ORIGINAL ARTICLES

HISTOLOGICAL STUDY OF HUMAN PLACENTA IN ULTRASONICALLY DETERMINED CASES OF INTRAUTERINE GROWTH RETARDATION

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ABSTRACT

Objectives: To study the light microscopic structure of human placenta in ultrasonically determined cases of intrauterine growth retardation (IUGR).

Study Design: A cross sectional comparative study.

Place and Duration of the Stud: This study was carried out at military hospital Rawalpindi from Jan 2002 to June 2002.

Material and Methods: Ten placenta of normal and 30 placentae of known intrauterine growth retardation cases were used in this cross sectional comparative study. Placentae were weighed and cut along their maximum diameter into two halves after trimming the membranes. Three specimens were taken: one from the center (A), one from the peripheral margin (C) and one from midway between the two (B).

Specimens were further processed for paraffin sections, 5µm thick sections were made on rotary microtome. Haematoxylin and eosin (H&E), periodic acid schiff (PAS) and Masson's trichrome stains were used. The morphology of villi was observed and syncytial knots and capillaries were counted.

Results: In comprehensive study of the gross observations of the 30 placentae of IUGR cases, it was noted that all (100%) had meconium staining with presence of marginal or retroplacental hemorrhages. Calcification was noted in 24 cases.

In the control group mean number of capillaries in A, B and C regions were 114 ± 14.56, 89 ± 8.61 and 92 ± 11.63 respectively. In the IUGR group mean number of capillaries in A, B and C regions were 127 ± 6.12, 125 ± 5.53, 122 ± 7.16 respectively. The difference between mean number of capillaries per field in A, B and C region of control and IUGR group was significant ($P<0.05$).

Mean birth weight, placental weight, placental diameter and placental thickness in IUGR group was 2.7 ± 0.200, 163 ± 18.26, 12.8 ± 1.18 and 1.46 ± 0.104 respectively. Difference between placental weight diameter and thickness of normal and IUGR group was statistically significant ($p<0.05$).

In control group mean number of syncytial knots in A, B and C regions was 114 ± 7.13, 93 ± 8.44 and 93 ± 6.80 respectively. IN IUGR group, the mean number of syncytial knots in A, B and C regions was 169 ± 7.09, 169 ± 8.93 and 165 ± 44.36 respectively. These differences were statistically significant ($P<0.05$)

Conclusion: In terminal villi, syncytial knots and capillaries of the IUGR cases were more in the central region as compared to in the peripheral region.

The quantitative difference between syncytial knots and capillaries in IUGR and control group were statistically significant ($p<0.05$).

Keywords: Human placenta, terminal villi, intrauterine growth retardation, capillaries, syncytial knots.

INTRODUCTION

Intrauterine growth retardation (IUGR) is associated with smaller than normal placenta and there is increased prenatal morbidity and mortality [1]. The progress towards understanding the placental pathology of IUGR has resulted from two

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Received: 11 July 2007: Accepted 19 May 2008

achievements. First, an appreciation of the developmental biology of the normal villous

Reduction in uteroplacental blood flow as compared to in normal pregnancies [2]. It is the placenta not the fetus that is initially affected by a failure of transformation of the uteroplacental circulation. 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 [3].

The appropriate response of the terminal villous tree to hypoxia is an increase in the number of capillaries in the terminal villi and a reduction in the diffusion distance [4].

The valuable work by various scientists in the field of placental morphometry in IUGR cases indicates stimulation of syncytial knots formation, persistence of villous cytotrophoblastic cells and hypercapillarization of the villous tree.

Present study was designed to study the light microscopic structure of human placenta of IUGR cases and comparison with the normal cases.

MATERIAL AND METHODS

This cross sectional comparative study was carried out at Military Hospital Rawalpindi from Jan 2002 to Jun 2002. 10 placentae of normal and 30 placentae of known intra uterine growth retardation cases were included in this study.They were confirmed cases of IUGR on the basis of ultrasound Placentae along with the umbilical cords were collected at the time of delivery from different hospitals for the time period of six months. Placenta was weighed and cut along its maximum diameter into two halves after trimming the membranes.

Approx 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 tree and secondly the greater application of ultrasound techniques [2]. There is 30-50% margin (C) and one from 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 objectives from A, B and C regions of placenta.

The arithmetic means of observation was calculated. The statistical significance of difference between different regions of placenta was evaluated by student's 't' test [5]. The difference was regarded statistically significant if the P value was equal to or less than 0.05.

