Chapter 10
Antiarrhythmics, Inotropes, and Vasopressors

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ABSTRACT

Arrhythmias, low cardiac output syndromes, and low blood pressure are commonly faced complications in the cardiothoracic surgery patient. In order to provide appropriate clinical management, one must identify underlying etiologies while recognizing and understanding available treatment options. The objective of this chapter is to review common agents utilized to manage arrhythmias and maintain hemodynamic stability following cardiac surgery. Mechanisms of action, key clinical pearls and relevant literature pertaining to each agent will be discussed.

BACKGROUND

One of the most common complications following cardiac or thoracic surgery includes cardiac arrhythmias. Postoperative atrial fibrillation has been associated with significant morbidity and mortality as well as increased cost and hospital length of stay. Nearly 30% of patients undergoing any form of chest surgery develop postoperative arrhythmias. Atrial fibrillation is the most common with ventricular ectopy being less common. Cardiac dysrhythmias can broadly be categorized into two categories – chronic and acute. Chronic arrhythmias have multiple treatment options including pharmacological therapy, internal defibrillators and surgery. Acute arrhythmias are more commonly managed medically.

Low cardiac output syndrome occurring during or post cardiopulmonary bypass (CPB) is also common and may be a result of reperfusion injury, inflammatory and coagulation cascade activation, or direct ischemic insult. Additionally, many patients have underlying cardiac dysfunction or heart failure, contributing to low output states after surgery. As with any critically ill patient, shock states may also develop in the postoperative period due to hypovolemia, cardiogenic or obstructive causes, distributive causes such as sepsis, or an overlapping variety of each.

DOI: 10.4018/978-1-4666-8603-8.ch010

These complications require most patients to be supported in the short-term with some form of antiarrhythmic, inotrope and/or vasopressor. While many older generation antiarrhythmic agents are available, postoperative arrhythmias are often managed with amiodarone, lidocaine, β –blockers, calcium channel blockers, or a combination of these therapies. In order to augment cardiac output (CO) or vascular tone in shock states, inotropic and vasopressor agents are administered. In this chapter, differences in mechanism of action, adrenergic receptor selectivity, adverse effects, and clinical features that influence the selection of an agent will be discussed. There is a high degree of variability in the use of specific therapy that will be discussed; the choice is often driven by clinical context, expert opinion, and clinician preference.

ANTIARRHYTHMIC AGENTS

Antiarrhythmic drugs exert their action by blocking sodium, potassium or calcium. They are classified as either Class IA (prolong action potential), IB (shorten action potential), IC (slow conduction), II (block beta adrenergic receptors), III (prolong repolarization), and IV (blocker calcium channels) (Table 1.) While a number of medications exist in each category, most intensive care units use a handful of medications with which they have familiarity. Guidelines related to the pharmacological management of perioperative atrial fibrillation for cardiothoracic surgery patients highlight the use of β –blockers and amiodarone (Martinez, 2005a; Martinez 2005b; Frendl, 2014).

β-Blockers

Class II agents largely include all β -blockers. While a number are commercially available, the most commonly utilized include metoprolol, carvedilol, atenolol and esmolol. These agents can be utilized in

Table 1. Vaughn-Williams Classification of Antiarrhythmic Agents

Classification	Agents	Primary Ion Blockade/Effect
1a	**Disopyramide** **Quinidine** **Procainamide**	Na^+ Increased refractory period
1b	**Lidocaine** **Mexiletine**	Na^+ Decreased refractory period
1c	**Flecainide** **Propafenone**	Na^+ No effect on refractory period
II	**Metoprolol** **Atenolol** **Esmolol**	Ca^{2+} (through β-receptor blockade) Increased refractory period Decreased atrioventricular conduction
III	**Amiodarone** **Dronedarone** **Sotalol** **Dofetilide**	K^+ Increased refractory period
IV	**Verapamil** **Diltiazem**	Ca^{2+} Increased refractory period Decreased atrioventricular conduction