

# Unusual microbiological presentations in polymicrobial post-operative endophthalmitis and their clinical correlations

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## Abstract

**Purpose** To report the clinical course, microbiological spectrum and visual outcomes of three cases of post-operative endophthalmitis caused by unusual combination of micro-organisms.

**Methods** Retrospective review of medical charts at a tertiary eye care centre over a period of 1 year, of subjects with post-operative endophthalmitis and more than one microbiological isolate.

**Results** We report 3 cases with unusual combination of microorganisms. In case 1, two organisms (*Burkholderia cepacia* and *Aeromonas veronii*, from the vitreous cavity and capsular bag, respectively) with an identical antibiotic sensitivity pattern were found, while in case 2, the organisms (*Streptococcus pneumoniae* and *Sphingomonas paucimobilis*, from

cornea and vitreous cavity, respectively) isolated had different sensitivity patterns. In case 3, two different strains of the same organism (*Enterococcus faecalis*) were found. Cases 1 and 2 achieved good anatomical and visual outcomes, while in case 3, vision remained poor despite a good anatomical outcome.

**Conclusion** Unusual combinations of organisms in post-operative endophthalmitis can introduce unique clinical characteristics and should specifically be considered in atypical clinical presentations, poor response to standard therapy and unusual recurrence patterns.

**Keywords** Polymicrobial · Endophthalmitis · Antimicrobial resistance

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## Introduction

Microbiological identification of causative organisms is crucial for appropriate diagnosis and management of any form of endophthalmitis [1]. Conventional microbiological techniques generally reveal a single causative organism from ocular samples in majority of the cases [2]. Polymicrobial infection has also been reported in different forms of endophthalmitis [3–6]. It is relatively rare in post-operative endophthalmitis (2.4–3.9%), as compared to traumatic endophthalmitis [4, 5]. Another study reported that 20.9% of polymicrobial endophthalmitis were due to post-operative

causes, while 72.1% were due to post-traumatic causes [3]. Polymicrobial infections generally lead to poorer anatomical and visual prognosis compared to monomicrobial infections [6]. However, none of the previous reports have explored the unique clinical characteristics introduced by specific organisms isolated in polymicrobial infections. Herein, we report a series of three cases, in which two different organisms were isolated from ocular samples in post-operative endophthalmitis and investigate possible relationships between these organisms and the clinical presentation in each case.

## Methods

We reviewed the microbiological reports of all patients with post-operative endophthalmitis between January and August 2017, where more than one organism was isolated by standard microbiological techniques. Our laboratory protocol involved careful handling of samples to prevent any contamination during inoculation, transport or incubation of media. All organisms were identified by standard biochemical tests and confirmed by VITEK 2 compact system. Antibiotic susceptibility of organisms was done by Kirby–Bauer disc diffusion method and for colistin specifically by broth microdilution test. Significant growth in inoculated media was considered based on any 1 or more of the following 3 criteria: (a). growth of the same organism at the site of inoculation in 2 or more media. (b). Growth of the same organism as seen in the smear at the site of inoculation on a single media. (c). Confluent growth of the organism at the site of inoculation (> 10 colonies) on a single media. All patients with clinical diagnosis of infective post-operative endophthalmitis received standard therapy of vitreous biopsy with intravitreal vancomycin (1 mg/0.1 ml), ceftazidime (2.25 mg/0.1 ml) and dexamethasone (400 µg/0.1 ml). Further treatment was based on specific microbiology reports and clinical response to treatment.

