Journal of Medical Sciences

ISSN 1682-4474

science alert

ANSInet
an open access publisher
http://ansinet.com

Research Paper

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued eight times per year on paper and in electronic format.

For further information about this article or if you need reprints, please contact:

F. Moslemi
Department of Anesthesiology,
Faculty of Medicine,
Tabriz University,
Alzahra Hospital, Tabriz, Iran

J. Med. Sci., 7 (6): 1044-1048
15th August, 2007

Comparison of Spinal Versus General Anesthesia for Cesarean Delivery in Patients with Severe Preeclampsia

F. Moslemi and S. Rasooli

This study examined both markers of neonatal condition and maternal hemodynamic in severely preeclamptic patients receiving spinal or general anesthesia. Sixty patients were randomized to general (n = 30) or spinal anesthesia (n = 30). The general anesthesia group received thiopental 4-5 mg kg^{-1}, succinylcholine 1 mg kg^{-1} for rapid sequence induction, followed by 50% nitrous oxide in oxygen and 0.5-0.75% halothane, 0.15 mg atracurium after intubation and 1 μg kg^{-1} fentanyl after delivery. Spinal group received 2 mL of 0.5% hyperbaric bupivacaine plus 10 μg fentanyl intrathecaly. Bradycardia and any alteration in blood pressure in the range of 30% from baseline were treated with Atropine, Ephedrine (hypotension) and Nitroglycerine infusion (hypertension), respectively. After delivery, neonatal 1st and 5th apgar scores were evaluated and umbilical arterial blood gas samples were taken and analyzed. There was not any significant deference in blood pressure changes in the range of higher than 30% from baseline between two groups ($p = 0.95$). 1st and 5th apgar scores ($p>0.05$) and umbilical arterial blood gas markers (pH, PCO_2, HCO_3, BE) showed no deference between two groups ($p>0.05$). Also postoperative complications (nausea, vomitingand hypertension) were higher in general anesthesia group ($p = 0.04$). The use of spinal anesthesia in severe preeclamptic patients has no significant effect of maternal hemodynamic and therefore on utero-placental perfusion. Also neonatal apgar score and umbilical arterial blood markers which have predictive value on neonatal outcome are not influenced with it. Besides using spinal anesthesia do not expose the mothers to the hazards of general anesthesia.

Key words: Preeclampsia, spinal, general anesthesia, apgar score, umblical blood gas

ANSInet
Asian Network for Scientific Information

Department of Anesthesiology, Faculty of Medicine, Tabriz University, Alzahra Hospital, Tabriz, Iran

INTRODUCTION

It has been several controversies about the technique of choice for cesarean section in severe preeclampsia for several years. According to the pathophysiology of severe preeclampsia, there has been an understandable caution as regards spinal anesthesia in these patients, because of the theoretical possibility of precipitous hypotension, decreased cardiac output and associated placental hypoperfusion (Miller, 2005; Dyer *et al*., 2003; Camann, 2003; Stoelting, 2002). On and doerdorf, the other hand, the risks of general anesthesia, including failed or esophageal intubation, pulmonary aspiration, drug-related fetal depression, blood pressure changes during laryngoscopy and intubation and the risk of cerebral hemorrhage may be more greater in preeclamptic women than normal parturients and healthy patients (Miller, 2005; Stoelting and Dierdorf, 2002; Santoa and Brinbach, 2003). However, recent studies about spinal anesthesia have found that blood pressure changes during this technique in patients with preeclampsia are not different from those that occur in normal patients and adequate prehydration or treatment with standard vosopressor therapy is similarly effective for both groups (Camann, 2003; Santoa and Brinbach, 2003; Antoin *et al*., 2003; Farragher and Data, 2003). Also, intrathecaly use of opioids with low-dose local anesthetic can decrease the incidence and severity of spinal-induced hypotension and improve the quality of intra and postoperative analgesia (Antoin *et al*., 2003; Farragher and data, 2003; Chestnut, 1999; Ben-David *et al*., 2000). Furthermore, studies on neonatal well being after spinal anesthesia for cesarean delivery in preeclampsia confirm the safety of this technique (Camann, 2003; Ahmed *et al*., 1999; Aya *et al*., 2005).

It was therefore decided to compare the hemodynamic status of severely preeclamptic parturients undergoing general or spinal of anesthesia with low dose local anesthetic-opioid and evaluate the neonatal outcome in each groups. Presumably the use of spinal anesthesia in these patients is of considerable benefit, as it does not affect the neonates outcome and prevent those patients the particular hazards of general anesthesia.

