IJCNP, Volume 2, Issue 11, 2024 ISSN: 2995-536X
https://medicaljournals.eu/index.php/IJCNP

INTERNATIONAL JOURNAL OF COGNITIVE NEUROSCIENCE AND PSYCHOLOGY

THE ROLE OF ARTIFICIAL INTELLIGENCE IN OPHTHALMIC IMAGE INTERPRETATION

Jalalova Dilfuza Zuhridinovna
Department of Ophthalmology, Samarkand State Medical University

Kasimov Turdiali
Samarkand State Medical University, Department of Ophthalmology, 1st year clinical ordinator

Abstract: Thus, the main conditions of this study were as follows: firstly, the clinical needs of visualizing the anterior segment of the eye for timely and adequate diagnosis of various pathological conditions, secondly, the lack of sufficient information of widely used examination methods and thirdly, it is necessary to study the principles of scanning, to search for clinical and instrumental parallels in the analysis and interpretation of the results of ultrasound biomicroscopy, which will help to more effectively use and expand the potential capabilities of this method. Work.

Key words: Mechanical damage to the eye, Evaluation of complex lesions UBM.

UBM is an independent non-invasive diagnostic technology that significantly expands the possibilities of intravital imaging in ophthalmology, its clinical significance varies depending on the nature of the tasks being solved, and complementing each other, increasing the information content. , reliability and accuracy of non-alternative diagnostics.

The proposed scanning algorithm is based on the application of the principle of complementarity, localization and quantitative echography, and is based on sequential axial, meridional and tangential scanning of the eyeball, as well as horizontal and vertical scanning of the eyelids. . Maximize the visualization capabilities of the UBM method.

The range of UBM capabilities based on high accuracy ensures that the ultrasound sections are highly compatible with the anatomical structure of the anterior segment of the eye, which was used to determine the acoustic "norm" of the parameters of the anatomical structures of the eye. conditionally normal eye and anterior segment of the eyelids, as well as the eye of the Chinchilla rabbit - the most common experimental model in ophthalmology.

Ultrasound scanograms reflect the nature of structural changes in tissues clearly and with high reliability and complement the clinical picture of inflammatory diseases of the sclera and choroid, choroid tumors of pre-equatorial localization, degenerative-dystrophic conditions (iridocorneal endothelial). syndrome and cysts of the squamous part of the ciliary body), damage to the structures in the front of the eye due to mechanical damage, neoplasms of the skin of the eyelids and the periorbital region, which allows the use of UBM in the diagnosis and differential diagnosis of pathological conditions.

Ultrasound biomicroscopy was performed under epibulbar anesthesia. A funnel-shaped eyelid dilator is placed in the conjunctival cavity, filled with an immersion fluid (saline or oftagel), an ultrasound sensor is inserted into it, and the eyeball under it is placed in a certain plane. tissues were scanned. The ultrasonic radiation frequency was 35/50 MHz, the scanning depth was 18.5x14mm/12x14mm, and the measurement accuracy was 27-35mm/23-27μm.

The removed tumors of the eyeball, lid skin and periorbital region were subjected to histological examination.

Statistical processing of the results was carried out using the Statistica 8.0 software package.

Scanning algorithm and UBM technology. It is common to visualize the anatomical structures of the eye.

The uniqueness of the ultrasound biomicroscopy procedure is determined by the features that fundamentally distinguish it from traditional ultrasound scanning methods. Among them, the presence of a moving sensor that performs vibration during learning; the need to install an immersion cannula using an immersion tool; short working distance (from the sensor to the scanned object). Strict perpendicular positioning and the most accurate movement of the sensor relative to the structures being scanned are the keys to obtaining high-quality scans that clearly reflect the anatomical picture.

The algorithm of ultrasound examination, including the sequential use of axial, longitudinal (or meridional) and tangential scanning, as well as the complementary principle of research, localization and quantitative echography, allowed to visualize and evaluate the parameters of all structures. anterior segment of the eye in different planes. Eyelids were scanned in vertical and horizontal planes.

Visualization is a collective term that reflects the ability of a method of estimating the acoustic parameters of structures in the context of UBM, i.e. The evaluation criteria of scanning results were reflection, homogeneity, surface profile relief, quantitative parameters and spatial relationships of anatomical structures. In some cases, the repetition of colors allowed a better visualization of the details of the reflection. The qualitative and quantitative characteristics of the scanograms obtained during repeated examinations were compared with the previous ones.

