

ORIGINAL ARTICLE

Comparing the effects of general and spinal anesthesia on the postoperative pain intensity in patients undergoing emergent or elective cesarean section

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ABSTRACT

Objective: The aim of this study is to compare the effects of general and spinal anesthesia on postoperative pain intensity and analgesic agent requirements in patients scheduled for emergent or elective cesarean sections.

Patients and Methods: This was a prospective, observational study conducted in patients who underwent emergent or elective cesarean delivery under spinal or general anesthesia. Postoperative pain intensity and analgesic agent requirements, postoperative complications and patients' satisfactions were evaluated during the first 48 h postoperatively.

Results: A total of 212 parturients were enrolled; 104 (53 elective, 51 emergent) patients received general and 108 (54 elective, 54 emergent) patients received spinal anesthesia. Preoperatively, patients who underwent emergent cesarean section under spinal or general anesthesia had higher Numeric Rating Scale (NRS) scores than the patients who underwent elective cesarean delivery ($p < 0.001$). In the first postoperative 48 h, NRS pain scores were similar in patients who underwent emergent or elective cesarean sections under spinal or general anesthesia. Postoperative analgesic agent requirements and patients' satisfactions were not statistically significant between groups.

Conclusion: The effects of general and spinal anesthesia on postoperative pain were similar in emergent and elective cesarean sections. Therefore, postoperative analgesic effect should not be a determining factor in choosing the anesthesia method in cesarean sections.

Keywords: Cesarean section, Emergent cesarean sections, Elective cesarean sections, Postoperative pain, General anesthesia, Spinal anesthesia

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Introduction

Widely used obstetric anesthesia guidelines favour the use of spinal anesthesia over the administration of general anesthesia for cesarean sections [1,2]. Even though, spinal anesthesia has many advantages including safety of the baby and avoidance of the unwanted effects of general anesthesia (i.e. sore throat, altered mental status, pulmonary aspiration, necessity for endotracheal intubation), many centers still use general anesthesia for both emergent and elective cesarean sections.

Cesarean section is the most common cause of postoperative pain regarding obstetric interventions [3]. Preoperative anxiety is an important factor affecting the patient's perception of postoperative pain [4]. It is known that in elective cesarean sections, reduced preoperative anxiety decreases postoperative analgesic agent consumption having favorable effects on maternal satisfaction and recovery [4,5]. However, in patients undergoing emergent cesarean section, pain due to uterine contractions, absence of the preoperative surgical optimization, uncertainty about the baby's condition may lead to anxiety in the preoperative period. In this condition, performing spinal anesthesia may exacerbate the anxiety. As a result, pain experienced in the post-cesarean section period is closely related to the preoperative anxiety, urgency of the procedure and anesthesia method [3-7].

In literature, there are studies comparing the effects of analgesic agents and methods used to relieve pain after cesarean section [8]. Furthermore, although the effects of the preoperative anxiety and anesthesia methods (general versus spinal anesthesia) on the post-cesarean pain intensity have been previously investigated, studies comparing the

effects of spinal and general anesthesia in elective and emergent cesarean sections are lacking. The main objective of this study is to compare the effects of general and spinal anesthesia on the postoperative pain intensity and analgesic agent requirements in patients undergoing emergent or elective cesarean sections. The secondary aim is to determine the satisfaction of the patients, in the postoperative period.

Patients and Methods

This prospective, observational study was approved by the Istanbul Kartal Dr Lutfi Kirdar Training and Research Hospital Clinical Research Ethics Committee (Date: 29 July, 2016, No:2016.514.88/9). Written informed consent was obtained from all participants. Two hundred twelve American Society of Anesthesiologists (ASA) physical status I or II parturients with singleton and uncomplicated full-term pregnancy, aged between 18-40 years old, scheduled for emergent or elective cesarean delivery under spinal or general anesthesia were included into the study. Patients were required to have sufficient level of Turkish to understand and complete the questionnaires. Exclusion criteria were defined as obstetric and fetal problems (preeclampsia, eclampsia, fetal distress, congenital malformations), maternal cardiac, renal, pulmonary disorders and allergy to any one of the local or general anesthetic agents used.

