Journal of Chitwan Medical College 2024;14(47):79-83
Available online at: www.jcmc.com.np

ORIGINAL RESEARCH ARTICLE

CLINICAL PROFILE AND OUTCOME OF INFANT OF DIABETIC MOTHER IN A TERTIARY CARE CENTRE

Madhu Shah[1,*], Saurav Poudel[1], Bivusha Parajuli[1], Muskan Yadav[2]
[1]Department of Pediatrics and Neonatology, Nobel Medical College Teaching Hospital, Biratnagar-4, Morang, Nepal
[2]Department of Pediatrics and Neonatology, BP Koirala Institute of Health Sciences, Dharan-18, Sunsari, Nepal

Received: 19 Jan, 2024
Accepted: 19 Mar, 2024
Published: 30 Mar, 2024

Key words: Birth defects; Hypoglycemia; Infants; Maternal diabetes.

***Correspondence to:** Madhu Shah, Department of Pediatrics and Neonatology, Nobel Medical College Teaching Hospital, Biratnagar-4, Morang, Nepal.
Email: shahmadhu365@gmail.com

DOI:https://doi.org/10.54530/jcmc.1470

Citation

Shah M, Poudel S, Parajuli B, Yadav M. Clinical profile and outcome of infant of diabetic mother in a tertiary care centre. Journal of Chitwan Medical College.2021;11(38):79-83.

Peer Reviewed

ABSTRACT

Background: Diabetes poses risks during gestation, with 80% attributed to gestational diabetes mellitus. It leads to complications from pre-conception to long-term. Infants born to diabetic mothers face various challenges, from spontaneous abortions to congenital anomalies. The study aimed to assess the clinical profile and outcome of the infants born to diabetic mothers at Nobel Medical College.

Methods: This was a prospective observational study carried out in the Department of Pediatrics, Nobel Medical College Teaching Hospital, Biratnagar from September 2022 to August 2023. Consecutive sampling was done to include infants born at our institute to diabetic mothers. Variables like demographic and obstetric profile of the mothers, sex of the newborn, mode of delivery, birth weight, complications, and outcome were collected. Descriptive data analysis was done using SPSS Version 29.

Results: A total of 79 infants born to diabetic mothers at our institute were studied. Of them, 18 (21.52%) were born to prediabetics and 61 (78.44%) to mothers with gestational diabetes. There were 42 (53.16%) male and 37 (46.84%) female. Twenty-six (32.91%) were born preterm, and LSCS was required in 41 (51.89%) cases. Sixteen (20.25%) were large for gestational age. Fifty-five (69.62%) developed one or multiple complications while 44 (55.7%) required NICU admission. The most common was hypoglycemia, followed by respiratory complications seen in 19 (24.05%) and 16 (20.25%) respectively.

Conclusions: Diabetes during pregnancy is associated with various complications for the infant. A timely diagnosis and proper glycemic control of the mother are of great importance in the reduction of complications.

INTRODUCTION

Diabetes is one of the most common medical complications during pregnancy which affects about 7% of all pregnancies.[1] Diabetes in pregnancy is divided into pre-gestational or gestational diabetes mellitus, where 80% of this is caused by gestational diabetes mellitus (GDM).[2] GDM is characterized by carbohydrate intolerance with the onset or first recognition during pregnancy.[3] Infants born to diabetic mothers are always at a disadvantage with complications affecting since the pre-conception period, extending to fetal, neonatal, and even long-term complications being very common.[4] Pre-gestational diabetes or overt diabetes can cause spontaneous abortions and congenital anomalies in the first trimester. Increased fetal growth, neonatal hypoglycemia, jaundice, and polycythemia may occur during the second and third trimesters.[2] In such newborns and throughout infancy various complications such as large for gestational age, various growth abnormalities, metabolic and electrolyte disturbances, respiratory ailments, hematological disturbances, hyperbilirubinemia, congenital defects, neurological deficits, and a wide spectrum of musculoskeletal abnormalities and movement disorders are commonly observed. Prematurity is also common in such newborns.[5]

The proper identification and timely interventions reduce the occurrence of such complications in the infants of diabetic mothers. It is particularly necessary in resource-limited areas such as Nepal, where mitigation of risk factors is sometimes the only economically viable option. This study sought to contribute to the prevalent literature by helping identify complications associated with infants of diabetic mothers.

