Severe bilateral pseudomonas sclerokeratitis in comatose patient (clinical case)

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The article presents a clinical case of severe bilateral pseudomonas sclerokeratitis in a patient with occlusion hydrocephalus and intracranial hypertension, who was in a coma and on a ventilator for 20 days. At first examination (7 days after the onset of purulent keratitis, during which the process had been rapidly progressing), the clinical picture included lagophthalmos, severe purulent corneal ulcer, bilateral purulent scleromalacia, perforated cornea in the left eye. On the same day, in order to maintain eye integrity, urgent reconstructive penetrating sclerokeratoplasty with subsequent sclerocorneal coating was performed in both eyes right in the intensive care unit. Parts of the melted iris and ciliary body pars plana that were left in place were abundantly washed with BSS and moxifloxacin solutions — 150 µg/ml. Postoperative care included forced instillations of antibiotics and antiseptics. Two years after the first surgery, 2 more full-thickness corneal transplantations were performed in the patient’s right eye aiming at restoration of its optical system. Thus, immediate sclerokeratoplasty with anterior segment irrigation and intraocular administration of highly diluted antibiotics appeared to be the only chance to save the vision in one eye. The fellow eye, where perforation occurred as a result of severe purulent sclerokeratitis and purulent iridocyclitis, despite all measures taken, lost its sight. After three surgeries (penetrating sclerokeratoplasty and two re-PK), visual acuity in the only seeing (right) eye was 0.1, which can be considered a satisfactory result.

Keywords: exposure keratopathy, pseudomonas sclerokeratitis, sclerokeratoplasty, intraocular administration of antibiotics, keratitis in comatose patient on ventilator, eye care in comatose patients.

Healthcare Associated Infection (HAI) in intensive care units (ICU) holds a unique position among all purulent-septic diseases. The ICU-wide prevalence of HAI varies between 20% to 25% [1, 2].

Over 50% of all HAI are caused by gram-negative bacteria, dominated by Pseudomonades, Pseudomonas aeruginosa in particular [3–6].

Pseudomonas infection is likely to occur under specific circumstances, including long-term exposure to invasive methods of monitoring and life support: controlled mechanical ventilation, urethral and central venous catheterization, nasogastric intubation and prolonged stay in the ICU [1].

Bacterial colonization of ICU patients develops rapidly and directly correlates with the duration of their stay in the intensive care unit.

Pseudomonas aeruginosa can be detected in tracheal and urine aspirate specimens in 2–3 days following tracheal intubation or urinary catheterization [7]. The number of patients with P. aeruginosa colonization and infection reaches 23.4% after a week stay in the ICU, in two weeks it goes up to 57.8% [8].

Mechanically ventilated comatose patients are at increased risk for exposure keratopathy, corneal inflammation and ulceration, especially if they have lagophthalmos with a limited or absent blink reflex and developing chemosis. Corneal contamination with Pseudomonas aeruginosa happens as a result of manipulation of tracheostomy tubes by nursing staff in the ICU. Bacteria settle from the tubes onto the corneal epithelium and invade the corneal stroma [9].

Pseudomonas aeruginosa is the most frequently isolated Gram-negative pathogen in cases of severe purulent corneal ulcer. This keratitis has the following specific characteristics: profuse purulent discharge; fulminant progression of the ulcer; stromal infiltration of yellow-grey or yellowish color, stromal colliquative necrosis; descemetocele or corneal perforation [10]. Lysis of corneal epithelial cells is attributed to toxins and proteolytic enzymes produced by Pseudomonas aeruginosa [11].

The infection spreads rapidly in all directions, may enlarge and spread deeper into the cornea, and, without adequate treatment, it can affect the sclera [10, 12].

In one or two days the corneal ulcer may reach the Descemet’s membrane and can lead to descemetocele, perforation, endophthalmitis, panophthalmitis and eye loss.

We totally share P.R. Laibson`s point of view that in case of purulent corneal ulcer rapid progression, the surgeon has 24–48 hours to decide whether to perform an urgent penetrating keratoplasty [13].

This paper presents a case of bilateral purulent sclerokeratitis caused by pseudomonas aeruginosa, developed in a comatose patient P. suffering from occlusive hydrocephalus and intracranial hypertension following a VP shunt surgery.

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A 38-years-old female comatose patient P. stayed in the intensive care unit (ICU) in a clinic for neurologic diseases receiving controlled mechanical ventilation for 20 days.

We were asked to advise on that patient on the 7th day after a purulent keratoconjunctivitis occurred, affecting both eyes. The keratoconjunctivitis progressed rapidly. She was treated with instillations of Chloramphenicol. However the treatment was not effective.

Status oculorum: Thick purulent discharge from both eyes, on the eyelids and eyelashes, filling the palpebral fissures. Purulent discharge was submitted for bacteriological examination. The purulence was carefully removed from the eyelids surface and palpebral fissure with sterile gauze tampons and conjunctive sacs were washed with 0.25% boric acid solution. Medical examination was then performed.

