Journal of Clinical Anesthesia (2016) **34**, 208–215

ELSEVIER

Journal of Clinical Anesthesia

Original contribution

A randomized trial comparing prophylactic phenylephrine and ephedrine infusion during spinal anesthesia for emergency cesarean delivery in cases of acute fetal compromise☆,☆☆,★

Kajal Jain MD (Professor)[a,*], Jeetinder Kaur Makkar MD, DNB[a], Siva Subramani VP MD[a], Shalini Gander MD[b], Praveen Kumar MD, DM (Professor)[c]

[a]*Department of Anaesthesia & Intensive Care, Postgraduate Institute of Medical Education and Research, Sector 12, Chandigarh 1600012, India*
[b]*Department of Obstetrics & Gynecology, Postgraduate Institute of Medical Education and Research, Sector 12, Chandigarh 1600012, India*
[c]*Department of Paediatrics, Postgraduate Institute of Medical Education and Research, Sector 12, Chandigarh 1600012, India*

Received 4 November 2015; revised 3 March 2016; accepted 5 March 2016

Keywords:
Cesarean;
Emergency, category II;
Anesthesia;
Spinal, vasopressor;
Ephedrine, phenylephrine

Abstract

Background: Previous evidence showed that use of phenylephrine was associated with higher umbilical artery pH (UA pH) than ephedrine after elective cesarean delivery (CD). However, the best choice of vasopressor and its effect on funic gases in cases of acute fetal compromise require additional studies.

Methods: Ninety parturients showing acute fetal compromise during intrapartum period and taken up for CD (category II) under spinal anesthesia were randomized to receive prophylactic infusion of ephedrine 2.5 mg/min or phenylephrine 30 μg/min. Systolic blood pressure was targeted between 90% and 110% of baseline. Incidence of fetal acidosis (UA pH <7.2 and/or base deficit >12 mmol/L) was recorded. Other parameters of cord gases, Apgar score, need for immediate resuscitation, maternal hemodynamics, and adverse events were also compared.

Results: Number of neonates showing acidosis with ephedrine or phenylephrine was comparable ($P = .22$). Of these, newborns with base deficit >12 mmol had low 1-minute Apgar scores (n = 15/23). The ephedrine group had higher oxygen content in UA ($P = .03$). There was no adverse neonatal outcome during the period of observation. Incidence of maternal nausea and vomiting was higher with ephedrine than with phenylephrine (22.2% vs 4.4%; $P = .02$). Maternal bradycardia was observed with phenylephrine ($P = .02$).

Conclusion: Our data report similar fetal acidosis with either phenylephrine or ephedrine administered during spinal anesthesia for treating maternal hypotension in cases of emergency CD.

☆ Funding: This project has not been funded by any foundations, institutions, pharmaceutical and device manufacturers, private companies, or intramural departmental sources.

☆☆ Trial Registry: CTRI/2015/05/005,777

★ Conflict of interest: None.

* Corresponding author. Kajal Jain, MD, Professor, Department of Anaesthesia & Intensive Care, PGIMER, Chandigarh 160012, India. Tel.: +91 9814528468; fax: +91 172-2744401x2745078.

E-mail address: kajalteji@gmail.com (K. Jain).

http://dx.doi.org/10.1016/j.jclinane.2016.03.015
0952-8180/

1. Introduction

Spinal anesthesia (SA) is the technique of choice for cesarean delivery (CD) because of its simplicity, safety, and ease of performance [1]. Some studies reported fetal acidosis after SA, probably due to greater hemodynamic disturbances and concurrent use of ephedrine [2,3]. However, recent data suggest that keeping blood pressure (BP) at baseline value using prophylactic phenylephrine is associated with best neonatal (highest umbilical artery pH) and maternal outcome (no nausea/vomiting) during CD [4,5]. Most of the evidence came from elective settings and low-risk pregnancy where fetal acidosis did not affect neonatal outcome. However, in cases of intrapartum fetal compromise (category II), it may be of further interest to study the effects of phenylephrine or ephedrine infusion on fetal acid-base status. We report funic gases using either phenylephrine or ephedrine infusion for maintaining maternal BP during CD indicated for acute fetal compromise (category II). The primary outcome of the study was to assess the incidence of fetal acidosis in newborns. Apgar score, need for immediate neonatal resuscitation, maternal hemodynamics, and adverse effects, if any, were the secondary outcomes assessed.