## Results

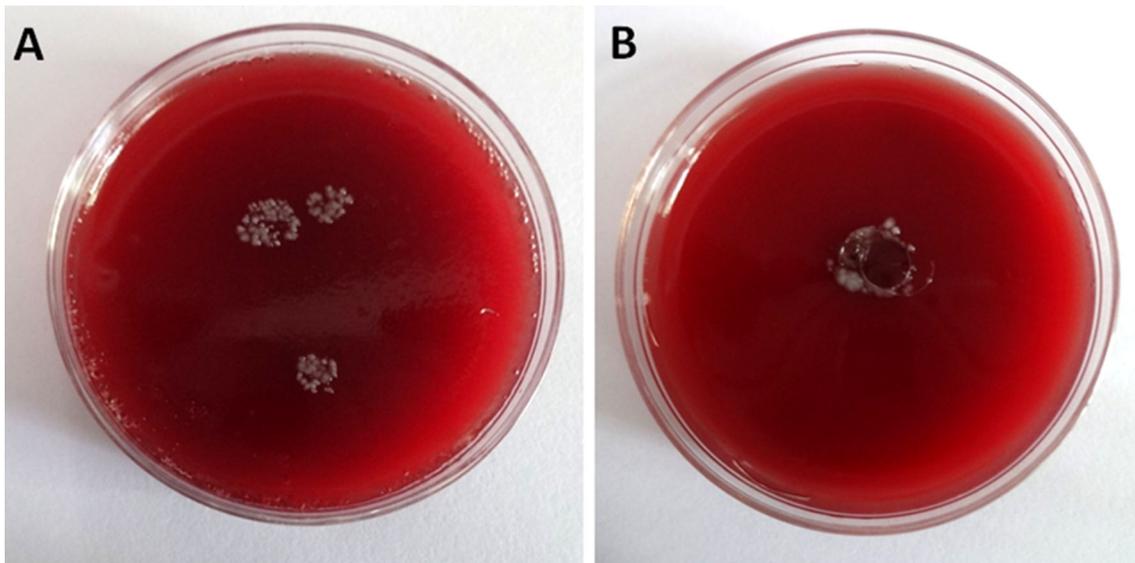
We found 7 patients (0.12%) with polymicrobial post-operative endophthalmitis out of 65 culture-positive cases during the study period. Here in, we report 3

cases, where each microbiological isolate individually influenced the clinical outcome of the disease.

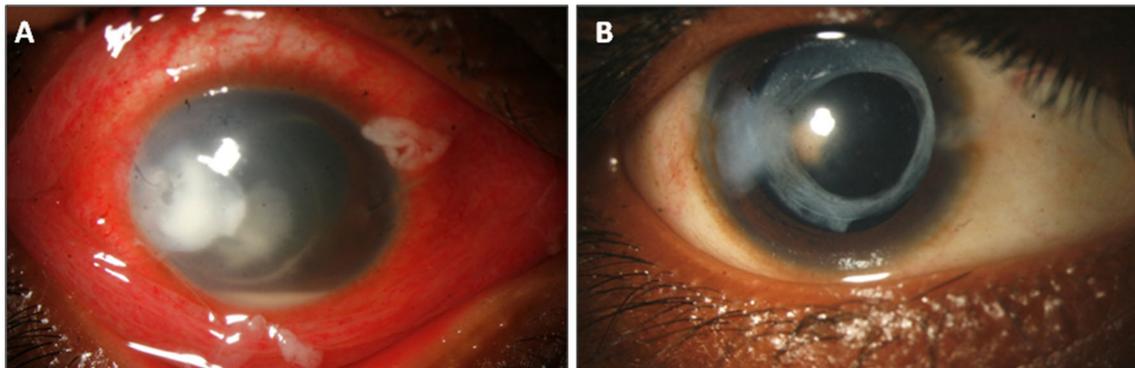
## Case reports

**Case 1** A 71-year-old diabetic and hypertensive female on irregular treatment presented with redness, pain and watering in right eye, following an uneventful manual small incision cataract surgery with intraocular lens (IOL) implantation in the same eye 1 month ago. At presentation, her BCVA in right eye was finger count at 30 cm with 1-mm hypopyon and dense vitritis with hazy fundus view. We diagnosed delayed onset post-operative endophthalmitis in right eye and treated her with vitreous biopsy and standard empirical intravitreal therapy (vancomycin, ceftazidime and dexamethasone). Microbiological evaluation of vitreous biopsy showed gram-negative bacilli on smear and significant growth of *Burkholderia cepacia* on culture (Fig. 1a), which was resistant to fluoroquinolones, macrolides, chloramphenicol and colistin and sensitive only to ceftazidime, imipenem and piperacillin–tazobactam. As patient's condition did not improve after 5 intravitreal imipenem injections and high oral dose (750 mg) of ciprofloxacin, she underwent IOL explantation and vitreous debulking. Though the aqueous and vitreous were sterile this time, the IOL had a significant growth of a gram-negative bacillus identified as *Aeromonas veronii* (Fig. 1b), which had exactly the same pattern of antibiotic susceptibility as the *B. cepacia* isolated earlier. The patient received repeated imipenem injections and improved to a corrected vision of 20/50 in her right eye with no recurrence till the last follow-up at 6 months post-vitreotomy.

