

# Intravitreal moxifloxacin in acute post-phacoemulsification endophthalmitis: a case report

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## Abstract

**Background:** Vancomycin and ceftazidime are commonly used intravitreal antibiotics to treat acute post-phacoemulsification endophthalmitis. However, they are not commercially available in appropriate therapeutic dose for intravitreal injection. Moxifloxacin is a broad-spectrum antibiotic that is commercially available in appropriate therapeutic dose for intravitreal injection, thus providing a rationale for its use in acute post-phacoemulsification endophthalmitis.

**Case presentation:** A 46-year-old female presented with blurred vision, redness, and pain in the right eye 5 days after phacoemulsification. Visual acuity was hand movement and conjunctival and circumcorneal injection, corneal oedema, anterior chamber reaction, and vitreous opacities were observed. The patient was treated with intravitreal moxifloxacin 500 µg/0.1 ml, vitrectomy, and topical and oral antibiotics. Visual acuity improved to 6/15 and follow-up at 5 weeks did not reveal any signs of intraocular inflammation.

**Conclusion:** Intravitreal moxifloxacin is an alternative in the treatment of acute post-phacoemulsification endophthalmitis.

**Keywords:** acute post-phacoemulsification endophthalmitis, intravitreal moxifloxacin

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# Penggunaan moxifloxacin secara intravitreal untuk 'post-phacoemulsification endophthalmitis' akut

## Abstrak

*Latarbelakang:* Vancomycin dan ceftazidime adalah antibiotik intravitreal yang kerap digunakan untuk rawatan 'post-phacoemulsification endophthalmitis' akut. Namun, dos terapeutik yang sesuai untuk suntikan intravitreal tidak terdapat secara komersial. Moxifloxacin adalah antibiotik spektrum lebar yang terdapat secara komersial dalam dos sesuai untuk suntikan intravitreal dan oleh itu menjadi rasional untuk rawatan 'post-phacoemulsification endophthalmitis' akut.

*Pembentangan kes:* Seorang wanita berusia 46 tahun hadir dengan kabur penglihatan, mata merah dan sakit pada mata kanan, 5 hari selepas 'phacoemulsification'. Hasil pemeriksaan mendapati akuiti visual adalah pergerakan tangan, injeksi konjunktiva dan 'circumcornea', oedema kornea, reaksi kamar anterior dan opasiti vitreous. Pesakit dirawat menggunakan intravitreal moxifloxacin 500 µg/0.1 ml, vitrectomy dan antibiotik topikal dan oral. Akuiti visual meningkat ke 6/15 dan pemeriksan susulan selepas 5 minggu tidak menunjukkan sebarang inflamasi intra okular.

*Kesimpulan:* Moxifloxacin intravitreal merupakan alternatif rawatan 'phacoemulsification endophthalmitis' akut.

*Kata kunci:* moxifloxacin intravitreal, 'phacoemulsification endophthalmitis' akut

## Introduction

Endophthalmitis is an inflammation involving intraocular tissue and fluid that can be caused by microorganisms from exogenous (postoperative and post-traumatic) or endogenous (septicaemia) origins which occupy the anterior and posterior segments of the eye. Endophthalmitis is an ophthalmological emergency and may lead to permanent visual deterioration or even blindness if not dealt with prompt therapy.<sup>1</sup>

The incidence of postoperative endophthalmitis at Cipto Mangunkusumo-Kirana Hospital, Jakarta, Indonesia between January 2007 and July 2010 was 0.45% and 74.7% of those cases were found after cataract surgery.<sup>2</sup> The causative microorganisms were *Pseudomonas* species, *Staphylococcus epidermidis*, *Acinetobacter* species, haemolytic *Streptococcus*, *Klebsiella* species, *Streptococcus viridians*, *Bacillus* species, *Enterobacter* species, and *Serratia liquefaciens*.<sup>2</sup> Among of them, the most common causative microorganisms were *Pseudomonas* species (17%) followed by

