Orbital Abscess—Two Case Reports with Review

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Abstract Periorbital infections lead to severe condition of the orbital abscess, and eventually to sight loss, and even death. Current study aims in reviewing the literature regarding orbital abscess in adult patients and presenting 2 original cases. A surgical intervention to drain the abscess and a revision of the orbital was required. A review of literature is also reported focusing on aetiology and treatment options dealing with an orbital abscess.

Keyword Orbital abscess · Orbital trauma · Treatment

Introduction

Periorbital infections lead to severe condition of orbital abscess, and eventually to sight loss, and even death [1, 2]. They carry the risk of rapid deterioration, hence require immediate management [3].

In 1970, Chandler et al. proposed the classification of orbital complications depending on its extention: I—pre-septal cellulitis; II—orbital cellulitis; III—subperiostal abscess; IV—orbital abscess; V—cavernous sinus thrombosis [4]. Current study aims in reviewing literature regarding orbital abscess in adult patients and presenting 2 original cases.

Case Report 1

A 35-year-old woman presented to the maxillofacial surgery department in Poznań due to massive eyelid swelling and severe pain in the left eye. Three days before the patient was admitted to the department, she was injured with a blunt instrument. The physical examination shows massive swelling of the eyelids of the left eye—closing the eyelid gap, exophthalmos of the left eyeball, severe pain on palpation, redness and warming of the surrounding soft tissues, eruptions on the skin of the upper and lower eyelids, body temperature 37.9 °C (Fig. 1). No other irregularities were found. Computed tomography of the orbital without contrast and an X-ray of the lungs, laboratory tests, electrocardiogram were ordered. Additional a smear was taken for bacteriological examination. The computed tomography image shows phlegmon of the left cheek and orbital (Fig. 2). In the ophthalmological examination, the right eye remained unchanged. In the left eye, there was an abscess of the eyelids and orbit, swelling of the eyeball and eyelid conjunctiva; transparent cornea; iris unchanged; the pupil is even, round and reacts correctly to light. The image of the fundus of the right eye was normal, the left eye was not available for examination. The patient was administered amoxicillin and clavulanic acid 1.2 g intravenous (IV) three times a day, Metronidazole 500 mg three times daily IV, ketoprofen 0.1 g twice daily, enoxaparin 0.4 ml once daily subcutaneous. Additionally, drops containing dexamethasone and tobramycin every two hours were used for the left eye. Under general endotracheal anaesthesia, an incision and drainage of the left orbital phlegmon were performed from the supraorbital and suborbital incisions,

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resulting in abundant purulent exudate (Fig. 3). The abscess cavity was rinsed with saline. A flow drain was introduced. In the postoperative period, the level of CRP and WBC was monitored—a decrease in CRP and WBC was observed. On the third day after surgery, a control ophthalmological examination confirmed correct vision in the left eye (Fig. 4). The microbiological examination revealed the alarm pathogen *Streptococcus pyogenes* susceptible to empirical therapy, *Staphylococcus aureus, Staphylococcus epidermidis*. The patient was discharged from the clinic on day 9 in good general condition. There were no visual disturbances in the left eye. The only permanent consequence was scarring of the facial skin after surgical access (Fig. 5).

**Case Report 2**

A 63-year-old man was transferred from the department of ophthalmology to the department of maxillofacial surgery due to blindness in the left eye due to orbital phlegmon in order to decompress the abscess. 8 days before hospitalization, the patient suffered a facial injury as a result of

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**Fig. 1** The physical examination shows massive swelling of the eyelids of the left eye—closing the eyelid gap, exophthalmos of the left eyeball, severe pain on palpation, redness and warming of the surrounding soft tissues, eruptions on the skin of the upper and lower eyelids

**Fig. 2** The computed tomography image shows phlegmon of the left cheek and orbital

**Fig. 3** An incision and drainage of the left orbital phlegmon were performed from the supraorbital and suborbital incisions, resulting in abundant purulent exudate