MATERIALS AND METHODS

Sixty parturients with severe preeclampsia candidated for cesarean section and randomized into two groups of 30 for either spinal or general anesthesia. Patients are parturients with the criteria of severe preeclampsia (blood pressure > 160/90 mmHg, proteinuria greater than 5 g per 24 h with at least one of the associated symptoms of sever preeclampsia as headache, visual disturbance, epigastric pain, hyperreflexia, dizziness or vomiting). Exclusion criterias were cardio-vascular and pulmonary disease, diabetes, HELLP syndrome, less than 34 week's gestation, fetal bradycardia and any contraindication of regional anesthesia including patients refusal, severe hemorrhage, coagulapthy and sepsis. In the antepartum management, all patients received magnesium sulfate as seizure prophylaxia and hydralazime intravenously as a vasodilafor for additional blood pressure control against their standardized protocol. Previous use of other drugs (alpha-methyldopa, dexamethasone) was recorded. After taking informed written consent, all patients received 8 mL kg^{-1} of crystalloid before anesthesia and basic vital signs (arterial blood pressure and heart rate) were controlled and recorded. Spinal group (group S, n = 30) received 6-10 mg (1/1-2 mL) of 0.5% hyperbaric bupivacaine plus 20 μg fentanyl intrathecally from L_3-L_4 or L_4-L_5 interspace in sitting position with 25 guage quinke needle. Patients received 6-8 L min^{-1} oxygen from face mask throughout surgery. General anesthesia group (group G, n = 30) underwent general anesthesia with rapid sequence induction. After preoxygenation, fentanyl 1 μg kg^{-1}, lidocaine 1 mg kg^{-1}, thiopental 4-5 mg kg^{-1}, succynilcholine 1 mg kg^{-1} were administered and they were intubated under celic maneuver. Maintenance of anesthesia was achieved with 50% N_2O in 50% oxygen, 0.5-0.75% halothane and 0.15 mg kg^{-1} atracurium. Patients were extubated awake with full dose reversal of atracurium. Demographic data including age, weight, gravidity, gestational age were recorded. Vital signs (BP, HR) and arterial oxygen saturation (S_aO_2) were controlled before (baseline) and immediately after anesthesia, every minute until neonatal delivery and every 5 min thereafter throughout surgery using automated noninvasive device.

Peak sensory block level was assessed in group S. Also, Mallampatti's class and grading of laryngoscopy were determined in group G. Any decrease or increase in blood pressure about 30% from baseline was treated with 2.5-5 mg ephedrine and repeated as need or with nitroglycerine infusion, respectively. After neonatal delivery, 1st and 5th minute apgar scores were assessed and umbilical artery blood sample was taken for blood gas analysis. In the postoperative period vital signs and any complication as nausea, vomiting, hyper or hypotension, agitation, were controlled and treated as needed. All data analyzed using paired t-test, independent t-test and χ^2/fisher exact test. Statistical analysis was performed using SPSS 13.

RESULTS

There was not any significant difference in demographic data between two groups (Table 1). According to the technique of anesthesia (Table 2), all patients in the spinal group had satisfactory sensory block level for cesarean section and no patient required

Table 1: Demographic data

Variables	SP group (n = 30)	GA group (n = 30)	p+
Age (year) (mean±SD)	30.17(4.99)	28.40(6.65)	0.249
Weight (kg) (mean±SD)	82.63(14.22)	81.43(9.72)	0.704
Gravidity (N)			
Nuliparity (1)	18	17	0.793
Multiparity (≥2)	12	13	
Gestational age (34-36 week)	21	22	0.774
Gestational age (37-39 week) (N)	9	8	
Baseline (preinduction sys. BP*) (mean±SD)	155.83(10.68)	157.63(10.54)	0.514
Baseline (preinduction dis BP•)(mean±SD)	94.57(11.87)	94.77(17.12)	0.958

*Systolic blood pressure, •Diastolic blood pressure, +p<0.05 is significant

Table 2: Patients characteristics according to anesthesia technique

Variables	SP group (n = 30)	GA group (n = 30)
Sensory block level	N (%)	-
T_3	1 (1.6)	
T_4	13 (21.0)	
T_5	4 (6.5)	
T_6	10 (16.1)	
T_7	2 (3.2)	
Malampathy class	-	N (%)
1		17 (27.4)
2		12 (19.4)
3		1 (1.6)
4		0 (0)
Laryngoscopy grading	-	N (%)
(I)		13 (21.0)
(II)		13 (21.0)
(III)		4 (6.5)
(IV)		0 (0)

additional analgesia or anesthesia. In general group, the majority of patients were in mallampatti's class 1 or 2 and laryngoscopic grading of I or II. None of them had mallampatti class 4 or grade IV of laryngoscopy. Four patients had laryngoscopic grading of III, so were intubated using stylet. Failed or esophageal intubation was not seen.

