Risk Factors Associated with Birth Asphyxia of Neonate at Faculty of Medicine, Vajira Hospital

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Abstract

Objective: To determine risk factors associated with birth asphyxia in pregnancies.

Methods: A case control study was conducted by including 578 newborns delivered at Vajira Hospital between January 2018 and March 2020. Cases were 289 women who delivered the baby with Apgar score ≤ 7 at 1 minute, while the controls were 289 women who delivered the baby with Apgar score > 7 at 1 minute. The data was collected from medical records. Antepartum factors, intrapartum factors and newborn factors were analyzed with univariate analysis and binary logistic regression analysis.

Results: Factors significantly associated with birth asphyxia included breech presentation (OR 3.18, 95% CI 1.10-9.22), vacuum extraction (OR 10.06, 95% CI 2.00-50.45), cesarean section (OR 2.53, 95% CI 1.59-4.03), preterm delivery (OR 6.62, 95% CI 3.26-13.46) and birthweight < 2500 grams (OR 3.49, 95% CI 1.54-7.90).

Conclusion: The statistically significant risk factors associated with birth asphyxia were breech presentation, vacuum extraction, cesarean section, preterm delivery and birthweight < 2500 grams.

Keywords: birth asphyxia, risk factors

ปัจจัยเสี่ยงที่สัมพันธ์กับภาวะขาดออกซิเจนของทารกแรกเกิด ในโรงพยาบาลวชิรพยาบาล

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาปัจจัยเสี่ยงต่อการเกิดภาวะขาดออกซิเจนในทารกแรกเกิด ในโรงพยาบาลวชิรพยาบาล

วัสดุและวิธีการ: เป็นการศึกษาย้อนหลังแบบมีกลุ่มควบคุม (case control study) เก็บข้อมูลจากบันทึกทางเวชระเบียน และแบบบันทึกการคลอดของหญิงตั้งครรภ์ ที่มาคลอดที่โรงพยาบาลวชิรพยาบาล ตั้งแต่ มกราคม 2561 ถึง มีนาคม 2563 กลุ่มศึกษาคือทารกที่มีคะแนน Apgar ที่ 1 นาทีน้อยกว่าหรือเท่ากับ 7 จำนวน 289 คน และกลุ่มควบคุม คือ ทารกที่มีคะแนน Apgar ที่ 1 นาทีมากกว่า 7 จำนวน 289 คน เปรียบเทียบข้อมูลระหว่าง กลุ่มศึกษาและกลุ่มควบคุม โดยศึกษาปัจจัยก่อนคลอด ระหว่างคลอด และทารกหลังคลอด โดยใช้สถิติ t-test และ chi-square คำนวณทางสถิติโดยวิธีวิเคราะห์ถดถอยโลจิสติกขั้นเดียวและการวิธีวิเคราะห์ถดถอยโลจิสติก หลายตัวแปร

ผลการศึกษา: ปัจจัยเสี่ยงที่มีผลต่อภาวะขาดออกซิเจนในทารกแรกเกิด ได้แก่ การคลอดที่มีส่วนนำเป็นก้น (OR 3.18, 95% CI 1.10-9.22), วิธีคลอดที่ใช้เครื่องดูดสุญญากาศ (OR 10.06, 95% CI 2.00-50.45), การผ่าตัดคลอด ทางหน้าท้อง (OR 2.53, 95% CI 1.59-4.03), ภาวะคลอดก่อนกำหนด (OR 6.62, 95% CI 3.26-13.46) และภาวะน้ำหนักแรกคลอดน้อยกว่า 2500 กรัม (OR 3.49, 95% CI 1.54-7.90)

สรุป: ปัจจัยเสี่ยงที่มีผลต่อการเกิดภาวะขาดออกซิเจนในทารกแรกเกิดอย่างมีนัยสำคัญทางสถิติ ได้แก่ การคลอด ที่มีส่วนนำเป็นก้น วิธีคลอดที่ใช้เครื่องดูดสุญญากาศ การผ่าตัดคลอดทางหน้าท้อง ภาวะคลอดก่อนกำหนด และ ภาวะน้ำหนักแรกคลอดน้อยกว่า 2500 กรัม

คำสำคัญ: ภาวะทารกแรกเกิดขาดออกซิเจน, ปัจจัยเสี่ยง

Introduction

Birth asphyxia is a perinatal event, in serious cases leading to a fatal outcome with risk of death or permanent sequelae[1]. The severe birth asphyxia often causes of mental retardation and epilepsy. The mild birth asphyxia lead to attention deficits and hyperactivity[2].