*S. epidermidis* (11%), and *Acinetobacter* species (11%).<sup>2</sup>

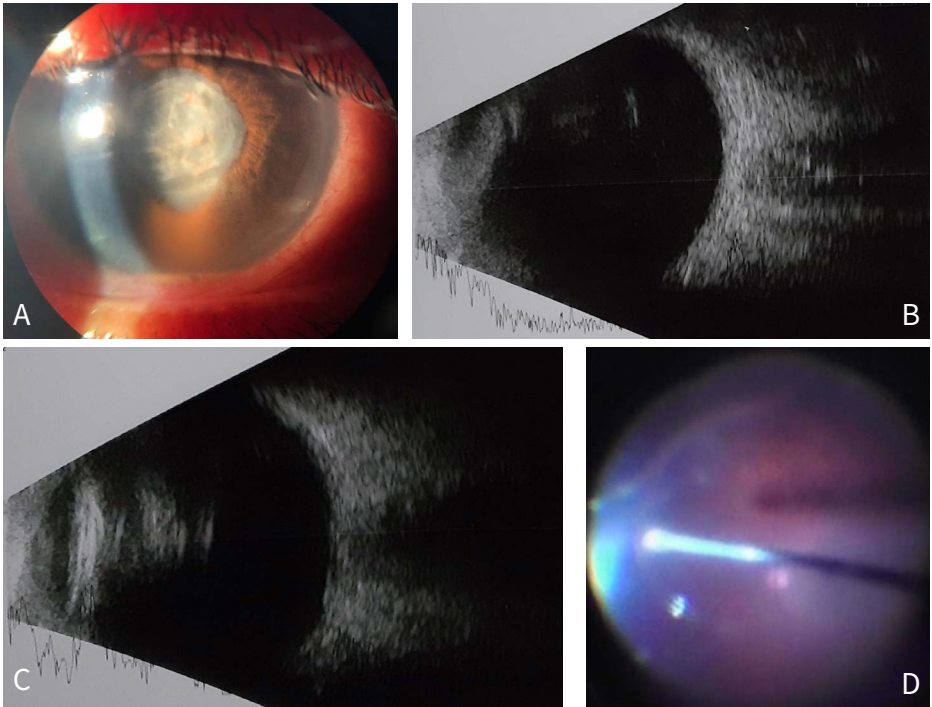
Commonly used intravitreal antibiotics to cover gram-positive and gram-negative bacteria in acute post-phacoemulsification endophthalmitis are vancomycin and ceftazidime. However, vancomycin and ceftazidime are not commercially available in appropriate therapeutic dose for intravitreal injection, thus requiring manual dilution. This may increase the risk of contamination and dilution errors, which may further cause intraocular toxicity.

One of the newest fourth-generation fluoroquinolones is moxifloxacin, which targets both DNA gyrase and type IV topoisomerase. Moxifloxacin has superior coverage for gram-positive bacteria in comparison to second and third-generation fluoroquinolones and also sustains exceptional exposure for gram-negative bacteria with low minimum inhibitory concentration. We found two case reports where commercially available, undiluted moxifloxacin ophthalmic solution was administered intravitreally and found effective and safe in the treatment of post-traumatic endophthalmitis in humans.<sup>3,4</sup> These case reports provided the rationale for intravitreal administration of a single antibiotic with broad spectrum coverage in the case of acute post-phacoemulsification endophthalmitis we herewith present.

## Case presentation

A 46-year-old non-diabetic female presented with sudden blurred vision, redness, photophobia, and pain in the right eye 5 days after phacoemulsification in the right eye. Visual acuity was hand movement. Blepharospasm, conjunctival and circumcorneal injection, chemosis, mild corneal oedema, +4 flare and +4 cells in the anterior chamber with 1 mm hypopyon, pupillary membrane occluding the pupil (Fig. 1A), intraocular lens (IOL) in the capsular bag, and intraocular pressure (IOP) of 20 mmHg were noted. B-scan ultrasonography showed vitreous opacities (Fig. 1B) and flat retina. We diagnosed the patient as acute post-phacoemulsification endophthalmitis. We started treatment with 0.5% moxifloxacin eye drops (Molcin HCl 5 mg/ml ophthalmic solution, Bekasi, Indonesia) hourly, combination of tobramycin 3 mg and dexamethasone 1 mg eye drops (Cendo Tobroson, Bandung, Indonesia) hourly, ciprofloxacin tablets 500 mg twice daily, atropine sulfate 1% eye drops (Cendo Tropin, Bandung, Indonesia) twice daily, timolol 0.5% eye drops (Cendo Timol, Bandung, Indonesia) twice daily, and emergency intravitreal injection of moxifloxacin 0.1 ml of 500 µg/0.1 ml (Molcin HCl 5 mg/ml ophthalmic solution, Bekasi, Indonesia) because we could not perform pars plana vitrectomy at the time.