All patients underwent preanesthetic evaluation, but no premedication was given. Patients scheduled for emergent or elective cesarean section were assigned to either general or spinal anesthesia groups, according to their own choice. Routine monitoring parameters included heart rate (HR), non-invasive systolic blood pressure (SBP), diastolic blood pressure (DBP), peripheral oxygen saturation (SpO_2) and body temperature. Intravenous crystalloid solutions (4-6 mL/kg/h) were infused during the procedure.

In cases of general anesthesia, after preoxygenation, anesthesia was induced intravenously with propofol (2-3 mg/kg), remifentanyl (1 mg/kg) followed by rocuronium bromide (0,6 mg/kg) to facilitate endotracheal intubation. Rapid-sequence induction with cricoid pressure was routinely applied to prevent regurgitation or aspiration of the gastric contents. Maintenance of anesthesia was performed with sevoflurane 2% in a mixture of air and oxygen, with a ratio of 1:1. After delivery, intravenous fentanyl (2 μ g/kg) was administered. At the end of the surgery, volatile anesthetics were discontinued, neuromuscular blockade was antagonized with neostigmine and extubation was performed when the patient was fully awake.

In cases of spinal anesthesia, under aseptic conditions, by the midline approach, spinal anesthesia was performed between the L3-4 interspace via a 25-gauge Quincke spinal needle, with the patient in the left lateral decubitus position. Following successful dural puncture, hyperbaric bupivacaine hydrochloride 0.5% (11-12.5 mg) was administered. Following injection, patients were returned to the supine position. The level of sensory block was tested by the pinprick test via a 23-gauge hypodermic needle and the degree of motor block was measured by the Bromage scale. Surgery started when the sensory block achieved to T4 level. Hypotension was defined as a decrease in SBP to less than 90 mmHg or 20% of the baseline value. Bradycardia was defined as a HR below 50 bpm. In cases of hypotension and/or bradycardia, ephedrine hydrochloride (5 mg) or atropine sulphate (0.5 mg) were administered.

Pain assessment was done during the first postoperative 48 h. Patients recorded their pain intensity using an 11-point Numeric Rating Scale (NRS), with no pain at 0 and worst pain imaginable at 10. Patients were asked to rate their highest NRS scores at rest and with motion preoperatively (NRS 0), on the first 24 hours (NRS 1) and the second 24 hours (NRS 2), postoperatively. NRS lower than 3 defined mild pain, NRS between 4-7 defined moderate pain and NRS higher than 7 defined severe pain. All patients received a standard post-operative analgesic regimen consisting of 500 mg oral acetaminophen with 6 h intervals. Intravenous tramadol hydrochloride (50 mg) or intravenous diclofenac sodium (75 mg) was administered as a rescue analgesic, if the patient's NRS scores were higher than 4 with motion. The time to rescue analgesic and total analgesic agent consumption during the first 48 h were recorded by the nursing staff. The maximum allowable daily dose of diclofenac sodium and tramadol hydrochloride were 150 mg and 400 mg, respectively. Respiratory depression was defined as a respiratory rate below 8 breaths/min and/or SpO_2 below 95% and was treated with oxygen or positive pressure support via a face mask. HR, SBP, DBP and SpO_2 were recorded with 5 minute intervals during the first 30 minute, and thereafter with 15 minute intervals. Sedation-agitation levels were monitored with the Riker Sedation-Agitation Scale (SAS) (1=unarousable; 2=very sedated; 3=sedated; 4=calm and cooperative; 5=agitated; 6=very agitated; 7=dangerous agitation) [9]. Patient's satisfactions degrees deemed with a 5-point Likert scale: very satisfied (= 5), relatively satisfied (= 4), fairly satisfied (= 3), relatively dissatisfied (=2) and very dissatisfied (=1). Postoperative adverse effects such as nausea, vomiting, shivering,

respiratory depression, bradycardia or hypotension were recorded. Data were used for statistical comparisons.

