



Case report

Renal abscesses and endogenous endophthalmitis due to hypermucoviscous hypervirulent *Klebsiella pneumoniae* (HVKP)Fadi Hassanin^{a,b,*}, Dareen Khawjah^c, Sahar Elkhamary^a, Hailah Al Hussain^a^a King Khaled Eye Specialty Hospital, Riyadh, Saudi Arabia^b Department of Ophthalmology, College of Medicine, Jeddah University, Jeddah, Saudi Arabia^c Department of Ophthalmology, College of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

ARTICLE INFO

Article history:

Received 8 February 2021

Received in revised form 17 April 2021

Accepted 17 April 2021

Keywords:

Endogenous endophthalmitis

Panophthalmitis

Hypermucoviscous

Klebsiella pneumoniae

ESBL

ABSTRACT

We describe a diabetic patient with left eye endogenous endophthalmitis due to hypervirulent hypermucoviscous *Klebsiella pneumoniae* (HKVP) originating from right renal abscesses. A rare source of HVKP causing endogenous endophthalmitis. Despite treatment with intravenous ceftazidime and pars plana vitrectomy, the patient required enucleation of the left eye. A high index of suspicion for endogenous endophthalmitis and awareness of the virulence and potential antibiotic resistance of HVKP strains in the community is needed to avoid vision and life-threatening consequences.

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Introduction

Endogenous endophthalmitis (EE) is a serious vision-threatening and potentially life-threatening emergency that can lead to devastating consequences if not diagnosed and treated promptly [1]. EE results from the dissemination of the infectious agent from the endogenous focus through the blood to the internal ocular spaces breaching the blood-ocular barrier [1].

The incidence of EE is reported to be 2–8 % of all endophthalmitis cases [2,3]. An underlying medical condition predisposing to the infection can usually be identified including immune suppressed status (DM, post organ transplantation), post-surgical (commonly following cancer surgeries) [1]. A worldwide systematic survey of endogenous bacterial endophthalmitis reported that diabetes was the most common predisposing medical condition, and the liver abscess was the most common extraocular focus of infection [4].

EE is associated with poor visual outcome in most cases which can be related to late presentation, delayed diagnosis, or virulence of the causative organism [5].

The most implicated microorganism causing endogenous endophthalmitis worldwide is the Gram-positive Staphylococcus

species [1]. In East Asia, however Gram-negative bacterial particularly *Klebsiella pneumoniae* (KP) is more common.³ Arising trend of KP infection has been observed worldwide [6]. The visual prognosis of *Klebsiella* infections is poor. The phenotypic and genotypic features of the organism are understudied in the literature [7].

In this report, we describe a rare case of hypermucoviscous hypervirulent *Klebsiella pneumoniae* (HKVP) renal abscesses with a metastatic lesion to the left eye.

Case report

A 55-year-old diabetic woman patient experienced severe left eye pain and decreased vision to light perception. On initial physical examination, she was afebrile and had stable vital signs but appeared acutely ill. The ophthalmic exam showed diffuse lid swelling with limitation of extraocular motility, severe 360-degree conjunctival injection, corneal edema, a 4 mm hypopyon, cataractous lens, and a dim red reflex. Clinical findings were consistent with endophthalmitis. She had no apparent endogenous or exogenous source on initial evaluation (Fig. 1). The right eye exam was normal. Evaluation for the septic focus of her infection included blood and urine cultures, computer tomography (CT) of the brain and orbit scans, and CT of the chest, abdomen, and pelvis.

On laboratory evaluation, she had an elevated white blood cell count ($19.9 \times 10^9/L$). Urinalysis was normal. Blood and urine cultures were negative. B-scan ultrasonography and CT scan of the orbit and brain suggested panophthalmitis with findings of ocular

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Fig. 1. External photo of the left eye showing proptosis, 360° conjunctival chemosis with hypopyon consistent with endophthalmitis.

wall thickening, optic nerve thickening, extraocular muscles, and lacrimal gland enlargement.

The patient was admitted and treated empirically with intravenous ceftazidime, vancomycin, and metronidazole. She underwent pars plana vitrectomy (PPV) with intravitreal injection of vancomycin and ceftazidime. Vitreous and aqueous samples were sent for cultures and stains.