RESULTS

In a comprehensive study of gross observations noted in the 30 placentae of IUGR cases. It was noted that all (100%) had meconium staining with presence of marginal or retroplacental haemorrhages. Calcification was noted in 24 cases (80%)

Mean birth weight, placental weight placental diameter and placental thickness in IUGR group was 1.7cm±0.200, 177cm±18.26, 10cm±1.18 and 1.1±0.104 respectively. Difference between placental weight thickness of normal and IUGR group was statistically significant ($P<0.05$).

The placental tissue was arranged as a chorionic plate, a basal plate and between the two, the villus stem, their branches and the inter villous space in both the control and IUGR group. The chorionic plate was made up of simple cuboidal epithelium followed by

connective tissue layer having blood vessels and the syncytial wall of the intervillous space. The basal plate (decidual tissue) had large number of cells with basophilic nuclei which were the decidual cells (Fig. 1).

The terminal villi were composed of connective tissue cells, fibers, nuclear debri and capillaries. The capillaries lying within the core of loose C.T were closely opposed to the syncytial trophoblast in IUGR cases. They were numerous and seemed to the have wider lumen as compared to normal.

The syncytiotrophoblast covered the terminal villi and the surface of the basal plate. A basement membrane best demonstrated in PAS stained sections, beneath the cytotrophoblast layer separates the trophoblast layer from the stromal core of the villus (Fig. 2). At places the syncytial layer became discontinuous. Syncytial knots were recognized as uneven distribution of nuclei within syncytial trophoblast.

In control group mean number of syncytial knots in A, B and C regions was 114±7.13, 93±8.44 and 93±6.80 respectively. In IUGR group mean number of syncytial knots in A, B and C regions was 169±7.09, 169±8.93 and 165±44.36 respectively. The quantitative difference between mean number of syncytial knots per field in different regions of control and IUGR groups was statistically significant (P<0.05) (table 2).

In control group mean number of capillaries in A, B and C regions was 114±14.56, 89±8.61 and 92±11.63 respectively. In IUGR group mean number of capillaries in A, B and C regions was 127±6.12, 123±5.53 and 123±7.16 respectively. The difference between mean number of capillaries per field in A, B and C regions of control and IUGR group was significant (P<0.05) (table 3).

Table-1: Mean Values of Birth Weight, Placental Weight, Placental Diameter and Placental Thickness

	Control Group n=10 Mean ± S.E	IUGR Group n=30 Mean ± S.E	Statistical Difference between Control and IUGR Group
Birth weight (kg)	3.1 ± 0.206	1.7 ± 0.200	P< 0.05
Placental weight (g)	327 ± 25.14	177 ± 18.26	P< 0.05
Placental diameter (cm)	15 ± 0.421	10 ± 1.181	P< 0.05
Placental thickness (cm)	2.5 ± 0.273	1.1 ± 0.104	P< 0.05

Table-2: Mean Number of Syncytial Knots per Field in Different Regions

Region	Control (n=10) Mean ± S.E	IUGR (n=30) Mean ± S.E	Significance of difference between control and IUGR group
A	114 ± 7.13	169 ± 7.09	p < 0.05
B	93 ± 8.44	169 ± 8.93	p < 0.05
C	93 ± 6.80	165 ± 44.36	p < 0.05

Table-3: Mean Number of Capillaries per Field in Different Regions

Region	Control (n=10) Mean ± S.E	IUGR (n=30) Mean ± S.E	Significance of difference between control and IUGR group
A	114 ± 14.56	127 ± 6.12	p < 0.05
B	89 ± 8.61	123 ± 5.53	p < 0.05
C	92 ± 11.63	123 ± 7.161	p < 0.05

Table-4: Mean Number and Statistical Significance between Syncytial Knots and Villous Capillaries in IUGR and Control Groups

	Control n = 10 Mean ± S.E	IUGR n = 30 Mean ± S.E	Statistical Significance of difference between IUGR and control group
Syncytial knots	199.4 ± 69.50	504.2 ± 35.30	p < 0.05

On pooling the data of all the three regions of IUGR group a total number of syncytial knots and capillaries was 15126 and 11197 respectively. The mean number was 504.2±35.30 and 373.3±51.83 respectively. On pooling the data of all the three regions in control group the total number of syncytial knots and capillaries was 1994 and 2959 respectively. Their mean number was 199.4±69.50 and 295.9±79.7 respectively. The quantitative difference between IUGR and control group was statistically significant (P<0.05) (table 4).