**Fig. 4** On the third day after surgery, a control ophthalmological examination confirmed correct vision in the left eye
hitting a metal gate. Immediately after the injury, the skin wound was treated at the ophthalmology department. Symptoms of acute inflammation appeared on the 5th day after the injury. Physical examination shows a contaminated, extensive wound to the skin of the upper eyelid and the left supraorbital area, penetrating the orbital along the roof and the sidewall, from which the exudate of the purulent content emerges. Left eye exophthalmos, the blindness of the left eye, significantly limited mobility of the left eyeball. Due to the swelling, the palpebral fissure was narrowed. Disturbed sensation in the area of the left orbital. Fracture in the craniofacial skeleton was not detected (Fig. 6). Body temperature was normal. The patient does not report comorbidities and allergies. The patient does not take medications and does not mention any social problems. Magnetic resonance imaging orbitals was performed, which showed an image of an abscess of the left orbit, exophthalmos and a forced course of the optic nerve (Fig. 7). Additionally, a craniofacial CT scan, lung X-ray, ECG were performed, a smear was taken for bacteriological examination and blood was taken for laboratory tests. The patient was administered ceftriaxone 1.2 g intravenous (IV) twice daily, Metronidazole 500 mg three times daily IV, ketoprofen 0.1 g twice daily, enoxaparin 0.4 ml once daily subcutaneous, dexamethasone 8 mg IV once daily. Additionally, drops containing dexamethasone and tobramycin every two hours were used for the left eye. Under general endotracheal anaesthesia, an incision and drainage of the left orbital phlegmon were performed from the supraorbital traumatic wound and suborbital incisions, resulting in abundant purulent exudate. The abscess cavity was rinsed with saline. A flow drain was introduced (Fig. 8). The wounds were surgically prepared and the necrotic masses were removed. In the postoperative period, the level of CRP and WBC was monitored—a decrease in CRP and WBC was observed. A control CT performed on the 3rd day after the procedure showed the correct position of the drain in the eye socket and a significant reduction in exophthalmos. The microbiological examination revealed the alarm pathogen *Streptococcus pyogenes* susceptible to empirical therapy, *Klebsiella pneumoniae*, *Proteus mirabilis*. On the 3rd day after the procedure, the patient reports a subjective sense of light in the left eye (Fig. 9). On the 8th day of hospitalization, the patient was returned to the Ophthalmology Department. The consequence of the injury and infection was permanent blindness of the left eye.

Fig. 5 The only permanent consequence was scarring of the facial skin after surgical access

Fig. 6 Physical examination shows a contaminated, extensive wound to the skin of the upper eyelid and the left supraorbital area, penetrating the orbital along the roof and the sidewall, from which the exudate of the purulent content emerges. Left eye exophthalmos, the blindness of the left eye, significantly limited mobility of the left eyeball. Due to the swelling, the palpebral fissure was narrowed

Fig. 7 Magnetic resonance imaging orbitals was performed, which showed an image of an abscess of the left orbit, exophthalmos and a forced course of the optic nerve
Discussion

Owing to the retrospective nature of this study, it was granted an exemption by the Poznan University of Medical Science review board.

The first literature case reports of orbital abscess originated in 1884 [5, 6]. However, PubMed research revealed only 254 results using the formula orbital[title] AND abscess[title], and 863 results, when using the formula orbital[title/abstract] AND abscess[title/abstract] (and 1359 results for orbital[all fields] AND abscess[all fields]).

Orbital abscess formation occur in 8% of patients with retroseptal orbital cellulitis [7].

Symptoms

The most frequently encountered signs and symptoms include periorbital edema, restricted ocular movement, orbital pain, proptosis, periorbital erythema, chemosis and vision deterioration—Table 1. [3, 8]–[39]

Etiology

Bacterial etiology is the most common and regards pathogens such as Streptococcus spp. [7, 11, 14, 16, 28, 31, 33, 35, 39, 40]. Staphylococcus aureus [9, 36, 40] (also methcylin resistant Staphylococcus aureus [20, 21, 34, 40]) and Pseudomonas aeruginosa [24, 30, 41]. Additionally, wide spectrum of bacteria are rarely encountered: Haemophilus spp. [28, 39]. Coagulase-negative staphylococcus [23, 40], Peptostreptococcus spp. [8, 27], Citrobacter freundii [11, 40], Enterobacter spp. [40], Enterococcus spp. [39, 40], Acinetobacter spp. [40], Actinomyces israelii [40], Diphtheroids [40], Morganella Morgani [17], Proteus mirabilis [17, 40], Escherichia coli [40], Granulicatella Adiacens [22], Prevotella melaninogenica [27], Eikenella corrodens [28], Propionibacterium acne [42], Pseudomonas stutzeri [38] as well as polymicrobial infections [3, 11, 28, 39, 40]. Gram-negative infections are at higher risk of visual deterioration or loss, especially in regard to Acinetobacter spp. [40] Fungal etiology occurs very infrequently and includes Exophiala dermatitidis [15] and Candida albicans [11]. Occasionally, the infection etiology remains unknown despite culture sampling and isolation attempt [10, 19, 29, 43]—according to Teena et al. 68.8% of orbit specimens finds the infectious pathogen [40]. Some articles omit stating exact etiology [12, 13, 26].

