

The Effect of General and Spinal Anaesthesia on Maternal and Newborn Cortisol Levels in Elective Cesarean Deliveries

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Abstract

Objective: The aim of this study is to compare the concentrations of maternal and fetal cortisol levels in patients received either spinal and general anesthesia in elective term cesarean deliveries.

Methods: Pregnants were randomly assigned into two groups to receive general (n=32, Group 1) or spinal anaesthesia (n=39, Group 2) for elective cesarean section. Maternal cortisol samples were taken after the fifth minute of cesarean operation and newborn cord blood cortisol levels were taken after the fifth minute of delivery. A student t test and Pearson correlation coefficients were performed for statistical analysis. A p value of less than .05 was considered statistically significant.

Results: Maternal cortisol levels were higher in general anaesthesia groups (14.20± 2.45 µg/dl) than spinal anaesthesia group (8.90± 2.18 µg/dl) (p<0.001). Newborn cord blood cortisol levels were higher in general anaesthesia groups (12.88± 5.06 µg/dl) than spinal anaesthesia group (6.74± 2.61 µg/dl) (p<0.001). A significant positive correlations between maternal and newborn cortisol levels were not found between general and spinal anaesthesia groups.

Conclusion: We found lower maternal and newborn cortisol levels in spinal anaesthesia group than general anaesthesia and spinal anaesthesia could be more preferable method in elective term cesarean deliveries due to exposed to less stress than general anaesthesia for fetus and mother.

Keywords: General anaesthesia, spinal anaesthesia, cortisol levels.

Elektif sezaryenlerde genel ve spinal anestezinin anne ve yenidoğan kortizol düzeylerine etkisi

Amaç: Elektif sezaryen nedeniyle spinal yada genel anestezi yapılan gebelerin, maternal ve yenidoğan kortizol seviyelerini ölçmek.

Yöntem: Elektif sezaryen yapılacak gebeler rastgele olarak genel (n=32, Grup 1) ve spinal anestezi (n=39, Grup 2) şeklinde iki gruba ayrıldı. Maternal kortizol seviyeleri sezaryen operasyonun 5.dakikasında ve yenidoğan kord kanı kortizol seviyeleri doğumun 5.dakikasında alındı. İstatistiksel analizde student-t ve Pearson correlation coefficient testi kullanıldı. p<0.05 istatistiksel olarak anlamlı kabul edildi.

Bulgular: Maternal kortizol seviyeleri genel anestezi alan grupta (14.20± 2.45 µg/dl) spinal anestezi alan gruba (8.90± 2.18 µg/dl) göre daha yüksekti (p<0.001). Yenidoğan kord kanı kortizol seviyeleri genel anestezi alan grupta (12.88± 5.06 µg/dl) spinal anestezi alan gruba göre daha yüksekti (6.74± 2.61 µg/dl) (p<0.001). Genel ve spinal anestezi alan grupta maternal ve yenidoğan kortizol seviyeleri arasında pozitif korelasyon saptanmadı (p<.05).

Sonuç: Spinal anestezi grubunda anne ve yenidoğan kortizol seviyelerini, genel anestezi grubuna göre daha düşük bulduk. Elektif sezaryen ile doğumlarda spinal anestezi anne ve bebeği daha az strese maruz bıraktığı için genel anesteziye göre daha çok tercih edilebilecek bir metod olarak düşünülenilir.

Anahtar Sözcükler: Genel anestezi, spinal anestezi, kortizol seviyeleri.

Introduction

One of methods of general or regional anesthesia is preferred in cesarean operations in accordance with the reason and emergency of the operation, experience of anesthetist and request of the patient. In choice of anesthesia, anesthesia method which is believed ensuring convenient working conditions for the surgeon, least depressive for newborn and secure and comfortable for mother should be chosen.^{1,2}

The most preferred method was general anesthesia due to the fact that it affects rapidly in previous years at urgent cesarean operations. But relationship between general anesthesia and mortality of mother is clearly related with failure at intubation and aspiration of gastric content. Spinal anesthesia may be preferred instead of general anesthesia due to the fact that mother is awake, it makes minimal newborn depression and it decreases risks of thromboemboly and postoperative respiration morbidity.³

Cortisol hormone is a stress hormone and conditions creating stress (trauma, surgical interference, anesthesia, shock, serious infection, anxiety, hypoglycemia etc.) may increase cortisol secretion up to ten times. Secretion of cortisol hormone increases parallel to intensity of stimulus by activating the secretion of hypothalamo-pituitary by stimulus from surgical areas during surgical process.⁴

We aimed in our work to determine the effects of general and spinal anesthesia over blood cortisol levels of intraoperative maternal and newborn in elective cesarean operations.

