

Expression of Type IV Collagen in The Placenta in Undifferentiated Displasia Connecting Tissue

Smirnova Tatyana Lvovna¹, Sharapova Olga Viktorovna^{2,3}, Gerasimova Liudmila Ivanovna^{2,4}, Zhuravleva Nadezhda Vladimirovna¹, Sidorov Anatoly Evgenievich¹, Yastrebova Svetlana Alexandrovna¹, Romanova Lyubov Petrovna¹ and Denisova Elena Alekseevna¹



¹Internal Medicine Department of the Federal State Budgetary Educational Institution of Higher Education "Chuvash State University named after I.N. Ulyanov", 428017, Chuvash Republic, Cheboksary city, Moskovsky prospect, 45, Russia

²State Budgetary Healthcare Institution "City clinical hospital of Vinogradov V.V." of the Healthcare Department of Moscow, 117292, Vavilova street, 61, Moscow, Russia

³Medical Institute of Continuing Education of Federal State Budgetary Educational Institution of Higher Education "Moscow State University of Food Production", 125080, Volokolamskoe highway, 11, Moscow, Russia

⁴Institute of Clinical Medicine of Federal State Autonomous Educational Institution of Higher Education I.M. Sechenov First Moscow State Medical University of the Ministry of Healthcare of the Russian Federation (Sechenovskiy University), 119435, Bolshaya Pirogovskaya st., 2, build.4, Moscow, Russia

***Corresponding author:** Gerasimova Liudmila Ivanovna, head of the educational and methodological office of the State Budgetary Healthcare Institution of the city of Moscow "Vinogradov City Clinical Hospital of the Moscow Department of Healthcare", address: 117292, Vavilova st., 61, building, Moscow, Russia

ARTICLE INFO

Received: 📅 November 04, 2022

Published: 📅 November 14, 2022

Citation: Smirnova Tatyana Lvovna, Sharapova Olga Viktorovna, Gerasimova Liudmila Ivanovna, Zhuravleva Nadezhda Vladimirovna, Sidorov Anatoly Evgenievich, et al. Expression of Type IV Collagen in The Placenta in Undifferentiated Displasia Connecting Tissue. Biomed J Sci & Tech Res 47(1)-2022. BJSTR. MS.ID.007453.

ABSTRACT

In the preparations of women in childbirth with undifferentiated connective tissue dysplasia, positive structures to type IV collagen were revealed. A pronounced immunopositive reaction (+++) was observed by us in the subendothelial layer of the vessels of the chorionic villi, the stroma of the villi and cells. The area of expression of type IV collagen in women in the control group was $1363.9 \pm 14.9 \mu\text{m}^2$. The expression of type IV collagen significantly ($p \leq 0.05$) increased in women with connective tissue dysplasia syndrome - $3824.16 \pm 16.9 \mu\text{m}^2$.

Keywords: Type IV Collagen, Placenta, Undifferentiated Connective Tissue Dysplasia, Pregnancy, Immunohistochemistry, Stroma, Chorionic Villae

Introduction

Collagens are the main proteins of the extracellular matrix, and collagen fibrils form structures that resist stretching. There are 12 types of collagens known. Collagens are made up of three chains, which are very rich in glycine and proline. The role of proline is to stabilize the helical conformation of the strands, while glycine allows the coiled strands to adhere tightly to each other. Collagen contains nonessential amino acids and very small amounts of methionine, tyrosine, histidine. Collagen contains almost no tryptophan and cysteine. In addition to collagen fibers, glycosaminoglycans are present in the intercellular substance of the connective tissue: proteoglycans and glycoproteins, which are synthesized by mast cells. Mast cells synthesize heparin. Collagen synthesis is provided by connective tissue fibroblasts. The maturation of synthesized collagen includes 2 stages: intracellular and extracellular. Collagen breakdown occurs slowly, under the influence of metalloproteinase: Ca^{2+} , Zn^{2+} -dependent collagenase breaks down the bonds within the collagen molecule, then the proteins are denatured and are influenced by proteolytic enzymes. In the intercellular substance, collagen binds to fibronectin; however, fibronectin itself can bind to cells and heparin. When collagen breaks down, hydroxyproline is formed, the amount of which can increase with accelerated breakdown and disruption of biosynthesis, development of fibrosis and collagenases.