In order to study the main possibilities of visualization of the structures of the anterior segment, as well as the options and methods of their quantitative assessment, a study of the eyes of patients conditionally defined as normal was carried out.

The criteria for inclusion of patients in the group of "conditionally normal eyes" were as follows:

- age of the subjects is 18-67 years old,
- the length of the anterior-posterior axis (APA) of the eye is from 22.5 to 26.5 mm,
- no medical history. ophthalmic surgery,
- absence of concomitant eye pathology.

During the scanning process, the scanning algorithm and principles are as follows:

- anatomical structures (cornea, episclera and sclera, bulbar conjunctiva, iris, ciliary tube, lens with ligamentous apparatus, ciliary body, peripheral part of choroid, etc.) retina, anterior part of vitreous body (including anterior basis)

eye cavities (chambers), corners; and connections of various structures (anterior and posterior chambers of the eye, anterior chamber angle, trabecular-ciliary distance, trabecular-iris angle, etc.)

analysis of acoustic parameters of anatomical structures of conditionally normal eyes opened new possibilities. for how to qualitatively and quantitatively assess the anatomical structure of the anterior segment known from histological studies, the uniformity, the relief of the surface profile and the quantitative parameters. The possible measurement algorithm of various parameters (linear, angular) made it possible to significantly expand the possibilities of scientific and practical research in studying the peculiarities of the relative location of anatomical structures in the living eye, even under normal conditions. in pathological conditions.

Ultrasound examination of the eyelids of 22 patients showed that the method of ultrasound biomicroscopy revealed the skin of the upper and lower eyelids, the circular muscles of the eye (m. orbicularis palpebrarum), the tarsal plates of the eyelids, the levator of the upper eyelid. muscle aponeurosis (m. levator palpebrae superioris), muscle complex Müller - conjunctiva, ducts of Krause's glands, orbital fat tissue. Dynamic measurement of the parameters in different directions of the eye showed that the thickness of the levator aponeurosis of the upper eyelid increased by 52% from the initial value, and the thickness of the Mullerian muscle-conjunctival complex increased by 28%.

Comparative studies of the possibilities of biometry of structures in the front of the eye were carried out using ultrasound biomicroscopy, spatial ultrasound and the method of forming optical parts (based on the Scheimpflug principle). When measuring the width of the corner and the depth of the anterior chamber, the results of the analysis showed the high accuracy of these methods (correlation coefficients in the range of 0.85-0.97). At the same time, the important advantages of UBM were a combination of high resolution with no dependence on the degree of transparency of the studied structures (in particular, lenses).

Ultrasound visualization during changes of various origins of the anatomical structures of the eye

Ultrasound biomicroscopy in inflammatory processes

Among the main signs of inflammation established by Hippocrates, Celsus, Galen (calor, rubor, tumor, dolor, functio laesa), the most important during ultrasound biomicroscopy is swelling, because it leads to a violation of the anatomical structure. can be assessed qualitatively and quantitatively in scanograms.

UBM in the diagnosis of inflammatory diseases of the fibrous membrane

The diagnosis of inflammatory processes in the sclera can be difficult due to the intensive static injection of superficial vessels, masking the involvement of deeper layers and complicating the differentiation of episcleritis and scleritis, evaluating the type and dynamics of inflammation.

UBM was used for the diagnosis and monitoring of episcleritis and scleritis localized in the preequatorial zone of the eyeball in 44 patients (32 women and 12 men, 57 eyes). The initial test with a vasoconstrictor (irifrin 10%) did not allow to clearly determine the type of injection of the eyeball in 56% of cases. According to the results of the scan, episcleritis was detected in 81% of cases (by type: simple sectoral or diffuse, with an average increase in the thickness of the conjunctiva with the episclera in the inflammatory area up to 280±46. μm - 49% of the eyes, 315±24 μm in the locally affected area with nodular episcleres with an average total thickness of the conjunctiva - 32% of the eyes. Scleritis was diagnosed in 19% of cases: an increase in the thickness of the sclera itself in the acute inflammatory phase to an average of 1280±137 μm in the acute inflammatory phase and without diffuse necrosis, a decrease in reflection, eye 9 percent had no nodules. - in 10% of eyes, necrosis with more pronounced swelling and infiltration of the sclera (inflammation of "nodules" reached a thickness of 2.5-2.6 mm). In 12% of cases (5 patients, 7 eyes), scleroveitis was detected, which was not detected before UBM. Both hyperreflective areas of scar thinning of the sclera and relatively hypoechoic, heterogeneously reflective areas with focal edema have been shown in patients with long-standing scleritis. In the waning stage of inflammation, more pronounced thinning of the sclera (up to 190-200 μm) was observed in patients with nodular scleritis.