Methods

Totally 69 pregnant which were on their 38th-42nd gestational weeks that they were planning elective cesarean in between April 2005 – October 2005 at Gynecology Clinics of Medical Faculty of Dicle University were included into work. Consents were taken from all cases about that they were volunteers for the study. Gestation age was evaluated by using Toshiba SSH-140A, 3.5 MHz colored Doppler ultrasonography device with convex probe and by using measurements of BDP (biparietal diameter) and AC (abdominal circumference) and FL (Femur Length).

Cases which have been done elective cesarean were separated into two groups as to their anesthesia type. General anesthesia was applied to first group (Group 1; n=32) and spinal anesthesia was applied to second group (Group 2; n=39).

Cases did not included to the work which did not accept regional anesthesia, which had long aPTT and pT values, which had a systematic illness (diabetes mellitus, preeclampsia, hypertension etc.), which were sensitive to local anesthesia and had addiction to any kind of medicine, had anticoagulant usage, disc hernia or vertebra surgery case.

All pregnant were monitored by ECG, arterial blood pressure and pulse oximeter and gauge intravenous cannula was placed one of front arm venous of cases of both groups in order to take cortisol hormone sample. Also, cesarean process was performed to all cases before 11:00 a.m. in terms of convenience for diurnal rhythm. Premedication was not applied to cases.

Intubation process was performed just after obtaining convenient condition by giving 5-7 mg/kg thiopental sodium as intravenous anesthetic and 0.1 mg/kg vecuronium as muscle relaxant to cases of Group I at induction for general anesthesia. Tidal volume of mechanical ventilator was set as 10 ml/kg and respiration frequency was set as 12 in a minute. Dosage of muscle relaxant was repeated at the rate of 1/3 with intervals of 30 minute. 1% isoflurane + 50% O₂ + 50% N₂O were used in continuation of the anesthesia. Anesthesia was ended when the operation was finished and skin sutures were performed, and spontaneous respiration was waited. Cases were extubated by performing the termination process by means of 0.03 mg/kg neostigmine and 0.5 mg atropine.

Before the spinal anesthesia, 10 mg/kg 0.9% NaCl infusion was given to cases of Group II (n=39) for spinal anesthesia. In left side positioning, 2% lidocaine was infiltrated from L3-4 intervertebral interval on and under skin. 2 ml hyperbaric 0.5% bupivacain was given by 21 gauge pen edged spinal needle, when thoracic level reached 10, surgical operation was started.

Blood samples were taken from front arm venous at fifth minute of cesarean incision and from umbilical venous at fifth minute of baby delivery from all pregnant for cortisol hormone

measurements. Cortisol level (normal values; 6.2 – 19.4 µg/dl before noon) of serums obtained after centrifuging blood samples for 5 minutes at 3500 rpm was studied by chemiluminescence technique by using Roche E-170 device (Modular Analytics System) in Central laboratory.

For determining the correlation between student-t test and parameters statistically, Pearson correlation coefficient (R) was used. $p < 0.05$ value was deemed significant statistically.

Results

Totally 69 cases formed of pregnant which had general anesthesia (Group 1; $n=32$) and pregnant which had spinal anesthesia (Group 2; $n=39$) were included into the work. Demographic data of cases are shown in Table 1. There was no significant difference between groups for determining the demographic data of cases.

When both groups were determined in terms of maternal cortisol levels, maternal cortisol levels were found as 14.20 ± 2.45 µg/dl in group one (the group of general anesthesia) which was higher than maternal cortisol levels of group 2 (the group of spinal anesthesia) as 8.90 ± 2.18 µg/dl ($p < 0.001$) (Diagram 1).

When both groups were determined in terms of cortisol levels of baby cord blood, cortisol levels of baby cord blood were found as 12.88 ± 5.06 µg/dl in group one (the group of general anesthesia) which was higher than cortisol levels of baby cord blood of group 2 (the group of spinal anesthesia) as 6.74 ± 2.61 µg/dl ($p < 0.001$) (Diagram 2).

