Comparison of Maternal and Neonatal Effects of Combined Spinal Epidural Anaesthesia in Either the Sitting or Lateral Position During Elective Cesarean Section

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Objective: Our goal was to demonstrate which position would be hemodynamically and technically better by comparing the effects of combined spinal epidural (CSE) in the sitting or lateral decubitus position for elective cesarean deliveries on maternal and neonatal parameters and ephedrine requirement.

Methods: Sixty parturients were randomly assigned into two groups to perform CSE in the sitting (Group I, n=30) or right lateral decubitus position (Group II, n=30) using hyperbaric 10 mg bupivacaine and 20 µg fentanyl. Mean arterial pressure (MAP), heart rate (HR), and characteristics of sensory and motor block were recorded from intrathecal drug administration until the end of surgery. Ephedrine and 1st analgesic requirement, number of attempts to perform CSE, incidence of paresthesia during spinal needle insertion, and Apgar scores were recorded.

Results: Ephedrine requirements and HR changes were similar in both groups. However, MAP values at 45 min in Group II were significantly less than in Group I. Maximum sensory block levels in Group II were significantly higher than in Group I. Despite similar motor block recovery times in both groups, regression times of sensory block and 1st analgesic requirement in Group II were significantly longer than in Group I. Incidence of paresthesia due to spinal needle (3.3% versus 20% in Groups I and II, respectively) and number of attempts to perform CSE (26.7% versus 60% in Groups I and II, respectively) were significantly higher in Group II. Apgar scores were similar in both groups.

Conclusion: Performing CSE in the sitting position would be safer and easier because higher and earlier onset of sensory block, and a greater number attempts at epidural insertion and paresthesia develop to spinal needle insertion in the right lateral position.

Key Words: Cesarean section, epidural anesthesia, spinal anesthesia, position

Introduction

Due to the greater maternal and foetal advantages, regional anaesthesia has been increasingly used in caesarean sections (1, 2). According to the availability of appropriate drugs and equipment, regional anaesthetic techniques, namely spinal, epidural or combined spinal-epidural (CSE) anaesthesia can be used (3). CSE allows the advantages of spinal and epidural anaesthesia techniques without increasing the risk of complications. Thus, along with the rapid onset and reliability of spinal block, postoperative pain control can be provided by prolonging block duration via the epidural catheter (3-6). In single-dose spinal anaesthesia in pregnant women, rapidly developing hypotension due to sympathetic blockade can be decreased by the combination of local anaesthetic agents and opioids (7, 8).

Besides the studies showing that the position (sitting, right or left lateral) of the pregnant women while applying regional anaesthesia affects the hemodynamic parameters and vasopressor drug use, there are others showing the contrary (9-14). Therefore, in the present study we aimed to compare the effects of CSE anaesthesia applied in sitting or right lateral decubitus position in pregnant women scheduled to undergo elective caesarean section on maternal and neonatal parameters and ephedrine requirement and to demonstrate which position was better regarding the hemodynamic and technical aspects.

Methods

This present study was performed in the Department of Anaesthesiology and Reanimation of Gazi University Medical Faculty, on 60 American Society of Anaesthesiologists (ASA)

I-II risk group pregnant women scheduled to undergo elective caesarean section after approval was obtained from the Ethics Committee of Gazi University Medical Faculty (date: 27.03.2006 and number: 81).

Pregnant women who were scheduled to undergo caesarean section were informed about CSE anaesthesia in the preoperative visit and written informed consents of those who agreed to participate in the study were obtained. The pregnant women who were below the age of 18 years and those above the age of 45 years, those with a body weight >50 kg or <100 kg, those with a body height >150 cm or >180 cm, those with a gestational age <36 weeks, multiple pregnancy cases, those with a history of preeclampsia or known foetal anomaly were excluded. Additionally, pregnant women having contraindication for CSE anaesthesia, those with dural puncture during the identification of the epidural space and those in whom adequate anaesthesia could not be provided with spinal anaesthetics and required additional medication given through the epidural catheter in order to provide an adequate level of intraoperative anaesthesia or subjects that required general anaesthesia were also not included in the study.

Written consent was obtained from 60 pregnant women who would be included in the study. They were told not to eat or drink for at least 6 hours before the surgery. After they had been taken into the operating room, they were divided into two groups for CSE anaesthesia as Group I (n=30) sitting position and Group II (n=30) right lateral decubitus position by drawing cards from sealed envelopes. Half an hour before the surgery, an 18 G intravenous (IV) cannula was placed and 50 mg of IV ranitidine was given by slow infusion, and motor and sensory block examinations were performed before the procedure. After the subjects were taken into the operating room, they were given 10 mL kg⁻¹ lactated Ringer's solution by IV infusion in 15 minutes, followed by a maintenance infusion at a rate of 6-8 mL kg⁻¹ hr⁻¹. O₂ at a rate of 4 L minutes⁻¹ was delivered by face masks, the subjects were monitored by non-invasive methods and basal heart rate (HR), mean arterial pressure (MAP) and peripheral O₂ saturation (SpO₂) values were recorded as "control values".

