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# Clinicopathological Examination Of Placenta In Low Birth Weight Newborns Versus Normal Birth Weight Newborns- A Prospective Study In A Tertiary Healthcare Centre

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## ABSTRACT

***INTRODUCTION****: The antenatal health-care given to pregnant women influences the rates of perinatal death and morbidity. Amongst the different causes of perinatal mortality, low birth weight (LBW) is the single most significant factor. Placenta is a record of prenatal experience of an infant as it undergoes changes continuously throughout the gestation to support the prenatal life. Therefore, placenta from all the LBW babies should be examined routinely to find out the likely cause.*

***OBJECTIVES:*** *To compare clinicopathological features of placenta of LBW newborns and of normal birth weight newborns.*

***METHODS****: This was a case control prospective study. Forty placentae of newborns with LBW were cases and 40 placenta of normal birth weight newborns were controls. Antenatal and delivery details were collected. Gross and microscopic examination of placenta was done.*

***RESULTS:*** *Maternal age, BMI, parity and period of gestation (POG) were tabulated. The lesions observed were surface disruption, fibrosis, infarction, calcification, necrosis of vessels, hyalization of villi and chorioamnitis.*

***DISCUSSION****: Placental pathology is encountered often in LBW babies and can indicate an underlying pathology. Maternal age and BMI along with placental weight and POG were statistically significant. The cases showed infarction in 30%, surface disruption in 12.5%, calcification in 25%, necrosed vessels in*

*35%, & fibrosis in 40% cases, which were statistically significant.*

***CONCLUSION:*** *The study shows that LBW infants had considerably more placental pathology than the control group. Hence, all LBW newborns' placentas should be examined regularly to evaluate the underlying placental pathology.*

***Keywords:*** *Placenta, Low Birth Weight (LBW), Calcification, Fibrosis, Infarction*

**Introduction and need for the study:**

The antenatal health-care given to pregnant women has great influence on the rates of perinatal death and morbidity. Amongst the different causes of perinatal mortality, low birth weight (LBW) is the single most significant factor. [1] Irrespective of period of gestation, birth weight <2.5 kg is defined as LBW by international consensus. About 2/3 deaths among infants is among infants with less than 2500 g birth weight. [2, 3]. Those born before 37 weeks of gestation are preterm where as those born at term with birth weight < $10^{th}$ centile are small for gestational age (SGA) [4]. Those SGA fetuses have clinical growth restriction and are termed a intrauterine growth restriction (IUGR). [5] Fetal growth is largely determined by the availability of nutrients to the fetus. The fetus is at the end of a supply line that ensures delivery of nutrients from the maternal/uterine circulation to the fetus through the placenta. Placental function is pivotal to materno-fetal nutrient and metabolite transfer. [6] Maternal factors contributing to LBW are anemia, nutritional deficiencies, genetic factor, congenital/ acquired heart disease, narcotic addiction, alcoholism. Fetal factors contributing to LBW are genetic factor, chronic infection, and multiple pregnancies [7]. Premature aging of the placenta is thought to be responsible for poor fetal outcome in LBW babies, in cases not associated with any maternal or fetal disorders.[8] Placenta depicts the most accurate record of prenatal experience of an infant. It undergoes different changes in weight, volume, structure, shape and function continuously throughout the gestation to support the prenatal life. Careful examination of placenta can reveal many facts that may either directly or indirectly explain the past event that potentially determine the outcome of pregnancy. [9] We conducted this study to evaluate the clinical features and study gross and histological features of placenta in LBW newborns

**Objective:**

To compare clinicopathological features of placenta of LBW newborns and of normal birth weight newborns.

**Methodology:** This was a case control prospective study done at a tertiary healthcare centre MIMS Mandya, conducted over a period of 2 months.

Inclusion criteria: Control group: Placentae from full term vaginally delivered babies, weighing more than 2500 g

Cases: Placentae of all newborns with birth weight less than 2500 g.

