

## Comparison of the effects of spinal anesthesia between pre-eclamptic patients and normal pregnant women during cesarean section

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### ABSTRACT

**Objective:** To compare the effects of spinal anesthesia between pre-eclamptic patients and normal pregnant women during cesarean section.

**Methodology:** The participants of this hospital-based cohort study consisted of 60 women. Their age range was between 18-40. Thirty patients were pre-eclamptic and the others were normal pregnant women. Spinal anesthesia was administered with 2ml lidocaine 5%. Hemodynamic changes, dose of ephedrine requirement, incidence of nausea and Apgar score were compared between two groups. Data were transformed to the SPSS software. Then Chi-square, T-student and Fischer exact tests were performed for statistical analysis.

**Results:** There was no significant statistical difference of age and weight between two groups. In regard to basic, post spinal and post ephedrine systolic and diastolic blood pressure, significant statistical differences were noted. Similarly as regards the number of patients who developed hypotension and the dose of ephedrine injection, there were meaningful statistical differences between two groups.

**Conclusions:** Development of hypotension and dosage of ephedrine injection in pre-eclamptic patients were less than healthy pregnant women during cesarean section under spinal anesthesia. As such spinal anesthesia is a safe method for cesarean section in pre-eclamptic patients.

**KEY WORDS:** Pre-eclampsia, Cesarean Section, Spinal Anesthesia.

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### INTRODUCTION

Pre-eclampsia has been defined as hypertension developing after 20 weeks' gestation or in the early postpartum period and returning to normal within 3 months after delivery.<sup>1,2</sup> The classic triad of pre-eclampsia includes hypertension, proteinuria, and edema. Pre-eclampsia complicates up to 8% of pregnancies.<sup>1,3</sup> This condition is commonly found out by obstetric anesthesiologists in which an otherwise healthy parturient can become critically ill.<sup>1</sup>

The upper airway may become edematous in a pre-eclamptic woman and may lead to compromised airway and difficult intubation during general anesthesia. Pulmonary edema occurs in more than 3%

of these patients due to high left atrial, pulmonary capillary wedge pressure, increased capillary permeability, low plasma colloid and low osmotic pressure.<sup>1,4</sup>

The cardiovascular effects of pre-eclampsia may vary. Cotton and colleagues<sup>1,5</sup> described three subsets of cardiovascular changes in women with severe untreated pre-eclampsia:

1. Hyperdynamic circulation, high cardiac output, normal to increased systemic vascular resistance (SVR), and normal or slightly decreased blood volume and filling pressures
2. Normal cardiac output and lower filling pressures, but increased SVR
3. Highly elevated SVR, but reduced blood volume and decreased left ventricular function.

On the basis of above changes during general anesthesia, significant hypertension may occur at the time of laryngoscopy, at tracheal intubation, during emergence and extubation period. Also due to the presence of airway edema in these patients, the incidence of difficult ventilation will be increased.<sup>1</sup>

Due to the above dangerous and important changes in pre-eclampsia, general anesthesia may be hazardous. Thus some anesthesiologist recommend neuroaxial anesthesia as a good alternative method for cesarean section in pre-eclamptic patient.<sup>1</sup>

As regards neuraxial techniques, epidural anesthesia in a pre-eclamptic patient offers the advantage of a gradual onset of sympathetic blockage; it gives cardiovascular stability and avoids neonatal depression<sup>1,6</sup> but on account of slowing onset of the action, long time procedure, and high failure rate, epidural anesthesia may not be an attractive procedure in cesarean section.

When spinal anesthesia is used for cesarean delivery, there is a possibility of extensive sympatholysis with profound hypotension which may lead to diminished uteroplacental perfusion. In one study the incidence of hypotension after spinal anesthesia in pregnant women is 64-100%.<sup>7</sup> However, hypotension can be reduced by meticulous attention to anesthetic technique, careful volume expansion, and proper positioning.<sup>1</sup>

On the basis of above descriptions, we decided to compare the hemodynamic effects of spinal anesthesia between healthy pregnant women and pre-eclamptic patient in cesarean section.

## METHODOLOGY

The present hospital-based cohort study was performed at the Kosar hospital which is an obstetric center in Qazvin-Iran during April 2009 to

November 2009. The women, who consented to participate in this study, signed an agreement form and the study was approved by institution's human subject committee.

In this study, 60 women, 18-40 years of age who scheduled for cesarean section under spinal anesthesia were enrolled in two groups: 30 of them were pre-eclamptic and 30 had normal blood pressure.

Exclusion criteria were blood pressure more than 170/110mmHg, presence of chronic hypertension, diabetes mellitus, coagulopathy, systemic disorders, fetal distress, eclampsia, HELLP syndrome, and decreased level of consciousness. Patients in both groups received 10 ml/kg lactated ringer's solution twenty minutes before spinal anesthesia.

Blood pressure and heart rate had been measured during this time as basic information. Then in the sitting position by a 25-gauge needle, spinal anesthesia was administered to the patients through L3-L4 or L4-L5 space with 2 ml lidocaine 5%.