Evaluation of blood pressure alterations in each group separately, revealed that mean baseline systolic and diastolic arterial pressures in spinal group were 155.8±10.7 and 94.6±11.9 and after spinal anesthesia were 122.7±16.7 and 70.2±15.1, respectively. Comparing with paired t-test alterations in blood pressure before and after spinal anesthesia showed a significant differences in this group ($p<0.001$, $p<0.001$). in general group, mean systolic and diastolic blood pressure before induction were 157.63±10.3 and 94.8±17.1 and after induction were 154.1±14.0 and 94.5±7.2, respectively. These changes were found to be nonsignificant in this group ($p = 0.946$, $p = 0.174$).

Further analysis of BP changes and comparing them between two groups, revealed that mean systolic BP alteration before and after anesthesia in spinal group was 33.1±13.9 mmHg and in general group was 3.5±13.7 mmHg, which had significant between-group difference ($p<0.001$). In this way, mean diastolic BP change before and after anesthesia was 24.3±140.1 mmHg in spinal group and 0.23±18.8 mmHg in general group and this difference was also significant as comparing two groups ($p<0.001$). However, with regard to that BP alterations more than 30% from baseline are important and need for medical intervention, in this study, only 5 patients in group S and 1 patient in group G had BP changes more than 30% from baseline which has no significant difference between groups in statistical analysis ($p = 0.195$). Neonatal condition markers are presented in Table 3. According to Table 3, there was not any significant difference in 1st and 5th minute's apgar scores and blood gas values of neonatal umbilical artery between two groups.

Table 3: Neonatal condition markers in two groups

Variables	SP group (n = 32)*	GA group (n = 30)	p-value
1st apgar score (mean±SD)	7.66 (1.43)	7.57 (1.43)	0.80
5st apgar score (mean±SD)	9.41 (0.5)	94.43 (0.77)	0.89
1st apgar score <7 (N)	5	6	0.65
1st apgar score ≥7 (N)	27	24	
pH (mean±SD)	7.275 (0.154)	7.259 (0.174)	0.330
PCO_3 (mean±SD)	44.48 (6.42)	47.26 (6.30)	0.91
BE (mean±SD)	-5.55 (2.08)	-5.42 (1.63)	0.782
HCO_3 (mean±SD)	21.92 (2.67)	22.42 (2.42)	0.443

*Two pregnancies were twin

In postoperative period, 3 patients in group S and 9 patients in group G were reported to have problems. This difference is significant ($p = 0.04$). From 3 patients of group S, 2 patients had transient nausea without vomiting and one had nausea with mild vomiting. None of them need for treatment. From 9 patients of group G, 5 patients had blood pressure more than 160/90 mmHg, which were consulted with medical physician for BP control. From another 4 patients, one had transient nausea without vomiting, another one had nausea with limited vomiting and they need not for treatment. Only 2 patients had persistent nausea and vomiting, treated with 10 mg metoclopramide. Other complications including hypotension, cardiac arrhythmias, pulmonary edema, delayed awaking and were not seen.

DISCUSSION

It is likely that, there are many influences on neonatal outcome after cesarean delivery in preeclampsia. These including severity of maternal and fetal condition, anesthesia and surgical management; Fetal development is related to gestational age and to chronic uteroplacental insufficiency, which results in intrauterine growth restriction. In addition any acute maternal deterioration may impact unfavorably on fetal outcome (Ronald and Miller, 2005; Robert *et al*., 2002; Dyer *et al*., 2003; Camann, 2003). In this study the equivalence is seen between the two study groups in terms of

demographic and clinical data, severity of maternal disease and gestational age. Such that mean baseline systolic and diastolic BP of all mothers were high (although in the acceptable range for preeclampsia) inspite of preoperative antihypertensive therapy. Furthermore a large proportion of neonates were preterm according to the gestational age (Table 1). All of these, allowed us to assess the influence of anesthesia independely.

One of the most important factor in the spinal anesthesia is sensory block level. The appropriate sensory level for cesarean section is T_4 (Ronald and Miller, 2005). Adequate analgesia eliminate the using of supplemental systemic analgesia which could more interfere with maternal and fetal condition. On the other hand, high level of block may influence the hemodynamic of the mothers with higher sympathetic block which could more lessen the BP of them. In this study the sensory level of the spinal group mothers' were adequate (Table 2) and there was not seen any decrement in maternal BP in higher levels (T_3) in compared with lower levels (T_7). Also, the quality of analgesia was satisfactory, probably due to adding of opioids to the local anesthetic, so it did not necessitate for additional systemic analgesia or anesthesia.

