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## RISK FACTORS FOR POTENTIAL COMPLICATIONS OF CATARACT SURGERY IN THE EYES WITH VARYING DEGREES OF PSEUDOEXFOLIATIVE SYNDROME DEVELOPMENT

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## SUMMARY

**Purpose** – to investigate the predictors of potential complications of cataract surgery in eyes with varying degrees of pseudoexfoliation syndrome (PES) from the standpoint of choosing the optimal treatment tactics.

**Material and methods**

Results of a survey of 150 patients aged 56 to 86 years old (mean age  $72.2 \pm 0.9$ ) before cataract surgery, of which 12 had open-angle glaucoma.

Ophthalmic examination methods: visometry (without correction, with correction), 2-stage biomicroscopy (with a narrow pupil, after tonometry – with mydriasis), gonioscopy, ultrasonic biomicroscopy (UBM-plus, Accutome, USA).

**Results**

From the point of view of cataract surgery, the most significant predictors of potential complications of cataract surgery (weakening of the pupil reaction,

changes in the Zinn ligament fibers) are determined by the degree of PES development, 3 degrees (stages) of PES development, characteristic changes are distinguished. In assessing the degree of development of PES, it is important to highlight two main points: the nature of the deposits of pseudoexfoliative material (PEM) and the severity of dystrophic changes in structures (dystrophic component).

**Conclusion**

The choice of the optimal tactics of surgical treatment of cataracts in eyes with PES is based on the degree of progression of the syndrome, including PEM deposits, a dystrophic component of changes in the structures of the eye.

**Key-words:** *pseudoexfoliative syndrome, cataract, biomicroscopy, ultrasound biomicroscopy, predictors of complications, stages of pseudoexfoliative syndrome*

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## PSEUDOEXFOLIATİV SINDROMUN İNKİŞAFI VƏ KATARAKTA CƏRAHİYYƏSİNİN POTENSİAL RİSK FAKTORLARI

## XÜLASƏ

**Məqsəd** – optimal müalicə taktika seçimi baxımından psevdoksfoliativ sindromun (PES) müxtəlif dərəcələrinin inkişafının katarakta cərrahiyyəsində potensial risk amillərini öyrənmək.

**Material və metodlar**

Katarakta əməliyyatından əvvəl 56-86 yaş arası (ortayaş  $72.2 \pm 0.9$ ) 150 xəstənin sorğusunun nəticələri, onlardan 12-si açıqbucaqlı qlaukoma (ABQ) olmuşdur.

Oftalmoloji müayinə üsulları: vizometriya (korreksiya etmədən, korreksiya ilə), 2 mərhələli biomikroskopiya (dar göz bəbəyi ilə, tonometriyadan sonra –midriaz ilə), qonioskopiya, ultrasəs biomikroskopiya (UBM-plus, Accutome, ABŞ).

**Nəticələr**

Katarakta cərrahiyyəsi nöqtəyi-nəzərindən cərrahiyyənin potensial risk amilləri (bəbəyin reaksiyasının zəifləməsi, Zinn liflərində yaranan

dəyişikliklər) PES-un inkişaf dərəcəsi xarakterik dəyişikliklər ilə fərqlənir, PES-un inkişafının 3 dərəcəsi (mərhlələri) ilə proqnozlaşdırıla bilər. PES-un inkişaf dərəcəsini qiymətləndirərkən iki əsas məqamı vurğulamaq vacibdir: psevdoeksfoliativ materialın (PEM) formalaşması və strukturlarda olan distrofik dəyişikliklərin proqresi (distrofik komponent).

**Açar sözlər:** *psevdoeksfoliativ sindrom, katarakta, biomikroskopiya, ultrasəsbiomikroskopiya, fəsadların proqnozlaşdırılması, psevdoeksfoliativ sindromun mərhələləri*

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## ФАКТОРЫ РИСКА ПОТЕНЦИАЛЬНЫХ ОСЛОЖНЕНИЙ ХИРУРГИИ КАТАРАКТЫ НА ГЛАЗАХ С РАЗНОЙ СТЕПЕНЬЮ РАЗВИТИЯ ПЭС

### РЕЗЮМЕ

**Цель** – с позиций выбора оптимальной тактики лечения исследовать предикторы потенциальных осложнений хирургии катаракты на глазах с разной степенью развития псевдоэксфолиативного синдрома (ПЭС).

