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Effectiveness of Intrathecal Administration of Bupivacaine with Fentanyl versus Nalbuphine for Elective Cesarean Section

Thesis

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Nada Mohamed Bahaa

List of Contents

List of Tables

List of Tables

List of Figures

List of Figures (Cont...)

List of Abbreviations

Abb.	Full term
µg	*Microgram*
ASA	*American Society of Anesthesiologists*
CNS	*Central Nervous System*
CO	*Cardiac output*
CPR	*Cardiopulmonary Resuscitation*
CSE	*Combined Spinal Epidural*
CSF	*Cerebrospinal Fluid*
CVP	*Central venous pressure*
FRC	*Functional Residual Capacity*
GA	*General Anesthesia*
GFR	*Glomerular filtration rate*
INR	*International Normalized Ratio*
IT	*Intra-thecal*
ITP	*Immune Thrombocytopenic Purpura*
IVC	*Inferior Vena Cava*
LA	*Local Anesthesia/Anesthetics*
LMWH	*Low Molecular Weight Heparin*
LOS	*Lower oesophageal sphincter*
MAC	*Minimal Alveolar Concentration*
MAP	*Mean arterial Blood pressure*
MV	*Minute Ventilation*
PCA	*Patient-controlled Analgesia*
PDPH	*Post-dural Puncture Headache*
SVR	*Systemic vascular resistance*
SpO_2	*peripheral capillary oxygen saturation*
TV	*Tidal volume*
V.D	*Vasodilatation*
VAS	*Visual analogue score*
VR	*Venous return*

Abstract

Aim of the Study:

The study aims to compare the intraoperative and postoperative analgesic efficacy of Fentanyl versus Nalbuphine when used with intrathecal injection of 0.5% hyperbaric bupivacaine in spinal anesthesia in patients undergoing elective cesarean section, the hemodynamics changes and occurrence of post-operative side effects.

Patients and Methods:

In our study, Fifty adult females underwent elective cesarean section in obstetrics and gynecology Ain Shams university hospital (El Demerdash) were randomly allocated into 2 groups (25 patients each)

Group A: (n = 25): patients will receive 25microgram (0.5ml) fentanyl with 10mg of 0.5% hyperbaric bupivacaine (2ml) intrathecal.

Group B: (n=25): patients will receive 0.8mg (0.4ml) nalbuphine (to be completed to 0.5ml by adding 0.1ml of normal saline in order to have the same volume of drug administered in both groups) with 10mg of 0.5% hyperbaric bupivacaine (2ml) intrathecal.

Keywords: Post-dural Puncture Headache - peripheral capillary oxygen saturation - Post-dural Puncture Headache

INTRODUCTION

Spinal anesthesia is the most popular procedure in the field of anesthesiology ***(Naaz et al., 2017).***

The use of opioids in sub-arachnoid block started in 1979; hence forth they have been used either as solitary agents or, more commonly, combined with local anesthetics. When combined, opioids act on spinal cord receptors while local anesthetics block neuro-axonal transmission ***(Raghuraman, 2017).***

Fentanyl is a lipophilic opioid acting as μ agonist with a rapid onset following intrathecal injection without migrating to the 4th ventricle which might otherwise cause respiratory depression. Nalbuphine hydrochloride is a mixed agonist antagonist. It produces analgesia and sedation through agonism at the kappa receptor and lesser side effects through binding the μ receptor competitively displacing other μ antagonists (partial antagonist) ***(Gurunath and Madhusudhana, 2018).***

Intrathecal nalbuphine versus intrathecal fentanyl as an additive with bupivacaine for orthopedic surgery of lower limbs was studied; and the study concluded that the duration of rescue analgesia was statistically significant prolonged when 2mg of nalbuphine was given intrathecally as compared to 25μg of fentanyl with both added to 17.5mg of hyperbaric bupivacaine. ***(Gupta et al., 2016).***

Nalbuphine exhibits a ceiling effect to analgesia, comparing 0.2 mg of intrathecal morphine with different doses of intrathecal nalbuphine (0.2,0.8, 1.6 mg) in elective cesarean section concluded that intrathecal nalbuphine 0.8mg provides good intraoperative and early postoperative analgesia without side effects (no postoperative nausea and vomiting or pruritus) and that nalbuphine 1.6 mg did not increase efficacy but increased the incidence of complications. Concluding that 0.8mg as the most effective safe dose even in cesarean section patients ***(Culebras et al., 2000).***

Aim of the Work

The study aims to compare the postoperative analgesic efficacy of Fentanyl versus Nalbuphine when used with intrathecal injection of 0.5% hyperbaric bupivacaine in spinal anesthesia in patients undergoing elective cesarean section as the primary outcome, also compares intraoperative hemodynamic changes and postoperative side effects as the secondary outcome.

Chapter 1
PHYSIOLOGICAL AND ANATOMICAL CHANGES WITH PREGNANCY

During pregnancy, anatomical and physiological changes occur to meet the increased metabolic needs, to permit appropriate development of fetus and to prepare the body for childbirth.

Cardiovascular System

It is a basic physiological fact that arterial blood pressure is generated by the left ventricle ejecting blood into the systemic vasculature, which acts as a resistance to cardiac output. Within the organs, the arterial vasculature undergoes extensive branching and the vessel diameters decrease. The smaller arteries and arterioles serve as the chief resistance vessels, and through changes in their diameter, serve to regulate systemic vascular resistance and organ blood flow. In hemodynamic terms, the mean arterial pressure (MAP) can be described by the following equation MAP = (CO x SVR) + CVP. Where CO = cardiac output, SVR = systemic vascular resistance, and CVP = central venous pressure. Therefore, increases in CO, SVR or CVP will lead to increases in MAP ***(Klabunde, 2012).***

During pregnancy, specifically by 8th week of gestation, there are increased levels of estrogen and progesterone, causing peripheral vasodilatation (V.D.) and a resultant decrease in systemic vascular resistance (SVR). Furthermore, cardiac output (CO) increases in order to maintain adequate blood pressure (BP = CO × SVR). Blood volume increases, beginning from 6 to 8 weeks of gestation, to reach a maximum increase of about 20% by mid-third trimester ***(Chestnut et al., 2014).***

At 20 weeks of gestation, the gravid uterus begins to cause mechanical compression of inferior vena cava (IVC) and descending aorta in supine position. Consequently, leading to a decrease in venous return (VR) and CO resulting in maternal hypotension and fetal compromise. As a compensatory mechanism for this aortocaval compression, both the sympathetic tone and the HR increase and blood from lower limb is shunted to the right side of heart through vertebral plexus and azygos veins ***(Lanni et al., 2002).***

Anesthetic implications

On one hand; the aforementioned expansion in blood volume provides some reserve for the normal blood loss during delivery (about 300–500 ml for vaginal delivery and 600–1000 ml for cesarean delivery) and peripartum hemorrhage.