Statistical analysis

Based on previous studies, we hypothesized that the highest NRS score in the first 24 h should be around 5,6 [10]. The sample size was determined to obtain 90% power to detect a 10% difference between the highest NRS scores between groups. With the statistical significance set at a p-value of 0.05 and a standard deviation at around 1.2, calculations showed that 51 patients should attend to each group.

Data were presented as median or mean ± standard deviation (SD) as appropriate. For statistical analysis, comparisons were tested by ANOVA and chi-square tests where appropriate. Nonparametric data were compared by Kruskal–Wallis test. SPSS version 21 (IBM SPSS Inc., Chicago, IL, USA) was used. p<0.05 was considered statistically significant.

Results

A total of 212 parturients were enrolled into the study. General anesthesia was administered in 104 parturients: 53 women underwent elective and 51 women underwent emergent cesarean section. Spinal anesthesia was performed in 108 parturients: 54 women underwent elective and 54 women underwent emergent cesarean section.

The demographic and clinical characteristics of the patients were presented in Table I. There were no significant differences between groups regarding maternal age, gestational age, gravidity and parity. The indications for cesarean delivery were similar between groups (Table II).

Table I. Demographic and clinical characteristic of the patients

Anesthetic techniques	Spinal anesthesia		General anesthesia		P
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)	
Age (years)	29.5±0.7	28.2±0.7	30.6±0.7	28.8±0.8	0.133
Weight (kg)	76.9±1.7	75.2±1.7	78.2±2.2	76.1±1.9	0.093
Height (cm)	161.2±0.9	158.7±0.8	159.9±0.8	161.5±0.9	0.865
Gestational age (weeks)	38.2±0.3	38.1±0.7	38.1±0.3	38.4±0.4	0.058
Previous cesarean section (%)	46.3 *	66.7	41.2 #	75.5 **	0.001
Tubal ligation (%)	14.8	18.9	5.9 *	28.3 *	0.022
Gravidity	3(1-8)	2.5(1-6)	3(1-10)	2(1-9)	0.050
Parity	3(1-5)	2(1-4)	2(1-7)	2(1-5)	0.099
Hypotension (%)	40.7 *	31.5 #	0 **	0 **	<0.001
Hospital stay length (days)	3.0±0.1	3.1±0.2	3.0±0.1	3.0±0.1	0.896

Data are mean ± SD, median (range) actual number or percentage.

* p < 0.05 between groups, # p < 0.001 between groups

Table II. Indications for cesarean delivery

	Spinal anesthesia		General anesthesia	
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)
Non-reassuring fetal heart rate	1	11	1	8
Cephalopelvic disproportion	5	8	2	2
Failure to progress	2	4		7
Unanticipated malposition		1		1
Other	5	4	11	7
Primary elective			3	
Elective repeat	36	24	34	17
Breech/malposition	4	1	1	7
Placenta previa	1	1	1	2

Data are numbers of patients

Numeric Rating Scale scores of the patients were summarized in Table III. Patients in the emergent cesarean section groups had higher preoperative NRS scores when compared to patients with elective cesarean section groups under spinal and general anesthesia.

Table III. NRS scores of the patients

	Spinal anesthesia		General anesthesia		P
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)	
Preoperative	0.9±1.1	6.5±1.9 **	1.4±1.3	7.3±2.2 **	<0.001
With rest (During the first 24 h)	3.2±2.6	4.2±2.4	3.7±2.4	4.3±2.9	0.118
With motion (During the first 24 h)	6.1±2.2	5.3±2.1	6.2±2.3	5.7±2.1	0.158
With rest (During the second 24 h)	1.9±1.8	2.5±2.2	1.8±1.6	2.5±2.5	0.196
With motion (During the second 24 h)	4.7±1.9	4.5±1.4	4.9±1.9	4.4±1.3	0.548

Data are presented as mean ± SD.

