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Original Research Article

Histomorphological Study of Placenta in Pregnancy Induced Hypertension

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Abstract:

Introduction: The development of foetus is mainly dependant on normal placental development Pregnancy induced hypertension (PIH), a well-known complication of pregnancy is significantly responsible for perinatal morbidity and mortality due to its effects on the growing foetus. Pregnancy induced hypertension causes considerable changes in the histopathology of placental tissue. The main aim of the present study record the data on the morphology and histology of placenta from mothers with PIH and correlate the findings with the birth weight of the new born babies, severity of hypertension, age of the patient and parity.

Materials and Methods: The present study was a retrospective study of 23 cases of pregnancy induced hypertension (PIH) conducted in Department of Pathology in collaboration with Department of Obstetrics and Gynecology, Kurnool medical college, Kurnool from January 2024 to February 2024. The statistical significance between different histologic findings and severity of PIH calculated.

Results: Of the 23 cases of pregnancy induced hypertension analysed in the present study 10 cases were of mild pregnancy induced hypertension, 5 cases were of moderate pregnancy induced hypertension and 7 cases were of severe pregnancy induced hypertension and one case with recurrent PIH in all the three previous pregnancies. Incidence of pregnancy induced hypertension was found to be more above 21 years of age (82.6%) and was found to be almost equal in both primi parous and multiparous women. Foetal outcome was worst in severe PIH (IUGR of 6% and IUD of 5%). The gross abnormalities noted were retroplacental hematomas (30.4%) and small sized placentae (21.7%); and were more often seen in severe PIH. The consistent histological changes observed include intra-villous and extra-villous fibrin deposition (82.6%), inter-villous haemorrhage 16 (69.5%), chorangiosis (47.8%), fibrinoid necrosis of villi (34.7%), increased syncytial knots (30.4%) and calcifications (30.4%).

Conclusion: The present study helps in evaluating the various morphological changes in placenta in the hypertensive disorder of pregnancy. Irrespective of the parity, the prevalence of pathological changes in the placenta seen in PIH patients was almost equal. The present study helps in anticipating the occurrence of changes in the subsequent pregnancy induced hypertension cases.

Keywords: PIH, Placental Pathology, Maternal Under Perfusion, Foetal Vasculopathy, Villous Abnormalities, Fibrinoid Necrosis.

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Introduction

Placenta is essential for maintenance of pregnancy and for promoting normal growth and development of fetus [1]. Placental examination plays an important role in improving outcome of pregnancy. It is strategically located at feto-maternal interface. It acts like a record of pregnancy in which the cumulative effects of pregnancy related events and changes reflecting the intrauterine environment can be scrutinized [2]. Hypertensive disorders complicate 5-10% of all pregnancies, and contribute greatly to maternal morbidity and mortality [3]. Pregnancy induced hypertension is the leading cause of maternal mortality and is an important factor in foetal wastage. The incidence is high in developing countries like India where the prevalence of malnutrition, hypoproteinemia were high with poor obstetric facilities. Pregnancy complications like hypertension are reflected in

placenta in a significant way both grossly and microscopically. Several studies have shown that utero-placental blood flow is decreased in PIH due to maternal vasospasm [4]. This leads to constriction of foetal stem arteries and has been associated with the changes seen in the placenta of preeclamptic women [5]. Maternal vasospasm leads to foetal hypoxia and accordingly it may lead to foetal distress and foetal death [6]. In various studies the association of PIH with low birth weight and stillbirth is documented. Present study has been undertaken to record the data on the morphology and histology of placenta from mothers with PIH and correlate the findings with the birth weight of the new born babies. The pathological changes due to maternal hypertension are reflected in the placenta as it is the mirror of both maternal and foetal status.

Materials and Methods

Study Design: The present study was a retrospective study of 23 cases of pregnancy induced hypertension (PIH) conducted in Department of Pathology in collaboration with Department of Obstetrics and Gynaecology, Kurnool medical college, Kurnool from January 2024 to February 2024. PIH cases were evaluated both clinically and by routine laboratory investigations. Ethical clearance was obtained from the Institutional ethical committee. After delivery, placentas of pregnancy induced hypertension cases were received and examined for placental morphology in relation to varying degrees of PIH.

