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RESEARCH ARTICLE

Placenta previa, anemia, care in antenatal, employment score: Development of a scoring system to predict low birth weight in underserved area in Indonesia

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ABSTRACT

Background: Early intervention of low birth weight (LBW) should reduce maternal and fetal morbidity. In underserved areas, with inadequacy of health technologies, it was very important to develop a simple scoring system based on the LBW risk factors. **Aims and Objective:** The aim of this study is to develop a scoring system to predict LBW in underserved area. **Materials and Methods:** This case–control study enrolled total of women with a singleton LBW in Padang Sidempuan General Hospital. For every case, the subsequent woman who delivered a baby weighing ≥2500 g acted as control. All data were by Chi-square or Fisher's exact test. Significant variables were taken to be analyzed in backward stepwise binary regression. Then, receiver operating characteristic curve was developed to determine cutoff point and diagnostic value. This was done by SPSS (Statistical Product and Service Solutions, Chicago, IL, USA) 22.0 with 95% confidence interval significant value. **Results:** This study involved 62 LBW and 62 normal birth weight newborns. Among all variables, only four variables were found to be significant, such as employment, antenatal care, history of anemia in pregnancy, and history of placenta previa in pregnancy. The placenta previa, anemia, care in antenatal, employment (PACE) score was obtained as score for employment was +1, antenatal care was −2, history of anemia in pregnancy was +2, and history of placenta previa was +3. The cutoff point was determined as 0, where a positive score will predict fetal with LBW and total score ≤0 (negative) will predict fetal with normal weight. This model had sensitivity of 88.7%, specificity of 66.1%, and area under curve 0.844 ($P < 0.001$). **Conclusion:** Positive total score of PACE could be a promising predictor for LBW in underserved area.

KEY WORDS: Low Birth Weight; Placenta Previa, Anemia, Care in Antenatal, Employment Score; Predictor

INTRODUCTION

Low birth weight is defined as birth weight <2500 g (5.5 pounds). This is based on the World Health Organization epidemiological observations that infants weighing <2500 g are approximately 20 times more likely to die than heavier babies.[1] Low birth weight (LBW) remains a major cause of neonatal morbidity and mortality. As many as 16% of newborns in worldwide to experience LBW with an incidence of 18 million annually. In developing countries, incidence of LBW was two times higher than in developed countries.[2] LBW can cause early life mortality and development of chronic diseases in the elderly.[3]

Pregnancy risk factors could be the important determinant to the development of LBW. These might include maternal age

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<20 or >35 years old,[4] parity >3,[5] employed,[6] antenatal care <4 visits,[7] birth spacing >2 years,[5] and maternal morbidity (anemia, preeclampsia, and placenta previa).[8,9] In Indonesia, Trihardiani (2011) found no effect of maternal height with LBW.[10]

In underserved areas, which were still abundant in developing countries, clinicians should predict LBW as early as possible to reduce the morbidity and mortality of maternal and fetal. In these areas, we could not do the standardized diagnostic test; even many areas did not have ultrasonography device or electricity to operate it.

MATERIALS AND METHODS

This was an analytical, case–control study that conducted at Padang Sidempuan General Hospital from January to November 2015. This study has been approved by the Ethical Committee of University of Sumatera Utara. All LBW neonates born from January to November 2015 were approached to participate in this study. LBW is defined as weight below 2500 g. Birth weight was measured by a calibrated weight scale. Those women with malformed baby, HIV infection, and malignancy were excluded from this study. Others data were taken from medical records or structured interview. These participants were included in the case group. For every case, the subsequent woman who delivered a baby weighing ≥2500 g acted as control. The parameters taken were maternal age, parity, birth spacing, employment, antenatal care, history of anemia, placenta previa, abruptio placenta, and preeclampsia in pregnancy.

Data were analyzed by SPSS (Statistical Product and Service Solutions, Chicago, IL, USA) 22.0 for Windows. Categorical data were expressed as number and continuous data as mean ± standard deviation. The qualitative variables in this study were analyzed by Chi-square or Fisher's exact test. Significant value was taken by 95%, and $P < 0.05$ was considered significant.