The World Health Organization (International Classification of Diseases) has divided birth asphyxia into 2 categories: severe birth asphyxia, which is defined by a 1-minute Apgar score between 0-3 and moderate birth asphyxia, which is defined by an Apgar score between 4-7[3-4].

According to data from the Ministry of Public Health, Thailand reported in 2010 showed that the incidence of birth asphyxia in Thai pregnant women was 22.8%[5]. Therefore, to prevent and reduce the incidence of birth asphyxia, the factors that affect the condition must be characterized.

The aim of this retrospective case control study was to identify the important risk factors for birth asphyxia among pregnant women. The second objective was to assess the prevalence of low Apgar score at 5 minutes.

Materials and methods

This is retrospective study. Data were collected at Vajira Hospital, Navamindradhiraj University between January 2018 and March 2020 with the ethical approval of Vajira Institutional Review Board (registered Number 094/63). The inclusion criteria were pregnant women who attended at antenatal clinic and delivered at Vajira Hospital at a gestational age at or beyond 24 weeks which calculated from last menstrual period or ultrasonography at first or second trimester. Birth with major fetal anomaly, chromosomal abnormality, stillbirth and incomplete data record were excluded.

The study population was calculated from the previous studies[4,6,7]. The 289 subjects for each group were recruited using computer generated numbers until the sample size was attained. Cases were the women who delivered the baby with Apgar score ≤ 7 at 1 minute, while controls were the women who delivered the baby with Apgar score >7 at 1 minute.

The collected data were divided into 3 groups; antepartum factors, intrapartum factors and newborn factors. Antepartum factors were age, the number of antepartum visits (ANC), gravida, gestational age (GA), diabetes disorders, hypertensive disorders, intrauterine growth restriction (IUGR) and abnormal amniotic fluid index (AFI).

Intrapartum factors were fetal presentation, chorioamnionitis, meconium-stained amniotic fluid, intrauterine fetal status, predelivery sedative treatment, oxytocin use, cephalopelvic disproportion (CPD), shoulder dystocia and delivery route (spontaneous vaginal delivery, cesarean delivery or vacuum extraction). Newborn factors were newborn birth weight, multiple gestations and preterm delivery which means delivery before 37 weeks' gestation.

All data was entered and analyzed using SPSS version 22.0. Descriptive statistics reported as the percentage, mean, standard deviation, median, minimum and maximum. Analysis of qualitative data for relationship between different factors associated with birth asphyxia was performed by using Chi -square test or Fisher's exact test. The quantitative data were analyzed by using student t-test. A p-value of <0.05 was considered to be statistically significant. After a univariate

analysis and selection of variables with statistical significance, a multivariate analysis was performed using Binary Logistic Regression.

Results

Data of all 578 subjects (289 study and 289 control subjects) were enrolled in this study. Demographic and clinical characteristics of both groups were shown in table 1.

With respect to their antepartum risk factors, women from the case group were observed to have significantly higher rates of advanced maternal age, nulliparous, ANC < 5 times, hypertensive disorders and IUGR. About the intrapartum factors, the cases had significantly higher of breech presentation, non-reassuring fetal status or fetal distress, oxytocin use, vacuum extraction and cesarean delivery. As for the newborn factors, the cases were statistically significant higher of preterm delivery, birthweight < 2500 grams and multiple gestations (table 2).

After multivariate analysis, vacuum extraction was the strongest risk factor associated with birth asphyxia (OR 10.06, p =0.005) and the second was preterm delivery (OR 6.62, p <0.001). Other significant factors were birthweight < 2500 grams (OR 3.49, p = 0.003), breech presentation (OR 3.18, p = 0.033) and cesarean section (OR 2.53, p <0.001) (table 3).

The prevalence of still low Apgar score at 5 minutes was 54 subjects (18.69%). The risk factors that were statistically associated with low Apgar score at 5 minutes were preterm delivery (OR 2.79, 95% CI 1.51-5.14) and birthweight <2500 grams (OR 2.92, 95% CI 1.57-5.50).

