Original article

The Effect of Delivery Type on the Indices of Term Newborn Infants' Umbilical Vein Blood Gas

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Abstract:

Introduction: Caesarean section (also known as C-section or caesarean delivery) has undergone an enormous increase over the recent decades, particularly in Iran where the rate of C-section is five times larger than that of the global standards. Moreover, according to several studies, there is the possibility that caesarean delivery can affect umbilical vein blood gas. Accordingly, the present study was conducted aiming to examine the impact of delivery type on the indices of term newborn infants' umbilical vein blood gas.

Methods: The present cross-sectional study explored a total of 222 newborn infants born in Shahid Motahari Hospital, Marvdasht, Iran in 2015 based on three delivery-type groups, namely, natural delivery, general anesthesia-used caesarean and spinal anesthesia-used caesarean. Of all the infants, an amount of 0.5cc umbilical vein blood was taken and then examined in terms of blood gases. The two groups were compared with each other with regard to 1st and 5th minutes' Apgar score, anesthesia duration as well as its influence on blood gases. The data was then analyzed using SPSS software.

Findings: Mean and standard deviation values for Apgar score in natural delivery at the beginning of birth equaled 8.8 ± 0.59, suggesting a significant difference between natural delivery and other caesarean groups (P= 0.01). It should be noted that no significant difference was reported in infants' umbilical vein blood in the two groups in terms of pH (P=0.08), PO2 (P=0.79) and PCO2 (P= 0.85). Likewise, there was a significant difference in umbilical base excess of natural delivery and caesarean groups (P=0.03).

Conclusion: Based on the research results, compared to infants in caesarean groups, those born naturally enjoy higher Apgar score and base excess.

Keywords: Apgar Score, Blood Gases, Caesarean, Natural Delivery, Umbilical Vein.

Introduction:

In most of the times, vaginal delivery has been regarded as the best and usually the most complication-free delivery type. Nonetheless, due to highly increasing caesarean trend, natural delivery type is experiencing a reducing trend. Overall, the degree of caesarean has been increasing all over the world, for which no acceptable reason has been introduced (1). According to the World Health Organization (WHO), the expected domain of caesarean is 10-15% (2). However, in Iran, the caesarean statistics is far higher than that of WHO to the extent that it occurs in state centers and non-state centers of Babel County by 40.5 % and 50%, respectively (3). Additionally, studies conducted in Iran have revealed that caesarean has increased three times in comparison with the 1970s (4). Moreover, studies have also indicated that naturally born patients' quality of life is at far better levels compared to those in caesarean groups (5) and furthermore, in addition to caesarean disadvantages as a surgery, emergency caesarean brings about side effects, mortality and other cases (6).

Various studies carried out on the effect of delivery type on mothers and infants showed that not only did sudden increases in catecholamine in the second labor phase in fetus contribute to maintaining blood flow in the brain, heart, and adrenal, but it improved the adaptive fetal cardiovascular changes as well and led to increases in surfactant. However, maternal hyperventilation, in response to pain, has adverse effects on fetus including respiratory alkalosis and left deviation in oxygen dissociation curve. On the other hand, labor stress and release of cortisol and catecholamine might prolong the labor, leading to decreases in fetal blood flow and asymptotic asphyxia (7). Moreover, using either general or spinal anesthesia influences, directly or indirectly, the fetus, reflecting in the form of changes in umbilical cord blood gases (8), which can determine to a great extent the fetal metabolic status and is routinely performed in all the deliveries in some centers (9). Moreover, it can also be added as one of the best indicators of fetal acidic and alkaline status after changing into the delivery protocol in Iran. A wide variety of studies has addressed the examination of umbilical cord blood gases, suggesting that they be taken into account (10, 11). Additionally, the studies have supported that Apgar score and umbilical cord blood gases are significantly associated, contending that umbilical cord blood gases should be examined, particularly in low-Apgar infants (12, 13). Meanwhile, few studies have addressed the difference in umbilical cord blood gases in various delivery methods with differing results.

Thus, umbilical cord blood gases and Apgar score can be utilized as an index for weighing advantages and disadvantages of the delivery types. Given the varying findings yielded by studies conducted in this regard, the present study was conducted aiming to determine the relationship between umbilical cord blood gases and fetal Apgar score in different delivery methods.

Methods:

The present cross-sectional study was conducted at Shahid Motahari Hospital Marvdasht, Iran in 2015. The study protocol was confirmed by the Ethics Committee of Shiraz University of Medical Sciences (Research Ethics Code, 1425). A total of 222 subjects, entered into the study via convenient sampling method and categorized in three groups, comprised the research sample: 1) natural delivery, 2) general anesthesia-used caesarean, and 3) and spinal anesthesia-used caesarean.

