



# The Society of Thoracic Surgeons 2017 Clinical Practice Guidelines for the Surgical Treatment of Atrial Fibrillation

Vinay Badhwar, MD, J. Scott Rankin, MD, Ralph J. Damiano, Jr, MD,  
A. Marc Gillinov, MD, Faisal G. Bakaeen, MD, James R. Edgerton, MD,  
Jonathan M. Philpott, MD, Patrick M. McCarthy, MD, Steven F. Bolling, MD,  
Harold G. Roberts, MD, Vinod H. Thourani, MD, Rakesh M. Suri, MD, DPhil,  
Richard J. Shemin, MD, Scott Firestone, MS, Niv Ad, MD

Division of Cardiothoracic Surgery, West Virginia University, Morgantown, West Virginia (VB, JSR, NA); Division of Cardiothoracic Surgery, Washington University, St. Louis, Missouri (RJD); Division of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Cleveland, Ohio (AMG, FGB, RMS); Department of Cardiothoracic Surgery, Baylor Plano Heart Hospital, Plano, Texas (JRE); Department of Cardiothoracic Surgery, Sentara Heart Hospital, Norfolk, Virginia (JMP); Division of Cardiac Surgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois (PMM); Department of Cardiac Surgery, University of Michigan, Ann Arbor, Michigan (SFB); Department of Cardiovascular Services, Florida Heart and Vascular Care at Aventura, Aventura, Florida (HGR); Division of Cardiothoracic Surgery, Emory University, Atlanta, Georgia (VHT); Division of Cardiothoracic Surgery, University of California Los Angeles David Geffen School of Medicine, Los Angeles, California (RJS); and The Society of Thoracic Surgeons, Chicago, Illinois (SF)

## Executive Summary

Surgical ablation for atrial fibrillation (AF) can be performed without additional risk of operative mortality or major morbidity, and is recommended at the time of concomitant mitral operations to restore sinus rhythm. (Class I, Level A)

Surgical ablation for AF can be performed without additional operative risk of mortality or major morbidity, and is recommended at the time of concomitant isolated aortic valve replacement, isolated coronary artery bypass graft surgery, and aortic valve replacement plus coronary artery bypass graft operations to restore sinus rhythm. (Class I, Level B nonrandomized)

Surgical ablation for symptomatic AF in the absence of structural heart disease that is refractory to class I/III antiarrhythmic drugs or catheter-based therapy or both is reasonable as a primary stand-alone procedure, to restore sinus rhythm. (Class IIA, Level B randomized)

Surgical ablation for symptomatic persistent or longstanding persistent AF in the absence of structural heart disease is reasonable, as a stand-alone procedure

using the Cox-Maze III/IV lesion set compared with pulmonary vein isolation alone. (Class IIA, Level B nonrandomized)

Surgical ablation for symptomatic AF in the setting of left atrial enlargement ( $\geq 4.5$  cm) or more than moderate mitral regurgitation by pulmonary vein isolation alone is not recommended. (Class III no benefit, Level C expert opinion)

It is reasonable to perform left atrial appendage excision or exclusion in conjunction with surgical ablation for AF for longitudinal thromboembolic morbidity prevention. (Class IIA, Level C limited data)

At the time of concomitant cardiac operations in patients with AF, it is reasonable to surgically manage the left atrial appendage for longitudinal thromboembolic morbidity prevention. (Class IIA, Level C expert opinion)

In the treatment of AF, multidisciplinary heart team assessment, treatment planning, and long-term follow-up can be useful and beneficial to optimize patient outcomes. (Class I, Level C expert opinion)

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## Introduction

Techniques for the surgical treatment of atrial fibrillation (AF) have assumed a more prominent role in adult cardiac surgical practice. Most commonly applied as a concomitant procedure during valve or coronary

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The STS Executive Committee approved this document.

Address correspondence to Dr Badhwar, West Virginia University, 1 Medical Center Dr, Morgantown, WV 26506; email: [vinay.badhwar@wvumedicine.org](mailto:vinay.badhwar@wvumedicine.org).

