Risk Factors of Delivery of Low Apgar Score Newborn Below 7 at 1 Minute : A Case-Control Study

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Abstract

To determine the significant risk factors of delivery of low Apgar score newborns below 7 at 1 minute, a case-control study was analysed in pregnant women delivered at Rajavithi Hospital between December 1, 1995 and June 30, 1996. Two hundred and two pregnant women who delivered low Apgar score newborns below 7 at 1 minute and four hundred and four pregnant women who delivered normal Apgar score newborns $\geq$ 7 at 1 minute were recruited in the study by simple random sampling. Risk factors which were significantly associated with low Apgar scores below 7 at 1 minute were gestational age less than 37 weeks or more than 42 weeks, birth weight less than 2,500 g or more than 4,000 g, meconium passage in the amnionic fluid, narcotic analgesic use and breech presentation. The non-significant risk factors were maternal medical or obstetric complications and oxytocin use.

Key word : Risk Factors, Apgar Score, Newborn Case-Control Study

In 1952, Apgar score was first described by Dr.Virginia Apgar[1] for a quick method of assessing newborn status. Low Apgar scores at 1 and 5 minutes are excellent indicators for identification of those infants who need resuscitation recommended by the American College of Obstetricians and Gynecologists[2]. There are many methods for newborn evaluation in labor rooms such as : umbilical arterial blood pH, blood glucose, Dubowitz examination, but there is some difficulty in clinical practice with these methods.

From previous studies, low Apgar score newborns below 7 at 1 minute might lead to mortality if no further appropriate treatment especially in the preterm baby with a birth weight below 1,500 g[3,4]. There are many risk factors of delivery of low Apgar score newborns below 7 at 1 minute such as birth asphyxia, immaturity, structural central ner-

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vous system disorder, congenital muscular or neuromuscular disorder, intrauterine infection, disorder of respiratory tract, thoracic cage or diaphragm, obstetric trauma, maternal drug use (narcotics) intrapartum hypoxia, chronic fetal hypoxia(5).

The objective of our study was to determine the significant risk factors of delivery of low Apgar score newborns below 7 at 1 minute from the following risk factors : gestational age, birth weight less than 2,500 grams, or more than 4,000 grams, meconium passage in amnionic fluid, maternal medical or obstetric complication, narcotic analgesic use, oxytocin and breech presentation.

MATERIAL AND METHOD

This case-control study was done between December 1, 1995 and June 30, 1996 at Rajavithi Hospital. All cases of low Apgar score newborns below 7 at 1 minute were included in the study. The Apgar score newborns ≥ 7 at 1 minute born before and after the study case were assigned as the control group. Therefore, the ratio of study cases to control cases was 1 : 2. We excluded multifetal pregnancy, stillbirth, severe anomalies such as hydrops fetalis and anencephaly and incomplete data. Apgar score was graded by obstetricians or a midwife. Each chart was reviewed for evaluation to select risk factors of delivery of low Apgar score newborns.

Statistical Analysis

The qualitative data was analysed using Chi-square test (X^2) and Fisher exact test when the frequency in each cell was less than 5. The quantitative data was analysed using arithmatic mean, standard deviation and unpaired *t*-test.

Comparison of the risk factors in the study cases and the control group was done using odd ratio and multiple logistic regression analysis. Statistical significance was defined as $P<0.05$. All data was collected and analysed by using computer program Epi-info and STATA version 3.1.

RESULTS

Between December 1, 1995 and June 30, 1996, there were 255 cases of low Apgar score newborns below 7 at 1 minutes delivered in Rajavithi Hospital. We collected 217 completed data. Then we excluded 12 cases of multifetal pregnancy and 3 cases of severe anomalies : anencephaly, Hydrops fetalis and craniofacial anomaly. So, we included 202 cases in the study. Then, we selected 404 control cases.

The mean age and S.D. was 26.55 ± 6.26 years in the study cases and 25.35 ± 5.96 years in the control cases. There was no significant difference between the two groups ($P < 0.05$).

Table 1 shows the association of preterm (<37 wk), term (37-41 wk) and post-term delivery (≥ 42 wk) in the study and control cases. Preterm and post-term delivery had a significantly higher risk in the study cases compared with the control cases (OR = 2.46 and 2.41 respectively). The association of birth weight in the study and control cases is shown in Table 2. Birth weight ≤ 1,499, 1,500-2,499 and ≥ 4,000 g had a significantly higher risk in the study cases compared with the control cases (OR = 14.94, 2.64 and 3.20 respectively).

Table 1. Gestational age at birth.

Gestational age (weeks) at birth	Delivery of: Cases (N=202)	Control (N=404)	Odd Ratio OR crude (95% CI)
< 37	47 (23.27%)	46 (11.39%)	2.46 (1.57-3.86)
37-41	144 (71.28%)	347 (85.89%)	1
≥ 42	11 (5.45%)	11 (2.72%)	2.41 (1.04-5.56)

$X^2 = 18.68$
$P< 0.001$
Cases = Low Apgar score newborn below 7 at 1 minute
Control = Low Apgar score newborn ≥ 7 at 1 minute

Table 2. Birth weight.