Exclusion criteria: Placentae of intrauterine death

Multiple pregnancy cases

The following clinical parameters are recorded:

Parity of the mother, maternal age, maternal weight, height, body mass index, period of gestation, and mode of delivery were collected. The birth weight was taken as weight taken in $1^{st}$ hour after birth and APGAR

score was collected from the records.

Examination of placentae:

All the specimen were immediately immersed in 10% Neutral Buffered Formalin for fixation following which they were transferred to the Dept of Pathology.

Gross examination: Weight, dimensions, membranes, surfaces, discoloration, umbilical cord attachment, number of vessels, number of knots

Microscopic examination: calcification, placental infarction, fibrinoid necrosis of vessels, stromal fibrosis, hyalinization of villi and presence of chorioamnitis.

**Statistics**

Statistical correlation of was done by using SPSS 22 version. Chi-square test with or without Yate's correction was used as and when required. Independent Samples Test wqas also used. $P < 0.05$ was taken as critical level of significance.

**RESULTS:**

The study included 40 cases and 40 controls. The mean age of the mothers in the cases group was 27.22 years whereas the mean age was 27.68 years among the control group. Using the Independent samples test, it was found that higher maternal age, weight and BMI are significant in cases with LBW babies. The mean weight of fetus in cases group was 1.86 kgs and average placental weight was 414.98 grams whereas among control group, the mean fetal weight was 2.6 kgs and weight of placenta was 450.26 grams. The p value is 0.016022, which is statistically significant. Among cases, LBW babies were born to 72.5% of nullipara and 27.5% of primipara women whereas in the controls group, 47.5% women were nullipara. This is statistically significant with p value 0.0129. The period of gestation is directly implicated in birth weight of the fetus and is statistically significant with p value being 0.048479. The mode of delivery was equivocal in both groups with 21 cases through vaginal birth, and thus, was not statistically significant.

On comparison of APGAR score in both groups, the Chi square showed the p value to be 0.060. This indicates that although there appears to be an association between the two, it is not statistically significant.

