

Concomitant LAA Closure during Cardiac Surgery-Update 2025

Sören Schenk¹ Simon Pecha² Nicolas Doll³ Heiko Burger⁴ Michael Knaut⁵

¹Department of Cardiac Surgery, Sana Herzzentrum Cottbus, Herzchirurgie, Cottbus, Germany

²Department of Cardiovascular Surgery, Universitäres Herz- und Gefäßzentrum Hamburg, Klinik für Herz- und Gefäßchirurgie, Hamburg, Germany

³Department of Cardiac Surgery, Schüchtermann-Klinik, Abteilung für Herzchirurgie, Bad Rothenfelde, Niedersachsen, Germany

⁴Herzzentrum Kerckhoff-Klinik, Abteilung für Herzchirurgie, Bad Nauheim, Hessen, Germany

⁵Department of Cardiac Surgery, Klinik für Herzchirurgie, Herzzentrum Dresden Universitätsklinik an der Technischen Universität, Dresden, Dresden, Germany

Address for correspondence Simon Pecha, MD, Department of Cardiovascular Surgery, University Heart and Vascular Center Hamburg, Martinistr. 52, 20246 Hamburg, Germany (e-mail: s.pecha@uke.de).

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Abstract

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Atrial fibrillation is associated with an increased risk of embolic strokes and is present in about one-fourth of all patients undergoing cardiac surgery. Closure of the left atrial appendage (LAA) can effectively reduce the risk of neurological events and is now a class IB recommendation in the most recent ESC/EACTS AF guidelines. The working group “Heart Rhythm Disorders” of the German Society for Thoracic and Cardiovascular Surgery (DGTHG) evaluates the current state of clinical research and recommends concomitant LAA closure in patients with preoperative atrial fibrillation as a routine part of heart surgeries.

The Left Atrial Appendage as a Target for Minimizing Stroke Risk in Atrial Fibrillation

Atrial fibrillation is the most common cardiac arrhythmia. It affects more than 33 million people worldwide, and as life expectancy increases, a further rise in cases is expected.^{1,2} It particularly affects patients undergoing cardiac surgery. Due to risk factors such as heart failure, coronary heart disease, and heart valve abnormalities, as well as the aging population, atrial fibrillation is preoperatively identified in approximately one-fourth of these patients.³ In addition to the immediate consequences in terms of increased perioperative

morbidity and mortality, atrial fibrillation also holds significant long-term importance. Notably, there is a four to fivefold increased risk of embolic stroke.⁴ Apart from its societal implications, a neurological disorder can have substantial individual effects. In terms of survival and the recovery of neurological functions, an embolic stroke in atrial fibrillation is prognostically worse than other ischemic insults.⁵

The left atrial appendage (LAA) is the most common source of thromboembolism in patients with atrial fibrillation, accounting for over 90% of cases.⁶ This fact, along with the good accessibility of the LAA, implies a special significance and necessity for cardiac surgical treatment in minimizing the risk of stroke in patients with preexisting atrial fibrillation. The surgical closure of the LAA, often referred to as the “lethal appendage in humans,” has been advocated for decades.⁷ It's important to note that this therapy

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permanently reduces the risk of stroke.⁸ In contrast to medication-based treatment, no active participation from the patient is required. The effect of a successful surgical LAA treatment is thus constant and sustainable.

Current Status of LAA Closure in Cardiac Surgery Patients with Atrial Fibrillation

