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Syncytial Knots: A Reflection of Placental Injury in Diabetics and Hypertensive, in Comparison to Normal Placental Maturity

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ABSTRACT

The placenta's essential role in pregnancy is to support fetal development and maternal-fetal exchange. Despite medical advancements, abnormalities in placentas of diabetic and hypertensive women still remains a concern. The placenta manages vital functions like respiration, nutrition, and hormone production, but increased fetal monitoring and caesarean deliveries have not significantly improved outcomes, raising obstetric risks. The early appearance of syncytial knots may indicate abnormal placental function, impacting fetal health This study aimed to assess placental changes in diabetic and hypertensive pregnancies through a cross-sectional comparative design. Conducted at IBMS and DDRRL/DUHS, it involved 150 placental samples categorized into Control (A), Diabetic (B), and Hypertensive (C) groups, each with 50 samples. Placentas were preserved within 40 minutes post-delivery to avoid structural alterations. Tissue samples were taken from central and marginal regions for microscopic evaluation. Average syncytial knots were found to be significantly different in all the study groups. A stark difference was noticed in the diabetic & hypertensive group of about 10.76 and 13.86 respectively in comparison to the control group. This study identified a significant link between syncytial knot formation and pregnancy complications in diabetic and hypertensive groups. The mean syncytial knot count was 17.26 in diabetic placentas and 20.36 in hypertensive placentas, compared to 6.50 in normal pregnancies. Preeclampsia cases showed cytotrophoblast proliferation and excessive syncytial knots. Hypoxic changes and acute arthrosis were common in third-trimester placentas affected by eclampsia and preeclampsia. Previous research supported a relationship between the duration of hypertension and increased syncytial knots, and clinical hypertension classifications were found insufficient to fully capture placental morphology variations. The increased knots in hypertensive pregnancies demonstrate the trophoblast's hypoxia-driven adaptive response, characterized by abnormal cytotrophoblast proliferation and structural changes.

Keywords: *Placental morphology, Syncitial knots, Gestational Diabetes, Preeclempsia hypertensive pregnancy.*

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1. INTRODUCTION

The placenta is a vital organ for maintaining pregnancy and promoting normal fetal development. It is sometimes described as mirror of perinatal period. One of the common methods of investigation of factors endangering the fetus and newborn during the perinatal period is the examination of placenta.

Despite improvement in care over past decades Numerous ultrastructural abnormalities have been observed in placentas from diabetic and hypertensive women. These structural changes could alter the placental function and result in alterations in maternal-fetal exchange.

Placenta functions as respiratory, excretory, and nutritive organ between fetus and mother. Increase pathological clusters like syncytial knots; are prominent in preeclamptic & gestational diabetics hence leading to hypoxic mechanism disorders & clinically relevant pregnancy complications occurs.[1]

A massive increase in the intensity of fetal monitoring and changes in the method of delivery including increased use of caesarean sections have not decreased the incidence of poor fetal outcome, leading to elevated risk in obstetrics.

The presence of Syncytial knots is one of the placental abnormalities if found in early pregnancy as it can lead to an increased number then after in mature placenta and alter its function, which is useful for outling the the comparions of upshots in study groups

2. METHODS

Cross sectional comparative study was carried at the department of Anatomy, Institute of Basic Medical Sciences (IBMS) and Dow Diagnostic Research and Reference Lab, Dow University of health sciences (DDRRL/DUHS), and cases were examined and identified for diabetes and hypertension during pregnancy.

After delivery, the placenta along with cord and membranes was weighed and preserved in formalin containing plastic jars[2] within 40 minutes of delivery to avoid any ultra structural changes.3

150 samples were collected comprising 3 groups Control (A), Diabetic (B), and Hypertensive (C), having 50 placentas in each group. The samples were obtained from tissue of both normal and abnormal appearance, [4] with labeling as:

A. Center of placenta

B. 12'clock margin of placenta

C. 6' clock margin of placenta

The data was entered and analyzed on SPSS version 16.0. Mean ± standard deviations were computed for the average syncytial knots on microscopy. The results were expressed as mean standard deviation and confidence interval was measured, while p-value was calculated. P-value of < 0.05 was taken as significant.

The study project's proposal was presented in front of the IRB of Dow University along with the consent form from the consultants, hospitals and patients (informed consent). Approval was given by the board for the study

3. RESULTS

Average Syncytial knots on microscopy

Number of Villi with syncytial knots/lpf at 10x magnification in group "A" (6.50) when compared to group "B" (17.26) has p-value (<0.005) significant and group "A" (6.50) when compared to group "C" (20.36) was also p-value (<0.005) significant. And while group "B" (17.26) when compared to group "C" (20.36) again a significant p-value (<0.005) was calculated.

It was observed that the average Syncytial knots of 24.7 percent patients out of 150 were lying in the range 16-20 and 17.3 percent of patient's average Syncytial knots was less or equal to 5 (as shown in Fig VII).

