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CASE REPORT

Necrotizing fasciitis of the periorbital region: from presentation to reconstructive journey

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Abstract

Periorbital necrotizing fasciitis is a very rare condition with a UK incidence of 0.24 cases per million per annum. Outcomes can range from disfigurement to sight loss and even death. Debridement is crucial when sight or life is threatened and the subsequent reconstructive stages can be challenging. We describe two cases of periocular necrotizing fasciitis demonstrating the progression of the disease as well as the surgical debridement for both pre-septal and post-septal disease and the reconstructive steps leading to outcome.

Level of evidence: Level V, therapeutic study.

Keywords Periorbital necrotizing fasciitis · Orbital necrotizing fasciitis · Debridement · Eyelid reconstruction · Pre-septal · Post-septal

Introduction

Periorbital necrotizing fasciitis is a very rare condition with a UK incidence of 0.24 cases per million per annum [1]. Outcomes can range from disfigurement to sight loss in 14%. Risk of death is 3%, much lower than other sites where death can occur in up to 35% [2]. This is attributed to the earlier presentation, the rich blood supply allowing better antibiotic penetration, and also the orbital septum which provides a barrier to posterior spread [3]. The mainstay of treatment is multidisciplinary, involving infectious diseases, intensivists, plastic surgery, and ophthalmology. Emergency debridement is crucial when sight or life is threatened and the subsequent reconstructive stages can be challenging. We describe two cases of periocular necrotizing fasciitis demonstrating the progression of the disease as well as the reconstructive steps and outcome.

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Case 1

This was a 68-year-old lady who presented with periocular necrotizing fasciitis following an episode of dermatitis, a reaction to a shampoo. She took serial selfies which demonstrated progression from a superficial dermatitis to orbital involvement (Figs.1, 2, and 3). On day 10, she presented to hospital with orbital pain. Even though she was afebrile (36.7 °C), she had significant proptosis with pus discharging from her eye (Fig. 4). WCC was 12.82 × 10^9/L; CRP was 308 mg/L. She was started on tazocin, clindamycin, and piptazocin. CT scans showed extensive soft tissue thickening anterior to the right orbit with central abscess formation. Within the orbit, there was a collection at the superolateral aspect extending to the nasal side. She underwent immediate decompression. Intraoperatively, pus was found in both her upper and lower

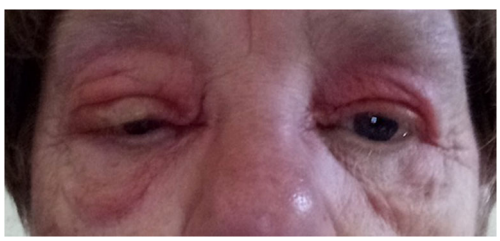

Fig. 1 Initial reaction in periorbital area showing dermatitis on day 2

Fig. 2 Periorbital cellulitis with pus collections day 4

eyelids, in the post-septal and retro-orbital area and there was necrotic tissue over the malar rim and cheek which was debrided (Fig. 5). Her right orbit was enucleated as there was a high risk of the infection spreading to the brain via the optic nerve. Her eye swab grew *Streptococcus pyogenes* (group A) and *Staphylococcus aureus*. Six days later, she underwent reconstruction. There was medial orbital bone loss and the ethmoidal air sinus was exposed. A contralateral paramedian forehead flap was raised and part de-epithelialized to be tunneled through the glabellar area and used to cover the ethmoidal sinus. The tip of the flap was folded on itself and inset to provide an epithelial surface for both lining of the inner sinus as well as the orbit. A split skin graft was used to surface the remaining orbital socket. A cheek advancement flap was then used to cover the inferior orbital rim (Fig. 6). Six months later once healed (Fig. 7), 3 titanium bone anchors were placed in the orbit in stages to be fitted with an osteo-integrated prosthesis (Fig. 8). The forehead flap can be seen medially covering the previously exposed sinus (Fig. 9). The prosthesis fitting was delayed due to the COVID-19 pandemic and photos were therefore not available.

