The Retrospective Evaluation of the Effects of the Delivery Time Intervals on the Newborn During Elective Cesarean Sections Under Spinal Anesthesia

Nejla Mendil Erdogan[1], Berrin Gunaydin[1,*], Asiye Ugras Dikmen[2], Merih Bayram[3] and Ebru Ergenekon[4]

[1]*Gazi University School of Medicine, Department of Anesthesiology, Ankara, Turkey*

[2]*Gazi University School of Medicine, Department of Public Health, Ankara, Turkey*

[3]*Gazi University School of Medicine, Department of Gynecology and Obstetrics, Ankara, Turkey*

[4]*Gazi University School of Medicine, Department of Pediatrics, Ankara, Turkey*

Abstract: *Aim*: We aimed to investigate whether delivery time intervals are related to newborn outcome by evaluating Apgar scores and umbilical cord blood results during elective cesarean section under spinal anesthesia.

Materials and Methods: Records of the 203 ASA I or ASA II pregnant women underwent elective cesarean section under spinal anesthesia during one-year period were evaluated retrospectively. Demographic properties of the parturients (age, weight, body mass index, gravidity, parity and gestational week) and newborns (birthweight and gender), and duration of surgery were presented. In order to demonstrate any possible relationship, time intervals from completion of spinal anesthesia (SA) to skin incision (SI), uterine incision (UI) and umbilical cord clamping (UCC) and from skin and uterine incisions to UCC, Apgar scores, umbilical artery and vein (UA and UV) blood gas analysis (UA-pH, UA-BE, UA-PO_2, UA-PCO_2, UV-pH, UV-BE, UV-PCO_2 and UV-PO_2) were also documented.

Results: There was a significant correlation between delivery time intervals including SA-SI, SA-UI and SA-UCC to UA-pH, UA-BE, UV-pH and UV-BE (p=0.0001). There was also a correlation between SI-UCC and UI-UCC to UV-pH (p=0.0001 and p=0.02) but not with UV-BE. No correlation was observed between SA-SI, SA-UI and SA-UCC to mean Apgar scores at 1 min. However, relatively significant correlation was observed between the time interval SA-SI to mean Apgar scores at 5 min (r=0.13, p=0.04).

Conclusion: We observed a strong correlation between the time intervals from SA to SI, UI, and UCC with the newborn outcome in terms of UV-pH and UV-BE. There was also a correlation between the time interval from SA to SI with Apgar score at 5 min. Therefore, prolongation of the delivery time interval particularly for parturients scheduled to undergo elective cesarean delivery under spinal anesthesia might possibly affect newborn outcome.

Keywords: Cesarean delivery, spinal anesthesia, Apgar score.

INTRODUCTION

Several prospective or retrospective observational studies for emergency or elective cesarean deliveries have been conducted to demonstrate whether anesthesia technique might affect the time interval from decision to delivery or time required for surgical readiness until now [1-4]. According to a retrospective audit in emergency cesarean deliveries, time required for surgical readiness was found to be significantly faster with general anesthesia when compared to spinal anesthesia (15.4 min and 27.6 min during general and spinal anesthesia, respectively)[1]. On the other hand in a prospective study examining the relationship between the intervals from decision to delivery with or without fetal distress during emergency cesarean sections, general anesthesia rather than regional anesthesia resulted in shorter time intervals for fetal distress [2]. However, these two studies compared general versus regional anesthesia for emergency cesarean deliveries. Yet to our knowledge there were no information about the impact of delivery times on the newborn outcome at birth only for elective cesarean deliveries under spinal anesthesia rather than comparing two main anesthesia techniques. Since spinal anesthesia has been the most preferred anesthesia choice for the elective cesarean deliveries worldwide and the relationship between decision-to-delivery interval and umbilical artery pH have already been reported, we aimed to investigate whether there was a relationship in the delivery time intervals particularly during spinal anesthesia for elective CS on the newborn outcome by retrospectively evaluating Apgar scores and umbilical artery and venous blood gas analysis.