Definitions: According to NHS guidelines PIH is defined as a blood pressure- systolic ≥140mm of Hg and/or diastolic ≥ 90mm of Hg diagnosed after 20 weeks of gestation. It is graded as:

i) Mild: 140/90 to 149/99 mm of Hg,
ii) Moderate: 150/100 -159/109 mm of Hg and
iii) Severe: ≥160/110 mm of Hg.

Inclusion Criteria: Placentae of cases of pregnancies complicated by pre-eclampsia/ eclampsia were included in the study.

Exclusion Criteria: The placentae of pregnancies complicated by other medical disorders like diabetes mellitus, heart diseases and other chronic diseases and preterm pregnancies were excluded.

The placentas received in the lab were examined in a fresh state. Examination of the membranes, umbilical cord, foetal surface and maternal surface was done to identify gross abnormalities.

After gross examination placentas were fixed in 10% neutral buffered formalin. Tissue samples which were obtained from the placenta, foetal membranes and the umbilical cord were fixed in 10% neutral buffered formalin and embedded in paraffin. At least three sections of placenta were submitted including two sections from grossly normal central placental parenchyma. Additional sections were submitted wherever found essential. Sections of tissue blocks were stained with hematoxylin and eosin and all the slides were examined by a pathologist. Histopathological changes of the placenta were documented.

Statistical Analysis: The frequency of microscopic lesions and their degree of association with PIH cases of varying severity was determined. Statistical analysis was done using χ 2 test; p value of <0.05 was considered significant.

Results

Of the 23 cases of pregnancy induced hypertension analysed in the present study 10 cases were of mild pregnancy induced hypertension, 5 cases were of moderate pregnancy induced hypertension and 7 cases were of severe pregnancy induced hypertension and one case with recurrent PIH in all the three previous pregnancies.

Age wise analysis of cases: Age of the patients varied from 16 years to 36 years. Incidence of pregnancy induced hypertension was found to be more above 21 years of age (Table 1).

Table 1: Age wise analysis of cases of pregnancy induced hypertension

Age in years	Mild PIH	Moderate PIH	Severe PIH	Recurrent PIH
≤20	3	1	-	-
21-25	4	3	5	-
26-30	1	1	1	1
>30	2	-	1	-
Total	10	5	7	1

Parity: Incidence of pregnancy induced hypertension was found to be almost equal in both primi parous and multiparous women (Table 2).

Table 2: Parity in 23 cases of pregnancy induced hypertension

Parity	Mild PIH	Moderate PIH	Severe PIH	Recurrent PIH	Total
Primi	4	3	4	-	11
Multiparous	6	2	3	1	12

Foetal outcome: No change in foetal outcome was seen in cases with mild pregnancy induced hypertension. A gradual rise in the number of I.U.G.R cases and IUDs were seen from moderate to severe PIH (Table 3).

Table 3: Foetal Outcome in 23 cases of pregnancy induced hypertension

Foetal outcome	Mild PIH	Moderate PIH	Severe PIH	Recurrent PIH
Normal	8	1	2	1
IUGR	1	3	2	-
IUD	1	1	3	-

Gross abnormalities: The gross abnormalities found in the present study were retroplacental hematoma and small sized placenta. Retroplacental hematomas were more common than small sized placenta. One case of mild PIH shows retroplacental clot only. Morphological changes were found more frequently in severe than the moderate pregnancy induced hypertension cases (Figure 1).