DISCUSSION

The anatomic alterations observed in the IUGR study was specifically related to the presence or absence of any etiology in the IUGR group. Placental hypoxic, ischaemic and haemorrhgeic lesions on the maternal surface was very high (100%). It is evident that infarcts create hemodynamic modifications at the level of intervillous chamber and impede the normal functional changes in a small or large part of the placenta [6].

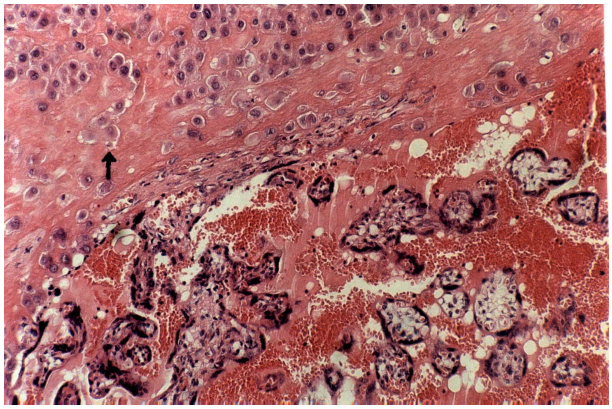

Fig. 1: Section showing Decidual Cells of Human Placental Tissue

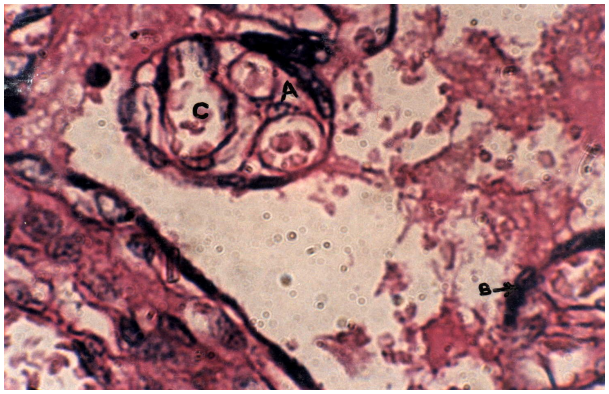

Fig. 2: Section showing Terminal Villi (A), Syncytial Villi Knots (B) and Capillaries (C) Of Human Placental Tissue

Our study has demonstrated the overall increase of syncytial knots being significantly higher in the syncytial membrane. There are number of important factors that should be considered in interpretation of these findings. Syncytial knots formation is up regulated by intra placental hypoxia and down regulated by increasing intra placental oxygen levels [7].

Increased number of syncytial knots indicate a degenerative process as response to local hypoxia. It is interesting to see them sprouting in early placenta and in the mature placenta. This is considered an adaptive phenomenon to reduce the diffusion distance from the intevillous space to the fetal capillaries in the presence of reduced oxygen tension, since the movement of the cells into clumps (knots) reduces the number of cells, covering the remainder of the surface and hence the thickness of this cellular layer [8].

Nuclear clusters appeared more darkly stained by PAS stain in IUGR group. The terminal villi were prematurely aged as judged by their cytologic and histochemical appearance. Aging of the syncytium is characterized by thinning, basophilia and increased affinity of acid dyes. Although syncytial degeneration does occur under hypoxic results. It is interesting that a concomitant proliferation of cytotrophoblast may occur which might represent an attempt at repair.

Mean number of capillaries in all the three regions of the placental tissue were increased in our study. The increased number of capillaries in the stromal core of terminal villi indicates that hypoxia induces hypercapillarization and vasodilation in many systemic vessels but causes vasoconstriction in pulmonary vessels [8, 9].

It may be hypothesized that intra uterine growth retardation, with or without etiology leads to chronic "stress" to the fetus with chronic hypoxia and release of vasoactive substances, these substances cause chronic vasoconstriction and vascular hypertrophy [10].

The anatomical (gross and microscopic data) considered leads to the conclusion that disease process which depends on a reduction in the maternal blood affects those part of the organ furthest from the origin of that blood supply, that is the periphery of the placenta.

CONCLUSION

In terminal villi, syncytial knots and capillaries of the IUGR cases were in the central (A) region as compared to in the peripheral (C) region.

The quantitative difference between syncytial knots and capillaries in IUGR and control group was statistically significant.

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