The acoustic image reflected the clinical course of the disease clearly and with a high degree of reliability and was well correlated with the actual image of the histopathological changes occurring in various inflammatory processes of the sclera. Thus, an isolated (without the involvement of the sclera itself), a diffuse or local increase in the thickness of the conjunctiva and episclera, with a slight decrease in reflection, reflects the picture of vascular injection, swelling and cell infiltration in episcleritis. Diffuse or focal thickening of the sclera, impaired homogeneity, hyporeflexia, and blurred borders indicated its swelling and infiltration by inflammatory cells and immune complexes that occur with scleritis. Perivascular infiltration around branches of the ciliary artery that pierces the sclera appeared as a hyporeflective channel in the sclera on scans.

In all cases, UBM made it possible to conduct a differential diagnosis of episcleritis and scleritis, to determine the type, degree and phase of inflammation, to identify the inflammatory process of eye tissues, including "silent" zones. uveal path covered with sclera, objectification of assessment of the dynamics of inflammatory and cicatricial processes in the sclera and correction of treatment tactics. In clinical practice, the second is the appearance of systemic immune disorders, which is especially important in monitoring scleritis, which has a more stable and severe course and requires longer, complex and systematic treatment.

UBM in the diagnosis of inflammation of the choroid (uveitis).

Difficulties in the diagnosis and treatment of uveitis - a heterogeneous group of diseases, the common feature of which is inflammation of the vascular paths of the eye - are not only complex, but often unclear. the mechanism of development and the variety of clinical manifestations, as well as by problematic visualization of "invisible" structures (iris stroma, ciliary body, parietal parts of the vitreous body) using regular methods, especially in conditions of reduced transparency of optical means. Diagnostic possibilities of UBM are acute inflammation, inflammation of the preequatorial localization choroid with the consequences of previous uveitis in remission or the most obvious changes in the scanogram are patients with acute uveitis (sclerouveitis). . The main localization of inflammation (iris, ciliary body or choroidal periphery), a change in the surface profile (flattening of the relief), a decrease in reflection due to systemic disorders caused by swelling.

In the scanograms in the active stage of inflammation, the cell reaction in the aqueous humor of the anterior chamber of the eye and ultrasound signs of localized inflammation in the vitreous (thin opacities, snow-like exudate, threads of different intensity and length; fixed fibroglial membranes at the anterior base of the vitreum) in a relatively resorbed state found in the phase of remission, as well as long after the inflammation has subsided. This is consistent with known observations of long-term persistence of the inflammatory substrate in the vitreous. Unspecified parietal opacities were found mainly in the lower parts of the eyeball.

The variability of the ultrasound picture in uveitis of different origins reflected the type and stage of the inflammatory process (acute or chronic, slow or recurrent) during UBM. This study made it possible to identify clinical situations in which the visualization of pathological changes is possible only with the help of UBM:

- uveitis in a pseudophakic eye - in 59% of cases, due to UBM, a violation of the capsular fixation of the IOL. The contact of the supporting elements and/or the optical part of the IOL with the reactive tissue causing uveitis has been reliably determined;
- intermediate uveitis - 56% of cases;
- decreased transparency of the optical environment (corneal transparency, anterior chamber fluid, complex uveal cataract) - 19% of cases.

UBM allowed the most accurate assessment of the level and dynamics of inflammation and the effectiveness of treatment, and therefore can be recommended as a sufficient objective method for the diagnosis and monitoring of patients with uveitis of various origins.

UBM in the diagnosis of choroid tumors

It is known from the literature that among all neoplasms of the choroid, tumors of iridociliary and/or ciliochoroidal localization are the most difficult to identify (also at relatively later stages of development) (Brovkina AF et al. al., 1980, 2002).