Table 1:

Clinical characteristics and demographic data

	Case group (n = 289)	Control group (n = 289)	P value
Age (years)	29.64±7.32	27.43±7.13	<0.001
Nullipara	159 (55.0)	134 (46.4)	0.038
Smoking	2 (0.7)	2 (0.7)	1.000
Drug abuse	6 (2.1)	2 (0.7)	0.154
Number of ANC < 5 times	46 (15.9)	21 (7.3)	0.001
Anemia	108 (37.4)	104 (36.0)	0.730
Maternal complications	60 (20.8)	30 (10.4)	0.001

Data are mean (SD) or n (%)
Abbreviation: ANC = antenatal care

Table 2:

Univariate analysis of factors associated with birth asphyxia

Risk	Case group (n = 289)	Control group (n = 289)	Odds ratio	95%CI	P value
Antepartum factors					
Advanced maternal age	87 (30.1)	58 (20.1)	1.72	1.17-2.51	0.005
Teenage pregnancy	28 (9.7)	39 (13.5)	0.69	0.41-1.15	0.153
Nulliparous	159 (55.0)	134 (46.4)	1.42	1.02-1.96	0.038
Obesity	17 (5.9)	19 (6.6)	0.89	0.45-1.75	0.731
ANC < 5 times	46 (15.9)	21 (7.3)	2.42	1.40-4.17	0.001
Diabetes disorders	60 (20.8)	45 (15.6)	1.42	0.93-2.18	0.106
Hypertensive disorders	43 (14.9)	10 (3.5)	4.88	2.40-9.91	<0.001
Oligohydramnios	9 (3.1)	2 (0.7)	4.61	0.99-21.54	0.063
IUGR	30 (10.4)	4 (1.4)	8.25	2.87-23.74	<0.001
Intrapartum factors					
Chorioamnionitis	4(1.4)	1(0.3)	4.04	0.45-36.39	0.178
Breech presentation	34 (11.8)	5 (1.7)	7.57	2.92-19.66	<0.001
Fetal non-reassuring	43 (14.9)	14 (4.8)	3.43	1.83-6.43	<0.001
Meconium stain in fluid	48 (16.6)	41 (14.2)	1.21	0.77-1.90	0.420
Oxytocin use	61 (21.1)	83 (28.7)	0.66	0.45-0.97	0.034
Analgesia use	34 (11.8)	41 (14.2)	0.81	0.50-1.31	0.386
CPD	21 (7.3)	25 (8.7)	0.83	0.45-1.52	0.539
Shoulder dystocia	5 (1.7)	1 (0.3)	5.07	0.59-43.67	0.101
Cesarean delivery	189(65.4)	96(33.2)	4.23	3.00-6.01	<0.001
Vacuum extraction	11(3.8)	2(0.7)	11.80	2.56-54.37	0.002
Newborn factors					
Multiple gestation	22 (7.6)	2 (0.7)	11.82	2.75-50.77	<0.001
Birthweight < 2500 g	126 (43.6)	17 (5.9)	12.37	7.19-21.27	<0.001
Preterm delivery	123 (42.6)	17 (5.9)	11.86	6.89-20.40	<0.001

Abbreviation: ANC = antenatal care; IUGR = intrauterine growth restriction; CPD = cephalopelvic disproportion; g = grams

Table 3:

Multivariate analysis of factors associated with birth asphyxia

Risk	ORs	95% CI	P value
Breech presentation	3.18	1.10-9.22	0.033
Vacuum extraction	10.06	2.00-50.45	0.005
Cesarean section	2.53	1.59-4.03	<0.001
Preterm delivery	6.62	3.26-13.46	<0.001
Birthweight <2500 grams	3.49	1.54-7.90	0.003

Discussion

In Thailand, birth asphyxia rate or an Apgar score at 1 minute ≤ 7 is listed as one of the important indicators used to monitor the status of neonatal health, and the rate has been suggested to be less than 25 per 1000 live births[8].

This study demonstrated an association between birth asphyxia, which were breech presentation, vacuum extraction, cesarean section, preterm delivery and birthweight < 2500 grams. These risk factors were in accordance with previous studies[4,6-7,9-13].

Breech presentation was 3.18 times higher risk of birth asphyxia than cephalic presentation which was similar to previous studies[4,7,10,11,13]. The explanation for this association may be that breech presentation had higher risk of umbilical cord prolapse, head entrapment, birth trauma and perinatal mortality[15].

The method of delivery was also the risk factor of birth asphyxia. This study showed that vacuum extraction and cesarean section were associated with birth asphyxia which were similar to previous studies[6,11,13-14]. The reasons were probably the pre-existing risk factors of the mothers and the neonates who need operative vaginal delivery or cesarean section such as fetal distress, indicated preterm, etc.

Preterm delivery was 6.62 times higher risk of birth asphyxia than term delivery which was similar to previous studies[4,6-7,9-10,12-14]. This could be the fact that preterm delivery is the cause of respiratory distress syndrome, necrotizing enterocolitis and intracranial hemorrhage.