MATERIALS AND METHOD

Anesthesia records of 203 parturients having American Society of Anesthesiologists (ASA) I or II

*Address correspondence to this author at the Gazi University School of Medicine, Department of Anesthesiology, Besevler 06500, Ankara, Turkey; Tel: +90 312 202 53 18; Fax: +90 312 489 21 19; E-mail: gunaydin@gazi.edu.tr

E-ISSN: 2309-4400/13

class underwent elective CS during one-year period at Gazi University School of Medicine Department of Anesthesiology were included in this retrospective audit after the approval of Gazi University Ethic Committee (Date: 25.06.2010, No: 078). The pregnants included in the study had vertex presentation, single pregnancy and no additional systemic disease. The records of the parturients having hepatic, renal, cardiovascular, central nerve and muscle-skeleton system disease or receiving calcium channel blocker, opioid, anticoagulant, antidepressant or antipsychotic drugs, alcohol or drug addicted and morbid obese patients were not included.

All parturients enrolled in the present audit had a standard spinal anesthesia and surgical care for elective cesarean deliveries in our institution. After overnight fasting, they received intravenous (iv) aspiration prophylaxis including 50 mg ranitidine and metoclopramide 10 mg half an hour before the operation. Routine monitorization included heart rate (HR), non-invasive blood pressure (BP) and peripheral oxygen saturation (SpO_2). All parturients had spinal anesthesia in the sitting position by midline approach using 25 G pencil point spinal needle with hyperbaric bupivacaine 12 mg, fentanyl 10 µg and morphine 100 µg. The surgical technique was also uniform including extoriorization of the uterus [5].

Demographic characteristics of the mother (age, body weight, body mass index, gravidity, parity, and gestational week) and the newborn (birthweight and gender) and duration of surgery were recorded. Hemodynamic parameters HR, BP and SpO_2 of the parturients until delivery of the newborn were documented. Then, time intervals from completion of spinal anesthesia (SA) to skin incision (SI), uterine incision (UI) and umbilical cord clamping (UCC) and from skin and uterine incisions to UCC, Apgar scores at 1 and 5 minute, umbilical artery and vein (UA and UV) blood gas analysis (UA-pH, UA-BE, UA-PO_2, UA-PCO_2, UV-pH, UV-BE, UV-PCO_2 and UV-PO_2) were also noted.

Statistical Analysis

Data were evaluated by SPSS 15.0 package program. The results were presented as frequency (n), percentage or mean ± standard deviation (sd) or median (minimum and maximum values). After performing descriptive statistics, the relationship between time intervals (SA-SI, SA-UI, SA-UCC, SI-UCC, UI-UCC) to umbilical cord blood gas results and Apgar scores at 1 and 5 minutes were analyzed with chi-square and Pearson correlation tests. When positive (+) correlation is found between two compared parameters, it means that they both increase or decrease. As for interpretation of negative (-) correlation, it means that while one of the compared parameter increases, the other decreases or vice versa. A p value less than 0.05 was accepted as statistically significant.

RESULTS

Maternal demographic properties and duration of surgery were presented in Table **1**.

Table 1: Demographic Properties of the Parturients and Duration of Surgery [(mean ± sd)(minimum – maximum values)]

Age (year)	30.6±5.2 (18-43)
Weight (kg)	76.6±9.5 (56-96)
Gravidity (n)	1.9±1.2 (1-6)
Parity (n)	0.6±0.8 (0-4)
Gestational age (week)	38.5±1.03 (31-42.3)
Duration of surgery (min)	31.6±8.4 (18-55)

Hemodynamic parameters (heart rate and non-invasive mean arterial blood pressure) and SpO_2 of the parturients under spinal anesthesia until delivery of the newborn were documented but since they were stable and remained within clinically normal limits, data have not been shown.

Mean time intervals related to delivery (SA-SI, SA-UI, SA-UCC, SI-UCC, UI-UCC) were shown in Table **2**.

Table 2: Time Intervals Related to Delivery (Umbilical Cord Clamping) of the Newborn [(mean ±sd)]

1.	Spinal Anesthesia (SA) until Skin Incision (SI)(min)	10.1±4
2.	Spinal Anesthesia (SA) until Uterus Incision (UI)(min)	14.2±4.9
3.	Spinal Anesthesia (SA) until Umbilical Cord Clamping (UCC)(min)	15.7±5.1
4.	Skin Incision (SI) until Umbilical Cord Clamping (UCC)(min)	4.1±1.7
5.	Uterus Incision (UI) until Umbilical Cord Clamping (UCC)(min)	1.47±0.83

SA: Spinal Anesthesia; SI: Skin Incision; UI: Uterus Incision; UCC: Umbilical Cord Clamping.

