Anesthetic Consideration for Non Obstetric Surgeries during Pregnancy

Essay
Submitted for the master degree **in anesthesia**

By
Eman Ibrahem Abdel Ghany
M B B CH

Supervised by

Prof. Dr. Zakaria Abdel Aziz Moustafa

Professor of Anesthesiology and Intensive Care
Faculty of Medicine - Ain Shams University

Dr. Waled Ahmad Abdel Rahman Mansour

Lecturer of Anesthesiology and Intensive Care
Faculty of Medicine - Ain Shams University

Dr. Mostafa Mohammed Serry

Lecturer of Anesthesiology and Intensive Care
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
2014

بسم الله الرحمن الرحيم

وقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ
ورَسُولُهُ والْمُؤْمِنُونَ

صدق الله العظيم

سورة التوبة آية (١٠٥)

*First, thanks are all due to **Allah** for Blessing this work until it has reached its end, as a part of his generous help throughout our life.*

*My profound thanks and deep appreciation to **Prof. Dr. Zakaria Abdel Aziz Moustafa,** Professor of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University for his great support and advice, his valuable remarks that gave me the confidence and encouragement to fulfill this work.*

*I am deeply grateful to **Dr. Waled Ahmad Abdel Rahman Mansour,** Lecturer of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams university for adding a lot to this work by his surgical experience and for his keen supervision.*

*I would like to direct my special thanks to **Dr. Mostafa Mohammed Serry,** Lecturer of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University, for his invaluable help, fruitful advice, continuous support offered to me and guidance step by step till this essay finished.*

*I am deeply grateful to **my mother and father** who directed and encouraged me during the preparation of this work.*

Eman Ibrahem Abdel Ghany

List of Contents

List of Abbreviations

ACTH : Adrenocorticotropic hormone

ALS : Advanced life support

APC : Acquired activated Protein C

ATLS : Advanced trauma life support

BUN : Blood urea nitrogen

CO2 : Carbon dioxide

CPB : Cardiopulmonary bypass

CSF : Cerebral spinal fluid

CT : Computerized tomography

CTG : Cardiotocography

DVT : Deep venous thrombosis

ECG : Electrocardiogram

FBS : Fetal blood sampling

FDA : Food and drug administration

FHR : Fetal heart rate

FSH : Follicle-stimulating hormone

HELLP syndrome: Hemolytic anemia/elevated liver enzymes/low platelet count

HIV : Human immunodeficiency virus

IM : Intramuscular

LH : Luteinizing hormone

MAC : Minimal alveolar concentration

MRI : Magnetic resonance imaging

List of Abbreviations (Cont.)

NICE : National Institute of Health and Clinical Excellence

NO2 : Nitrous oxide

PG2 : Prostaglandin 2

PT : Prothrombin time

PTH : Parathyroid hormone

PTT : Partial thrombin time

TBG : Thyroxine binding globulin

TSH : Thyroid stimulating hormone

UTI : Urinary tract infection

VD : Volume of distribution

VWF : von willibrand factor

List of Figures

List of Tables

Introduction

Pregnant women undergo Physiological adaptations to pregnancy due to hormonal changes, mechanical effects of enlarged uterus and increase metabolic demand of fetus. Physiology of pregnancy affect pharmacokinetic of medication and certain drugs cross placenta causing congenital abnormalities. Effect of drugs depend on time of exposure, amount of drugs and it's distribution ***(Reitman et al., 2011).***

About 0.7 to 2% of pregnant women undergo non obstetric surgeries during their pregnancy. Around 35% in first trimester, 42% in second Trimester and 32 % during third trimester.

Appendectomy, cholecystectomy, ovarian torsion and trauma are most common causes.

Elective surgeries shouldn't be performed during pregnancy, but emergency surgeries must proceed regardless of gestational age. Surgeries during first trimester increase the risk of congenital malformation and abortion, third trimester increase risk of preterm labor. If feasible, second trimester is the best period for surgery. Preoperative obstetric consultation is mandatory to discuss the risk of preterm labor and view the availability of tocolytics use ***(Alkis, 2010).***

Anesthetic drugs decrease both fetal heart rate and

variability. Fetal heart rate monitoring is essential if technical available to detect early compromise, this allow optimizing maternal conditions like (oxygenation, fluid therapy and position adjustment).