We examined 232 patients (232 eyes) aged 4 to 78 years (mean age 44.8±16.5 years) with suspected or confirmed choroidal tumor. 84 men and 148 women were examined. When conducting UBM:

- the meridian/sector of the location of the tumor, its dimensions (maximum values of meridional, tangential size and thickness), acoustic structure and configuration of the tumor were determined;
- evaluated the borders of the tumor, its relationship with the neighboring anatomical structures and the condition of the tissues surrounding the tumor;
- Ultrasound examination was performed both to evaluate the growth and structural changes of the tumor and during tumor removal. A retrospective analysis of ultrasound scans obtained during UBM at the time of tumor resection was performed, comparing them with images of available histological specimens.

According to the results of ultrasound examination of 232 patients sent to the UBM to see the tumor, the diagnosis of "choroidal tumor" was excluded in 9% of cases (21 eyes). As shown by UBM, in 19 eyes, the hyaline appearance of the iris was due to the growth of iridociliary neuroepithelial cysts (defined biomicroscopically when the diameter increased to 1.3-1.5 mm or more) or the presence of lens masses (2 eyes z), due to the insufficient level. aspirated during phacosurgery. Table 3 shows the ultrasound results of 211 eyes (91%) in which tumors were reliably visualized during the scan and summarizes the usefulness of UBM for different localizations of choroidal tumors; In addition, a single isolated tumor of the ciliary body without clinical manifestations, incidentally detected during UBM, was included.

detailed determination of iris tumor borders by ultrasound became the basis for transferring 10 of them to the iridociliary group.

UBM in the evaluation of complex lesions in mechanical eye injuries

In 75% of cases, mechanical damage leads to the development of a complex, combined pathology involving the anterior segment of the eye, which can be difficult to assess in detail due to a number of conditions. caused during trauma, for example, optical means due to a decrease in transparency (Gundorova RA et al., 1986, 2009).

Using the UBM method, 192 eyes with long-term treatment within 1 month (45.5%) and 55 years, including 178 patients with 68% closed and 32% open eyes were examined old (54.5%) . Immersion research technology allows UBM to be performed when there are no obvious defects in the outer membranes of the eyeball.

Despite the complexity of the detected injuries, analysis of trauma scans for individual anatomical structures was performed.

Corneal damage detected in 68 eyes, including penetrating corneal damage with foreign body penetration into the cornea - 3, penetrating corneal damage with foreign body penetration - 2, penetrating corneal damage after PCO (including corneoscleral) - 8, corneal rupture according to keratotomy scar - 1, post-traumatic cornea - 47, post-traumatic descemetitis and swelling of the cornea - 7. In 89% of cases, according to UBM, post-traumatic corneal cataracts are divided into II-categories. VI, that is. combined with damage to other anatomical structures of the eye. Traumatic damage to the structures of the uveal pathways was observed in 160 cases. Ultrasound signs of iris damage were identified (traumatic mydriasis - 87, pupillary sphincter tear - 42, iridodialysis - 17, aniridia - 2, various iris tissue defects after penetrating wounds - 34, synechia (front and/or back) - 58, implantation cysts growing on the iris - 5), angle of the anterior chamber of the eye (AKA) recession with localization and size determination - 5, cyclodialysis - 9, ciliochoroidal detachment (CD) - 22, traumatic uveitis - 11 eyes. A clear advantage of the UBM was the ability to assess the location, meridional and tangential extent, height and nature of the central storage facility composition. Based on the height of the choroidal compartment, we can distinguish flat (0.12 - 1.5 mm) - 10 eyes, medium vesicular (1.5-3 mm) - 7 eyes and upper vesicle (3 - 5 .8 mm) - we distinguished 5 cases.

Analysis of the state of the lens and ligament apparatus using ultrasound allowed to identify 2 types of damage during trauma: damage to the ligament apparatus with an intact lens capsule (with or without cataract) - 112 eyes (104 patients) and integrity damage. lens capsule - 46 eyes (46 patients). Evaluation of the ligament defect from the scanograms allowed us to identify grade I, II, and III subluxation in 31, 54, and 22 eyes, respectively. In 4 cases, luxation was described in the vitreous body, and in 1 case, in the anterior chamber of the eye.

