

## OBSTETRICS

# Risk Factors Associated with Low Apgar Score of Newborn at One Minute

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## ABSTRACT

**Objective** To determine the risk factors of delivery newborn with Apgar score equal or less than 7 at 1 minute.

**Study design** Case - control study.

**Setting** Prachuab - Khirikhan Hospital.

**Method** From October 1997 to September 1999, 180 cases of newborn who had 1 minute Apgar score equal or less than 7 were studied. Control cases were cases of newborn who had 1 minute Apgar score more than 7, born follow the study cases in ratio case : control 1:2. Forteen risk factors were grouping and using Chi-square and multiple logistic regression analysis to find out real risk factors.

**Results** Using multiple logistic regression risk factors which were significantly associated with newborn Apgar score  $\leq 7$  at 1 minute were pregnancy induced hypertension (OR = 12.83, 2.511 - 65.561), prolonged second stage (OR = 8.73, 2.229 - 34.192), moderate to thick meconium stained of amniotic fluid (OR = 5.063, 2.606 - 9.831), breech presentation (OR = 3.93, 1.693 - 9.144), gestational age less than 37 weeks (OR = 3.74, 1.764 - 7.928), and birth weight  $< 2500$  g. (OR = 2.11, 1.071 - 4.139).

**Conclusion** Most of the risk factors of low Apgar score newborn at 1 minute were simple to identify. Early detection and appropriate care should decrease newborn of low Apgar score.

**Key words:** Risk factors, low Apgar score, one minute

Asphyxia is still the major problem in maternal and child health care. Eventhough, it is not the first cause of perinatal mortality, but its sequelae is high.<sup>(1,2)</sup> National Public Health Policy uses low Apgar score ( $\leq 7$  at 1 minute and 5 minutes) as a tool to improve birth asphyxia. From National Public Health statistics, average newborn of Apgar score  $\leq 7$  at 1 minute in general hospital is 50.5:1000 live birth. In 1998 newborn of low Apgar score at 1 minute in Prachuab - Khirikhan Hospital was 62:1000 live birth. To decrease

cases of low Apgar score at 1 minute, significant risk factors must be find out.

## Materials and methods

- 1) Case - control study between October 1, 1997 and September 30, 1999 at Prachuab - Khirikhan Hospital
- 2) Study cases, were 180 cases of newborn of Apgar score  $\leq 7$  at 1 minute.

Control cases were cases of newborn Apgar

score > 7 at 1 minute, born follow the study cases. Ratio of study cases and control cases was 1:2.

- 3) Exclusion criteria were cases of multifetal pregnancy and severe anomalies.
- 4) Fourteen study factors were : maternal age, gravida, antepartum complication, PIH (Pregnancy Induced Hypertension), PROM > 12 hours (Premature Rupture Of Membrane), Narcotic analgesic within 4 hours before delivery, syntocinon used, CPD (Cephalo Pelvic Disproportion), prolonged 2<sup>nd</sup> stage, time at birth, meconium stained amniotic fluid, gestational age, birth weight and presentation.
- 5) Gestational age was confirmed after delivery using Ballard score, by Pediatricians or attended midwife.
- 6) All data was collected and analysed by using Chi-square test ( $\chi^2$ ) OR (odds ratio) and multiple logistic regression with computer program SPSS for window version 8. For quantitative data, we used mean, SD and unpaired t-test.

## Results

From October 1, 1997 to September 30, 1999 there were 188 cases of low Apgar score  $\leq 7$  at 1 minute, 8 cases were infants from multiple pregnancy. Thus, only 180 cases were study and control cases were 360. The mean age and SD in study cases and control case were  $26.04 \pm 6.66$  and  $25.62 \pm 6.05$  respectively. There was no significant difference between the two groups.

Table 1 shows maternal factors and outcome of Apgar score at 1 minute. Maternal age, gravida and antepartum complication were no statistical significant. Statistical significant factors were PIH (OR = 11.65, 2.554 - 53.148), PROM > 12 hours (OR = 3.04, 1.272 - 7.244), CPD (OR = 2.43, 1.129 - 5.217), prolonged 2<sup>nd</sup> stage (OR = 8.5, 2.367 - 30.522). Details of antepartum complication was in Table 2.

