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CASE REPORT

Management of Recurrent Keratitis as a Complication of *Androctonus crassicauda* Black Scorpion Sting: A Case Report

Asem Alqudah, Abdel Rahman Bani Yassin, Said Yaseen, Leen El Taani

Division of Ophthalmology, Department of Special Surgery, Faculty of Medicine, Jordan University of Science and Technology (JUST), Irbid, Jordan

Correspondence: Asem Alqudah, Division of Ophthalmology, Department of Special Surgery, Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan, Tel +962795458496, Email asemq981@yahoo.com

Abstract: Scorpions are a group of arthropods known to be highly toxic to humans. We report the case of a previously healthy 61-year-old male who sustained a sting from an Androctonus crassicauda scorpion to his right eye. The patient was admitted to the intensive care unit (ICU) in a comatose state immediately after the sting. A few days later, he suffered from tearing right-eye pain and loss of vision, which persisted despite initial treatment. The patient was subsequently diagnosed with keratitis and admitted to King Abdullah University Hospital (KAUH). He was prescribed various antibiotics, which initially improved his condition. However, the patient experienced subsequent deterioration and recurrent episodes of keratitis. The patient's visual acuity improved after treatment with a combination of antifungal and antibiotic medications, suggesting a polymicrobial infection. Despite the improvement in his condition, the sting left a central corneal scar, necessitating corneal transplant surgery as a definitive treatment. To the best of our knowledge, this scenario has not been previously documented.

Keywords: scorpion bite, keratitis, corneal transplantation, corneal ulceration, ocular, *Androctonus crassicauda*

Introduction

Scorpions are a group of arthropods with more than 2200 species, thirty species of which are identified to have the potential to be highly toxic to humans.[1] Jordan, which is a small country In the Middle East, is divided into many biogeographical distributions; one of these regions is the Saharo-Sindian region, which covers most of the Jordanian desert and resembles the most appropriate region for the four most common scorpions in Jordan to grow; these scorpions are as follows: *Buthacus leptochelys, Scorpio maurus palmatus, Androctonus crassicauda, Androctonus amoreuxi*.[2,3]

Androctonus crassicauda is a black scorpion inhabiting horizontal burrows and found mostly within the eastern Arabian desert region of the Palearctic.[2] It has the slowest venom elimination among all scorpions; which can cause systemic manifestations such as hypertension and Central nervous system complications. However, the slow venom elimination contributes to the effective serotherapy treatment even hours after the sting.[4]

Depending on the scorpion species involved, the site of the sting and the pathophysiology of the venoms, ophthalmic complications may occur. Blindness and optic neuropathy are rare, but possible complications are reported only in a few cases around the world.[5] We present a case report of a scorpion sting in a 61-year-old man first diagnosed with keratitis with recurring infections that were only responsive to anti-fungal medications.

Case Presentation

A 61-year-old Bedouin man presented to a local hospital in September 2021 with a history of a black scorpion sting to his right eye, when he suddenly felt severe pain in his right eye and flanks along with loss of consciousness. He was subsequently admitted to the intensive care unit until his case improved. The scorpion was later found hidden within his

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clothes, identified as *Androctonus crassicauda*, commonly known as the Arabian fat-tailed scorpion, a type of arachnid that is widespread in the desert of Jordan.

Initial Ocular Presentation: February–March 2022

Two days after the bite, the patient described having severe tearing pain in the right eye, headache and loss of vision that lasted later for a month. Subsequently, he sought medical treatment from five different private ophthalmologists without improvement. Consequently, the patient was referred to our tertiary ophthalmic center, and he had been on atropine 1% eye drops twice daily, moxifloxacin eye drops 0.5% four times a day, acyclovir eye ointment 5% four times a day, oral acyclovir 400 mg four times a day, and oral Levofloxacin 500mg once a day.

Upon examination at our center, the patient was presented with visual acuity of counting fingers close in the right eye, crescent-shaped epithelial defect, central corneal thinning surrounded by infiltrate (5mmx5mm), severe ciliary injection and hypopyon (3mm), all consistent with signs of keratitis. The treatment plan was modified as follows: the initial treatment plan was maintained with atropine 1% twice daily - and oral levofloxacin 500mg once a day, while the frequency of oral acyclovir 400 mg was increased to 5 times/day. Newly added medications included fortified vancomycin eye drops 5% every hour, fortified amikacin eye drop 2.5% every hour and lubricant eye drops every 1 hour. Topical moxifloxacin and acyclovir ointment were discontinued, and the patient was discharged with a follow-up appointment scheduled after 2 days.