Figure 1 shows the Receiver Operating Curve from PACE Score. The area under curve (AUC) obtained was 0.844 with 88.7% and 66.1% as the best sensitivity and specificity, respectively.

All significant variables were taken to be analyzed in backward stepwise binary regression and Hosmer–Lemeshow test. A weighted score was then determined by Exp (B) from the logistic regression. Then, the weighted scores were simplified by their decimals to obtain simpler equation. Receiver operating characteristic curve was then being constructed to prove the diagnostic value of the scoring system. Cutoff point was determined using Youden index, with the best sensitivity and specificity value.

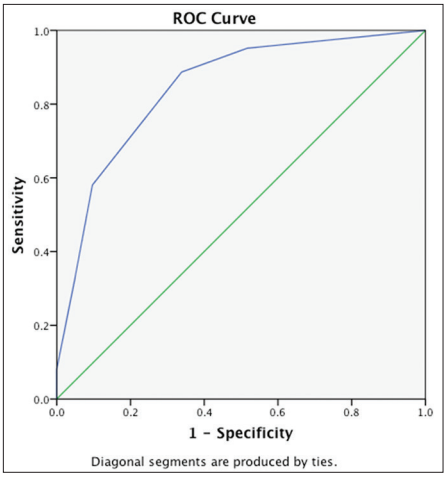

Figure 1: Receiver operating curve

RESULTS

This study involved 62 LBW and 62 normal birth weight newborns. Association between LBW risk factors could be seen in Table 1.

To develop a scoring model using logistic regression (backward stepwise), we included all significant variables. Among all variables, only four variables were found to be significant, such as employment, antenatal care, history of anemia in pregnancy, and history of placenta previa in pregnancy.

In backward stepwise binary regression, all independent variables were found to affect LBW outcome by 43.8% (Nagelkerke R square). All variables, employment, antenatal care, history of anemia in pregnancy, and history of placenta previa, were significant ($P = 0.038$; $P = 0.001$; $P < 0.001$; and $P < 0.001$). In this study, the models to predict LBW were shown below:

y = 0.01+0.766 * Employment −1.747 * Antenatal care +2.127 * Anemia +3.023 * Placenta previa

Based on Hosmer–Lemeshow test, this model was well calibrated with $P = 0.034$, χ^2 10.388. However, we simplified the equation to,

y = 1 * Employment −2 * Antenatal care +2 * Anemia +3 * Placenta previa

The cut-off point was taken by Youden index with the best sensitivity and specificity. We took 0 as the cutoff value, with sensitivity of 88.7% and specificity of 66.1%. Any participant with total score ≤0 (negative) will be said not to have LBW baby in upcoming delivery while participant with total score >0 (positive) will be said to have LBW baby in upcoming delivery. The area under curve (AUC) obtained was 0.844 ($P < 0.001$).

Table 1: Risk factors for low birth weight fetal

Characteristics	Low birth weight (*n*=62)		Normal birth weight (*n*=62)		*P*	OR	95% CI
Maternal age							
20-35 years old	29	46.8	29	46.8	1.000	1.000	0.494-2.025
<20 or >35 years old	33	53.2	33	53.2			
Parity							
<3	39	62.9	39	62.9	1.000	1.000	0.483-2.072
>3	23	37.1	23	37.1			
Birth spacing							
>2 years	30	48.4	39	62.9	0.148	1.809	0.883-3.703
<2 years	32	51.6	23	37.1			
Employment							
Not employed	35	56.5	46	74.2	0.038*	2.218	1.039-4.736
Employed	27	43.5	16	25.8			
Antenatal care							
Complete	39	62.9	20	32.3	0.001*	0.281	0.134-0.352
Uncomplete	23	37.1	42	67.7			
Anemia							
No	39	63.9	59	95.2	<0.001*	11.598	3.259-41.271
Yes	23	37.1	3	4.8			
Placenta previa							
No	45	72.6	61	98.4	<0.001*	23.044	2.957-179.587
Yes	17	27.4	1	1.6			
Abruptio placenta							
No	57	93.4	57	91.9	1.000	0.800	0.204-3.133
Yes	4	6.6	5	8.1			
Preeclampsia							
No	49	79.0	56	90.3	0.081	2.476	0.875-7.010
Yes	13	21.0	6	9.7			