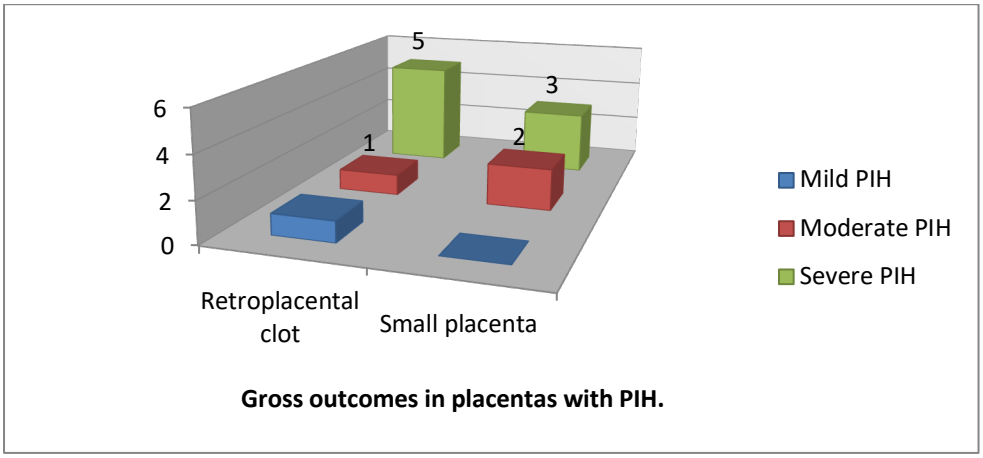

Figure 1: Gross outcomes in placentas with PIH

Histomorphological changes (Figure 2): Analysis was done depending on the grading of hypertension. Most common histological findings in different degrees of PIH were:

- Mild PIH – Intravillous and extravillous fibrin deposition in 9 (90%) cases, and intravillous hemorrhage in 7 (70%) cases.
- Moderate PIH– Intervillous haemorrhage, chorangiosis and calcification in 4 cases (80%) each.
- Severe PIH– Intravillous and extravillous fibrin deposition in 7 cases (100%), chorangiosis in 6 cases (85.7%), Fibrinoid Necrosis in 5 cases (71.4%), increased syncitial knots in 5 cases (71.4%), intervillous haemorrhage in 5 cases (71.4%) followed by concentric hypertrophy of blood vessels in 3 cases (42.8%).
- One case of Recurrent PIH showed intravillous and extravillous fibrin deposition and intervillous haemorrhage.

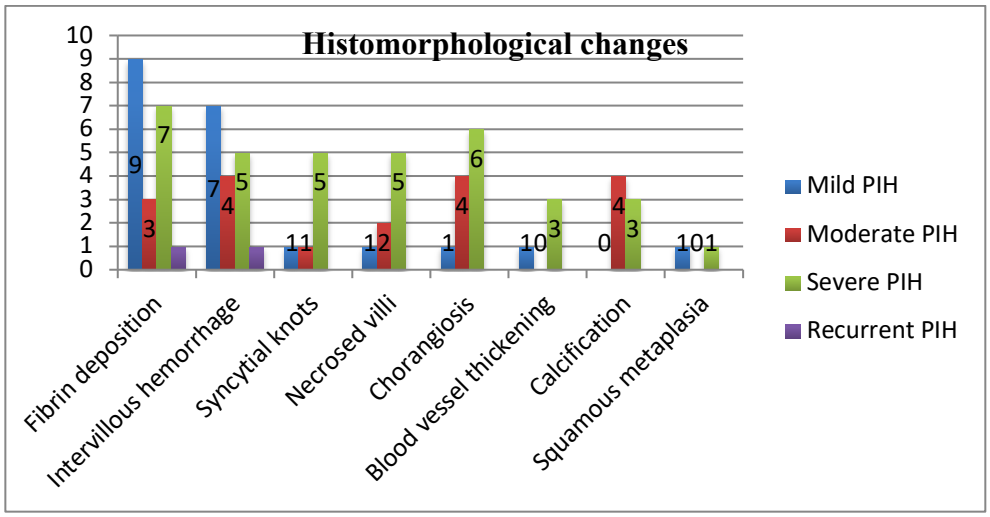

Figure 2: Histomorphological changes

Discussion

The placenta is considered to be a very complex organ. Placental changes in disorders of pregnancy are reflected in macroscopic and microscopic abnormalities [7]. The present study was undertaken to critically analyse the placental changes in various grades of toxaemia of pregnancy.

Macroscopic abnormalities: The predominant macroscopic abnormality found in this study was retroplacental hematomas. Retroplacental hematoma is a hematoma between the placental floor and myometrium. It represents the pathologic lesion responsible for clinical placental abruption.

Large retroplacental clots cause the placenta to separate it from its blood supply causing placental infarctions. Extensive recent hemorrhage causes foetal distress necessitating immediate delivery [8]. Large hematomas depriving its blood supply form 40% or more of the villous population are associated with high incidence of foetal hypoxia and death [9].