Table 1. Demographic data of groups

Parameters	Group 1 (Average \pm SD)	Group 2 (Average \pm SD)	P
Age	30.28 \pm 6.40	29.70 \pm 5.59	$p > 0.05$
Gravida	5.00 \pm 3.54	4.90 \pm 3.40	$p > 0.05$
Parity	3.37 \pm 3.34	3.02 \pm 3.13	$p > 0.05$
Gestational week	39.15 \pm 1.02	38.06 \pm 1.29	$p > 0.05$
Weight (kg)	73.71 \pm 5.59	74.5 \pm 4.76	$p > 0.05$
Height (cm)	167.12 \pm 6.67	165.41 \pm 5.29	$p > 0.05$
Apgar 1	7.0 \pm 1.9	7.0 \pm 1.8	$p > 0.05$
Apgar 5	8.5 \pm 1.8	8.6 \pm 1.7	$p > 0.05$
Born weight	3545.5 \pm 476.4	3532.4 \pm 402.7	$p > 0.05$

$p > 0.05$ is statistically insignificant.

No correlation between cortisol levels of mother (14.20 ± 2.45 µg/dl) and cortisol levels of baby (12.88 ± 5.06 µg/dl) was found in group which had general anesthesia (Group 1; $n=32$) ($p=0.522$, $r=0.0138$) (Diagram 3).

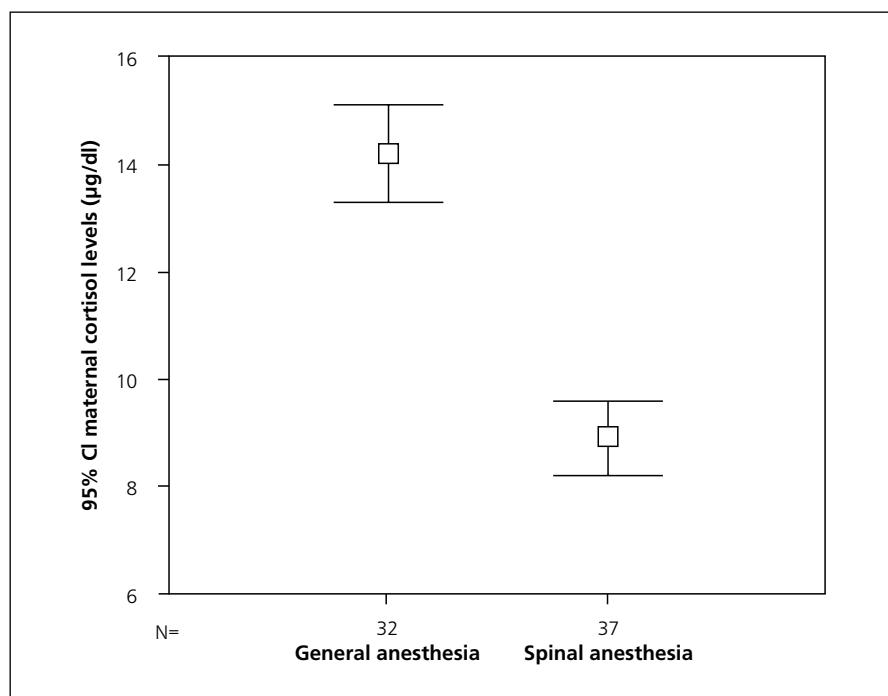


Diagram 1. Maternal blood cortisol levels in group being done general anesthesia and group being done spinal anesthesia.