*Significant. OR: Odds ratio, CI: Confidence interval

DISCUSSION

In this study, a scoring model was developed to predict LBW baby in upcoming delivery. The scoring model was named placenta previa, anemia, care in antenatal, employment (PACE) score. From all risk factors of LBW, we found that only four variables, employment, antenatal care, history of anemia in pregnancy, and history of placenta previa in pregnancy, were significant, even after logistic regression. The weighted score for employment was +1, antenatal care was -2, history of anemia in pregnancy was +2, and history of placenta previa was +3. The constant 0.01 was omitted due to the low yield value. As seen in Table 2, we could be designed a scoring system.

All scores were summed. The maximal value was 6 and the minimal value was −2. The cutoff point was determined as 0, where a positive score will predict fetal with LBW and total score ≤0 (negative) will predict fetal with normal weight. This model had sensitivity of 88.7%, specificity of 66.1%, and AUC 0.844 ($P < 0.001$).

Antenatal care was the most interesting factor to be analyzed in this study. Isiugo-Abanihe and Oke (2011) found that low antenatal care visits were more associated with having LBW babies. About 27% of women with <6 antenatal care visits had LBW babies relative to 15% of those who had more than six ANC visits ($\chi^2 = 23.6$; $P < 0.05$).[11] Siza et al. (2008) also showed pregnant women who did not attend antenatal care service had about one-third (28.57%) of their neonates in the LBW group as compared with 13.78% of those who attended.[3] Mumbare et al. (2012) also emphasize inadequate ANC (odds ratio [OR] - 4.98, 95% confidence interval [CI] - 2.64-9.39) as one of the most significant risk factors for LBW along with maternal weight and height.[12] However, da Fonseca et al. (2014) found no association between adequacy of ANC and LBW.[13]

Although antenatal care is one of the most effective ways of reducing maternal and perinatal mortality and morbidity, this study found contradictory results in LBW pregnancy. Complete antenatal care increased the risk of having a LBW baby. The author assumed that mother who was felt that she

Table 2: PACE score

Risk factor	Category	Score
Employment	Employed	1
	Not employed	0
Antenatal care	Complete (≥4)	−2
	Uncomplete (<4)	0
History of anemia in pregnancy	Yes	2
	No	0
History of placenta previa in pregnancy	Yes	3
	No	0

had high-risk pregnancy of threatened pregnancy would be more likely to control her pregnancy compared to the normal one. Triped et al. (2012) also showed antenatal care <4 visits was the significant protective factor of LBW in Maharat Nakhon Ratchasima Hospital. However, this would be bias results for LBW resulted from uncomplete antenatal care.[14]

Dooley and Prause (2010) showed that adverse employment change was associated with decreased intrauterine growth and weight gain due to poor nutrition of risky health behaviors by the mother. Employed mothers were also associated with more activities and less intake of nutrition. Stress in working could also contributed to have LBW babies.[6] Baum (2004), in the other hand, did not show any indirect effect of employment during pregnancy with LBW.[15]

Anemia and placenta previa were both associated with blood loss during pregnancy.[16] Elhassan et al. (2010) found that maternal anemia (OR = 9.0, 95% CI = 3.4-23.8; $P < 0.001$) was the main risk factor for LBW.[8] Lone et al. in a multivariate analysis of their study population showed that the risk of LBW babies in the anemic population was 1.9 times higher (95% CI = 1.0-3.4).[17] Kollman et al. (2013) found that in 328 patients with placenta previa and 35.6% would deliver LBW babies.[9]

Limitations in this study are the case–control design and the risk of recall bias. The strength of this study is the representative samples in underserved area with high incidence of LBW babies. The author hoped for the improvement of this PACE score.