**Case 2** A 16-year-old boy with right eye developmental cataract operated by lens aspiration and IOL implantation presented for follow-up at 3 weeks, when one of his two corneoscleral sutures was removed aseptically, while the other was mistakenly left behind. He presented a week later with decreased vision and corneal ulcer at the corneal end of the remaining suture, hypopyon and dense vitritis in the operated eye (Fig. 2a). He had no symptoms of any other systemic infections and reported head bath with tap water immediately after suture removal. He underwent corneal scraping, removal of the retained suture, vitreous biopsy and standard intravitreal vancomycin, ceftazidime and dexamethasone. Corneal



**Fig. 1** **a** Significant growth of *Burkholderia cepacia* on vitreous biopsy in sheep blood agar. **b** Significant growth of *Aeromonas veronii* on IOL (intraocular lens) on sheep blood agar from the same patient

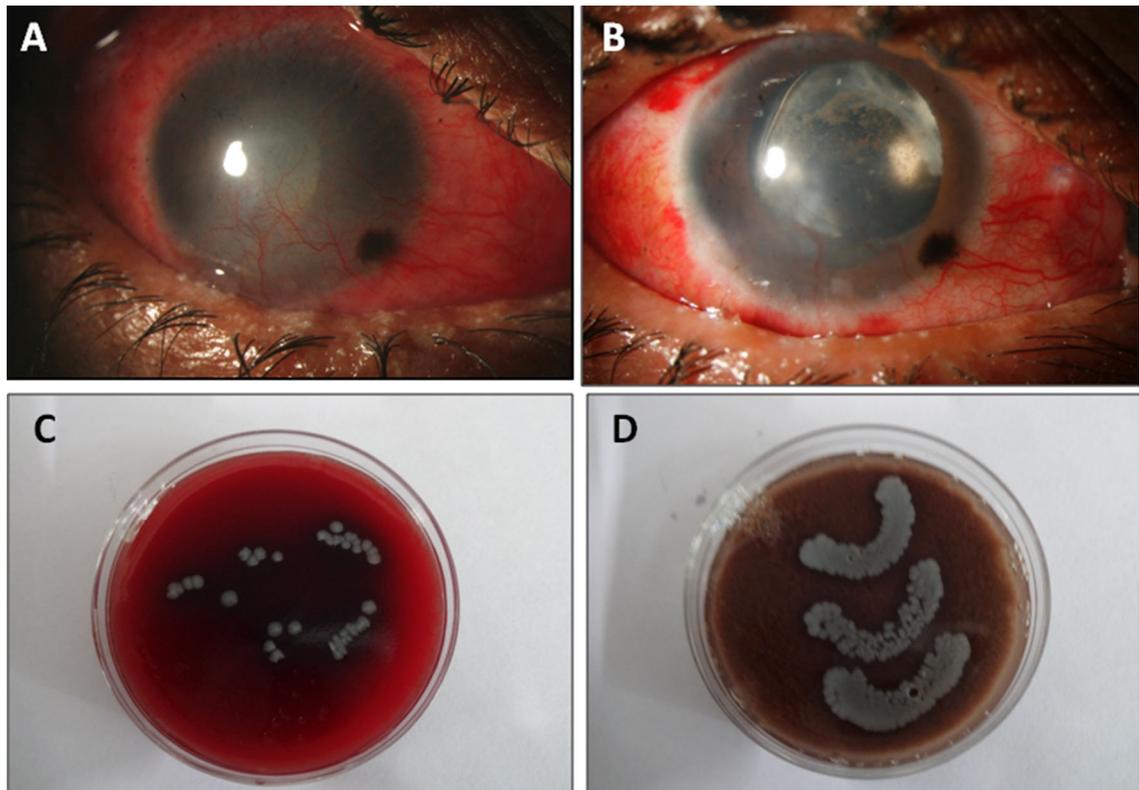


**Fig. 2** **a** External photograph, right eye, showing corneal infiltration at site of left-behind suture (10'o clock) with features of conjunctival congestion, hypopyon and dense vitritis, 1 week

post-cataract surgery. **b** Post-treatment (6 weeks) photograph of the same eye showing healing of corneal ulcer with scarring and resolving features of endophthalmitis

scraping showed significant growth of *Streptococcus pneumoniae*, sensitive to fluoroquinolones, vancomycin and cefazolin. In contrast, vitreous grew *Sphingomonas paucimobilis*, sensitive to aminoglycosides, fluoroquinolones, imipenem and colistin and resistant to chloramphenicol, ceftazidime and piperacillin–tazobactam. Patient was treated with oral ciprofloxacin, topical moxifloxacin and prednisolone acetate eye drops. The corneal ulcer healed with scarring, vitritis resolved and BCVA improved to 20/60 in right eye without any recurrence till the last follow-up at 6 months (Fig. 2b).