Case 2

This was a 62-year-old man with type 2 diabetes who was assaulted with a wooden plank and rusty nail on his frontal scalp area sustaining a laceration 3 days prior. The laceration was sutured and a head injury was ruled out with a CT scan. The next day, he developed a rapid progressive bilateral

Fig. 3 Periorbital necrosis with proptosis day 8

Fig. 4 Periorbital necrosis, pus, and proptosis day 10

periorbital cellulitis and proptosis followed by transient loss of vision of his right eye (Fig. 10). He was pyrexial at 38.7 °C and confused. WCC was 24.5 × 10^9/L and CRP was 330 mg/L. He was immediately started on meropenem and clindamycin. Repeat CT orbit showed extensive bilateral periorbital swelling with stranding of the subcutaneous fat with fluid collections within the pretarsal regions and lateral to the globes. There was extensive soft tissue swelling over the nasal bridge (Fig. 11). He underwent immediate debridement of the necrotic tissues. This included the underlying fascia, frontalis, and nasal bridge skin to the lid margin, including the orbicularis oculi which was resected. Orbital septum and levators were left intact (Fig. 12). The extent of the defects

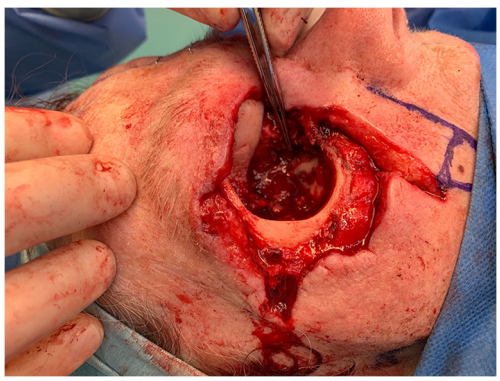

Fig. 5 Post debridement and enucleation (forceps pointing at exposed ethmoidal sinus)

Fig. 6 Post reconstruction with cheek advancement, forehead flap, and skin graft

was similar bilaterally and extended to the vertex with bare periosteum in the midline (Fig. 13). A week later, reconstruction was performed. Scalp flaps were raised bilaterally (Fig. 14). Both cheeks were advanced superiorly for lower eyelid reconstruction using nasolabial incisions (Fig. 15). A lateral canthopexy was performed bilaterally. Palmaris tendon was used as slings for lower eyelid support bilaterally (Fig. 16). The upper eyelids were reconstructed using compound grafts from the scrotum incorporating skin and cremasteric muscle. Sural nerve grafts were coapted to the frontal nerve bilaterally (Fig. 17) and directly onto the cremasteric muscular aspect of the compound graft to neuratize and reinnervate this muscle for upper eyelid dynamic reconstruction in both upper eyelids (Fig. 18). The cremasteric muscle is a thin layer of striated muscle found in the scrotum between the external and internal layers of spermatic fascia that functions to raise and lower the testes for temperature regulation. It demonstrates a cremasteric reflex as well as contracts voluntarily. It is supplied by the

Fig. 8 Radiograph of bone anchors

Fig. 7 6 months post reconstruction

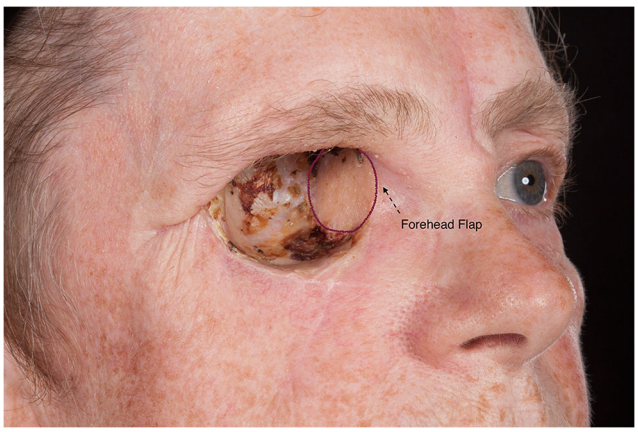

Fig. 9 Forehead flap covering medial orbital wall

Fig. 10 Bilateral periorbital involvement with proptosis

cremasteric artery, a branch of the inferior epigastric artery and the genitofemoral nerve, both of which were not dissected out. Instead, this muscle was neuratized by the frontal nerve and sural nerve graft. This was based on the concept of muscle graft for dynamic facial reanimation first described by Noel Thompson in 1971 [4] and also Nassif et al. [5] The reason for using the scrotum as a donor site for the skin graft, along with the cremasteric muscle, was twofold. Firstly, as skin grafts were required for the upper eyelid reconstruction, a compound graft with the cremasteric muscle component would serve the secondary purpose of dynamic reconstruction for spontaneous eye closure. Secondly, with the frontal nerve identified and readily available post-debridement, coapting a nerve graft for the short distance to the muscle graft on each side seems an obvious reconstructive step. Further conventional technique, albeit more complex and time-consuming surgery using the platysma muscle to restore spontaneous blink, would still be possible by re-coaptation to the same nerve graft in the future and tunneling the muscle under the previous graft, so no bridges were burnt. With further lateral canthopexy procedures 6