In 7 out of 23 cases studied (30.4%) showing retroplacental hematomas, 5 cases were in severe PIH and 1 case each was seen in mild and moderate PIH, thus explaining the increased foetal morbidity in severe PIH. The incidence of retroplacental hematomas in studies conducted by Agarwal et al, Narasimha et al and S Rajya Lakshmi et al were 32.5% [9], 40.7% [2] and 42% [10] respectively. In study conducted by Ahmed et al, none of the mild PIH cases had a hematoma; 10% of moderate and 36.4% of severe PIH cases had retroplacental hematoma [11]. The other gross abnormality which was found in the present study was the small-sized placentas. In the present study out of 23 cases of pregnancy induced hypertension small placenta was seen in 5 cases (21.7%) out of which 2 cases were of moderate and 3 cases were of severe PIH.

The incidence of small placenta in PIH cases was similar to the study conducted by S Rajya Lakshmi et al which constituted 24% [10]. Bar et al have documented statistically significant low values of placental diameter in hypertensive pregnancies compared to normal ones [12]. Karun Jain et al have shown that smaller babies had smaller placentas [13]. Ahmed et al came across a significant negative correlation between placental thickness and PIH severity i.e. as the PIH severity increased, the placental thickness decreased [11].

Microscopic abnormalities: Many studies have established the different histologic findings in hypertensive disorders of pregnancy. The present study showed the following histologic features.

Intra-villous and extra-villous fibrin deposition (Figure 3): In the present study, out of 10 cases of mild pregnancy induced hypertension, intra-villous and extra-villous fibrin deposition was seen in 9 cases (90%), out of 5 cases of moderate PIH, 3 cases (60%) show fibrin deposition.

In all cases of severe and recurrent PIH intra-villous and extra- villous fibrin deposition was seen. Narsimha et al noted significant villous fibrin deposition in 97.82% cases of preeclampsia-eclampsia syndromes [2].

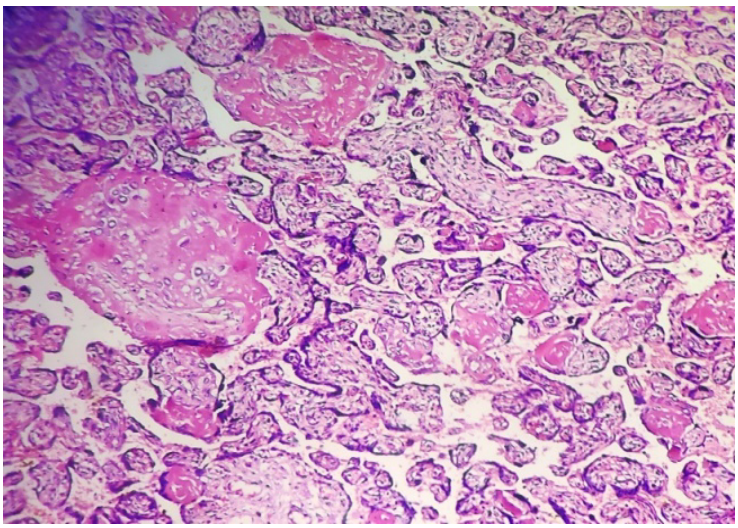

Figure 3: Intra villous and extra villous fibrin deposition (H&E 10x)

Inter-villous haemorrhage (Figure 4): In the present study, 70% cases of mild, 80% of moderate and 71.4% of severe pregnancy induced hypertension cases showed inter-villous haemorrhage.

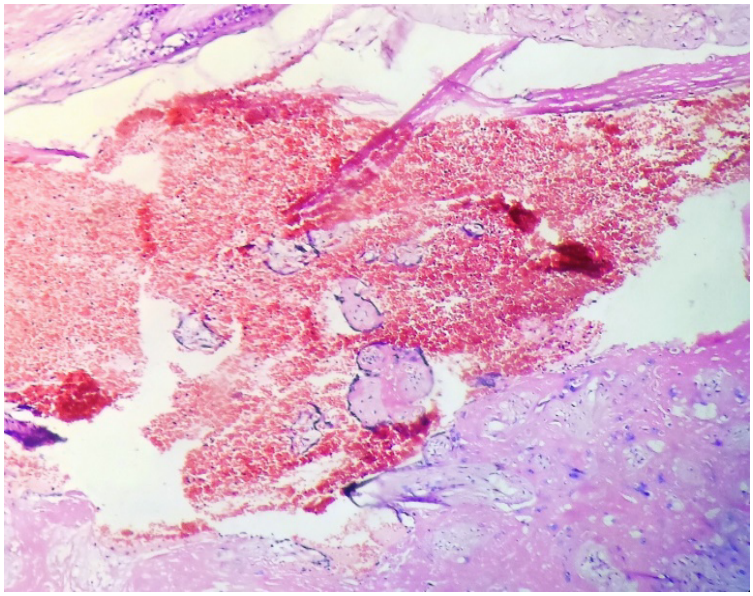

Figure 4: Inter-villous haemorrhage (H&E 10x)