It was also noticed that majority of the patients who had average less than or equal to 5 belonged to the control group (i.e. 48%) and those who had average Syncytial knots 16-20 belonged to the hypertensive group (i.e. 44%) whereas, in diabetic group 38% patients had average Syncytial knots ranging from 11-15. (Fig no. IX, X, XI)

It was also seen that in hypertensive group none of the patients had average Syncytial knots less than or equal to five and in control (normal) group none of the patients had average more than 20. On the other hand, in diabetic group the number of patients who had average syncytial knots ≤5 or 6-10 were same (i.e. 4%) (As shown Fig VIII).

Average syncytial knots on microscopy were found significantly different in all the study groups ($p < 0.005$). An enormous difference was noticed in the diabetic and hypertensive group of about 10.76 and 13.86 respectively in comparison to the control group. (As shown in Table I)

Summary result

Average Syncytial knots were found to be significantly different in all the study groups. A stark difference was noticed in the diabetic & hypertensive group of about 10.76 and 13.86 respectively in comparison to the control group.

Table I: Statistical Comparison of disease groups according to different variables.

Disease group (Mean ± SD)	Normal (A)	Diabetic (B)	Hypertensive (C)	P-value
Weight of placenta	567.2 ± 73.770[a]	658.4 ±166.676[b]	459.9± 148.765[c]	<0.005
Average syncitial knots on microscopy	6.50 ± 3.671[a]	17.26 ± 6.064[b]	20.36± 5.170[c]	<0.005
Systolic blood pressure of mother	115.30 ± 9.058[a,b]	120.32 ± 13.710[b]	153.90 ± 18.98c	<0.005
Diastolic blood pressure of mother	76.70 ± 6.671[a,b]	79.56 ± 8.274[b]	97.20 ± 12.296[c]	<0.005
Blood sugar of mother	98.28±22.01[a, c]	175 ± 49.703[b]	100.88 ± 23.892[c]	<0.005

Fig VII:Percentage distribution of average syncitial knots

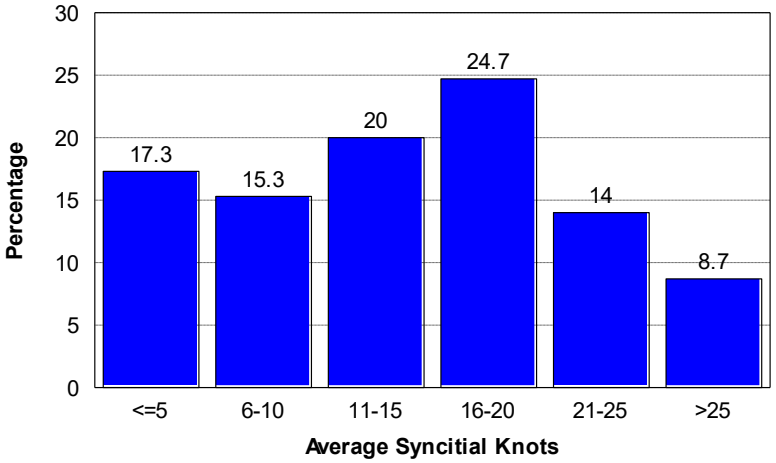
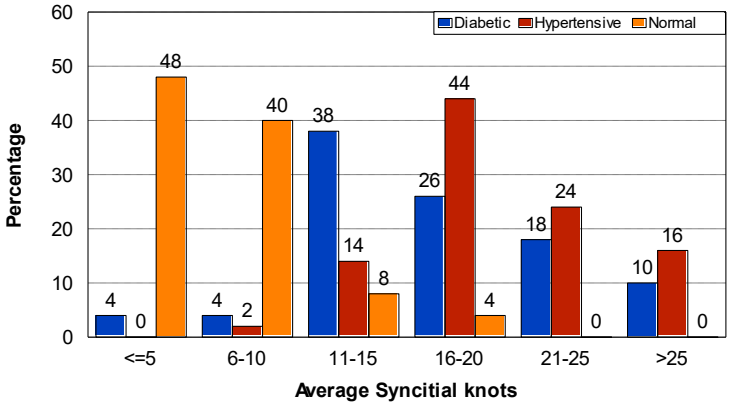


Fig VIII:Percentage distribution of Average syncitial knots according to disease group



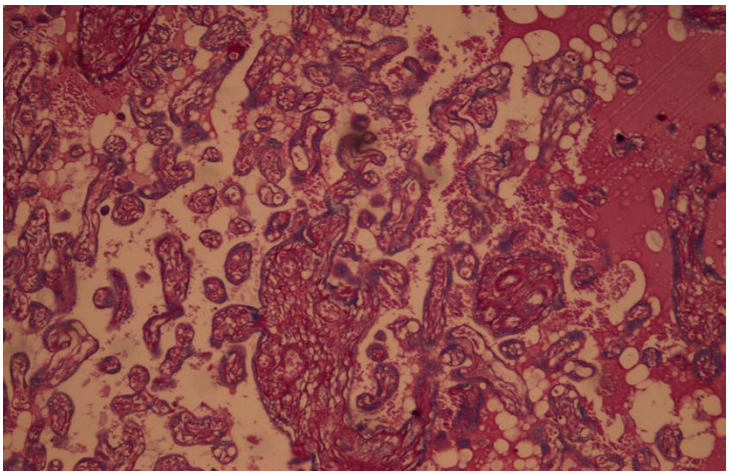


Fig No I. Photomicrograph showing average number of syncytial knots in normal placental villi at 10x magnification/lpf with H&E staining

