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Recent Updates of Perioperative Anesthetic Management of Patients with Coronary Stents undergoing Non-cardiac Surgery

An Essay

Submitted for partial fulfillment of Master Degree in Anesthesia

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بسم الله الرحمن الرحيم

﴿ وَفِي الأَرْضِ آيَاتٌ لِلْمُوقِنِينَ (٢٠)
وَفِي أَنْفُسِكُمْ أَفَلا تُبْصِرُونَ(٢١) ﴾

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List of Abbreviations

ACC	American college of cardiology
ACS	acute coronary syndrome
ADP	adenosine diphosphate
AHA	American Heart association
AM	acute marginal
AMP	adenosine mono phosphate
ASRA	American Society of Regional Anesthesia
ATP	adenosine triphosphate
AV	atrio-ventricular
BMS	Bare metal stent
CABG	coronary artery bypass grafting surgery
CAD	coronary artery disease
CO	cardiac output
CO_2	carbon dioxide
COX	cyclo-oxygenase enzyme
CVD	Cardiovascular disease
DANAMI-2	Danish Multicenter Randomized Study of Fibrinolytic Therapy versus Acute Coronary Angioplasty in Acute Myocardial Infarction 2
DBP	diastolic blood pressure
DES	drug eluting stents
DPTI	diastolic pressure time index
DSE	Dobutamine stress echocardiography
DTS	Dipyridamole-thallium scintigraphy
ECG	electrocardiogragph
EVR	endocardial viability ratio
FDA	Food and Drug Administration
GMP	guanosine mono phosphate
GPIIb/IIIa	glycoprotein IIb/IIIa
GTN	Glyceryl trinitrate
H^+	hydrogen
HDL-C	high-density lipoprotein cholesterol
ISR	in-stent restenosis
K^+	potassium
LAD	left anterior descending coronary artery

List of Abbreviations

LCX	left circumflex coronary artery
LCx	left circumflex artery
LDL-C	low-density lipoprotein cholesterol
LM	left main coronary artery
LMWH	low molecular weight heparin
LPA	lipoprotein (a)
LV	left ventricle
LVEDP	left ventricular end-diastolic pressure
LVH	Left ventricular hypertrophy
M V̇O2	Myocardial Oxygen consumption
MAP	Mean arterial blood pressure
MET	metabolic equivalents
MI	myocardial infarction
NSTEMI	non-ST-elevation myocardial infarction
OM	obtuse marginal branches
PACU	postanesthesia care unit
PAF	platelet activating factor
PCI	percutaneous coronary intervention)
PCI	percutaneous Coronary Intervention
PDA	posterior descending artery
PES	paclitaxel (‘Taxus’ stent)(
PF3	phospholipid surface
PFA	platelet function analyser
PLA	postero-lateral artery
PRAGUE-2	Primary Angioplasty in Patients Transferred from General Community Hospitals to Specialized Percutaneous Transluminal Coronary Angioplasty Units with or without Emergency Thrombolysis 2
PTCA	percutaneous transluminal coronary angioplasty
PWA	plateletworks analyser
RCA	right coronary artery
RCA	right coronary artery
RECOVERS	The Randomized Evaluation of Polytetrafluoroethylene Covered Stents in Saphenous Vein Grafts study
REST	Randomized Restenosis Stent

List of Abbreviations

RV	right ventricle
RVEDP	Right ventricular end-diastolic pressure
SA	sinoatrial
SES	sirolimus (‘Cypher’ stent)
STEMI	ST-elevation myocardial infarction
SYNTAX	Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery Study
TOE	Transoesophygeal Echocardiography
TTI	tension time index
TXA_2	thromboxane A_2
UFH	unfractionated heparin
USA	United States of America
VSD	Ventricular septal defect
VWf	Von Willebrand factor