#### Материал и методы

Результаты обследования 150 пациентов в возрасте от 56 до 86 лет (средний возраст  $72,2 \pm 0,9$ ) до хирургического лечения катаракты, из которых у 12-ти была открытоугольная глаукома (ОУГ).

Офтальмологические методы обследования: визометрия (без коррекции, с коррекцией), 2-х этапная биомикроскопия (с узким зрачком, после тонометрии – с мидриазом), гониоскопия, ультразвуковая биомикроскопия (UBM-plus, фирма Accutome, USA).

**Ключевые слова:** *псевдоэксфолиативный синдром, катаракта, биомикроскопия, ультразвуковая биомикроскопия, предикторы осложнений, стадии псевдоэксфолиативного синдрома*

According to the WHO, the majority of the 1.3 billion global population with visual impairment are over 60 years of age, whereas cataract and glaucoma are one of the main causes of blindness [1, 2].

### Yekun

PES olan gözlərdə katarakta cərrahiyəsinin optimal taktika seçimi ən əsas cərrahi risk amilləri sindromun inkişaf dərəcəsindən, eləcə də strukturlarda yaranan distrofik komponentdən və PEM formalaşmasından asılıdır.

### Результаты

С позиций хирургии катаракты, наиболее значимые предикторы потенциальных осложнений хирургии катаракты (ослабление реакции зрачка, изменения волокон цинновой связки), определяются степенью развития ПЭС, выделены 3 степени (стадии) развития ПЭС, характерные изменения. В оценке степени развития ПЭС важно выделить два основных момента: характер отложений псевдоэксфолиативного материала (ПЭМ) и выраженность дистрофических изменений структур (дистрофический компонент).

### Заключение

В основе выбора оптимальной тактики хирургического лечения катаракты на глазах с ПЭС определяющее значение имеет степень прогрессирования синдрома, включающая отложения ПЭМ, дистрофический компонент изменений структур глаза.

Pseudoexfoliation syndrome (PEX) is among the age-related changes of the eye and leads to a high worldwide incidence of cataract and glaucoma. As a systemic dystrophic process PEX is characterized by

characteristic deposits of pseudoexfoliative material (PEM) not just inside the eye, but orbit, skin, internal organs and has a close link to cardiovascular pathology [3-5].

Nevertheless, cataract surgery is one of the most common procedures worldwide, surgery in patients with PEX is still very challenging and possesses an increased risk of complications, such as contractile capsular syndrome, dislocation of the capsular bag complex, which are known to be based on ligamentous failure and reduced tolerance to mechanical (surgical) trauma [6-13].

At the same time, the assessment of the degree (stage) of PEX from the standpoint of the surgical risk for potential complications remains ambiguous [14-17].

Purpose of the study is to investigate predictors of complications of cataract surgery in eyes with PEX from the standpoint of choosing adequate tactics for cataract surgery.

#### Material and methods

One hundred and fifty patients who undergone cataract extraction were included in the study with the mean age of  $72.2 \pm 0.9$  (56-86 years), including 12 patients with open angle glaucoma (OPXG)

Ophthalmical examination consisted of :visual acuity check (uncorrected, corrected), 2-stage biomicroscopy (undilated, tonometry and dilated) gonioscopy, ultrasound biomicroscopy (UBM-plus, Accutome, USA), biometry (IOL -Master, Zeiss, FRG), specular microscopy.

Results of anterior segment biomicroscopy in patients with PEX were analysed according to the criteria of potential risk of cataract surgery complications (including inflammatory ones). Evaluation criteria in UBM were usual landmarks: relief of surface profile, reflectivity of the investigated structure, spatial and quantitative parameters

of interrelation of anatomical structures. Axial longitudinal, tangential slices (scanning variants), color reproduction were used [14, 17-20].

The research protocol has been approved by the ethical committee of the National Ophthalmology Center named after acad. Zarifa Aliyeva. Informed consent was obtained from all patients.

#### Results and discussion

Preoperative ophthalmological examination with complex evaluation of biomicroscopic changes, subsequent detailed examination of changes of UBM, ascertaining of revealed changes during surgical intervention in total analysis allowed to confirm significant risk factors of potential complications of cataract surgery and their dependence on the degree of PEX development. We believe that two main aspects may be singled out in evaluation of PEX degree: the nature of PEM deposits and dystrophic component.

