

Prognostic Indicators for Survival of Very Low Birth Weight Infant

Rajin Arora*

Wanlika Kaesuriya**

Aintila Jongpoo**

*Department of Obstetrics and Gynecology, Lampang Regional Hospital.

**Labor Unit, Department of Nursing, Lampang Regional Hospital.

Abstract Very low birth weight (VLBW) infants were known to have high morbidity and mortality. It was hard for obstetricians to predict the chance of survival of these infants when multiple factors were involved. This retrospective cross sectional study was to determine the prognostic indicators of VLBW infants and to develop an equation to predict the chance of survival. All live born VLBW infants who delivered in labor room of Lampang Regional Hospital from January 2005 to December 2009 were included. Their maternal medical records and neonatal charts were reviewed for antenatal, peripartum and neonatal factors. Data were analyzed using descriptive and inferential statistics. There were 223 live born VLBW infants in the study period and 74.9 percent survived beyond 28 days. After univariate analysis was done for every factor. Multiple logistic regression analysis of the significant antenatal factors was done. There were 3 factors that were significant enough to include in the equation. They were gestational age, anomaly and giving dexamethasone. The significant antenatal, peripartum and perinatal factors shown in this study were similar to other studies. Having the survival score equation and the graph of the chance of survival posted in labor room of any hospital can help obstetricians in counseling with the pregnant woman regarding the prognosis of her fetus. In conclusion, this study ultimately showed 3 prognostic indicators which were used in a more useful way, as a survival score equation. This should help obstetricians to know better, regarding the prognosis of a VLBW infant.

Key words: very low birth weight infant, prognosis, survival

Introduction

Very low birth weight (VLBW) infants are known to have high morbidity and mortality rate. Lately, intensive neonatal care and advance medical technologies could improve the outcomes of these infants. However, it is hard for obstetricians to predict the

chance of survival when multiple factors are involved.

There were reports stating that many factors do involve in the survival of VLBW infants. Birth weight < 1,000 grams, low gestational age (GA), Black ethnic group, neonatal hypothermia and having congenital anomaly were shown to be poor prognostic indica-

tors.⁽¹⁻⁷⁾ High Apgar score at 1 or 5 minute, giving dexamethasone to mother, cesarean section delivery and no CPR needed in NICU were all shown as good indicators.^(1-3,5,8-11) There are also some unknown or uncertain indicators. For example, there are conflicting reports mentioning, either female VLBW infants do survive more, or less than male infants.^(6,9) Twins were also shown to be insignificant prognostic indicator as well.⁽¹²⁾ However, there is a report showing that principal pregnancy complication that led to preterm delivery significantly influenced pre-discharge morbidity of the infant. Fortunately, this does not influence the pre-discharge survival.⁽¹³⁾

Lampang Regional Hospital is one of the regional hospitals in northern Thailand taking care of pregnant women in Lampang province and nearby. With 800 beds facility, Lampang Hospital is equipped with high technology medical tools for intensive neonatal care. Lately, there was an increase incidence of VLBW infants in the hospital. Chance of survival of VLBW infants depends partly on some maternal characteristics. In cases with the history of infertility treatment, chance of survival might be enhanced by aggressive obstetrical and neonatal management. But those who are unwanted pregnancies, result might be in contrary. It is hard for obstetric staff to counsel the prognosis of the fetus when there are multiple factors and biases involved. Sometimes, plan of management comes from subjective perception of the responsible personnel.

This study was to determine the prognostic indicators for survival of VLBW infants. It could objectively state that which factors really correlate with the survival of these infants. Another objective was to develop an equation to predict chance of survival from then proven prognostic indicators. This would really help obstetric staff in counseling with the patient and her relatives especially in controversial cases.

Methods

This was a retrospective cross sectional study. All live-born very low birth weight infants, weighing less than 1,500 grams by the WHO criteria⁽¹⁴⁾, who delivered in labor room of Lampang Regional Hospital from January 2005 to December 2009, were included. Their maternal medical records were reviewed for antenatal and peripartum characteristics. Neonatal charts were reviewed for neonatal outcomes. Neonatal death was defined as death of a live-born infant within 28 days.⁽¹⁵⁾ Data were analyzed using standard statistical software. Fisher's exact probability test, student t-test, Rank sum test, and regression analysis were used for univariate and multivariate analysis accordingly.