Collagen type IV is the main component of basement membranes. The function of type IV collagen is to maintain tissue structure during embryogenesis, remodeling, and regeneration. The type IV collagen molecule is a ligand for integrins, receptors on the cell surface, providing cell adhesion, migration, and differentiation. Collagen provides tissue strength, cell adhesion and cell proliferation. Biosynthesis of type IV collagen occurs in all structures of the placenta already at the early stages of development of the placental

complex: cytotrophoblast, decidual cells, endometrial stromal cells, vascular wall cells Autio-Harminen H, et al. [1]. We have not found any studies aimed at studying the immunoeexpression of type IV collagen in undifferentiated connective tissue dysplasia in the literature.

Purpose of the Study: to identify the expression of type IV collagen in the placenta of puerperal with undifferentiated connective tissue dysplasia.

Materials and Methods

The study included 120 women with undifferentiated connective tissue dysplasia and 100 women with physiological pregnancy. An immunohistochemical study of the placenta of puerperal for type IV collagen was carried out. Placenta sections were fixed in buffered 10% formalin. Immunohistochemical reactions were carried out according to a special technique with antigens unmasking in a microwave oven on serial paraffin sections. From paraffin blocks, histological sections with a thickness of 5 μm were prepared, which were fixed in glass, previously coated with an adhesive (APES-acetone). Endogenous peroxidase was blocked with 3% hydrogen peroxide solution in dewaxed sections. Antigen unmasking was carried out in an oven for 20 minutes at 600 V in a dissolved citrate buffer with pH 6.0. Rabbit polyclonal antibodies specific to type IV collagen (Imtek, Russia) were used as primary specific antibodies. A universal kit containing a conjugate of horseradish peroxidase with sheep antibodies specific to rabbit IgG, IgA, IgM (Imtek, Russia) was used as secondary antibodies. The results of the immunohistochemical picture were assessed qualitatively (Figures 1&2). Systemic morphometric analysis of histological preparations was performed using the hardware-software complex «Video-Test Morphology 5.0».

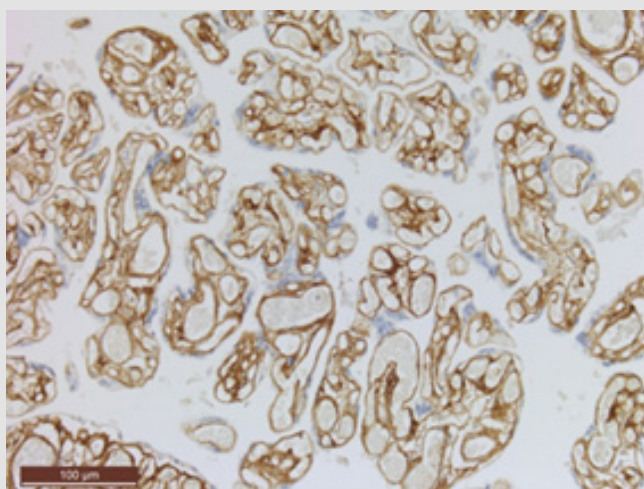


Figure 1: Type IV collagen in the placenta during the physiological course of pregnancy (immunohistochemical method, magnification $\times 400$).

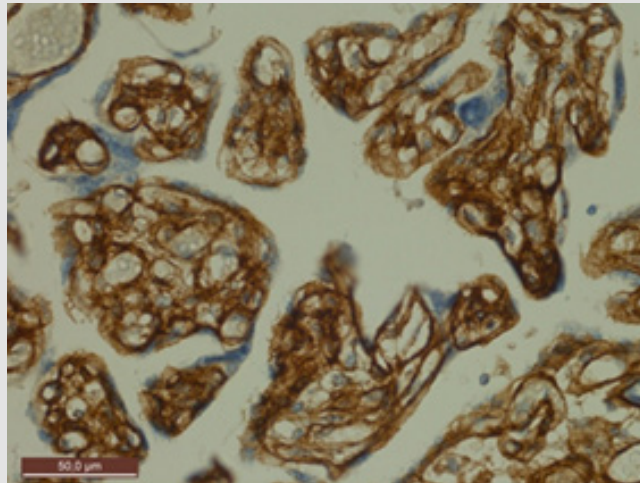


Figure 2: Expressed expression of type IV collagen in the placenta in connective tissue dysplasia (immunohistochemical method, magnification $\times 400$).