Two days later, the patient returned to the outpatient clinic with a deterioration in vision, presented with a visual acuity of hand motion. There was no improvement in clinical signs, including a hypopyon of 2.5 mm, a large central ulcer with thinning, ciliary injection, and mild eyelid swelling. Consequently, the patient was admitted to the inpatient department. After 3 days of no improvement, amphotericin-b fortified eye drops 0.15% were added every hour, alternating with fortified vancomycin 5% and amikacin 2.5% every hour. One-week post-admission, clinical examination revealed a 1.5 mm hypopyon and a corneal ulcer. Antibiotics were discontinued to obtain an eye swab and fungal cultures, which returned negative. Treatment was adjusted, changing the frequency of fortified antibiotics every 4 hours (amikacin 2.5%, vancomycin 5%, amphotericin b 0.15%). Loteprednol etabonate 0.5%, and chloramphenicol eye ointment 1% were then added to the treatment plan 1 week later.

Three weeks after presentation, his exam revealed a visual acuity of counting fingers close in his right eye, hypopyon 2 mm, ciliary injection, and a large area of infiltrates with an overlying epithelial defect. All fortified antibiotics and antifungal eye drops were discontinued after the corneal ulcer improved, with a significant reduction in symptoms, including less pain. The patient was maintained on lubricant eye drops every 2 hours, moxifloxacin 0.5% eye drops 6 times/day, chloramphenicol eye ointment 1%, and atropine 1% every 12 hours. Despite the improvement, the patient was not yet discharged due to the need for continued monitoring and treatment.

At discharge, the corneal ulcer continued to show signs of improvement, with resolved hypopyon, formation of a scar overlying the corneal infiltrate and reduced ciliary injection with a visual acuity of 20/60 for the patient was discharged on lubricants every hour, cyclopentolate 1% every 12 hours, loteprednol etabonate 0.5% every 12 hours, moxifloxacin 0.5% 4 times/day, and chloramphenicol ointment 1% at bed time.

Six months later (August 2022), he returned for a follow-up appointment with opacity in the right eye and old vascularization, but no signs of infection. His visual acuity was 20/100. He was maintained on loteprednol etabonate 0.5%, moxifloxacin 0.5%, and lubricating eye drops.

Last Presentation (July–September 2023)

In July 2023, the patient reported a gradual loss of vision in his right eye exacerbated by one heat wave, accompanied by right-sided headaches, burning sensation, itching, diplopia, tears, tinnitus and heat-induced severe pain. On July 31st, 25 days after the onset of symptoms, he presented to the hospital with another attack of keratitis in the right eye.

Ophthalmic examination of the right eye revealed visual acuity of Hand motion. Anterior segment exam revealed central scar with an overlying epithelial defect 3mm*4mm with corneal neovascularization in the right eye. Initially, the patient was treated with fortified vancomycin 5% every hour, alternating with fortified amikacin 2.5%.

On the 3rd of August, he presented again for follow-up with a visual acuity of hand motion, a central corneal scar with an overlying epithelial defect measuring 3 mm × 5 mm, and 360-degree corneal vascularization. The patient complained

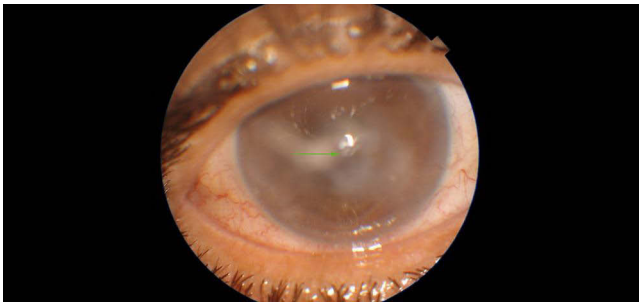

Figure 1 Slit-lamp demonstration for the right corneal scar at last follow up.

of irritation attributed to the fortified antibiotic eye drops. Consequently, fortified vancomycin and amikacin were discontinued, moxifloxacin was increased to once every hour, and chloramphenicol ointment was added. Nonetheless, on August 7th, his visual acuity remained hand motion. He additionally had a 0.5 mm hypopyon, a large ring corneal abscess, and an epithelial defect measuring 3 mm × 5 mm. As a result of these findings, he was diagnosed with recurrent fungal keratitis (Figure 1). His treatment plan was adjusted accordingly to include lubricant eye drops every 2 hours and fortified voriconazole 1% eye drops four times a day, due to the unavailability of amphotericin B. On 11th of August, his visual acuity was still hand motion, and examination revealed a ciliary injection and an epithelial defect measuring 3 mm × 3mm. The hypopyon had increased to 2 mm. As a result, all antibiotics were held, and cultures were taken again, which also came back negative. After culture collection, the patient was restarted on fortified voriconazole eye drops 8 times a day, moxifloxacin eye drops every hour, and lubricants every hour. Moreover, oral fluconazole 400 mg was given as a loading dose, followed by 200 mg once daily as maintenance.