Pathogenesis

Orbital abscess formation originates from odontogenic, periorbital, sinonasal, traumatic, or systemic pathologies, like wise iatrogenic complications. Odontogenic pathogenesis includes incorrect or complicated intraoral interventions, such as tooth extractions and endodontic treatment [12, 19, 33, 35] as well as delayed dental procedures related to 'extreme phobia' of dental procedures and severe caries [8, 18]. Common ophthalmological procedures may result in orbital abscess: posterior subtendon injection [9, 15, 29, 34], strabismus surgery [16], trabeculectomy [38], canaliculitis surgical treatment [28], or orbital implants placement [3, 42]. Frequently, the abscess arises from dacryocystitis [17, 23, 27, 37, 44, 45], and rarely from conjunctivitis [20]. Another cause come from sinus pathologies such Pott’s Puffy Tumor [13] or frontoethmoidal mucopyocele [30] as well as sinusitis and...
nonspecific upper respiratory infection [20, 46]. The important origin regards posttraumatic fractures, lacerations and impacted foreign bodies [11, 22, 26]. Finally, systemic conditions such as human immunodeficiency virus (HIV) infection [46], immunosuppression after transplantation [24] or congenital immunodeficiency (in pediatric population) [41]. There are cases where exact pathogenesis remains unknown [25, 32].

Sequels

Orbital abscess sequels apply not only to the orbit, restricted ocular motility, impaired or lost vision, and central retinal artery occlusion. Infection may spread causing superior orbital fissure syndrome, cavernous sinus thrombosis, meningitis, brain abscess, and subdural empyema [23, 47–49]. On the other hand, Hughes et al. reported a case of an orbital abscess concomitant to aseptic meningitis and cavitory lung lesions which pathogenesis concerned severe caries. They claimed hematogenous spread of the infection, because maxillary sinus showed no infection. [8]

Table 1  Orbital abscess signs and symptoms

| Signs and symptoms                  | Percentage |
|-------------------------------------|------------|
| Periorbital edema                   | 70         |
| Restricted ocular movement          | 67         |
| Orbital pain                        | 55         |
| Proptosis                           | 55         |
| Periorbital erythema                | 45         |
| Chemosis                            | 42         |
| Vision deterioration                | 39         |
| Purulent discharge                  | 24         |
| Fever                               | 21         |
| Diplopia                            | 18         |
| Facial tenderness                   | 18         |
| Ptosis                              | 15         |
| Face edema                          | 15         |
| Exophthalmos                        | 15         |
| Inability to open an eye            | 12         |
| An eye mass                         | 9          |
| Vision loss                         | 9          |
| Nausea                              | 6          |
| Facial pain                         | 6          |
| Nasal obstruction                   | 6          |
| Corneal edema                       | 6          |

Percentage based on current literature review [3, 8]–[39]

Imaging

Ocular ultrasonography provides immediate assessment of an orbit and opportunity to follow treatment outcomes without unnecessary exposure to radiation [20, 21]. However, more accurate examinations such as CT or MRI are crucial to evaluate local extension and involvement of adjacent structures, especially before surgical treatment. Despite CT is the first line imaging technique in eye infections and pathologies, it has limited power to visualise orbital abscess. In case of severe symptoms and not significant CT examination, additional MRI scans should be performed [21, 25, 50]. According to Sepahdari et al. diffusion-weighted imaging (DWI) of MRI provides accurate imaging of orbital abscess and grants the sufficient tool for patients with renal insufficiency, if used without intravenous contrast. However, they performed a preliminary study with only 9 cases of orbital infections, including 2 lacrimal gland abscess, 2 eyelid abscess, extracanal abscess, intraconal abscess, and subperiosteal abscess [51]. Panoramic radiograph may be used to visualise oral pathologies in case of odontogenic origin of orbital abscess. [31]

Differential Diagnosis

Numerous conditions present similar symptoms as orbital abscess, possibly misleading the diagnosis, for instance: neoplasms—osteoma of the ethmoid sinus, [52], small cell neuroendocrine carcinoma of the orbit [53] plasmacytoma [54], infections—primary orbital tuberculosis [55], globe subluxation [56], or liquefied hydrogel implant accumulation [57]. On the other hand, physicians reported cases of true orbital abscess primarily misdiagnosed with other pathologies, such as retrobulbar haemorrhage [11], tumor [25], frontal-orbital mucocele, [32] or granulomatosis with polyangiitis exacerbation [58]. Therefore, precise diagnostic process is crucial, including past medical history, clinical assessment, imaging, microbiological tests and histopathological evaluation.