After the pregnant women were placed in sitting (Group I) or right lateral decubitus (Group II) position, surgical area was cleaned with povidone-iodine. For CSE block, L2-3 and L3-4 intervertebral spaces were identified and from the suitable intervertebral space infiltration anaesthesia was applied to the skin and subcutaneous space using 2 mL of 2% lidocaine. After epidural space was identified with an 18 G *Tuohy* needle in the CSE set (Braun, Germany) using loss of resistance technique, intrathecal space was entered with a 27 G *pencil point* spinal needle using needle through needle technique. After free cerebrospinal fluid (CSF) flow was seen, 2 mL of 0.5% heavy bupivacaine (10 mg) plus 0.4 mL fentanyl (20 µg) and 0.6 mL 0.9% NaCl was given from the spinal needle in 30 seconds. After the spinal needle was withdrawn, an epidural

catheter with blunt-tip and 3 lateral holes was placed into the epidural space. After confirming that no blood or CSF leakage was present through the catheter, the catheter was advanced 3-4 cm into the epidural space and fixed to the skin surface. Immediately after the procedure, the subjects were placed in supine position, and the operating table was placed 20° left lateral tilt to prevent compression of the uterus.

After drug was delivered into the intrathecal space, hemodynamic parameters (HR and MAP), SpO₂, sensations of warmth and cold using cold alcohol soaked gauze pad, cranial spread of the sensory block by "pin prick" test and motor block levels according to the modified *Bromage* Scale (0=no block, 1=difficulty in hip flexion when told to raise the legs without flexion of the knees, 2=difficulty in knee flexion, 3=difficulty in ankle flexion) were recorded in 2 minute intervals at the first 10 minutes and in 5- minute intervals until the end of the first hour.

Maximum sensory block level and the time to reach that level, the time to achieve sensory block at T6 dermatome, the time to regression of the sensory block to T10 and L1 dermatomes, maximum motor block level (MBL) and the time to reach the maximum level of motor block, total duration of motor block and duration of the surgery were recorded.

- **Maximum sensory block level and the time to reach that level:** The highest dermatome level at which the needle tip is not sensed as sharp for at least 10 minutes after local anaesthetics were given into the intrathecal space, and the time to reach that level.
- **The time to achieve sensory block at T6 dermatome:** The time until the needle tip is not sensed as sharp at T6 dermatome after local anaesthetics were given into the intrathecal space.
- **The time to regression of the sensory block to T10 and L1 dermatomes:** The time from local anaesthetic delivery into the intrathecal space to the regression of the sensory block to T10 and L1 dermatomes, respectively.
- **Maximum motor block level and the time to reach maximum motor block level:** After local anaesthetics were given into the intrathecal space, the maximum motor block level according to the modified *Bromage* Scale and the time to reach that level.
- **Total motor block duration:** The time from onset of motor block to the regression of motor block to grade 0 according to the modified *Bromage* Scale.
- **The duration of the surgery:** The time from the beginning of the skin incision to the last suture.

The time of skin incision, uterine incision, clamping of the cord, 1- and 5-minutes Apgar scores and body weights of the newborn were recorded. After the cord was clamped, 10 IU synthetic oxytocin (Synpitan, Deva, Turkey) was administered as IV infusion in 400-500 mL lactated Ringer's solution. In case of uterine hypotonicity 1 ampoule intramuscular (IM) methylergonovine was used.

If MAP decreased by more than 20% of the basal value during surgery, the subject was treated with 10 mg IV bolus ephedrine. Ephedrine dose used in the first 6 and 10 minutes and total ephedrine requirement was calculated at the end of the operation.

Heart rate <50 beats minutes^{-1} was considered as bradycardia and was treated with 0.5 mg IV atropine. In case of nausea and vomiting 10 mg IV metoclopramide and in case of pruritus 45.5 mg IV pheniramine maleate (Avil®, Hoechst Marion Roussel, Germany) was given.

After the surgery, the time of first analgesic requirement, first mobilization and flatulence were recorded.

In the recovery room, the patients were informed about Visual Numeric Scale (VNS; 0=no pain, 10=worst possible pain) that would be used in postoperative pain assessment. In the postoperative duration, the time when VNS >3 was recorded as the time of first analgesic requirement and after it was confirmed by aspiration that there was no blood or CSF flow from the epidural catheter using a 2 mL sterile empty injector, 3 mL of 2% lidocaine involving 5 $\mu\text{g mL}^{-1}$ adrenalin was given. After one minute, the subjects were asked whether they had a sensation of warmth at the thighs, numbness in the legs and around the mouth, tingling, tachycardia, tinnitus, or metallic taste. It was determined whether there was an increase $>25\%$ in the heart rate, thereafter, the subject was told to move her legs and motor block was assessed. It was assured that the catheter was in the epidural space, and 10 mL of 0.125% bupivacaine and morphine (2 mg) was administered through the catheter. Thereafter, for postoperative analgesia, the subjects were given 10 mL of 0.125% bupivacaine through the catheter, whenever the VNS >3 during 24 hours.

During combined spinal epidural anaesthesia, the number of attempts and the frequency of complications associated with the technique, including accidental dural puncture with the epidural needle, development of paraesthesia during the placement of the epidural needle, spinal needle or epidural catheter, blood vessel puncture with the epidural needle or catheter and dural puncture with the epidural catheter, were recorded. In addition, following the identification of the epidural space, the time from intrathecal drug injection to placement of the patient to supine position was recorded.

The possible maternal complications during surgery (i.e. hypotension, bradycardia, nausea, vomiting, pruritus, shivering, sedation, shoulder pain) were also recorded.