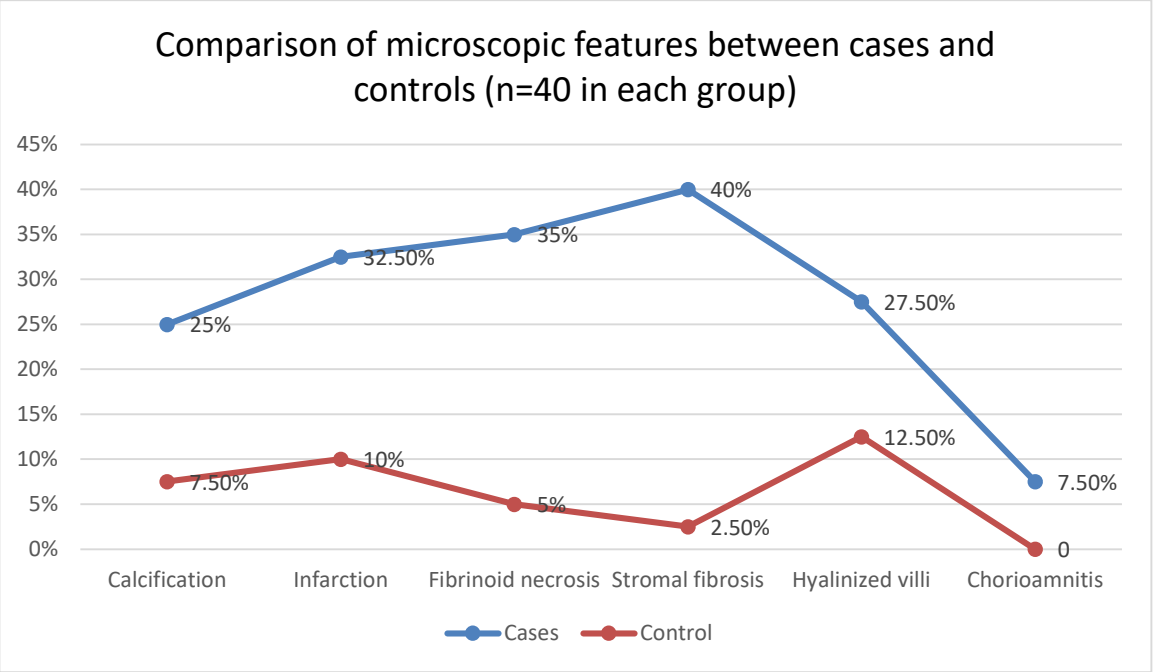
Table 1: Gross placental features

| **Features** | | **Cases** | **Control** | **P Value** |
|---|---|---|---|---|
| Attachment of cord | Central | 27 | 34 | 0.0001 |
| | Non-central | 13 | 6 | |
| Number of vessels in cord | | 3 (40) | 3 (40) | -- |
| Placental surfaces | | Disrupted (5) | Intact (40) | 0.020905 |
| Fibrosis | | Present (16) | Present (2) | 0.00041 |

| | | | |
|---|---|---|---|
| Discoloration | Present (12) | Present (1) | 0.000812. |
| Knots | Present (5) | Present (4) | 0.723674 |
| Calcification | Present (9) | Present (7) | 0.575 |
| Infarction | Present (12) | Present (7) | 0.188923 |

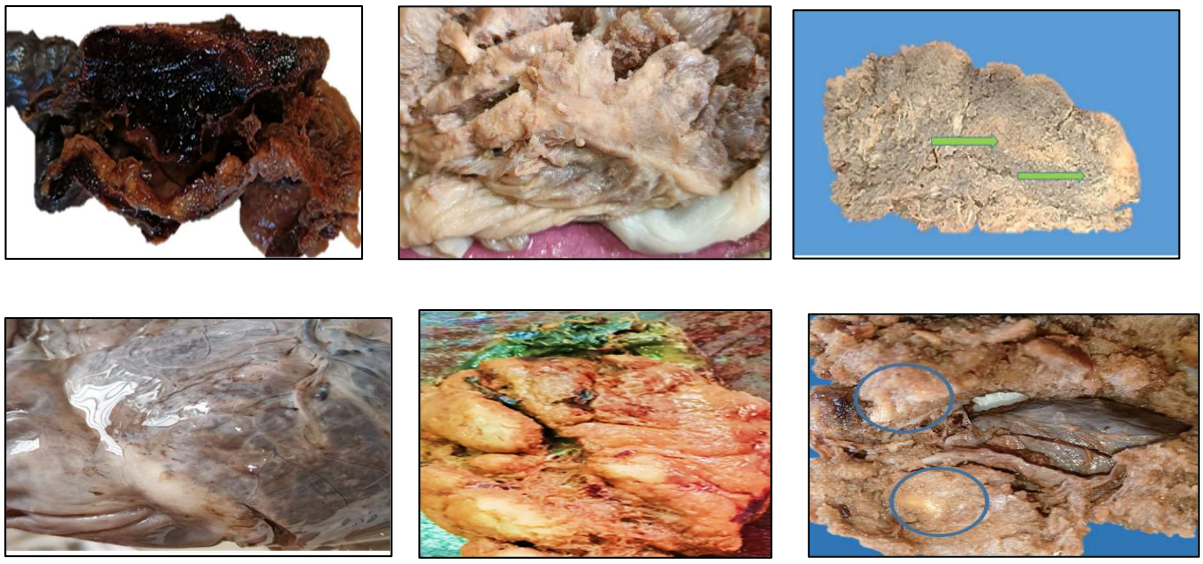
Table 2: Microscopic placental features

| **Features** | **Cases** | **Control** | **P Value** |
|---|---|---|---|
| Calcification | Present (10) | Present (3) | 0.033875 |
| Placental Infarction | Present (13) | Present (4) | 0.188923 |
| Fibrinoid necrosis of vessels | Present (14) | Present (2) | 0.000796 |
| Stromal fibrosis (Intervillous fibrin deposition) | Present (16) | Present (1) | 0.000041 |
| Hyalinization of villi | Present (11) | Present (5) | 0.095 |
| Chorioamnitis | Present (3) | Absent | 0.77479 |



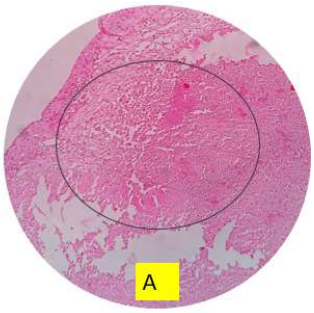

No cysts or tumors were observed in the received specimen.

