The Impact of Iron Deficiency Anemia on Histomorphological Features of Placenta and the New Born Infants

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Abstract

Iron deficiency anemia during pregnancy is mutual hematological disorder that happens in pregnancy, it affects maternal blood, leading to hypoxia, which cause changes in the structure of the placenta. Aim of study to explore the changes occurs both in gross morphology and in histology of the placenta in anemic mothers. Methods: A fifty placentas were taken from mothers (full term) delivered at hospital constituted the material for the present study. Full term placenta was collected with case history and investigated after delivery of fetus. Two cm pieces were removed from both anemic and normal group of placenta fixed in 10% formalin and used for processing and staining. The microscopic study revealed histomorphological abnormalities as increased capillaries per villas, thickening of capillary basement membrane, cytotrophoblastic basement membrane, cytotrophoblastic proliferation, syncytial knots and fibrosis. All these changes occurred maintaining sufficient efficiency of placenta, to fulfill demand of oxygen in the fetus.

Key words: anemia, histology, placenta, pregnancy.

Introduction

Anaemia in pregnancy is still a recognized obstetric risk in the tropics. Placenta is the only organ to develop in adulthood and is the only one with a defined end date [1]. The structure of placenta has a strong relation with pregnancy length. It undergoes continuous change in weight structure, shape and function throughout gestation in order to support prenatal life [2].

Hemoglobin concentration cut-offs to define anemia recommended by WHO are 11g/dl at any gestation age disregarding the physiological changes occurring during pregnancy [3]. Fetal growth and well-being depend on the structural and functional component of the placenta [4].

Material and Methods

This is cross-sectional hospital base study. A study having both descriptive and analytical components was carried out to explore the gross and histomorphological features of both anaemic and non-anaemic.

Tenty-five placentas with it's cords of non-anaemic mothers and twenty five placentas with it's cords of non-anaemic mothers were selected from Gynecology and Obstetrics Department of (Al-Hilla Teaching hospital-Iraq). Routine investigations were done and mode of delivery noted along with foetal outcome.

The placentae taken soon after the delivery were cleaned keeping one centimeter long umbilical cord. The weight, volume, shape and number of cotyledon of each placenta were noted. After the gross examination, tissue of the size 2 cm was taken and processed for histological observations. Histomorphological changes in placenta were noted down in both the groups.

Sample size: One fifty (50) full term freshly delivered placentas

- Take a verbal consents of the mothers
- Questionnaire form including (Age of mother, duration of pregnancy, history of anaemia, tonic drug……etc)
- Determination of the type of anaemia
- Collection of placenta after normal deliveries and caesarean sections
- Observation of the perinatal outcome

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• Morphological and histological of the study samples
• Reported the data
• Analysis of obtained data

Results

Morphological parameter of placentae with it’s cords studied and fetal outcome are shown in Table 1, 2, and 3 respectively.

Table 1: Morphological features of placenta in anemic and non-anemic mothers

<table>
<thead>
<tr>
<th>Features</th>
<th>Anemic (n= 25)</th>
<th>Non-anemic (n=25)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean placental weight(gm)</td>
<td>450±21</td>
<td>582±48.2</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean of cotyledons per placenta (n)</td>
<td>16.16</td>
<td>18.80</td>
<td>0.08</td>
</tr>
<tr>
<td>Mean thickness of placenta (in cm)</td>
<td>2.9±0.13</td>
<td>2.95±0.44</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean diameter of placenta (in cm)</td>
<td>14.01±0.01</td>
<td>15.51±0.60</td>
<td>≥ 0.1</td>
</tr>
</tbody>
</table>

Table 2: Gross observation of Umbilical cord in anemic and non-anemic mothers

<table>
<thead>
<tr>
<th>Observation</th>
<th>Anemic</th>
<th>Non-anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion site of umbilical cord (n)</td>
<td>Centric</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Eccentric</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Marginal</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Velementous</td>
<td>3</td>
</tr>
<tr>
<td>Cord length (n)</td>
<td>&lt;50</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>51-70</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>&gt;70</td>
<td>0</td>
</tr>
<tr>
<td>Cord Thrombosis</td>
<td>present</td>
<td>Absent</td>
</tr>
</tbody>
</table>

Table 3: The Correlation of anemia in pregnancy outcome

<table>
<thead>
<tr>
<th>Parameters type</th>
<th>anemic</th>
<th>Non-anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight (Kg)</td>
<td>2.9±0.3</td>
<td>3.4±0.89</td>
</tr>
<tr>
<td>Preterm –birth (n)</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Apgar-Score(n)</td>
<td>≤ 7</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>&gt; 7</td>
<td>17</td>
</tr>
<tr>
<td>Gestational age(n)</td>
<td>&gt;37 wk</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>37-40 wk</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>40-42 wk</td>
<td>3</td>
</tr>
</tbody>
</table>