Fig. 11 CT head showing swelling and collection in periorbital areas

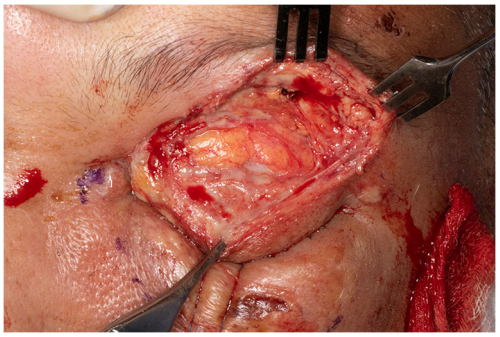

Fig. 12 Debridement of upper eyelids showing pre-septal involvement

months down the line, the patient could achieve closure of his eyelids even though spontaneous blink was not present. However, the patient declined further surgery and was satisfied with the result having had no episodes of eye infections (Fig. 19).

Discussion

The most common trigger for periorbital NF is penetrating or surgical trauma. Patients who are immunocompromised or with chronic conditions are also more at risk [1]. Necrotizing fasciitis is divided into types 1 and 2. Type 1 being polymicrobial is caused by both aerobic and anaerobic organisms and occurs in immunocompromised patients. Type 2 is more common in periorbital necrotizing fasciitis and is usually due to *Streptococci* or *Staphylococci*, with β-haemolytic *Streptococci* A being the most common causative organism cultured.

Periorbital necrotizing fasciitis can be divided into pre-septal and post-septal. In pre-septal involvement, the septum is not breached and the aim is to preserve as much orbicularis as possible for function with a non-radical debridement only to healthy tissues and not beyond. Lateral canthotomies may be required for access during debridement. Post-septal involvement is usually pre-determined on CT, if there is

Fig. 13 Defect post debridement

Fig. 14 Raising scalp and cheek flaps for reconstruction

breach of the septum or obvious bulging with proptosis. In post-septal disease, there is risk of spread via the optic nerve to the brain and enucleation is an important consideration.

Fig. 15 Advancements of scalp and cheek flaps

Fig. 16 Palmaris longus and plantaris tendon for lower eyelid support

Diagnosis is mainly based on the clinical features with patients presenting with acute periorbital swelling associated with severe pain and pyrexia. Skin may appear erythematous

Fig. 17 Sural nerve graft for dynamic upper eyelid reconstruction with cremasteric muscle

Fig. 18 Immediate post reconstruction

or gangrenous. CT and MRI may help in the diagnosis, MRI showing appearance of gas while CT being useful for determining the extent of spread particularly if there has been postseptal extension. The criteria for debridement and extent of debridement remain unclear. The majority of cases identified by Lazzeri [6] and Amrith [7] involved surgical management. Medical management can be effective when early disease is restricted to the eyelids [8].

Reconstruction can be challenging and should be commenced as soon as possible to protect the orbital contents as well as mitigate the psychological sequela of disfigurement with the orbital area being a central area of focus in appearances. Our cases demonstrate in detail the devastating outcomes of periorbital necrotizing fasciitis, the importance of early presentation, intervention with emergency debridement, and reconstruction to restore the patients' form and function, as well as to protect vision.

Fig. 19 1 year post reconstruction

Compliance with ethical standards

Conflict of interest Shameem A. Haque, Andreas Georgiou, Hugo Henderson, and Alexander Woollard declare no conflict of interest.

Ethical approval Ethics approval is not required for this paper. However, all procedures performed were in accordance with the ethical standards of the institution and with the 1964 Helsinki declaration.

Informed consent Informed consent was obtained from all individual participants included in the study.

Patient consent The patients discussed in this case report provided consent for photographs in accordance with institutional policies.

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