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Possible Perioperative Arrhythmias

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Abstract

Atrial fibrillation (AF) is the most common persistent cardiac arrhythmia, and it is predicted that one of four middle-aged adults in developed countries will develop AF. By 2030, 14-17 million patients with AF are expected in the European Union, with 120.000-215.000 newly diagnosed patients per year. AF is independently associated with an increased risk of death and high morbidity, such as heart failure and stroke, but also with frequent hospitalizations and reduced quality of life. AF usually progresses from short, rare paroxysmal episodes to longer and more frequent attacks, culminating as persistent AF. Although the pattern of AF may be the same, the mechanisms that induce AF vary significantly between patients.

Keywords: Atrial fibrillation (AF); Supraventricular tachycardias (SVTs); Electrocardiogram (ECG); Health

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Introduction

Atrial tachyarrhythmias in the early perioperative period are extremely common and encompass atrial fibrillation (AF), atrial flutter, and atrial tachycardia, and certain other reentrant supraventricular tachyarrhythmias [1]. These rhythm disturbances are all closely related in terms of risk factors and management. AF greatly outweighs the incidence of the others and has been the focus of essentially all the existing retrospective, observational, and prospective randomized controlled trials.

Electrolyte disorders, heart structure defects, inflammation, myocardial ischemia, cardiomyopathies, and conduction abnormalities can all contribute to the development of perioperative arrhythmias and heart block [2]. Consequently, the anesthesia staff must be prepared to manage both chronic and new-onset cardiac rhythm problems.

Supraventricular tachycardias (SVTs) can have hemodynamic consequences secondary to loss of AV synchrony and decreased diastolic filling time. Loss of the "P" wave on the ECG (electrocardiogram) with a fast ventricular response is consistent with SVTs. Most SVTs occur secondary to a reentrant mechanism. Reentrant arrhythmias occur when conduction tissues in the heart depolarize or repolarize at varying rates. In this manner, a self-perpetuating loop of repolarization and depolarization can occur in the conduction pathways and/or AV (ventricular tachycardia) node. SVTs producing hemodynamic collapse are treated perioperatively with synchronized cardioversion. Adenosine can likewise be given to slow AV node conduction and potentially disrupt the reentrant loop. SVTs in patients without accessory conduction bundles (Wolff –Parkinson–White [WPW] syndrome) are treated with β-blockers and calcium channel blockers. In patients with known WPW, procainamide or amiodarone can be used to treat SVTs. At times, SVTs manifest with a broad QRS complex and seem to be similar to VTs. Such rhythms, when they present, should be treated like VT, until proven otherwise.

Atrial fibrillation (AF) can complicate the perioperative period. Up to 35% of cardiac surgery patients develop postoperative AF. Moreover, many patients present with AF for anesthesia and noncardiac surgery. The ACC/AHA has issued voluminous guidelines for the outpatient management of AF. The guidelines recommend use of β-blockers or nondihydropyridine calcium antagonists for ventricular rate control in patients without accessory conduction pathways. Amiodarone, procainamide, disopyramide, and ibutilide are suggested for ventricular rate control in patients with accessory pathways. The use of digitalis and nondihyropryidine calcium channel blockers is contraindicated in patients with accessory pathways.

Dysrhythmias

Cardiac dysrhythmias affect up to 29% of patients having non-cardiac surgery and are a significant cause of morbidity and mortality in the perioperative period [3]. Although dysrhythmia may be the manifestation of an underlying cardiac disorder, they are an independent risk factor for future cardiac events. The incidence of dysrhythmias is greater following cardiac surgery. Postoperative AF is associated with a 2.3-fold increase in the

risk of stroke, as well as an increased incidence of ventricular dysrhythmias, myocardial infarction, congestive cardiac failure and renal failure.

The majority of cardiac dysrhythmias occur in patients with pre-existing heart disease who have sustained an additional insult in the perioperative period. Cardiac, thoracic and laparoscopic surgeries are the commonest settings for perioperative dysrhythmias, with more than 15% of thoracic patients having an arrhythmia.

Long QT syndrome, whether congenital or acquired, is significant as it predisposes to the development of polymorphic ventricular tachycardia torsade de pointes, which can degenerate to ventricular fibrillation and sudden death. Patients with cardiomyopathy are at a significantly increased risk of PMI or sudden death during non-cardiac surgery.

