Comparative Study between General versus Spinal Anesthesia on Fetal Outcome in Elective Cesarean Section

Thesis

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List of Abbreviations

ABP	Arterial blood pressure
ACTH	Adrenocorticotropic hormone
BPM	Beat per minute
BP	Blood pressure
CHD	congenital heart diseases
CNB	Central neuraxial blockade
CNS	Central nervous system
CO2	Carbon Dioxide
CPAP	Continuous positive airway pressure
CS	Cesarean Section
CSE	Combined spinal–epidural
CSF	Cerebro-spinal fluid
DA	Ductus-arteriosus
EBP	Epidural blood patch
ELBW	Extremely low birth weight
$ETCO_2$	End-tidal carbon dioxide
ETT	Endotracheal tube
FRC	Functional residual capacity
GA	General anesthesia
HCO_3^-	Bicarbonate
H_2CO_3	Carbonic acid
HR	Heart rate
IV	Intravenously

kg	Kilogram
L	Liter
LA	Local anesthetic
LP	Lumbar puncture
MAC	Minimum alveolar concentration
μg	Microgram
mEq	Milli equivelant
mg	Milligram
mmHg	Millimeter mercury
NA	Neuraxial anesthesia
NICU	Neonatal intensive care unit
NIBP	Non invasive blood pressure
NRAS	The Neonatal Resuscitation Adaptation Score
NRP	The Neonatal Resuscitation Program
NS	Normal saline
O_2	Oxygen
$PaCO_2$	Arterial Partial Pressure Of Carbon Dioxide
PaO_2	Arterial Partial Pressure Of Oxygen
PDPH	Post-dural puncture headache
PEEP	Positive End Expiratory Pressure
pH	Hydrogen ion measure
pK	Acid dissociation constant

PPV°	Positive pressure ventilation via either mask or endotracheal tube
PT	Prothrombin time
PTT	Partial thromboplastin time
RC	Respiratory center
SpO2	Saturation of Oxygen in The Arterial Blood
SVR	Systemic vascular resistance

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Introduction

The rate of Cesarean Section (CS) has been increased rapidly during the last two decades to reach 50% in some countries of the world. Many factors have contributed to this rise including improved surgical and anesthetic techniques and reduced risk of post-operative complications ***(Villar et al., 2006).***

The focus on the effect of type of anesthesia used in CS on the short term neonatal outcome has been recently increased with different perspectives of the advantages and disadvantages of the type of anesthesia used in CS ***(Linton et al., 2004).***

For the past five decades, the Apgar score has been the primary tool used when evaluating the clinical status of neonates at birth. It has been used one and five minutes to predict later neonatal morbidity and outcome. It is a composite measure of breathing effort, heart rate, muscle tone, reflexes and skin color. It is an indicator of the newborn's need for medical attention shortly after birth. Each of these is given a score of 0, 1 and 2. Neonates with a score ≥ 7 are considered normal ***(AAP, 2006).***

The Neonatal Resuscitation Program (NRP) recommends a standardized and simple scoring system to assist in identification of neonatal health status and provides need to resuscitation regardless of gestational age ***(Perlman et al., 2012).***

The Neonatal Resuscitation Adaptation Score (NRAS), the new score uses 5 objective parameters. Two parameters assess the newborn's cardiovascular status: heart rate and cardiovascular support. Two measures assess the respiratory status: supplemental oxygen and respiratory support. One parameter assessing the neurological status: palmar grasp reflex ***(Futagi et al., 2012).***

Internationally, obstetric anesthesia guidelines recommend regional blocks over general anesthesia (GA) for most cesarean sections ***(Eltzching et al., 2003).***

The anesthetic plan for cesarean delivery should take into account the well-being of two persons: the mother and the fetus. Regional anesthesia is the most common method of anesthesia for delivery because it allows the mother to be awake and immediately interact with her baby. It is also safer for the mother than general anesthesia ***(Bloom et al., 2005).***

In contrast to regional anesthesia, general anesthesia (GA) offers a very rapid and reliable onset, control over the airway and ventilation and potentially less hypotension. The major adverse fetal effect of regional anesthesia and its sympathetic blockade is uteroplacental hypoperfusion which leads to an acute fall in intervillous blood flow with the potential for fetal acidemia ***(Bucklin et al., 2005).***

So, umbilical cord blood gases analysis is considered a gold standard to assess the acid base status and uteroplacental performance, especially in high risk pregnancies and the possibility of fetal depression ***(Littleford, 2004).***

Aim of the Work

This study aimed at comparing general anesthesia versus spinal anesthesia as regard their effects on Neonatal Resuscitation Adaptation Score, acid-base status of the newborn as a primary outcome and on vital signs of the mother for elective cesarean delivery as a secondary outcome.

Chapter (1)

Maternal Physiological Consideration

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).***

Cardiovascular changes:

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 ***(Jensen et al., 2002)***.

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).***

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 15percent above base line ***(Semin, 2009).***