About 20 seconds after lidocaine injection, the patients lied down and sensory level had been tested by a blunt needle. Blood pressure and heart rate of the patients had been measured in the first minute and then every two minutes till fetal delivery and then every five minutes until the end of the operation.

We administered 5mg ephedrine when systolic blood pressure decreased about 30% or when it was less than 100 mmHg. We also evaluated dose of ephedrine requirement, total amount of ephedrine administration, incidence of nausea, and finally Apgar score of the newborns.

Data were transformed to the SPSS software. Chi-square, T.student and Fischer exact tests had been used for the analysis of the data. Level of significance was considered less than 0.05.

## RESULTS

At the beginning of the study, two groups were statistically equal according to their age and weight (Table-I). Concerning Apgar scores in first and 5<sup>th</sup> minutes, there were not significant statistical differences between two groups (Table-II). About basic heart rate, post spinal heart rate, and post ephedrine heart rate, there were no significant statistical differences either between two groups (Fig.1).

In both groups, the differences of heart rate (HR) in different periods were not significant statistically (Table-III). As regards basic, post spinal, and post ephedrine systolic blood pressures, there were significant statistical differences between two groups (Fig.2). Similarly as regards basic, post spinal, and

Table-I: Comparison of the age and weight of two groups (mean  $\pm$  standard deviation) '.

Mean/Group	H(n=30)*	P(n=30)*	P-Value
Age(years)	26.63 $\pm$ 5.93**	26.57 $\pm$ 5.36**	0.964
Weight(kg)	78.20 $\pm$ 6.88**	79.53 $\pm$ 6.66**	0.449

\* H: healthy, P: pre-eclamptic  
 \*\* (mean  $\pm$  standard deviation)

post ephedrine diastolic blood pressure, there were significant statistical differences between two groups (Fig.3).

The number of the hypotensive patients (decreased systolic blood pressure more than 30% of base line) who received ephedrine and dose of ephedrine prescription, there were significant statistical differences between two groups (Table-IV). The number of patients who developed nausea was 14 in healthy pregnant women and 12 in pre-eclamptic ones, so there was not significant difference between two groups (P.value = 0.170).

### DISCUSSION

The main purpose of our study was to compare the effects of spinal anesthesia between pre-eclamptic patients and healthy pregnant women during cesarean section. In the current study, the development of hypotension and dosage of ephedrine requirement in pre-eclamptic patients were less than healthy pregnant women during cesarean section under spinal anesthesia.

There are some controversies about safety of spinal anesthesia for cesarean section in pre-eclamptic patients because spinal anesthesia by sympathetic block and producing hypotension may decrease utero-placental circulation and lead to fetal distress. Also prevention and treatment of hypotension by crystalloid solution may produce pulmonary edema.<sup>7-9</sup> Recently, some investigators have

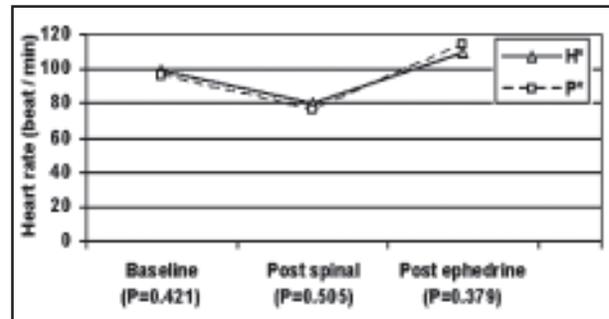


Fig-1: Comparison of the heart rate between two groups in different periods (\* H: healthy, P: pre-eclamptic)

suggested that epidural and spinal anesthesia are desirable and range of hemodynamic changes is safe in these patients.<sup>1,10-14</sup>

In a prospective and randomized trial study by Hood DD, Curry R, there was no significant difference in the incidence of hypotension in severely pre-eclamptic women having spinal as compared with epidural anesthesia for cesarean delivery.<sup>15</sup> The findings of this paper generated interest among anesthesiologists and obstetricians because it was performed at Parkland Hospital in Dallas, Texas, an institution in which for many years it was taught that spinal anesthesia was absolutely contraindicated in severely pre-eclamptic women.

In another study by Wallace DH, et al, it was demonstrated that general anesthesia as well as regional anesthetic methods are equally acceptable for cesarean delivery in pregnancies complicated by severe pre-eclampsia if steps are taken to ensure a careful approach to either method.<sup>8</sup> But general anesthesia may be hazardous in these patients due to excessive airway edema, soft tissue swelling, presence of difficult intubation, and excessive hemodynamic responses to endotracheal intubation.<sup>1</sup>

Previously due to worries about the occurrence of pulmonary edema in pre-eclampsia, anesthetists

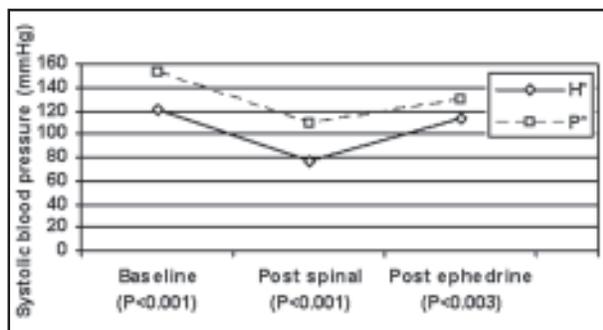


Fig-2: Comparison of the systolic blood pressure between two groups in different periods (\* H: healthy, P: pre-eclamptic)

