrhage, and transient ischaemic attack. CVA not only extended the duration in the intensive care unit and hospital, but also increased the mortality rate due to the high mortality of acute cerebrovascular accident [3,4]. However, little information is available for the effect of a history of previous stroke on the incidence of early acute cerebrovascular accidents in patients receiving OPCAB. Here we retrospectively analysed predictive factors for early acute cerebrovascular accident in 468 patients with stroke history following OPCAB in order to reduce mortality and morbidity.

Material and methods

A total of 13873 patients received OPCAB surgery in Beijing Anzhen Hospital between January 2010 and September 2012, of which 13352 patients did not have previous stroke and 521 had a history of stroke. 394 patients (2.95%, 394/13352) suffered from early acute cerebrovascular accidents after OPCAB in patients without stroke history, while 76 patients (14.59%, 76/521) suffered from early acute cerebrovascular accidents after OPCAB in patients with a stroke history. Finally, 468 patients were included in this study based on our inclusion and exclusion criteria, in which 347 were male patients, with 121 females. Age range was from 44 to 87 years old, and mean was 66.7 ± 7.2.

Inclusion criteria: Inclusion criteria included patients with prior stroke history who received OPCAB. The exclusion criteria included chronic renal failure (eight patients), repeat thoracotomy approach (five patients), intraoperative or postoperative extracorporeal membrane oxygenation (ECMO) in 12 patients, and a severely atherosclerotic or dilated ascending aorta (28 patients). Abnormality of the ascending aorta was defined as the presence of atheromatous plaque more than 4 mm in thickness or an ascending aorta 4 cm or greater in internal diameter.

The diagnosis of stroke was confirmed by CT or MRI. Patients were divided into two groups according to the timing of the acute cerebrovascular accident: a group with early acute cerebrovascular accident (ACBA group) and a group without early acute cerebrovascular accident (control group).

Clinic data

General information on patients was collected, including age, gender, body mass index (BMI), history of hypertension, diabetes, hyperlipidaemia, smoking, alcohol consumption. The results of laboratory tests were also collected, including serum lipids, fasting glucose, homocysteine. Other data included the results of echocardiography, peripheral vascular history, neuroimaging, the number of coronary artery bypass grafts, and the methods of aortic occlusion. Postoperative data collected included the incidence of acute myocardial infarction, hypotension, atrial fibrillation, and the presence of acute cerebrovascular accidents. The postoperative period was defined as the period in the Intensive Care Unit (ICU) following operation. Ventilation time is the time between arriving at ICU and extubation. Hypotension is defined as systolic blood pressure less than 90 mmHg (1 mmHg = 0.133 kPa) and lasting for more than 30 min.

Diagnosis criteria

New acute cerebrovascular accidents were defined as the incidents in ICU following operation, including cerebral infarction, cerebral haemorrhage, and TIA. Stroke was defined as a permanent neurological deficit. TIA was defined as a new focal neurological deficit of sudden onset, completely reversed to baseline within 24 hours. The diagnosis of a cerebral infarction and cerebral haemorrhage was based on the AHA/ASA recommendations [5]. Neck vascular ultrasound was applied to observe the internal carotid artery bilaterally in each patient. A severe carotid stenosis was diagnosed based on DSA prior to OPCAB when the stenosis was greater than or equal to 70% on the neck vascular ultrasound. Dyslipidaemia, acute myocardial infarction and atrial fibrillation were diagnosed according to generally accepted standard [6–8].

OPCAB procedures

The time interval between last stroke incidence and OPCAB was generally longer than six months. General anaesthesia was performed during OPCAB procedures according to routine operation method [9]. The left internal mammary artery was used for left anterior descending artery, and saphenous vein used for ascending aorta to obtuse marginal branch and posterior descending artery. We adopted the Enclose® II aortic proximal anastomotic device and aortic side-biting clamp in this study. Enclose® II proximal anastomotic device was used for proximal anastomosis between a great saphenous vein and the aorta in OPCAB. Carotid endarterectomy (CEA) and OPCAB were performed simultaneously in patients with severe bilateral carotid artery stenosis.

Statistics analysis

SPSS11.5 statistical software was used in statistical analysis. The difference between the two groups was analysed by Student t test for continuous data and χ^2 test for categorical