Spinal versus general anesthesia for elective cesarean delivery: A prospective comparative study

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Summary

Objective: To study the efficacy and safety of spinal anesthesia for elective cesarean section as compared with general anesthesia.

Patients and Methods: 175 women undergoing elective cesarean section were studied prospectively. They were allocated into two groups; the first group (n=60) received spinal anesthesia, and the second one (n=115) received general anesthesia for elective cesarean section. Preoperative and intraoperative BP and IV fluids were recorded. Chi-Square and Fisher's exact tests were used to compare differences between the two groups; $p < 0.05$ was considered significant.

Results: There were no differences between the two groups in terms of demographics, indication for elective cesarean section, operative time, gestational age, 1 and 5-min Apgar scores, and the means of preoperative and postoperative systolic and diastolic BP. A statistically significant increase was observed in terms of hypotension, postoperative analgesia, pre-induction and intraoperative IV fluids in the spinal group as compared to the general anesthesia group ($p < 0.001$, $p < 0.01$, and $p < 0.01$, respectively).

Conclusion: Spinal anesthesia is as effective as a general anesthesia. Maternal and fetal outcome are favorable. Maternal hypotension can be managed successfully with modest doses of ephedrine and IV fluid infusions. It provides sufficient postoperative analgesia allowing the mother to have more vitality and comfort than those who receive general anesthesia.

Key words: Spinal anesthesia; General anesthesia; Cesarean section, and hypotension.

Introduction

Managing cesarean section anesthesia is challenging and fraught with hazards. Each anesthetic option has different maternal and fetal risks. There will always be excuses available to explain away a depressed neonate or a poorly anesthetized mother when delivery – abdominal or vaginal – is an emergency operation. Anesthesia for elective cesarean section is pivotal since it provides the forum for assessing and compring the adequacy of various schedules of anesthesia.

Although the proportions of regional and general anesthetics were unknown, all anesthetic deaths involved general anesthesia and aspiration with airway difficulties being the most common causes of death [1]. Proper anesthesia for elective cesarean section protects both mother and fetus. Spinal anesthesia is an increasingly popular technique for elective cesarean section. It allows the mother to be awake and minimizes maternal aspiration pneumonitis and problems with difficult intubation [2]. The major adverse effects of spinal anesthesia for the mother are hypotension, nausea, vomiting, and headache [3, 4]. Mismanaged high blocks and local anesthetic toxicity account for most deaths associated with regional anesthesia [5]. We conducted this study to analyze the efficacy and safety of spinal anesthesia for elective cesarean section as compared to general anesthesia.

Patients and Methods

One hundred and seventy-five women undergoing elective cesarean section were studied prospectively at Prince Rhashed Hospital; 60 received spinal and 115 general anesthesia. The type of anesthesia was chosen by the patient in consultation with the anesthesiologist. Spinal anesthesia patients were managed preoperatively by receiving 700-1200 ml of Ringer's lactate solution intravenously immediately before induction of anesthesia, left uterine tilting, administration of 100% oxygen by clear mask, and recording of the blood pressure (BP) every five minutes. The spinal anesthesia was performed with a 25-G pencil-point spinal needle with the patient in a sitting position. Anesthesia was established with 10-12 mg hyperbaric bupivacaine which was given over 30 seconds. Three minutes after injection, the patient was placed in a supine position with her shoulders and neck elevated and slight flexion to limit cephalad migration of the anesthetic agent. Patients who developed hypotension (when systolic BP reached 100 mmHg) were managed by receiving Ringer's lactate infusions and ephedrine (5-20 mg IV).

General anesthesia patients were managed preoperatively by receiving 300-500 ml IV fluids, preoxygenation with 100% oxygen for 3-5 minutes, and recording the BP every five minutes. Induction of anesthesia was achieved by giving thiopental (3-5 mg/kg) and suxamethonium chloride (1 mg/kg), followed by intubation. Vecuronium (0.1 mg/kg) was given for muscle relaxation. Anesthesia was maintained using nitrous oxide N_2O 50%, O_2 50%, and halothene 0.4%. After delivery, 100 µg fentanyl for analgesia was administered and oxytocin infusion was started (20-40 U/L). The neuromuscular block was reversed using atropine (1.2 mg) and neostigmine (2.5 mg). All patients in both groups were monitored closely for at least 12 hours after surgery. Statistical analysis was performed using Chi-Square and Fisher's exact tests to compare the differences between the two groups; $p < 0.05$ was considered significant.