Alterations in blood pressure were evaluated from two aspects. First systolic and diastolic changes were assessed in each group before (baseline) and after anesthesia. In the spinal group these changes were significant and all of the patients in this group became hypotensive following spinal anesthesia. But in the general group these changes were not significant probably due to variable BP changes, were seen in this group. Such that some of the patients became hypertensive following induction of anesthesia (duo to laryngoscopy and intubation), some became hypotensive and the others did not experienced BP changes. Of course, most of these alternations were in the acceptable range (less than 30% from baseline) and only 5 patients in group S and 1 patient in group G had systolic pressure reduction higher than 30% of baseline. All of them treated promptly with ephedrine.

Also, systolic and diastolic BP alterations were evaluated between two groups. Systolic pressure changes from baseline were 33.1±13.9 and 3.5±13.7 mmHg in group S and group G, respectively, this between-group difference is significant. Changes in diastolic BP were 24.3±14.1 mmHg in group S versus 5.23±18.8 mmHg in group G and is significant when comparing the two group with each other. These results reveal that systolic and diastolic BP changes in spinal group were more notable than general group although in the range of 30% from baseline.

In the study of Ahmed *et al.* (1999), the effects of spinal anesthesia was compared with general anesthesia in preeclamptic parturients. Hypotension was seen in 47.1% of spinal group and 68.8% of general group became hypertensive. Antoine *et al.* (2003) showed that patients with severe preeclampsia experience less hypotension (6 times lesser) during spinal anesthesia with 0.5% Bupivacaine plus sufentanyl and morphine intrathecaly than healthy parturients. In another study, Aya *et al.* (2005). Compared the severity of hypotension in preeclamptics and normal parturients undergoing preterm cesarean delivery under spinal anesthesia and saw that the risk of hypotension and ephedrine use was almost 2 times less than that in the preterm group. They concluded that preeclampsia- associated factors, rather than a smaller uterine was account for the infrequent incidence of spinal hypotension in preeclamptic patients. In this study, although the incidence of hypotension was higher in spinal group as compared with general group, but it was in the acceptable range without any dangerous effect on the mother or her neonate. It was appeared that many factors such as prehydration, adding of opioids to the low-dose local anesthetic drug and the other unknown preeclampsia-related factors contribute to the lower incidence and severity of hypotension in preeclamtics undergoing spinal anesthesia.

After delivery, the most common method used to detecting neonatal condition is 1st, 5th and occasionally 10th min apgar scores. Also, the more accurate and predictive measure, specially in high risk condition such as fetal distress is neonatal umbilical arterial acid-base values (Miller, 2005; Stoelting, 2002). Of course, the primary outcome measure is mean neonatal umbilical arterial base deficit, because variations in maternal ventilation will alter umbilical PH and therefore, umbilical arterial base deficit is a more specific index of the metabolic component of acid-base balance. Accepted criteria used to identify newborn infants at risk of fetal hypoxia are apgar score less than 7 at 1 and 5 min, neonatal umbilical pH less than 7.20 and umbilical arterial base deficit greater than 10 mm (Robert *et al.*, 2002; Dyer *et al.*, 2003). In the current study, 1st and 5th apgar scores and umbilical arterial acid-base values were evaluated. According to Table 3, there was not seen significant between-group difference in pH, base deficit, HCO_3 and $PaCO_2$ values and 1st and 5th apgar scores. Five neonates in spinal group and 6 neonates in general group had 1st scores less than 7, but their 5th min scores became 9 or 10 after simple resuscitation (positive pressure ventilation, stimulation and free flow oxygen).

One study (Shifman and Filippovich, 2003) contains data on retrospective observation study of 54 cases with subarachnoid anesthetic management for cesarean section in preeclampsia. The results showed that no complications were detected in mothers and fetuses of the experimental group and confirmed the safety of this method in patients with preeclampsia.