After the intervention, the subjects and the surgeons were questioned on their satisfaction with anaesthesia, and they were asked to state their level of satisfaction as very bad, bad, intermediate, good or very good.

In the postoperative period, during the 48 hours till discharge and for 4 weeks after discharge, possible complications were inquired by phone interviews

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 11.0 software. The data were presented as mean $\pm$ standard deviation (mean $\pm$ sd), median, minimum, maximum, n and percentages (%).

After descriptive statistics, maternal age, body weight and height, the duration of gestation, body weight of the newborn, the duration of the surgery, the time to reach the sensory block to T6 dermatome, maximum sensory block level and the time to reach that level, the time to regression of the sensory block to T10 and L1 dermatomes, maximum motor block and the time to reach maximum motor block, total duration of motor block, first analgesic requirement, were compared using independent groups t-test. Repeated data in the groups (HR, MAP and SpO_2) was analysed using variance analysis (ANOVA). In repeated measures variance analysis, Bonferroni correction was performed when time factor was found significant. Intra-group comparison of the motor block levels with the control value was performed using Wilcoxon signed rank test.

Chi-square or Fisher's exact chi-square tests were used in the analysis of 1- and 5- minutes Apgar scores of the newborn, motor block level, ephedrine requirement, patient and surgeon satisfaction, and perioperative and postoperative adverse effects. A p value <0.05 was considered to be significant.

Results

In the comparison of the demographic characteristics, gestation weeks and the duration of surgery of 60 pregnant women who were included in the study, no significant difference was found between the groups (Table 1).

In comparison of the intraoperative HRs of the study groups, no significant difference was found. In the intra-group comparison with the control value, the values obtained at 2, 25, 35, 40, 50, 55, 60 and 70 minutes were significantly higher than the control values in Group I ($p<0.05$). Whereas, in Group II, the values obtained at 2, 4, 25, 30, 35, 50, 80 and 90 minutes were significantly higher than the control values ($p<0.05$) (Table 2).

When the groups were compared in terms of MAP values, it was observed that the values obtained at 45 and 70 minutes in Group II was significantly lower than that of Group I ($p<0.05$) (Table 3). In the intra-group comparison of MAP values with the control value the values obtained at 4, 6, 8, 10, 30, 35, 40 and 45 minutes in Group I, and the values obtained at 2, 4, 6, 8, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 70, 80 and 90 minutes in Group II were significantly lower than the control value ($p<0.05$) (Table 3).

SpO_2 value was 98% at all measurement time points, and no difference was found in the intra-group comparison with the control value and between the groups (data not presented).

Table 1. Demographic characteristics and the duration of surgery in the study groups [(mean±sd) (Minimum-Maximum)]

	Group I (n=30)	Group II (n=30)
Age (years)	32.0±4.6 (25-40)	32.1±4.5 (21-42)
Height (cm)	164.0±6.5 (153-176)	163.6±5.5 (155-180)
Body weight (kg)	80.1±11.1 (61.0-100.0)	78.9±8.8 (64.0-98.0)
Duration of pregnancy (weeks)	38.8±0.9 (37.1-41.0)	38.8±0.7 (37.7-40.7)
Duration of surgery (minutes)	30.4±11.7 (19.0-74.0)	30.7±12.9 (18.0-80.0)
p>0.05 (comparison between the groups, t-test)		

Table 2. Comparison of heart rates (HR) of the study groups according to measurement time points [(mean±sd) (Minimum-Maximum)]

Measurement time point	Group I (n=30)	Group II (n=30)
Control	86.2±11.5 (66-111)	85.7±12.5 (66-115)
2 minutes	93.7±17.1 (64-144) ^a	97.0±20.2 (66-150) ^a
4 minutes	90.5±20.7 (55-150)	93.4±22.8 (39-141) ^a
6 minutes	85.6±21.8 (49-147)	93.3±21.9 (63-150)
8 minutes	89.0±23.8 (57-170)	92.9±26.4 (61-152)
10 minutes	89.5±26.5 (49-174)	89.9±21.3 (59-137)
15 minutes	91.1±24.4 (61-165)	89.6±19.6 (60-137)
20 minutes	93.0±22.9 (63-162)	86.5±17.4 (57-128)
25 minutes	95.7±20.6 (66-148) ^a	92.7±13.9 (65-120) ^a
30. minutes	92.9±19.1 (67-138)	93.3±12.6 (67-115) ^a
35. minutes	93.8±19.2 (64-139) ^a	91.7±12.9 (69-120) ^a
40. minutes	93.6±19.5 (70-140) ^a	91.2±13.1 (74-117)
45. minutes	91.6±16.2 (69-120)	89.6±10.6 (75-119)
50. minutes	100.3±21.5 (75-129) ^a	91.5±14.7 (64-118) ^a
55. minutes	102.2±23.8 (79-127) ^a	84.9±13.2 (72-110)
60. minutes	113.3±19.9 (91-129) ^a	89.0±18.1 (69-111)
^a : p<0.05 (intra-group comparison with the control value, ANOVA)		
p>0.05 (comparison between the groups, t-test)

Figure 1. Cranial spread of the sensory block at all measurement times in the groups (median)

*: p<0.05 (comparison between the groups)

Table 3. Comparison of mean arterial pressure (MAP) values of the study groups according to measurement time points [(mean±sd) (Minimum-Maximum)]