On 25th of August, his visual acuity improved to counting fingers at 3 meters with resolution of the hypopyon and an ulcer size of 2 mm × 3mm. Oral doxycycline 100 mg once daily, and loteprednol etabonate eye drops 0.5% every 2 hours were added. Voriconazole and moxifloxacin eye drops were decreased to 4 times a day. The patient's case was monitored over 3 days.

The patient's case continued to improve until 27th September 2023 when he was discharged. Upon examination, his visual acuity was 20/125, and the ulcer had resolved, leaving a 3 mm*4 mm scar with no fluorescein uptake. Discharge medications included fortified voriconazole eye drops 1% twice a day, moxifloxacin eye drops 0.5% twice a day, lubricants eye drops every 2 hours, loteprednol etabonate eye drops 0.5% four times a day, cyclopentolate eye drops 1% twice a day, and oral doxycycline 100 mg once daily for 1 week, with eye drops administered only to his right eye. A follow-up appointment was scheduled 2 weeks later post-discharge.

During the follow-up appointment, examination revealed a visual acuity 20/200. The patient had a central scar measuring 3 mm × 4mm, corneal thinning, and vascularization. Moxifloxacin 0.5% and loteprednol etabonate 0.5% eye drops were reduced to twice daily, while lubricants were continued. Cyclopentolate 1% and fortified voriconazole 1% eye drops were discontinued. The patient was planned for corneal transplantation.

Discussion

Scorpions are arachnids that are widespread in the Middle East and parts of Asia. Scorpion stings are common and are not usually life-threatening, but they are present with various manifestations due to the venomous nature of the sting. Patients with scorpion stings usually present with cardiovascular, respiratory, neurological, and coagulation complications, reflecting the pathophysiology of the venom and the body's response to it. Most of these symptoms are mediated via the autonomic nervous system (ANS).[6] In Jordan, the most common manifestations of scorpion bites are local symptoms, including redness and oedema, which are typically not life-threatening.[3]

Ocular manifestations are relatively rare and include a wide spectrum of events.[5] These events range from transient blindness[7] and retinal hemorrhage[8] to complete persistent blindness,[9] macular branch retinal vein occlusion (BRVO),[5] bilateral optic neuropathy,[10] and ophthalmoplegia.[11] Recurrent keratitis is not a common and expected complication of scorpions' stings, thus the management of such cases depends solely on the doctor's clinical judgment (Table 1).

Table 1 Summary for the Management Plans of Reported Ophthalmologic Cases After Scorpion Stings

Author	Year	Country	Age	Sex	Scorpion Species	Ocular Manifestation	Management Plan	Outcome
Thacker[10]	2002	India	17	M	*Buthus tumulus*	Bilateral Optic Neuropathy	Local Xylocaine injection, diuretics, IV fluids and Dexamethasone	Left side Persistent Blindness
Sadeghian[11]	2003	Iran	54	F	*Mesobuthus Eupeus*	Transient ophthalmoplegia	Broad-spectrum antibiotics, Hydrocortisone, Ibuprofen, and Promethazine.	Complete Recovery
Sengupta et al[12]	2009	Nigeria	40	F	*Not reported*	Blindness	Conservative treatment	Cerebral blindness
Delma[9]	2012	Algeria	24	F	*Not reported*	Blindness	Hypertonic glucose solution, scorpion antiserum (Institut Pasteur, 1 vial intramuscularly), Paracetamol, High-dose corticosteroids, Cortancyl and Citicoline	Persistent Blindness
Hamid[5]	2018	Iran	45	F	*Mesobuthus Eupeus*	Macular BRVO	Intravitreal Bevacizumab	Complete Vision Recovery
Alqudah	2021	Jordan	61	M	*Androctonus crassicauda*	Recurrent keratitis	Antiviral agents: Acyclovir Antibiotics: Moxifloxacin, Levofloxacin, Chloramphenicol, Tobramycin + Dexamethasone, Ciprofloxacin, Doxycycline, fortified Vancomycin and fortified Amikacin. Antifungal agents: Fluconazole, Voriconazole Miscellaneous agents: Atropine, Loteprednol etabonate, Cyclopentolate, and lubricant eye drops	Planned for corneal transplant surgery

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The presented case report documents a complex clinical course following a scorpion sting to the right eye of a 61-year -old Jordanian Bedouin man. The patient's journey from the initial presentation to the subsequent presentations with recurring keratitis and eventually the decision for a corneal transplant surgery highlights several clinical considerations. The severity of the envenomation in the case necessitated admission to the intensive care unit (ICU), with leukocytosis indicating an immediate inflammatory response. The scorpion sting, which led to the penetration of the right upper eyelid, was presented with various ophthalmic manifestations.