Fetal heart rate variability is a good indicator for fetal wellbeing and can be monitored from 25 weeks of gestation ***(Reitman et al., 2011).***

Choice of anesthetic technique depend on patient present surgical status, gestational age of fetus, pregnancy induced Physiological changes and other coexisting comorbidities.

The most important and serious risk to fetus during surgery is intrauterine Asphyxia. Therefore, it's important to avoid fetal asphyxia by maintaining normal maternal oxygenation, hemodynamics and normocapnia ***(Mhuireachtaigh et al., 2006).***

Physiological changes during pregnancy

Maternal physiological changes in pregnancy are the normal adaptations that a woman undergoes during pregnancy to better accommodate the embryo or fetus . These physiological changes are entirely normal and include cardiovascular, hematologic, metabolic, renal and respiratory changes that become very important in the event of complications. The earliest of these changes are hormonal driven while changes that occur later during pregnancy are due to the mechanical effect of the enlarging uterus and increased metabolic demands of fetus.

The body must change its physiological and homeostatic mechanisms in pregnancy to ensure the fetus is provided for. Increases in blood sugar, breathing and cardiac output are all required. Levels of progesterone and estrogens rise continually throughout pregnancy, suppressing the hypothalamic axis and subsequently the menstrual cycle ***(Reitman et al., 2011)***.

Changes in cardiovascular system :

The heart is displaced to the left and upward during pregnancy because of the progressive elevation of the diaphragm by the gravid uterus. The electrocardiogram of normal parturients may include: (1) benign dysrhythmia, (2) reversal of ST, T, and Q waves, and (3) left axis deviation ***(Reitman et al., 2011)***.

Cardiac output increases by 30% to 40% during pregnancy, and the maximum increase is attained around 24 weeks of gestation. The increase in heart rate lags behind the increase in cardiac output initially and then ultimately rises by 10 to 15 beats perminute by 28 to 32 weeks of gestation. The increase in cardiac output initially depends mainly on the rise in stroke volume, and later the increase in heart rate also becomes an important factor ***(Van de velde, 2007).***

Even with this increase in cardiac output the systolic blood pressure does not change during pregnancy; however, the diastolic blood pressure drops by I to 15 mm Hg. There is also decrease in mean arterial pressure because of an associated decrease in systemic vascular resistance. Pregnancy hormones like estradiol-17b and progesterone are probably responsible for these vascular changes ***(Gorman et al., 2004)***.

Cardiac output can vary depending on the uterine size as well as on the maternal position at the time of measurement. The enlarged gravid uterus can cause aortocaval compression while the pregnant woman is in the supine position, and this will lead to reduced venous return and ultimately maternal hypotension.

This effect will be exaggerated in parturients with polyhydramnios or multiple gestations. Hence left uterine displacement must always be maintained. This becomes more important following regional (spinal orepidural) analgesia or

anesthesia. Volume expansion is always important ***(Reitman et al., 2011)***.