ECG monitoring is standard during anaesthesia but a 12-lead ECG may be required postoperatively to confirm the diagnosis. Evaluation of the EC regularity, the presence of p-waves and the configuration of the QRS complex. It is also important to note the existence of myocardial ischaemia, which may be a cause or consequence of the dysrhythmia. Assessment of the degree of cardiovascular compromise caused by the dysrhythmia is also crucial.

Sinus arrhythmias (tachycardia and bradycardia) are the most frequently encountered intra-operative dysrhythmias. Bradycardia may follow activation of vagal reflexes such as the oculocardiac reflex during ophthalmic surgery, or the Brewer–Luckhardt reflex during anal or cervical stretching. Hypoxia, high-sympathetic block, acute myocardial infarction or drugs may all lead to bradycardia. Sinus tachycardia may be due to pain, light anaesthesia, sepsis, hypoxia, hypovolaemia, hypercapnia or drugs.

Conduction abnormalities may cause complete heart block, which may require temporary or permanent pacing. However, it is rare for patients with intraventricular conduction delays even in the presence of left- or right-bundle branch block to progress to complete heart block intra-operatively.

Perioperative Arrythmia

AF is the most frequently encountered arrhythmia in outpatient clinical practice, and therefore it is no surprise that it is also the most commonly encountered perioperative arrhythmia [1]. AF occurs in 4–20% of patients following noncardiac surgery, depending on the complexity of the operation, with the highest incidence occurring with vascular and major abdominal surgeries. In fact, in coronary artery bypass grafting (CABG), AF occurs in 25–33% of patients. Adding valvular surgery to CABG increases the incidence of AF up to 60% with aortic valve replacement and up to 63% with mitral valve replacement.

The exact pathophysiology of AF is poorly defined. The rhythm is characterized by multiple, simultaneously occurring atrial depolarizations that propagate chaotically throughout the atria. Even less is known about the development of AF in the perioperative setting, but it is thought to be related to (a) catecholamine excess, (b) autonomic imbalance, (c) inflammation, and (d) shifts in volume and pressure in the atria that can all affect electrical stability.

AF is commonly thought of as a disease of the elderly. Increasing age is the greatest risk factor for incident AF in both the outpatient and perioperative setting. In a study of 570 consecutive patients undergoing CABG, the risk of developing AF in those less than 60 was 18% and in those over 80 was as high as 52%. Additional independent risk factors for AF include prior AF, male gender, reduced left ventricular systolic function, valvular surgery, chronic obstructive pulmonary disease, chronic renal insufficiency, and diabetes mellitus.

Etiology

The etiology of perioperative arrhythmias is multifactorial [4]. Mechanistically, they can be separated into ectopic foci and reentrant circuits. Both originate either from abnormal cardiac tissue affected by ischemia, hypertrophy, dilation, cardiomyopathy, and scar or from normal cardiac tissue induced by inotropes, endogenous catecholamines, autonomic stimulation, and metabolic derangements.

Age is associated with supraventricular arrhythmias and heart block in both cardiac and other thoracic surgical patients. The etiology of this association is unclear, but the incidence in patients over 65 years of age is high enough to warrant prophylactic therapy in many cases. To this end, β-blockers (e.g., sotalol) and amiodarone are commonly used agents. Although routine preoperative prophylaxis against postoperative arrhythmias (particularly atrial fibrillation) remains controversial, it is increasingly supported by emerging data. Intrinsic cardiac disease, including cardiomyopathy, acute coronary insufficiency, valvular heart disease, congenital lesions, pulmonary hypertension, ventricular outflow obstruction, and ventricular failure, also increases the incidence and severity of arrhythmias in both the preoperative and postoperative periods.

Discussion and Conclusion

Many cardiovascular diseases and associated conditions increase the risk of developing AF, recurrent AF, and AF-related complications. These conditions increase the risk of AF with individual factors of each patient such as older age, obesity, smoking, excessive alcohol consumption, and frequent demanding physical activity. An important component of AF prevention and its burden is the identification of risk factors, their prevention and treatment. The initial assessment of a patient with newly diagnosed AF should include 5 parts: hemodynamic stability, the presence of a precipitating factor or pre-existing condition, risk of stroke and anticoagulation, frequency control, and the need for rhythm control therapy. Several diagnostic procedures are essential to define the best AF treatment. An examination by an AF service is usually recommended, including an urgent examination of the patient if necessary. An integrated, structured approach to AF, as successfully applied in other parts of medicine, will result in consistent AF-compliant AF treatment for all patients, with the potential to improve outcomes.

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