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Histomorphological Changes In Hypertensive Placentas And Its Correlation With Foetal Outcome

Dr. Geetanjali U. Yadgire[1], Dr. Shobha S. Rawlani[2], Dr. Anupama Sawal[3] ,

Dr. Deepali G. Vidhale[4]

[1]Assistant Professor, Department of Anatomy, Dr .Panjabrao Deshmukh Medical College , Amravati. geetu71yi@ gmail.com ,9922914787

[2]HOD & Professor, Department of Anatomy, Dr. Panjabrao Deshmukh Medical College Amravati. shobharawlani@rediffmail.com 9371547554

. [3]Associate Professor, Department of Anatomy Jawaharlal Nehru Medical College, Sawangi Meghe Wardha Datta Meghe Institute of Medical Sciences. anupamasawal05@gmail.com , 8888583371

[4]Associate Professor, Department of Anatomy, Dr. Panjabrao Deshmukh Medical College, Amravati. deepalividhale@gmail.com 9970022788

Corresponding Author:

Dr. Anupama Sawal , Associate Professor, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha. anupamasawal05@gmail.com ,8888583371

Abstract:

Placenta is an important organ which is necessary for the intrauterine growth of foetus.complications .due to Pregnancy like hypertension(PIH) affects the placenta and is the major factor to cause maternal & foetal death.

Objectives:1. To study the morphological and histological features of placenta in normal and hypertensive patients . 2.To Compare the two groups and study the correlation of their changes with the foetal outcome.

Material & Methods: 100 specimens of placentas of patients from normal as well as hypertensive group were collected from the labour room & operation theatre of Dept. of Obstetric & Gynaecology of Dr. Panjabrao Deshmukh Medical College and hospital, Amravati, Maharashtra .At first the gross features (morphological features) of placentas were observed.. To study the histology , sections from each placenta of size 5mm were taken. This was fixed in in 10% formal saline and further histological processing of the tissue was carried out.

Observations & Results: The gross morphological features like weight, size, surface area, number of cotyledons were reduced and areas of infarction, retroplacental clot, calcification were increase in hypertensive placenta than normal placenta. ($p<0.005$) Similarly, the histological features like increased syncytial knots, intravillous and intervillous fibrin

deposition, cytotrophoblastic proliferation, hyalinised villi, atherosis were observed in hypertensive placentas. These all changes were correlated with the foetal mortality and morbidity. And we observed that there was increase in foetal mortality and morbidity in hypertensive patients with the above histological changes in their placentas.

Key words –PIH (Pregnancy Induced Hypertension), Preeclampsia, placenta, syncytial knots, fibrin, villi, IUGR(intrauterine growth retardation), asphyxia .

Introduction:

Pregnancy is the important state of a woman's life**.** The placenta is the most vital organ interposed between mother and foetus which serves to maintain maternofoetal barrier for the exchange of blood gases, nutrients and waste products[1]. The 'placenta' promotes pregnancy and normal foetal development. Hence it is described as the 'mirror' of perinatal period[2].

Many studies indicate that hypertensive diseases in pregnancy are responsible for the complications in mother as well as foetus. Apart from preterm delivery and intrauterine growth retardation, the other deadly complications of preeclampsia are abruption of placenta, subcapsular haematoma of liver, cerebral oedema, renal failure, and thrombocytopenia and disseminated intravascular coagulation etc[3]. The placental insufficiency was the most attributable cause of foetal underperfusion and intra uterine growth retardation and was secondary to preeclampsia[4] Similarly there was higher incidence of the reduction in placental weight, volume and presence of placental infarction, retro placental haematoma and calcification in preeclampsia than control group and there were more foetal complications of hypoxia, low birth weight babies and still birth in preeclampsia as compared to the control group[4] .Lelia Duley in 2003, observed that preeclampsia was a major cause of perinatal mortality and morbidity [5].

