



Recent Updates in Anesthesia for Cardiac Patients Undergoing Non- Cardiac Surgery

Essay

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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List of Abbreviations

ACC	: American college of cardiologists
ACS	: acute coronary syndrome
AHA	: American heart association
AIDS	: acquired immune deficiency syndrome
APACHE	: acute physiology and chronic health evaluation
aPL	: antiphospholipid
AR	: aortic regurgitation
AS	: aortic stenosis
ASA	: American society of anesthesiologists
ASD	: atrial septal defect
AV	: atrioventricular
AVA	: aortic valve area
BBs	: beta blockers
BNP	: brain natriuretic peptide
BP	: blood pressure
Ca	: Calcium
CABG	: coronary artery bypass grafting
CAD	: coronary artery disease
CCBs	: calcium channel blockers
CCS	: chronic coronary syndrome
CHD	: congenital heart disease
CHF	: congestive heart failure
CO	: cardiac output
CO ₂	: carbon dioxide
CPG	: clinical practice guideline
CPR	: cardiopulmonary resuscitation
CRF	: chronic renal failure
CVP	: central venous pressure
CVS	: cerebrovascular stroke
DASI	: Duke activity status index
DM	: diabetes mellitus
EF	: ejection fraction
ETCO ₂	: end tidal carbon dioxide

List of Abbreviations (Cont.)

FMV	: floppy mitral valve
GDMT	: guideline directed medical therapy
GWC	: guideline writing committee
HDU	: high dependency unit
HOCM	: hypertrophic obstructive cardiomyopathy
HR	: heart rate
ICD	: implantable cardioverter defibrillator
ICU	: intensive care unit
IDDM	: insulin dependent diabetes mellitus
IEC	: infective endocarditis
IHD	: ischemic heart disease
IM	: intramuscular
IV	: intravenous
IVC	: inferior vena cava
K	: potassium
LA	: left atrium
LAD	: Left anterior descending
LBBB	: left bundle branch block
LCA	: left coronary artery
LCx	: left circumflex
LDL	: low density lipoproteins
LV	: left ventricle
LVEDP	: left ventricular end diastolic pressure
LVH	: left ventricular hypertrophy
LVOT	: left ventricular outflow tract
MACE	: major adverse cardiac event
MET	: metabolic equivalent
MI	: myocardial infarction
MR	: mitral regurgitation
MS	: mitral stenosis
MVP	: mitral valve prolapse
NBTE	: nonbacterial thrombotic endocarditis
NIBP	: noninvasive blood pressure

List of Abbreviations (Cont.)

NMBA	: neuromuscular blocking agents
NYHA	: New York heart association
O.R	: operating room
O ₂	: oxygen
PAC	: pulmonary artery catheter
PaCO ₂	: arterial carbon dioxide tension
PAI	: plasminogen activator inhibitor
PaO ₂	: arterial oxygen tension
PCI	: percutaneous coronary intervention
PCWP	: pulmonary capillary wedge pressure
PDA	: patent ductus arteriosus
PDA	: posterior descending artery
POSSUM	: physiological and operative severity score for the enumeration of mortality and morbidity
PVD	: peripheral vascular disease
PVR	: pulmonary vascular resistance
Qp	: pulmonary blood flow
RA	: right atrium
RCA	: right coronary artery
RV	: right ventricle
SA	: sinoatrial
SLE	: systemic lupus erythematosus
SMC	: smooth muscle cell
SpO ₂	: peripheral capillary oxygen saturation
STEMI	: ST-elevation myocardial infarction
SV	: stroke volume
SVC	: superior vena cava
SvO ₂	: mixed venous blood oxygen saturation
SVR	: systemic vascular resistance
TAPVC	: total anomalous pulmonary venous connection
TEE	: transesophageal echo
TGA	: transposition of great arteries
TOF	: tetralogy of Fallot

List of Abbreviations (Cont.)

TR	:	tricuspid regurgitation
UAP	:	unstable angina pectoris
UK NCEPOD:		united kingdom national confidential enquiry into patient outcome and death
VR	:	venous return
VSD	:	ventricular septal defect

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Introduction

Cardiac diseases-particularly ischemic, valvular and congenital heart disease- are the medical illnesses most frequently encountered in anesthetic practice, and a major cause of perioperative morbidity and mortality. Management of patients with these diseases continues to challenge the ingenuity and resources of the anesthesiologist. Optimal anesthetic management of patients with cardiovascular disease requires a thorough knowledge of normal cardiac physiology, the circulatory effects of the various anesthetic agents, and the pathophysiology and treatment of these diseases (*Morgan et al., 2006*).