**Case 3** A 21-year-old male patient underwent anterior vitrectomy and pars plana membranectomy for thick posterior capsular opacification in right eye (Fig. 3b). Past records showed that he had a BCVA of 20/20, N6 2 years ago, in both eyes. He had been diagnosed before as Steven–Johnson syndrome with dry eye, distichiasis and trichiasis in the right eye for which he received repeated epilations and intermittent treatment with topical steroids and antibiotics (Fig. 3a). On the third day, post-membranectomy, he presented with sudden reduction in vision to counting fingers at 2 m, hypopyon and dense vitreous exudates in the operated eye (Fig. 3a). With a diagnosis of acute



**Fig. 3** **a** External photograph, right eye, at presentation, showing distichiasis of upper and lower lid margins, diffuse conjunctival congestion, limbal naevus, diffuse corneal oedema, deep corneal vascularisation and posterior capsular opacification. **b** Post-treatment (6 weeks) photograph of the same eye

bacterial endophthalmitis, he underwent vitreous biopsy with intravitreal vancomycin, ceftazidime and dexamethasone injections. Vitreous samples grew significant *Enterococcus faecalis* (Fig. 3c). However, an antibiotic sensitivity test showed two distinct zones of inhibition for the same antibiotic discs, following which the two strains were separated and identified by standard biochemical tests and confirmed by Vitek both as *E. faecalis*. Interestingly, one strain was antibiotic sensitive, while the other was multidrug resistant (including resistance to vancomycin [by E-strip test], chloramphenicol, ciprofloxacin, ofloxacin, gatifloxacin, moxifloxacin, amikacin, cefazolin). This was confirmed by repeated antibiotic sensitivity testing for each individual strains. The growth from the conjunctival swab from the lower conjunctival fornix was similar to the multidrug resistance strain of *E. faecalis* with exactly similar sensitivity pattern (Fig. 3d). The other strain of *E. faecalis* from vitreous

showing corneal clearing, and resolution of vitreous exudates. **c** Significant growth of *Enterococcus faecalis* from vitreous biopsy on sheep blood agar of post-operative eye of the same patient. **d** Significant growth of *Enterococcus faecalis* from conjunctival swab of affected eye of the same patient

was sensitive to almost all drugs in the above panel (except chloramphenicol) but was not isolated from lower conjunctival fornix, and its source could not be traced. Both the strains of *E. faecalis* were sensitive to linezolid and daptomycin, which were subsequently used for treatment. Nasal swab of the patient yielded two completely different bacteria unrelated to the endophthalmitis: *Staphylococcus haemolyticus* and *Escherichia coli*. The endophthalmitis resolved through aggressive medical and surgical management, and the BCVA was 20/200 in the affected eye till the last follow-up at 10 months after the endophthalmitis event.

## Discussion

We have reported three cases in which two different organisms (different species in cases 1 and 2, and

different strains in case 3) were isolated from the same eye, either from anatomically separated spaces or from the same space. The microbiological characteristics of these organisms are summarised in Table 1. These organisms individually influenced the response to protocol-based treatment in each of these cases.

Case 1 demonstrates infection with two different organisms in relatively segregated anatomical compartments, but with a similar antibiotic sensitivity profile. Both the gram-negative bacilli, i.e. *B.cepacia* and *A.veronii*, have been reported to cause exogenous endophthalmitis separately, especially in the immunocompromised (both are soil and water saprophytes), but a combined infection by these organisms has not been previously documented [7, 8]. *B.cepacia* is a lactose non-fermenting bacilli belonging to Pseudomonads group, sensitive to meropenem, ceftazidime, piperacillin–tazobactam and co-

trimoxazole, while *Aeromonas veronii* belongs to family *Aeromonadaceae* and generally known to be multidrug resistant with maximum sensitivity to ciprofloxacin and least sensitivity to penicillin group of drugs [9].