Results

There were 223 live born VLBW infants in the study period. One hundred sixty seven or 74.9 percent of these infants survived beyond 28 days. Antenatal factors were analyzed as prognostic indicators and presented in table 1. From univariate analysis, it showed that gestational age significantly predicted survival of the infants. It also showed that survival group had significantly fewer ratios of cases with no antenatal care.

Table 2 shows the univariate analyses of peripartum factors. It showed that survival group had significantly fewer ratios of anomaly and unwanted pregnancy. Survivors also had significant higher ratio of cases with dexamethasone given ≥ 1 dose and obstetric complications. Common obstetric complications found in the survival group were pregnancy-induced hypertension (13.8%), HIV infection (3.6%), diabetes mellitus (3.6%) and antepartum hemorrhage (7.8%). Antenatal and peripartum factors which were not significantly different between survivors and non-survivors were maternal age, primigravida, occupation, membrane ruptured (MR) before admission,

Table 1 Antenatal prognostic indicators

Antenatal factor	Non-survivors n = 56	Survivors n = 167	p-value
Maternal age*	25.5 (7.4)	27.0 (7.8)	0.187
Gestational age*	27.2 (3.7)	29.3 (3.1)	< 0.001
Gestational age ≥ 28 weeks	27 (48.2%)	129 (77.2%)	< 0.001
Primigravida	35 (62.5%)	89 (53.3%)	0.277
Occupation			0.950
- no income	28 (50.0%)	80 (47.9%)	
- agriculture	9 (16.1%)	33 (19.8%)	
- labor force	18 (32.1%)	50 (29.9%)	
- public servant, state enterprise	1 (1.8%)	4 (2.4%)	
MR before admission	11 (19.6%)	48 (28.7%)	0.222
Multifetal pregnancy	6 (10.7%)	25 (15.0%)	0.509
No antenatal care	22 (39.3%)	39 (23.4%)	0.025
Place of antenatal care (n = 162)			0.681
- Lampang hospital	14 (41.2%)	39 (30.5%)	
- community hospital	11 (32.4%)	51 (39.8%)	
- private clinic	7 (20.6%)	26 (20.3%)	
- other	2 (5.9%)	12 (9.4%)	
Referral case	20 (35.7%)	66 (39.5%)	0.638
Maternal hematocrit (n = 209)	32.0 (11.3)	33.2 (8.7)	0.405

*mean (SD)

meconium stained amniotic fluid, mode of delivery, multifetal pregnancy, place of antenatal care, referral case and maternal hematocrit.

In table 3 it shows perinatal factors which were associated with neonatal mortality. Non-survivors had significantly less Apgar score at 1 minute, Apgar score at 5 minutes, body temperature at NICU and birth weight. Median duration of neonatal resuscitation was significantly higher in the non-survival group. However, it did not show significant difference for male infant ratio between groups.

Antenatal and peripartum factors, which were statistically significant, were analyzed with logistic regression model. The aim was to find some predictors which would be shown before delivery and could predict the survival of the fetus. The results are in table

4. The coefficient of 2 significant factors and 1 marginally significant factor were obtained. They were used to formulate an equation to calculate neonatal survival score. A graph of correlation between survival score (X) and predicted chance of survival (Y) was also created as graph 1. Any given survival score would be marked on X axis of the graph to find a chance of survival on Y axis. The equation was Survival score = $(0.2 \times GA) + (-3.6 \times anomaly) + (0.7 \times Dexa) - 5.0$

Discussion

The significant antenatal, peripartum and perinatal factors shown in this study were similar to other studies.⁽¹⁻⁹⁾ Low gestational age, low birth weight, neonatal hypothermia and having congenital anomaly

Table 2 Peripartum prognostic indicators

Peripartum factor	Non-survivors n = 56	Survivors n = 167	p-value
Meconium stained amniotic fluid	5 (8.9%)	11 (6.6%)	0.556
Anomaly	5 (8.9%)	1 (0.6%)	0.004
Mode of delivery			0.270
- vaginal delivery	38 (67.9%)	101 (60.5%)	
- cesarean section	11 (19.6%)	51 (30.5%)	
- vaginal breech delivery	7 (12.5%)	11 (6.6%)	
- vacuum extraction	0 (0.0%)	1 (0.6%)	
- forceps extraction	0 (0.0%)	3 (1.8%)	
Dexamethasone given \geq 1 dose	14 (25.0%)	86 (51.5%)	0.001
Obstetric complications	9 (16.1%)	59 (35.3%)	0.007
Unwanted pregnancy	25 (44.6%)	36 (21.6%)	0.002