**Table 1.** Maternal factors and result of Apgar score at 1 minute

<b>Maternal factors</b>	<b>1 min Apgar score</b>		<b>OR (95% CI)</b>	<b>P - Value</b>
	<b><math>\leq 7</math></b>	<b><math>&gt;7</math></b>		
1. Maternal age (yrs.)				NS
< 20	33 (18.3%)	60 (16.7%)		
20 - 39	138 (76.7%)	294 (81.6%)		
$\geq 40$	9 (5.0%)	6 (1.7%)		
2. Gravida				NS
1 - 3	167 (92.8%)	324 (90.0%)		
$\geq 4$	13 (7.2%)	36 (10.0%)		
3. Antepartum complications				NS
Yes	24 (13.3%)	28 (7.8%)		
No	156 (86.7%)	332 (92.2%)		
4. Intrapartum complications				
4.1 PIH	11 (6.1%)	2 (0.6%)	11.65 (2.554 - 53.148)	.000
4.2 PROM > 12 hr	13 (7.2%)	9 (2.5%)	3.04 (1.272 - 7.244)	.010
4.3 CPD	15 (8.3%)	13 (3.6%)	2.43 (1.129-5.217)	.019
4.4 Prolonged 2 <sup>nd</sup> stage	12 (6.7%)	3 (0.8%)	8.5 (2.367-30.522)	.000

**Table 2.** Details of Maternal antepartum complication

Antepartum complications	Delivery of	
	Case (N = 180)	Control (N = 360)
- Thalassemia	2 (8.33%)	2 (7.1%)
- Nephrotic syndrome	1 (4.17%)	0
- Malaria	1 (4.17%)	0
- HIV infection	6 (25%)	8 (28.7%)
- IUGR	2 (8.33%)	2 (7.1%)
- Placenta previa	2 (8.33%)	2 (7.1%)
- Previous caesarian section	10 (41.67%)	14 (50%)
<b>Total</b>	<b>24 (100%)</b>	<b>28 (100%)</b>

From table 3, significant fetal factors were moderate to thick meconium stained of amniotic fluid (OR = 5.39, 2.950 - 9.882) birth weight < 2500 g (OR = 6.16, 3.482 - 10.901) and breech presentation (OR = 8.209, 4.074 - 16.542)

**Table 3.** Fetal factors and result of Apgar score of 1 minute

Fetal factors	1 min Apgar score		OR (95% CI)	P - Value
	≤ 7	> 7		
1. Gestational age (wk)				
< 37	38 (21.1%)	17 (4.7%)	5.39 (2.950-9.882)	.000
37 - 42	131 (72.8%)	332 (92.2%)	1	
> 42	11 (6.1%)	11 (3.1%)		> 0.05
2. Birth Weight (gm)				
< 2500	46 (25.6%)	19 (5.3%)	5.16 (3.482-10.901)	.000
2500-3999	128 (71.1%)	334 (92.8%)	1	
≥ 4000	6 (3.3%)	7 (1.9%)		> 0.05
3. Meconium stained amniotic fluid				
Clear to mild	131 (72.8%)	342 (95.0%)	1	
Moderate to thick	49 (27.2%)	18 (5.0%)	7.107 (3.99 - 12.45)	.000
4. Presentations				
Cephalic	141 (78.3%)	349 (96.9%)	1	
Breech	37 (20.6%)	11 (3.1%)	8.209 (4.074 - 16.542)	.000
Transverse	2 (1.1%)	-	-	> 0.05

From table 4, others significant risk factors were narcotic analgesic (OR = 2.5, 1.059 - 5.903) and syntocinon used (OR = 1.56, 1.015 - 2.474)

After using multiple logistic regression analysis, we found that only 6 factors were real risk factors of low Apgar score, as shown in table 5

**Table 4.** Others study risk factors and results of Apgar score at 1 minute

Others study factors	1 min Apgar score		OR (95% CI)	P - Value
	≤ 7	> 7		
1. Narcotic analgesic used	12 (6.7%)	10 (2.8%)	2.50 (1.059-5.903)	.030
Not used	168 (43.3%)	350 (97.2%)	1	
2. Syntocinon used	42 (23.3%)	58 (16.1%)	1.59 (1.015-2.474)	.029
Not used	138 (76.7%)	302 (83.9%)	1	
3. Time of birth				> 0.05
08.31 - 16.30	70 (38.9%)	139 (38.6%)		
16.31 - 00.30	61 (33.9%)	112 (31.1%)		
00.31 - 08.30	49 (27.2%)	109 (30.3%)		

**Table 5.** Risk factors after using multiple logistic regression

Risk factors	OR (adjusted)	95% CI
1. PIH	12.83	2.511 - 65.561
2. Prolonged 2nd stage	8.73	2.229 - 34.192
3. Meconium stained Amniotic fluid	5.06	2.606 - 9.831
4. Breech presentation	3.93	1.693 - 9.144
5. Gestational age < 37 weeks	3.74	1.764 - 7.928
6. Birth weight < 2500 g	2.11	1.071 - 4.139

## Discussion

The Apgar score, devised in 1952 by Dr. Virginia Apgar,<sup>(3)</sup> is a quick method of assessing the state of the newborn. The ease of scoring by this method has led to its use in many studies of neonatal outcome. Low Apgar score at 1 and 5 minutes are excellent indicators for identification of infants needing resuscitation. Although low score may not be incidence of hypoxia, they are influenced by other factors affecting tone, responsiveness and respiration.<sup>(4)</sup> Only

low Apgar score does not correlate with long term outcome. For the ease, especially in the rural hospital, National Public Health Policy use Apgar score at 1 and 5 minute equal or less than 7 as a meaning of asphyxia.

