УДК 617.713.5-007.17-018.74

On the possibility of neoplastic growth of the descemet's corneal endothelium

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Щодо можливості неопластичного росту ендотелію десцеметової оболонки рогівки

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Abstract

Background. *The tumor process inside the eye covers most of the inner perimeter: from the iris to the optic nerve head. At the same time, there is a little information about neoplastic changes of Descemet's endothelium although the cells of this tissue prone to proliferation and pathological tissue growths.*

Aim. *To present a histomorphological picture of unusual proliferation of the Descemet's endothelium, which had some signs of a neoplasm.*

Materials and Methods*. The histomorphological picture of a unique pathological process was studied in 40 serial sections of the eyeball. The histological picture was compared with the clinical one.*

Results. *Histomorphological examination revealed obliteration of the iridocorneal angle with fibrosis-hyalinosis of the drainage zone and neoplastic changes inside the eye: a cavernous hemangioma, neoplastic complexes of flattened round-oval non-pigmented cells in the zonule of Zinn, in the anterior chamber, on the anterior surface of the iris and identical cell complexes along the surface of Descemet's membrane.*

Conclusions. *For the first time, emphasis was placed on the possibility of a neoplastic process in the endothelium of Descemet's membrane, the implementation of which is extremely difficult due to the absence of a stromal-vascular pool in this tissue system.*

Keywords: *posterior corneal epithelium, neoplastic proliferation, intraocular tumors.*

DOI: https://doi.org/10.31288/Ukr.j.ophthalmol.202613439

UDC: 617.7

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Received 2025-08-22

Accepted 2025-12-27

Cite this article as: Artemov A.V., Lytvynenko M.V., Kovalchuk L.Y., Larson L.M., Kotiuzhynska S.G., Chebotarova S.O., Koshelnyk O.L., Petrusenko I.M., Gargin V.V. On the possibility of neoplastic growth of the descemet's corneal endothelium. Ukrainian Journal of Ophthalmology. 2026;1:34-39.

Резюме

Обгрунтування. *Пухлинний процес всередині ока охоплює більшу частину внутрішнього периметра: від райдужної оболонки до диска зорового нерва. Водночас, інформації про неопластичні зміни ендотелію десцеметової оболонки мало, хоча клітини цієї тканини схильні до проліферації та патологічного розростання.*

Мета. *Представити гістоморфологічну картину незвичайної проліферації ендотелію десцеметової оболонки, яка мала деякі ознаки новоутворення.*

Матеріали та методи. *Гістоморфологічну картину унікального патологічного процесу вивчали на 40 серійних зрізах очного яблука. Гістологічну картину порівнювали з клінічною.*

Результати. *Гістоморфологічне дослідження виявило облітерацію іридокорнеального кута з фіброзно-гіалінозом дренажної зони та неопластичні зміни всередині ока: кавернозна гемангіома, неопластичні комплекси сплющених кругло-овальних непігментованих клітин у зонулі Цинна, у передній камері, на передній поверхні райдужної оболонки та ідентичні клітинні комплекси вздовж поверхні десцеметової оболонки.* ***Висновок.*** *Вперше було зроблено акцент на можливості неопластичного процесу в ендотелії десцеметової мембрани, реалізація якого надзвичайно складна через відсутність стромально-судинного пулу в цій тканинній системі.*

Ключові слова: *задній епітелій рогівки, неопластична проліферація, внутрішньоочні пухлини.*

Introduction

Among intraocular tumors, the most common are tumors of the choroid and retina. From the standpoint of histotopography, the tumor process inside the eye covers most of the inner perimeter: from the drainage zone and iris to the optic nerve head [1]. At the same time, there is limited information about tumors of the posterior corneal epithelium or lens epithelium, although the cells of these tissue structures are subject to proliferation with the formation of various pathological tissue growths of a non-tumor nature [2].