Research results

When staging an immunohistochemical reaction on sections of the placenta of puerperas, we found structures that were immunopositive to type IV collagen. In the placenta of women in childbirth with the physiological course of pregnancy, a moderate histochemical reaction was noted in the subendothelial layer of the vascular walls of the chorionic villi. Chorionic villus stroma and fibroblasts are immunopositive to type IV collagen. In the placenta preparations of women in childbirth with undifferentiated connective tissue dysplasia, positive structures to type IV collagen were also revealed. A pronounced immunopositive reaction (+++) was observed by us in the subendothelial layer of the vessels of the chorionic villi, the stroma of the villi and cells.

We have calculated the area of expression of immunoreactive structures. The area of expression of type IV collagen in women in the control group was $1363.9 \pm 14.9 \mu\text{m}^2$. The expression of type IV collagen significantly ($p \leq 0.05$) increased in women with connective tissue dysplasia syndrome - $3824.16 \pm 16.9 \mu\text{m}^2$.

Discussion

The study of the peculiarities of the course of pregnancy and the state of the placenta in the experimental model of the Ehlers-Danlos syndrome showed a decrease in the mass of the placenta, a change in the vascular structure, the phenomenon of ischemia and necrosis. Using the method of electron microscopy, it was found that the basement membranes of the capillaries of the villi have an abnormal structure Yoshizawa T, et al. [2].

Through platelets, collagen indirectly affects cells, vascular permeability, blood coagulation factors and immunity. Collagen enhances platelet aggregation and induces platelet aggregation in vascular damage. It was found that platelets have three receptors

for collagen: the indirect GP1b glycoprotein for initial engagement, the GP VI glycoprotein for activation, and $\alpha 2\text{b}1$ glycoprotein for full adhesion. In the process of platelet aggregation under the influence of collagen, ATP, ADP, serotonin, and other mediators are released, which enhance the proliferation of fibroblasts and smooth muscles. Collagen binds to the C1 and C3 components of the complement, promoting leukocyte chemotaxis. In clinical studies, weak expression of type I collagen in the wall of endometrioid ovarian cysts, moderate expression of type III collagen in the diffuse aspect of the stroma and cytoplasm of fibroblasts of the cyst capsule, pronounced expression of type IV collagen in the subendothelial layer of the vascular wall in women with undifferentiated connective tissue dysplasia [3]. In our immunohistochemical study of the placentas of women with connective tissue dysplasia, an increase in the expression of type IV collagen in the chorionic villi stroma was revealed, which is evidence of abundant vascularization and ongoing neoangiogenesis.

Conclusion

Thus, type IV collagen is found in the placenta of postpartum women both with the physiological course of pregnancy and in women with undifferentiated connective tissue dysplasia. In patients with undifferentiated connective tissue dysplasia, abundant vascularization of the chorionic villi and the ongoing process of neoangiogenesis are observed.

Financing

The study had no sponsorship.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

References

1. Yoshizawa T, Mizumoto S, Takahashi Y, Shimada S, Sugahara K, et al. (2018) Vascular abnormalities in the placenta of Chst14^{-/-} fetuses:

implications in the pathophysiology of perinatal lethality of the murine model and vascular lesions in human CHST14/D4ST1 deficiency. *Glycobiology* 28(2): 80-89.

2. Autio-Harminen H, Sandberg M, Pihlajaniemi T, Vuorio E (1991) Synthesis of laminin and type IV collagen by trophoblastic cells and fibroblastic stromal cells in the early human placenta. *Laboratory investigation* 64(4): 483-491.

3. Aleksanova EM, Aksenenko VA, Pilavova OM (2014) Distribution of collagen types I, III, and IV in the wall of endometrioid cysts. *Doctor Ru Gynecology Endocrinology* 8(96): 42-44.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.47.007453

Gerasimova Liudmila Ivanovna. Biomed J Sci & Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>