Closure of the Left Atrial Appendage During Cardiac Surgery
– Why, When and How? –

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Atrial fibrillation (AF) is a common cardiac arrhythmia, present in 1–2% of the general population. Its prevalence is projected to increase approximately 2.5-fold by the year 2015. The risk of developing stroke is at least 5-fold higher in patients with AF than in those without AF. Approximately 90% of all strokes are ischemic and 15–20% of all ischemic strokes are associated with AF. The left atrial appendage (LAA) has been identified as the source of up to 90% of LA thrombi in nonvalvular AF and 57% in valvular AF. The striking echocardiographic sequence shown in Figure 1 of a migrating LAA thrombus that resulted in a severe stroke reminds us that this is a potentially grave complication in patients with AF.

In this issue of the Journal, Kato et al. report on the effect of concomitant LAA closure/amputation (LAAC/A) at the time of cardiac surgery on early outcome (≤6 months) after the procedure. Their efficacy endpoint was the incidence of cerebrovascular accidents (CVA), while their safety endpoints were comorbidities associated with LAAC/A. As a primary study, they compared outcomes in patients with and without LAAC/A, and they further stratified patients according to the

**Figure 1.** Migration of left atrial appendage (LAA) thrombus (T). (Adapted with permission from Parekh et al.)

The opinions expressed in this article are not necessarily those of the editors or of the Japanese Circulation Society.
When Should Concomitant LAAC/A Be Added?

The decision about whether to add a concomitant procedure to the primary surgery is always based on the risk-benefit ratio. At the 2010 Annual Meeting of the American Association for Thoracic Surgery, an independent survey of attendees was conducted to determine why AF is ignored by surgeons in over two-thirds of patients presenting with AF in addition to their primary cardiac condition. The overwhelming reason given was that the surgeons were concerned about increasing the operative risk by adding an additional procedure for AF to the primary coronary, aortic, or mitral procedure.

In the paper by Kato et al., Professor Amano and his team carefully expanded the indications for adding LAAC/A to the primary procedure. Initially, they selected patients with fewer comorbidities and in stable condition under cardiopulmonary bypass, and later they included patients undergoing elective off-pump coronary artery bypass grafting. They found that the addition of concomitant LAAC/A procedures did not increase the mortality or re-exploration rate related to bleeding and did not affect the length of ICU stay. The question is whether we should perform LAAC/A procedures in patients who have no history of preoperative AF. Because adding the LAAC/A procedure did not increase the risk of perioperative comorbidity and perioperative AF can occur in patients without a history of preoperative AF, such an aggressive approach may be justified only when the LAAC/A procedure can be completed without leaving a significant remnant of the LAA and when there is no residual communication between the LA and the closed/amputated LAA.

Why Should LAAC/A Be Recommended at the Time of Surgery?

Published in 2004, the Framingham Heart Study reported a 5-fold increase in stroke in nonvalvular AF compared with patients in sinus rhythm, with an overall rate of ischemic stroke averaging 5% per year. This increases sharply with age, and the risk of stroke for an individual is as high as 35% over 10 years. Although warfarin anticoagulation has reduced the risk of stroke by 60–70% in AF patients, a pooled study indicated that 40–50% of patients who were prescribed warfarin did not take it, even while they were in hospital, for various reasons, including patient frailty and concern about risk from falls, difficulty in achieving the narrow INR target window for warfarin use, patient refusal because of lifestyle demands, or simply bad compliance because of senile dementia.

LAAC/A at the time of surgery is a simple solution to reducing the risk of stroke, especially in an aged population who may be at high risk if they receive anticoagulation therapy. At the same time, we have to remind ourselves that LAAC/A does not totally eliminate stroke either during the perioperative period or late after surgery. As Kato et al report, 4.8% of high-risk patients suffered a stroke within 6 months of surgery. Other causes of ischemic stroke, such as intracerebral vascular disease, carotid artery stenosis, atherosclerosis of the proximal aorta, and heart failure, should also be taken into account.

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How Should LAAC/A Be Performed?

In order to perform a complete LCCA/A, several factors need to be considered. First, significant variation exists among AF patients in LAA size, wall thickness and morphology (Figure 2A, B). In the “chicken wing” or “windsock” type (Figures 2A, B), a significant remnant may be left if the proximal neck of the LAA is not well identified. In the “cauliflower” and “cactus” types (Figures 2C, D), incomplete closure can occur because of the wide neck of the LAA. The LAA is located on the lateral wall of the heart near the circumflex artery, which may pose a risk for surgical occlusion. On the epicardial surface, the LAA is near the great cardiac vein. On the endocardial surface, it is close to the mitral valve annulus and the orifice of the left superior pulmonary vein. Thus, surgeons should always be careful not to injure these vessels.

The technique of surgical LAA closure usually falls into 2 categories: excision or exclusion. Exclusion methods from the epicardial surface include (1) running or mattress sutures with or without felt pledgets, (2) single ligation or (3) purse-string sutures from the epicardial surface, or running sutures or purse-string sutures from the endocardial surface. The most common excision techniques include a stapled excision or removal and oversew.

I congratulate Kato et al for their 100% early success rate for LAAC/A closure checked by intraoperative transesophageal echocardiography. However, there remains a major concern regarding late incomplete closure of the LAA. An elegant study performed at the Cleveland Clinic revealed that the success of LAA closure checked by intraoperative transesophageal echocardiography, in a patient with atrial fibrillation, resulting in a stroke. Circulation 2006; 114: e513–e514, doi:10.1161/CIRCULATIONAHA.106.617886.

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