1. Introduction

Atrial fibrillation (AF) is a frequent event following cardiac surgery, occurring in up to 40% of patients [1-5]. The arrhythmia itself is often benign such that its occurrence is sometimes not labeled as a “complication”; even so, postoperative AF is associated with an increased length of hospital stay following cardiac surgery. In addition, the sequellae of postoperative AF can be severe and even life-threatening including hemodynamic compromise and thromboemboli. As such, a thorough knowledge of the risk factors associated with the development of the arrhythmia is warranted. Furthermore, it is essential that this understanding include the underlying mechanisms by which these risk factors predispose, and to seek prevention and early treatment of postoperative AF.

Most clinically encountered AF unrelated to cardiac surgery is thought to result from reentry around fixed and/or functional barriers; the same holds true for postoperative atrial arrhythmias. Fundamental to the understanding of clinical arrhythmias resulting from a reentrant mechanism are the concepts of substrate, the underlying myocardial condition which makes development of the arrhythmia possible, and trigger, which initiates the arrhythmia in a given situation. As such, “risk factors” for the development of postoperative AF may reflect: 1) underlying abnormalities in the atrial substrate that existed preoperatively, (as would be reflected by a preoperative history of AF or hypertension), 2) abnormalities in the
atrial substrate that were created by the surgery itself (such as created by valvular surgery or differences in the technique used for atrial cannulation), or 3) influences which increase the presence of potential triggers for the arrhythmia (such as electrolyte abnormalities, increased sympathetic tone or beta-blocker withdrawal). It is in this context of substrate and trigger that this chapter will discuss risk factors for the development of postoperative AF.

2. Preoperative Clinical Risk Factors

Most preoperative clinical risk factors for the development of postoperative AF indicate (or even create) changes in the electrical substrate of the atrial myocardium. As such, the preoperative clinical risk factors most often evaluated are similar to AF unrelated to cardiac surgery.

2.1. Prior atrial fibrillation and other supraventricular arrhythmias

In a general cardiology population, the presence of prior atrial arrhythmias is strongly associated with the subsequent occurrence of AF; as would be expected, this association persists in patients following cardiac surgery. This association likely results from postoperative persistence of preoperative changes in the atrial structural substrate and of sensitivity to the same triggers which made AF possible previously. Other factors, such as the effect of the so-called “electrical remodeling” must also be considered [6, 7].

While patients with prior, preoperative AF are probably at greatest risk for the development of postoperative AF, supporting literature is less than overwhelming for several reasons. Firstly, a careful and precise definition of the term “prior AF” is absent from the literature. For example, patients with chronic AF prior to cardiac surgery would seem more likely to redevelop AF following that surgery. Some studies evaluating predictors of postoperative AF include these patients [8]; other studies clearly exclude these patients from analysis [9]). Unfortunately, most of the published literature fails to offer any definition of the term “prior AF”. Secondly, many large trials evaluating predictors of postoperative AF intentionally exclude patients with preoperative arrhythmias [3,10] complicating analysis of its true role as a risk factor. Along these same lines, several other large trials neither explicitly excluded these patients nor did they include prior AF as a preoperative factor being analyzed [11,2].

Of the studies that do analyze the association of preoperative AF and its postoperative development, the largest study is from the Multicenter Study of Preoperative Ischemia Cardiac Surgery (MCSP) database [80]. In this study, 2417 patients undergoing CABG with or without concomitant valvular surgery were randomly selected from 24 university-affiliated hospitals around the United States. Clinical variables were evaluated utilizing retrospective chart reviews and physician interviews. Of these patients, 332 had “prior AF” defined as “reported in the medical record or interviews” or present on preoperative ECG. 158/332 (48%) with