The following vitreous injuries were observed: anterior chamber hernias - 15 eyes, bleeding (hemophthalmos) - 22 eyes; Visualization of the anterior base of the vitreous body made it possible to use UBM to detect anterior proliferative vitreoretinopathy (APVP) - 19 eyes (the network and meridional level of the membranes, their intensity was determined, the localization of fixed ligaments and tractions was determined and detailed).

List of used literature:

1. Долиев, М. Н., Тулакова, Г. Э., Кадырова, А. М., Юсупов, З. А., & Жалалова, Д. З. (2016). Эффективность комбинированного лечения пациентов с центральной серозной хориоретинопатией. Вестник Башкирского государственного медицинского университета, (2), 64-66.
2. Zukhridinovna, Z. D. (2022). Modern aspects of neuroprotective treatment in hypertensive retinopathy.
3. Jalalova, D., Raxmonov, X., & Shernazarov, F. (2022). THE ROLE OF C-REACTIVE PROTEIN IN THE PATHOGENESIS OF VISUAL VASCULAR DISEASES IN PATIENTS WITH ARTERIAL HYPERTENSION. Science and Innovation, 1(8), 114-121.
4. Jalalova, D., Raxmonov, X., & Shernazarov, F. (2022). SIGNIFICANCE OF ENDOTHELIAL DYSFUNCTION IN THE DEVELOPMENT OF RETINOPATHY IN PATIENTS WITH AH AND WAYS OF ITS CORRECTION. Science and Innovation, 1(8), 101-113.
5. Jalalova, D., Axmedov, A., Kuryazov, A., & Shernazarov, F. (2022). COMBINED DENTAL AND EYE PATHOLOGY. Science and innovation, 1(8), 91-100.
6. Саттарова, Х. С., Жалалова, Д. З., & Бектурдиев, Ш. С. (2011). Причины слепоты и слабовидения при сахарном диабете. Академический журнал Западной Сибири, (6), 27-28.
7. Arunachalam, S. (2008). The science race continues in Asia. Current Science (00113891), 94(7).
8. Zukhriddinovna, Z. D. (2022). Development of Classification Criteria for Neuroretinal Ischemia in Arterial Hypertension. Central Asian Journal of Medical and Natural Science, 3(3), 59-65.
9. Жалалова, Д. З., & Исмоилов, Ж. Ж. (2024). ТЕОРЕТИЧЕСКОЕ ОБОСНОВАНИЕ ИССЛЕДОВАНИЯ ЭНДОТЕЛИНА-1 И Д-ДИМЕРОВ В КРОВИ И СЛЕЗНОЙ ЖИДКОСТИ ПАЦИЕНТОВ С ГИПЕРТОНИЧЕСКОЙ АНГИОРЕТИНОПАТИЕЙ. AMALIY VA TIBBIYOT FANLARI ILMIY JURNALI, 3(3), 294-299.
10. Киселева, Т. Н., Ежов, М. В., Аджемян, Н. А., Танковский, В. Э., & Ильина, Н. В. (2016). Особенности регионарного глазного кровотока при артериальной гипертензии I-II степени и субклиническом атеросклерозе. Российский офтальмологический журнал, 9(3), 26-33.
11. Жалалова, Д. З., Кадирова, А. М., & Хамракулов, С. Б. (2021). Исходы герпетических кератоувеитов на фоне лечения препаратом «офтальмоферон» в зависимости от иммунного статуса пациентов. междисциплинарный подход по заболеваниям органов головы и шеи, 103.
12. Дроздова, Е. А., & Хохлова, Д. Ю. (2015). Морфометрическая характеристика макулярной зоны у пациентов с окклюзией вен сетчаткипо данным оптической когерентной томографии. Медицинский вестник Башкортостана, 10(2 (56)), 64-67.
13. Jalalova, D., Axmedov, A., Kuryazov, A., & Shernazarov, F. (2022). СОЧЕТАННАЯ СТОМАТОЛОГИЧЕСКАЯ И ГЛАЗНАЯ ПАТОЛОГИЯ. Science and innovation, 1(D8), 91-100.
14. Zhang, S., & Melander, S. (2014). Varicose veins: Diagnosis, management, and treatment. The Journal for Nurse Practitioners, 10(6), 417-424.
15. Жалалова, Д. З., & Бабаев, С. А. (2024). РЕЗУЛЬТАТЫ ОЦЕНКИ УРОВНЯ ЭНДОТЕЛИНА-1 И Д-ДИМЕРОВ В СЛЕЗНОЙ ЖИДКОСТИ У ПАЦИЕНТОВ С АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ. AMALIY VA TIBBIYOT FANLARI ILMIY JURNALI, 3(3), 300-307.
16. Zukhriddinovna, Z. D. (2022). Development of Classification Criteria for Neuroretinal Ischemia in Arterial Hypertension. Central Asian Journal of Medical and Natural Science, 3(3), 59-65.