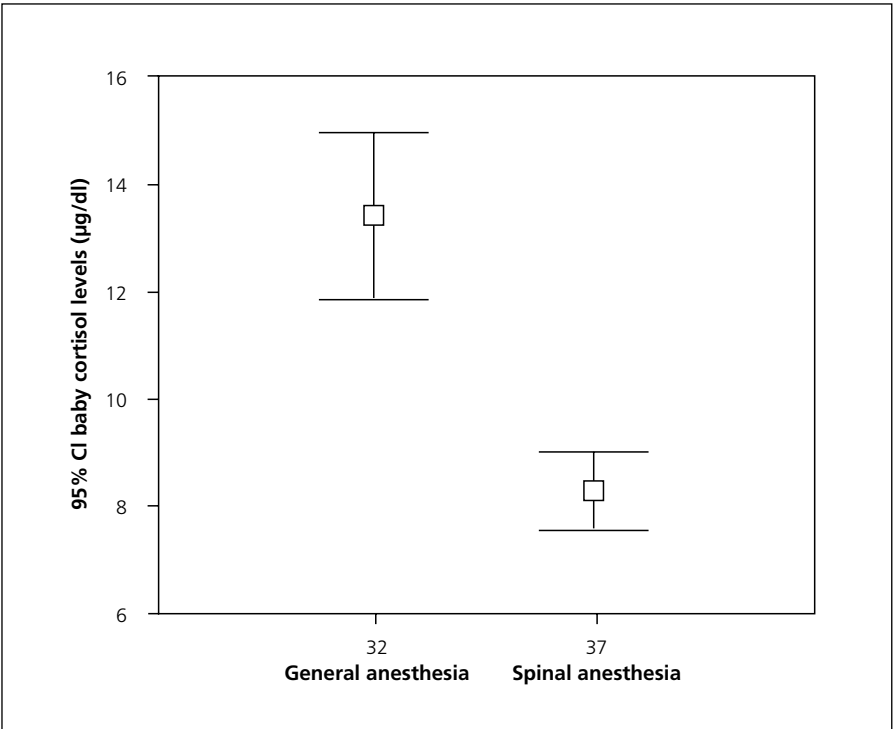


Diagram 2. Cortisol levels of baby cord blood in group being done general anesthesia and group being done spinal anesthesia.

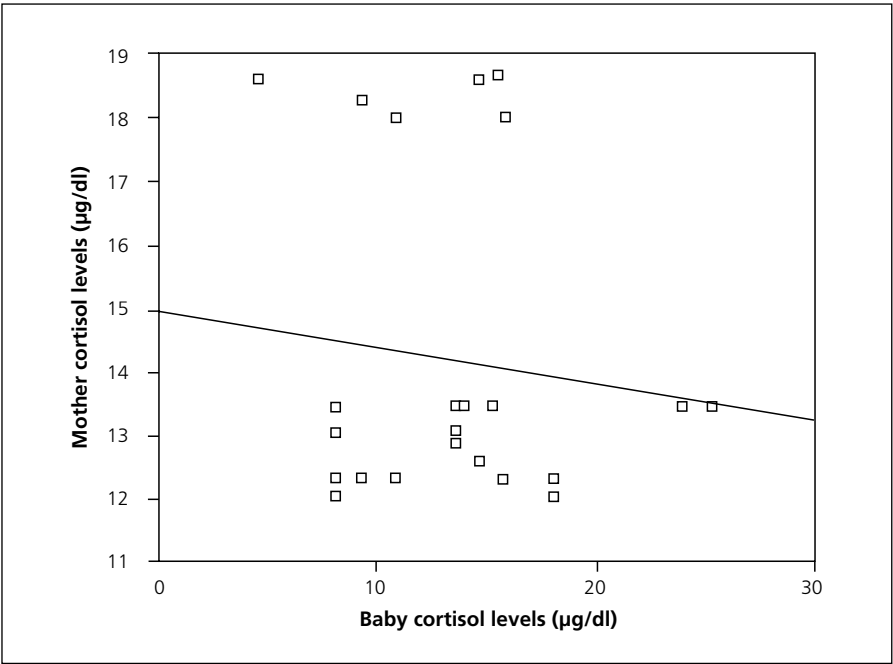


Diagram 3. Correlation between cortisol levels of mother and baby in group one (general anesthesia group).

No correlation between cortisol levels of mother (8.90±2.18 µg/dl) and cortisol levels of baby (6.74±2.61 µg/dl) was found in group which had spinal anesthesia (Group 2, n=37) (p=0.166, r=0.054) (Diagram 4).