Increased Syncytial knots (Figure 5): Syncytial knots are focal clumps of syncytial nuclei that protrude into the inter-villous space from the surface of the villi. Syncytial knots start appearing in the later stages of pregnancy and their number increases until term, at which time, knots are normally present on 11 to 30 % of villi. Formation of knots on more than a third of villi is considered excessive. The syncytial knots are frequently located at the periphery of the cotyledons. In preeclampsia, the excessive formation of syncytial knots in the placenta is a consequence of obliterative changes in the foetal stem arteries [9]. The syncytiotrophoblastic knotting is an indicator of chorionic villous capillary proliferation or exaggerated senescence induced by hypoxia due to foetal or maternal pathologic conditions [13, 14]. In the present study 1 out of 10 (10%) cases of mild, 1 case (20%) of moderate and 5 cases (71.4%) of severe pregnancy induced hypertension showed increased prominent syncytial knots. The number of syncytial knots increased with severity of PIH similar to the observation made in the study conducted by S Rajya Lakshmi et al [10].

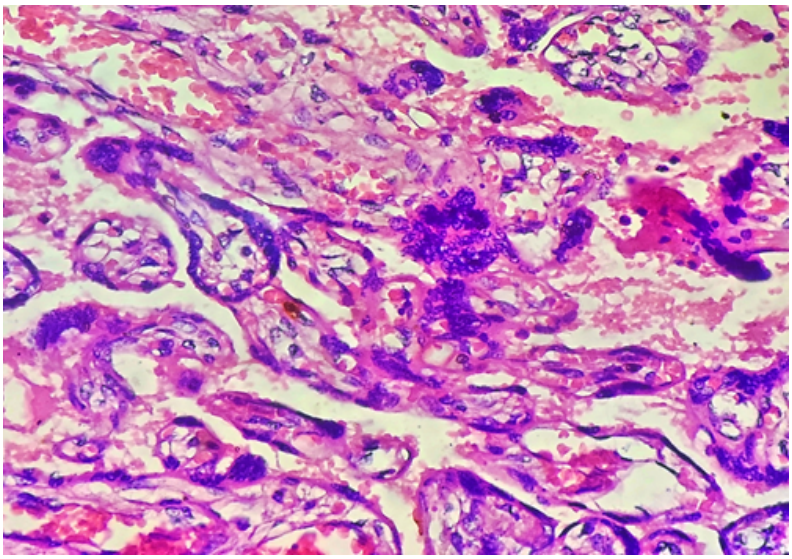

Figure 5: Presence of Increased syncytial knots (H&E 40x)

Chorangiosis (Figure 6): In the present study 1 out of 10 (10%) cases of mild, 4 case (80%) of moderate and 6 cases (85.7%) of severe PIH showed chorangiosis which is in concordance with study conducted by Manjunath HK et al and Shanmugasam et al [15, 16].

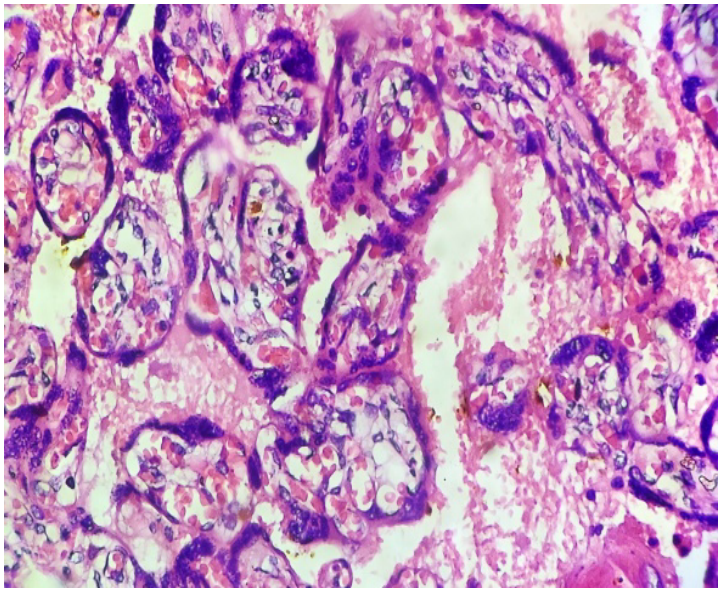

Figure 6: Chorangiosis (H&E 40x)

