HISTOLOGICAL STUDY OF HUMAN PLACENTA WITH EMPHASIS ON CAPILLARIES AND SYNCYTIAL KNOTS OF TERMINAL VILLI

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ABSTRACT

Objective: To study the light microscopic structure of human placenta from different regions. To determine the role of the placenta in nutrition of the human fetus.

Design: A descriptive study

Place and Duration of Study: The study was conducted at MH Rawalpindi from January to June 2002.

Materials and Methods: Ten placentae of normal cases were used in this study. Placentae was cut along the maximum diameters into two halves after trimming the membranes. Three specimens were taken: one from the centre (A), one from the peripheral margins (C) and one from midway between the two (B). Specimens were further processed for paraffin sections. Five µm thick sections were made on rotary microtome. Haematoxylin and eosin (H&E), Periodic acid schift (PAS) and Masson's trichrome stains were used. The morphology of villi was observed, and syncytial knots and capillaries were counted.

Results: The placental tissue was arranged as a chorionic plate, a basal plate and between the two the villous stems, their branches in the intervillous space.

Mean number of syncytial knots in A, B and C regions were 144±22.56, 93±26.70 and 93±21.52 respectively. The quantitative difference between regions A, B and C was statistically insignificant (P>0.05),

Mean number of capillaries in A, B and C regions was 114±46.04, 89±27.23 and 92±36.80 respectively. The quantitative difference between regions A, B and C was statistically insignificant (P>0.05).

Conclusion: In terminal villi, the syncytial knots and capillaries were more in the central (A) region as compared to in the peripheral (C) region. The quantitative difference between syncytial knots and capillaries of central (A) and peripheral (C) region was statistically insignificant.

Keywords: Human placenta; terminal villi, capillaries; syncytial knots.

INTRODUCTION

The birth of a healthy infant at term is dependent upon normal placental development [1]. The placenta proper comprises the chorionic villi with a thin decidual plate on the maternal surface and a chorionic plate on the fetal surface. The villi arising from the chorionic plate are termed as the stem villi. Villi of the first trimester are 70µm broad. On the surface of the villous is a rather thick, uniform layer of syncytial trophoblast with evenly spaced nuclei. The thick basal lamina beneath the cytotrophoblast separates the trophoblast layers from the stromal core of the villous.

As gestation continues, the terminal villi are reduced to about 35µm in diameter. The cytotrophoblast layer becomes discontinuous and eventually disappears [2]. An uneven distribution of nuclei within syncytial trophoblast results in cluster of nuclei called syncytial knots. Regions where the syncytial trophoblast is very thin, the dilated fetal capillaries are situated close to the surface and even bulge the surface of syncytial trophoblast in these regions [3].

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Present study has been designed to study the light microscopic structure of human placenta in its different regions.

MATERIALS AND METHODS

Ten placentae of normal cases were used in this study. Placentae showing any infarcts, haemorrhages or calcification were not included. Each placenta was cut along its maximum diameter into two halves after trimming the membranes.

Approximately five mm piece of placenta was cut from one half and further divided into two halves. Three specimens were taken. One from the center (A), one from the peripheral margin (C) and one from the midway between the two (B) and placed in duly numbered bottles containing 10% formaldehyde.

The specimens were further processed for paraffin sections. 5 µm thick sections were made on rotary microtome H&E, PAS and Masson's trichrome stains were used.

The morphology of villi was observed. Complete cross-sectioned encircled villi with core of connective tissue were selected and syncytial knots and capillaries were counted in five randomly selected different fields under 40 X objective from A, B and C regions of the placenta.

The arithmetic means of observation was calculated. The statistical significance of difference between different regions of placenta was evaluated by ANOVA. The difference was regarded statistically significant if the P value was equal to or less than 0.05.

RESULTS

The placental tissue was arranged as a chorionic plate, a basal plate and between the two the villus stem, their branches in the intervillous space.

The chorionic plate was made up of simple cuboidal epithelium followed by connective tissue layer having blood vessels and the syncytial wall of the inter-villous space. The basal plate (decidual tissue) had large number of cells with basophilic nuclei which were most probably the decidual cells.

The terminal villi were composed of a core of connective tissue which contained capillaries. The surface membrane facing intervillous space was composed of syncytial trophoblast with evenly spaced nuclei (fig. 1)

A basement membrane (best demonstrated in PAS stained sections), beneath the cytotrophoblast layer separates the trophoblast layer from the stromal core of villus. Syncytial knots were recognized as uneven distribution of nuclei within syncytial trophoblast (fig. 2).