Table 3: Umbilical Artery (UA) and Umbilical Venous (UV) Blood Gas Analysis [mean±sd (minimum – maximum values)]

	pH	PO_2 (mmHg)	PCO_2 (mmHg)	BE (mmol/L)
UA	7.3±0.07 (7.01 – 7.52)	25.3±9.2 (9.6 – 67.6)	48.6±10.2 (10.1 – 91.8)	-0.92±3.1 (-13 – 7.4)
UV	7.36±0.06 (7.10 – 7.55)	34.8±8.7 (7.3 – 60.0)	40.5±6.9 (22.2 – 71.7)	-1.60±3.0 (-13 – 8.2)

The UA and UV blood gas analysis which were collected from umbilical cord immediately after delivery were presented in Table **3**.

Newborns' birthweight, gender and Apgar scores at 1 and 5 minutes were presented in Table **4**.

Table 4: Newborns' Birthweight (mean±sd), Gender (n) and Apgar Scores [median (minimum – maximum values)]

Birthweight (g)	3343±484
Gender (female/male)	108/95
1 min Apgar	9 (9-10)
5 min Apgar	10 (9-10)

Then, the analysis of correlation between mean delivery time intervals (SA-SI, SA-UI, SA-UCC, SI-UCC, UI-UCC) to UA and UV blood gas results and Apgar scores were shown (Table **5**).

Either positive or negative correlation at varying significant levels was observed between all recorded delivery time intervals to UA and UV blood gas results except UA-PO_2. There was a significant correlation between time intervals SA-SI, SA-UI and SA-UCC to UA-pH, UA-BE, UV-pH and UV-BE (p=0.0001). There was also a correlation between SI-UCC and UI-UCC to UV-pH (p=0.0001 and p=0.02) but not with UV-BE.

No correlation was observed between SA-SI, SA-UI and SA-UCC to mean Apgar scores at 1 min. However, a relatively significant correlation was observed between the time interval SA-SI to mean Apgar scores at 5 min (r=0.13, p=0.04).

Table 5: Correlation between Time Intervals to UA and UV Blood Gas Analysis and Apgar Scores

	SA-SI	SA-UI	SA-UCC	SI-UCC	UI-UCC
UA-pH	r=(-)0.32 p=0.001	r=(-)0.43 p=0.0001	r=(-)0.46 p=0.0001	r=(-)0.17 p=0.01	Ø
UA-BE (mmol/L)	r=(-)0.32 p=0.001	r=(-)0.43 p=0.0001	r=(-)0.46 p=0.0001	r=(-)0.17 p=0.01	Ø
UA- PCO_2 (mmHg)	r=0.15 p=0.03	r=0.26 p=0.01	r=0.28 p=0.009	r=0.16 p=0.02	Ø
UV-pH	r=(-)0.27 p=0.0001	r=(-)0.38 p=0.0001	r=(-)0.41 p=0.0001	r=(-)0.21 p=0.0001	r=(-)0.27 p=0.02
UV-BE (mmol/L)	r=(-)0.27 p=0.0001	r=(-)0.39 p=0.0001	r=(-)0.41 p=0.0001	Ø	Ø
UV-PCO_2 (mmHg)	Ø	r=0.28 p=0.0001	r=0.32 p=0.0001	r=0.17 p=0.01	r=0.25 p=0.02
UV-PO_2 (mmHg)	Ø	r=(-)0.38 p=0.0001	Ø	Ø	Ø
Apgar 1 min	Ø	Ø	Ø	r=(-)0.17 p=0.013	r=(-)0.36 p=0.0001
Apgar 5 min	r=(-)0.13 p=0.04	Ø	Ø	Ø	Ø

SA: Spinal Anesthesia; SI: Skin Incision; UI: Uterus Incision; UCC: Umbilical Cord Clamping.
r=correlation coefficient.
(-)= negative correlation.
Ø: no correlation.