Postoperatively, her condition deteriorated. With headaches, worsening left eye pain, and loss of light perception. The eye became proptotic with a frozen globe. Two days following vitrectomy, evisceration was performed with insertion of 18 mm PMMA implant, fortified with ceftazidime and gentamicin wash for the inner ocular coat. Ocular content was sent for culture and sensitivity testing. Cultures grew hypervirulent hypermucoviscous strain of KP (HVKP) from the vitreous sample post vitrectomy, and subsequently from all the eviscerated ocular content.

The isolate was resistant to ampicillin, cefoxitin, cefuroxime, ciprofloxacin, gentamicin, nitrofurantoin, and trimethoprim-sulfamethoxazole and susceptible to ceftriaxone, cefepime, meropenem, piperacillin-tazobactam and ceftazidime. The isolated strain from the intraocular content was characterized by hypermucoviscosity demonstrated by a string test (Fig. 2).

Abdominal CT (Fig. 3) scan showed mildly enlarged right kidney with well-defined multiple focal cystic lesions along the right renal cortex with diffuse irregular thick enhancement associated with mild dilatation of the renal vessel with minimal thickening of the adjacent vessels, findings collectively were highly suggestive of renal abscesses. CT scan of the chest was normal. The patient was transferred to a general hospital for further management of her renal abscesses after completing a 14-day course of intravenous antibiotics (ceftazidime, vancomycin and metronidazole). Her ocular condition was stable.

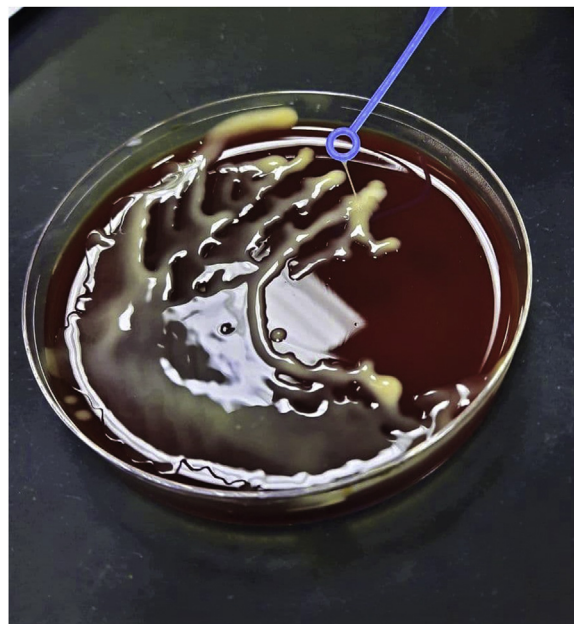


Fig. 2. String test demonstrating hypermucoviscosity of *Klebsiella pneumoniae*.

Discussion

We describe a patient with renal abscesses due to HKVP, that resulted in secondary endogenous panophthalmitis with orbital cellulitis. To our knowledge, this is the first case report of (HVKP) with renal abscesses and secondary ocular infection.

Recently, a hypervirulent strain of KP (HVKP) has emerged as a causative agent of EE especially in Southeast Asia [8–10]. This strain exhibits hypermucoviscosity on string test and is responsible for more severe and invasive infection [8–10].

HVKP is usually susceptible to most antimicrobial agents but emerging resistance to many antibiotic classes has been reported [6]. Liu et al. [11] reported 16.3 % of extended-spectrum beta-lactamase (ESBL) producing HVKP which is higher than previous reports. They also reported a worrisome emergence of Carbapenem-resistant HVKP isolates in 2 cases. Xu et al. [6] found a favorable outcome with the use of Carbapenem as a first line treatment of ESBL-resistant HVKP endophthalmitis. They speculated that HVKP acquires virulent and resistant plasmids through horizontal transmission.

In an experimental murine model of KP endophthalmitis, hypermucoviscosity was identified as a virulence factor in clinical isolates with bacteremia [9]. Another animal model study reported that HVKP did not cause more severe infections compared to a non-hypermucoviscous strain [6].