17. Andryev S. et al. Experience with the use of memantine in the treatment of cognitive disorders //Science and innovation. – 2023. – T. 2. – №. D11. – C. 282-288.
18. Antsiborov S. et al. Association of dopaminergic receptors of peripheral blood lymphocytes with a risk of developing antipsychotic extrapyramidal diseases //Science and innovation. – 2023. – T. 2. – №. D11. – C. 29-35.
19. Asanova R. et al. Features of the treatment of patients with mental disorders and cardiovascular pathology //Science and innovation. – 2023. – T. 2. – №. D12. – C. 545-550.
20. Begbudiyev M. et al. Integration of psychiatric care into primary care //Science and innovation. – 2023. – T. 2. – №. D12. – C. 551-557.
21. Bo'Riyev B. et al. Features of clinical and psychopathological examination of young children //Science and innovation. – 2023. – T. 2. – №. D12. – C. 558-563.
22. Borisova Y. et al. Concomitant mental disorders and social functioning of adults with high-functioning autism/asperger syndrome //Science and innovation. – 2023. – T. 2. – №. D11. – C. 36-41.
23. Ivanovich U. A. et al. Efficacy and tolerance of pharmacotherapy with antidepressants in non-psychotic depressions in combination with chronic brain ischemia //Science and Innovation. – 2023. – T. 2. – №. 12. – C. 409-414.
24. Nikolaevich R. A. et al. Comparative effectiveness of treatment of somatoform diseases in psychotherapeutic practice //Science and Innovation. – 2023. – T. 2. – №. 12. – C. 898-903.
25. Novikov A. et al. Alcohol dependence and manifestation of autoagressive behavior in patients of different types //Science and innovation. – 2023. – T. 2. – №. D11. – C. 413-419.
26. Pachulia Y. et al. Assessment of the effect of psychopathic disorders on the dynamics of withdrawal syndrome in synthetic cannabinoid addiction //Science and innovation. – 2023. – T. 2. – №. D12. – C. 240-244.
27. Pachulia Y. et al. Neurobiological indicators of clinical status and prognosis of therapeutic response in patients with paroxysmal schizophrenia //Science and innovation. – 2023. – T. 2. – №. D12. – C. 385-391.
28. Pogosov A. et al. Multidisciplinary approach to the rehabilitation of patients with somatized personality development //Science and innovation. – 2023. – T. 2. – №. D12. – C. 245-251.
29. Pogosov A. et al. Rational choice of pharmacotherapy for senile dementia //Science and innovation. – 2023. – T. 2. – №. D12. – C. 230-235.
30. Pogosov S. et al. Gnostic disorders and their compensation in neuropsychological syndrome of vascular cognitive disorders in old age //Science and innovation. – 2023. – T. 2. – №. D12. – C. 258-264.
31. Pogosov S. et al. Prevention of adolescent drug abuse and prevention of yatrogenia during prophylaxis //Science and innovation. – 2023. – T. 2. – №. D12. – C. 392-397.
32. Pogosov S. et al. Psychogenetic properties of drug patients as risk factors for the formation of addiction //Science and innovation. – 2023. – T. 2. – №. D12. – C. 186-191.
33. Prostyakova N. et al. Changes in the postpsychotic period after acute polymorphic disorder //Science and innovation. – 2023. – T. 2. – №. D12. – C. 356-360.
34. Prostyakova N. et al. Issues of professional ethics in the treatment and management of patients with late dementia //Science and innovation. – 2023. – T. 2. – №. D12. – C. 158-165.