Management of Parturient Patients with Cardiac Critical Diseases in ICU

Essay

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List of Contents

List of Tables

List of Figures

List of Abbreviations

Abb.	Full term

AAD ..... *Antiarrhythmic Drugs*
ACE ..... *Angiotensin-Converting Enzyme*
ACS ..... *Acute Coronary Syndrome*
AF ..... *Atrial Fibrillation*
AHA ..... *American Heart Association*
ALS ..... *Advanced Life Support*
AMI ..... *Acute Myocardial Infarction*
aPTT ..... *Activated Partial Thromboplastin Time*
ARBs ..... *Angiotensin Receptor Blocker*
AS ..... *Aortic Stenosis*
ASD ..... *Atrial Septal Defect*
AV ..... *Atrioventricular*
AVNRT ..... *Atrioventricular Nodal Re-Entrant Tachcardia*
AVSD ..... *atrioventricular septal defect*
BLS ..... *Basic Life Support*
BNP ..... *B-type Natriuretic Peptide*
BP ..... *Blood Pressure*
CHADS ..... *Congestive Heart Failure, Hypertension, Age, Diabetes, Stroke*
CO ..... *Cardiac Output*
CoA ..... *Coarction of the Aorta*
CRT ..... *Cardiac Resynchronization Therapy*
CT ..... *Computed Tomography*
CUS ..... *Compressing Ultrasonography*
CVD ..... *Cardiovascular Disease*
DBP ..... *Diastolic Blood Pressure*
DCM ..... *Dilated Cardiomyopathy*

List of Abbreviations (Cont...)

Abb.	Full term

DVT ..... *Deep Venous Thrombosis*
ECG ..... *Electrocardiogram*
EF ..... *Ejection Fraction*
FDA ..... *Food and Drug Administration*
HCM ..... *Hypertrophic Cardiomyopathy*
I.V ..... *Intravenous*
ICD ..... *Implantable Cardioverter-Defibrillator*
ICU ..... *Intensive Care Unite*
INR ..... *International Normalized Ratio*
LMWH ..... *Low Molecular Weight Heparin*
LUD ..... *Left Uterine Dispalacement*
LV ..... *Left Ventricule*
LVOTO ..... *Left Ventricular Outflow Tract Obstruction*
Mgy ..... *Gray*
MRI ..... *Magnetic Resonance Imaging*
MS ..... *Mitral Stenosis*
NON STEMI ..... *Non st Segment Elevation Myocardial Infarction*
NT-proBNP ..... *N-terminal Pro B-type Natriuretic Peptide*
NYHA ..... *New York Heart Association*
PAH ..... *Pulmonary Arterial Hypertension*
PAP ..... *Pulmonary Artery Pressure*
PCI ..... *Percutaneous Coronary Intervention*
PMCD ..... *Postmortem Cesarean Delivery*
PPCM ..... *Peripartum Cardiomyopathy*
PS ..... *Pulmonary Valve Stenosis*
ROSC ..... *Return of Spontaneous Circulation*

List of Abbreviations (Cont...)

Abb.	Full term
RV	*Right Ventricule*
SBP	*Systolic Blood Pressure*
STEMI	*st Segment Elevation Myocardial Infarction*
SVT	*Supraventricular Tachycardia*
TGA	*Transposition of the Great Arteries*
TR	*Tricuspid Regurgitation*
UFH	*Unfractionated Heparin*
VSD	*Ventricular Septal Defect*
VT	*Ventricular Tachycardia*
VTE	*Venous Thrombo-Embolism*
WHO	*World Health Organization*

Abstract

Introduction: Cardiac disease in pregnancy is the most common non-obstetric cause of maternal mortality. Cardiac disease complicates 1% of all pregnancies. It has become the leading cause of indirect maternal death in pregnancy, accounting for approximately 26.4% of pregnancy-related deaths, in developed nations. In the future, the number of pregnant women with cardiac disease is likely to rise as advances in health continue.

Cardiac conditions can be pre-existing (e.g. rheumatic or congenital heart disease) and unmasked by increased volume load in pregnancy, or can be caused by pregnancy [e.g. arrhythmia or peripartum cardiomyopathy, pulmonary embolism, pulmonary edema or myocardial infarction]. Pregnancy is a vasodilator state in which plasma volume and cardiac output increase such that many symptoms and signs of cardiac disease can occur physiologically.

Objectives: This work aims to give an overall view about parturient patients who suffer from cardiac critical diseases and how to manage each of it in obstetric ICU to decrease morbidity and mortality.