During the eye examination, a mild bilateral exophthalmos and lagophthalmos were found, together with mixed injection of the eyeball, and deep, extensive and diffuse purulent corneal infiltration in both eyes. OS had more pronounced lagophthalmos and exophthalmos. The central zone of infiltration was yellowish-gray; advanced purulent keratitis and purulent melting of the surrounding sclera were observed in the periphery of both eyes. Purulent exudate within the anterior chamber was visible in both eyes (OU) (Fig. 1a, b).

A linear corneal perforation (2 x 4 mm in size) was discovered 1 mm from the limbus in the upper outer quadrant of OS. Measuring intraocular pressure (IOP) through palpation showed a hypotony in OU.

Diagnosis: OU — advanced purulent sclerokeratitis with ulceration, hypopion, lagophthalmos. OS — corneal perforation, exophthalmos.

On the same day, 26 October 2009, emergency surgery was performed in the intensive care unit to save the eye as a functioning organ. Both eyes underwent a penetrating sclerokeratoplasty followed by a coating of the transplant with a sclero-corneal coat ("double" sclero-keratoplasty). The surgery was performed with a neurosurgical microscope (surgeons — A. A. Kasparov, Ev. A. Kasparova). The surgery was performed under general anesthesia performed by anesthesiologists from the neurosurgery department.

A customized 15.0 mm trephine was used to make an incision alternately in the right and left eye and to perform an excision in the area of the purulent-melted cornea, sclera and limbus. The clots of pus and fibrin were removed from the surface of iris and the pupil area with a wet sponge. A partial purulent melting of the iris was observed. The swelling crystalline lens of the right eye that had moved into the pupil area as a result of the purulent melting of ciliary zonnules was removed using the intracapsular method. The remains of the iris and pars plana were thoroughly washed with a BSS solution followed by Moxifloxacin solution 150 mg/ml (0.7 ml). An anterior vitrectomy then was performed. 0.1 ml of Amikacin saline solution, 400 mg/0.1 ml and 0.1 ml of Dexamethasone 4 mg/1 ml were injected into the vitreous cavity.

A 15.0-mm diameter trephine was used to dissect the sclera-corneal discs from donor eyeballs within were then attached to the sclera with 12 interrupted sutures 10.0.

Afterwards, the sclerocorneal transplants were covered with sclerocorneal coverage, which was fixed to the sclera with 4 interrupted sutures 9.0.

The Sclerocorneal coverage (coating) method was first proposed by Soviet surgeon Puchkovkaya NA in 1968. After a total separation of the donor’s cornea stroma to the depth of 0.4 mm, an excision the corneal flap with a scleral rim is performed. This flap is laid onto the surface of the recipient’s cornea (or transplant) and is fixed with 4 interrupted stitches through the scleral rim to the recipient’s sclera.

This operation is widely used in Russian ophthalmosurgical practice in various pathological processes of the cornea for which other treatments are ineffective, including nonhealing ulcers of the cornea and corneal grafts. The method effectively prevents corneal clear melting and stimulates the healing of corneal graft’s ulcers [14]. A partial tarsorraphy was performed in OS. A parabulbar injection of 0.8 ml Gentamicin was made in OU.

After surgery the eyes were left unbandaged. A fortified antibacterial, anti-inflammatory and anti-enzyme therapy was prescribed: Tobrex and Oftaquix eye drops were applied every 15 minutes during the first 3 hours after surgery, the frequency of application was gradually reduced from up to 8 times per day (in 4 days); boric acid solution was applied 8 times per day, Chlorhexidine 4 times per day, Diflucan 5 times per day, Indocollyre 4 times per day, the protease inhibitor Gordox 6 times per day, and artificial tear solution was applied every 2 hours.

To treat continued abundant discharge, the conjunctival cavity was thoroughly washed with 10 ml of 0.25% boric acid solution, 2–3 times daily during the initial days after surgery. Peribulbar injections of 0.5 ml of Gentamicini solution were performed daily in both eyes (within 6 days). A course of antibacterial and fungicide therapy was prescribed (Imipenem and Cilastatin Jodas, Mycosyst, Metronidazolum).

5 days after surgery, the mucopurulent conjunctival discharge from both eyes has ceased. The acute inflammation process was stopped successfully (Fig. 1c). The right eye in three days after emergency sclerokeratoplasty surgery, corneoscleral coating.

Bacteriological examination of purulent discharge from conjunctival sacs and tracheostome revealed Pseudomonas aeruginosa sensitive to Polymixin B; moderately resistant to Imipenem/Cilastatin and Cefotaxim and resistant to all other antibiotics.

In the next 3 weeks the following solutions were applied to both eyes: Polymixin B fortified eye drops 8 times daily, Indocollyre 4 times daily, Maxitrol 0.1%

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Fig. 1. General view of patient P. after removal of pus from the surface of the eyelids and eyeball (coma II, mechanical ventilation, 7th day after the onset of purulent keratoconjunctivitis in both eyes).

a, b – lagophthalmos is more pronounced on OS, corneal perforation OS, developed purulent corneal ulcer and purulent melting of the sclera OU; c – view of the right eye on the 3rd day after emergency sclerokeratoplasty and corneoscleral coating; d – view of the patient 2 years after the first (penetrating) sclerokeratoplasty, clouding of the corneal graft on OD, phthisis bubli in the left eye.