Mean number of syncytial knots in A, B and C regions were 144±22.56, 93±26.70 and 93±21.52 respectively (table-1). The difference between regions A, B & C was statically significant (P>0.05).

Mean number of capillaries in A, B and C regions was 114±46.04, 89±27.23 and 92 ± 36.80 respectively (table-2). This quantitative difference between regions A, B and C was statistically insignificant (P>0.05).

Table–1: Mean number of syncytial knots per field in different regions of placenta.

Region	Mean ± SD
A	114 ± 22.56
B	93 ± 26.70
C	93 ± 21.52
P-value	> 0.05

Table–2: Mean number of capillaries per field in different regions of placenta.

Region	Mean ± SD
A	114 ± 46.04
B	89 ± 27.23
C	92 ± 36.80
P-value	> 0.05

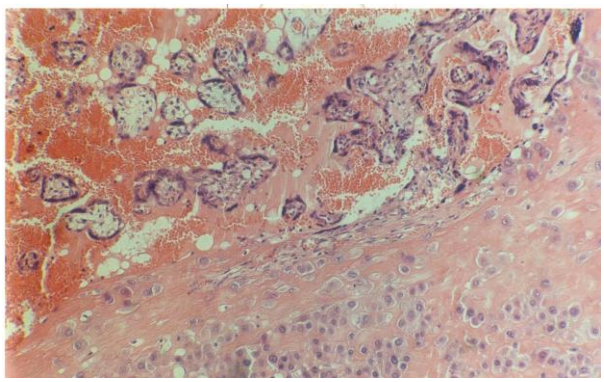

Fig. 1: The terminal villi are composed of a core connective which contained capillaries (H×E×200).

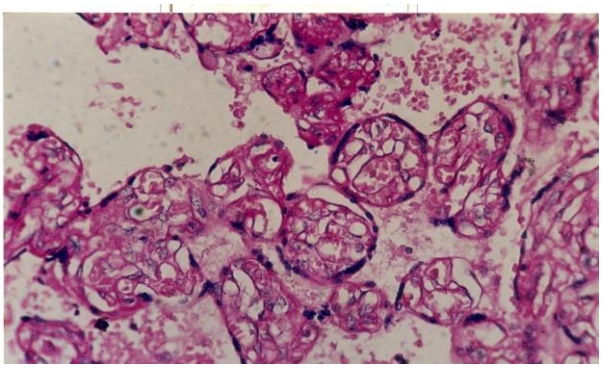

Fig. 2: A basement membarance beneath the cytotrophoblast separates the trophoblast layer from the stromal care of villies (PAS×400).

DISCUSSION

In the present study the trophoblast covering the terminal villi consisted of syncytiotrophoblast cells with evenly spaced nuclei. The decidual cells having basophilic nuclei were present in the basal plate, whereas chronic plate was made up of simple cuboidal eipithelium followed by connective tissue layer having blood vessels and the syncytial wall of the inter-villous space. These findings well correlate with the findings of previous workers [4].

Syncytial knots are present in 10 to 30% of the villi at term in normal pregnancies. The knots are most frequent at the periphery of placental tissue in each cotyledons [5]. Our results differ from the study. These showed a decreased pattern towards peripheral regions.

This is highly unlikely. Syncytial knots formation results due to villous cytotrophoblast proliferation as tissue response to hypoxia [6]. It has been assumed that fetal hypoxia is associated with hypoxia of the peripheral villous tree and the intervillous space as a consequence of a reduction in uteroplacental flow.

In present study there was close approximation of capillaries to the syncytium. Quantitative difference between central (A) and peripheral (C) region was insignificant. In normal placentae the center of each lobule lies opposite the opening of a spiral artery through the basal plate, and so maternal arterial blood is delivered into this region. The blood then disperses radially. If there is any fetal hypoxia, the appropriate response of terminal villous would be increase in the number of capillaries and a reduction in the diffusion distance. In the dual-perfused human placental cotyledons in vitro, the feto placental vessels constrict in response to maternoplacental hypoxia [7]. Results of this study support the concepts of preplacental and uteroplacental hypoxia as contributory factors in fetal hypoxia.

CONCLUSION

The placental tissue was arranged as a chorionic plate, a basal plate and between the two, the villous stem, their branches in the intervillous space. In terminal villi, the syncytial knots and capillaries were more in the central (A) region as compared to in the peripheral (C) region, but the quantitative difference between syncytial knots and capillaries of central (A) and peripheral (C) region was statistically insignificant showing the importance of preplacental and uteroplacental factors in fetal hypoxia.

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