ANOVA; *p < 0.001 versus spinal anesthesia (Elective); # p < 0.001 versus general anesthesia (Elective).

Postoperative analgesic requirements of the patients were summarized in Table IV. Regarding analgesic agent requirements, there were no significant differences between patients scheduled for emergent or elective cesarean section.

Regarding the incidence and type of the postoperative complications, there were no statistically significant differences between groups (Table V). The most common complication was difficulty in passing gas and stool. Headache was more common in patients undergoing spinal anesthesia; however, this difference was not statistically significant.

Table IV. Postoperative rescue analgesic requirements

	Spinal anesthesia		General anesthesia		P
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)	
0 – 24 h	26	28	39	24	0.275
24 – 48 h	9	15	11	8	0.685

Data are numbers of patients

Table V. The number of complications during the first 48 postoperative hours

	Spinal anesthesia		General anesthesia		P
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)	
0-24 hours					
Postoperative nausea and vomiting	4	4	4	4	0.999
Urine retention	3	0	2	1	0.331
Difficulties of the gas passage and stool discharge	42	42	41	42	0.985
Headache	3	3	0	1	0.285
Shoulder and neck pain	5	4	8	8	0.452
Urinary incontinence	3	1	1	3	0.572
24-48 hours					
Postoperative nausea and vomiting	1	4	1	1	0.281
Difficulties of the gas passage and stool discharge	5	5	13	6	0.045
Headache	2	2	0	0	0.149
Shoulder and neck pain	5	5	7	7	0.816
Urinary incontinence	2	0	1	2	0.527

The overall satisfaction score was obtained by calculating the arithmetic average of the patients' satisfaction scores. The overall satisfaction scores of the patients in the emergent (4.13 ± 0.75) or elective (3.91 ± 0.94) cesarean section groups under spinal anesthesia were similar between the patients in the emergent (3.83 ± 1.03) or elective (3.92 ± 0.87) cesarean section groups under general anesthesia ($p=0.36$).

The patients in the emergent cesarean section group had higher preoperative anxiety levels compared to patients in the elective cesarean section group ($p < 0.001$). During the first postoperative 48 h, sedation-agitation scores of the patients were not significantly different between groups (Table VI).

Table VI. Patients' sedation-agitation scores in the first 48 postoperative hours

	Spinal anesthesia		General anesthesia		P
	Elective (n=54)	Emergent (n=54)	Elective (n=53)	Emergent (n=51)	
Sedation-Agitation Score Basal	4.4±0.5	4.7±0.5 *	4.6±0.5	4.8±0.4 #	0.001
Sedation-Agitation Score 24 h	4.3±0.4	4.2±0.4	4.2±0.4	4.3±0.5	0.457
Sedation-Agitation Score 48 h	4.2±0.4	4.1±0.4	4.2±0.4	4.2±0.4	0.786

Data are mean ± SD. ANOVA; * $p = 0.002$ versus spinal anesthesia (Elective); # $p < 0.001$ versus spinal anesthesia (Elective)

Discussion

In this study, it was found that the pain scores were similar in the first postoperative 48 h in patients who underwent emergent or elective cesarean sections under general and spinal anesthesia. Analgesic requirements in the first 48 h after surgery were also similar in all groups. So, the main result of the study was that the NRS scores and analgesic requirements of parturients having emergent or elective cesarean section under general or spinal anesthesia, were not comparable during 48 h after surgery. Patients who underwent emergent cesarean section with general or spinal anesthesia reported higher preoperative NRS scores, compared to patients who underwent elective cesarean delivery under general or spinal anesthesia. This finding reflects the natural characteristic of an emergent cesarean delivery.