Treatment

According to current review, surgical treatment was necessary in 94% of cases. Abscess drainage is achieved via multiple approaches depending on its localisation: transcutaneous, lateral or anterior orbitotomy, Caldwell-Luc approach, intranasal endoscopy, needle aspiration guided by ultrasound, lower eyelid incision, subciliar incision, incision in four quadrants of the orbit. If it is necessary, surgical debridement of necrotic tissues is performed, as well as enucleation or exenteration. Antibiotic therapy is both, initial and supplementary to surgical treatment. Only
| Author                  | Year | Country          | Age | Gender | Etiology                                      | Pathogenesis                                      | Treatment                                                                 | Results                                      |
|-------------------------|------|------------------|-----|--------|-----------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------|
| Iwahashi et al. [15]    | 2020 | Japan            | 69  | Female | Exophiala dermatitidis                       | Complication of subtendon injection               | Surgical debridement within two surgeries, antibiotic therapy             | Complete recovery                           |
| Linton et al. [13]      | 2019 | United Kingdom   | 16  | Male   | No stated pathogen                          | Complication of Pott’s tumour                    | Supraorbital approach, antibiotic therapy                                 | Recovery with persistent mild visual acuity |
| Wang et al. [14]        | 2019 | China            | 16  | Female | Streptococcus intermedius                    | Complication of sinusitis                        | Ultrasound-guided drainage, irrigation, antibiotic therapy                | Complete recovery                           |
| Arora et al. [12]       | 2018 | India            | 22  | Female | No stated pathogen                          | Complication after tooth extraction by medical fraudster | An incision was given 5 mm below the right lower eyelid, antibiotic therapy | Complete recovery                           |
| Rhatigan et al. [9]     | 2017 | Ireland          | 57  | Male   | Staphylococcus aureus                       | Complication of posterior subtendon injection    | Orbitotomy via lower lid, antibiotic therapy                              | Complete recovery                           |
| Hughes et al. [8]       | 2017 | Ireland          | 58  | Female | Peptostreptococcus spp.                      | Complication of severe caries                    | Abscess drainage via lid crease incision, antibiotic therapy             | Complete recovery                           |
| Procacci et al          | 2017 | Italy            | 35  | Male   | Negative microbiological tests               |                                                   | Drainage via subciliary incision, antibiotic therapy                     | Complete recovery                           |
| Mohammed Saed [11]      | 2016 | United Kingdom   | 46  | Male   | Streptococcus parisinguinus Citrobacter freundii Candida albicans | Traumatic craniofacial fractures                | Surgical drainage, antibiotic therapy                                    | Recovery with loss of vision in the left eye |
| Strul et al. [16]       | 2014 | USA              | 60  | Female | Streptococcus spp.                          | Complication of strabismus surgery               | Lateral orbitotomy, antibiotic therapy                                    | Recovery with some restriction in abduction |
| Carruth and Wladis [17] | 2012 | USA              | 22  | Female | Proteus mirabilis                            | No stated pathogenesis                           | Orbitotomy with drainage, capsular excision and tarsorrhaphy, antibiotic therapy | No stated results                           |