Results

Table 1 shows the demographics of 175 patients who underwent elective cesarean section (60 patients with spinal and 115 with general anesthesia). There were no significant differences in terms of age, height, weight, gravidity, parity, and gestational age between the two groups. Indications for elective cesarean section were repeat cesarean, breech, maternal DM, multiple pregnancy, and fetal anomaly (Table 2). More cesarean sections were performed for repeat cesareans in both groups, and there was no significant difference between the two groups regarding the indications for cesarean section.

Table 3 shows the hemodynamic IV fluids and the operative data for both groups. No significant difference was found in terms of preoperative and postoperative means of systolic and diastolic BP. The same was noted for the operative time. A statistically significant increase in the total pre-induction and intraoperative IV fluids was observed in the spinal group as compared to the general anesthesia group (p < 0.01). Also, a statistically significant increase was noted in the time from the induction to

Table 1. — *Demographic data.*

	Spinal n=60	General n=115	p
Age (yrs)	27.6±5.9	28.1±4.9	NS*
Height (cm)	160±19	163±11	NS
Weight (kg)	83±17	83±13	NS
Gravidity	4±1.6	4±1.9	NS
Parity	3±1.2	3±1.3	NS
Gestational age (wks)	37±1.4	37±2.7	NS

NS = Not significant.

Table 2. — *Indications for cesarean section.*

	Spinal n=60	General n=115
Repeat cesarean	29	43
Breech	12	31
Diabetes Mellitus	4	9
Preeclampsia	6	11
Multiple pregnancies	7	16
Fetal anomaly	2	5

Table 3. — *Hemodynamic, IV fluids and operative data.*

	Spinal	General	p
Preoperative BP* (mmHg)			
– Mean systolic	123±19	116±18	NS
– Mean diastolic	78±17	76±15	NS
Intraoperative BP (mmHg)			
– Mean systolic	111±7	124±23	NS
– Mean diastolic	63±8	80±27	NS
Hypotension	10	0	<0.001
Pre-induction IV fluids (ml)	951±72	387±88	<0.01
Total intraoperative IV fluids (ml)	2105±132	1398±151	<0.01
Induction to skin incision interval (min)	20±1.7	2.7±1	<0.005
Uterine to incision interval (min)	1.6±0.6	1.3±0.4	NS
Operative time (min)	41±7	39±9	NS

Table 4. — *Maternal and neonatal outcome.*

	Spinal	General	p
Maternal	n=60	n=115	
– Pulmonary edema	0	1	NS
– Headache	2	0	NS
– Postoperative analgesia (h)	5-6	0-1/2	<0.01
Fetal	n=66*	n=130*	
– Gestational weight	3300±389	3290±400	NS
– 1-min Apgar score >7	41	94	NS
– 5-min Apgar score >7	58	122	NS
– NICU#	5	4	NS
– Neonatal death**	3	4	NS

*7, and 16 sets of twin pregnancy; **Include abnormal neonates; NICU# = Neonatal intensive care unit.

the skin incision in the spinal group (p < 0.005). Ten patients developed hypotension in the spinal group who were managed successfully with IV fluids and ephedrine compared with no cases in the other group. This difference was statistically significant (p < 0.001).

Complications such as pulmonary edema and headache were observed in our study. One patient who was pre-eclamptic developed pulmonary edema in the general anesthesia group, and two in the spinal group had headaches. The difference regarding these complications was not significant between the two groups. The time of postoperative analgesia was significantly higher in the spinal as compared to the general anesthesia group (p < 0.01). Regarding fetal outcome, there was no significant difference between the two groups in gestational weight. The 1-min Apgar score <7 was lower in the general anesthesia group compared to the spinal group, but this difference did not reach statistical significance. The 5-min Apgar score was similar in both groups, as shown in Table 4.