This study aimed to assess the clinical profile and outcome of the infants of diabetic mothers delivered at our institute.

METHODS

This was a prospective observational study done at the Department of Pediatrics, Nobel Medical College Teaching Hospital, Biratnagar, Nepal by collecting data prospectively from 2022 September to 2023 August. Ethical approval was taken from the Institutional Review Committee (Ref:655/2022). A written informed consent was signed by the legal guardians

of all the included infants, after a complete explanation of the nature and type of study.

All infants born to diabetic mothers with gestational and pre-gestational diabetes (type 1 and 2) at Nobel Medical College Teaching Hospital, were included in the study. Infants born to diabetic mothers but referred from other centers were excluded from the study.

Variables like age of mother, gestational age in weeks, BMI, period of gestation at which GDM was detected, parity and any history of pregnancy loss, sex of newborn, mode of delivery, APGAR score, birth weight, complications seen in neonates, interventions during resuscitation and outcome were studied during the study.

According to a study done by Kumari et. al, 20.6% of newborns of mothers with GDM developed hypoglycemia.[6] At 5% absolute precision and 95% Confidence Interval, the required sample size would be as follows.

Sample size (n) = $(Z^2pq)/(d^2)$

$n = (1.96^2 \times 20.6 \times 79.4)/ (5 \times 5)$

$n = 251.33 \approx 251$

Based on previous medical records of Nobel Medical College, the number of cases of GDM has been reported at 100 in 2021. So, N=100

Corrected sample size = n/(1+n/N) = 71.5
Adding 10% of non-responders
Final sample size = 71.5 + 10% of 71.5 = 78.65 ≈ 79.

A consecutive sampling technique was used for the data collection. The data were entered in a Microsoft Excel Sheet and descriptive analysis was done with IBM SPSS Statistics for Windows, version 29.

RESULTS

Over one year, 114 babies were born to diabetic mothers at our center. A consecutive sampling technique was used to include 79 children for the current study. Among the included cases, 18 (21.52%) were born to prediabetic mothers and 61 (78.48%) were born to mothers with gestational diabetes mellitus. The mean age of the mothers was 29.14 ± 4.31 years. Other demographic and clinical profiles of the mothers are tabulated (Table 1).

Among the 79 infants, 50 (63.3%) were male and 29 (36.7%) female. There were 2 twin pregnancies (5.07%) and the remaining 75 (94.93%) were singleton pregnancies. The most common method of delivery was lower segment cesarean section (LSCS) in 41 (51.89%), followed by spontaneous vaginal delivery (SVD) in 35 (44.3%), and assisted vaginal delivery by vacuum in 3 (3.81%) cases. The mean gestational age was 37.24 ± 2.64 weeks of gestation, with 26 (32.91%) being preterm, 6 (7.59%) post-term and the remaining 47 (59.5%) being term births. Other birth parameters are tabulated (Table 2).

Table 1: Demographic profile of the mothers n=79

Variables	n (%)
Mean age of the mother (years)	29.14 ± 4.31* years
Diabetic status	
Prediabetic	18 (21.52%)
Gestational Diabetes Mellitus	61 (78.84%)
Mean BMI (kg/m²)	27.23 ± 1.62*
Mean Gestational Age of GDM identification (weeks)	24.21 ± 4.53*
Gravidity	
Primigravida	37(46.84%)
Multigravida	42 (53.16%)
History of pregnancy loss	
No pregnancy loss	51 (64.56%)
1 pregnancy loss	19 (24.05%)
2 pregnancy loss	7 (8.86%)
More than 2 pregnancy losses	2 (2.53%)
Diabetic control methods	
Diabetic diet	57 (72.15%)
Oral hypoglycemic	6 (7.6%)
Insulin	2 (2.53%)
None	14 (17.72%)