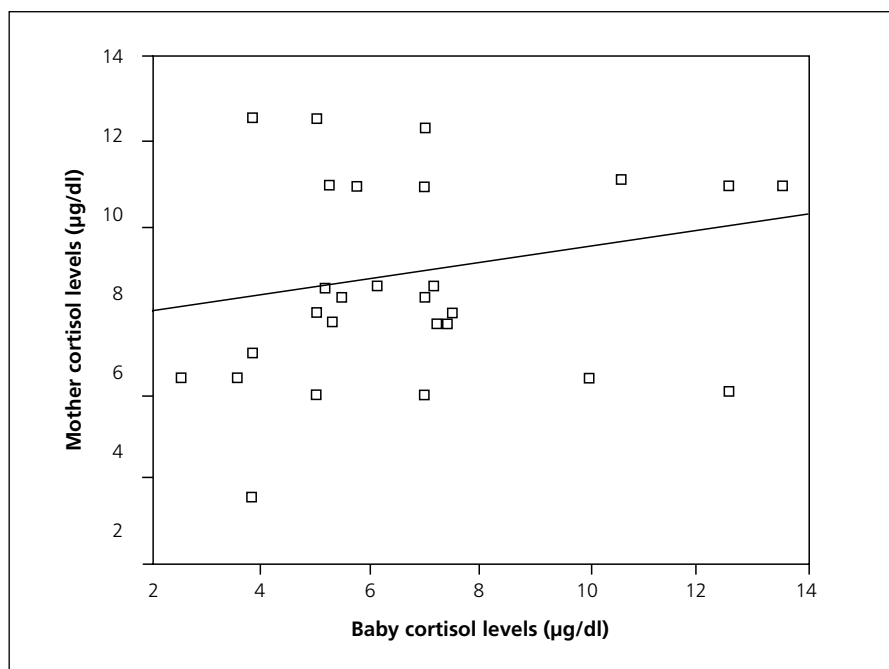


Diagram 4. Correlation between cortisol levels of mother and baby in group 2 (spinal anesthesia group).

Discussion

Spinal anesthesia has become more popular in cesarean operations after the discovery of pen edged spinal needles which are used in anesthesia. Spinal anesthesia ensures mother to be awake, it decreases pneumonia risk related to maternal aspiration, it prevents neonatal depression and it ensures mother to participate to the birth actively.¹⁻⁴

Toker et al found that 77% of cases were had cesarean by spinal anesthesia in their work in which they researched retrospectively 674 cesarean operation cases within 5 years.²

Kayacan et al found that regional anesthesia was more superior to general anesthesia in elective cesarean interferences in their randomized prospective work in which they worked on effects of regional and general anesthesia over mother and newborn.⁵ Kolatat et al found that Apgar scores of infants born by regional anesthesia were higher than infants born by general anesthesia in their work in which they worked on the effects of regional and general anesthesia over newborns.⁶ Adams et al found that spinal anesthesia technique was related with decreased stress hormones in

their work in which they compared regional and general anesthesia.⁷

Papadopoulou et al found that spinal anesthesia decreased maternal stress reply during urgent cesarean operation in their work in which they evaluated maternal stress reply of patients being applied general and spinal anesthesia due to urgent cesarean indication.⁸ Levy et al found that neonatal results were worse in fetuses having intrauterine growing retardation and being applied general anesthesia and also they found that general anesthesia decreased the pH values of umbilical artery of newborns.⁹

Mueller et al found that Apgar score of fifth minute was higher in group that had regional anesthesia in their work in which they researched effects of regional and general anesthesia on Apgar scores of newborns on 5806 pregnant.¹⁰

Cortisol hormone is a prototype stress hormone and conditions creating stress (surgical interference, anesthesia, shock, serious infection, anxiety, etc.) increase cortisol secretion.⁴ It was found that cortisol secretion increased significantly in mice which were exposed to conditions of stress.¹¹

We found maternal cortisol levels (14.20 ± 2.45 µg/dl) of general anesthesia group higher than spinal anesthesia group (14.20 ± 2.45 µg/dl) in our work ($p < 0.001$). Also, cortisol levels of newborn cord blood were found as 12.88 ± 5.06 µg/dl in general anesthesia group which was higher than cortisol levels of newborn cord blood of spinal anesthesia group as 6.74 ± 2.61 µg/dl ($p < 0.001$). No correlation was found between cord bloods of mother and newborn in groups which had general and spinal anesthesia ($p > 0.05$).

Highness of cortisol levels of mothers and babies which had general anesthesia in our work group shows that mothers and babies were exposed to more stress in general anesthesia. Non-correlation between cortisol levels of mother and baby makes us to think that fetal cortisol secretion was not affected from maternal cortisol secretion.

Consequently, we think that spinal anesthesia has less effect on maternal and fetal cortisol levels and the baby is exposed to stress less and spinal anesthesia is a preferable method in spite of general anesthesia in elective cesareans.

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