The absence of a tendency to neoplastic transformation in certain tissues may be due to resistance to mutations in pro- and antiapoptotic genes that control oncogenesis. Thus, according to the famous hypothesis of Alfred Knudson [3, 4], endogenous and exogenous carcinogenic factors that affect the body during life are triggered by the presence of a congenital mutation, which thus creates a predisposition to neoplasm. To a certain extent, this explains why not all tissues in the body become sources of neoplastic growth, despite equal exposure to carcinogenic effects throughout life and the presence of proliferative abilities of their cells. For example, eye tumors, whose source would be ganglion and bipolar cells of the retina, are not known. At the same time, photoreceptor cells of the retina, which are practically not involved in proliferative processes inside the eye, are the source of the well-known retinoblastoma [5, 6].

At the same time, an inherited tendency to tumor transformation is not yet a guarantee that a tumor will develop in a given tissue over time. Understanding this, in particular, is facilitated by studying the relationships between various cellular and tissue systems inside the eye. For example, the epithelium of the lens capsule, the ciliary epithelium, and the posterior epithelium of the cornea are completely isolated from the stroma and vessels, which in most integumentary epithelia of the body are located in the proper sheet (substantia propria). The absence of stromal-vascular territory deprives the tumor cells of the opportunity to form tumor tissue, condemning individual tumor cell complexes to inevitable death. The mechanism of this death is associated with a completely predictable loss of contacts between individual cells, which initiates one of the variants of apoptosis - anoikis [7].

Also, great difficulties in the formation of stromal-cellular contacts arise at the initial stages of the formation of tumors of the retinal pigment epithelium and retinoblastoma. Until the cellular elements of these neoplasms penetrate into the adjacent vascular-stromal territories, which for them are the vascular membrane of the eye and the inner layers of the retina, respectively, they cannot acquire the morphological characteristics of real neoplasms. Thus, isolated retinoblastoma complexes that have not gone beyond the outer nuclear layer of the retina can often be seen during histomorphological examination as foci of necrosis impregnated with calcium salts. The same small complexes of retinal pigment epithelium cells on the surface of Bruch's membrane, which do not have the features of a real neoplasm due to the absence of stroma and vessels, are described by some authors as accidental findings [8].

Thus, in accordance with the presented circumstances, it is difficult to imagine how a tumor can be created from the posterior corneal epithelium, although in the presence of appropriate neoplastic predetermination (which is neither confirmed nor refuted), one can assume the emergence, under certain conditions, the patterns of neoplastic proliferation similar to those described in the initial stages of the development of tumors of the retinal pigment epithelium.

Aim. Using a unique observation as an example, we would like to present a histomorphological picture of unusual proliferation of the posterior corneal epithelium (Descemet's endothelium) with signs of neoplasm.

Material and Methods

The analysis of the histomorphological picture of a unique pathological process is based on the study of surgi-

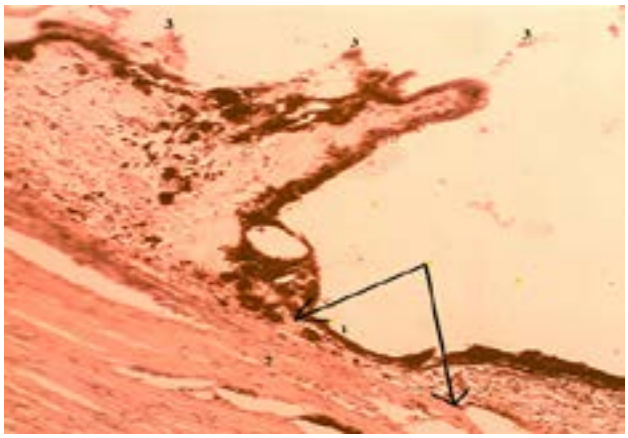

Fig. 1. Closure of the anterior chamber angle by the root of the iris (1), the extent of synechia is indicated by arrows. The drainage zone (2) is obliterated, on the processes of the ciliary body and in the posterior chamber, there are small accumulations of fibrin-like masses (3). Magnification 200X.