The inclusion criteria were singleton pregnancy, fetal term, and first pregnancy. Moreover, the exclusion factors included stillbirth, chromosomal abnormalities, retardation of intrauterine growth and any maternal disease such as diabetes, pregnancy toxicity, and mother fever.

In each of the three groups, after fetal birth, 0.5 ml umbilical cord blood samples were taken by obstetrician and then were immediately, in 5 minutes, taken to a laboratory for analysis in terms of pH, base excess, partial pressure of oxygen (PO2), and partial pressure of carbon dioxide (PCO2) using EFCHWEILER device. Likewise, the 1st and 5th-minute fetal Apgar scores for both groups were registered by the obstetrician. In addition, mother's demographic information, weight, stature, birth, fetal gender, and pregnancy age were recorded in pre-prepared forms. The data was then analyzed using SPSS software version 21. Also, ANOVA test was employed to examine umbilical cord indices as well as the delivery type. Likewise, to evaluate anesthesia duration and umbilical cord indices, linear regression analysis was used and regression coefficient was utilized to predict the change in umbilical cord indices. Moreover, to compare the mean blood indices and anesthesia duration as well as delivery types, independent t-test was used. In this study, P-values less than 0.05 were regarded as significant.

Findings:

In the present study, a total of 222 infants entered into three groups, namely, natural delivery (n= 99, 44.7%), general anesthesia-used caesarean (n= 103, 46.4%), and spinal anesthesia-used caesarean (n= 20, 0.9%) were examined. Also, with regard to their gender, 97 (56.3%) and 125 (43.4%) of infants were male and female, respectively. In the caesarean groups, 55.4% were born via elective cesarean section while the rest through emergency caesarean. The mean anesthesia duration was 26.51±4.5 minutes.

The results obtained from variance analysis indicated that the mean difference in pH, PO2 and PCO2 was not statistically significant in the groups (P-values were 0.08, 0.79 and 0.89, respectively). However, BE values in different delivery methods were statistically significant (P=0.03). Moreover, according to the post-hoc analysis, there was a significant difference between natural delivery and general anesthesia-used caesarean (P=0.04). Table 1 presents umbilical cord blood gases in all the three groups.

Table 2 provides the comparison of Apgar score for the beginning of birth and five minutes after birth in varying delivery groups by means of ANOVA, showing that Apgar score regarding the beginning of birth

and five minutes after birth had mean and standard deviation values equaling 8.87±0.59 and 10.02±0.73, respectively. Furthermore, the post-hoc analysis indicated a statistical difference between Apgar scores in natural delivery group and general anesthesia-used caesarean group (P=0.01) whereas comparison of the same scores for five minutes after birth in different delivery types was reported to have no statistically significant difference (0.71).

In the present study, the mean and standard deviation of anesthesia durations in general anesthesia-used caesarean equaled 47.67 and 7.20 minutes, respectively. In addition, the same anesthesia durations for women undergoing spinal anesthesia-used caesarean were 48.75 and 9.58, which show no statistical difference (P=0.56). Table 3 presents the effect of anesthesia duration on blood gases using linear regression model, suggesting that anesthesia duration in both spinal and general anesthesia-used deliveries are not significantly associated with indices such as pH, PCO2, BE and PO2 (P>0.05).

Discussion:

Apgar scores for the beginning of birth and five minutes after birth in natural delivery enjoyed the mean and standard deviation values of 8.87±0.59 and 10.02±0.73, suggesting a significant association with the type of delivery (P=0.01) and indicating that Apgar score in natural delivery is statistically higher than that of general anesthesia-used caesarean. Likewise, with regard to the comparison of mean differences of BE in various delivery methods, a statistically significant difference is reported (P=0.03) and, moreover, the mean difference in natural delivery and general anesthesia-used delivery was statistically significant, which can be due to the fetal weight not examined in the present study. Like the present study, a number of studies have examine Apgar score in varying delivery methods. For example, Rafati et al (2008) investigated 100 participants, declaring that Apgar scores in general anesthesia-used caesarean group were less than those of spinal anesthesia-used caesarean and natural delivery groups (8). Moreover, Thavarash and Lobo examining a number of 90 caesareans came this conclusion that only 40% of all the infants enjoyed Apgar scores higher than 7 in the first and third minutes (14). Also, in another study conducted by Know et al in 2009, it was concluded that Apgar scores for infants born through natural delivery are significantly higher than those born via caesarean (15). Findings yielded in other studies resemble those of the present one, suggesting higher Apgar scores in infants born through natural delivery. Thus, it is concluded that Apgar score is an important factor in fetal examinations as well as is associated with fetal health (16). The results of the present study, much consistent with other previous studies, indicated that natural delivery takes precedence over other methods.