Discussion

Our study revealed that both maternal and fetal outcome were favorable in both groups (spinal and general anesthesia). Proper anesthesia for elective cesarean section protects both mother and fetus [6]. Maternal anesthetic principles which include adequate oxygenation-ventilation, cardiovascular stability, and muscle relaxation will in turn offer fetal protection by maintenance of uterine perfusion, increasing fetal oxygenation and limiting anesthetic depression. Maternal complications such as hypotension and headache were noted in the spinal group and pulmonary edema was observed in the general anesthesia group. Maternal hypotension is by far the most common problem encountered during spinal anesthesia for cesarean delivery, [3] a finding which supports our results. Ten patients developed hypotension and they were treated with modest doses of ephedrine and intravenous crystalloids. However, Wallace *et al.* [7], reported that stimulation caused by tracheal intubation in general anesthesia may result in sudden hypertension, which causes pulmonary edema, cerebral edema, or intracranial hemorrhage. In our study, one patient in the

general anesthesia group who was preeclamptic developed pulmonary edema, most probably by the same mechanism. Although, the mean total of IV fluids was significantly higher in the spinal group, no patient developed such complication.

The 1-min Apgar score >7 was lower in the spinal as compared to the general anesthesia group. Rout *et al.* [3] reported that maternal hypotension, resulting from spinal anesthesia might be responsible for the higher incidence of low Apgar scores, as hypotension has a deleterious effect on uteroplacental perfusion. In contrast, Datta *et al.* [8] demonstrated that a uterine incision-to-delivery interval exceeding 90 seconds was associated with significantly poorer neonatal acid-base status and lower Apgar scores. However in a later study [9] they observed that increased levels of catecholamines in the umbilical arteries were associated with longer uterine-to-delivery intervals. According to the authors, this reflects a disruption of uteroplacental blood flow on one side and on the other side that these catecholamines also stimulate surfactant release and enhance surfactant synthesis with subsequent improvement of lung function at birth [10]. These observations may explain the low 1-min Apgar score in the spinal group and subsequent improvement, which was demonstrated by the 5-min Apgar score, since both hypotension and longer incision-to-delivery intervals were observed in our study. The outstanding advantage for the mother who choses spinal anesthesia is that she can see her infant at the time of birth, can probably hold it, even feed it during the subsequent course of the operation, and is able to continue these activities during the immediate postoperative period, since a longer time of postoperative analgesia (4-5 h) was observed versus 0-30 minutes for general anesthesia.

In summary spinal anesthesia is effective as a general anesthesia for elective cesarean section. The only significant complication of spinal anesthesia is hypotension which can be managed successfully with modest doses of ephedrine and IV fluids. Maternal and fetal outcome are similar.

References

[1] Fox E. J., Sklarge Hill C. H., Villanueva R., King B. D.: "Complications related to the pressor response to endotrachial intubation". *Anesthesiology*, 1977, *47*, 524.

[2] Morgan M.: "Anesthetic contribution to maternal mortality". *Br. J. Obstet. Gynecol.*, 1987, *59*, 842.

[3] Rout C. C., Rocke D. A.: "Prevention of hypotension following spinal anesthesia for cesarean section". *Int. Anesthesiol. Clin.*, 1994, *32*, 117.

[4] Vallego M. C., Mandell G. L., Sabo D. P., Ramanathan S.: "Post-dural puncture headache: a randomized comparison of five spinal needle in obstetric patients". *Anesth. Analg.*, 2000, *91*, 916.

[5] Russell I. F.: "Spinal anesthesia for cesarean section". *Br. J. Obstet. Gynecol.*, 1983, *55*, 309.

[6] Ratcliffe F. M., Evans J. M.: "Neonatal wellbeing after elective cesarean delivery with general, spinal and epidural anesthesia". *Eur. J. Anesthesiol.*, 1993, *10*, 175.

[7] Wallace D. H., Leveno K. J., Cunningham F. G., Giesecke A. H., Shearer V. E., Sidawi J. E.: "Randomized comparison of general and regional anesthesia for cesarean delivery in pregnancies complicated by severe pre-eclampsia". *Obstet. Gynecol.*, 1995, *86*, 193.

[8] Datta S., Ostheimer G. W., Weis J. B., Brown W. U., Alper M. H.: "Neonatal effect of prolonged anesthetic induction for cesarean section". *Obstet. Gynecol.*, 1981, *58*, 331.

[9] Bader A. M., Datta S., Arthur G. R., Benvenuti E., Courtney M., Hauch A. M.: "Maternal and fetal catecholamines and uterine-to-delivery interval during elective cesarean". *Obstet. Gynecol.*, 1990, *75*, 600.

[10] Lawson E. E., Brown E. R., Torday J. S., Mandansky D. L., Tauesch H. W.: "The effect of epinephrine on tracheal fluid flow and surfactant efflux in fetal sheep". *Am. Rev. Respir. Dis.*, 1978, *118*, 1023.

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