Comparison between the Effect of Volume Preload Versus Ephedrine Infusion for Prevention of Hypotension after Spinal Anesthesia for Cesarean Section

Thesis

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List of Abbreviations

ACTH	**:**	Adrenocorticotrophic hormone
ADRs	**:**	Adverse Drug Reactions
AMP	**:**	Adenosine monophosphate
ASA	**:**	American society of anesthesia
BMI	**:**	Body mass index
BP	**:**	Blood pressure
CC	**:**	Closing capacity
CNB	**:**	Central neuroaxial block
CNS	**:**	Central nervous system
CS	**:**	Cesarean section
CSF	**:**	Cerebrospinal fluid
CVS	**:**	Cardiovascular System
CSE	**:**	Combined spinal epidural
DA	**:**	Ductusarteriosus
EBP	**:**	Epidural blood patch
ECG	**:**	Electrocardiography
ETCO2	**:**	Endtidal CO_2
FDA	**:**	Food and drug administration
FRC	**:**	Functional residual capacity
HES	**:**	Hydroxyl-ethyl starch
GA	**:**	General anesthesia
GFR	**:**	Glomerular filtration rate

GMP	**:**	Guanisine monophosphate
GIT	**:**	Gastrointestinal tract
HR	**:**	Heart rate
IV	**:**	Intravenous
IM	**:**	Intramuscular
LP	**:**	Lumbar puncture
LAST	**:**	Local anesthetic systemic toxicity
MAC	**:**	Minimum alveolar concentration
MAO	**:**	Monoamine oxidase
LA	**:**	Local anesthetic
***p* value**	**:**	Probability value
PaCO2	**:**	Arterial carbon dioxide tension
PaO2	**:**	Arterial oxygen tension
PDPH	**:**	Post dural puncture headache
SBP	**:**	Systolic blood pressure
SD	**:**	Standard deviation
SpO2	**:**	Unintentional dural puncture
SEH	**:**	Spinal epidural hematoma
TED	**:**	Thromboembolic deterrent
RC	**:**	Respiratory center
UDP	**:**	Oxygen saturation
α	**:**	Alpha
β	**:**	beta

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Introduction

Caesarean section is a form of childbirth in which a surgical incision is made through a mother's abdomen (laparotomy) and uterus (hysterotomy) to deliver one or more babies. It is usually performed when a vaginal delivery would lead to medical complications. Regional anesthesia is the most common method of anesthesia for C/S because it allows the mother to be awake and immediately interact with her baby. It is also safer for the mother than general anesthesia. Regional anesthesia is used for 95 percent of planned cesarean deliveries in the United States ***(Bucklin et al., 2005)***.

Spinal anesthesia provides a fast, profound, and symmetrical sensory and motor block of high quality in patients undergoing lower abdominal and lower limbs surgeries. Spinal anesthesia has fewer side effects and risks than general anesthesia (asleep and pain-free). Patients usually recover much faster and can go home sooner ***(Park, et al., 2006).***

A successful regional anesthesia effectively suppresses many of the pain mediated stress responses to surgery such as rise in blood pressure, heart rate and increase in plasma

concentrations of catecholamines, cortisol and glucose. Spinal block is also associated with lesser amount of surgical haemorrhage ***(Hossain et al., 2002)*** Spinal anesthesia produces few adverse effects on the respiratory system as long as unduly high blocks are avoided ***(Ismail, Huda, 2009).***

Hypotension during spinal anesthesia can cause significant morbidity and mortality and it could be associated with severe nausea and vomiting. It leads to serious risk to the mother and baby (hypoxia, acidosis, and neurological injuries ***(Cyna et al., 2006).***

As a result, decreased systemic vascular resistance and peripheral pooling of blood occurs which decreases cardiac output. Bhagat, et al., 2004 The incidence of hypotension and high spinal anesthesia is higher in cesarean sections due to a decrease in the amount of cerebrospinal fluid (CSF) in the lumbosacral area and higher cephalad spread of local anesthetics. This is due to compression of inferior venacava by hypertrophic uterus and developing of collateral venous plexus circulation in the epidural space ***(Higuchi et al., 2004).***

Various attempts have been made to reduce the incidence and severity of hypotension including expansion of intravascular volume with up to 2liters of fluids. The use of lateral uterine displacement is a routine procedure to prevent hypotension. Fluid loading has been shown to reduce risk of hypotension but doesn't eliminate it. it also takes time to achieve and many patients still need vasopressor treatment to correct hypotension. An infusion of ephedrine may be an effective alternative ***(Jackson et al., 2005).***

Aim of the Work

In this present study we aimed at Comparing between the effect of volume preload (crystalloid preload) versus Ephedrine infusion for prevention of hypotension after spinal anesthesia for cesarean section.

Maternal and Fetal Physiology

Maternal physiology

Normal pregnancy involves major physiological and anatomical adaptation by maternal organs. It is important that anesthetists involved in the care of the pregnant woman to understand these changes, to provide safe maternal anesthetic care which is compatible with safe delivery of the baby ***(Duvekot and Peeters, 2009)***.

Pregnancy affects virtually every organ system; many of these physiological changes appear to be adaptive and useful to the mother in tolerating the stresses of pregnancy, labor and delivery. The maternal physiologic changes during pregnancy contribute to increased anesthetic risk for both the mother and fetus ***(Morgan and Mikhail, 2006).***

A-Cardiovascular changes:

1) **Changes in blood volume**: Expansion of the plasma volume and increase in red blood cell mass begin as early as the fourth week of pregnancy, peak at 28 to 34 weeks of gestation, and then plateau until parturition. Plasma volume expansion is accompanied by a lesser increase in red cell volume. As a result, there is a mild

reduction in hematocrit, with peak hemodilution occurring at 24 to 26 weeks. The blood volume in pregnant women at term is about 100 mL/kg ***(Jensen et al., 2002).***

2) Changes in vascular resistance and blood pressure: The arterial blood pressure (ABP) typically falls early in gestation and is usually 10 mmHg below baseline in the second trimester. In the third trimester, the diastolic blood pressure gradually increases and may normalize to nonpregnant values by term.

The factors responsible for the vasodilatation are incompletely understood, but one of the major findings is decreased vascular responsiveness to the pressor effects of angiotensin II and norepinephrine. Several additional mechanisms for the fall in vascular resistance have been proposed: increased endothelial prostacyclin and enhanced nitric oxide production ***(Thompson and Weiner, 1997)***.

3) Changes in Cardiac output: The cardiac output rises 30 to 50 percent (1. 8 L/min) above baseline during normal pregnancy; one-half of this increase occurs by 8 weeks of gestation. The elevation in cardiac

performance results from changes in three important factors that determine cardiac output: preload is increased due to the associated rise in blood volume, afterload is reduced due to the decline in systemic vascular resistance & maternal heart rate rises by 10 to 15 percent above base line ***(Semin, 2009).***

''Maternal supine hypotension syndrome'' results when the gravida assumes a supine position, leading to uterine compression of the Aorta and the inferior vena cava. Venous blood returns to the heart is decreased. The decreased preload reduces stroke volume and may result in a 25%to 30% decrease in cardiac output. Maternal symptoms include pallor, sweating, nausea, vomiting, hypotension, tachycardia, and mental status changes. Symptoms are more pronounced in the third trimester because of the expanding uterus and are alleviated by maintaining a left lateral decubitus position and displacing the uterus laterally ***(Metcalfe et al., 2008).***

B-Respiratory changes:

Progesterone gradually increases during the course of pregnancy. It acts as trigger of the primary respiratory center (RC) by increasing the sensitivity of the respiratory