List of Tables

No.	Title	Page.
1-	*MET in increasing order (Duke's Activity Status Index)*	*67*
2-	*Cardiac risk stratification of non-cardiac surgical procedures*	*66*
3-	*Preoperative evaluation in patients with coronary artery stents*	*71*
4-	*Duration of antiplatelet therapy and timing of non-cardiac surgery*	*73*
5-	*Summary of recommended minimum time intervals*	*83*
6-	*Laboratory investigations and neuraxial techniques*	*84*

List of Figures

No.	Title	Page.
1-	*3D composite of coronary vessels*	*4*
2-	*Diagram illustrating the right coronary artery*	*6*
3-	*Diagram showing the left coronary artery*	*8*
4-	*Diagram of the normal right-dominant*	*10*
5-	*Diagram of the normal left-dominant coronary artery anatomy*	*11*
6-	*The 7 stages of development of an atherosclerotic plaque*	*22*
7-	*Biodegradable iron stents*	*34*
8-	*Various shapes of stents mounted on ballon*	*35*
9-	*Bare-metal stent*	*36*
10-	*Microstructure of iron stents at different processing steps*	*45*
11-	*Platelet activation and inhibition mechanisms and the sites of action of antiplatelet drugs*	*49*
12-	*Stepwise approach to preoperative cardiac assessment (Cardiac Risk Stratification)*	*68*
13-	*Proposed algorithm for perioperative management of patients with bare-metal stents*	*79*
14-	*Proposed algorithm for perioperative management of patients with drug eluting stents*	*80*

List of Contents

	Page.
➢ List of Abbreviations	I
➢ List of Tables	II
➢ List of Figures	III
Introduction	**1-2**
Aim of the Work	**3**
➢ Coronary Circulation	4-17
➢ Pathophysiology of myocardial ischemia	18-31
➢ Coronary Stents	32-45
➢ Antiplatelets	46-61
➢ Anesthetic Management	62-87
Summary	**88-90**
References	**91-103**
Arabic Summary	**--**

INTRODUCTION

Coronary artery disease has dramatically increased during the last years. The evolution of management of coronary artery disease (CAD) over the last 30 years has also been dramatically changed. Until 1960's, medical treatment was the mainstay of management. But in 1970's coronary artery bypass grafting surgery (CABG) was the main treatment, and the overall strategy became invasive. In 1980's, percutaneous transluminal coronary angioplasty (PTCA) and coronary artery stents appeared .in 1990's, there has been a shift towards less invasive modality for revascularization ***(Serruys et al., 2006).***

Revascularization with coronary balloon angioplasty may cause vessel spasm and abrupt closure due to vessel recoil. The deployment of stents after angioplasty reduces the risk of abrupt vessel closure by sealing coronary artery dissection. Bare metal stents (BMS) deployment also reduce long term risk of restenosis by preventing elastic recoil and negative vessel remodeling ***(Ellis et al., 2004).***

To prevent re-stenosis, drug eluting stents (DES) were designed by coating a standard coronary stent with a thin polymer containing an anti-proliferative substance that inhibits smooth muscle proliferation and neointimal hyperplasia within the stented segment ***(Costa & Simon, 2005).***

Approximately 5% of patients in this group will undergo non-cardia surgery within the first year after stenting, and an increasing number will continue to present for surgery ***(Vicenzi et al., 2006).***

Because the success of stents requires long-term antiplatelet therapy, management of patients with these devices poses a dilemma to the anesthesiologist. Discontinuation of antiplatelet therapy relatively soon after PCI (percutaneous coronary intervention) with stenting confers significant mortality during non-cardiac surgery. As stent endotheli-alization may not yet be complete at the time of surgery, abrupt discontinuation of antiplatelets combined with the prothrombotic state induced by surgery increases the risk of acute perioperative stent thrombosis and myocardial infarction. Continuation of antiplatelet medications may be associated with an increased risk of intraoperative bleeding and also prevent administration of regional anesthesia ***(Popescu, 2010).***

AIM OF THE WORK

Review of update of possible management strategies of patients with cardiac stent undergoing non cardiac surgery.

