

Evaluation of Placental Pathology in Term Low Birth Weight Babies

Paul Sanchita¹⁾, Borah Kumar Binoy²⁾, Gogoi Amilee³⁾

¹⁾Post graduate student 3rd year department of pathology

²⁾Assistant Professor department of obstetrics and gynaecology

³⁾Demonstrator department of pathology, Jorhat medical college and hospital, Jorhat, Assam, India

ABSTRACT

Background: Low birth weight is the single most risk factor for perinatal mortality and placenta due to its importance in fetomaternal circulation plays an important role in pregnancy outcome. The present study aims to evaluate the pathological changes in the placenta in term (38-42 weeks) low birth weight babies.

Subjects and Method: It is case control study done in Jorhat Medical College and Hospital during the period from June 2020 to May 2021. Consecutive sampling was done. 100 placentae were subjected to detailed gross and histological examination. Sixty placentae were from full term babies with birth weight less than 2,500g (LBW). Forty placentae from full term babies with birth weight more than 2,500g were included in control group. Weight of the baby was taken within the 1st hour of birth and APGAR score was noted. Gross and microscopic examination of placentae was done. Statistical correlation was carried out between them by using Student t-test with SPSS software, P value <0.05 was taken as statistically significant.

Results: Weight of term LBW cases placentae were lighter compared to control, diameter of the placentae in term LBW cases placenta was lesser compared to control (p= 0.045). The syncytial knot count, cytotrophoblastic cell proliferation and perivillous fibrin deposition was more in placentae of term LBW cases compared to controls (p= 0.045).

Conclusion: Placental pathology among term LBW cases was high in comparison to control group. The present study shows the importance of histopathological examination of the placenta to know the exact mechanism of placental dysfunction in term LBW cases.

Keywords: low birth weight, perivillous fibrin deposition, syncytial knot count, cytotrophoblastic cell proliferation.

Correspondence:

Dr Sanchita Paul, house no.129, karimganj, Assam. Pin: 788710. Phone: 9678801472, Email: sanchitavortex@gmail.com.

Cite this as:

Azizah AM, Dewi YLR, Murti B (2022). Meta-Analysis: Breastfeeding and Its Correlation with Stunting. J Matern Child Health. 07(05): 572-579. <https://doi.org/10.26911/thejmch.2022.07.05.08>.



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BACKGROUND

The human placenta is a unique organ that is attached to the uterus on one side and connected to the fetus through the umbilical cord on the other side. It is a vital structure for fetomaternal circulation and is related to the growth and development of the fetus

by providing the fetus with nourishment, oxygen and protection by its excretory, immunological and endocrine functions (Magesh et al., 2019) Low birth weight (LBW) is the single most significant factor for perinatal mortality and about 2/3 deaths occurs in infants with birth weight less

than 2,500 g (Park, 2011). Due to its important role in determining pregnancy outcome, meticulous examination of the placenta for getting information about the cause of low birth weight has been recommended (Royal college of obstetricians and gynaecologists, Green top guidelines, 2010. American College of obstetricians and gynaecologists, ACOG practice bulletin, 2009). It is the record of anatomical condition, intra-uterine and intrapartum events of gestation (Benirshke et al., 1981) In South Asia, the prevalence of low birth weight decreased dramatically from 32.3% in 2000 to 26.4% in 2015 (Lancet Global health, 2019) In India in 2017, the prevalence of low birth weight was 21.4% and that of Assam was 20.8% (The global burden of disease study 1990-2017) Infant mortality rate is 20 times greater for LBW babies than the rest of the babies (Park, 2017). According to a survey report in 2014, 18.6% of babies born in India are LBW as compared to 4 % in developed countries (Public health foundation of India, 2015).

Causes of LBW is divided into maternal, fetal, placental and unknown causes. The most important pathophysiology for LBW is reduced availability of nutrients in mother or reduced transfer of nutrients from the placenta to the fetus (Dutta, 2004) Antenatal health care given to pregnant women thus plays a great influence on the rates of perinatal death and morbidity (Park, 2011).

Thus, researchers for a long time are curious in finding the association of placental pathological findings and its relationship with LBW. Factors like deficiencies in nutrition, anemia, alcohol intake, genetic causes and multigravida are considered risk factors in full term low birth weight babies (Magesh et al., 2019).

Information regarding placental pathology is crucial for early neonatal care,

risk assessment for the infant's neurological outcome and further reproductive planning for the family (Robert, 2008). The relationship between placental size and risk of term low birth weight is very well recognized. Placental volume may help in predicting birth weight and final outcome of the pregnancy. Fetal complications can occur in as much as 20% of pregnancies due to placental abnormalities. During pregnancy, measurement of placental volume using width, height and thickness of the placenta can be of utmost help in early clinical intervention (Azpura et al., 2010).