Measurement time points	Group I (n=30)	Group II (n=30)
Control	90.1±8.7 (69-106)	93.8±6.2 (82-105)
2 minutes	91.5±13.6 (66-127)	88.9±12.1 (61-114) ^a
4 minutes	79.3±17.1 (47-115) ^a	80.0±15.6 (50-111) ^a
6 minutes	76.9±15 (50-112) ^a	78.1±14.2 (50-106) ^a
8 minutes	77.0±12.8 (54-103) ^a	79.1±12.7 (55-111) ^a
10 minutes	79.9±14 (52-118) ^a	84.9±12.5 (58-113) ^a
15 minutes	85.7±14.8 (54-111)	85.5±11.9 (65-115) ^a
20 minutes	86.7±12.1 (62-112)	88.7±9.9 (70-108) ^a
25 minutes	86.1±12 (63-110)	82.4±13.1 (56-104) ^a
30 minutes	82.3±11.2 (65-107) ^a	80.5±11.6 (61-107) ^a
35 minutes	79.9±11.4 (45-111) ^a	78.5±8.6 (63-103) ^a
40 minutes	82.2±9 (64-99) ^a	80.9±9.1 (65-102) ^a
45 minutes	87.5±8.2 (72-100) ^a	79.3±9.9 (54-99) ^a
50 minutes	85.9±11.8 (61-96)	80.8±11.9 (54-101) ^a
55 minutes	85.0±7.2 (73-91)	83.3±11.3 (67-101) ^a
60 minutes	93.0±2.6 (91-96)	86.2±11.3 (76-100)
*: p<0.05 (comparison between the groups, t-test)		
*: p<0.05 (intra-group comparison with the control value, ANOVA)		

The maximum dermatome level of sensory block in the cranial direction was significantly higher in Group II than that in Group I at all measurement time points (p<0.05) (Figure 1).

In the evaluation according to the modified *Bromage* Scale, the degree of motor block at 2 minutes was higher in Group II than that of Group I (p<0.05) (Table 4). When the degree of motor block was compared according to groups, the number of patients with a MBL 0 and 2 at 2 minutes was significantly higher in Group II (MBL= 0, 11 patients, and MBL= 2, 3patients), than that in Group I (no patients with MBL= 0 and 2).

There was no statistically significant difference between the groups regarding the time to reach maximum sensory block level. The time to reach to T₆ dermatome was significantly shorter in Group II in comparison to that in Group I (p<0.05). The time to regression to T₁₀ and L₁ dermatomes was significantly longer in Group II when compared with Group I (p<0.05). No significant difference was found between the groups in terms of the time to onset of maximum motor block and total duration of motor block (Table 5).

It was observed that 1- and 5- minutes Apgar scores were similar in both groups (Table 6).

When the groups were compared, it was found that 23 subjects (76.7%) in Group I and 28 subjects (93.3%) in Group II required ephedrine (p>0.05, Chi-square). Total ephedrine

Table 4. The degree of motor block according to measurement time points in the study groups [(median) (Minimum-Maximum)]

Measurement time point	Group I (n=30)	Group II (n=30)
Control	0	0
2 minutes	1 (0-2)	1 (1-2)*
4 minutes	2 (0-3)	2 (1-3)
6 minutes	2 (1-3)	2 (1-3)
8 minutes	3 (2-3)	3 (2-3)
10 minutes	3 (2-3)	3 (2-3)
15 minutes	3 (2-3)	3 (2-3)
20 minutes	3 (3-3)	3 (2-3)
25 minutes	3 (3-3)	3 (2-3)
30 minutes	3 (3-3)	3 (2-3)
35 minutes	3 (3-3)	3 (2-3)
40 minutes	3 (3-3)	3 (2-3)
45 minutes	3 (3-3)	3 (2-3)
50 minutes	3 (3-3)	3 (3-3)
55 minutes	3 (3-3)	3 (2-3)
60 minutes	3 (3-3)	3 (2-3)

*: p<0.05 (comparison between the groups, t-test)
p>0.05 (intra-group comparison with the control value, Wilcoxon signed rank test)

Table 5. The characteristics of motor and sensory block in the study groups [(mean±sd) (Minimum-Maximum)]

	Group I (n=30)	Group II (n=30)
The time to onset of maximum motor block (minutes)	9.2±4.1 (4-20)	7.5±3.4 (4-15)
Total duration of motor block (minutes)	126.7±37.2 (54-268)	139.2±34.0 (84-215)
The time to achieve sensory block at T6 dermatome (minutes)	5.8±1.8 (2-10)	4.5±1.5 (2-8)*
Maximum sensory block level	T 3 (T 6-C 8)	T 2.5 (T 4-C 7)*
The time to reach the maximum sensory block level (minutes)	12.6±1.8 (4-25)	13.6±4.7 (6-20)
The time to regression of the sensory block to T10 (minutes)	152.7±31.3 (74-233)	195±43.8 (124-286)*
The time to regression of the sensory block to L1 (minutes)	173.3±32 (89-268)	211±41.6 (145-301)*

*: p<0.05 (comparison between the groups, t-test)

amount were similar in the groups (Group I: 31.3±18.9 mg, Group II: 33.2±13.6 mg).