ANATOMY OF THE CORONARY CIRCULATION

The arterial supply of the heart is provided by the right and left coronary arteries, which arise from the ascending aorta immediately above the aortic valve. The coronary arteries and their major branches are distributed over the surface of the heart, lying within subepicardial connective tissue ***(Snell, 2007).***

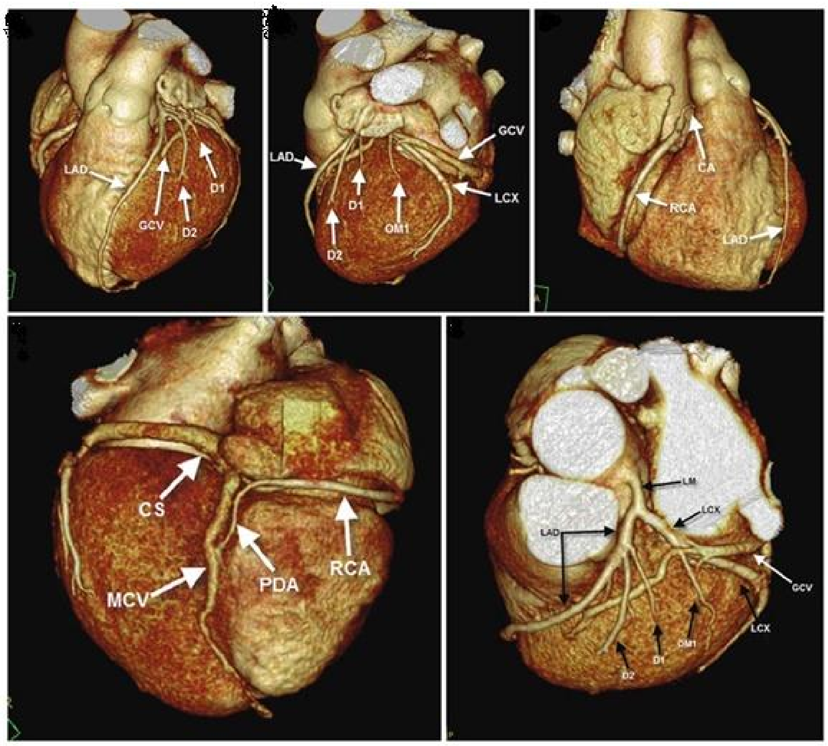

Fig. (1): *3D composite. CA, conus artery; CS, coronary sinus; D1, diagonal 1; D2, diagonal 2;GCV, great cardiac vein; LAD, left anterior coronary artery; LCX, left circumflex coronary artery; LM, left main coronary artery; MCV, middle cardiac vein OM1, obtuse marginal 1; PDA, posterior descending artery; RCA, right coronary artery; SA, sinoatrial artery* ***(Smuclovisky, 2009).***

The right coronary artery arises from the anterior aortic sinus of the ascending aorta and runs forward between the pulmonary trunk and the right auricle (fig.2). It descends almost vertically in the right atrio-ventricular groove, and at the inferior border of the heart it continues posteriorly along the atrioventricular groove to anastomose with the left coronary artery in the posterior interventricular groove. The right coronary artery (RCA) originates from the right coronary sinus and is divided into proximal, mid, and distal segments. The proximal segment of the RCA is from the ostium to the origin of the first acute marginal artery. In the majority of patients, the conus artery originates from the ostium of the RCA or separately from the right coronary sinus and is generally the first visualized branch. The conus artery has a superior and anterior course. The sinoatrial (SA) artery is generally the second artery to be visualized and originates from the proximal RCA and has a posterior course. The RCA gives origin to acute marginal (AM) branches, which vary in size and number and are labeled from proximal to distal, AM1, AM2, AM3, an so forth ***(Snell, 2007).***