*mean (SD)

Table 3 Perinatal prognostic indicators

Perinatal factor	Non-survivors (n = 56 infants)	Survivors (n = 167 infants)	p-value
Male	24 (42.9%)	85 (50.9%)	0.350
Apgar score at 1 minute*	5.2 (2.8)	7.1 (2.2)	< 0.001
Apgar score at 5 minutes*	6.2 (2.7)	8.1 (1.8)	< 0.001
Body temperature at NICU*	35.8 (0.6)	36.3 (0.6)	< 0.001
Birth weight*	941.2 (222.1)	1186.3 (208.4)	< 0.001
Duration of neonatal resuscitation (minute) (n = 191)	25thP 2 Median 5 75thP 10	25thP 1 Median 2 75thP 5	0.001

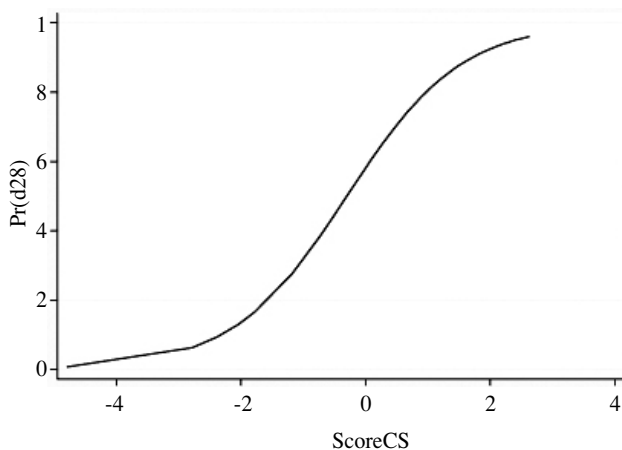
*mean (SD)

Table 4 Result of multivariate analysis for odds of survival

Antenatal factor	Odds ratio	95% confidence interval
Gestational age	1.22	1.07 - 1.38*
Anomaly	0.03	0.00 - 0.28*
No antenatal care	0.45	0.11 - 1.74
Dexamethasone given \geq 1 dose	2.00	0.93 - 4.29**
Obstetric complications	1.73	0.70 - 4.33
Wanted pregnancy	2.80	0.71 - 11.04

*Significant factor; **Marginally significant factor

were all shown to be poor prognostic indicators for survival. High Apgar score at 1 minute, 5 minutes and giving dexamethasone to mother were good prognostic indicators. In this study, mode of delivery did not significantly correlate with the prognosis of VLBW infants as in another study.⁽¹⁰⁾ Nevertheless, survival group had more cesarean section ratio and less vaginal breech delivery. As shown in the other study⁽¹¹⁾, the need of neonatal resuscitation in NICU significantly related with the survival of these infants. It



Graph 1 Correlation between survival score and predicted chance of survival

was shown in this study as well. With median duration of resuscitation at 5 minutes and 75th percentile at 10 minutes, non-survivors significantly had longer duration of resuscitation than the survivors.

In this study, obstetric complications correlated significantly with the survival of the infants. It could be explained that, VLBW infants who were born to mothers with obstetric complications were taken care better than other types of mother e.g. unwanted pregnancy. When pregnant women admitted with obstetric complication and preterm birth was unavoidable, aggressive managements were usually planned to increase fetal survival. These include giving dexamethasone and admission to NICU.

There are factors that rarely mentioned in other studies but significantly correlated with the chance of survival in this study. They are no antenatal care and unwanted pregnancy. Both factors might be confounded with each other. Sixty one cases in both survival and non-survival groups were noted as unwanted pregnancy. This number was nearly equal to the number of pregnant women who had no antenatal care. When obstetric personnel perceived that a pregnant woman was in the unwanted pregnancy group, it could induce both obstetrical and neonatal care to the non-aggressive treatment plan. The result from univariate

analysis showed that there was higher ratio of unwanted pregnancy in the non-survival group.

After multiple logistic regression analysis was done. There were 2 factors that were statistically significant and another one which was marginally significant. They were gestational age, anomaly and giving dexamethasone. These factors had different weight and direction of correlation. Their coefficient values were retrieved to formulate an equation that could help obstetric staff to deal with the chance of survival more objectively. With the equation shown above, one can put in GA in weeks, anomaly and dexamethasone as 0 or 1. After getting the survival score, one can plot it in the graph 1 and predicted chance of survival would be shown. After reviewing literature regarding prognostic indicator of VLBW infant, no report had proposed using these factors in a predictive equation before.