The spiral arteries which are initially small muscular arteries dilate at the decidual end where they loose endothelium, smooth muscle and inner elastic lamina. Due to this, they loose the power to constrict with the response to the neural signals[6]. Thus, the spiral arterioles are remodeled into the dilated inelastic tubes This vascular growth is compromised in preeclampsia and intrauterine growth retardation[7]. ROS (reactive oxygen substrate) associated placental damage, placental nitrification of proteins is noted in preeclampsia and intrauterine growth retardation[8]. In addition in PE, the intervillous fibrin deposition and infarction critically reduce the flow of nutrients from mother to foetus leading to Intrauterine growth retardation. Thus IUGR i. e. Intrauterine growth retardation occurs as a result of failure of angiogenic changes and formation of terminal villi [9] . The present study is planned to meet the demands for exploring the various histomorphological changes in placentas of the hypertensive patients so as to correlate them with the adverse pregnancy outcome.

Materials and methods:

The placentas were collected from the labour room and operation theatre of Department of Obstetrics and Gynaecology The gross features of the placentas such as weight, size, infarction, calcification or any retro placental clot were noted. Foetal gross observation done and following findings noted like APGAR score(score which gives prognosis of newborn depending upon the breathing, colour of the body, activity of the newborn) birthweight ,reflexes, maturity etc.

Histological Techniques: For histological study, biopsies were taken from the centre as well as from the peripheral part of each placenta **Fixation:** Tissues of 5mm size were fixed in 10% formal saline for 7 days. The steps followed were - 1] Dehydration 2] Clearing 3] Wax Impregnation .

Section Cutting: The back surface of the block was slightly heated and then mounted on microtome chuck & 5-7 micron thick sections were cut.

Staining: Following stains were used for the present study
i) Haematoxylin and Eosin (H&E Stain) ii) Masson's Trichrome Stain

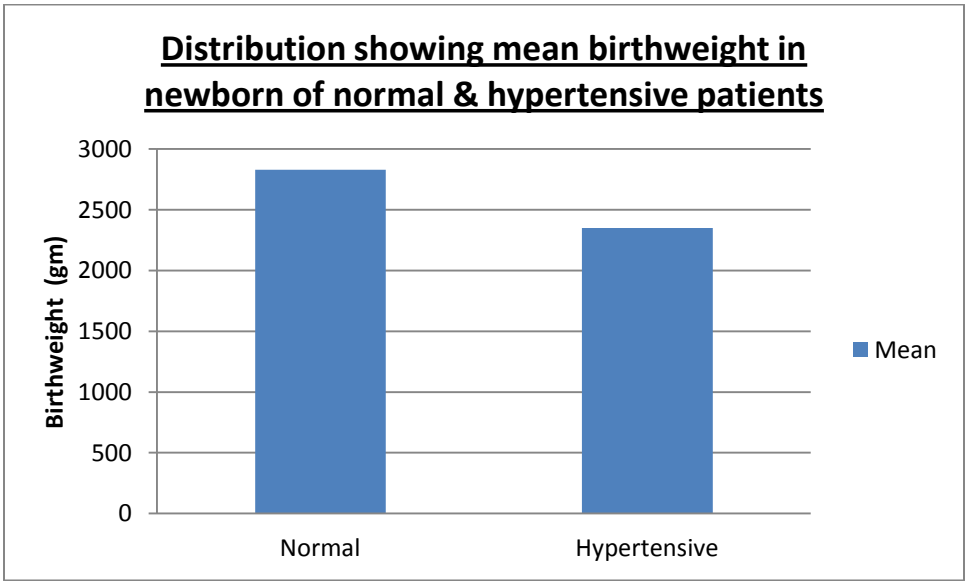
Observations and results:

Observations of Gross Findings-

When we studied the morphology of placenta, we recorded the size i.e. diameter (cm) and weight (gm) of placenta and we observed that in both the parameters, the values were lower in the hypertensive group as compared with the normal. With average diameter of placenta as 18.13 cm in normal and 16.23cm in hypertensive group.