Intravitreal injection of moxifloxacin was given under topical anaesthesia with tetracaine hydrochloride 0.5% (Cendo Pantocain, Bandung, Indonesia) using a 1 mL tuberculin syringe with a 30-gauge needle and inserted 3.5 mm posterior from the limbus in the inferotemporal quadrant. Previously, we performed anterior chamber paracentesis (0.1 ml) to take a specimen for culture and avoid IOP elevation.



*Fig. 1.* Clinical features of the right eye on presentation: (A) chemosis, mild corneal oedema, +4 flare, +4 cells, 1 mm hypopyon, and pupillary membrane on the slit lamp examination, as well as (B) vitreous opacities on B-scan ultrasonography. (C) B-scan ultrasonography of the right eye after 24 hours of emergency moxifloxacin intravitreal injection showing no improvement of vitreous opacities. (D) Pars plana vitrectomy after 24 hours of emergency moxifloxacin intravitreal injection showing no improvement of clinical features and B-scan ultrasonography.

Twenty-four hours after the moxifloxacin injection, the clinical features and the B-scan ultrasonography did not improve (Fig. 1C), so we performed an elective pars plana vitrectomy under general anaesthesia (Fig. 1D). Previously, we took a vitreous sample (0.2 ml) through the vitreous cutter for culture and sensitivity. We repeated intravitreal moxifloxacin at the end of pars plana vitrectomy.

Postoperative treatment included moxifloxacin 0.5% eye drops (Molcin HCl 5 mg/ml ophthalmic solution, Bekasi, Indonesia) hourly, combination of tobramycin 3 mg and dexamethasone 1 mg eye drops (Cendo Tobroson, Bandung, Indonesia) hourly, atropine sulphate 1% (Cendo Tropin, Bandung, Indonesia) twice daily, timolol 0.5% eye drops (Cendo Timol, Bandung, Indonesia) twice daily, and ciprofloxacin tablets 500 mg twice daily.

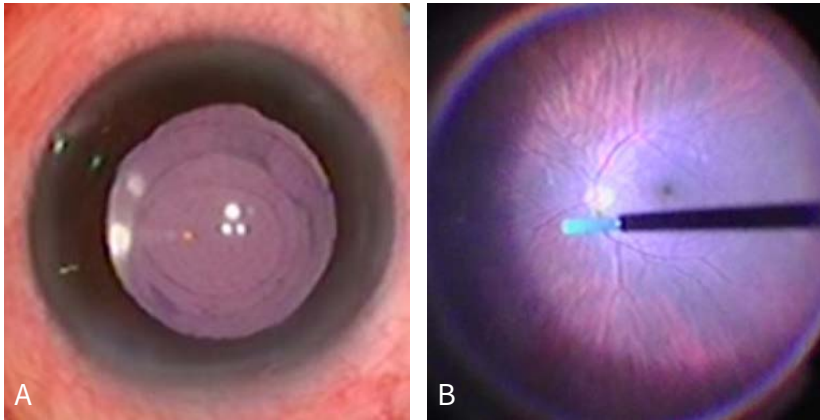


Fig. 2. Clinical features at 5-week of follow-up: (A) no signs of intraocular inflammation and (B) no signs of retinal toxicity.

We discharged the patient after 5 days of hospitalization with visual acuity of 3/60 and significantly improved clinical features. The aqueous and vitreous culture revealed no growth of microorganisms. At the 5-week follow-up (Fig. 2), visual acuity was 6/30, best-corrected visual acuity was 6/15, and the patient did not show any signs of intraocular inflammation or retinal toxicity such as retinal oedema, cotton wool spots, and retinal haemorrhages.