Data Sources: Medline databases (PubMed, Medscape, Science Direct. EMF-Portal) and all materials available in the Internet till 2017.

Summary: The cardiovascular system undergoes significant structural and hemodynamic changes during the course of pregnancy. There are major increases in cardiac output and a decrease in maternal systemic vascular resistance; the renin-angiotensin aldosterone system is significantly activated; and the heart and vasculature undergo remodeling. Understanding the normal cardiovascular changes in pregnancy is essential to care for patients with cardiovascular disease and predict possible cardiac complications.

Key words: *Advanced Life Support in Pregnancy- Atrial Fibrillation - Cardiovascular Disease*

INTRODUCTION

Cardiac disease in pregnancy is the most common non-obstetric cause of maternal mortality. Cardiac disease complicates 1% of all pregnancies. It has become the leading cause of indirect maternal death in pregnancy, accounting for approximately 26.4% of pregnancy-related deaths, in developed nations. In the future, the number of pregnant women with cardiac disease is likely to rise as advances in health continue ***(Malik and Sharma, 2016).***

Cardiac conditions can be pre-existing (e.g. rheumatic or congenital heart disease) and unmasked by increased volume load in pregnancy, or can be caused by pregnancy [e.g. arrhythmia or peripartum cardiomyopathy, pulmonary embolism, pulmonary edema or myocardial infarction]. Pregnancy is a vasodilator state in which plasma volume and cardiac output increase such that many symptoms and signs of cardiac disease can occur physiologically ***(Sliwa and Anthony, 2016).***

Pregnancy can cause a significant hemodynamic stress for women with congenital heart disease because of the increases in blood volume, cardiac output, heart rate, and myocardial contractility; previous studies in pregnant women with CHD have found rates of cardiac complications ranging from 11 %to 19%as well as increased obstetric and neonatal complications in comparison with women without CHD ***(Thompson et al., 2015).***

Cardiac arrest in pregnancy is one of the most challenging clinical scenarios that could be the most serious complication of previous cardiac conditions. Although most features of resuscitating a pregnant woman are similar to standard adult resuscitation, several aspects and considerations are uniquely different. The most obvious difference is that there are 2 patients, the mother and the fetus ***(Say et al., 2014).***

Management of the pregnant females who have cardiac critical diseases require a multidisciplinary approach involving the attending obstetrician, internist, and anesthetist. Ideally, the patient should be treated in an intensive care unit that is capable of providing maternal and fetal monitoring as well as a comprehensive obstetric service ***(Malik and Sharma, 2016)***.

Aim of the Work

This work aims to give an overall view about parturient patients who suffer from cardiac critical diseases and how to manage each of it in obstetric ICU to decrease morbidity and mortality.

Chapter 1
PHYSIOLOGICAL CHANGES OF THE CARDIOVASCULAR SYSTEM DURING PREGNANCY

Pregnancy in the human female is a unique state in which virtually all maternal systems are dramatically altered to permit the sustenance and growth of the intrauterine conceptus. Pregnancy is a dynamic process associated with significant physiological changes in the cardiovascular system (Table 1) ***(Purandare et al., 2016).***

Table (1): Hemodynamic changes during pregnancy, peripartum and postpartum

	Pregnancy	Peripartum	Post partum
Blood volume	↑	↑	↓
Systolic blood pressure	↓	↑	↑
Diastolic blood pressure	↓	↑	↑
Systemic vascular resistance	↓	↑	↑
Heart rate	↑	↑	↓
Stroke volume	↑	↑	↓
Cardiac output	↑	↑	↓

(Lind, 1985)

These changes are mechanisms that the body has adjusted to meet the expanded metabolic requests of the mother and fetus and to guarantee satisfactory uteroplacental

circulation for fetal growth and development. Inadequate hemodynamic changes can bring out maternal and fetal morbidity. Maternal inability to adjust to these physiological changes can uncover underlying, previously hidden, heart pathology, which is why some call pregnancy nature's stress test. Cardiovascular disease in pregnancy is the main cause of maternal mortality in North America ***(Berg et al., 2010a).***

During pregnancy, healthy women experience increased shortness of breath on exertion and increased fatigue. Because resting cardiac output is increased in pregnancy, the maximal cardiac output induced by exercise is achieved at a lower level of work. During rest or weight-bearing exercise, maternal oxygen uptake is significantly increased compared with the nonpregnant state. Furthermore, resting minute ventilation and tidal volume are increased and the expiratory reserve volume and functional residual capacity are decreased in pregnancy. Under the influence of neurohormonal changes, plasma volume increases more than red blood cell mass, resulting in the "physiological anemia" of pregnancy ***(Melzer et al., 2010).***

I. Maternal Hemodynamic Changes

Pregnancy is associated with vasodilation of the systemic vasculature. The systemic vasodilation of pregnancy happens as early as at 5 weeks and therefore precedes full placentation and the complete development of the uteroplacental circulation ***(Chapman et al., 1998).***

Figure 1 shows the hemodynamic changes throughout pregnancy.