Due to its role in determining pregnancy outcome, meticulous examination of the placenta for getting information about the cause of low birth weight has been recommended by the Royal College of Obstetricians and Gynecologists (RCOG), American College of Obstetricians and Gynecologists (ACOG) and Perinatal Society of Australia and New Zealand (PSANZ) (Royal college of obstetricians and gynaecologists, Green top guidelines, 2010; American College of obstetricians and gynaecologists; ACOG practice bulletin, 2009).

Thus, the study of histopathology of placenta in term low birth weight is more intriguing, fascinating, challenging and the present study is an attempt to discuss various pathological changes in placenta in term LBW cases. The aimed to study to evaluate the pathological changes in the placenta in term (38-42 weeks) low birth weight babies.

SUBJECTS AND METHOD

1. Study Design

It is a case control study conducted in Jorhat Medical College and Hospital, Jorhat for a period of one year from June 2020 to May 2021.

2. Population and Sample

Total 100 placenta were collected that com-

prised of 60 cases which delivered term LBW baby and 40 placentas of normal cases as control. The cases and controls were selected by consecutive sampling technique.

3. Study Variables

Dependent variables were weight, diameter, shape of placenta, syncytial knot count, cytotrophoblastic cell proliferation. Independent variables were age of the mother, duration of pregnancy.

4. Operational Definition Variable

Term baby was baby delivered between 38weeks-42weeks.

Term low birth weight baby was term baby but birth weight less than 2500g.

5. Instruments of the Study

Surgical scalpel, rotary microtome, hot air oven, water bath.

6. Data Analysis

It was done by entering the data in MS Excel sheet. P value was calculated to know whether the difference between two groups are statistically significant or not. It was calculated using student t-test with the help of SPSS software.

6. Research Ethics

Ethical clearance was obtained from the Institutional Ethics Committee (H) of Jorhat Medical College and Hospital prior to the commencement of the study.

RESULTS

Gross and histological features of 100 placentae were studied. Sixty placentae were from full term babies with birth weight less than 2,500g (LBW). Fourty placentae from full term babies with birth weight more than 2500g were included in control group.

GROSS EXAMINATION



Figure 1. Gross picture of fetal side and maternal side of placenta

Table 1. Distribution of placental weight

Weight (in g)	Controls (N=40)	Cases (term LBW)	
		Term with IUGR (N= 40)	Term without IUGR (N= 20)
Up to 300	0	4 (10%)	2 (10%)
301-400	3 (7.5%)	13 (32.5%)	11 (55%)
401-500	30 (75%)	19 (47.5%)	7 (35%)
>500	7(17.5%)	4 (10%)	0

Table-2. Distribution of placental diameter

Diameter in cm	Controls (N=40)	Cases (term LBW)	
		Term with IUGR (N= 40)	Term without IUGR (N= 20)
15-17	5 (12.5%)	22 (55%)	5 (25%)
18-20	24 (60%)	16 (40%)	15 (75%)
>20	11 (27.5%)	2 (5%)	0