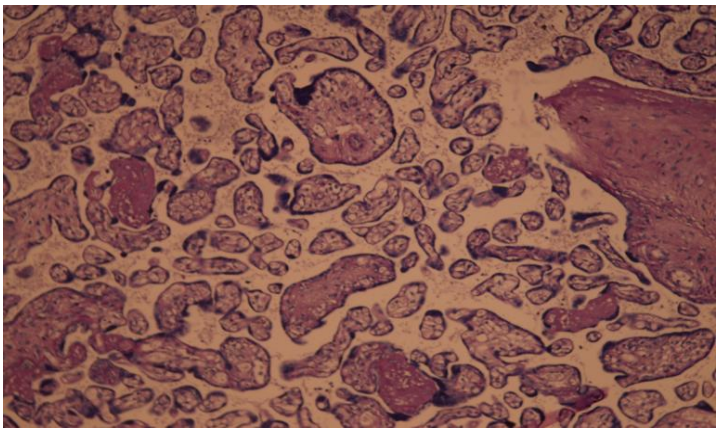


Fig No. II: Photomicrograph showing increased number of syncitial knots in hypertensive placental villi at 10 magnification /lpf with H&E stain

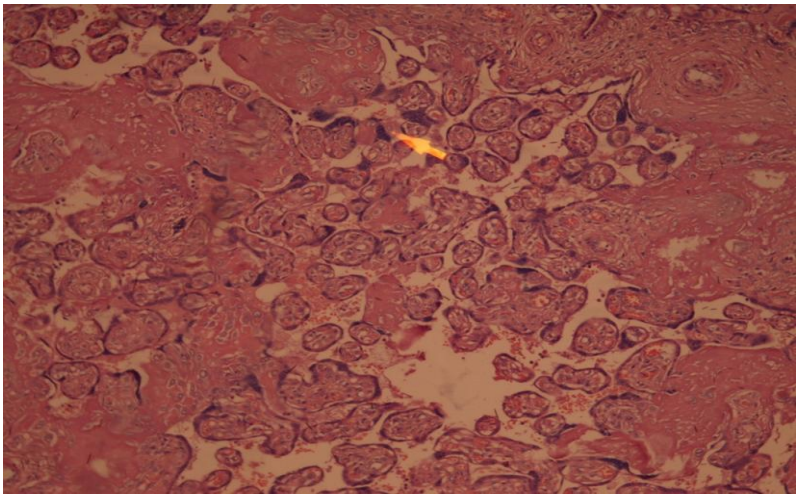


Fig No. III: Photomicrograph showing increased number of syncitial knots in diabetic placental villi at 10 magnification /lpf with H&E stain

4. DISCUSSION

In our study association was found in increased number of Syncytial knots and disease groups. We found an increase in Syncytial knots formation in diabetic and hypertensive group with a mean of 17.26 and 20.36 respectively as compared to normal which has a mean of 6.50. The pregnancies complicated by Preeclampsia, the overlying placental Villi showed evidence of cytotrophoblast proliferation and excessive formation of syncytial knots. A relative frequency of hypoxic changes and acute athetosis in the third trimester placentas from pregnancies complicated by the eclampsia /Preeclampsia was expected.[5] The number of knots increases with the duration of hypertension as observed by Rosana RM & co-workers. [6] Medina Lomeli & co-workers. Resolved that though hypertension is classified into different stages according to clinical data but this criterion is not enough to verify the types though difference in duration of disease affects the morphology of placenta.[7] This Increase in number of syncytial knots in hypertensive pregnancies are in response to the hypoxia showing the response capability of trophoblast.[8,9] Altered morphology evidenced by abnormal cytotrophoblasts proliferation and increased formation of syncytial knots.[10] The association found among the disease groups and this parameter in our study is consistent with the work done before by Gratton RJ (2004), Alvare CH (1974), and Daskalakis G (2008). Freedman AA, et al. (2023) documented maternal vascular malperfusion lesions such as increased syncytial knots are significantly more common in preeclamptic placentas. Syncytial knots are highlighted as markers of hypoxic stress. [11] Gupta A, et al.(2022) said Diabetic placentas shows syncytial knots reflective maladaptive changes due to hyper glycemia .[12] An HJ et al. (2022) provided metholodigical details in quantifying syncytial knots making a strong reference for histomorphometric analysis of placenta.[13] A higher incidence of syncytial knots in GDM & hypertensive placenta was reported by Molitierno R, et al. (2025).[14] In a study published in 2023 Arshad R, et al. reported Histo morphometric changes such as syncytial knots in diabetic placentas.[15]

5. SUGGESTION

Still in our part of the world reinforcement is needed. It is suggested that detailed examination of placenta should be brought into practice by a pathologist immediately after delivery to minimize the consequences in successive pregnancies. The study opens a discussion for further research in micrometry of placenta specifically the thickness of placental barrier (placental membrane).

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