## Discussion

The gold-standard treatment of endophthalmitis is vitrectomy.<sup>5</sup> However, if it cannot be performed immediately, intravitreal antibiotics may be used as an alternative therapy.<sup>5</sup> Intravitreal antibiotics without pars plana vitrectomy can also be administered if the retina cannot be visualized or there is fundus reflex.<sup>6</sup> The patient should be monitored very closely, especially in the first 24 hours.<sup>6</sup> Pars plana vitrectomy can be performed if the clinical condition does not improve.<sup>6</sup>

Moxifloxacin is a fourth-generation fluoroquinolone that can rapidly inhibit DNA synthesis by promoting cleavage of bacterial DNA in the DNA-enzyme complexes of DNA gyrase and type IV topoisomerase, resulting in rapid bacterial death.<sup>7</sup> It has improved the coverage of gram-positive, gram-negative, and anaerobic bacteria.<sup>8</sup> Moxifloxacin also exceeded the known minimum inhibitory concentration values for most pathogens that cause endophthalmitis in infected rabbit eyes.<sup>8</sup> Several bacteriological, histopathological, and clinical outcome studies in experimental animal and cell culture models have explored the role of intravitreal moxifloxacin in the treatment of endophthalmitis. Intravitreal moxifloxacin did not cause electroretinographic or retinal histologic abnormalities in rabbit eyes at a concentration up to

150 µg/mL (0.1 ml of 200 µg moxifloxacin injected intravitreal into 1.2 ml of rabbit vitreous volume).<sup>9</sup> If proven safe and efficacious by further study in humans, intravitreal moxifloxacin injections could be considered as an alternative to currently used antibiotics.<sup>9</sup> Another study reported that intravitreal use of moxifloxacin at concentrations of up to 150 µg/mL did not show significant toxicity in primary human retinal pigment epithelium cells and primary optic nerve head astrocyte cells.<sup>10</sup>

Two case reports reported that intravitreal moxifloxacin was effective and safe in the treatment of post-traumatic endophthalmitis in humans.<sup>3,4</sup> In an era of increasing multidrug resistance, intravitreal moxifloxacin may play a role in the management of endophthalmitis. The vitreous volume of an adult emmetropic human eye is approximately 4 mL, giving an empiric concentration of 125 µg/mL when 500 µg/0.1 mL moxifloxacin is injected intravitreally.

Keeping the aforementioned studies in mind, we performed intravitreal injection of moxifloxacin 0.1 ml of 500 µg/0.1 ml in our case. We used undiluted, unpreserved, ready-to-use, and commercially available moxifloxacin ophthalmic solution to avoid the cumbersome procedure of intravitreal injection preparation, risk of contamination, and dilution error, which might further cause intraocular toxicity.

Intraocular purulent material accumulation in endophthalmitis comprises endotoxins, exotoxins, bacterial cell walls, enzymes, inflammatory cells, and humoral agents representing the body's immune response.<sup>6</sup> The retina may continue to be damaged by the remaining inflammatory response even when the intravitreal antibiotic has successfully destroyed the bacteria.<sup>6</sup> Vitrectomy can maximize the removal of the infectious and inflammatory load in the eye.<sup>6</sup> It appears rational to remove all harmful agents from the vitreous cavity before visual acuity deteriorates to light perception and irreversible damage occurs.<sup>6</sup> We performed vitrectomy as there was no clinical improvement after 24-hours of intravitreal antibiotics. The clinical result in our case was good with improved visual acuity, complete reduction of intraocular inflammation, and no signs of retinal toxicity.

## Conclusion

As demonstrated by previous case reports and this report, intravitreal injection of moxifloxacin is a potentially safe and effective alternative to intravitreal injection of vancomycin and ceftazidime in the treatment of acute post-phacoemulsification endophthalmitis. However, further studies may be required to assess the long-term effectivity and safety of this drug compared to intravitreal injection of vancomycin and ceftazidime as the standard intravitreal antibiotic treatment for endophthalmitis.

## Declarations

### Consent for publication

The patient has provided informed consent for the use of their clinical data and images in this case report.

### Competing interests

None to declare.

### Funding

None to declare.

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