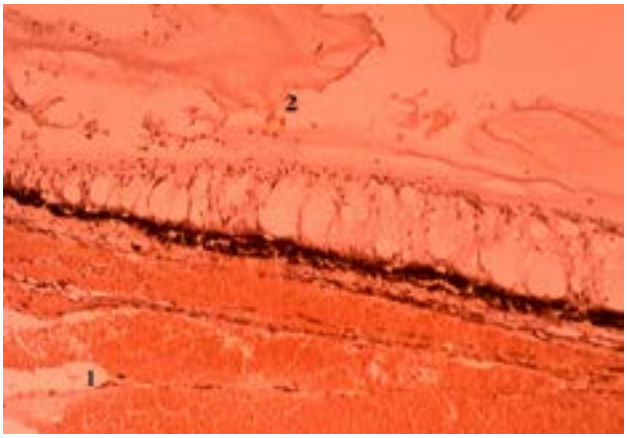

Fig. 2. Cavernous hemangioma of the choroid - cavernous dilated vessels (1) near the ora serrata. Above the cystically altered retina there is an accumulation of fibrin-like masses (2). Magnification 200X.

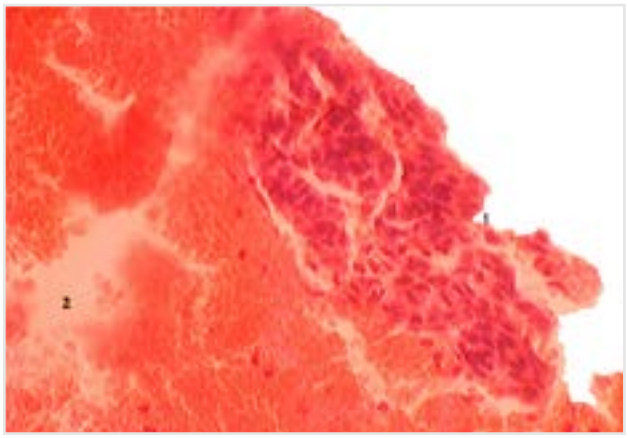

Fig. 3. Complexes of cells of neoplastic nature (1) among erythrocytes and small fibrin deposits (2) near zonule of Zinn. Magnification 200X

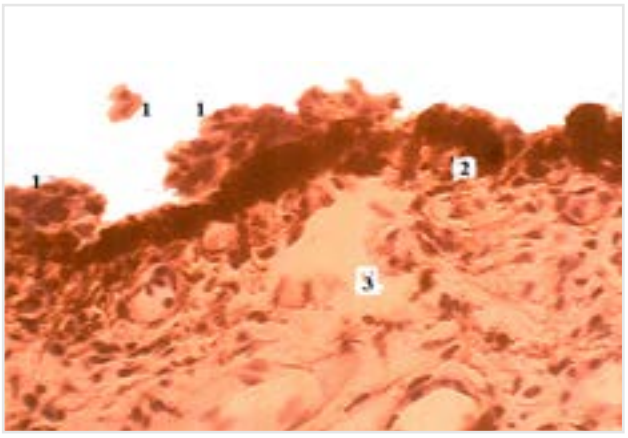

Fig. 4. Complexes of round-oval non-pigmented cells (1) on the surface of the anterior pigmented epithelium (2) of the iris (3). Magnification 200X.

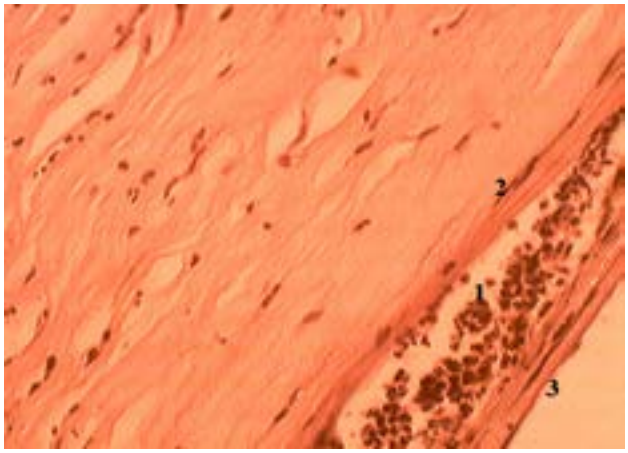

Fig. 5. Tumor-like proliferation of round-oval cells (1) on the surface of Descemet's membrane (2); a membrane-like structure is visible medially from the proliferation (3). Magnification 200X.