Examination of eyes at the first stage by 2-stage biomicroscopy (at first with narrow pupil, after tonometry - with mydriasis) allowed to estimate the degree of ocular structures dystrophic changes, including angle of anterior chamber (AAC) and character of PEM deposits. Subsequent examination of UBM enabled to correlate the degree of dystrophic changes of ocular structures with the risk of potential complications of the planned surgery in more details. In terms of obtaining information on changes of the anterior and posterior chamber UBM is invaluable diagnostic device [14,19,20]. It is always possible to resolve existing clinical doubts by targeted imaging of structures, confirmed by morphometric parameters.

From the standpoint of planned cataract surgery, biomicroscopy highlighted the most significant risk factors of possible complications and assessed the degree of dystrophic changes cumulatively of the PEX features.

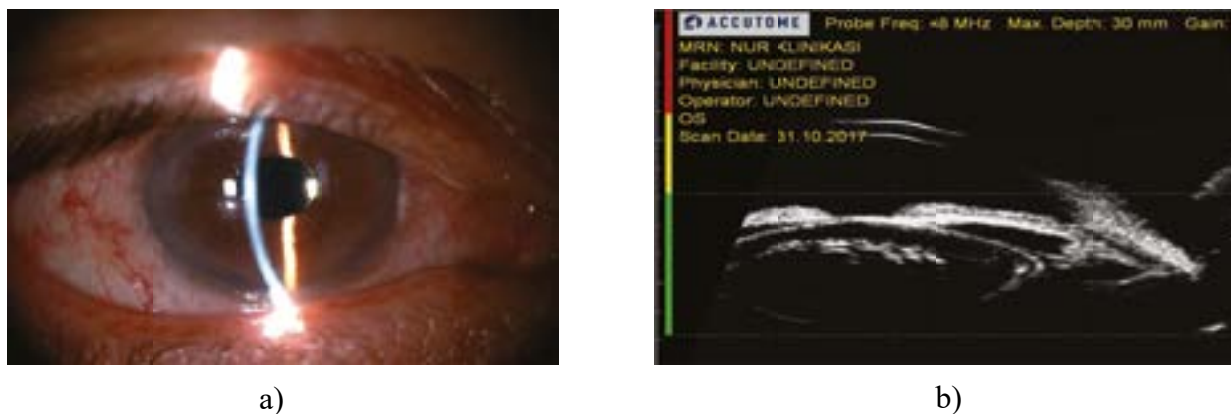


a)



b)

**Fig. 1.** First stage PEX biomicroscopy and ultrasound biomicroscopy (UBM)



**Fig. 2.** II stage PEX biomicroscopy and ultrasound biomicroscopy (UBM)

Thus, in 56 (37,3%) eyes with normal intraocular pressure the response of the pupil to the light and midriatics was within normal limits. In this variant of changes destruction of pigmentary border of the pupil margin in the form of partial sloughing was combined with abrasion of iris pattern, sclerosis of trabecular tissue, slight exogenous pigmentation of AAC, which we regarded as stage I. In this stage, UBM confirmed the absence of changes in the capsular fibers (Fig. 1).

In 58 (38.7%) eyes the distinctive feature on biomicroscopy was a decreased pupil response to mydriatics. Dystrophic component of ocular structures was more intensive: smoothing of iris pattern, moderate pigmentation of surface were accompanied by changes of pigmentary border of the pupil margin in form of partial disappearance, more often - complete destruction, confirming more significant changes.

Deposits of PEM on pupil margin were more pronounced, dystrophic changes of stroma were more evident in trabecular and mixed type of iris structure than in spongy type. PEM deposits in the form of solitary ones also occurred on the corneal endothelium. There were no changes of ligaments of Zynn, no lens tremulation was detected. The totality of changes corresponded to grade II PEX stage. Decreased pupillary responses, as our long-term observations have shown, at this stage are more related to iridocapsular synechia development, due to intensified extravasation from iris vessels, and with appearance of irrelevant proteins in anterior chamber of the eye including acute phase of inflammation [21,22]. Mydriatic pupil dilation reveals both remnants of pigmentary sheet on anterior lens capsule and increased pigment dispersion. UBM confirmed the iridocapsular synechias of varying length, degree of severity, single initial changes of cinnamic ligament fibers but no significant changes. In