MICROSCOPIC EXAMINATION

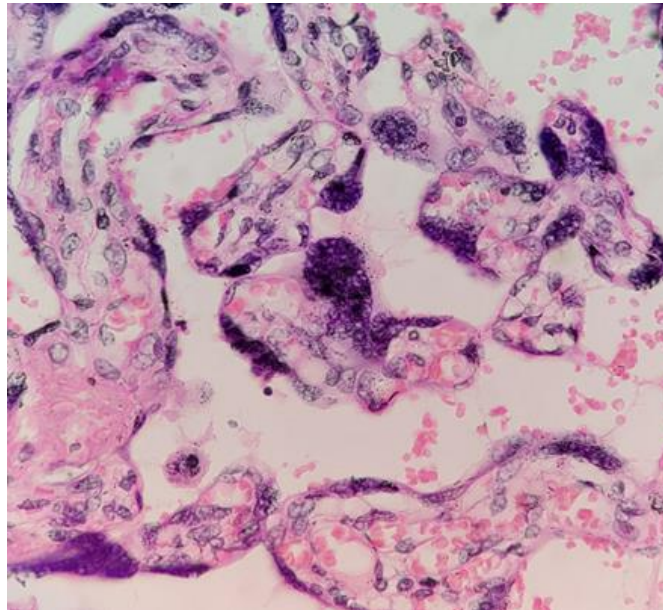


Figure 2. Shows syncytial knot in high power field

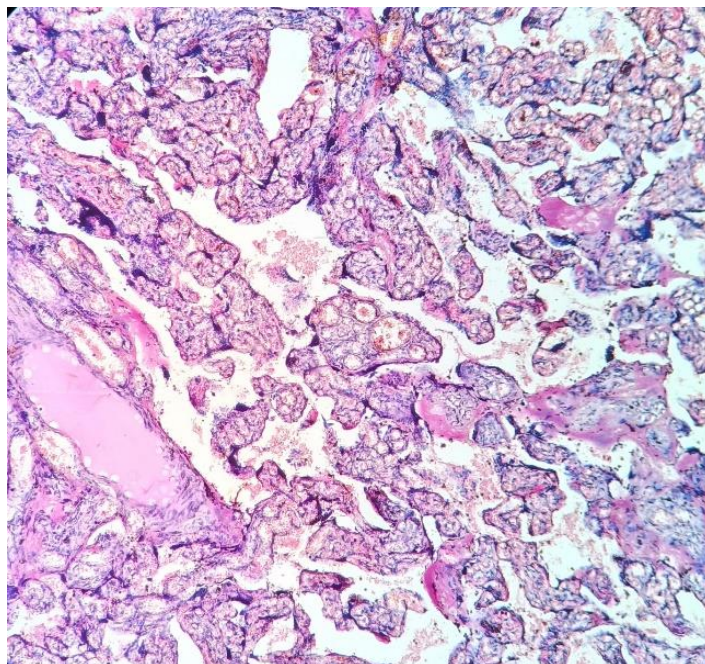


Figure 3. Shows perivillous fibrin deposit in low power field

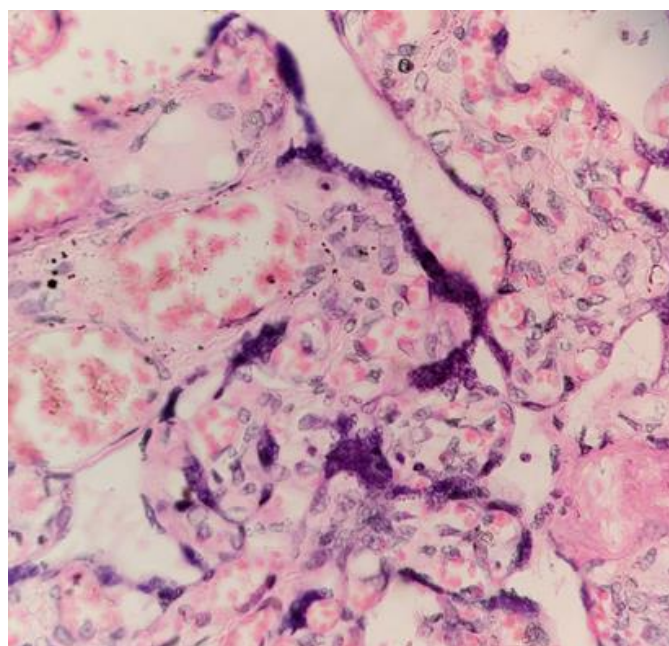


Figure 3. Shows cytotrophoblastic cell proliferation in high power field.

Syncytial knot count, cytotrophoblastic cell proliferation and perivillous fibrin deposition was more in placentae of term LBW

cases compared to controls ($p < 0.05$), results are shown in tables 3,4,5 respectively.

Table 3. Distribution of syncytial knot count

Syncytial knot count/100 villi	Controls (N=40)	Cases (term LBW)	
		Term with IUGR (N=40)	Term without IUGR (N=20)
≤30%	33 (82.5%)	5 (12.5%)	14 (70%)
31-60%	7 (17.5%)	25 (62.5%)	5 (25%)
>60%	0	10 (25%)	1 (5%)

Table 4. Distribution of cytotrophoblastic cell proliferation

Cytotrophoblastic cell proliferation per 100 villi	Controls (N=40)	Cases (Term LBW)	
		Term with IUGR (N=40)	Term without IUGR (N=20)
<20%	37 (92.5%)	11 (27.5%)	12 (60%)
20-40%	3 (7.5%)	20 (50%)	6 (30%)
>40%	0	9 (22.5%)	2 (10%)

Table 5. Distribution of perivillous fibrin deposit

Perivillous fibrin deposit/LPF	Controls (N=40)	Cases (Term LBW)	
		Term with IUGR (N=40)	Term without IUGR (N=20)
Absent	35 (87.5%)	24 (60%)	16 (80%)
Present	5 (12.5%)	16 (40%)	4 (20%)

DISCUSSION

For the optimal fetal growth placenta is essential as it provides nutrients to the fetus

(Brett et al., 2014). Any pathology in placenta can contribute to reduced uteroplacental blood flow thereby resulting in intrauterine

fetal growth retardation (Jadhav et al., 2018). The placenta, mother and fetus form a triad and proper functioning of each of them is necessary for a favorable outcome. The present study aims at examining the placenta at gross and microscopic level associated with term low birth weight infants and compare it with normal placenta.