**Mean ± Standard deviation*

Table 2: Profile of the infants of diabetic mothers n=79

Variables	n (%)
Sex of the newborn	
Male	42 (53.16%)
Female	37 (46.84%)
Type of gestation	
Singelton	74 (94.93%)
Twins	4 [2 twin pregnancy] (5.07%)
Gestational age	
Preterm (<37 weeks)	26 (32.91%)
Term (37-42 weeks)	47 (59.5%)
Post-term (>42 weeks)	6 (7.59%)
Mean weeks of gestation	37.24 ± 2.64 weeks*
Method of delivery	
Spontaneous vaginal delivery	35 (44.3%)
LSCS	41 (51.89%)
Assisted vaginal delivery	3 (3.81%)
Mean birth weight	3.2 ± 0.92 kg*
Small for age	6 (7.6%)
Appropriate for age	57 (72.15%)
Large for age	16 (20.25%)
Mean APGAR score at 1 min	7.29 ± 1.45*
Mean APGAR score at 5 min	8.33 ± 1.52*

**Mean ± Standard deviation*

The majority of the children required routine oro-nasal suctioning or no active resuscitative procedure, done for 65 (82.28%) neonates, while bag and mask ventilation was required for 9 (11.39%) while intubation was required for 5 (6.33%). After the birth, 44 (55.7%) babies required NICU admission.

The most common cause of admission was hypoglycemia seen in 17 (38.63%) cases followed by respiratory distress seen in 13 (29.55%) cases. The mean NICU stay of the admitted children was 5.54 ± 3.42 days. After admission, 32 (72.72%) were discharged after recovery, 3 (6.82%) needed a referral to other higher centers, 6 (13.64%) were taken against medical advice, and 3 (6.82%) mortality were observed (Table 3).

Table 3: Immediate complications of newborns n=79

Variables	n (%)
Resuscitation requirement	
Oronasal suction/none	65 (82.28%)
Bag and mask	9 (11.39%)
Intubation	5 (6.33%)
Need of NICU	
Yes	44 (55.7%)
No	35 (44.3%)
Indication of NICU admission (n=44)	
Hypoglycemia	17 (38.63%)
Respiratory distress	13 (29.55%)
Neonatal hyperbilirubinemia	4 (9.09%)
Cardiovascular causes	3 (6.82%)
Sepsis	3 (6.82%)
Other	4 (9.09%)
Outcome after admission (n = 44)	
Discharge after normal recovery	32 (72.72%)
Referral	3 (6.82%)
LAMA	6 (13.64%)
Mortality	3 (6.81%)
Birth asphyxia	1 (2.27%)
Complex cardiac disease	1 (2.27%)
Sepsis	1 (2.27%)

One or multiple complications were observed in 55 (69.62%) infants with 44 (55.7%) requiring NICU admission at the time of birth. During the study period, the complications observed in the infants of diabetic mothers were mostly hypoglycemia, seen in 19 (24.05%), which required NICU admission for 17 of the 19 cases. It was followed by respiratory complications such as transient tachypnea of the newborn (TTN), meconium aspiration syndrome (MAS), respiratory distress syndrome (RDS), and birth asphyxia were observed in 6 (7.59%), 4(5.06%), and 3 (3.81%) and 3 (3.81%) newborns respectively, where all cases of MAS, RDS, birth asphyxia and 3 cases of TTN had to be admitted to NICU for further care. The complications observed are tabulated (Table 4).

Table 4: Complications of infants n=79

Complications of infants of diabetic mothers	n (%)
Hypoglycemia	19 (24.05%)
Respiratory complications	
Meconium aspiration syndrome	4 (5.06%)
Respiratory distress syndrome	3 (3.81%)
Birth asphyxia	3 (3.81%)
Transient tachypnea of newborn	6 (7.59%)
Neonatal hyperbilirubinemia	8 (10.12%)
Biliary atresia	2 (2.53%)
Cardiovascular complications	
ASD	3 (3.81%)
VSD	3 (3.81%)
PDA	2 (2.53%)
Complex cyanotic heart disease	1 (1.26%)
Sepsis	
Without shock	4 (5.06%)
With shock	2 (2.53%)
Facial nerve palsy	1 (1.26%)
Erb's palsy	1 (1.26%)

DISCUSSION

During the study period, 79 infants of diabetic mothers were studied. Among the 79 infants, 18 (21.52%) were born to prediabetic mothers and 61 (78.48%) were born to mothers with GDM. This higher proportion of GDM is similar to the findings of Shirazi et al., and Anjum et al. where the proportion was 84% and 86% respectively.[2,7] In contrast, Das et al. found the proportion of GDM to be at 57.33%.[8] The increased incidence of GDM in areas of higher ambient temperature was observed by Preston et al.[9] The warmer tropical climate of Biratnagar in contrast to temperate climate of Dharan, might have increased the proportion of GDM in our study in comparison to Das et al.