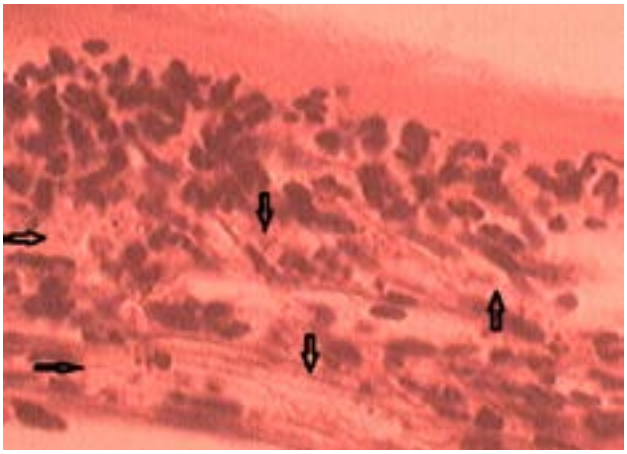

Fig. 6. Fragment of tumor-like proliferation on the surface of Descemet's membrane: the stromal component in the form of small accumulations of fibrin and collagen fibrils (arrows) is extremely reduced. Magnification 400X.

cal material - an enucleated eye, which was removed due to irreversible loss of vision against the background of secondary glaucoma and a tendency to the development of atrophy. The material was processed using a traditional histological technique, sections were prepared from paraffin blocks, and standard staining with Harris hematoxylin and eosin was used [9, 10]. For the study, 44 serial sections were made from blocks with different orientations of fragments of the eyeball. The histological picture was compared with the clinical one.

Results

The basis for this study was an unusual clinical observation associated with a 60-year-old female patient who, against the background of secondary glaucoma treated with laser exposure to the irido-ciliary zone and surgical intervention, including basal iridectomy, developed a tendency to atrophy of the left eyeball. As a result of the developed cataract and glaucomatous neuroretinopathy, the eye became blind and was enucleated. Histomorphological examination of the anterior part of the eye revealed obliteration of the iridocorneal angle against the background of fibrosis-hyalinosis of the drainage zone, which is characteristic of a neglected glaucomatous process (Fig. 1).

Along with changes in the iridocorneal zone, neoplastic changes were detected inside the eye, which were not established during clinical observation due to the opacity of the ocular media. At the same time, their presence largely explains the cause of the progression of atrophic changes in the eye.

The first, most obvious, neoplastic process detected during histomorphological examination was a cavernous hemangioma node. The tumor prominence was up to 2 mm, the extension along the sclera was from the serrated line to the equator of the eyeball. The pigment epithelium above the tumor node was largely desquamated, and its fragments were involved in multiple serous-hemorrhagic subretinal exudates with fibrin deposition (Fig. 2). Similar exudates were present on the retinal surface near the serrated line, as well as in the anterior and posterior chambers of the eye.

The formation of serous-hemorrhagic exudates, including those with fibrin admixture, is characteristic of cavernous hemangioma. However, some of them contained neoplastic complexes of flattened round-oval non-pigmented cells. The presence of these cell complexes cannot be explained by the presence of hemangioma. Thus, the largest accumulation of neoplastic cells was found in the zonule of Zinn, as well as in the anterior chamber and on the anterior surface of the iris (Figs. 3 and 4).

The origin of these complexes becomes clear in connection with the detection of neoplastic proliferation on the posterior surface of the cornea in a number of serial sections. Cellular complexes similar to those described above were distributed along the surface of Descemet's membrane in the form of a convex strand up to 300 μm thick (Fig. 5-6). This neoplastic formation began at some distance from the angle of the anterior chamber (at least 2-3 mm) and had a length of up to 5-6 mm.