Similarly weight of placenta was average 469.60gm for normal and 388.60gm for hypertensive group. Both these parameters were having **significant p value**.

In **normal** patients **22%** of newborn were below 2500 gm while **in hypertensive group 67%** of the newborns were having birth weight of less than 2500 gm i e intrauterine growth retardation.

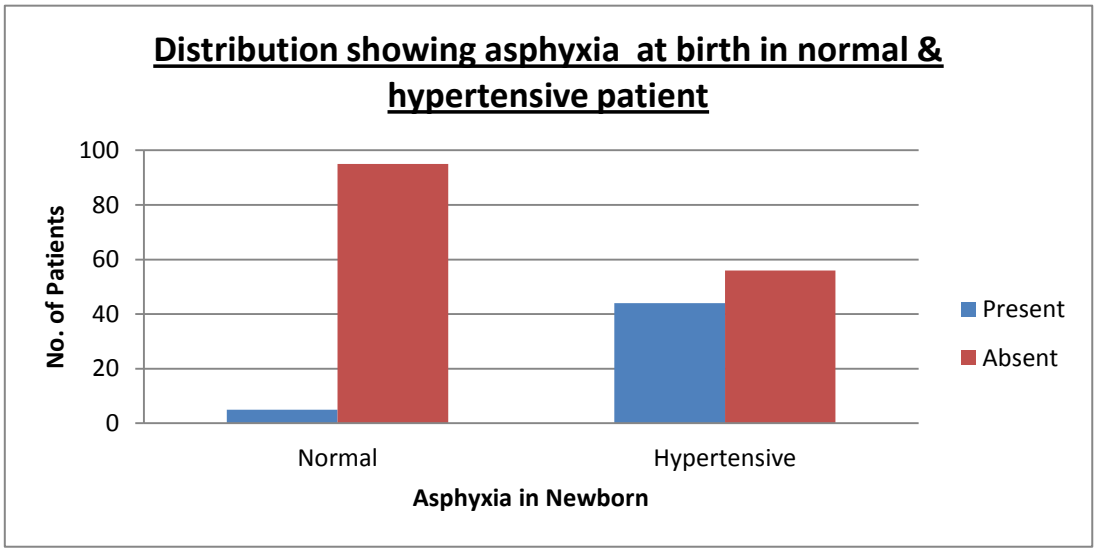


Observed difference was statistically significant.

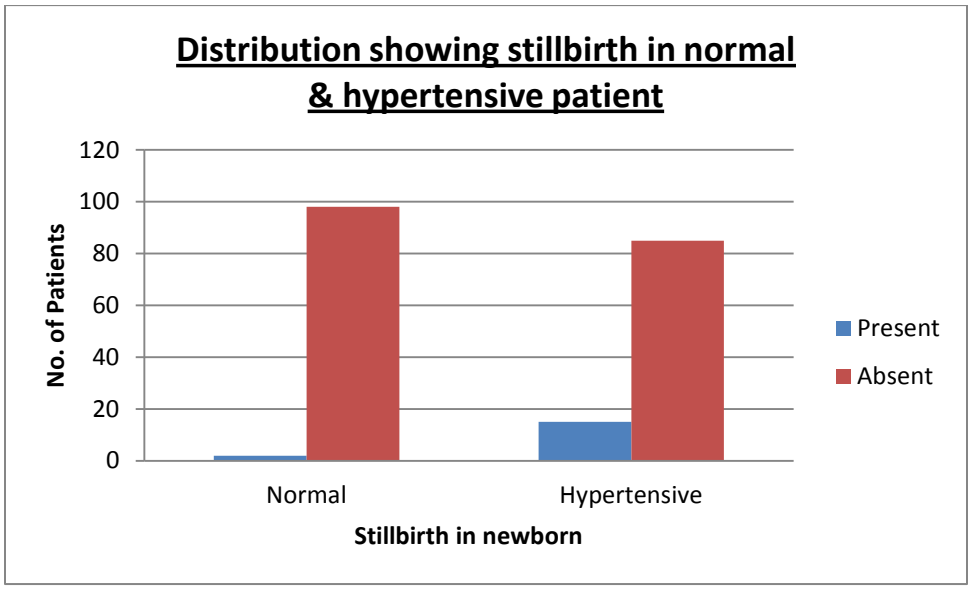
We observed that no. of babies with **asphyxia in normal** patients was only **05%** and in **hypertensive** patients was **44%**. And p value was statistically significant