Necrosed villi (Figure 7):

In the present study 1 out of 10 (10%) cases of mild, 2 cases (40%) of moderate and 5 cases (71.4%) of severe PIH showed fibrinoid necrosis. This finding correlates with the study conducted by Narasimha A et al [2] and S Rajya Lakshmi et al [10]. The cause for fibrinoid necrosis is mainly due to the immunological reaction within the villous cytotrophoblastic tissue.

It was also postulated that pregnant women with toxaemia shows increased levels of serum antitrophoblastic antibodies.

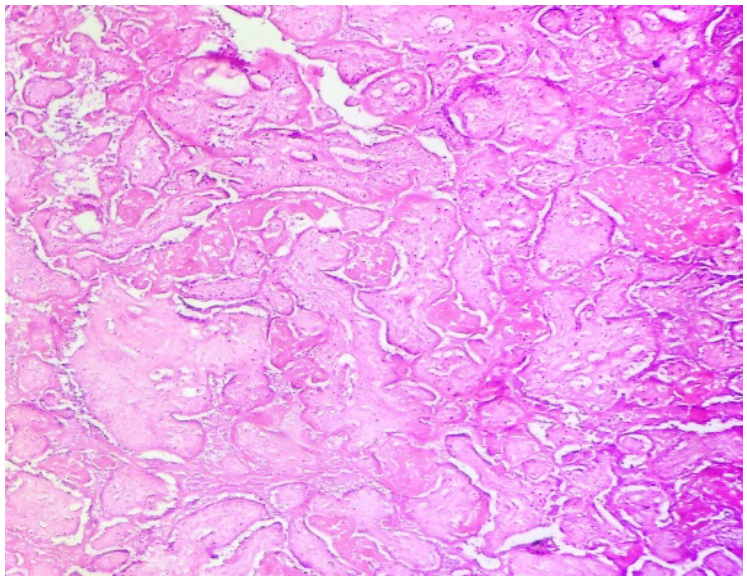

Figure – 7: Fibrinoid necrosis of villi (H&E 10X)

Concentric hypertrophy of blood vessels (Figure 8): In the present study, there was muscular hypertrophy of the arterial wall in 1 case of mild and 3 cases of severe PIH. The muscular walls of the affected vessels in the decidua parietalis were thickened, and there was marked luminal narrowing.

Mural hypertrophy is diagnosed when the mean wall diameter is greater than 30% of the overall vessel diameter.

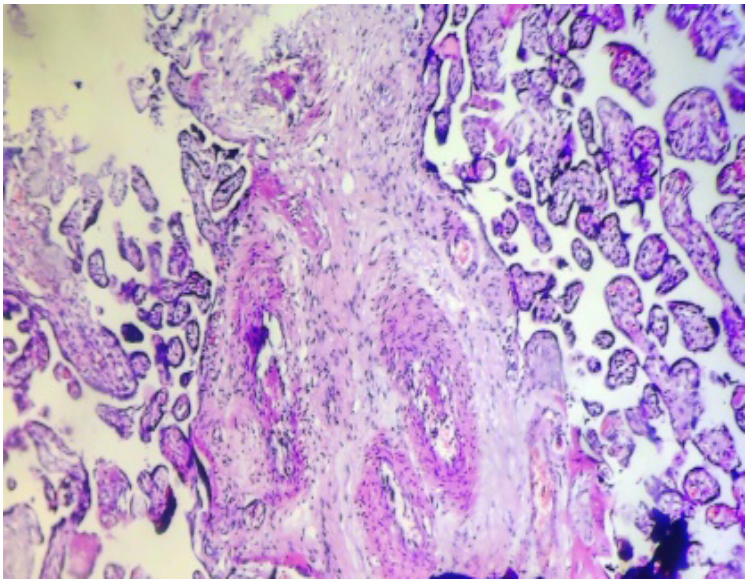

Figure 8: Concentric hypertrophy of blood vessels (H&E 10x)

Calcification (Figure 9): In the present study calcification was seen in 40% and 42.8% of moderate and severe PIH cases. The incidence of calcification in other studies were 26.9% and 60.5% (2,14); S Rajya Lakshmi et al have shown incidence of 31.2% and 42.8% in moderate and severe PIH[10]. Ahmed et al have shown an incidence of 15.38%, 30% to 50% in mild, moderate and severe PIH [11].