In the above case both *Burkholderia* and *Aeromonas* appeared to be multidrug resistant with an unusually similar antibiogram profile. On appropriate antibiotic treatment, *B.cepacia* died out and was not isolated subsequently from the vitreous. However, *A.veronii* was well protected from antibiotics in the capsular bag resulting in persistent endophthalmitis. The patient improved dramatically following explanation of IOL, removal of capsular bag and treatment with appropriate antibiotics. We speculate that the exactly similar pattern of multiantibiotic resistance in these two different organisms could have resulted

**Table 1** Organisms isolated, anatomical locations of isolation and their antibiotic sensitivity pattern in the three cases of post-operative endophthalmitis

Serial number	Clinical diagnosis	Organisms	Anatomical location	Sensitive antibiotics	Resistant antibiotics
1	Post-operative endophthalmitis	(a) <i>Burkholderia cepacia</i>	General vitreous cavity of affected eye	Ceftazidime, imipenem, piperacillin–tazobactam	Amikacin, gentamicin, ofloxacin, ciprofloxacin, gatifloxacin, chloramphenicol, colistin
		(b) <i>Aeromonas veronii</i>	Sequestered in capsular bag with IOL in affected eye	Ceftazidime, imipenem, piperacillin–tazobactam	Amikacin, gentamicin, ofloxacin, ciprofloxacin, gatifloxacin, chloramphenicol, colistin
2	Post-operative endophthalmitis	(a) <i>Streptococcus pneumoniae</i>	Corneal ulcer at site of left-behind suture	Vancomycin, cefazolin, ciprofloxacin, gatifloxacin, moxifloxacin	Chloramphenicol
		(b) <i>Sphingomonas paucimobilis</i>	General vitreous cavity of affected eye	Amikacin, ciprofloxacin, ofloxacin, gatifloxacin, imipenem, colistin	Chloramphenicol, ceftazidime and piperacillin–tazobactam
3	Post-operative endophthalmitis	(a) <i>Enterococcus faecalis</i> antibiotic-resistant strain	(a) General vitreous cavity of affected eye (b) Lower conjunctival fornix of affected eye	Linezolid	Vancomycin, chloramphenicol, ciprofloxacin, amikacin, ofloxacin, gatifloxacin, moxifloxacin, cefazolin
		(b) <i>Enterococcus faecalis</i> antibiotic-sensitive strain	General vitreous cavity of affected eye	Linezolid, vancomycin, ciprofloxacin, amikacin, ofloxacin, gatifloxacin, moxifloxacin, cefazolin	Chloramphenicol

from plasmid-mediated transfer of antibiotic resistance genes between the two.

Case 2 demonstrates the presence of two different organisms of differing virulence in anatomically separate but interconnected spaces (cornea and vitreous cavity, respectively, connected by patent suture tract). *S. paucimobilis* resembles *Pseudomonas* species but is much less virulent, while *S. pneumoniae* is a highly virulent, multidrug-resistant organism known to cause fulminant ocular infections leading to loss of vision as well as the eye and is frequently associated with poor visual outcome [10]. This case is unique in the sense that two absolutely different organisms grew at two interconnected sites (through suture tract) of infection. There was a possibility of the highly virulent *S. pneumoniae* to completely overgrow the relatively less virulent *S. paucimobilis* in the vitreous cavity. We speculate that *S. paucimobilis*, in the vitreous cavity, inhibited growth and virulence factors of *S. pneumoniae* in the same space, as has been demonstrated in *in vitro* studies [11]. The patient had a final best corrected visual acuity of 20/60 in the affected eye after appropriate treatment.

Case 3 is different from the other two cases as two different strains of the same organism were isolated from the same anatomical space. *E. faecalis*, a Group D *Streptococcus* and a resident commensal of the gut microbiome, is infrequently seen in ocular microbiome. It is extremely sturdy, capable of withstanding high alkaline pH (9.6), high temperature (60 °C) and desiccation, and shows multidrug resistance, especially in nosocomial infections. Several reports of exogenous *E. faecalis* pseudophakic endophthalmitis with poor visual outcome, due to poor post-operative hygiene or unknown cause, exist [12–14]. In our case, altered ocular surface secondary to prolonged dry eye and topical steroids and the use of topical antibiotics following repeated epilations could have permitted growth of highly virulent and multidrug-resistant organisms. Indeed, we traced the source of multidrug-resistant strain to conjunctival flora in our case.

In conclusion, we have demonstrated the influence of polymicrobial infection on disease course in post-operative endophthalmitis. Our cases highlight the need to re-evaluate patients not responding to standard therapy for the possibility of polymicrobial infection.

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