Distribution showing asphyxia at birth in normal & hypertensive patient

Chi square test =39.03 P value = 0.0001
Observed difference is statistically highly significant



Inourstudy ,there were only **2% stillbirth babies in normal** patients & **in hypertensive** patients no. of stillbirth babies were **15%** here also the p value was stastisticaly significant .

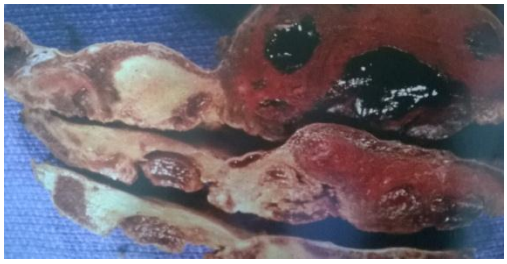


Observed difference is statistically highly significant.

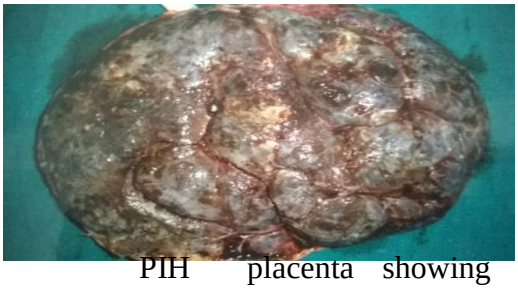
In normal patients 91% patients had central insertion of cord and eight% patients had eccentric insertion of cord and 1% only with marginal insertion .While in hypertensive patients there were 80% placenta with central insertion of cord, 2% with eccentric and 18% with marginal insertion. There was only one% patient with retroplacental clot in the normal group and in hypertensive group there were 14 %patients with retroplacental clot.

Small atrophic placenta of PIH.

Placenta showing area of retroplacental hematoma .



Cut sections of placenta with areas of infarction



PIH placenta showing areas of calcification

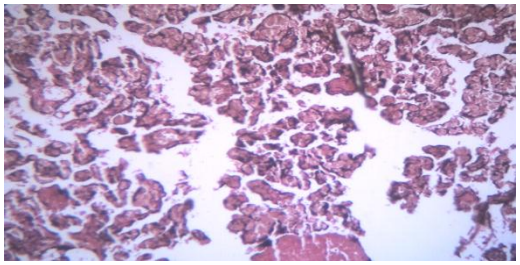
Only **4%** patients in **normal** group had areas of infarction on placenta while there were **44% patients in hypertensive** group who were having infarction on placenta. In our study, 33 out of 100 patients were having calcification in normal while , there were 47out of 100 patients in hypertensive group with calcification of placenta Observed difference for all the above findings was statistically highly significant.

Observation - Histological findings :