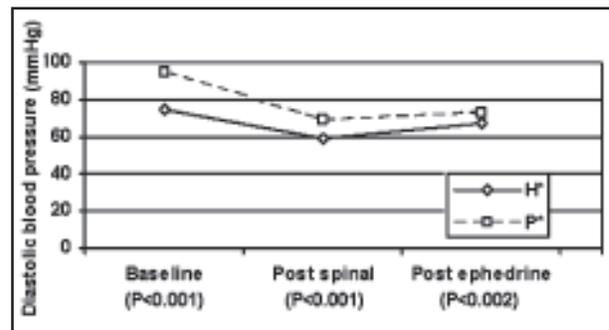


Fig-3: Comparison the diastolic blood pressure between two groups in different periods (\* H: healthy, P: pre-eclamptic)

Table-II: Comparison of Apgar score in two groups.

Group / Apgar Score	<7	7	8	9	10	Total	P.Value
H* (1min)/Number of Patient	0	1	4	25	-	30	0.058
P* (1min) /Number of Patient	2	3	3	22	-	30	
H* (5min) /Number of Patient	-	-	-	-	30	30	0.083
P* (5min) /Number of Patient	1	-	2	3	24	30	

H: healthy, P: pre-eclamptic

agreed with less fluid therapy, although the patients were hypovolemic due to vasoconstriction. Therefore less fluid therapy lead to severe hypotension after spinal anesthesia.<sup>7,11,16</sup>

In our study, it was demonstrated that in pre-eclamptic patients, the incidence of hypotension which needed to ephedrine therapy was less than normal pregnant women which may be due to sufficient fluid therapy (10ml/kg) before spinal anesthesia. In normal pregnancy, preload will be decreased and incidence of supine hypotensive syndrome (SHS) will be increased because of pressure effect of enlarged uterus on inferior vena cava (IVC).<sup>1,17</sup>

In contrast, fetus of pre-eclamptic cases may develop intra uterine growth retardation (IUGR) and low birth weight with little compressive effects on IVC. Thus in pre-eclamptic patients, the incidence of SHS is lower than normal pregnant ones<sup>7</sup> and there may be another mechanism of the less hemodynamic changes and ephedrine requirement after spinal anesthesia in the patients in our study. Moreover in normal pregnancy, pressure effects of uterus on IVC will be transmitted to epidural vessels, so distending them decreases epidural space and increasing local anesthetic concentration in the CSF. As a result cephalic spread of local anesthetics will increase sensory level of anesthesia and may lead to

significant hypotension.<sup>7</sup> But these effects may not occur in pre-eclamptic patients.

Vascular tone which modulates blood pressure is under regulation of two systems: sympathetic nervous system and vascular endothelium. In pre-eclamptic patients, there are sympathetic over activity and some defects in vascular endothelium which decrease vascular relaxation.<sup>1,7</sup> Secretion of vasopressor factors in circulation will also be increased.<sup>7</sup> In contrast to sympathetic system, vasopressor factors and endothelial system will not be affected by spinal anesthesia and it may increase the vascular tonicity and reduce the rate of hypotension development. Moreover due to the presence of high sensitivity of vasculature to vasoconstrictor drugs in pre-eclamptic patients, one can treat hypotension with smaller dose of vasoconstrictors such as ephedrine.<sup>18</sup> All above mechanisms explain the results of our study that, why blood pressure decreases gradually in pre-eclampsia during cesarean section under spinal anesthesia. On the basis of this theory, blood pressure of these patients will be regulated by lower amount of ephedrine.

Due to hemodynamic stability and maintenance of uteroplacental circulation in pre-eclamptic patients, we can illustrate that why there were not significant statistical differences regarding to

Table-III: Comparison of the difference of heart rate (HR) in different periods between two groups (mean  $\pm$  standard deviation)

HR / Group	*H	P*	P.Value
Basic HR - post spinal HR	19.70 $\pm$ 14.16**	19.43 $\pm$ 18.10**	0.962
Post ephedrine HR - post spinal HR	42.78 $\pm$ 13.43**	48.88 $\pm$ 16.48**	0.329

\*H: healthy, P: pre-eclamptic \*\* (mean  $\pm$  standard deviation)

Table-IV: Comparison of the number of the patients who received ephedrine and dose of ephedrine prescription between two groups.

Parameter / Group	*H	P*	P.Value
Ephedrine receiving patients /total	18/30	8/30	0.008
Ephedrine prescribed dosage (mg)	14.17 $\pm$ 5.21**	7.50 $\pm$ 5.34**	0.018

\* H: healthy, P: pre-eclamptic \*\* (mean  $\pm$  standard deviation)

babies' Apgar score between two groups of our study. Finally it shows that, in pre-eclamptic patients spinal anesthesia is a safe method for cesarean section and anesthetists can use it with meticulous fluid therapy and proper positioning.

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