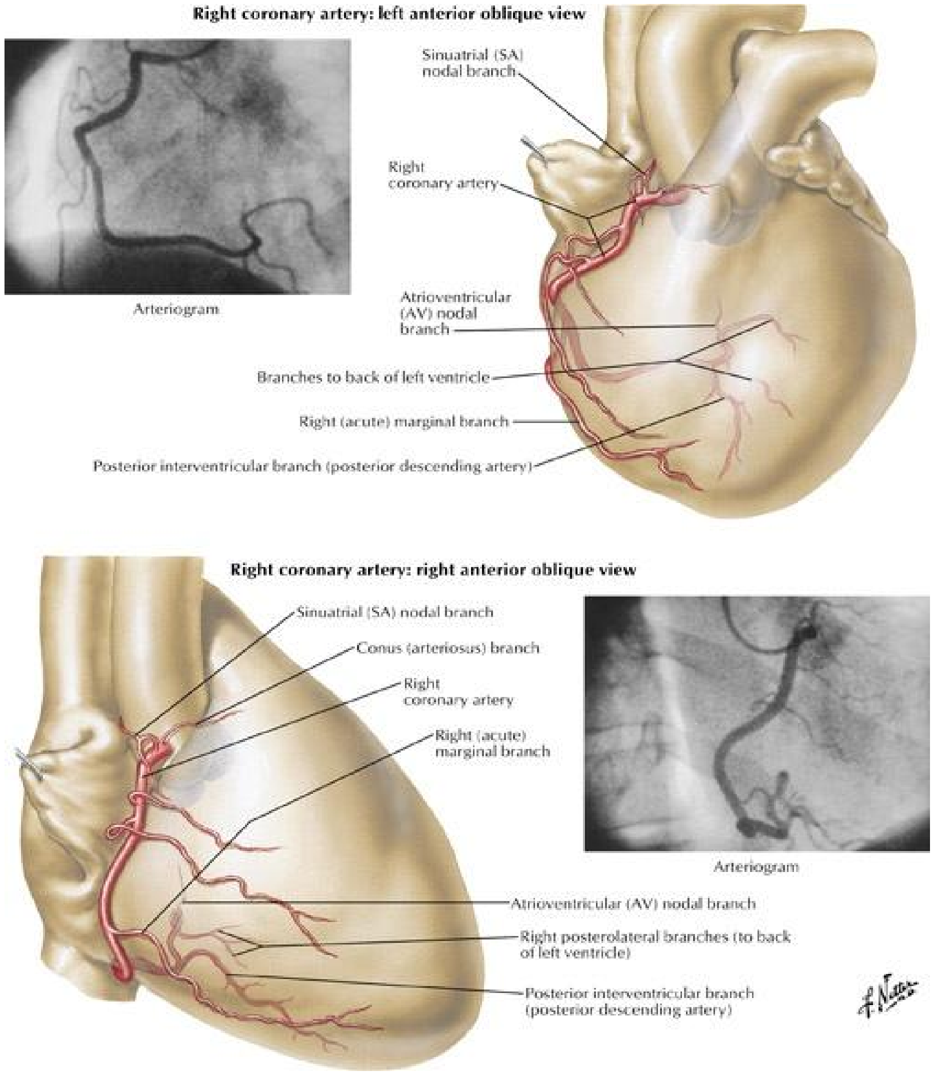

Fig. (2): *Diagram illustrating the right coronary artery [RCA] and the course of the sinoatrial [SA] node artery. (A) Right coronary artery with the SA nodal artery in the left anterior oblique view with a corresponding angiogram and (B) right coronary artery with the SA node artery in a right anterior oblique view with corresponding angiogram. (Images reprinted from: Netter FH. Colacino S (ed). Atlas of Human Anatomy. Summit, NJ:1 Ciba-Geigy Corp.; 1989. © Elsevier Science Ltd. Netter illustrations used with permission of Elsevier Inc. All rights reserved.)* ***(Fiss, 2007).***