According to a study by Karun Jain, calcification was seen in 20% of PIH cases without IUGR and 41.37% in PIH cases with IUGR [13].

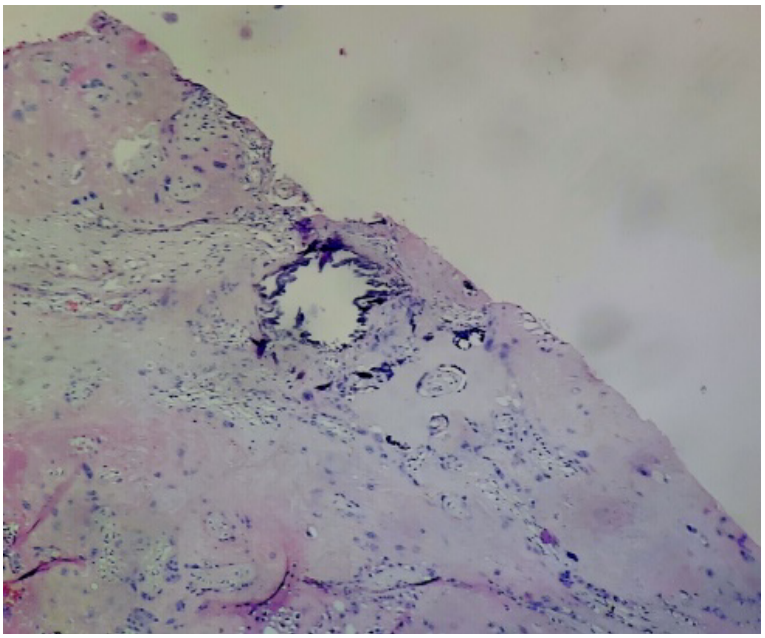

Figure 9: Calcification (H&E 10x)

Squamous metaplasia (Figure 10): The present study also observed squamous metaplasia of the membranes in one case of mild and severe PIH. Foci of squamous metaplasia are slightly elevated, sometimes targetoid, pearly-white macules that tend to be most numerous at the site of cord insertion; foci of squamous epithelium, with or without keratinization, have a sharp transition with the surrounding amnionic epithelium [8].

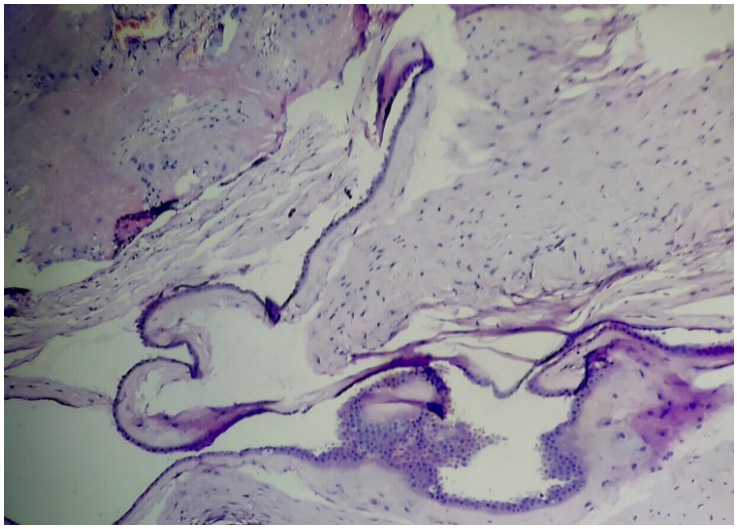

Figure 10: Squamous metaplasia of membranes (H&E 10x)

Limitations of the present study:

1. The correlation between placental lesions and severity of maternal hypertension was poor, probably because the sample size was small and a greater sample size could give a definite association of these lesions with pregnancy induced hypertension.
2. The co-morbid conditions associated with PIH were not taken into consideration in the present study. The contribution of these co-morbid conditions to placental histology needs to be determined.