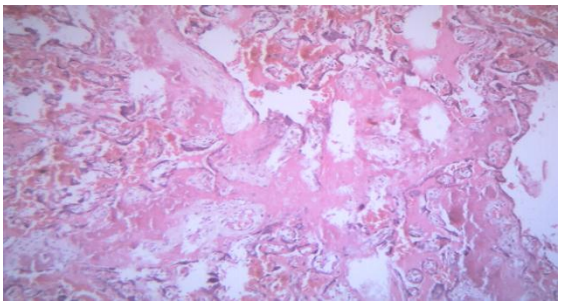
In control group of placentas, it was worth noting that the outer layer of the placental villi contained thinned out syncytiotrophoblastic lining. Their cytoplasm was distinctly basophilic In T.S. there was thinning of syncytium with evident vasculosyncytial membrane Intervillous fibrin deposit was seen and it was scanty. The amount of collagen in the villi was variable and abundant in some areas and were well stained (blue) by Masson's Trichrome. Some of the villi showed intervillous fibrin deposits.There was fibrosis of the villous stroma and sclerosis of the foetal vessels and the trapped villi appeared as isolated fibrous blobs in a mass of fibrin and showed hyalinised type of villous stromal appearance . So there were increased number of avascular and hypovascular villi. Some of the villi were sclerosed with structural distortion and were referred to as **'Ghost villi'**.

There were changes in the intimal or endothelial layer as degeneration and deposition of cholesterol laden macrophages (fatty infilteration) .The change was called as **atherosis**.

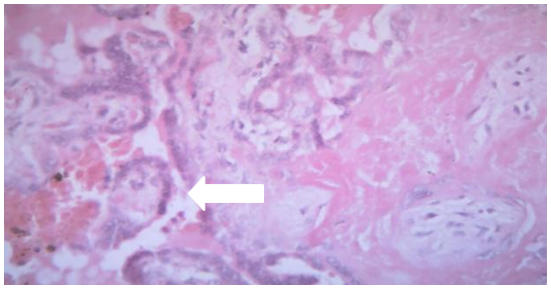
Some villi showed abundant collagen deposition .The foetal blood vessels in these villi in hypertensive placentas showed thrombosis in lumen , fibrinoid infiltration in the wall. Mean no of **Syncytial knots** in normal and hypertensive was 42.68 and 112.34 respectively .



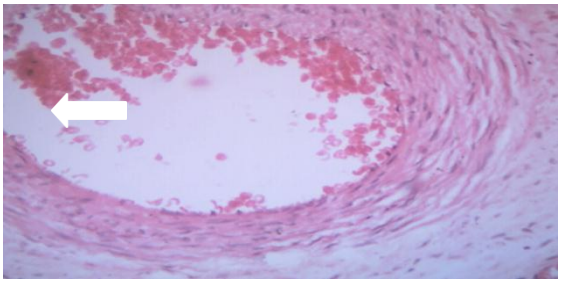
PIH placenta showing Excessive syncytial knots.



PIH placenta showing hyalinization of villi



PIH Placenta absence of vasculosyncitial membrane



atherosis seen in decidual vessel Endothelial degeneration

Paucity of Vasculosyncitial membrane was found 16% in normal and 92% in hypertensive placenta respectively.

Excessive fibrin deposition i e 12% and 93% **perivillous fibrin** was found in normal and hypertensive placentas respectively **Infarction** was observed in 19% in hypertensive and X cells were observed 48% in hypertensive placentas.

Hyalinised villi were 43% in hypertensive and 8% in normal placentas. **Atherosis** was present in 42% in hypertensive group with intimal or endothelial layer as degeneration and deposition of macrophages.

Discussion :

There have been various studies in the past revealing the correlation of placental weight and the birth weight to the pregnancy induced hypertension and the associated perinatal mortality and morbidity. Stillbirth was observed a common adverse outcome of hypertensive pregnancy .Many authors have also studied that there was significant weight reduction in the foetus i. e **. Intrauterine growth retardation** (IUGR) as well as in the placenta in hypertensive pregnancies. The reduction in placental morphological parameters might be the reason for the reduction in baby growth in preeclampsia[10]. The changes like fibrinoid necrosis, paucity of vasculosyncytial membrane, trophoblastic membrane thickening were all directly proportional to severity of PIH and the perinatal outcome was worse with increasing severity of PIH[11] .