The posterior corneal epithelium is a tissue system that is not renewed throughout life, but only regularly undergoes apoptotic elimination, as a result of which the number of endothelial monolayer cells decreases exponentially [11, 12]. At the same time, already in the middle of the last century, high proliferative abilities of corneal endothelial cells were established, which are realized in various pathological processes in the anterior part of the eye; trauma (including postoperative), corneal burns, various inflammatory processes in the inner layers of the eye [13-16]. The proliferation of endothelial cells is accompanied by the formation of collagenous-fibrous tissue, which is sometimes difficult to distinguish histologically from normal corneal stroma. At the same time, on the side opposite the posterior surface of the cornea, a Descemet-like hyaline membrane is often formed. These formations are well known as retrocorneal membranes. In our observation, the proliferation of the corneal endothelium in the most places was not accompanied by the formation of fibrous-collagenous tissue and only on the surface were there up to 2-3 layers of collagen fibers and a well-contoured hyaline membrane. It is interesting to note that in some areas this membrane looked more formed structurally than the natural Descemet's membrane (Fig. 5). This can be explained by the fact that due to the involvement of the endothelium in neoplastic proliferation, its metabolic effect on the membrane itself was disrupted and it began to undergo destructive changes.

The peculiarity of this observation was that in all foci of corneal endothelial proliferation, cellular elements predominated and only on the posterior surface of the cornea was there a slight formation of fibrous-collagenous tissue and Descemet-like membrane. A weakly expressed tendency to fibroblastic transformation brings this process closer to neoplasia.

In the well-known classical descriptions of retrocorneal membranes, a significant predominance of the fibrous component is noted, while the cellular elements are reduced and are represented only by barely noticeable scattered flattened cells (7). Therefore, we draw attention to this observation, since its histomorphological patterns indicate a neoplastic character rather than the known fibroblastic metaplasia of Descemet's endothelium, leading to the formation of retrocorneal membranes.

We have to resume, that despite significant achievements of the last decade in digital medicine [17, 18] and oncologic field partly [19, 20], there are numerous cases which are characterized unexpected histogenesis as described.

Conclusions

The corneal endothelium is known for its tendency to fibroblastic metaplasia, resulting in the formation of retro-

coneal membranes. An unusual clinical case, including the consequences of an neglectced glaucomatous process that occurred against the background of a cavernous hemangioma, draws attention to the possibility of neoplastic proliferation of Descemet's endothelium, the implementation of which is extremely difficult due to the lack of stromal-vascular territory in this tissue system.

Author Contributions

Artemov A.V. – conceptualization, methodology, writing, revision and editing; Lytvynenko M.V. – methodology, writing, design and editing; Kovalchuk L.Y. – formal analysis, writing; Larson L.M. – writing and drafting; Kotiuzhynska S.G. – methodology, review, revision; Chebotarova S.O. – writing, revision; Koshelnyk O.L. – review and revision; Petrusenko I.M. – review and revision; Gargin V.V. – review and revision, Lunyov V.Ye. – review and revision. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

Disclaimers

The authors declare that the views expressed in this article are their own and do not reflect the official position of the institutions.

Funding

The authors declare that they did not receive any funds, grants, or other support during the preparation of this manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest that could bias their opinion regarding the subject matter or materials described and discussed in this manuscript.

Ethics Statements

This manuscript does not present results from studies involving human subjects and/or animals that require ethics committee approval.

Informed Consent

This study did not involve human participants, which requires informed consent for participation in the study

Data Availability Statement

Data disclosure is not applicable to this article, as no datasets were generated or analyzed during this study. All data generated or analyzed during this study are included in this published article.Data supporting the findings of this study are available from the authors upon reasonable request.