Conclusion

From the present study it confirms that the pre-eclampsia and eclampsia adversely affects the histology of placenta. The severity of the pathological changes is increased with the degree of PIH. A statistically significant association between the microscopy and degree of PIH was seen in fibrinoid necrosis, chorangiosis and presence of increased syncytial knots. These findings are to be studied in association with the pathophysiologic processes to draw conclusions on the pathogenesis. The frequency of histological changes increased with the increasing severity of PIH.

Hence early detection and management of hypertension reduces foetal and maternal morbidity.

References

1. Udainia A, Jain ML. Morphological study of placenta in pregnancy induced hypertension with its clinical relevance. J Anat Soc India. 2001; 50:24–7.
2. Narasimha Aparna, Vasudeva DS. Spectrum of changes in Placenta in toxemia of pregnancy. Indian J Pathol Microbiol 2011:54 (1): 15-20
3. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al. editors. Williams Obstetrics. 24th ed. New York: McGraw Hill; 2014;728-70. PMid: 250258 71.
4. Bewly S, Cooper D, Campbell S. Doppler investigation of utero-placental blood flow resistance in the second trimester. A screening study for pre-eclampsia and intra-uterine growth retardation. Br J Obst Gynaecol. 1991; 98:871–9.
5. Stock MK, Anderson DF, Phernetton TM, McLaughlin MK, Rankin JH. Vascular response of the maternal placental vasculature. J Dev Physiol. 1980; 2:239–46.
6. Thomson AM, Billewickz, Hytten FE. Placenta in relation to birth weight. J Obstet Gynecol Br CW. 1969; 76:865–72.
7. Ogge G, Chaiworapongsa T, Romero R, Hussein Y, Kusanovic JP, Yeo L, et al. Placental lesions associated with maternal underperfusion are more frequent in earlyonset than in late-onset preeclampsia. J Perinat Med. 2011; 39(6):641-652. doi: 10.1515/JPM.2011.098.
8. Gersell DJ, Kraus FT. Diseases of the Placenta. In: Kurman RJ, Ellenson LH, Ronnett BM (Eds). Blaustein's Pathology of the Female Genital Tract. 6th ed. Springer 2011.
9. Agrawal A, Kumar K, Kumar S, Nayak S, Khushboo, Yadav N. Spectrum of placental changes in Toxemia of pregnancy: A case series study. Int J Clinic Obstet Gynaecol. 2017; 1(1):8-13.
10. S. Rajyalakshmi, Vani B S, Jijiya Bai P, Placental pathology in different degrees of pregnancy induced hypertension (PIH), Tropical Journal of Pathology & Microbiology,December, 2019/ Vol 5/ Issue 12 Print ISSN: 2456-9887, Online ISSN: 2456-1487
11. Ahmed M, Daver RG. Study of placental changes in pregnancy induced hypertension. Int J Reprod Contracept Obstet Gyneco.l 2013;

2(4):524-527. doi: 10.5455/2320- 1770.ijrcog 20131207.
12. Bar PK, Ghosh S, Gayen P, Mandal S, De A, Biswas A. Morphologixcal study of placenta in hypertensive disorders in pregnancy. Trop J Path Micro. 2019; 5(6):366-373. doi: 10.175 11/jopm. 2019. i6.06.
13. Jain K, Kavi V, Raghuveer CV, Sinha R. Placental pathology in pregnancy-induced hypertension (PIH) with or without intrauterine growth retardation. Indian J Pathol Microbiol. 2007; 50(3):533-537.
14. Mohan SR, Jyosna, Anil S, ChandraSekar S. Morphological changes in placentas of normal and high risk pregnancies-2 years study in MGM hospital. IAIM 2017; 4(5):61-78.
15. Manjunatha HK, KishanprasadHL, Ramaswamy AS, Aravinda P. Study of histopathological changes in placenta in pregnancy induced hypertension. Int J cur Sci Res 2012; 2(1):255-258.
16. Shanmugasam. K, Anandraj Vaithy, Rupal Samal, Uma Devi K. R, Sowmya. Histopathological study of placental changes associated with pre-eclampsia and eclampsia in a tertiary care centre of Puducherry. IP Archives of Cytology and Histopathology Research, January-March 2019; 4(1):57-60.