Gross Findings:

Figen Barut And Aikut Barut mentioned that **placental weight**(wt) in normal patients was 508 gm and 404gm in hypertensive patients. It was 291 gm in hypertensive patients and 573 gm in normal patients as was found by S. kotgiwar and N. Ambiye [12]. K. devishankaran [13] & Vissiellekki kressie[3] found the weight of placenta in mild PIH was 427gm and in severe PIH was 374gm . According to Thomson et al in 1969, birth weight of foetus and weight of the placenta, both were below average in preeclampsia but their ratios were slightly increased [14]. In our study it was 388gm for hypertensive patients and 469gm for normal patients.

3. 5 % **mean areas of infarction** were observed in normal placentas while 17. 4 %were the mean areas of infarction in hypertensive placentas as studied by Dr Pradeep Londhe [15]. The areas of infarction in normal and hypertensive patients were respectively 3.77 % and 16 .5% acc to Mujumdar S. and H. Dasgupta [16]. In our study in normal patients areas of infarction were 4% and in hypertensive patients were 44% . Fox in 1964 found 24.6% calcification in normal group[17].With **significant "p" value**, Pushpa Goswami [18] et al in 2012, found that mean number of calcified areas of placentas in PIH were more than those found in normal patients. Our findings were nearly similar with the above findings.

Histological findings :

Syncytial knots found in normal patients were 9 and in hypertensive patients were 27 acc to study by H. Dasguta. Acc to Pooja Dhabai, in nornal patients syncytial knots were 6 and in hypertensive patients were 23 i.e . almost three times [19] . Acc. to K. Devishankar and Sreechitrakarta [20], there was 2 to 3 fold rise in syncytial knots in hypertensive placentas as compared to normal patients. Ambedkar Raj [21]observed more than 30% syncytial knots in hypertensive than normal patients [21] .In our study, it **was 42 syncytial knots in normal** patients **and 112 in hypertensive** patients .

In our study , the **intervillous fibrin** deposition largely replaced the degenerated trophoblastic lining Dasgupta H. found 33 % more areas of fibrinoid necrosis in hypertensive patients than in normal patients . Pooja Dhabai found 296 areas of fibrinoid necrosis in normal patients and 696 areas in hypertensive patients .Similarly , Sreechitrakartha found 2% areas of fibrinoid necrosis in normal patients and 19% in hypertensive patients.Ambedkar Raj found 5% rise in such areas of fibrinoid necrosis in every field. Maham Aklaq observed 40% areas of fibrinoid necrosis in normal patients and 84% in hypertensive patients[22]. Zhang P. et al in 2006,observed the mean 0f 2.96 +-3.52 areas of fibrinoid necrosis in normal and 6.26 +-2.8 in PIH which was significant [23] . Pandure and Ghosh D.K. in 2011, reported 33.34% of placentas to have fibrinoid necrosis [24] . In our study we got **12% areas of fibrinoid necrosis in norma**l patients and **93% in Hypertensive** patients. It was observed that the poor pregnancy outcome due to poor perfusion of villi, was attributable to the cause like increase in fibrin deposit .

Acc. to Pooja Dhabai, 0.26 were **hyallinised villi** in normal patients and 5.7 were in hypertensive patients.Sreechitrakartha found 5 % hyallinised villi in normal patients and 27 in hypertensive patients. Maham Aklaq found 6% hyallinised villi in normal patients while 40% in hypertensive patients and our findings were sinilar as 8% in normal patients and 43% in hypertensive patients. S.Kotgiwar and M. Ambiye found that there was perivillous fibrin deposition in 16% of vill in PIH patients .This perivillous fibrin deposition in intervillous space was the result of thrombosis of maternal blood as observed by Malik, et al and Mirchandani, et al [25].

In our study in cases of PIH placentas especially in cases of abruption placenta (retroplacental clot) the blood vessels in the basal plate were congested and infiltration of cytotrophoblasts in the vascular wall was noted. Reda Awadallah SALEH[26] in 2008, observed the villi showing **endothelial degeneration** and the **atheromatous plaque** formation were more common in PIH and were present in significantly more value [26].