Unlike other major abdominal surgeries, pain after cesarean section has negative effects both on the mother and the baby. It is essential to relieve post-cesarean pain effectively because the newborn should be nursed regularly and efficiently. In other words, post-cesarean pain has its own characteristics and this yields investigators to compare analgesic agents and methods used in the postoperative period [11,12]. Nevertheless, in literature, there are few numbers of studies performed on surgical births comparing the effects of general and spinal anesthesia on postoperative pain [7]. Published meta-analyses point out to the effects of general and spinal anesthesia on maternal death and perioperative complications, but not to the comparison of their effects on postoperative pain characteristics [12]. No studies are available that investigate how these anesthesia techniques affect postoperative pain when applied to both emergent and elective cesarean sections. In the present study, postoperative pain was evaluated in four groups,

involving patients who underwent emergent and elective cesarean section under spinal or general anesthesia.

Kessous et al. compared the effects of general and spinal anesthesia on postoperative pain perception after cesarean delivery [6]. In the first postoperative 8 h, they found that VAS scores were significantly higher in patients with spinal anesthesia compared to patients administered general anesthesia (3.9 versus 3.2, respectively) [6]. The authors emphasized that these scores were within low to moderate ranges in defining pain intensity and had negligible clinical significance. They further stated that there were no differences between two groups at the 12th and 24th postoperative h. Maximum pain intensity during 24 h was not comparable [6]. We only evaluated pain scores with 24 h intervals postoperatively and recorded the highest pain in every 24 h, during 48 h. Patients in the emergent cesarean section with spinal anesthesia group reported higher NRS scores than the elective cesarean sections (4.2 versus 3.2, respectively). These scores were clinically unimportant as they reflected low to moderate pain intensity. Furthermore, the lack of statistical significance between all the study groups suggested that spinal or general anesthesia had similar effects on postoperative pain. In studies investigating the effects of spinal and general anesthesia on postoperative pain, it was found that parenteral morphine consumption and pain scores were less in patients who received spinal or epidural anesthesia [11,12]. These results lead to the conclusion that spinal anesthesia might have a preemptive effect on post-cesarean pain. In our study, it was not possible to evaluate the preemptive effect of the spinal anesthesia since labor had already begun in many patients who underwent emergent cesarean section.

Preoperative anxiety is another factor increasing the severity of the postoperative pain [4,5]. In our study, patients in the emergent cesarean section group had higher preoperative anxiety levels compared to patients in the elective cesarean section group (Table VI). High preoperative anxiety levels can be explained by the pain due to uterine contractions or the patient's uncertainties on the outcome of herself and the baby. Furthermore, patients under spinal anesthesia were witnesses at the preparation time until surgery unlike patients under general anesthesia. This might result in high anxiety levels. Hereby, the intensity and the cause of preoperative anxiety should be evaluated in parturients undergoing emergent cesarean section with spinal anesthesia. The information about the process and indication of the emergency should be given to the patient.

Patient satisfaction during postoperative period was similar in all groups. Regarding patient satisfaction, many studies reported conflicting results. Açikel et al., stated that the satisfaction of the patients was higher after emergent cesarean section under spinal anesthesia compared to general anesthesia, due to the faster recovery and earlier return to normal activity [13]. According to the results of the Cochrane study group, patients having general anesthesia would again prefer the same anesthesia technique if they would have a subsequent cesarean section [14].

It was demonstrated that parturients with high plasma progesterone concentrations had less intraoperative anesthetic and postoperative analgesic requirements [12]. As a limitation, it was not possible to predict the analgesic effects of progesterone on postoperative pain scores, because we did not measure the plasma progesterone concentrations of the patients. Another limitation was that analgesic consumption was not measured by patient-controlled analgesia method. This limitation was due to technical inefficiencies such as inadequate number of devices, and the lack of logistic support such as human resources and time for follow-up.

Conclusion

In conclusion, the effects of general and spinal anesthesia on postoperative pain were not comparable in emergent and elective cesarean sections performed under general or spinal anesthesia. Therefore, the effect of these methods on postoperative pain intensity should not be a determining factor in choosing the anesthesia method in emergent and elective cesarean sections.

Compliance with Ethical Standards

- **Funding:** The study was not supported by any funds.
- **Conflict of Interest:** the authors have no conflicts of interest to declare.
- **Ethical approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
- **Informed consent:** Informed consent was obtained from all individual participants included in the study.

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