CONCLUSION

Positive total score of PACE could be a promising predictor for LBW in underserved area.

REFERENCES

1. World Health Organization. Low Birth Weight: Country, Regional, and Global Estimates. Available from: http://www.apps.who.int/iris/bitstream/10665/43184/1/9280638327.pdf/. [Last accessed 2016 June 12].
2. Beddek F, Demmouche A, Mai AH, Ghani A, Benali A. Low birth weight in Sidi Bel Abbes region (West of Algeria): Retrospective study of 10008 deliveries. J Blood Disorders Transfus. 2014;5:1-4.
3. Siza JE. Risk factors associated with low birth weight of neonates among pregnant women attending a referral hospital in Northern Tanzania. Tanzania J Health Res. 2008;10(1):1-8.
4. Feresu SA, Harlow SD, Woelk GB. Risk factors for prematurity at Harare Maternity Hospital, Zimbabwe. Int J Epidemiol. 2004;33(6):1194-201.
5. Kazaura MR, Kidanto HL, Massawe SN. Levels, trends and risk for early neonatal mortality at Muhimbili National Hospital, Tanzania, 1999-2005. East Afr J Public Health. 2006;3:10-3.
6. Dooley D, Prause J. Birth weight and mothers' adverse employment change. J Health Soc Behav. 2005;46:141-55.
7. Chumnijarakij T, Nuchprayoon T, Chitinand S, Onthuam Y, Quamkul N, Dusitsin N, et al. Maternal risk factors for low birth weight newborn in Thailand. J Med Assoc Thai. 1992;75:445-52.
8. Elhassan EM, Abbaker AO, Haggaz AD, Abubaker MS, Adam I. Anaemia and low birth weight in Medani, Hospital Sudan. BMC Res Notes. 2010;3:181.
9. Kollman M, Gaulhofer J, Lang U, Klaritsch P. Placenta previa: Incidence, risk factors, and outcome. J Matern Neonatal Med. 2013;34(1):1-4.
10. Trihardiani I. Risk factors for LBW in Puskesmas Singkawang. Available from: https://www.core.ac.uk/download/files/379/11731574.pdf. [Last accessed 2016 June 28].
11. Isiugo-Abanihe UC, Oke OA. Maternal and environmental factors influencing infant birth weight in Ibadan, Nigeria. Afr Popul Stud. 2011;25(2):250-66.
12. Mumbare SS, Maindarkar G, Darade R, Yenge S, Tolani MK, Patole K. Maternal risk factors associated with term low birth weight neonates: A matched-pair case control study. Indian Pediatr. 2012;49(1):25-8.
13. da Fonseca CR, Strufaldi MW, de Carvalho LR, Puccini RF. Adequacy of antenatal care and its relationship with low birth weight in Botucatu, São Paulo, Brazil: A case-control study. BMC Pregnancy Childbirth. 2014;14:255.
14. Triped O, Arj-Ong S, Aswakul O. Maternal risk factors of low birth weight at Maharat Nakhon Ratchasima hospital. Thai J Obstet Gynecol. 2012;20:12-20.
15. Baum CL. The effects of employment while pregnant on health at birth. Univ Middle Tennesse State. 2004. Available from: http://www.mtsu.edu/econfin/docs/working-papers/Ruhm%20VII.pdf. [Last accessed 2016 June 30].
16. Jang DG, We JS, Shin JU, Choi YJ, Ko HS, Park IY, et al. Maternal outcomes according to placental position in placental previa. Int J Med Sci. 2011;8(5):439-44.
17. Lone FW, Qureshi RN, Emanual F. Maternal anaemia and its impact on perinatal outcome in a tertiary care hospital in Pakistan. Trop Med Int Health. 2004;9(4):486-9.

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