Having this equation and graph posted in labor room of any hospital can help obstetricians in 2 folds. Firstly, they can use the predicted chance of survival to counsel pregnant woman and her relatives. So, they can have more scientific information for decision making. Secondly, if they want to really improve the chance of survival of the unborn child, they could consider doing the ultrasound to identify anomaly or giving dexamethasone to the mother. For these factors were shown to have impact on the chance of survival.

Nevertheless, precautions have to be taken before extrapolating the results of this study. Power calculation of the 3 variables that were not statistically significant in multivariate analysis showed that 2 of them had the power (β) less than 0.8. The power of the factor no antenatal care was 0.6; obstetric complications was 0.2 and wanted pregnancy was 0.8. Another research with a new set of subjects should also be done to show the quality of prediction of the equation. However, the concept of survival prediction in a scoring fashion should be promoted. It could give

both obstetric personnel and patients an objective figure to rely their important decision on.

Conclusion

This study ultimately showed 3 prognostic indicators for survival of VLBW infants. They were gestational age, anomaly and giving dexamethasone. These prognostic indicators were used in a more useful way, as a survival score equation. This should help obstetricians to know better, regarding the prognosis of a VLBW infant.

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บทคัดย่อ ปัจจัยพยากรณ์การรอดชีวิตของทารกแรกเกิดน้ำหนักตัวน้อยมาก

รายิน อโรรา*, วันลิกา แก้วสุริยา**, อินทิรา จงภู**

*กลุ่มงานสูติรีเวชกรรม โรงพยาบาลศูนย์ลำปาง, **งานห้องคลอด กลุ่มการพยาบาล โรงพยาบาลศูนย์ลำปาง
วารสารวิชาการสาธารณสุข 2555; 21:3-9.

เป็นที่ทราบกันดีว่าทารกแรกเกิดน้ำหนักตัวน้อยมาก มีอุบัติการณ์การเจ็บป่วยและการเสียชีวิตสูง แต่เป็นการยากสำหรับสูติแพทย์ในการพยากรณ์โอกาสรอดชีวิตเนื่องจากมีปัจจัยหลายอย่างเกี่ยวข้องกับ การศึกษานี้ พยายามหาปัจจัยที่สามารถพยากรณ์การรอดชีวิตของทารกแรกเกิดน้ำหนักตัวน้อยมาก โดยพัฒนาเป็นสมการ คำนวณเพื่อหาโอกาสรอดชีวิตดังกล่าว การศึกษาเป็นแบบตัดขวางเก็บข้อมูลย้อนหลัง ตั้งแต่ เดือนมกราคม พ.ศ. 2548 ถึง เดือนธันวาคม พ.ศ. 2552 ทารกแรกเกิดมีชีพทุกคนที่คลอดในห้องคลอดโรงพยาบาลศูนย์ลำปาง ได้รับการคัดเลือกเข้าการศึกษา โดยมีกรเก็บปัจจัยของมารดาและทารก วิเคราะห์ข้อมูลทั้งแบบพรรณนาและ แบบอนุมาน ในช่วงระยะเวลาที่ศึกษามีทารกคลอดน้ำหนักตัวน้อยมาก 223 คน ร้อยละ 74.9 สามารถมีชีวิต ได้เกิน 28 วัน จากการวิเคราะห์แบบถดถอยพหุโลจิสติกส์พบว่า มี 3 ปัจจัยที่มีนัยสำคัญพอที่จะนำไปสร้าง สมการหาค่าคะแนนได้ คืออายุครรภ์ ความพิการแต่กำเนิด และการที่แม่ได้รับยาเดกซาเมธาโซน การมีสูตร คำนวณและกราฟทำนายโอกาสรอดชีพของทารกแรกเกิดน้ำหนักตัวน้อยมากนี้ จะทำให้สูติแพทย์มีเครื่องมือ ที่ดีในการให้คำปรึกษาแนะนำแก่สตรีตั้งครรภ์ และญาติ โดยเฉพาะในกรณีที่มีความคลุมเครือในการตัดสินใจ

คำสำคัญ: ทารกแรกเกิดน้ำหนักตัวน้อยมาก, พยากรณ์, การรอดชีวิต