The frequency of simultaneous surgical LAA closure during cardiac surgeries has not been recorded in the DGTHG (German Society for Thoracic and Cardiovascular Surgery) annual statistics. However, there is a consensus that only a portion of patients with preoperative atrial fibrillation receive such treatment, even though it is almost always a viable option. Reliable data can be derived from atrial fibrillation ablations, as LAA closure is often performed in conjunction. The German Cardiac Surgery Atrial Fibrillation Registry (CASE-AF) under the auspices of the Institute for Heart Attack Research supports this assumption. According to the registry, LAA was addressed in 88% of the 1,289 patients who underwent surgical atrial fibrillation ablation until 2021. If we consider atrial fibrillation ablations as an indicator of the actual LAA closures, it becomes evident that only a minority have undergone this treatment so far. Data from 79,134 Medicare patients who underwent cardiac surgery were analyzed, and 28.4% of these patients had preoperative atrial fibrillation, of which less than a quarter underwent ablation.³ The DGTHG annual statistics show similar data. In 2021, approximately 4,000 surgical ablations were documented out of around 80,000 surgeries (on/off-pump CABG, CABG + heart valve operations, isolated heart valve operations, and aortic surgery), accounting for approximately 5%.⁹ However, conservatively estimated, the proportion of patients with atrial fibrillation is about one-fourth. Thus, it can be assumed that only approximately 20% of possible LAA treatments have been performed. Recently published data on 18,434 cardiac surgical patients with atrial fibrillation quantify the percentage of LAA closure at 47.7%, with significant variation among different hospitals.¹⁰ Analyses conducted in the institutions of the authors confirm this trend.

Most recent atrial fibrillation guidelines from the European Society of Cardiology (ESC) and European Society of Cardiothoracic Surgery (EACTS) recommend LAA closure during cardiac surgery with a class I and a level of evidence of B.¹¹ Data from randomized trials have led to this upgrade in a class of recommendation compared with previous versions.

Quantifying Stroke Risk Reduction through LAA Closure and Related Aspects

The effect of simultaneous LAA closure during cardiac surgery in patients with preoperative atrial fibrillation is well-documented. Here are some key publications: Yao et al conducted a cohort study on 79,782 patients undergoing CABG or heart valve surgeries. Using propensity scores, they identified 8,590 patients differing only in LAA closure status. Over an average follow-up of 2.1 ($\pm$ 1.9) years, patients with preoperative atrial fibrillation had a significantly lower risk

of stroke when the LAA was simultaneously closed (1.11 vs. 1.71 events per 100 person-years; HR, 0.68 [95% CI: 0.50–0.92]; $p=0.01$). Mortality was also positively impacted by LAA closure (3.22 vs. 4.93 events per 100 person-years; HR, 0.67 [95% CI: 0.56–0.80]; $p<0.001$).¹²

In a meta-analysis of 22 studies involving a total of 280,585 patients, Gutiérrez et al examined the relationship between LAA closure and the occurrence of stroke after cardiac surgery. They found that patients with preoperative atrial fibrillation had a significantly lower risk of postoperative neurological events (RR 0.64, 95% CI: 0.53–0.77; $p<0.00001$).¹³

The recently published Left Atrial Appendage Occlusion Study (LAAOS III) provides a definitive answer to the question of whether simultaneous LAA closure during cardiac surgery in patients with atrial fibrillation should be performed.⁸ This randomized, multicenter study included 4,770 patients with atrial fibrillation and a mean CHA₂DS₂-VASc score of 4.2 who underwent heart surgery for other indications. Of these patients, 2,379 underwent LAA closure, while the remaining 2,391 formed the control group without LAA closure. The mean follow-up time was 3.8 years, with 76.8% of patients receiving anticoagulation after 3 years. Patients with LAA closure had a 33% lower risk of stroke or systemic embolism at the end of the observation period. There were 114 (4.8%) events in the LAA closure group and 168 (7.0%) in the control group (HR: 0.67; 95% CI: 0.53–0.85; $p=0.001$). The effect of LAA closure in preventing thromboembolism is even more significant after 30 days (HR: 0.58; 95% CI: 0.42–0.80), as there are immediate postoperative reasons for stroke directly related to the surgical procedure. This effect is consistently observed, as the incidence of thromboembolic events increases less when LAA closure is performed. It is worth noting that there were no differences between the two groups in terms of mortality, bleeding, other perioperative complications, myocardial infarction, or heart failure. Therefore, simultaneous LAA closure does not increase perioperative risk. The clinical relevance of reduced reservoir function or initial decreased atrial natriuretic peptide was also definitively refuted, as the number of hospitalizations due to heart failure did not increase either immediately postoperatively or in the long term. LAA closure required only a 4-minute increase in mean aortic cross-clamp time. The authors concluded that simultaneous LAA closure in patients with preoperative atrial fibrillation reduces the risk of stroke.⁸

Instructions for Performing LAA Closure

LAA closure is a universally applicable technique that is easy to implement and does not significantly disrupt the surgical procedure. Nevertheless, some considerations should be taken into account as the LAA is often composed of fragile tissue. In cases of cardiac reoperations with adhesions in this area, the surgical risk can be disproportionately high, making LAA closure more challenging or preventing it. On the other hand, minimally invasive heart valve surgeries using partial sternotomy or right lateral thoracotomy may occasionally

not allow for a secure or complete LAA closure, potentially depriving patients of its therapeutic benefits. Given that the benefits in terms of long-term reduction of the risk of neurological events likely outweigh any cosmetic advantages, alternative approaches should be offered in such cases.