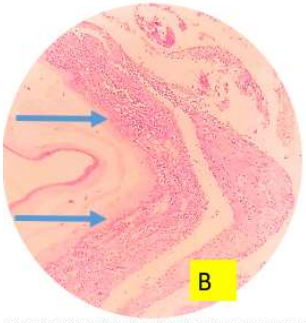
Figure 1:



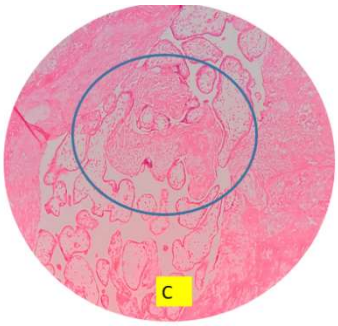
*A: Cut surface of placenta shows haemorrhage*
*B, C: Cut surface of placenta with chalky white nodules*
*D: Pocket of pus seen on gross examination*
*E Meconium discoloration*
*F: Irregular diffuse areas of infarction*

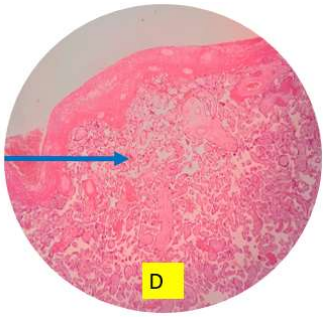
Microscopy:



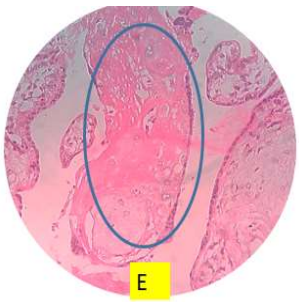



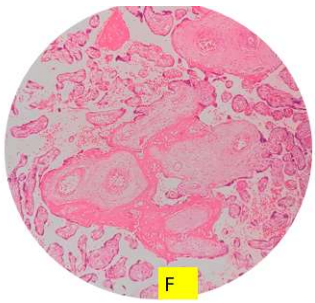

*A and B show pockets of mixed inflammatory infiltrate within the membranes along with areas of fibrinoid necrosis beneath the membrane*

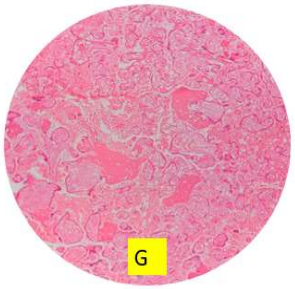


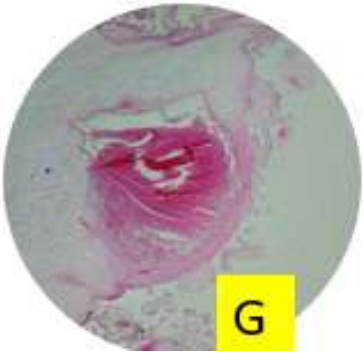

*C and D show subchorionic infarction along with hyalinised villi.*



*E, F and G show hyalinization and fibrinoid necrosis of the villi. There in increased stromal deposition in surrounding the villi.*




*H shows calcification.*

**DISCUSSION:**

Intrauterine growth restriction (IUGR) refers to a condition where a fetus is smaller than expected for the number of weeks of pregnancy. It is often a result of various factors that interfere with the circulation and efficiency of the placenta, fetal development, or maternal health and nutrition.

IUGR can be a normal fetal response to conditions of nutritional or oxygen deprivation. Therefore, the primary concern isn't the IUGR itself but rather the ongoing risks of malnutrition or hypoxia (lack of oxygen), which can have significant implications for the health and development of the fetus. When the placenta doesn't function optimally, it can lead to restricted blood flow or nutrient and oxygen deprivation, contributing to conditions like IUGR. Proper prenatal monitoring is essential to detect any placental insufficiency early on, ensuring appropriate intervention to protect both mother and baby. Proper medical monitoring and intervention are crucial to manage these risks and ensure the well-being of both the mother and the fetus.