Pyogenic liver abscess caused by KP is the most common focus of infection that causes EE with a risk of 3 %–7.8 % [12]. There are limited reports of renal or perinephric abscess as the primary infection focus for EE [13–16]. A delay in treatment can occur as a result of the occult nature of the perinephric abscess and the infrequent association, placing the patient at risk of complications [13]. Although most of the patients with secondary ocular focus will have an aberrant septic focus [16], our patient is unusual in having a renal abscess with no associated symptoms. Similar to our case, Stotka et al. [16] described a case of KP septicemia in a 64 years old immunocompromised male with ocular endophthalmitis and orbital cellulitis as the initial presentation of the bacteremia. Their patient was treated with intravenous and intravitreal antibiotics, but his condition worsened, and they required

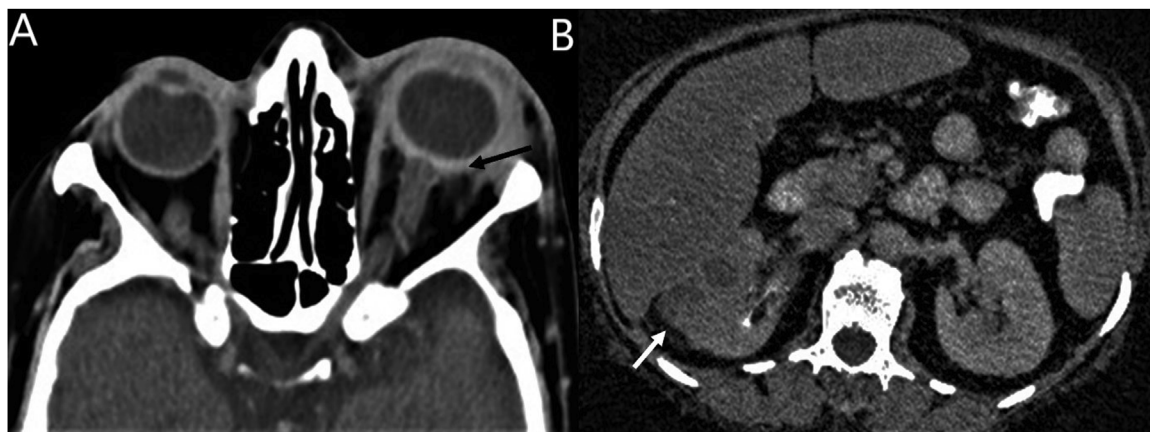


Fig. 3. Post-contrast CT scan orbit (A) and abdomen (B). (A) left proptosis, uveoscleral thickening, fat stranding (black arrow). (B) Right Renal abscess appears as a well-defined mass (white arrow) of low attenuation with a thick, irregular wall, subtle fascial and septal thickening is present in the perinephric fat.

enucleation of the left eye. In Stotka et al.'s [16] case, the infection focus was an asymptomatic renal stone complicated by perinephric abscess along with ecthyma gangrenosum, eventually requiring nephrectomy.

Divyanshu et al. [14] reports a case of embolic *K. pneumoniae* renal abscess with multiorgan involvement (eye, lung and brain). This case improved after drainage of the abscess along with intravitreal Vancomycin and Ceftazidime and an 8-week course of intravenous Meropenem.

Chen et al. [13] reported two cases of KP endophthalmitis in elderly diabetic women caused by a perinephric abscess, resulting in loss of light perception vision and a phthisical eye, despite aggressive treatment with intravitreal and intravenous antibiotics.

Our literature search found only one reported case of KP endophthalmitis with a renal abscess as the primary focus in Saudi Arabia [17]. The patient had 4/200 vision after a long treatment course with antibiotic and PPV.

Al-Mahmood et al. [18] reported two patients with KP endophthalmitis caused by a hepatic abscess, both received a combination of antibiotics and antifungal intravitreally, and intravenous antibiotics. The first patient lost all vision but light perception, and the second case underwent evisceration for a blind painful eye.

Conclusion

Klebsiella endophthalmitis is associated with poor visual outcomes with many patients requiring enucleation or evisceration. Ophthalmologist should be aware of this entity and have a high index of suspicion for HVKP in the community and the possibility of antibiotic resistance. Timely diagnosis, thorough diagnostic evaluation, and aggressive treatment with intravenous and intravitreal antibiotics are essential for avoiding the devastating consequences of metastatic infection and loss of the eye.

Funding

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Ethical section

- The study was approved by the Institutional Review Board at King Khaled Eye Specialist Hospital and adhered to the ethical principles outlined in the Declaration of Helsinki.

- A written patient consent form for participating and for clinical photographs and was obtained from the patient.

Author contributions

- Fadi Hassanin MD, Principal investigator, manuscript writing, submission, revision.
- Dareen Khawjah MD, IRB submission, manuscript writing.
- Sahar Elkhamary MD, manuscript writing, technical support.
- Hailah Al Hussain MD, critical manuscript review.

Data sharing statement

- The data of the study are available from the corresponding authors.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgment

The authors thank King Khaled Eye Specialty Hospital for providing the case and all the clinical data required for the submission.

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