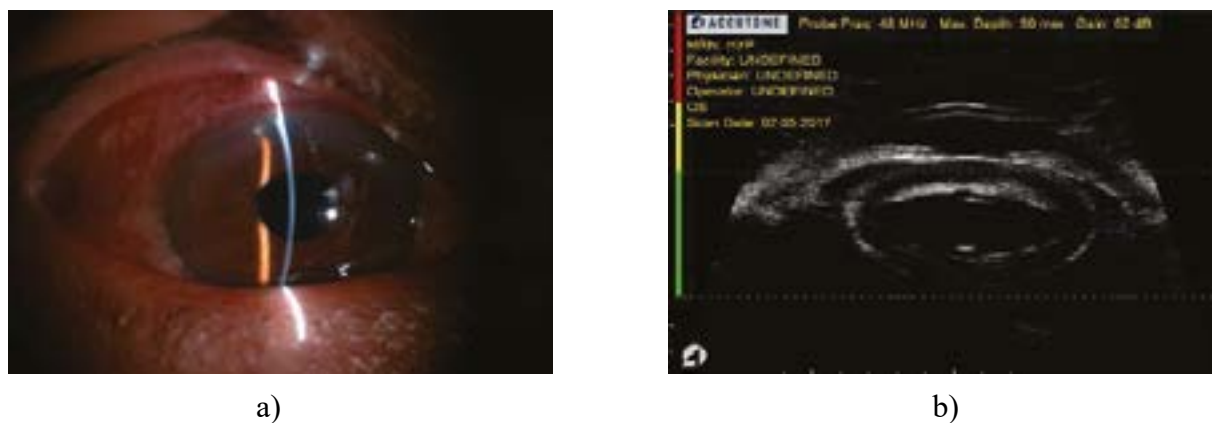
cases of iridocorneal contact (synechiae) the acoustic density was close to that of the iris with reduced thickness and relief (Fig. 2).

In 38 (25.3%) eyes the distinctive feature on biomicroscopy were changes in the cinnamic ligament fibres. The dystrophic component of the changes was the most pronounced (grade III changes, PEX stage). Leaching of pigmentary border of pupil margin up to its complete absence was combined with changes of iris pigmentary sheet, in some observations - with translucency and exposure of stromal vessels. Stiffness of the pupil was detected against the background of iridocapsular synechiae reduction. If at biomicroscopy there were changes of anterior chamber, lens tremulation or its sublaxation, in UBM these changes were confirmed by significant changes of Zinn fibers. The UBM confirmed lens displacement caused by changes in the zinnamic bundle fibers, which ranged from subtle to more significant. Changes in the posterior portion of the capsular fibers were most frequently detected. In 5 eyes where a subtle lens tremulation against the background of rigid pupil was only questionable, UBM revealed insignificant lens dislocation, including significant changes of the ligaments of Zynn, but with iridocapsular synechiae present. Undoubtedly, the possibility to visualize the cingulum fibers, timely detect lysis of the fibers can guarantee an adequate treatment tactics.

There were no significant differences in the nature and intensity of lens opacity. The lens opacities of varying degrees, with varying acoustic density of the capsule were present in almost all observations.

With the progression of dystrophic changes in the syndrome, including an increase in the tendency of pigment dispersion, with UBM, the nature and abundance of PEX deposits changed in the dynamics of the progression of structural changes. If, during





**Fig. 3.** III stage PEX biomicroscopy and UBM

the initial changes in the structures of the PEX, the deposits were in the nature of rare very delicate layers of a granular nature with a low acoustic density, as on the ciliary processes, the posterior surface of the iris, then as they progressed, were more of a confluent character. At the same time, PEX deposits were located densely in the form of conglomerates, confluent foci, forming iridocapsular synechia, with increased echo density of the iris. As the area of the developing iridocapsular synechia increased, the response of the pupil to light and mydriatics decreased. The progression of the degree of the development of the syndrome was accompanied by changes in the fibers of the Zinn's ligament from barely noticeable to pronounced changes, most often in the posterior portion of the Zinn fibers (Fig. 3).

In eyes with OPXG and cataracts bilateral PEX was diagnosed in 10 patients (83.3%), unilateral in 2 patients (16.7%). In biomicroscopy of eyes with glaucoma and cataracts, changes according to the criterion of surgical risk were similar to changes in the first stage of PEX in 4 (33.3%) eyes, in the 2-nd stage in 4 (33.3%), in the 3rd stage of PEX in 4 (33.3%) eyes. Glaucoma according to A.P. Nesterov classification was in an advanced stage. It was noted that iridocapsular changes in the form of planar synechia were more significant, which affected both the degree of pupil dilation and pigment dispersion.