DISCUSSION

In the present audit, we observed a correlation between delivery time intervals to UA and UV blood gas analysis and Apgar scores, when we retrospectively analyzed anesthesia records of the pregnants underwent elective CS under spinal anesthesia. We have showed that the time periods from spinal anesthesia to skin and uterine incisions to umbilical cord clamping were related to the newborns' outcome.

When general anesthesia was compared with spinal anesthesia during elective CS, the surgical readiness and duration of anesthesia and surgery were longer in the spinal group. But emergence time was longer in the general anesthesia group while the total time in the operating room was comparable between the two anesthesia techniques [4]. In our audit we did not compare the two anesthesia techniques according to these time periods. We have rather focused on the possible relationship between specific time periods with umbilical cord blood gas results and Apgar scores in parturients underwent elective CS with spinal anesthesia.

We observed a medium-high negative correlation between the time intervals (from spinal anesthesia until skin and uterus incisions and umbilical cord clamping) and UA-pH and UA-BE, while there was a weak-medium positive relationship for UA-CO_2. The longer time interval from spinal anesthesia until skin incision might have resulted decreased UV-pH and UV-BE where there was a significant medium-high negative correlation between them. When the time interval from spinal anesthesia until uterine incision prolonged, UV-pH, UV-BE and UV-O_2 decreased but UV-CO_2 increased. These results showed a significant medium-high negative relationship between the time interval SA-UI to each parameters of UV blood gas content. As for the comparison of mean time interval from skin incision until umbilical cord clamping with UA-pH and UA-BE, we observed weakly negative relationship, while that relationship was found to be weakly positive for UA-CO_2.

Fast and safe anesthesia practice is always important for either elective or emergency CS. Although spinal block can be performed as quickly as general anesthesia for CS even under emergency conditions, there were no very strong evidences to support it. It has been reported that the decision time to perform CS to the delivery of the newborn must not exceed 30 minutes [6]. Regarding induction of general anesthesia with thiopental at sufficient doses for pregnant women, mean UA/UV ratio is 0.87 with an induction to delivery time interval ranging from 8 to 22 minutes. However, larger induction doses like 8 mg/kg can cause significant neonatal depression [7]. Additionally, when that time period exceeds 8 minutes, neonatal acidosis might occur [7]. Moreover, umbilical cord pH and Apgar scores might also decrease if the period from uterine incision to birth takes more than 3 minutes [8]. In our study the mean time interval UI-UCC was approximately 1.47 minutes which is significantly less than 3 minutes.

One of the limitations of our audit might be the lack of decision time to perform CS to the delivery of the newborn. But according to the documentation of all these time components until delivery of the newborn and presented mean data, we might say that the procedure was performed timely under elective conditions even without decision time records.

On the other hand based on the studies investigating the time period from decision to perform CS to newborn delivery, these time periods with or without fetal distress were found to be 42.9 and 71.1 minutes, respectively [2, 3]. However, it has been reported that the standard 30 min for operation decision did not comply with it [3]. Therefore, the reliability of that time might be considered as somehow arguable. Another possible limitation could have been the insufficient numbers of parturients underwent elective CS with general anesthesia for comparison because spinal anesthesia has been the most preferred technique for elective cesarean deliveries in our institution according to the recently published data [9].

As for the comparison of time intervals including SA-SI and SI-UCC, we observed that our SA-SI and SI-UCC (10.1±4 and 4.1±1.7 minutes) times were markedly shorter than that of McCahon and Catling's [1] results from their spinal group (17.4±7.22 and 5.93±3.4 minutes) though McCahon and Catling [1] studied emergency cases.

In conclusion our findings supported that there was a relationship in the delivery time intervals during spinal anesthesia for elective CS on the newborn outcome when Apgar scores and umbilical cord blood gas analysis were retrospectively evaluated. Because of the strong correlation between the time intervals from SA to SI, UI, and UCC to UV-pH and UV-BE and

between SA-SI to Apgar score at 5 min as well, prolongation of each of these intervals might possibly affect newborns of parturients scheduled to undergo elective cesarean delivery under spinal anesthesia.

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Received on 11-06-2013 Accepted on 20-06-2013 Published on 30-06-2013

DOI: http://dx.doi.org/10.14205/2309-4400.2013.01.01.3