Perioperative management of patient with pacemaker undergoing non cardiac surgery

Essay

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Amira Reda Abo Deif

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List of Abbreviations

4-AP	**:**	4-aminopyridin
ACC	**:**	American College of Cardiology
ACLS	**:**	Advanced Cardiac Life Support
AF	**:**	Atrial fibrillation
AHA	**:**	American Heart Association
ANS	**:**	Autonomic nervous system
APD	**:**	Action Potential Duration
ARCO	**:**	Atlantic Richfield Company
A-V	**:**	Atrioventricular
AVN	**:**	Atrioventricular node
BPEG	**:**	British Pacing and Electrophysiology Group
bpm :	**:**	beat per minute
Ca^{2+}	**:**	Calcium
cAMP	**:**	Cyclic Adenosine Monophosphate
CIED	**:**	Cardiovascular implantable electronic devices
$\underline{Cl^-}$	**:**	Chloride
CRMD	**:**	Cardiac Rhythm Management Devices
CRT	**:**	Cardiac resynchronization therapy
DAD	**:**	Delayed afterdepolarization
DC	**:**	Direct current
EAD	**:**	Early afterdepolarization

ECG	**:**	Electrocardiogram
ECT	**:**	electroconvulsive therapy
ELT	**:**	Endless-loop tachycardia
EMGs	**:**	Electromyelograms
EMI	**:**	Electromagnetic Interference
ERI	**:**	elective replacement indicator
ESWL	**:**	Extracorporeal shock wave lithotripsy
GDMT	**:**	Guideline-directed medical therapy
HB	**:**	Bundle of His
HF	**:**	Heart failure
HOCM	**:**	Hyperobstructive cardiomyopathy
ICDs	**:**	Intensified follow-up required
IFI	**:**	Intrinsic heart rate
IHR	**:**	Inferior vena cava
IVC	**:**	Potassium
K^+	**:**	Kilogram
Kg	**:**	Left atrium
LA	**:**	Left bundle branch
LBB	**:**	Left bundle branch block
LBBB	**:**	Left flank
LF	**:**	Left ventricle
LV	**:**	Left ventricular ejection fraction
LVEF	**:**	Left ventricular free wall
LVW	**:**	Maximum

max	**:**	Intensified follow-up required
Mg	**:**	Milligram
MI	**:**	Myocardial infarction
min	**:**	Minute
Mm	**:**	Millimeter
mmol/L	**:**	Millimole/ liter
MRI	**:**	Magnetic resonance imaging
mV	**:**	Millivolt
MV	**:**	Minute ventilation
Na^+	**:**	Sodium
NASPE	**:**	North American Society of Pacing and Electrophysiology
NYHA	**:**	New York Heart Association
P	**:**	Posteroinferior fascicle of the left bundle
PA	**:**	Pulmonary artery
PF	**:**	Purkinje fiber
PMT	**:**	PACEMAKER-mediated tachycardia
RA	**:**	Right atrium
RBB	**:**	Right bundle branc
RBBB	**:**	Right bundle branc block
RCA	**:**	Right coronary artery
RF	**:**	Radio frequency
RFA	**:**	Radiofrequency ablation
RV	**:**	Right ventricle

SA node	**:**	Sinoatrial node
sec	**:**	Second
SSS	**:**	Sick sinus syndrome
SVC	**:**	Superior vena cava
SVT	**:**	Supraventricular tachycardia
TENS	**:**	Transcutaneous electrical nerve stimulation
TUNA	**:**	Transurethral needle ablation
TURP	**:**	Transurethral resection of the prostate
USA	**:**	United States of America
VA	**:**	Ventricloarterial
VF	**:**	ventricular fibrillation
VT	**:**	ventricular tachycardia

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Introduction

A pacemaker (or artificial pacemaker, so as not to be confused with the heart's natural pacemaker) is a medical device that uses electrical impulses, delivered by electrodes contracting the heart muscles, to regulate the beating of the heart. The primary purpose of a pacemaker is to maintain an adequate heart rate, either because the heart's natural pacemaker is not fast enough, or there is a block in the heart's electrical conduction system. Modern pacemakers are externally programmable and allow the selection of the optimum pacing modes for individual patients. Some combine a pacemaker and defibrillator in a single implantable device. Others have multiple electrodes stimulating differing positions within the heart to improve synchronization of the ventricles of the heart ***(McWilliam, 2007).***

The first pacemaker was invented by electrical engineer John Hopps and Drs. Bigelow and John Callaghan at the Banting William Institute, University of Toronto, was developed in 1950 ***(John, 2010).*** In 1958, Senning and Elmqvist performed the first implantation of an electronic pacemaker ***(Si Larrson, 2003).*** Since then, pacemaker technology has improved enormously to include inhibition by spontaneous beats, rate responsiveness to exercise, dual-chamber pacing, and improvement in adaptability such as hysteresis. Pacemaker software has benefitted from advances in microprocessor technology, and the devices are now controlled by embedded microcomputers. Once reserved for the treatment of intractable recurrent bradycardia and blocks, pacemakers are now placed prophylactically to prevent syncope and bradycardia in at-risk

patients ***(Mirowski, 1980).*** Nowdays pacemakers are being used with greater frequency that an estimated 4 million people worldwide live with a pacemaker. Annually, 200 000 pacemakers are implanted in the United States. As roughly 10% of the population undergo a surgical procedure each year ***(Wood and Ellenbogen, 2002).***

The effect of surgery on pacemaker is unclear. The most common perioperative problem is the presence of major electromagnetic interference, in particular the use of the electrical cautery ***(Domino, 1983)***.

Pacemaker is constantly increasing in complexity and management strategies so the perioperative period for patients with pacemakers poses unique challenges to ensure a high degree of patient safety and identifies the interactions that may occur during anesthesia and surgery to help prevent device-related complications ***(Hayes and Zipes, 2001).***

Aim of the Work

The aim of this work is to facilitate safe and effective perioperative management of the patient with a pacemaker and reduce the incidence of adverse outcomes.