Following epidural intervention for combined spinal epidural anaesthesia, the mean time from intrathecal drug injection

Table 6. Comparison of the groups in terms of 1- and 5- minutes Apgar scores [(n).(%)] and newborn body weight [(mean±sd) (Minimum-Maximum)]

		Group I (n=30)	Group II (n=30)
Apgar 1 minutes	≥7	30 (100)	30 (100)
	<7	0 (0)	0 (0)
Median (minimum-maximum)		8.5 (7-10)	9 (8-10)
Apgar 5 minutes	≥7	30 (100)	30 (100)
	<7	0 (0)	0 (0)
Median (minimum-maximum)		10 (8-10)	10 (9-10)
Newborn body weight (g)		3180.0±467.8	3266.3±445.7
p>0.05 (comparison between the groups, Chi-square)			

to positioning of the patient in supine position was 1.8±0.4 minutes in Group I, and 1.9±0.2 minutes in Group II. There was no significant difference between the two groups.

When the groups were compared regarding the time to first analgesic requirement, it was observed that the time to first drug administration from the epidural catheter (when VNS >3) was longer in Group II than that of Group I (p<0.05). The time to first flatulence was similar in the groups (Table 7).

When the groups were evaluated regarding the complications observed during the procedure, it was found that the frequency of paraesthesia during spinal needle placement was significantly higher in Group II (p<0.05). However, the groups were similar regarding the frequency of blood vessel puncture with the epidural needle or epidural catheter. Comparison of the groups in terms of the number of attempts for identifying epidural space during combined spinal-epidural anaesthesia demonstrated that the number of attempts was significantly higher in Group II than that in Group I (p<0.05) (Table 8).

There was no statistically significant difference between the groups in terms of possible intraoperative and postoperative side effects (Table 9).

No difference was found between the groups in terms of levels of satisfaction with anaesthesia (Table 10).

Discussion

This present study showed that although CSE anaesthesia applied in sitting or right lateral position had similar effects on newborn parameters and ephedrine consumption, sensory block reaches to high levels in a shorter time in right lateral position and the number of epidural attempts and the frequency of paraesthesia was higher during spinal intervention. There was no difference between the groups regarding the Apgar scores, intraoperative and postoperative side effects and patient-surgeon satisfaction.

Table 7. Comparison of the groups with regards to the time to first analgesic requirement, mobilization and flatulence [(mean±sd) (Minimum-Maximum)]

	Group I (n=30)	Group II (n=30)
The time to first analgesic requirement (minutes)	187.7±29.2 (124-238)	226.0±48.1 (124-316)*
The time to mobilization (hr)	10.9±3.1 (7-22)	12.8±3.9 (5.5-22)
The time to first flatulence (hr)	20.5±7.4 (4.5-33)	19.6±5.9 (6-32)
*: p>0.05 (comparison between the groups, t-test)		

Table 8. The frequency of complications in the groups [(n), (%)]

	Complications during the procedure					
	Paraesthesia			Blood vessel puncture		
	None	Epidural Needle	Spinal Needle	Epidural catheter	Epidural Needle	Epidural catheter
Group I (n=30)	26 (86.7)	0 (0)	1 (3.3)	0 (0)	0 (0)	3 (10)
Group II (n=30)	23 (76.7)	0 (0)	6 (20)*	0 (0)	0 (0)	1 (3.3)
The number of attempts during CSE application						
	1			>1		
Group I (n=30)	22 (73.3)			8 (26.7)		
Group II (n=30)	12 (40.0)*			18 (60.0)*		
CSE: Combined spinal epidural						
*: p<0.05 (Comparison with Group I, Chi-square)						

Although there is no difference regarding the hemodynamic parameters, ephedrine use, quality of anaesthesia, sensory and motor block levels during the application of intrathecal anaesthesia in right or left lateral decubitus position during caesarean section, this is not the case in the comparison of sitting and lateral decubitus positions (14-16). There is still no consensus on the effects of regional anaesthesia induction in sitting or lateral decubitus position on hemodynamic parameters and vasopressor drug use in pregnant women (10, 11, 16-18). In addition, the use of different doses of local anaesthetics and opioids in the studies comparing the positions makes it difficult to compare the hemodynamic variables.

Although Russell et al. (19) found that hemodynamic parameters and ephedrine consumption when using 12.5 mg hyperbaric bupivacaine and 12.5 µg fentanyl in CSE anaesthesia was similar in right lateral decubitus and sitting position for caesarean section, ephedrine requirement which was 18 mg (0-60 mg) in the sitting position was 12 mg (0-42 mg) in right lateral decubitus position. In the same study, after spinal injection the time from epidural catheter placement to the positioning of the parturient was 3.25 minutes in sitting position and 3.18 minutes in lateral position; the correspond-

Table 9. The frequency of intraoperative and postoperative side effects in the groups [(n), (%)]

Intraoperative	Group I (n=30)	Group II (n=30)
Nausea	3 (10)	9 (30)
Vomiting	0 (0)	2 (6.7)
Pruritus	2 (6.7)	6 (20)
Flushing of the face	4 (13.3)	1 (3.3)
Bradycardia	2 (6.7)	1 (3.3)
Shivering	3 (10)	3 (10)
Sedation	8 (26.7)	13 (43.3)
Chest pain	0 (0)	0 (0)
Shoulder pain	0 (0)	1 (3.3)
Respiratory distress	0 (0)	0 (0)
Postoperative	Group I (n=30)	Group II (n=30)
Nausea	0 (0)	1 (3.3)
Vomiting	0 (0)	1 (3.3)
Pruritus	3 (10)	3 (10)
Urine retention	0 (0)	0 (0)
Back pain	1 (3.3)	2 (6.7)
Headache	0 (0)	0 (0)
p>0.05 (comparison between the groups, Chi-square)		