4 times daily, Preservative Free Lubricant Eye Drops 4 times daily, Corneregel per night.

Regression of hydrocephalus was revealed after several neurosurgical operations of ventriculoperitoneal shunting with controlled CT scan of the brain. However in one month the patient had to undergo an endoscopic ventriculostomy to treat progressive ventricular hydrocephalus and sustain the patient’s critical life functions. In the postoperative period numerous breast abscesses occurred confined to the skin area around of the ventriculoperitoneal shunting catheter complicated by purulent inflammation along catheter tubing tracts. The ventriculoperitoneal shunt was removed and abscesses were opened up and drained.

Bacteriological examination of purulent discharges from the abscesses revealed growth of Pseudomonas aeruginosa. The patient was given a repeated course of antibiotics; frequent instillations of antibiotic and antiseptic eye drops were applied in both eyes until a complete healing of the skin.

Lysis of the sclerocorneal coating occurred in both eyes within 2 months of initial sclerokeratoplasty. Graft opacification was observed in the right eye (OD), while the left eye demonstrated phthisis. IOP of the right eye
palpatory was in the normal range. Numerous microbiological swabs for culture, that were taken from the conjunctival sac showed absence of bacterial growth.

Still unconscious, the patient was transferred to other medical neurological institutions. We observed the patient regularly.

Due to progressive thinning of sclerocorneal transplant in the right eye in 3 months after sclerokeratoplasty, we had to perform repeated, second epikeratoplasty, followed by tarsorrhaphy.

Only in June 2009, 9 months after the initial eye surgery, the condition of the patient had considerably improved — she began to recognize voice and spoken commands and demonstrated minimal active movements.

During the next 2 years after undergoing several courses of rehabilitation treatment, including neurometabolic treatment, physical exercise therapy, speech rehabilitation, and the patient demonstrated a positive dynamics. She began to sit up unaided, was able to get up and walk and improved her speech articulation. During the entire observation period the right eye remained stable, IOP was within a normal range. The transplant of the right eye was cloudy (Fig. 1d).

In the two years after sclerokeratoplasty the patient was clearly conscious, sociable, able to correctly orient herself in time, space, and in the relationship with others, had normal speech and no signs of cognitive impairment. No changes in intelligence and mnestic functions were observed. OD – condition after sclerokeratoplasty, transplant opacification, aphasia, aniridia, scleral thinning. OS – phthisis bulbi. A thin-walled cosmetic ocular prosthesis was installed in the left eye.

On the 28 March 2012 the patient underwent a penetrating keratoplasty with anterior vitrectomy on the right eye, the only one that preserved visual functions.

<table>
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<tr>
<th>Date of eye surgery</th>
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<th>Eye surgery, aim</th>
<th>Outcome</th>
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<td>26/10/2009</td>
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<td>Urgent sclerokeratoplasty OU</td>
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<td>Moxifoxacini (150 mg/ml) irrigation of anterior segment of the right eye, Amikacini and Dexamethsoni solutions intravitreal injection OD</td>
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<td>Sclerocorneal coating of sclerocorneal grafts</td>
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<td>29/01/2010</td>
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Discussion

This case report of bilateral keratitis caused by Pseudomonas aeruginosa occurred in a comatose female patient offers a dramatic illustration of the unfavourable course of pseudomonas infection development. Without timely and adequate treatment the purulent sclerokerat-
tis lead to a sharp decline of visual functions and danger of total loss of vision in both eyes.

Surgery that included urgent sclerokeratoplasty with rinsing and intraocular instillation of highly dilute antibiotic solution was the only chance of saving the sight in the right eye. All attempts to save the left eye had unfortunately failed; the situation was complicated by corneal perforation followed by purulent sclerokeratitis, purulent iridocyclitis and endophthalmitis.

The best-corrected visual acuity after three surgeries (sclerokeratoplasty and two penetrating keratoplasty) in the right eye is 0.15 and has an overall satisfactory rating.

Many patients in the ICU, especially in a coma and on a mechanical ventilation, are at an increased risk of exposure keratopathy and further cornea infection as a result of their weakened immune system; increased virulence of Pseudomonas aeruginosa and rapid progression of purulent corneal ulcers and therefore require an extra level of eye care and attention.

**Conclusion**

An advanced corneal ulcer caused by Pseudomonas aeruginosa is characterized by a malignant progression, has a fulminant onset and rapid progression and lead to devastating consequences, especially in cases when ulceration destroys both cornea and sclera, causing corneal and scleral melting.

An emergency sclerokeratoplasty in combination of the antibiotics and antienzymes in the early post-operational period helped to arrest the progression of severe purulent sclerokeratitis, caused by Pseudomonas infection and preserve the sight in one eye.

**Conflict of interest statement:** None declared