Normal placental weight at term ranges from 400-600 gm. Factors like age, duration of pregnancy, size of the baby, socioeconomic status, any associated disease are the various factors on which the weight of the placenta depends. In this study it was observed that the placental weight of the term LBW cases is lesser than normal term placental weight. The mean placental weight in controls were found to be 464.59 gm whereas in term LBW, mean placental weight was 370.14. Thus, significant reduction in placental weight was found in term LBW cases as compared to controls ($p < 0.001$).

In the study of Nigam et al. (2014) the mean placental weight in LBW cases was 266.94 gm and in the study by Suneeta et al. (2017) it was found to be 380gm. Study of Oliveira et al., 2002; Paiva de Alvarez et al., 1986 also reported the same findings. The mean placental weight of LBW cases in all these studies was found to be less than 400g. In the present study the mean placental diameter of term LBW cases were found to be Mean= 17.67; SD= 1.56 cm whereas the mean placental diameter of the control group was Mean= 18.54; SD= 1.22 cm. Thus, in the present study placental diameter is found to be decreased in term LBW cases as compared to control and is found to be statistically significant ($p < 0.05$). Study conducted by Veena A et al also observed mean placental diameter in LBW group lesser than the control group.

In the present study syncytial knots was present in more than 30/100 villi in 7 (17.5%) of the controls, while count for the

same was 25 (62.5%) in case of Term with IUGR cases and 5 (25%) in case of term without IUGR. None of the controls showed syncytial knots more than 60% whereas in Term with IUGR cases it was found in 10 (25%) and in term without IUGR it was present in 1 (5%) case. Study conducted by Veena et al. (2014); Mardi et al. (2003); Hemlata et al. (2014) observed increased syncytial count in LBW cases. Increased syncytial knot is an indicator of excessive chorionic villous capillary proliferation induced by reduced blood flow due to several maternal or fetal pathologic conditions that finally leads to term LBW baby. In the present study it was observed that in controls the number of cytotrophoblastic cell proliferation less than 20% was in 37 (92.5%) cases, 20-40% cytotrophoblastic cell proliferation in 3 (7.5%) cases and none of the normal cases showed more than 40% of cytotrophoblastic cell proliferation. In term with IUGR, 11 (27.5%) of cases had less than 20%, 20 (50%) cases had 20-40% and 9 (22.5%) cases shows more than 40% of cytotrophoblastic cell proliferation. In term without IUGR cases 12 (60%) of cases had less than 20%, 6 (30%) cases had 20-40% and 2 (10%) cases shows more than 40% of cytotrophoblastic cell proliferation. Studies by Mardi et al., 2003; Nigam et al (2014) observed increase cytotrophoblastic cell proliferation in placenta of LBW cases. According to Genset the cytotrophoblastic cell proliferation and excessive syncytial knot formation occurs in response to reduction of perfusion of the placenta which in turn lead to LBW baby.

In the present study it was found that out of 40 controls only 5 (12.5%) cases showed perivillous fibrin deposit and in case of Term with IUGR out of 40 cases 16 (40%) cases and in term without IUGR cases out of 20 cases 4 (20%) cases showed perivillous fibrin deposition. Oliveira et al

found significant increase in perivillous fibrin deposition in LBW cases. Katzman et al found massive perivillous fibrin deposition IUGR cases.

The present study showed that compared to control, weight and diameter of the placenta of term LBW cases were significantly decreased. Microscopically, increased villous lesions were seen in the placenta of term LBW cases as compared to control. These lesions were increased syncytial knots formation, cytotrophoblastic cell proliferation, perivillous fibrin deposit. The present study thus be devised to help in contributing to more effective treatment in prevention of term LBW in future.

AUTHOR CONTRIBUTION

In conceptualization, data collection and analysis, typing and editing.

FUNDING AND SPONSORSHIP

None.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENT

All the learned faculty members of Pathology and Obstetrics and Gynaecology Department of Jorhat Medical College and Hospital without whose help and expertise this manuscript would not have been possible. We thank our families and friends for their forbearance and support throughout.

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