Table 10. Patient and surgeon satisfaction with anaesthesia [(n), (%)]

	Very good	Good	Intermediate	Bad	Very bad
Patient satisfaction					
Group I (n=30)	26 (86.7)	4 (13.3)	0 (0)	0 (0)	0 (0)
Group II (n=30)	23 (76.7)	7 (26.3)	0 (0)	0 (0)	0 (0)
Surgeon satisfaction					
Group I (n=30)	29 (96.7)	1 (3.3)	0 (0)	0 (0)	0 (0)
Group II (n=30)	30 (100)	0 (0)	0 (0)	0 (0)	0 (0)
p>0.05 (comparison between the groups, Chi-square)					

ing figures were 1.8 minutes and 1.9 minutes, respectively, in our study. Although, we used a lower dose of local anaesthetic and a similar fluid preload in our study, the higher ephedrine requirement in the right lateral decubitus position (33.2 mg) when compared to the sitting position (31.3 mg) was attributed to the placement of the epidural catheter in a shorter period in CSE, rapid sympathetic blockade due to the attainment of T6 sensory levels in a shorter duration and the presence of no case with inadequate sensory block. Yun and colleagues (11) used higher amounts of ephedrine as they observed a higher frequency of hypotension when they used intrathecal hyperbaric bupivacaine (12 mg) and 10 µg of fentanyl in the sitting position. They reported the total ephedrine use as 17±12 mg and 38±18 mg in the right lateral decubitus and sitting position, respectively, and the lowering

of the systolic blood pressure with regards to the control values was 32% in the right lateral decubitus position and 47% in the sitting position (11). However, in our study, although there was no difference between the groups regarding the total amount of ephedrine used, the mean arterial pressure at all measurement time points was significantly lower than that of the control value during CSE anaesthesia performed in right lateral decubitus position. As none of the MAP values was 20% lower than the control MAP, ephedrine use was similar in both groups.

In the prevention of hypotension, the most frequent side effect of regional anaesthesia, crystalloid and/or colloid use, administration of vasopressor drugs such as ephedrine and/or phenylephrine and their combinations besides positioning the patient during or after induction, and physical methods like leg elevation can lower the incidence of hypotension to 40% (20). In our study, considering the types of fluid used in other studies on maternal positioning, in order to compare the hemodynamic parameters reliably CSE anaesthesia was applied 15 minutes after 10 mL kg⁻¹ IV crystalloid (lactated Ringer's solution) preload. Similar to the studies of Inglis et al. (17) and Patel et al. (10), lowering of the mean arterial pressure earlier and for a longer period in comparison to control values in the right lateral decubitus group despite fluid preload, is caused by rapid sympathetic blockade due to the achievement of sensory level T6 in a shorter period (4.5±1.5 minutes) during CSE anaesthesia induction in the right lateral decubitus position.

In the literature, the studies using 6.6, 12 mg and 12.5 mg hyperbaric bupivacaine, reported the maximum mean sensory block level in sitting position as T2–T3, and in lateral decubitus position as T1–T3 (11, 18, 19). Spinal anaesthesia using the same local anaesthetic agent in the same dose and volume can lead to different levels of sensory block according to the changes in the baricity of the local anaesthetic agent. Hallworth and colleagues (21) in their study evaluating the effects of 10 mg hyperbaric, isobaric and hypobaric bupivacaine forms on the mother's position and hemodynamic characteristics, found the mean maximum sensory block level in sitting and lateral positions as T3 in the hyperbaric groups, and T2 in the isobaric and hypobaric groups. In the hyperbaric group, there were 3 patients (12%) with cervical dermatome involvement in the lateral position; however, none of the patients in sitting position had cervical dermatome involvement. In our study, C7 and C8 dermatome involvement was observed in 1 (3.3%) patient in sitting position and 4 (13.4%) patients in the right lateral position.

The higher sensory levels in the lateral position compared to sitting position when using hyperbaric local anaesthetics, is associated with the changes in vertebral anatomy in pregnancy. When the anatomy of the vertebrae was evaluated in pregnant and non-pregnant women, it was reported that and lumbar lordosis slide caudally decreasing thoracic kyphosis

and flattening the spine in the last period of gestation (22). Thus, the highest point of thoracic kyphosis is at T8 in non-pregnant women and at T6–7 in pregnant women, therefore hyperbaric local anaesthetics show a greater cephalic distribution in pregnant women. While maximum sensory block level in lateral decubitus position was at T2,5, it was at T3 in sitting position in our study. The significant increase in the lateral decubitus position was similar to the maximum sensory block levels observed in the study of Coppejans and colleagues (18). High sensory block level in spinal anaesthesia is the most important factor increasing hypotension incidence regardless of the amount of fluid replacement (23). Therefore, higher sensory block levels were reached in a shorter time in patients in right lateral decubitus position. However, due to the sympathetic blockade and stasis associated with peripheral vein dilatation, although MAP was lower in patients in right lateral decubitus than those in sitting position at 45 minutes of surgery (the end of surgery), it was not 20% lower than the mean control MAP.

