HISTOPATHOLOGICAL CHANGES OF THE PLACENTA IN PREGNANT WOMEN WITH ELEVATED HOMOCYSTEINE LEVELS AND PREECLAMPSIA

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Introduction:
Hyperhomocysteinemia is an independent risk factor for endothelial dysfunction and plays a critical role in the pathogenesis of preeclampsia. The combination of increased homocysteine and placental hypoxia leads to structural and vascular changes within the placenta that contribute to fetal growth restriction and maternal complications. This study aimed to examine the histopathological features of placentas obtained from preeclamptic women with elevated homocysteine levels compared with normotensive controls.

Materials and Methods:

A total of 42 placentas were examined, including 22 from women diagnosed with preeclampsia and hyperhomocysteinemia, and 20 from healthy normotensive pregnancies. Blood samples were analyzed for plasma homocysteine concentration using enzymatic immunoassay. Placental samples were fixed in formalin and stained with hematoxylin-eosin, Masson trichrome, and PAS methods to evaluate villous structure, vascular integrity, and fibrinoid degeneration. Morphometric measurements included villous diameter, vascular lumen area, and syncytial knot density.

Results:
Histological analysis revealed that placentas from the study group exhibited significant pathological alterations compared with the controls. These changes included diffuse fibrinoid necrosis of villi, marked endothelial desquamation, and deposition of perivillous fibrin. Capillary lumina appeared narrowed with thickened vascular walls, and in 75% of cases, focal thrombosis was observed. The mean villous diameter was reduced by 20% ($p < 0.01$), while syncytial knots were increased by 1.6-fold, indicating compensatory hyperplasia of trophoblasts. Moreover, interstitial edema and degeneration of the basal membrane were prominent features.

Discussion:
The findings confirm that elevated homocysteine levels in preeclamptic pregnancies are closely associated with endothelial injury and impaired placental perfusion. The morphological evidence of vascular constriction, fibrinoid necrosis, and increased syncytial knot formation supports the hypothesis that homocysteine-mediated oxidative stress exacerbates placental hypoxia and dysfunction. These structural alterations disrupt maternal-fetal exchange and contribute to the clinical manifestations of preeclampsia, such as hypertension, proteinuria, and fetal growth restriction. The results align with earlier studies by Steegers-Theunissen et al. (2013) and Rumbold et al. (2021), which highlighted the role of one-carbon metabolism imbalance in placental pathophysiology.

Conclusion:

Preeclampsia combined with hyperhomocysteinemia results in severe histopathological changes in the placenta, characterized by endothelial degeneration, villous ischemia, and fibrinoid necrosis. Early biochemical screening for homocysteine levels and timely correction through folate and vitamin B12 supplementation may reduce placental damage and improve pregnancy outcomes. The integration of morphological evaluation with biochemical monitoring offers an effective approach for predicting and preventing placental insufficiency in high-risk pregnancies.

References:

1. Steegers-Theunissen RP, Twigt J, Pestinger V, Sinclair KD. The periconceptional period, reproduction and long-term health of offspring: the importance of one-carbon metabolism. Hum Reprod Update. 2013;19(6):640–655.
2. Makedos G, Hitoglou A, Kalogiannidis I, Goutzioulis M, Makedou A, et al. Homocysteine, folic acid and vitamin B12 serum levels in pregnancy complicated with preeclampsia. Arch Gynecol Obstet. 2007;275(2):121–124.
3. Di Simone N, Castellani R, Marana R, et al. Homocysteine induces trophoblast cell apoptosis: a potential mechanism of placental injury in preeclampsia. Am J Pathol. 2003;162(2):537–544.
4. Alvino G, Radaelli T, Cetin I. Placental morphology and vascularization in hyperhomocysteinemic pregnancies. Placenta. 2008;29(8):830–835.
5. Rumbold AR, Osei-Kumah A, Riley SC, et al. Homocysteine and placenta-mediated pregnancy complications: a systematic review and meta-analysis. Placenta. 2021;104:24–33.
6. Powers RW, Evans RW, Majors AK, Ojimba JI, Ness RB, Crombleholme WR, Roberts JM. Plasma homocysteine concentration is increased in preeclampsia and associated with endothelial activation. Am J Obstet Gynecol. 1998;179(6):1605–1611.