Furthermore, it has been shown that surgical LAA closure is often incomplete.¹⁴ When comparing the primarily performed techniques, including epicardial ligation or endocardial suture, LAA amputation using a stapler, and excision, rechanneling, residual LAA, or a stump was frequently observed.¹⁵ Excision remains the most effective technique.¹⁶ Additionally, an epicardial clip system is available, which is atraumatic and almost always ensures complete LAA closure.^{17,18} Similar results were published by Petersen et al. In their transesophageal echo follow-up study, they evaluated four different surgical LAA closure techniques. Here, the epicardial clip system as well as the surgical excision have shown the best long-term results in terms of successful LAA closure.¹⁹ Echocardiographic criteria for successful LAA closure are: 1) no flow between the left atrium and LAA, and 2) a remaining LAA stump or pocket of <1 cm in maximum length.¹⁴

Future Perspectives: Concomitant LAA Closure in Patients at Risk for AF

At the moment, more and more trials are running, focusing on concomitant prophylactic LAA closure during cardiac surgery in patients at risk of AF.

A small prospective randomized trial has shown a significant reduction in postoperative ischemic brain injury, in patients receiving LAA Closure concomitant to elective heart surgery, independently of atrial fibrillation history. In this study, in the LAA Closure group, only 16.3% of patients had a history of atrial fibrillation,²⁰ showing that these positive effects were independent of AF history.

At present, two large randomized multicenter trials are running, investigating the effects of concomitant LAA closure in patients without a history of atrial fibrillation, but at risk for AF, undergoing cardiac surgery. The LAA-CLOSURE trial is a prospective randomized trial investigating stroke prevention by prophylactic LAA Closure with an LAA Clip in patients undergoing bioprosthetic aortic valve replacement. The primary endpoint is a composite of cardiovascular mortality, stroke, and systemic arterial embolism at 5-year follow-up.²¹

The LeAAPS trial is one of the largest randomized cardiac device trials which will test whether prophylactic exclusion of the LAA with a dedicated LAA clip can mitigate the occurrence of ischemic strokes and systemic arterial embolism in patients undergoing cardiac surgery who have risk factors for AF and ischemic stroke but without a clinical history of AF.²²

Due to its high efficacy and low complication rate,^{17–19} the used LAA clip might be suitable for prophylactic LAA occlusion if the above-mentioned large randomized trials will show positive results. Then, LAA closure might become a routine part of cardiac surgical procedures, at least in patients at risk for AF.

Conclusion/Recommendations

This position paper is an updated version of the previously published paper “Verschluss des linken Vorhofohrs bei Herzoperationen,”²³ incorporating the most recent ESC/EACTS AF Guidelines and an outlook on ongoing studies for prophylactic LAA closure during cardiac surgery. LAA closure is recommended for patients with preoperative atrial fibrillation undergoing cardiac surgery. This technique significantly and sustainably reduces the occurrence of thromboembolic events and does not lead to increased perioperative complications. According to recent ESC/EACTS AF guidelines, it is recommended with a class IB indication. LAA closure is a safe procedure, and the surgical approach should be chosen accordingly to ensure effective closure. In addition to excision with over-and-over suturing or stapler use, clip systems can also be employed. Closure using a simple ligature or basic suture without LAA excision is often ineffective and not recommended. The success of LAA closure should be verified intraoperatively using transesophageal echocardiography. However, robust data on discontinuing oral anticoagulation after surgical LAA closure are not yet available. The continuation of anticoagulation still requires an individual decision, taking into account the CHA2DS2-VASc score.

Conflict of Interest

None declared.

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