Coppejans et al. (18), in their study, in which they used 6.6 mg hyperbaric bupivacaine and 3.3 µg sufentanyl for CSE anaesthesia induction, found that hypotension incidence, though not significantly different, was 18% and 40% in sitting and lateral positions, respectively; the frequency of patients with systolic blood pressure below 100 mmHg was 21% and 50%, respectively. In addition, they reported that ephedrine dose was higher (14.5 mg) in lateral position than that in sitting position (8 mg) (18). The reason of finding higher ephedrine doses was that the intrathecal local anaesthetic dose, 10 mg hyperbaric bupivacaine and 20 µg fentanyl, the determined ED50 and ED95 dose (23) for caesarean section, was higher than the dose used in the study of Coppejans and colleagues (18). Thus, the epidural catheter was not used in any of the patients for inadequate surgical anaesthesia during surgery. Whereas, it was reported that additional doses were administered through the epidural catheter in 11 of 60 subjects, when using study doses lower than ED50 (18). Patel et al. (10) preferred to use 2 mL of 0.5% hyperbaric bupivacaine; although total ephedrine dose was similar in the sitting position (27.2±12.4 mg) and left lateral position (31.4±8.9 mg) they found that hypotension incidence was higher in the lateral position (13% vs. 48%). In our study, hypotension defined as the decrease in mean arterial pressure >20% than the control value was treated with 10 mg of IV ephedrine, and we found no significant difference between the patients in sitting position (76.7%) and in right lateral decubitus position (93.3%) regarding ephedrine requirement.

Although the time to reach the T6 dermatome was significantly shorter in the lateral decubitus position compared to that in sitting position, the time to reach the maximum sensory block levels was (13.6±4.7 minutes in lateral decubitus position and 12.6±1.8 minutes in sitting position) not significantly different between the two groups similar to the results of the study performed by Inglis et al. (17).

In the study of Patel and colleagues (10), the onset of third degree motor block, defined according to the modified *Bromage* Scale, was shorter in CSE applied in the lateral position (6.9 ± 2.4 minutes) than that in the sitting position. In our study, although the onset of MBL was earlier in the lateral decubitus position, the time to reach the maximum motor block level and the total duration of motor block was similar in the two groups (7.5 ± 3.4 minutes and 139.2 ± 34 minutes in the lateral decubitus position vs. 9.2 ± 4.1 minutes and 126.7 ± 37.2 minutes in the sitting position). Although there was no difference between the groups regarding the time to regression of motor block, sensory block continued longer in the right lateral decubitus group. The time to regression of sensory block to T10 and L1 dermatomes was longer in the lateral decubitus position (195 ± 43.8 minutes and 211 ± 41.6 minutes, and 152.7 ± 31.3 minutes and 173.3 ± 32 minutes, respectively) in comparison to that in the sitting position. As mentioned earlier, sensory block levels being at higher dermatomes in CSE anaesthesia applied in right lateral decubitus position due to the anatomical changes in pregnancy affects the time to regression of anaesthesia and prolongs the time to requirement of first analgesic dose (22). In patients whose first epidural analgesic was applied 226.0 minutes after placement in right lateral decubitus position, and 187.7 minutes after placement in sitting position, the mean time to first analgesic requirement was 38.3 minutes in the right lateral decubitus group, and it was longer than that in the sitting group. Right lateral decubitus position providing longer periods of analgesia without a difference in motor block duration seems to be more advantageous.

Generally, a healthy foetus tolerates <4 minutes of maternal hypotension (11). In studies, in which hemodynamic effects of maternal position was compared, independent from the severity of hypotension, 1- and 5-minutes Apgar scores are similar in lateral and sitting positions (11, 18, 19, 21, 23). Similarly, in our study, besides no difference was found between the groups, none of the newborns had a 1- and 5-minutes Apgar score <7. With close blood pressure monitoring, and an early diagnosis and treatment with vasopressor agents, long lasting hypotension is not seen in pregnant women. Therefore, Apgar scores used to determine the well-being of the newborn is not affected by the position of the mother during anaesthesia induction.

In our study, the time from intrathecal drug injection to placement of the patient in supine position was 1.8 ± 0.4 minutes and 1.9 ± 0.2 minutes in right lateral decubitus and sitting positions, respectively. In single-dose spinal anaesthesia, especially, in patients who are kept waiting in sitting position during hyperbaric local anaesthetic application, the onset of anaesthesia in thoracic dermatomes is late due to baricity. For this reason, in CSE applications, the time from intrathecal drug injection to the placement of epidural catheter may affect the level of sensory block and maternal hemodynamic parameters. However, Kohler and colleagues (24) compared

the subjects who were kept waiting in sitting position for 3 minutes after spinal anaesthesia and thereafter placed in supine position, and the subjects who were placed in supine position immediately after induction and found no difference between the two groups regarding the incidence and severity of hypotension. In the same study, only 2% of the subjects who were kept waiting in sitting position for 3 minutes and 23% of those placed in supine position immediately reached sensory levels >T1, and inadequate anaesthesia was not a problem in any of the subjects. It was reported that 3 minutes of waiting during the placement of epidural catheter would not affect the quality of CSE anaesthesia applied in sitting position, and this was a sufficient time for the procedure (24).