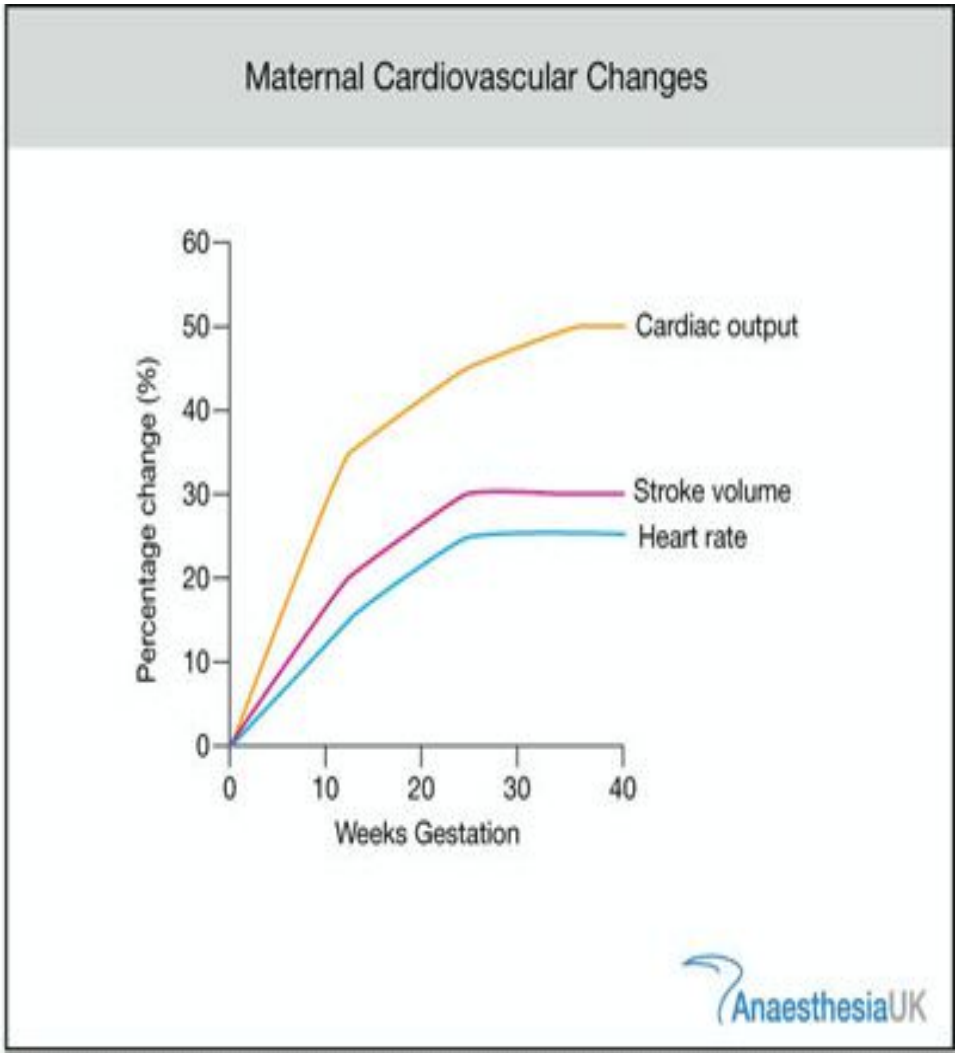

Fig. (1): Maternal cardiovascular changes ***(Heidemann et al., 2003)***

Cardiac output increases further during labor and may show values 50% higher than prelabor values. In the immediate postpartum period, cardiac output increases maximally and can rise 80% above prelabor values and

approximately 100% above nonpregnant measurements. The increase in stroke volume as well as in heart rate maintains the increased cardiac output ***(Van de Velde et al., 2007)***.

An increased cardiac output might not be well tolerated by pregnant women with valvular heart disease (e.g., aortic or mitral stenosis) or coronary arterial disease. A severe decompensation in myocardial function can develop at 24 weeks' gestation, during labor, and especially immediately after delivery. Cardiac output, heart rate, and stroke volume decrease to pre-labor values 24 to 72 hours postpartum and return to non pregnant levels within 6 to 8 weeks after delivery ***(Gorman et al., 2004)***.

Changes in blood volume:

Maternal blood volume increases during pregnancy, and this involves an increase in plasma volume as well as in red cell and white cell volumes. The plasma volume increases by 40% to 50%, whereas the red cell volume goes up by only 15% to 20%, which causes a situation that is described as physiological anemia of pregnancy ***(Reitman et al., 2011).***

The increased blood volume serves several important functions:

- It takes care of the increased circulatory need of the enlarging uterus as well as the needs of the fetoplacental unit.

- It fills the ever-increasing venous reservoir.
- It protects the parturient from the bleeding at the time of delivery as parturients become hypercoaguable as the gestation progresses ***(Gorman et al., 2004).***

Because of this apparent hemodilution, blood viscosity decreases by approximately 20%. The exact mechanism of this increase in plasma volume is unknown. However, several hormones such as rennin angiotensin, aldosterone, atrial natriuretic peptide, estrogen, and progesterone may be involved in this phenomenon ***(Van de Velde et al., 2007)***.

Pregnancy is associated with significant changes in the hemostatic profile. Fibrinogen and clotting factors VII, VIII, X, XII, vWF and ristocetin co-factor activity increase remarkably as gestation progresses. Increased levels of coagulation factors are due to increased protein synthesis mediated by the rising estrogen levels. In in vitro experiments, pregnant plasma has been demonstrated to be capable of increased thrombin generation. Thus, pregnancyis a prothrombotic state. In pregnancy, aPTT is usually shortened, by up to 4 s in the third trimester, largely due to the hormonallyinfluenced increase in factor VIII. However, no marked changes in PT or TT occur ***(Bernstein et al., 2001)***.

There are changes in the levels and activity of the natural anticoagulants also. Levels and activity of Protein C do