On gonioscopy APC the Sampalessi line occurred in almost all eyes with PEX, both with and without glaucoma, however, the degree of APC pigmentation in eyes with glaucoma was more significant.

As observations show dystrophic changes in the structures of the eye are not specific only for PEX, but in eyes with PEX they occur more often and are much more pronounced and tend to progress. Among

them, varying degrees of severity of changes in the structures of the iridociliary zone, the lens, and the fibers of the Zinn's ligament are revealed. The relief of the iris, reflecting changes in its structure from intact, acoustically homogeneous to sub-atrophy, segmental atrophy can be very variable, sometimes thickened in places, sometimes evenly smoothed, including asymmetrical on axial sections, etc. Most often in the eyes with PEX, sub-atrophy of the iris took place in the form of its flattening, some thinning, and a decrease in relief.

Changes in the ciliary body with a rigid pupil, a decrease in the transparency of optical media, cannot be clinically detected, as is known. However, UBM revealed changes in the ciliary body in the form of a decrease in the thickness of the structure, the absence of space between the processes on the tangential scan before atrophy, including the nature of the PEM deposits [14,18,19,23,24].

As observations, publications show, from the position of planned surgical intervention, clinical assessment of changes in ocular structures by biomicroscopy in eyes with PEX is, no doubt, extremely important and of paramount importance, since it allows not only to detect PEX, predict surgical risk factors, choose preventive measures, elaborate optimal tactics and surgical technique, and also helps with the choice of IOL sselection. However, in terms of more reliable criteria for predicting potential complications, including a distant postoperative period, seems to be insufficient. For timely and adequate assessment of changes caused by the development of PEX, the possibilities and advantages of UBM are invaluable.

## Conclusion

The potential risk factors for complications of cataract surgery in the eyes with pseudoexfoliation syndrome are based on the degree of progression of the syndrome, including both PEM deposits and a component of dystrophic changes in the structures of the eye.

Thus, changes in the form of the degree of development of PEM, forming risk factors for potential complications of cataract surgery, underlie the choice of tactics and techniques of surgery.

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## REFERENCES:

1. [http://www.who.int/ru/news-room/fact-sheets/detail/blindness-and-visual-impairment]
2. Zhao, Y. Epidemiology and clinical characteristics of patients with glaucoma: Analysis of hospital data between 2003 and 2012 / Y.Zhao, J.L.Fu, Y.L.Li [et al.] // *Indian J. Ophthalmol.*, – 2015. 63, №11, – p.825-831.
3. Schlötzer-Schrehardt, U., Naumann G.O.H. Ocular and systemic pseudoexfoliation syndrome // *Amer. J. Ophthalmol.*, – 2006. 141, – p.921-937.
4. Sekeroglu, M.A. Systemic associations and prevalence of exfoliation syndrome in patients scheduled for cataract surgery / M.A.Sekeroglu, B.Bozkurt, M.Irkec [et al.] // *Europ. J. Ophthalmol.*, – 2012. 18, – p.551-555.
5. Yildirim, N. Prevalence of pseudoexfoliation syndrome and its association with ocular and systemic diseases in Eskisehir / N.Yildirim, E.Yasar, H.Gursoy [et al.] // *Int. J. Ophthalmol.* – Turkey: – 2017. 10(1), – p.128-134.
6. Vanags, J., Laganovska G. Long-Term Outcome of Cataract Surgery in Eyes with Pseudoexfoliation Syndrome Associated with Weak Zonules: A Case Report // *Case Rep. Ophthalmol.*, – 2020. 11, – p.54-59.
7. Turalba, A. Outcomes after cataract surgery in eyes with pseudoexfoliation: Results from the veterans affairs ophthalmic surgery outcomes data project / A.Turalba, T.Cakiner-Egilmez, A.R.Payal [et al.] // *Canad. J. Ophthalmol.*, – 2017. 52, – p.61-68.
8. Shingleton, B.J. Outcome of phacoemulsification and intraocular lens implantation in eyes with pseudoexfoliation and weak zonules / B.J.Shingleton, Y.N.Neo, V.Cvintal [et al.] // *Acta. Ophthalmol.*, – 2017. 95, – p.182-187.
9. Tekin, K. Monitoring and management of the patient with pseudoexfoliation syndrome: current perspectives / K.Tekin, M.Inanc, U.Elgin [et al.] // *Clin. Ophthalmol.*, – 2019. 13, – p.453-464.
10. Baig, M.A., Munir R. Late within the Capsular Bag Intraocular Lens Dislocation (Ten – Year Experience) // *Pak. J. Ophthalmol.*, – 2021. 37(2), – p.179-182. Doi: <http://doi.org/10.36351/pjo.v37i2.1110>
11. Vazquez-Ferreiro, P. Intraoperative complications of phacoemulsification in pseudoexfoliation: Metaanalysis / P.Vazquez-Ferreiro, F.J.Carrera-Hueso, J.E.Poquet-Jornet [et al.] // *J. Cataract Refract Surg.*, – 2016. 42(11), – p.1666-1675. doi: 10.1016/j.jcrs.2016.09.010.
12. Потёмкин, В.В., Агеева Е.В. Нестабильность связочного аппарата хрусталика у пациентов с псевдоэкзофолиативным синдромом: анализ 1000 последовательных факоэмульсификаций // *Офтальмологические ведомости*, – 2018. 11, №1, – с.41-46. doi: 10.17816/OV11141-46.