**Abbreviations and Acronyms**

AF	= atrial fibrillation
AVR	= aortic valve replacement
CABG	= coronary artery bypass grafting
EO	= expert opinion
LA	= left atrial
LD	= limited data
MVRR	= mitral valve repair or replacement
NR	= nonrandomized
PVI	= pulmonary vein isolation
R	= randomized
RCT	= randomized controlled trial
RF	= radiofrequency
SA	= surgical ablation
STS	= The Society of Thoracic Surgeons

revascularization operations, but also as a primary or stand-alone procedure, the frequency of surgical ablation (SA) performance and durable rhythm success have steadily increased. The Society of Thoracic Surgeons (STS) periodically summarizes scientific evidence into clinical practice guidelines and recommendations that may contribute to improving surgical outcomes. It is anticipated that such guidelines, based on systematic evaluation of current scientific literature, can contribute importantly to quality of patient care. Accordingly, the current document was developed to summarize the relevant literature, to classify outcome results, and to provide clinically applicable recommendations. Prior multiple society interdisciplinary recommendations on SA were formulated based on earlier literature and consideration of all cardiac operations as a whole [1, 2]. This guideline assessed the optimal application of SA to provide recommendations for three operation categories in clinical practice: primary open atrial operations, primary closed atrial operations, and stand-alone operations for AF.

Creation of myocardial ablation lines, as a treatment for atrial arrhythmias, was first accomplished experimentally by Williams and associates [3], and reported at the 1980 annual meeting of the American Association for Thoracic Surgery. In discussing the paper, Dr Will Sealy commented: "Its real importance lies in the demonstration that the atrial conduction system can be manipulated deliberately and selectively by the surgeon." In 1987, after extensive laboratory and clinical investigation, Dr James Cox completed the first clinical ablation procedure for AF, called the maze I, and reported 22 successful cases by 1991 [4]. Over subsequent years, the operation evolved into the maze III, or the "cut-and-sew" maze [5], which was applied extensively in clinical practice [6]. Modifications of the atrial lesion sets ensued as new energy sources were developed [7, 8]; and Damiano and associates [9, 10] used a combination of radiofrequency energy and cryoablation to replace several of the maze III cut-and-sew lesions and called this facilitated procedure the Cox-Maze IV. Similarly, in select AF patients without structural heart disease, this enabling technology has stimulated a resurgence of interest in epicardial SA

performed as a stand-alone procedure, or in combination with staged hybrid catheter-based ablation. Ultimately, the lesion sets of the Cox-Maze IV further evolved to its current form [11, 12]. The speed and efficacy of the technique produced an accelerated application while adhering to Cox's electrophysiologic principles [5], especially concomitant to mitral valve surgery. With the trend toward more mitral valve repair, SA provides a method of avoiding long-term anticoagulation therapy in patients with AF and primary mitral regurgitation, and thus, mitral repair and SA with the Cox-Maze procedure have become naturally complementary operations [13, 14]. The rate of SA performed concomitantly in patients with AF at the time of mitral valve repair in the United States has risen from 52% to 61.5% over the last decade [15, 16], and an opportunity exists to improve this rate further.

In the current literature, numerous studies have investigated a number of energy sources, lesion sets, comprehensive procedural outcomes, and specific clinical indications. Although results of previous work have at times seemed unclear owing to procedural or electrophysiologic heterogeneity, a consistent clinical picture has emerged in recent years. The success of surgical ablation is dependent on the lesion set and the tools used to create the lesions. Surgeons should be aware of the advantages and disadvantages of surgical options for ablation, and a thorough knowledge of the current scientific literature is invaluable as an overall guide to surgical practice. For optimal outcome, surgeons should become skilled in SA through fellowship training, peer-to-peer education, or proctorship. To ensure guidelines remain current, new data will be reviewed periodically and the guidelines modified to reflect evolving scientific understanding. The objectives of this guideline are (1) to present a balanced review of current knowledge in the area of surgical ablation; (2) to provide evidence-based recommendations for clinical practice; and (3) to potentially improve and optimize future patient outcomes.

### *Outcomes and Endpoints*

The primary objective of this guideline is to assess the safety of performing SA as a concomitant or principal procedure, defined by mortality or major morbidity, for three surgical approaches: primary atriotomy operations, primary nonatriotomy operations, and stand-alone operations. The secondary objective is to provide a summary assessment of efficacy regarding quality of life and rhythm endpoints as measured by multiple-society monitoring standards.

### **Methodology**

The STS Workforce on Evidence Based Surgery assembled a task force in 2015 to address recommendations for surgical ablation for AF. The guideline writing committee reviewed the literature and assessed the quality of evidence relative to operation type. Operations were classified as concomitant SA associated with primarily open atrial operations (ie, mitral valve repair or replacement [MVRR]), concomitant SA at the time of primary closed

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