The initial examination revealed severe ciliary injury, hypopyon, central corneal thinning, and crescent-shaped epithelial defects, all of which are related signs of keratitis. The involvement of the eye's vital structures raised concerns regarding visual prognosis. The patient's treatment plan included a combination of topical and systemic antimicrobial agents, as well as adjustments based on his response to therapy. The patient's first response to antibiotics suggests three important facts:

1. The cause of blindness is not related to the higher centers but is mostly caused by the trauma and the venom's direct effect on the eye. However, the mechanism of the scorpion's venom effect on the eyes has never been reported to our knowledge.
2. The patient did not suffer from any neurological complications, which is similar to the case in Algeria and differs from the two other cases of blindness in the literature.[5,13]
3. Despite the initial improvement in the patient's visual acuity on the first treatment plan, subsequent deterioration and lack of improvement, despite the administration of both oral and eye drop antibiotics, suggests that bacterial infection may not be the sole cause of the first episode of keratitis in this patient. This observation is further supported by negative bacterial and fungal cultures. The introduction of antifungal eye drops also failed to yield improvement. However, after transitioning to a regimen of mixed antibiotics and antifungal eye drops and ointments, the patient's condition showed improvement over a two-week period, suggesting the possibility of a mixed infection contributing to the patient's keratitis.[14]
4. Despite negative bacterial and fungal cultures, the patient's response to both antifungal and antibiotic therapy suggests a more complex etiology than initially suspected. This observation highlights the limitations of traditional diagnostic methods in capturing the full spectrum of ocular infections.[15]

The patient's subsequent presentations over the following months were marked by recurrent keratitis, with the last episode showing only partial responsiveness to anti-fungal medications. This response highlights several key facts:

1. The last episode of keratitis is mostly caused by a fungal infection.
2. Fungal keratitis is typically exogenous and infects the injured cornea in half of the cases,[16] explaining the corneal ulcer and opacity seen in our patient.
3. The patient's experience of the second keratitis episode in an environment associated with windy and harvest seasons, such as summer and autumn, aligns with the typical occurrence of fungal infections,[17,18] which is applicable to our case as the patient felt the last episode of fungal keratitis in such environment.
4. Fungal keratitis is usually caused by weak immune response elicited by the patient,[19] and the open wound left behind by the scorpion sting could serve as a potential source for this.

Despite various modifications to his treatment regimen, including topical antibiotics and antifungal agents, the right eye's opacity persisted.

The diagnosis of recurrent fungal keratitis prompted the introduction of Voriconazole eye drops, systemic antifungals, and a combination of fortified antibiotics. Then Voriconazole was replaced by Fluconazole a few days later after the eye status deteriorated indicating better response to fluconazole. The presence of a corneal ulcer with infiltrates, ciliary injection, and hypopyon added more obstacles to the management plan and to the expected response. After months of medical therapy and fluctuations in visual acuity, the decision for corneal transplant surgery was made as a radical management for his visually significant central corneal scar.

Globally, scorpion sting is relevant in at least 7 limited areas of the world. The incidence and severity of envenomation are higher in the northern Sahara; the southern and eastern regions of Africa; the Middle East; southern India; Mexico; Brazil; and the Amazonian basin area (Guyana, Venezuela, and northern Brazil).[6] In Jordan, a study was conducted by Amr et during the period between 2006 and 2012, 1205 stings were recorded in Jordan, with young males having the highest rates, July and August months were assigned as the months with the peak of stings.[3] The recorded Scorpion stings caused manifestations such as irritability, fever and elevated white blood cell count. Complications include severe cardiovascular and neurological complications with arrhythmia, hypertension, pulmonary edema, dizziness, drowsiness, numbness and shortness of breath are the most frequent.[3] Eighteen species of scorpions belonging to 3 families (Buthidae, Scorpionade, and Diplocentridae) were identified. Five species are considered highly venomous (Androctonus amoreuxi, Androctonus bicolor, Androctonus crassicauda, Leiurus hebraeus, and Leiurus jordanensis).[3]

In conclusion, this case report focuses on the complexity of the management of scorpion stings to the eye and highlights the importance of a multidisciplinary approach, including ophthalmologists, infectious disease specialists, and intensivists, to provide comprehensive care. Prompt and appropriate medical intervention, including suitable antimicrobial therapy and surgical considerations, played a pivotal role in the patient's eventual recovery.

Data Sharing Statement

Data sharing does not apply to this article as no datasets were generated or analyzed during the current study.

Ethics Approval

The Institutional Board Review approval was obtained from Jordan University of Science and Technology (ID: 2023-673).

Consent for Publication

Written informed consent was obtained from the patient.

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Disclosure

The authors declare no conflicts of interest in this work.

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