The mean age of the mothers was 29.14 ± 4.31 years. The finding is similar to the study done by Bhatta et al. in Eastern Nepal, where they found the mean age to be 27.7±4.6 years.[10] Similar findings have been reported by Dhillon et al. (28.88 ± 3.11 years), Anjum et al. (28 years), and Kumari et al. (28.87±4.33 years).[2,6,11] However, studies outside of South Asia such as by Al-Khalifah et al. found the mean age to be 33.5±5.7 years.[12] Different marriage and childbearing practices heavily influence the mean age of mothers.

During our study, there were 42 (53.16%) multigravida mothers while the remaining 37 (46.84%) were primigravida. There was no significant difference in the occurrence of GDM with multiple gestations. This finding is similar to the finding of Bhatta et al., where the percentage of multigravida mothers was 56%.[10]

The occurrence of GDM or pre-gestational diabetes is almost similar among primigravida and multigravida however, the rate is slightly higher in multigravida. The increased incidence of diabetes with gestation is a similar finding evidenced also by Seshiah et al. and Das et al. in their respective studies.[8,13] The slightly higher proportion of diabetes in the multigravida can also be attributed to the generally advanced age and more lifetime exposure to risk factors.[13,14]

The occurrence of intrauterine fetal loss or abortions among diabetic mothers, was found to be prevalent in at least 28 (35.44%) of the total cases. The majority had one abortion or fetal loss, seen in 19 (24.05%) cases. The increased occurrence of fetal loss among diabetic mothers has been reported by other authors as well. In the meta-analysis done by Wang et al., they included 31 studies with 311,900 subjects and compared

GDM to non-GDM mothers where they found the prevalence of lost parity was higher in mothers with GDM and thus concluded that the occurrence of fetal loss is significant for the occurrence of GDM.[15] Similar findings were identified by Zhao et al. and Vaajala et al.[16,17]

The majority of the mothers, 57 (72.15%) were on a diabetic diet. This is a common diabetic control method recommended by several guidelines for the control of diabetes in pregnancy.[18] Few required pharmacotherapy, for their uncontrolled diabetes. None were prescribed teratogenic hypoglycemics. Similar findings of diabetes control have been found in the studies of Bhatta et al. and Kumari et al.[6,10]

In our study, out of 79 babies, there were 42 (53.16%) males and 37 (46.84%) females. A similar result of almost similar sex ratio has been identified by other authors as well such as in the meta-analysis of Wang et al., where the male and female percentage was 52.2% and 47.8% respectively.[19] However, there is recent evidence that women bearing male fetuses are at a higher risk of developing GDM than those bearing female fetuses.[19,20]

During our study, the neonates were born mostly at term with 45 (56.97%) term births. The occurrence of term births was followed by preterm. This is a common finding, also seen in the studies of Dhillon, Bhatta, and Anjum.[2,10,11] The average birth weight of the neonates born during our study period was 3.2 ± 0.92 kg. The majority 65 (82.28%) were appropriate for gestational age, while 8 (10.12%) were large for gestational age. The increased rate of large babies is a well-documented and evidenced occurrence in the infants of diabetic mothers.[21] Similar rates of birth of large babies were found in the studies in different parts of the world such as by Bhatta in Nepal, Yokomichi in Japan, and Lendoye in Africa.[10,22,23]

During our study, a majority of the newborns were born via Lower Section Cesarean Section (LSCS). There is an increased rate of LSCS deliveries in cases of diabetic mothers, which is well documented in various studies.[24,25] This increased LSCS rate can be attributed to increased macrosomia observed in fetuses of diabetic mothers.[25]

Fetal macrosomia is defined as the birth weight of more than 4000 grams.[21] In our study, we observed macrosomia in 16 (20.25%) babies. The normal occurrence of macrosomia in normal women is around 12% and the risk of macrosomia increases to 15-45% in newborns of women with gestational diabetes mellitus.[21] This increased occurrence of macrosomia was prevalent in our study as well. Various studies have had different results regarding the birth weight of newborns of diabetic mothers. Dhillon et al. and Bhatta et al. had significantly lower rates of macrosomia at 2% and 6% respectively, while Kumari et al. had a macrosomia incidence of 28.2%.[6,10,11]