With regard to umbilical cord blood gases, Rafati et al showed that PO2 is larger in general anesthesia-used caesarean than the other two groups while no statistical difference was reported in pH, PCO2, HCO3. Additionally, Pence et al examined patients in three natural delivery, general anesthesia-used and spinal anesthesia-used

caesarean groups, reporting the highest levels of PO2 in the latter (17). In addition, according to other studies, there is a relationship between other blood gas parameters, namely, BE, PCO2, and pH and delivery type. In another research carried out by Loh et al, it was shown that the degree of pH in natural delivery is less than that of caesarean while the degree of BE is higher than that of caesarean. Also, Know et al (15) as well as Moddaressnejad (18) suggested there was no significant difference between umbilical cord blood gases in different delivery types. In the present, blood gases showed no significant difference in delivery groups except for BE, which can be due to blood-taking techniques and time.

Likewise, in the study by Rafati et al, there was a statistically significant difference between anesthesia duration and PO2 such that increases in anesthesia duration led to decreases in PO2 (8). However, in the present study, there was only a direct and significant relationship between BE and duration of general anesthesia in such a way that as anesthesia rose, so did the BE. Such a difference in the results can be due to the difference in interfering factors in the studies as blood gases measured were based on a wide range of factors such as various measurement and operation techniques, length of delivery and pregnancy age (19, 20) which might have led to the findings. Moreover, demographic differences including drugs used by mothers and background diseases like kidney, liver and heart related ones can impact on blood gases and lead to differences.

Limitations of the present study include interfering factors such as the duration of natural delivery (21) not controllable by the researchers as delivery is an automatic process.

Given the fact that caesarean is increasing in our country, it is suggested that patients' information concerning selection of delivery method be improved so as to establish an appropriate ground for a comprehensive knowledge of advantages provided by natural delivery in society. Moreover, if forced to employ caesarean, those anesthesia methods be used, in which duration of anesthesia is decreased, thereby BE parameters in umbilical cord blood gases reduce.

Conclusion:

In conclusion, the present study revealed that Apgar scores, an important and determining factor in prediction of infants' status in the next few hours after birth, are higher in natural delivery than those of two other groups, namely, general and spinal anesthesia-used caesareans, suggesting the precedence of natural delivery over other methods.

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References:

1. Taffel SM, Placek PJ, Liss T. Trends in the United States cesarean section rate and reasons for the 1980-85 rise. Am J Pub Heal 1987;77:955-9.

2. WHO statement on caesarean section rates.

wwwwhoint/entity/reproductivehealth/publications/maternal_perinatal_health/cs-statement/en/ - 33k. (accessed 05.02.2016).

3. Faramarzi M, Bakhtiari, A, Nazari, T. The study on prevalence and causes of cesarean section in Babol. JBUMS 2000;2:53-6.

4. Miri Farahani L, Abbasi Shavazi MJ. Caesarean Section change trends in Iran and some demographic factors associated with them in the past three decades. J Fasa Uni Med Sci 2012;2:127-34.

5. Nikpour M, Abedian Z, Mokhber N, Ebrahimzadeh S, Khani S. Comparison of Quality of life in women after vaginal delivery and cesarean section. 2011;13(1):44-50.

6. Asnafi N, Hajian, K, Hesari, H. Causes and complications of emergency cesarean-section in Yahyanejad Hospital, Babol, 1999. JBUMS. 2002;4:16-9.

7. Reynolds F. The effects of maternal labour analgesia on the fetus. Best Prac Res Clin Obst Gynecol 2010;24:289-302.

8. Raafati S, Borna H, Tehrani FHE, Nodoshan MJ, Mozafari M, Eslami M. Neonatal apgar scores and umbilical blood gas changes in vaginal delivery and cesarean: a comparative study. Tehran Uni Med J (TUMJ) 2006;64:61-8.

9. Blickstein I, Green T. Umbilical cord blood gases. Clin Perinatol 2007;34:451-9.

10. Westgate J, Garibaldi JM, Greene KR. Umbilical cord blood gas analysis at delivery: a time for quality data. Int J Obst Gynaecol. 1994;101:1054-63.