When the paraesthesia incidence in obstetric cases during the placement of spinal needle while applying needle through needle CSE technique was compared with those observed when applying spinal anaesthesia, the rate of paraesthesia was 37% in the CSE group and 9% in the spinal group (25). However, it was not reported whether paraesthesia incidence differed according to the position, when the position during anaesthesia induction was left to the preference of the anaesthetist. In this study, the incidence of paraesthesia was 20% in the lateral decubitus group, it was 3% in the sitting position group. Ahn and colleagues (26) compared two different CSE techniques in right lateral decubitus position using 18 G epidural and 27 G *pencil point* spinal needle, and found the paraesthesia incidence during placement of the spinal needle as 20.7% in needle through needle technique and 8.8% in double segment technique. The type and size of the needle we used, and the paraesthesia incidence found as 20% in the right lateral decubitus position in our study was similar to the results of the study of Ahn and colleagues (26). Looking from the patients' perspective, paraesthesia is an unpleasant experience during anaesthesia induction. In addition sensation of paraesthesia, may lead to sudden and uncontrolled movement of the patient when *Tuohy* needle is in the epidural and may increase the complication risk.

In obese subjects, the incidence of blood vessel puncture was reported to be 12%, 7.3% and 1.3% during epidural catheter placement in sitting, horizontal lateral and head down lateral position, respectively (27). Thus, the rate of 10% blood vessel puncture during epidural catheter placement in sitting position, and 3.3% in right lateral decubitus position in our study is similar to the results of Bahar et al (27). As identification of the epidural space is difficult in patients scheduled to undergo catheter-associated-techniques, even though the incidence of paraesthesia is high, CSE applied in lateral position can be preferred as epidural vein congestion will be lower in lateral position.

It is easier to define the midline anatomical structures in sitting position and there are fewer difficulties associated with the CSE technique (18, 28). In comparison of the number of attempts during CSE, it was observed that epidural space

was identified in the first attempt in 73.3% of subjects in sitting position and 40% of subjects in right lateral decubitus position. This difference may be attributed to the easiness of central block application in sitting position due to anatomical reasons, and the experience of the anaesthetist regarding the position of CSE.

Side effects associated with neuraxial opioid use may range from pruritus, nausea and vomiting, urine retention, respiratory depression, changes in mental state, central nervous system excitation, hyperalgesia, gastrointestinal dysfunction, thermoregulation disorders, ocular dysfunction, heart rhythm disorders, neurotoxicity to anaphylaxis. However, pruritus-skin eruptions most commonly localize on face, neck and superior thoracic region and the incidence of this complication changes according to the opioid used (29). The observation of similar pruritus incidence in both groups in our study was associated to the use of same dose of intrathecal opioid in both groups.

The most frequent side effects associated with regional anaesthesia during intraoperative period are nausea and vomiting, hypotension, increased vagal activity due to sympathetic blockade and neuraxial opioid use, and surgical stimuli, uterotonic agents and movement may be counted among the non-anaesthetic reasons (30). When maternal positions in spinal or CSE anaesthesia were compared, the frequencies of intraoperative nausea and vomiting in lateral decubitus and sitting positions were found to be 53-6.6% and 50-3.3% and 30%-0 and 33%-0, respectively (11, 18, 19, 21). Similarly, in our study, though there was no significant difference, the frequency of nausea and vomiting were 30% and 6.7% in lateral decubitus position, while the corresponding figures were 10% and 0% in sitting position. When all nausea and vomiting reasons were considered, surgical intervention for caesarean section and the dose of uterotonic agent and intrathecal opioid dose associated with anaesthesia were similar in both groups in our study. The frequency of nausea and vomiting was 30% and 6.7% in right lateral decubitus position. Patel et al. (10) reported 61% and 22% nausea in lateral decubitus and sitting positions. As the time to reach T6 sensory levels was 5.8 minutes in sitting position and 4.5 minutes in lateral position in our study, secondary hypotension due to rapid sympathetic blockade might be the reason for higher nausea and vomiting incidence in right lateral decubitus position in comparison to sitting position.

In our study, in which 27 G pencil point spinal needle was used in dural puncture, none of the subjects developed post spinal headache, which is an important reason for postoperative morbidity. Flaatten and colleagues (31) reported the incidence of post spinal headache as 0.38% with 27 G pencil point spinal needle, when compared to atraumatic needle. The occurrence of this postoperative complication may vary according to the size and type of the needle used in dural puncture regardless of the maternal position (31).

Postoperative patient and surgeon satisfaction with anaesthesia was reported as very good in both groups. We think that adequate surgical anaesthesia provided with intrathecal 10 mg hyperbaric bupivacaine and 20 µg fentanyl in all subjects contributed to this opinion.

In a recent study, hypotension incidence was lower in patients who were treated with 10-12 mg plain bupivacaine in spinal anaesthesia in left lateral position, compared to those in sitting position (32). In our study, 10 mg of hyperbaric bupivacaine was preferred to be used in both groups.

Conclusion

Although the amount of ephedrine used in both positions during CSE application was similar, considering the more rapid onset of sensory block at higher levels, the relatively higher effects on hemodynamic parameters and the higher frequency of paraesthesia due to greater number of CSE attempts and spinal needle insertion in right lateral position, we concluded that CSE application in sitting position would be much more reliable and easier in pregnant women.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gazi University School of Medicine (27.03.2006, 81).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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