Diabetes in the mother can cause hypoglycemia in the newborn, which predisposes the neonate to several neurological and developmental problems in the future.[26] In our study, the development of hypoglycemia was the most common complication seen and also the leading indication for NICU admission following birth. Diabetes in the mother is also associated with an increased risk of neonatal respiratory morbidity more than what can be accounted for the prematurity of the newborn.[27] In our study, we observed 16 (20.25%) cases of respiratory morbidity among the newborns. Respiratory morbidity was the second most prevalent complication and the second most common cause of NICU admission during our study. Birth asphyxia was observed in 3 (3.81%) newborns, which was managed in the NICU. Two of the three neonates recovered fully and were neurologically normal up to the time duration of our study, while we observed one mortality due to birth asphyxia. Other causes of mortality were due to sepsis progressing to septic shock and a case of complex cardiac disease.

During the follow-up period, we observed one or multiple complications in a total of 55 (69.62%) with 44 (55.7%) of them requiring NICU admission. There is an elevated complication rate seen in infants of diabetic mothers, this is also evidenced by other studies such as by Anjum et al., Kumari et al., and Dhillon et al.[2,6,11] A longer follow-up is necessary to determine the real rate of long-term complications seen in infants of diabetic mothers.

Our study was a single-center descriptive study, with a limited study pool. To further know the impact of the problem on society a multi-institutional study is recommended.

CONCLUSION

In our study, diabetes caused several complications in the infants which were most often seen as hypoglycemia and respiratory complications. Most infants have a normal recovery but undesirable outcomes are also frequent. Proper diagnosis and control of diabetes in pregnancy is advised to mitigate such problems.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:

1. Murphy A, Janzen C. Diabetes Mellitus & Pregnancy. DeCherney AH, Nathan L, Laufer N, Roman AS, eds. CURRENT Diagnosis & Treatment: Obstetrics & Gynecology, 12e. New York, NY: McGraw-Hill Education; 2019. [LINK]
2. Anjum SK, H. T. Y. A study of neonatal outcome in infants born to diabetic mothers at a tertiary care hospital. Int J Contemp Pediatrics. 2018;5(2):489-92. [DOI]
3. Balaji V, Balaji M, Anjalakshi C, Cynthia A, Arthi T, Seshiah V. Diagnosis of gestational diabetes mellitus in Asian-Indian women. Indian J Endocrinol Metab. 2011;15(3):187-90. [DOI]
4. Nold JL, Georgieff MK. Infants of diabetic mothers. Pediatr Clin North Am. 2004;51(3):619-37, viii. [DOI]
5. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR,

Trimble ER, Chaovarindr U, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358(19):1991-2002. [LINK]

6. Kumari R, Dalal V, Kachhawa G, Sahoo I, Khadgawat R, Mahey R, et al. Maternal and Perinatal Outcome in Gestational Diabetes Mellitus in a Tertiary Care Hospital in Delhi. Indian J Endocrinol Metab. 2018;22(1):116-20. [DOI]

7. Shirazi H, Riaz S, Mahmood I, Gul S. Neonatal Outcome of Diabetic Pregnancy. Ann Pak Inst Med Sci. 2010; 6(2):107-12. [LINK]

8. Das A. Maternal and perinatal outcomes in diabetic pregnancies at BPKIHS. Int J Reprod Contracept Obstet Gynecol. 2017;6(6):2262-6. [DOI]

9. Preston E V., Eberle C, Brown FM, James-Todd T. Climate factors and gestational diabetes mellitus risk – a systematic review. Environmental Health. 2020 Dec 9;19(1):112. [DOI]

10. Bhatta M, Aneja V. Morbidities and its Immediate Outcome in Newborns Born Through Mothers with Gestational Diabetes Mellitus. Nep J Health Sci. 2022;2(1):72-9. [DOI]

11. Dhillon GK, Kushvanth KN, Dhillon HS, Sasidharan S, Singh V. A prospective case-control study to compare the clinical outcomes and metabolic profile in neonates born to diabetic mothers in a tertiary care armed forces hospital, India. J Nepal Paediatr Soc. 2021;41(2):127-33. [DOI]