**Two years later**

Morganella morganii

| Author                  | Year | Country          | Age | Gender | Etiology                                      | Pathogenesis                                      | Treatment                                                                 | Results                                      |
|-------------------------|------|------------------|-----|--------|-----------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------|
| Vijayan et al. [18]     | 2012 | Brazil           | 45  | Male   | Streptococcus spp.                           | Complication of dacryocystitis                    | Transcaruncular orbitotomy with abscess drainage, antibiotic therapy      | No stated results                           |
| Kent et al. [3]         | 2012 | Canada           | 30  | Male   | Multibacterial infection (gram-positive cocci and rods, gram-negative rods, and anaerobic organisms) | Complication after porous polyethylene implant placement | Surgical drainage, antibiotic therapy                                    | No stated results                           |
| De Medeiros et al. [19] | 2012 | No stated age    |     | Female | Negative microbiological tests                | Complication after endodontic treatment           | Superior medial palpebral technique and inferior palpebral technique, antibiotic therapy | Complete recovery                           |
| Author          | Year | Country       | Age | Gender | Etiology                  | Pathogenesis                           | Treatment                                      | Results                                      |
|-----------------|------|---------------|-----|--------|---------------------------|----------------------------------------|-----------------------------------------------|----------------------------------------------|
| Secko et al.    | 2012 | USA           | 36  | Female | *Methicillin resistant*   | *Staphylococcus aureus*                | Surgical drainage, antibiotic therapy        | No stated results                           |
| Derr and Shah   | 2012 | USA           | 57  | Female | *Methicillin resistant*   | *Staphylococcus aureus*                | Anterior orbitotomy with abscess drainage,  | No stated results                           |
| Teo et al.      | 2011 | Singapore     | 40  | Male   | *Granulicatella Adiacens* | Complication of posttraumatic peri orbital skin laceration with foreign body | Lateral orbitotomy with abscess drainage and foreign body removal, antibiotic therapy | Recovery with residual proptosis and mild limitation of abduction and adduction |
| Coskun et al.   | 2011 | Turkey        | 45  | Female | Coagulase-negative       | *Staphylococcus*                       | Lateral lower lid incision and abscess drainage, antibiotic therapy | Recovery with vision loss                    |
| Hull et al.     | 2011 | United Kingdom| 65  | Male   | *Pasteurella aeruginosa*  | Complication of dacryocystitis          | Endonasal endoscopic drainage of the abscess, antibiotic therapy | Complete recovery                           |
| Qi and He       | 2010 | China         | 68  | Male   | *Streptococcus Viridans*  | No known direct cause                  | Drainage of the orbital abscess and debridement of necrotic peri orbital soft tissues, antibiotic therapy | Complete recovery                           |
| Sousa et al.    | 2009 | Brazil        | 20  | Female | No stated pathogen        | Complication of facial trauma           | Surgical abscess drainage, antibiotic therapy | Complete recovery                           |
| Martins et al.  | 2009 | Brazil        | 39  | Female | *Prevotella melaninogenica* | *Peptostreptococcus prevotii*          | Subciliary approach, abscess drainage, antibiotic therapy | Complete recovery                           |
| Hatton and Durand| 2008 | USA           | 60  | Female | *Streptococcus anginosis, Eikenella corrodens, Haemophilus paraphrophilus* | Complication after surgical canaliculitis treatment | Medial left upper eyelid crease incision, abscess drainage, antibiotic therapy | Complete recovery                           |
| Ram et al.      | 2008 | India         | 54  | Female | Negative microbiological tests | Complication of subtenon injection | Antibiotic therapy | Recovery with adjacent conjunctival and corneal scarring |
| Kau et al.      | 2007 | Taiwan        | 74  | Male   | *Pseudomonas aeruginosa*  | Complication of frontal ethmoidal mucopyocele | Nasal endoscopic approach, antibiotic therapy | Complete recovery                           |
| Hong et al.     | 2006 | Korea         | 73  | Female | *Propionibacterium acne*  | Porous Orbitonal Implant infection      | Exenteration, antibiotic therapy             | Recovery after exenteration                  |
| Kim et al.      | 2007 | Korea         | 31  | Male   | *Streptococcus Viridans*  | Complication of the periapical abscess of the upper right second and third molars | Antibiotic therapy | Recovery with impaired visual acuity          |
| Aydin et al.    | 2006 | Turkey        | 77  | Female | No pathogen stated        | | Surgical drainage, antibiotic therapy | Complete recovery                           |
two cases resolved with alone antibiotics administration—Table 2 [3, 8]–[28, 30, 32]–[39, 42].

Outcomes

Complete recovery succeed in 49% of cases, whereas 11% of patients recovered with vision loss, 9% with vision deterioration, 6% with persistent movement restrictions, 3% with exenteration, 3% with enucleation, 3% with residual enophatonom, 3% with residual proptosis, and 3% with corneal scarring. Exact results were not presented in 14% of cases. Fortunately, any patient died in the investigated reports [3, 8]–[28, 30, 32]–[39, 42].

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