References

1. Gündüz AK, Mirzayev I. Surgical Approach in Intraocular Tumors. Turk J Ophthalmol. 2022;52(2):125-138. doi:10.4274/tjo.galenos.2021.24376
2. Yu H, Zhang C, Tong N, et al. Intraocular myofibroblastoma tumour of the ciliary body: a case report and literature review. BMC Ophthalmol. 2022;22(1):200. doi:10.1186/s12886-022-02411-0
3. Knudson AG Jr. Mutation and cancer: statistical study of retinoblastoma. Proc Natl Acad Sci U S A. 1971;68(4):820-823. doi:10.1073/pnas.68.4.820
4. Knudson AG Jr. Retinoblastoma: a prototypic hereditary neoplasm. Semin Oncol. 1978;5(1):57-60. 3. 3Frisch SM, Screaton RA. Anoikis mechanisms // Current Opinion in Cell Biology. 2001.13 (5):555–62. doi:10.1016/S0955-0674(00)00251-9.
5. Dimaras H, Corson TW. Retinoblastoma, the visible CNS tumor: A review. J Neurosci Res. 2019;97(1):29-44. doi:10.1002/jnr.24213
6. Raval V, Kaliki S. Cavitary retinoblastoma: A review of literature. Surv Ophthalmol. 2022;67(3):723-728. doi:10.1016/j.survophthal.2021.10.002
7. Frisch SM, Francis H. Disruption of epithelial cell-matrix interactions induces apoptosis. J Cell Biol. 1994;124(4):619-626. doi:10.1083/jcb.124.4.619
8. Jones IS, Reese AB. Benign melanomas of the retinal pigment epithelium. Am J Ophthalmol. 1956;42(2):207-212. doi:10.1016/0002-9394(56)90922-9
9. Gargin V, Radutny R, Titova G, et al. Application of the computer vision system for evaluation of pathomorphological images. 2020 IEEE 40th International Conference on Electronics and Nanotechnology, ELNANO 2020 - Proceedings; 2020. 469-473, doi: 10.1109/ELNANO50318.2020.9088898
10. Schabadasch A. Intramurale nervengeflechte des darmrohrs // Z Zellforsch. 1930;10(2):320-85. doi:10.1007/BF02450699
11. Voyno-Yasenetsky V.V. Growth and variability of eye tissues in its diseases and injuries /Voyno-Yasenetsky V.V. // Kyiv: Vishcha shkola. 1979. - 224 p (in Russian).
12. Lytvynenko MV, Alekseeva VV, Gargin VV, Neskoromna NV, Koshelnyk OL, Artemov OV. Rare neurogenic retinal tumors in adults: morphological features and diagnostic challenges. J.ophthalmol.(Ukraine).2022;6:30-34. doi: 10.31288/oftalmolzh202263034
13. Shi H, Mirzaei N, Koronyo Y, et al. Identification of retinal oligomeric, citrullinated, and other tau isoforms in early and advanced AD and relations to disease status. Acta Neuropathol. 2024;148(1):3. doi:10.1007/s00401-024-02760-8
14. Hart de Ruyter FJ, Evers MJAP, Morrema THJ, et al. Neuropathological hallmarks in the post-mortem retina of neurodegenerative diseases. Acta Neuropathol. 2024;148(1):24. doi:10.1007/s00401-024-02769-z
15. Helei N, Zheliznyak M, Helei V. Analysis of clinical manifestations in patients during complex treatment of oroantral junctions. Kharkiv Dental Journal. 2025;1(3):25-32. doi:10.26565/3083-5607-2025-3-03
16. Wireko AA, Adebusoye FT, Tenkorang PO, Mehta A, Mustapha MJ, Debrah AF, Yarlagadda R, Asieduwaa OY, Abdul-Rahman T, Victor ON, Sikora V, Papadakis M. Management of orofacial clefts in Africa, insufficient management centers, and workforce. Int J Surg. 2023 Mar 1;109(3):232-234. doi:10.1097/JS9.0000000000000139.
17. Alekseeva V, Nechyporenko A, Frohme M, Gargin V, Meniailov I, Chumachenko D. Intelligent Decision Support System for Differential Diagnosis of Chronic Odontogenic Rhinosinusitis Based on U-Net Segmentation. Electronics (Switzerland), 2023:12 (5), doi: 10.3390/electronics12051202
18. Krivenko S, Krylova O, Bataeva E, Lukin V. Smart lossy compression of images based on distortion prediction. Telecommunications and Radio Engineering (English translation of Elektrosvyaz and Radiotekhnika). 2018;77(17):1535-1554. doi: 10.1615/TelecomRadEng.v77.i17.40

19. Lyndin M, Kravtsova O, Sikora K, Lyndina Yu, Kuzenko Ye, Awuah WA, Abdul-Rahman T, Hyriavenko N, Sikora V, Romaniuk A. COX2 Effects on endometrial carcinomas progression. Pathol Res Pract. 2022;238:154082. doi: 10.1016/j.prp.2022.154082

20. Norrie JL, Nityanandam A, Lai K, et al. Retinoblastoma from human stem cell-derived retinal organoids. Nat Commun. 2021;12(1):4535. doi:10.1038/s41467-021-24781-7.