From this study, we obtain 6 real risk factors, PIH (OR = 12.83), prolonged second stage (OR = 8.73) meconium stained amniotic fluid (OR = 5.06), breech presentation (OR = 3.93), gestational age < 37 weeks (OR = 3.74) and birth weight < 2500 g (OR = 2.11). From the study of Koravisarach E and Juntasom, C<sup>(5)</sup>

risk factors of delivery of low Apgar score < 7 at 1 minute were gestational age < 37 weeks or > 42 weeks, birth weight < 2500 g and > 4000 g, meconium stained amniotic fluid, narcotic analgesic used and breech presentation. Unlike our study, post term and birth weight > 4000 g were significant risk factors may be from using Ballard score to estimate gestational age after delivery from our study and smaller sample size.

From many studies, maturity was the most potent influencing the incidence of asphyxia, the more preterm the infant, the more likely the low Apgar score.<sup>(6,7)</sup> Mac Donald HM et al<sup>(7)</sup> showed that asphyxia occurred in 62.3% of infants < 27 weeks gestation and decreased to 0.4% in infants > 38 weeks gestation. Catlin EA et al<sup>(8)</sup> demonstrated that this direct relationship with gestational age is due to the decreased motor tone, reduce respiratory effort and decreased reflex irritability of healthy preterm infants, despite normal cord gases. Efforts aimed at preventing prematurity should therefore contribute effectively to decreasing the overall incidence of and mortality associated with perinatal asphyxia.

According to the birth weight, the incidence of asphyxia was indirectly related to, from a low of 0.5% in infants > 2500 g to a high of 72.3% infants < 750 g.<sup>(7)</sup> Meconium stained amniotic fluid was significant risk factors in many studies.<sup>(7,9-11)</sup> Using NCPR (Neonatal Cardio Pulmonary Resuscitation) team did not improve Apgar score at 1 minute, but improve Apgar score at 5 minute and infant mortality. Apgar score at 1 minute was affected by tracheal intubation and suction in thick meconium stained of amniotic fluid. Meconium stained usually occurred in cases of intrauterine growth retardation and postterm. Good antenatal care should have early detection of these cases, and with appropriate care, they may have good results. In active phase, color of amniotic fluid should be known, and so further proper management.

Pregnancy induced hypertension (PIH) was one of the real risk factors (OR = 12.83). PIH may reduced placental perfusion and cause both antepartum and intrapartum asphyxia. Magnesium sulfate used in PIH may also depress respiration of the newborn at birth

and caused low Apgar score. Daga AS et al<sup>(6)</sup> and Chandra S et al<sup>(12)</sup> showed that pregnancy induced hypertension significantly increase risk of low Apgar score like our study. Using low dose aspirin in pregnant woman to prevent PIH is equivocal.<sup>(13)</sup>

Breech presentation was a risk factor of asphyxia to both preterm and term infants.<sup>(7)</sup> External cephalic version at  $\geq$  37 weeks should reduce this risk. From the study of Bewley S et al,<sup>(14)</sup> they concluded that external cephalic version at term can be introduced safely and without difficulty, with a strict protocol.

From this study, prolonged second stage of labor was a significant risk factor of low Apgar score (OR = 8.73) same as the study of Chandra S et al.<sup>(12)</sup> Prolonged second stage of labor is a time of particular anxiety to the obstetricians. Both cord compression and fetal head compression can cause fetal bradycardia during second stage of labor.<sup>(15)</sup> With continuous electronic FHR monitoring, there was no significant relationship between second stage duration and low Apgar score at 5 minute.<sup>(16)</sup> From the study of Low JA et al,<sup>(17)</sup> they concluded that a narrow an hour window of FHR patterns before delivery, including minimal baseline variability and prolonged deceleration will predict fetal asphyxia exposure before decompensated and newborn morbidity. Thus, in second stage of labor that lasts more than 1 hour FHR should be close observed and evaluated to prevent unnecessary intervention or increased in morbidity.

PROM > 12 hrs, CPD, norcotic analgesic used and syntocinon were not real significant risk factors from our study after control confounding.

At Prachuab Khirikhan Hospital, we have used Partogram more than 5 years, NCPR team for 2 years. From this study, further management to improve Apgar score should be:

1. Whenever uterine size is in doubt, gestational age should be confirmed.
2. Early detection and appropriate care of preterm labor.
3. Early detection and appropriate care of PIH.
4. Color of amniotic fluid should be seen in pregnant

women with active phase of labor.

5. In breech presentation, external cephalic version should be done at 37-38 weeks gestation.
6. Fetal heart rate should be closed monitoring when second stage of labor lasts more than 1 hours.

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