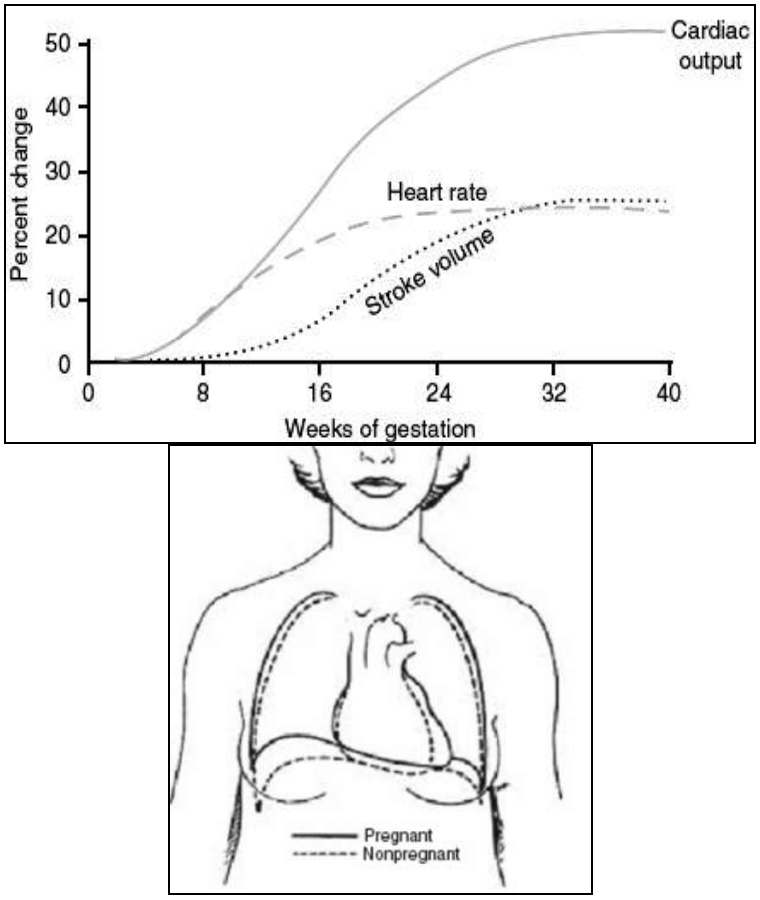

Figure (1): Hemodynamic parameters during pregnancy ***(Purandare et al., 2016).***

In the first trimester, there is a significant reduction in peripheral vascular resistance, which diminishes during the middle of the second trimester with a subsequent plateau or slight increase for the rest of the pregnancy. The reduction is ≈35% to 40% of baseline. Systemic vascular resistance

increases to near-prepregnancy levels postpartum, and by 2 weeks after delivery, maternal hemodynamics have to a great extent returned to nonpregnant levels ***(Mahendru et al., 2014).***

Vasodilation of the kidneys vasculature results in a 50% increase in renal plasma flow and glomerular filtration rates by the end of the first trimester. This results in decline in serum creatinine, urea, and uric acid values ***(Cheung and Lafayette, 2013).***

A- Cardiac Output:

Cardiac output has been the most widely studied measure of cardiac performance during pregnancy and is dependent on heart rate and stroke volume, both of which increment during pregnancy. Cardiac output increments by about 30- 50% with the first increase noted as early as week 5 of gestation and reaching a peak at roughly the end of the second trimester ***(Robson et al., 1989).***

Cardiac output increases throughout pregnancy. Invasive measuring techniques are rarely utilized during pregnancy, so echocardiography is most ordinary used to evaluate hemodynamics in pregnancy. Cardiac output measurements are usually done with the mother in the left lateral decubitus position to prevent positional variation ***(Ducas et al., 2014).***

The highest rise in cardiac output occurs by the start of the first trimester, and there is continuous increase during the second