Another early study (Visalyaputra *et al*., 2005) comparing the effects of spinal and epidural anesthesia for cesarean delivery in severely preeclamptic patients showed that although the incidence and severity of hypotension and ephedrine use were significantly more in spinal group than in the epidural group, but the duration was short (< or = 1 min) in both groups and neonatal apgar scores and the umbilical arterial blood gas analysis were similar in either groups. Karien *et al.* (1996) studied the effect of preloading with crystalloid (1 L Ringer), before spinal anesthesia in preeclamptic parturients undergoing elective cesarean section and measured maternal-placental uterine artery circulation using a pulsed color Doppler technique. They resulted that preload with crystalloid solution does not prevent maternal hypotension in preeclamptic patients and that changes in uterine artery velocity waveforms were minor when systolic arterial pressure was 80% or more of baseline during spinal anesthesia which appear to have not any major effect on the clinical condition of the neonates, a assessed by apgar score and umbilical artery pH values. Robert *et al.* (2003) compared general with spinal anesthesia for cesarean delivery in preeclamptic patients with a nonreassuring fetal heart rate trace and showed that the hemodynamic of the mothers was similar in both groups, but median neonatal umbilical artery pH was lower (7.20 versus 7.25) and mean neonatal arterial base deficit was higher (7.13 versus 4.24) in spinal group than general group, but they were not find any correlation between ephedrine use (associated with hypotension) and base deficit values. They concluded that the clinical significance of these results remains to be established.

In this study, we evaluated the probable complications might be seen in recovery period after anesthesia. In general group, postoperative hypertension and nausea and vomiting were significantly higher than spinal group. In the study of Ahmed *et al.* (1999), Also, the incidence and severity of postoperative complications (hypertension, pulmonary edema, delayed awaking and mortality) were higher in general group in compared with spinal group.

According to these findings and the results of the other studies, we conclude that severe preeclamptic parturients undergoing spinal anesthesia, experience more hemodynamic instability (in the face of hypotension) than general group, but these changes are not severe, are transient, in the acceptable range and do not influence the neonatal outcome. So, subarachnoid block may be an appropriate anesthetic choice for women with severe preeclampsia having a cesarean delivery. Furthermore, because of its simplicity and rapidity we also believe that spinal anesthesia should be considered as an alternative to general anesthesia for emergency cesarean delivery in preeclamptic women who have been adequately prepared with judicious amount of IV preload.

REFERENCES

Ahmed, S.M., R.M. Khan, S. Bano, P. Ajmani and A. Kumar 1999. Is spinal anesthesia safe in pre-eclamptic toxemia patients? J. Indian Med. Assoc., 97: 165-168.

Antoine, G.M. Roseline Mangin and N. Vialles *et al*., 2003. Patients with severe preeclampsia experience less hypotension during spinal anesthesia for elective cesarean delivery than healthy parturients: A prospective cohort comparison. Anesth. Analg., 97: 867-872.

Aya, A.G., N. Vialles and I. Tanoubi *et al*., 2005. Spinal anesthesia induced hypotension: A risk comparison between patients with severe preeclampsia and healthy women undergoing preterm cesarean delivery. Anesth. Analg., 101: 869-875.

Ben-David, B., R. Frankel and T. Arzamonov *et al*., 2000. Minidose Bupivacaine-Fentanyl spinal anesthesia for Surgical repair of hip fracture in the aged. Anesthesiology, 2: 6-10.

Camann, W., 2003. Spinal anesthesia in Obstetrics-New concepts and developments. Ob/Gyn women's health, pp: 8.

Chestnut, D.H., 1999. Obstetric Anesthesia. Mosby, St Louis.

Dyer, R.A., F.C. Llse Els Ped and Josef Farbas *et al*., 2003. Prospective, randomized trial comparing general with spinal anesthesia for cesarean delivery in preeclamptic patients with a nonreassuring fetal heart trace. Anesthesiology, 99: 561-569.

Farragher, R. and S. Datta, 2003. Recent advances in Obstetric Anesthesia. J. Anesth., 17: 30-41.

Karien, J., J. Rasanen and S. Alahuhta *et al*., 1996. Maternal and uteroplacental haemodynamic state in preeclamptic patients during spinal anesthesia for cesarean section. Br. J. Anesth., 76: 616-620.

Robert, K., Stoelting and S.F. Dierdorf, 2002. Anesthesia and Co-existing Disease. Churchill Livingstone, New York.

Ronald, D. and R.D. Miller, 2005. Miller's Anesthesia. Elsevier Churchill Livingstone, Philadelphia.

Santos and D.J. Brinbach, 2003. Spinal anesthesia in the parturient with severe preeclampsia: Time for reconsideration. Anesth. Analg., 97: 621-622.

Shifman, E.M. and G.V. Filippovich, 2003. Safety of Saborachnoid anesthesia during cesarean section in pregnant women with preeclampsia. Anesteziol Reanimatol., 5: 38-41.

Visalyaputra, S., O. Rodanant and W. Somboonviboon *et al*., 2005. Spinal versus epidural anesthesia for cesarean delivery in severe preeclampsia: A prospective randomized, multicenter study. Anesth. Analg., 101: 862-868.