Birthweight < 2500 grams was 3.49 times higher risk of birth asphyxia than others which was similar to previous studies[4,6-7,9,13]. This was confirmed the fact that low birth weight was related to complicated pregnancy such as preterm delivery, anemia in pregnancy and poor control diabetes mellitus[16].

Although some studies have shown that analgesic drugs and oxytocin use were associated with birth asphyxia[5,6,11], the study did not. This study showed that the oxytocin use reduced the risk of birth asphyxia, this discrepancy may be due to awareness, close monitoring and active management by clinicians.

The strength of this study was case control design. We discuss nearly each and every risk factor of birth asphyxia. The limitations of this study were retrospective and unmatched study.

Regarding clinical application, the factors that related to birth asphyxia risk can be used as an initial screening to identify who are likely to have

birth asphyxia because proper team, equipment and interventions could be prepared and applied to the high-risk cases during intrapartum period and immediately after birth. This may improve the pregnancy and neonatal outcomes.

In conclusion, this study demonstrated that the significant risk factors that associated with birth asphyxia were breech presentation, preterm delivery, low birth weight, operative vaginal delivery by vacuum extraction and cesarean section. Preventing preterm policy and reduce operative vaginal delivery may improve the neonatal outcome.

Acknowledgement

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO estimates of the causes of death in children. Lancet 2005;365(9465):1147–52.

2. Golubnitschaja O, Yeghiazaryan K, Cebioglu M, Morelli M, Herrera-Marschitz M. Birth asphyxia as the major complication in newborns: moving towards improved individual outcomes by prediction, targeted prevention and tailored medical care. EPMA J 2011;2(2):197–210.

3. World Health Organization. International statistical classification of diseases and related health problems -10th revision. 2nd. Geneva: WHO; 2010.

4. Pitsawong C, Panichkul P. Risk factors associated with birth asphyxia in Phramongkutklao Hospital. Thai J Obstet Gynaecol 2011;19(4):165–71.

5. Department of Health, Ministry of Public Health, Thailand. 2010 Annual report. Bangkok: Ministry of Public Health 2011:25-26.

6. Saksangawong S, Rattanamongkolgul S. Risk factor and risk score for birth asphyxia in Kumpawapi Hospital, Udonthani province. RTA Med J 2019;72:41-52.

7. Aslam HM, Saleem S, Afzal R, Iqbal U, Saleem SM, Shaikh MW, et al. Risk factors of birth asphyxia. Ital J Pediatr 2014;40:94.

8. Strategy and Planning Division, Ministry of Public Health, Thailand. Strategy and KPI in year 2016. Bangkok: Ministry of Public Health, Thailand 2015: 42-48.

9. Lee AC, Mullany LC, Tielsch JM, Katz J, Khatry SK, LeClerq SC, et al. Risk factors for neonatal mortality due to birth asphyxia in Southern Nepal: A prospective community-based cohort study. Pediatrics 2008(5);121: 1381-90.

10. Chen ZL, He RZ, Peng Q, Guo KY, Zhang YQ, Yuan HH, et al. Prenatal risk factors for neonatal asphyxia: how risk for each? Zhongguo Dang Dai Er Ke Za Zhi 2009(3);11:161-5.

11. Milsom I, Ladfors L, Thiringer K, Niklasson A, Odeback A, Thornberg. Influence of maternal, obstetric and fetal risk factors on the prevalence of birth asphyxia at term in a Swedish urban population. Acta Obstet Gynecol Scand 2002; 81(10):909-17.

12. Panna S. Risk factors for birth asphyxia in newborns delivered at Nongkhai Hospital. Srinagarind Med J 2020;35(3):278-86.

13. Kolatat T, Vanpragar N, Thitadilok W. Perinatal asphyxia: multivariate analysis of risk factor. J Med assoc Thai 2000;83(9):1039-44.

14. Suwannachat B. Risk factors for birth asphyxia in Kalasin Hospital. Srinagarind Med J 2004; 19(4):233-40.

15. Gunay T, Turgut A, Demircivi Bor E, Hocaoglu M. Comparison of maternal and fetal complications in pregnant women with breech presentation undergoing spontaneous or induced vaginal delivery, or cesarean delivery. Taiwan J of Obstet Gynecol 2020(3);59:392-7.

16. Bener A, Salameh KM, Yousafzai MT, Saleh NM. Pattern of maternal complications and low birth weight: Associated risk factors among highly endogamous women. ISRN Obstet Gynecol 2012;2012:540495. doi: 10.5402/2012/540495.