2. Methodology

2.1. Study design and setting

After institute ethic committee approval (chairperson: Professor S.K. Jindal MS/1750/MD/8457; 5.10.2011) this randomized, double-blind, prospective trial was conducted in the obstetric unit of a tertiary care hospital.

2.2. Participant selection

Ninety-four American Society of Anesthesiologists I-II term pregnant women who were admitted to labor room with spontaneous onset of labor for normal vaginal delivery and later on taken up for emergency CD due to acute fetal compromise were recruited in this study. Acute intrapartum fetal compromise included those women (1) who had a category I fetal heart trace at the beginning of labor and later on showed a change to category II trace with no improvement following intrauterine resuscitative measures [6]. (2) Fetal growth restriction (FGR) requiring emergency CD was included if the subject was near-term pregnancy with fetal biophysical profile >6 before induction of labor and later on showed category II trace. The decision (1) to augment the labor with oxytocin during intrapartum course and (2) to proceed with emergency CD was made by the obstetric team as per the institutional protocol. None of the participants were receiving labor analgesia. A balanced salt solution was administered as intravenous fluid during labor. Patients who had contraindications for SA, cardiovascular or cerebrovascular diseases, fetal malformations, hypertensive disorders of pregnancy, diabetes, multiple gestation, growth restricted fetuses having chronic asphyxia (previous abnormal nonstress test and biophysical profile <6), ruptured membranes with meconium stained liquor, or evidence of intrauterine infection were excluded. Women undergoing induction as a result of fetal or maternal complications were also not included.

2.3. Consent

The eligible parturients were approached for provisional verbal consent after explaining the study protocol in the labor room. Subsequently, if a decision was made to proceed to emergency CD, willingness to participate was confirmed and written consent was obtained.

2.4. Randomization

A random number chart was generated from computer software (Tippet). The sealed opaque envelopes with random numbers were shuffled and picked up by an anesthesiologist (K.J.) who prepared vasopressor infusion according to the group allocation and was not involved in the further management of the patient. Another anesthesiologist who was blinded to the drug solution collected the intraoperative data (S.S.).

2.5. Intervention

Identical 50-mL syringes were prepared with phenylephrine 30 μg/mL and ephedrine 2.5 mg/mL. Rescue boluses were prepared similarly in identical 10-cc syringes to deliver phenylephrine 50 μg/mL and ephedrine 4 mg/mL depending on the group of study.

2.6. Study procedure

Maternal history was recorded for eligible participants. Intravenous metoclopramide 10 mg and ranitidine 50 mg were administered as soon as the decision to operate was taken.

In the operation room, the parturient was monitored for electrocardiogram, noninvasive BP, and oxygen saturation (5/Avance; Datex Ohmeda, Inc, Madison, WI). SA was given under aseptic precautions in left lateral position at $L_{3\text{-}4/4\text{-}5}$ space using 26-gauge Quincke needle. Once free flow of cerebrospinal fluid was obtained, hyperbaric bupivacaine 0.5% (10 mg) with fentanyl (25 μg) was injected. The patient was turned supine with slight left uterine displacement. Oxygen supplementation was given at 5 L/min using clear ventimask (fraction of inspired oxygen 40%). Upper sensory level of anesthesia was measured every 1 minute using loss of pin prick sensation. A block level of $T_{4\text{-}6}$ was considered as adequate surgical anesthesia. Non-invasive BP recordings were taken at 1-minute interval beginning after spinal injection and continued till delivery of the baby. Immediately after intrathecal injection, prophylactic intravenous infusion of phenylephrine