12. Al-Khalifah R, Al-Subaihin A, Al-Kharfi T, Al-Alaiyan S, AlFaleh K. Neonatal short-term outcomes of gestational diabetes mellitus in Saudi mothers: A retrospective cohort study. J Clin Neonatol. 2012;1(1):29. [DOI]

13. Seshiah V, Balaji V, Balaji MS, Sanjeevi CB, Green A. Gestational diabetes mellitus in India. J Assoc Physicians India. 2004 Sep;52:707-11. [LINK]

14. Li G, Wei T, Ni W, Zhang A, Zhang J, Xing Y, et al. Incidence and Risk Factors of Gestational Diabetes Mellitus: A Prospective Cohort Study in Qingdao, China. Front Endocrinol (Lausanne). 2020;11:636. [DOI]

15. Wang H, Guo X, Song Q, Su W, Meng M, Sun C, et al. Association between the history of abortion and gestational diabetes mellitus: A meta-analysis. Endocrine. 2023;80(1):29-39. [DOI]

16. Zhao Y, Zhao Y, Fan K, Jin L. Association of History of Spontaneous or Induced Abortion With Subsequent Risk of Gestational Diabetes. JAMA Netw Open. 2022;5(3):e220944. [DOI]

17. Vaajala M, Liukkonen R, Ponkilainen V, Kekki M, Mattila VM, Kuitunen I. Previous induced abortion or miscarriage is associated with increased odds for gestational diabetes: a nationwide register-based cohort study in Finland. Acta Diabetol. 2023;60(6):845-9. [DOI]

18. Zhang M, Zhou Y, Zhong J, Wang K, Ding Y, Li L. Current guidelines on the management of gestational diabetes mellitus: a content analysis and appraisal. BMC Pregnancy Childbirth. 2019 Dec 13;19(1):200. [DOI]

19. Wang WJ, Zhang L, Zhang DL, Zheng T, He H, Fang F, et al. Exploring Fetal Sex Dimorphism in the Risk Factors of Gestational Diabetes Mellitus-A Prospective Cohort Study. Front Endocrinol (Lausanne). 2019;10:848 [DOI]

20. Retnakaran R, Kramer CK, Ye C, Kew S, Hanley AJ, Connelly PW, et al. Fetal Sex and Maternal Risk of Gestational Diabetes Mellitus: The Impact of Having a Boy. Diabetes Care. 2015;38(5):844-51. [DOI]

21. KC K, Shakya S, Zhang H. Gestational diabetes mellitus and macrosomia: a literature review. Ann Nutr Metab. 2015;66 Suppl 2:14-20. [DOI]

22. Lendoye E, Ngoungou EB, Komba OM, Ollomo B, N'negue-Mezui MA, Bekale S, et al. Prevalence and factors associated to gestational diabetes mellitus among pregnant women in Libreville: a cross-sectional study. Pan Afr Med J. 2022;41:129. [DOI]

23. Yokomichi H, Mochizuki M, Shinohara R, Kushima M, Horiuchi S, Kojima R, et al. Gestational age, birth weight, and perinatal complications in mothers with diabetes and impaired glucose tolerance: Japan Environment and Children's Study cohort. PLoS One. 2022;17(6):e0269610. [DOI]

24. Boriboonhirunsarn D, Waiyanikorn R. Emergency cesarean section rate between women with gestational diabetes and normal pregnant women. Taiwan J Obstet Gynecol. 2016;55(1):64-7. [DOI]

25. Gorgal R, Gonçalves E, Barros M, Namora G, Magalhães Â, Rodrigues T, et al. Gestational diabetes mellitus: A risk factor for non-elective cesarean section. J Obstet Gynaecol Res. 2012;38(1):154-9. [DOI]

26. Bamehrez M. Hypoglycemia and associated comorbidities among newborns of mothers with diabetes in an academic tertiary care center. Front Pediatr. 2023;11:1267248. [DOI]

27. Kawakita T, Bowers K, Hazrati S, Zhang C, Grewal J, Chen Z, et al. Increased Neonatal Respiratory Morbidity Associated With Gestational and Pregestational Diabetes: a retrospective study. Am J Perinatol. 2017;34(11):1160-8. [DOI]