11. Thorp JA, Rushing RS. Umbilical cord blood gas analysis. Obst Gynecol Clin North Am 1999;26:695-709.

12. Kaveh M, Davari F, Farahani M. Apgar score and arterial blood gas in the first hour of birth in neonates. Iran J Ped 2004;14(1):27-32.

13. Anyaegbunam A, Fleischer A, Whitty J, Brustman L, Randolph G, Langer O. Association between umbilical artery cord pH, five-minute Apgar scores and neonatal outcome. Gynecol Obst Invest 1991;32:220-3.

14. Thavarasah A, Lobo R. The value of maternal and fetal blood gas analysis in cesarean sections under general anesthesia. Biol Res Preg Perinatol 1986;8(2 2D Half):76-83.

15. Kwon JY, Yoon WS, Lee GSR, Kim SJ, Shin JC, Park IY. Umbilical arterial blood gas and perinatal outcome in the second twin according to the planned mode of delivery. International journal of medical sciences. 2011;8(8):643.

16. Harrington DJ, Redman CW, Moulden M, Greenwood CE. The long-term outcome in surviving infants with Apgar zero at 10 minutes: a systematic review of the literature and hospital-based cohort. American journal of obstetrics and gynecology. 2007;196(5):463. e1-. e5.

17. Pence S, Kocoglu H, Balat O, Balat A. The effect of delivery on umbilical arterial cord blood gases and lipid peroxides: comparison of vaginal delivery and cesarean section. Clinical and experimental obstetrics & gynecology. 2001;29(3):212-4.

18. Modarressnejad V. Umbilical cord blood pH and risk factors for acidaemia in

neonates in Kerman. EMRO J. 2005;13(1):127-31.

19. Pomerance J. Umbilical cord blood gases casebook. Interpreting umbilical cord blood gases, VII. Journal of perinatology: official journal of the California Perinatal Association. 2000;20(5):338.

20. Dickinson JE, Eriksen NL, Meyer BA, Parisi VM. The effect of preterm birth on umbilical cord blood gases. Obstetrics & Gynecology. 2012;79(4):575-8.

21. Wood C, Hing Ng K, Hounslow D, Benning H. Time—an important variable in normal delivery. Int J Obst Gynaecol. 2009;80(4):295-300.

Tables and Charts:

Table 1: Comparison of Umbilical Cord Blood Gases in Different Delivery Methods.

Umbilical Cord Indices		**BE**		**PCO2**		**PO2**		**PH**	
Delivery Method	**Comparison Group**	Mean Difference (SD)	P Value	Mean Difference (SD)	P Value	Mean Difference (SD)	P Value	Mean Difference (SD)	P Value
Natural Delivery	**General Anesthesia Caesarean**	-1.17 (0.53)	0.04	-0.76 (0.22)	0.84	1.35 (1.02)	0.91	-0.03 (0.018)	0.28
	Spinal Anesthesia Caesarean	-1.19 (0.93)	0.11	-0.43 (0.12)	0.98	-2.27 (1.67)	0.91	-0.01 (0.01)	0.11
Spinal Anesthesia Caesarean	**General Anesthesia Caesarean**	0.73 (0.93)	0.71	-0.32 (0.42)	0.99	3.63 (2.01)	0.79	0.02 (0.018)	0.48

Table 2: Comparison of Apgar Score for The Beginning of Birth and Five Minutes in Different Delivery Methods.

Delivery		Apgar Score For The Beginning Of Birth		Apgar Score For Five Minutes After Birth	
Delivery Method (Basis)	**Comparison Group**	Mean Difference (SD)	P Value	Mean Difference (SD)	P Value
Natural Delivery	**General Anesthesia Cesarean**	0.02 (0.008)	0.01	0.007 (0.01)	0.77
	Spinal Anesthesia Caesarean	0.009 (0.01)	0.08	0.01 (0.01)	0.08
Spinal Anesthesia Caesarean	**General Anesthesia Cesarean**	0.01 (0.01)	0.53	-0.004	0.97

Table 3: The Relationship between Anesthesia Duration and Umbilical Cord Blood.

Anesthesia Duration In Delivery Methods	**BE**		**PCO2**		**PO2**		**PH**	
	Pearson Correlation Coefficient	**P Value**	**Pearson Correlation Coefficient**	**P Value**	**Pearson Correlation Coefficient**	**P Value**	**Pearson Correlation Coefficient**	**P Value**
General Anesthesia Caesarean	0.12	0.98	0.87	0.29	0.76	0.20	0.36	0.75
Spinal Anesthesia Caesarean	0.23	0.68	0.64	0.61	0.58	0.64	0.42	0.65