Cardiovascular disease is a major cause of disability and premature death throughout the world, and contributes substantially to the escalating costs of health care (*WHO, 2007*).

Ischemic Heart Disease (IHD), otherwise known as Coronary Artery Disease (CAD), is a condition that affects the supply of blood to the heart .The blood vessels are narrowed or blocked due to the deposition of cholesterol plaques on their walls. This reduces the supply of O₂ and nutrients to the heart musculature, which is essential for proper functioning of the heart. This may eventually result in a portion of the heart being suddenly deprived of its blood supply leading to the death of

that area of heart tissue. A multitude of factors are responsible for the development of IHD. The major risk factors are smoking, diabetes mellitus (DM) and high cholesterol levels. Valvular heart disease continues to be an important cause of perioperative morbidity and mortality. Valvular heart disease places a hemodynamic burden on the left and/or right ventricle which eventually leads to cardiac muscle dysfunction, congestive heart failure, or even sudden death. The most frequently encountered cardiac valve lesions produce pressure overload (mitral stenosis, aortic stenosis) or volume overload (mitral regurgitation, aortic regurgitation) on the left atrium or left ventricle. (*Hines & Marschall, 2012*)

Congenital heart disease (CHD) encompasses a seemingly endless list of abnormalities that may be detected in infancy, early childhood, or less commonly, adulthood. The incidence of CHD in all live births approaches 1%. The natural history of some defects is such that patients often survive to adulthood. Moreover, the number of surviving adults with CHD appears to be steadily increasing, possibly as a result of advances in medical treatment. An increasing number of patients with CHD may therefore be encountered during non-cardiac surgery. (*Morgan et al., 2006*)

Preoperative risk assessment is an important step in reducing perioperative morbidity and mortality in patients undergoing noncardiac surgery. Successful perioperative evaluation is best achieved by combining an integrated multidisciplinary approach with good communication between the patient, primary care physician, anesthesiologist, consultant, and surgeon. The goal of appropriate preoperative evaluation and therapy should be to not only improve immediate periprocedural outcomes but also to improve long term clinical outcome. **(Mukherjee et al., 2003).**

Anesthetizing patients with cardiovascular disease is one of the greatest challenges facing the anesthesiologist. The constellation of anesthetic drug effects, the physiologic stresses of surgery, and underlying cardiovascular diseases complicate and limit the choice of anesthetic techniques for any particular procedure. The anesthesiologist's approach to the patient with cardiovascular disease is to select agents and techniques that will optimize the patient's cardiopulmonary function. The perioperative management of a patient with cardiovascular disease requires close cooperation between the cardiologist/internist, surgeon, and anesthesiologist. Each specialist has a unique knowledge base that complements the others. The approach should emphasize a continuum of care from the preoperative evaluation through the extended postoperative period. **(Fuster et al., 2000).**

Aim of the Work

This work aims to describe the most frequently encountered cardiac diseases in anesthetic practice and the optimal ways to manage, pre, intra and postoperatively.

Anatomy of the Heart

Structure of the Heart

The heart is a hollow, cone-shaped muscular pump located within the mediastinum of the thorax and resting upon the diaphragm (*Shier et al., 2007*).

Size and Location of the Heart

Heart size varies with body size. However, an average adult's heart is generally about 14 cm long and 9 cm wide (*Shier et al., 2007*).

The heart is located in the middle mediastinum, one of the divisions of the thoracic cavity, at the level of the thoracic vertebrae T₅₋₈. The heart rests on the diaphragm, beneath the sternum, bordered laterally by the lungs, posteriorly by the vertebral column, and anteriorly by the sternum. The heart's distal end extends downward and to the left, terminating as a bluntly pointed apex at the level of the 5th intercostal space. (*Drake et al., 2005*).

Wall of the Heart

The wall of the heart is composed of three distinct layers; the outer layer, or epicardium, which protects the heart by reducing friction. The middle layer, or myocardium, which