The mean age of the mothers in the cases group was 27.22 years whereas the mean age was 27.68 years among the control group. The results were similar to Nigam et al[1], Nkwabong et al[9] and Nechal Kaur[15].
The period of gestation is directly implicated in birth weight of the fetus and is statistically significant with p value being 0.048479. Similar observations were made by Panti et al[17].
The average placental weight was 414.98 grams among cases whereas among the control group, the average weight of placenta was 450.26 grams. Similar observations with reduced placental weight in cases of LBW newborns was observed by Khajuria R et al[10] and Samaddar, *et al*[18]. Among cases, 72.5% of mothers were nullipara whereas in the study by Deveguru A et al[19], they found 31.2% cases of LBW babies in nullipara women. Kaur S et al[20] also found similar observations.

Gross Features:
In this study, eccentric attachment of umbilical cord was significantly more in cases than controls. Similar observations were made by Sharma M[11], Nigam et al[1] and Kotgirwar et al[14], and Nechal Kaur et al[15].

In the present study, placental surfaces were disrupted in 12.5% of cases and was discoloured in 30% of cases, similar to Nechal Kaur et al[15] and Nigam et al[1].
Infarction was seen in 30% cases and 17.5% of controls in the present study. This observation is slightly lower than studies like Nigam et al[1], Nechal Kaur et al[15]. Kleebkaow et al[16] observed that the prevalence of placental infraction in LBW infants was 30.4%.

Microscopic features:
In the present study, infarction was seen in 32.5% of cases and 10% of control. Nigam et al[1] found 16% of cases had infarction, Chaithra R Jadhav et al[7] found 64% of cases, Nechal Kaur et al[15] found 43% of cases and 18% of controls had infarction.
Calcification was 25% of cases and 7.5% of controls in the present study. Chaithra R Jadhav et al[7] found 32% of cases had calcification whereas Nigam et al[1], Nechal Kaur et al[15] and Nkwabong et al[9] found higher percentage of cases had calcification.
The present study showed 35% of cases and 5% of control patients showed fibrinoid necrosis around the villi. Nigam et al[1] found 66.67%, Chaithra R Jadhav et al[7] 40%, Sharma M et al[11] 55.8%, and Kotgirwar et al[14] found 46.7% of cases had fibrinoid necrosis.
Fibrosis of villi was seen in 40% of cases in the current study, whereas Nigam et al[1] found 75%, Chaithra R Jadhav et al[7] found 48%, Sharma M et al[11] 50% and Nechal Kaur et al[15] found 30% of cases had similar findings.
Chorioamnitis was seen in 7.5% of cases in the current study. Nechal Kaur et al[15] found similar findings with 19% cases showing chorioamnitis. Few other studies reported higher number of cases.

**CONCLUSION**:
The study shows that low birth weight (LBW) infants had considerably more placental pathology than a control group. This analysis is important because it offers more precise insights into the reasons of LBW. According to the results, prolonged ischemia and related secondary alterations probably lead to inadequate perfusion, which exacerbates LBW. As such, it is advised that all LBW newborns' placentas be examined in order to detect any potential diseases.

**LIMITATIONS**:
The study's small sample size raises the possibility that it is not representative of the general population. Furthermore, it's possible that the diversity of environmental, socioeconomic, and genetic influences has been underestimated. Particularly in some areas, tertiary care facilities might not have enough money for thorough research, skilled pathologists, or cutting-edge diagnostic equipment. Referral bias may arise because tertiary care facilities frequently manage situations that are more severe and complex. It's possible that the sample overrepresents cases of LBW that are more severe than normal cases found in the general community. It's possible that the conclusions drawn from one tertiary care facility won't apply to primary care or rural locations, where the patient base and medical infrastructure can be very different. Recognizing these constraints is necessary for better research.

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