Birth weight (grams)	Delivery of Cases (N=202)	Control (N=404)	OR crude (95% CI)
≤ 1,499	12 (5.94%)	2 (0.50%)	14.94** (3.12-97.86)
1,500 - 2,499	36 (17.28%)	34 (8.42%)	2.64 (1.59-4.36)
2,500 - 3,999	145 (71.78%)	361 (89.35%)	1
≥ 4,000	9 (4.46%)	7 (1.73%)	3.20 (1.21-8.45)

$X^2 = 36.36$
$P < 0.001$
** Fisher exact test 2 tailed $P < 0.01$
Cases = Low Apgar score newborn below 7 at 1 minute
Control = Low Apgar score newborn ≥ 7 at 1 minute

Table 3. Other risk factors of delivery of low Apgar score newborn below 7 at 1 minute.

Risk factors	Delivery of Cases (N=202)	Control (N=404)	OR crude (95% CI)	P-value
1. Mecomium passage in amnionic fluid	59 (29.21%)	73 (18.07%)	1.87 (1.26-2.77)	< 0.002
2. Maternal medical or obstetric complication	34 (16.83%)	31 (7.67%)	2.44 (1.45-4.08)	< 0.001
3. Oxytocin use	67 (33.17%)	103 (25.50%)	1.45 (1.006-2.09)	0.048
4. Narcotic analgesic use	50 (24.50%)	68 (16.83%)	1.63 (1.08-2.45)	0.020
5. Breech presentation	46 (22.72%)	13 (3.22%)	8.87 (4.70-16.72)	< 0.001

Cases = Low Apgar score newborn below 7 at 1 minute
Control = Low Apgar score newborn ≥ 7 at 1 minute

Table 3 shows the association of other risk factors in both groups such as : meconium passage amnionic fluid, maternal medical or obstetric complication, oxytocin use, narcotic analgesic use and breech presentation.

The significantly higher risks in the study cases compared with the control cases were meconium passage in the amnionic fluid (OR = 1.87), maternal medical or obstetric complication (OR = 2.44), oxytocin use (OR = 1.45), breech presentation (OR = 8.87), narcotic analgesic use (OR = 1.63). The details of maternal medical or obstetric complications are shown in Table 4.

When we used adjusted analysis to find out the confounder, we found that only neonatal birth weight, gestational age had no confounder.

The other risk factors had confounder. After using multiple logistic regression analysis, we identified that narcotic analgesic use, meconium passage in amnionic fluid and breech presentation were the true risk factors shown in Table 5.

DISCUSSION

In our study the significant risk factors of delivery of low Apgar score newborns below 7 at 1 minute were gestational age at birth, birth weight

Table 4. Detail of maternal medical or obstetric complication.

Maternal medical or obstetric complication	Delivery of	
	Case (N=202)	Control (N=404)
- Hypertensive disorder in pregnancy	12 (35.29%)	10 (32.26%)
- Diabetes mellitus	1 (2.94%)	6 (19.35%)
- Abruptio placentae	2 (5.88%)	1 (3.22%)
- Placenta previa (totalis, partialis)	5 (14.71%)	-
- Placenta previa (low lying)	4 (11.77%)	-
- Heart disease	3 (8.82%)	-
- Latent Syphilis	-	6 (19.36%)
- Other	7 (20.59%)	8 (25.81%)
Total	34 (100%)	31 (100%)

Cases = Low Apgar score newborn below 7 at 1 minute
Control = Low Apgar score newborn ≥ 7 at 1 minute

Table 5. Risk factors of delivery of low Apgar score newborn below 7 at 1 minute after using multiple logistic regression analysis.

Risk factors	OR crude (95% CI)	OR adjust (95% CI)	P-value
- Maternal medical or obstetric complication	2.44 (1.45-4.08)	1.38 (0.77-2.49)	0.283
- Oxytocin use	1.45 (1.004-2.09)	1.47 (0.95-2.27)	0.085
- Narcotic analgesic use	1.63 (1.06-2.45)	2.14 (1.33-3.12)	< 0.001
- Meconium passage in amnionic fluid	1.87 (1.26-2.77)	2.20 (1.46-3.32)	< 0.001
- Breech presentation	8.87 (4.70-16.72)	3.49 (1.75-7.02)	< 0.001

less than 2,500 g or more than 4,000 g, narcotic analgesic use, meconium passage in the amnionic fluid and breech presentation. We used multiple logistic regression analysis to rule out confounders. The confounders in this study were maternal medical or obstetric complications and oxytocin use. Gestational age has been shown to influence the one-minute Apgar in healthy infants[6]. Catlin et al[7] recently demonstrated that this direct relationship with gestational age is due to the decreased motor tone, reduced respiratory effort, and decreased reflex irritability of healthy preterm infants. In their study, 14 of 22 infants at less than 30 weeks' gestation required intubation at birth despite normal cord gases.