Fig. 1(a-d): (a) Cross morphology of the foetal surface of placenta.. (b) shows umbilical cord with blood clots. (c) Fetal surface shows marginal insertion. (d) abnormal neonat

Fibrin deposits within the villi (intravillous fibrin deposition) and between the villi(perivillous/intervillous fibrin deposition) were noted to be increased in these placentas as compared to non-anaemic group were marked in the subchorionic areas, the entrapped villi were sclerosed, lacked syncytial lining and capillaries were either reduced in number or absent. Basal plates were noted to have fibrinoid deposits, presence of increased number of x-cells which are extravillous large cytotrophoblasts. Are as of infarction were found to be extensive, describe by villous crowding and increased number of hypovascular.
Fig. 1(a-b-c): (a) Show cytotrophoblastic proliferation with perivillous fibrin deposition, (b) showing increased number of syncytial knots and dilated capillary per villous (c) showing the fibrin deposition around congestion capillary

Fig. 2(a-c): Fig (a) perivillous fibrin deposits showing deteriorated trophoblastic lining, reduced number of capillaries and fibrosis, (b) fibrin deposition replaced tunica intima and increase syncytial knots, thickening of basement membrane of villous capillaries

Discussion

Placental weight and thickness has been taken as an indicator of placental function. The recent study found that mean placental weight in the maternal anemia group was less than that of control group. Dhall (1994) observed that the weight of placenta reduced in the anaemic group but the difference was statistical insignificant [5]. Recent study revealed the thickness of placenta in normal group more than non-anaemic group agreement with (Begum 2009). The recent study revealed decreased number of cotyledons of placenta may be result of hypoxic conditions caused by maternal anaemia. This result of study agreement with Mongia et al [6].

Another study by Begum et al observed a significant difference in diameter among different group of anaemia [7]. Fetal well-being depend much on normal function and structure of the umbilical cord. Morphology of the u.c should be important aspects to be considered in understanding feto-maternal functional relationship and related clinical conditions. Marginal insertion of umbilical cord associated with growth retardation of embryo and preterm birth and that may be regarde to faluse implantation of blastocyst of uterine endometrium (Baergen et al 2001). Our study revealed that the umbilical cord length mostly was less than 50 cm.

This study revealed the present of thrombosis in mostly umbilical cord of anaemic group but it not found in normal group that may be the abnormal RBC attached toqgether with platelets. This study agreement with Sellman 2000 [8]. The effect of iron deficiency on fetal development and Pregnancy outcome. The recent study revealed all the parameters of fetal outcome mostly adverse in anaemic group than in control group. Normal fetal development is largely dependent on adequate placental blood perfusion.

Abnormal structural organization of the feto-placental vasculature in the chorionic plate, which is the main source for intra-cotyledon fetal blood flow thus leading to prematurity and low birth weight credited to early maturity of placenta in hypoxic condition. This result of recent study agreement with Kelly et al 2000 [9].

The maternal anaemia showed a significant correlation with birth weight, Apgar score, gestational age and birth asphyxia [10]. Our study associated with other reseachers on altered histomorphology of placenta in pregnancy anemia, where according to them anaemia is the cause for altered placental histomorphology leading to placental malformation [11].
Placental histological changes show the signs of chronic hypoxic stress and placental insufficiency. In our study it was observed that elevated capillary density and dilatation of sinusoids, my opinion this is the main adaptation to hypoxia in ischemic placenta. Our finding agreement with another study by [12].

Histological findings explore the hypoxia and reduced oxygen perfusion of placenta in pregnancy anemia. Low oxygen causes cytотrophoblastic proliferation and leading to increase in syncytium thickness. The factors responsible for the formation of stromal fibrosis are normal ageing process and reduced uteroplacental blood flow. It is fibrin which is formed by thrombosis of maternal blood in intervillous space. Thrombosis occurs as a result of whirlpool currents; this decreases the intervillous space. Perivillous fibrin depositions might be acting as a barrier between fetal and maternal circulation. These perhaps resulted into chronic placental insufficiency; therefore causing decrease birth weight and adverse outcome.

**Conclusion**

The Morphological parameter of placentae, The changes in placenta during pregnancy anaemia comprise of decrease in weight, number of cotyledon, diameters, decrease in villous vascularity, increase syncytial knots, fibrinoid necrosis, cytотrophoblastic proliferation, stromal fibrosis, increased number of syncytial knots and dilated capillary per villous correlates to the hypoxic effects of anaemia. These changes in placenta to early maturity of placenta, resulting in poor foetal outcome as prematurity, low birth weight.

**References**