13. Намазова, И.К. Ультразвуковая биомикроскопия при механической травме глаза пациентов старшего возраста / И.К.Намазова, И.Ч.Джарулла-заде, Э.Р.Джалилова [и др.] // Офтальмохирургия, – 2012. №4, – с.76-81.
14. Inazumi, K. Ultrasound biomicroscopic classification of zonules in exfoliation syndrome / K.Inazumi, D.Takahashi, T.Taniguchi [et al.] // Jpn. J. Ophthalmol., – 2002. 46, №5, – p.502-509.
15. Bartolomew, R.S. Lens displacement associated with pseudocapsular exfoliation // British J. Ophthalmol., – 1970. 54, №11, – p.744-750.
16. Nizankowska, H.M. Jaskra Wspolczesne zasady rozpoznawania // – Wroclaw: Gornicki Wydawnictwo Medyczne, – 2001. – p.107.
17. Тахчиди, Х.П. Патология глаза при псевдоэкзофолиативном синдроме / Х.П.Тахчиди, В.В.Баринов, В.В.Агафонова [и др.] // – Москва: – 2010. – с.154.
18. Erkan, U. Ultrasound biomicroscopy in patients with unilateral pseudoexfoliation / U.Erkan, E.Kadir, M.Ilkay [et al.] // Int. J. Ophthalmol., – 2015. 8(4), – p.754-758. doi:10.3980/j.issn.2222-3959.2015.04.20
19. Pavlin, C.J. Imaging zonular abnormalities using ultrasound biomicroscopy / C.J.Pavlin, Y.M.Buys, T.Pathamathan [et al.] // Arch. Ophthalmol., – 1998. 116, №7, – p.854-857. doi: 10.1001/archophth.116.7.854
20. Kosmala, J. Recommendations for ultrasound examination in ophthalmology. Part I: Ultrabiomicroscopic examination / J.Kosmala, I.Grabska-Liberek, R.S.Ašoklis [et al.] // Journal of Ultrasonography, – 2018. 18, №75, – p.344-348. doi: 10.15557/jou.2018.0050
21. Подгорная, Н.Н. Исследование микроциркуляции радужной оболочки при псевдоэкзофолиативном синдроме и старческой катаракте методом флюоресцентной ангиографии / Н.Н.Подгорная, И.К.Намазова, В.Н.Дземешкевич [и др.] // Вестн. офтальмол., – 1988. №5, – с.46-50.
22. Dotsenco, V. Hageman factor and Kallikrein in pathogenesis of senile cataract and the pseudoexfoliation syndrome / V.Dotsenco, E.Neshkova, H.Namazova [et al.] // Immunopharmacology, – 1996. 32, №1–3, – p.141-145.
23. Ritch, R. Ultrasound biomicroscopic assessment of zonular appearance in exfoliation syndrome / R.Ritch, R.M.Vessani, H.V.Tran [et al.] // Acta. Ophthalmol. Scand., – 2007. 85(5), – p.495-499.
24. Guo, S. Characterizing pseudoexfoliation syndrome through the use of ultrasound biomicroscopy / S.Guo, M.Gewirtz, R.Thaker [et al.] // J. Cataract. Refract. Surg., – 2006. 32(4), – p.614-617.

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