Goldenberg et al[8] reported that the more premature the infant, the more likely the Apgar score would be low in the presence of a pH ≥7.25. Conversely, the closer to term, the more frequently an infant with a pH of < 7.25 had an Apgar score of > 7. Therefore, in preterm infants, there is little congruity between the Apgar score and umbilical cord pH

Daga et al[9] reported preterm and low birth weight babies without an increase in cesarean section decreased the risk of delivery of low Apgar score newborns ≤ 7 at 1 minute. In their study, they didn't use multiple logistic regression analysis to rule out confounders. They reported that meconium passage in the amnionic fluid is not significantly

associated with a risk of low Apgar score newborns ≤ 7 at 1 minute unlike in our cases.

Nathan et al[10] compared retrospectively the outcomes in pregnancies with meconium and pregnancies with clear amnionic fluid. They reported Apgar scores of 3 or less at 1 and 5 minutes was significantly more common in association with meconium. The incidences of admission to the special care nursery, respiratory distress, and seizures within 24 hours of birth were significantly increased in those with meconium. Katz and Bowes[11] said that several modern studies have examined data collected around the time of birth to correlate meconium passage and fetal distress. Such data must be viewed cautiously because the association of the events of labor and particularly of delivery does not necessarily represent the intrauterine environment at the time of meconium passage. For example, analysis of Apgar scores to correlate distress with meconium stained fluid may be misleading, because Apgar scores are affected by tracheal intubation. They concluded that underlying asphyxia, rather than the meconium that may accompany the asphyxia, can produce pulmonary pathology.

Factors unrelated to placental compromise such as narcotic analgesic used during labor can cause neonatal respiratory depression, possibly resulting in low Apgar scores[6]. Breech presentation has been found significantly the highest risk among antepartum and intrapartum factors reported by Daga et al[9]. MacDonald HM et al[12] also reported that breech delivery was associated with a higher incidence of asphyxia. The study of Daga et al[9] showed that pregnancy induced hypertension significantly increase the risk of low Apgar score newborns, but antepartum hemorrhage did not significantly increase those risks. Maternal medical or obstetric complications such as diabetes mellitus and hypertensive disorder in pregnancy were reported as significant risk factors of nonatal asphyxia in term infants[12]. But in our study, maternal medical or obstetric complications did not significantly increase the risk of low Apgar score newborns after using multiple logistic regression analysis. We postulated the reason of the different results might come from a smaller sample size (202 study cases) in our study compared to 541 study cases and 447 study cases in the studies of Daga et al[9] and MacDonal HM et al[12] respectively. Another reason was the different criteria for diagnosis of neonatal asphyxia in each study. Daga et al[9] used Apgar score 7 and less at 1 minute while we used Apgar score below 7 at 1 minute as the criteria for diagnosis. MacDonald et al[12] diagnosed neonatal asphyxia when infants who required >1 minute of positive pressure ventilation before sustained respiration occurred

Risk factors of delivery of low Apgar score newborns below 7 at 1 minute should help us in prediction and identification of patients at increase risk for delivery of neonatal morbidily and perinatal death in the antepartum and intrapartum periods[13].

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ปัจจัยเสี่ยงต่อการคลอดทารกที่มีคะแนนแอพการ์ต่ำกว่า 7 ที่ 1 นาที

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การศึกษาเพื่อหาปัจจัยเสี่ยงต่อการคลอดทารกที่มีคะแนนแอพการ์ต่ำกว่า 7 ที่ 1 นาที ในหญิงตั้งครรภ์ที่คลอดบุตรที่โรงพยาบาลราชวิถี ตั้งแต่ 1 ธันวาคม 2538 ถึง 30 มิถุนายน 2539 ได้ศึกษาหญิงตั้งครรภ์ 202 คนที่คลอดทารกที่มีคะแนนแอพการ์ต่ำกว่า 7 ที่ 1 นาที และหญิงตั้งครรภ์ 404 คนที่คลอดทารกที่มีคะแนนแอพการ์เท่ากับหรือมากกว่า 7 ที่ 1 นาที โดยวิธีสุ่มตัวอย่างแบบง่าย พบว่าปัจจัยเสี่ยงที่มีนัยสำคัญทางสถิติต่อการคลอดทารกที่มีคะแนนแอพการ์ต่ำกว่า 7 ที่ 1 นาที คืออายุครรภ์น้อยกว่า 37 สัปดาห์หรือมากกว่า 42 สัปดาห์ น้ำหนักแรกคลอดน้อยกว่า 2,500 กรัมหรือมากกว่า 4,000 กรัม การตรวจพบขี้เทาในน้ำคร่ำ, การได้รับยาระงับอาการปวดชนิด Narcotics และการคลอดท่าก้น ส่วนปัจจัยเสี่ยงที่ไม่มีนัยสำคัญทางสถิติ คือ ภาวะแทรกซ้อนของมารดาทางอายุรกรรมและสูติกรรม และการได้รับยาออกซิโทซิน

คำสำคัญ : ปัจจัยเสี่ยง, คะแนนแอพการ์, ทารก

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