Such changes in chorionic villi which **affected interchange of material** between mother and foetus leading **to low APGAR score** increased perinatal mortality and morbidity .

Summary :

Our study was aimed to correlate the histological and morphological changes of the PIH placentas with the perinatal outcome and also comparison with those of the normal group. The birth weight. of newborn in hypertensive group was on lower side than those in the normal group and the APGAR score was also lower than normal and was statistically significant The retroplacental haematoma , areas of infarction and calcification were noted in more no. in placentas with history of PIH than in normal group. In the histological study, **syncytial knots** were found to be more in the PIH group than in normal group and the observed difference was **statistically highly significant. (P< 0.0001).** Increased **fibrin deposits** were due to poor circulation in the intervillous space which was found statistically highly significant. (P<0.0001).

Cytotrophoblastic proliferation and X cells was a response to ischaemia to replace the damaged syncytiotrophoblast in ischemic placentas. This was statistically highly significant. (P< 0.0001).This ischemia was responsible for the resultant insult to the foetus in the form of poor birth weight or birth asphyxia . Low birth weights of babies in cases of PIH were possibly due to changes in chorionic villi which affected interchange of material between mother and foetus leading to low APGAR score increased perinatal mortality and morbidity. **Various histological changes leading to** poor perfusion of villi like increase fibrin deposit, thickening of basement membrane of the chorionic villi, cytotrophoblastic hyperplasia, paucity of vasculosyncytial membrane, atherosis in decidual arteries were the probable factors leading to poor pregnancy outcome in PIH.

Definitely all the above observations lead to the conclusion that the **intranatal and perinatal asphyxia is increased in hypertensive** pregnancies due to the various histological and gross changes occurring in placentas of hypertensive patients

So all these changes, **increase the morbidity and mortality of the foetus** is due to the reduction in blood vascularity of the villi and poor perfusion of the foetus

Knowing that placenta is the mirror image providing a wealth of information on the antenatal events ,it is very important to have examination of placenta adequately after delivery as a routine .

References:

[1] FOX H. Foeto-placental function: its nature and assessment. The histopathology of placental insufficiency. J Clin Path Suppl (Roy Coll Path . 2010 ; 29 : 1-8.
[2] Udainia A , Jain ML . Morphological Study of Placenta in Pregnancy Induced Hypertension With its Clinical Relevance. J Anat Soc India . 2001; 50(1): 24-27.
[3] Krielessi, V , Papantoniou N , Papageorgiou I , Chatzipapas I , Efstathios M, Zakopoulos N ,et al. Placental Pathology and Blood Pressure's Level in Women with Hypertensive Disorders in Pregnancy Obstetric and Gynaecology International Volume. 2012;ArticleID684083:1-6. doi:10.1155/2012/684083.
[4] Navbir P. Placental Morphology And Its Correlation With Foetal Outcome In Prgnancy-Induced Hypertension . International Journal of Basic and Applied Medical Sciences. 2012 September-December;2 (3):120-125.
[5] Duley L. Pre-eclampsia and the hypertensive disorders of pregnancy. British Medical Bulletin. 2003; 67: 161–176. DOI: 10.1093/bmb/ldg005.
[6] Roberts JM and Escudero C . The placenta in preeclampsia. Pregnancy Hypertens. 2012 April 1; 2(2): 72–83. doi:10.1016/j.preghy. 2012.01.001.
[7] Mayhew T M . A stereological perspective on placental morphology in normal and complicated pregnancies. J Anat 2009;215:77–90. doi: 10.1111/j.1469-7580.2008.00994.x
[8] Seth Guller. Role of the syncytium in placenta-mediated complications of preeclampsia. Thromb Res.2009 September; 124(4):389–392. doi:10.016/ j.thromres.2009.05.016.
[9] Barut F, Barut A, Gun B D, Kandemir NO, Harma M I, Harma M, et al. Intrauterine growth restriction and placental angiogenesis. Diagnostic Pathology. 2010; 5:24-30.
[10] Bhavina K , Sundara Pandian S , Priya G. A study on morphology of placenta and umbilical cord in Hypertensive pregnancy with and without Proteinuria. Journal IJBAR 2013;04(01):50-54. DOI:10.7439/ijbr.
[11] Kurdukar M D , Deshpande N M , Shete S S , Zawar M P. Placenta in PIH . Indian J Pathol Microbiol . 2007 Jul; 50(3): 493-7.
[12] Kotgiwar S, Ambiye M, Athawale S, Gupta V, Trivedi S. Study Of Gross And HistologicalI Features Of Placenta In Intrauterine Growth Retardation .j.Anat. Soc India. 2011; 60(1): 37-40
[13] Devi Sankar K , Bhanu P S , Kiran S , Ramakrishna B A and Shanthi V. Vasculosyncytial membrane in relation to syncytial knots complicates the placenta in preeclampsia: a histomorphometrical study. Anat Cell Biol. 2012 Jun; 45(2): 86–91.
[14] Thomson A M, Billewicz W Z and Hytten F E. The weight of the placenta in relation to birth weight .The Journal of Obstetrics and Gynecology of the British Common Wealth.1969; 76(10) : 865- 871.
[15] Londhe PS, Mane AB. Morphometric Study Of Placenta And Its Correlation In Normal And Hypertensive Pregnancies . International Journal of Pharma and Bio Sciences. 2011 Oct-Dec; 2(4): 429-437.
[16] Majumdar S, Dasguptha H, Bhattacharya K, Bhattacharya A. A study of placenta in normal and hypertensive pregnancies. J Anat Soc India 2005;54:34-8.
[17] Fox H. Calcification Of The placenta. Journal of Obstetrics and Gynaecology.1964;(1-6):759-765 j

[18] Goswami P , Lata H , Memon S , Khaskhelli L B .Excessive Placental Calcification Observed in PIH Patients and its Relation To Fetal Outcome. JLUMHS September-December 2012;Vol11 No.03:143-148.
[19] Dhabhai P , Dr Gupta G , Dr Bapna N . Histological Study Of Human Placenta In Normal And Pregnancy Induced Hypertension (PIH) Cases. International Journal of Pharmaceutical Science Invention .2013 November; 2 (11):30-35.
[20] Kartha S , Poothiode U, Jayalakshmy P S . Placental Pathology In Pregnancy Induced Hypertension. Journal of Evolution of Medical and Dental Sciences.2014August;3(35):9272-9278.DOI:10.14260/ jemds/ 2014/3197.
[21] Ambedkar R K ,. Srinivasamurthy B C , Murugan A and Mutharasu A.. Morphology and Morphometric Study of Human Placenta in Rural Southern India. British Journal of Medicine & Medical Research. 2014;4(15): 2995-3008.
[22] Akhlaq M , Nagi A H , Yousaf A W. Placental morphology in pre-eclampsia and eclampsia and the likely role of NK cells. Indian J Pathol Microbiol. 2012;55:17-21.
[23] Zhang P , Schmidt M , Cook L . Maternal vasculopathy and histologic diagnosis of preeclampsia: poor correlation of histologic changes and clinical manifestation. American Journal of Obstetrics & Gynecology. 2006 Apr; 194(4):1050–6. [PubMed: 16580295]
[24] Pandure M M, Ghosh D K . Morphology Of Preterm Placenta And It's Clinicopathological Correlation Pravara Med Rev 2011;3(2):4-10.
[25] Mirchandani J, Mallik G, Chitra S. Villous fibrinoid necrosis and basement membrane thickening in toxemia of pregnancy and in intrauterine growth retardation. J obstet and Gynecol India. 1978; 29: 805-10.
[26] Saleh R A , D Khil Mohamed A M . Structural Changes of Placenta in Preeclamptic Patients: Light and Electron Microscopic Study. Turk J Med Sci 2008; 38(3):219-225.