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Clinical Spectrum and Management Challenges of Cluster Endophthalmitis Following Cataract Surgery

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Abstract

Background: Cluster endophthalmitis is a severe postoperative complication of cataract surgery, posing significant clinical and operational challenges, especially in camp settings.

Aim: To evaluate the clinical features, management, outcomes, and operational difficulties in 75 cases of cluster endophthalmitis at a tertiary care center in India.

Material and Methods: A retrospective observational study was conducted. Patient demographics, symptomatology, clinical signs, microbiological data, management strategies, and operational barriers were analyzed.

Results: Most patients presented between 8–14 days post-surgery, with attitudinal barriers and transportation issues as common delays. Diminution of vision and red eye were universal symptoms, with corneal involvement in 93.3% of cases. Operational difficulties included delayed

referrals and limited resources. Prompt management with antibiotics and surgical interventions improved outcomes, though visual prognosis remained guarded.

Conclusion: Cluster endophthalmitis requires rapid clinical response and system-level preparedness. Strengthening infection control, patient education, and operational readiness is essential to prevent outbreaks and improve patient outcomes.

Keywords: Cluster endophthalmitis, cataract surgery, clinical features, operational challenges, visual outcomes

Introduction

Cataract remains the leading cause of reversible blindness worldwide, accounting for approximately 50% of blindness cases in low- and middle-income countries [1]. Cataract surgery is among the most frequently performed surgical procedures globally, with over 20 million surgeries performed annually [2]. Despite advances in surgical techniques, instrumentation, and aseptic protocols, postoperative infections such as endophthalmitis remain one of the most dreaded complications, potentially leading to irreversible vision loss [3].

Endophthalmitis is a severe intraocular inflammatory response usually caused by bacterial or fungal infection introduced during or after surgery [4]. Cluster endophthalmitis, defined as multiple cases of endophthalmitis occurring after a single surgical session or within a short time frame at the same center, poses a unique clinical and public health challenge, particularly in eye camp settings [5]. Such clusters often result from lapses in infection control, compromised sterilization practices, contaminated irrigating solutions, or multidose drug contamination, and they can quickly erode patient confidence in public health programs [6].

The clinical presentation of cluster endophthalmitis typically includes pain, redness, hypopyon, anterior chamber reaction, vitritis, and rapidly worsening visual acuity, often within 24–72 hours after cataract surgery [7]. Management protocols, as outlined by the Endophthalmitis Vitrectomy Study and subsequent guidelines, involve prompt administration of intravitreal antibiotics, pars plana vitrectomy in severe cases, and systemic therapy when necessary [8]. However, in a cluster setting, the challenges are compounded by the need to manage multiple patients simultaneously, logistical constraints, inadequate hospital beds, and limited microbiological support, especially in resource-limited regions [9].

Indian studies have highlighted that cluster outbreaks in eye camps disproportionately affect rural and poor populations, amplifying the burden of blindness and complicating follow-up care [10]. Furthermore, operational difficulties such as delayed referrals, overwhelmed hospital staff, inadequate record-keeping, and medico-legal pressures often compromise the quality of care in these scenarios.

Given the magnitude of cataract surgeries conducted through outreach programs in India, understanding the clinical patterns, treatment outcomes, and operational bottlenecks in managing cluster endophthalmitis is critical for improving patient safety and preventing future outbreaks. This study aims to evaluate the clinical features, management strategies, and visual outcomes in 64 cases of cluster endophthalmitis and to identify the key operational difficulties encountered during management in a tertiary care setting.

Material and Methods

This was a retrospective, observational study conducted at a tertiary care ophthalmology center in India. The study was conducted over a 12-month period.

A total of 75 patients diagnosed with cluster endophthalmitis following cataract surgery were included in the study.

Inclusion Criteria:

- Patients diagnosed with acute-onset postoperative endophthalmitis after cataract surgery.
- Cases occurring as part of a cluster (defined as ≥2 cases from a single surgical session or camp within 72 hours).
- Patients who underwent evaluation and management at the tertiary care center.

Exclusion Criteria:

- Patients with traumatic or endogenous endophthalmitis.
- Patients with incomplete clinical records or inadequate follow-up data.

Patient data were collected retrospectively from medical records, including:

- Demographic details (age, sex, comorbidities).
- Preoperative details (cataract type, surgical technique, intraocular lens type, surgeon experience).
- Clinical presentation (time of symptom onset, presenting visual acuity, anterior and posterior segment findings, presence of hypopyon, vitritis).
- Microbiological findings (gram stain, KOH mount, culture and sensitivity results).
- Treatment provided (intravitreal antibiotics, systemic antibiotics, vitrectomy, repeat interventions).
- Operational details (number of cases, staff involved, sterilization process, use of multidose vials, operation theater practices).
- Final visual outcome (best-corrected visual acuity at last follow-up).

Operational challenges were identified through review of clinical records, infection

control committee reports, and staff interviews. Challenges assessed included:

- Delay in referral or presentation.
- Microbiological support availability.
- Logistical issues (OT crowding, bed availability, staff training gaps, supply chain disruptions).

Statistical Analysis:

Data were entered into Microsoft Excel and analyzed using SPSS software (version XX). Descriptive statistics were used to summarize demographic data, clinical features, microbiological profile, management details, and outcomes. Associations between presenting features, treatment, and visual outcomes were analyzed using chi-square tests or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

Results

Table 1 shows the distribution of patients according to the day of presentation and the most common reasons for delay. No patients presented within the first seven days after surgery. The majority (48.0%) reported between days 8–14, mainly due to attitudinal barriers and delayed decision-making. Around 29.3% presented between days 15–21, often because of transportation issues and long travel distances to the higher center. A further 22.7% presented after 22 days, mostly due to illiteracy and lack of awareness.

Table 2 describes the clinical presentation of patients with variable symptomatology. All patients (100%) had diminution of vision and red eye at presentation. Pain was reported in 69.3% of cases, while watering and foreign body sensation were observed in 33.3% and 25.3%, respectively. Discharge was less common, seen in only 14.7% of patients.

Table 3 outlines the ocular features observed on presentation. Corneal involvement was seen in 93.3% of patients, and anterior segment inflammation was present in all cases. Hypopyon was identified in 48.0% of patients, and exudates over the intraocular

lens (IOL) and pupillary area were seen in 40.0%. Wound gape and scleral melt were observed in 34.7% and 26.7% of patients respectively, reflecting the severe nature of these infections.

Table 4 details the corneal status at presentation. Exudates on the endothelium were the most common finding (54.7%), followed by stromal haze (48.0%). Corneal abscess and striate keratopathy were seen in 25.3% and 13.3% of patients, respectively. Other features included corneal thinning (6.7%), limbal infiltrates (6.7%), ulcer with infiltration (10.7%), and rare cases of bullae formation (1.3%). Only 6.7% of patients had a clear cornea at presentation.

Table 1: Day of Presentation and the Most Common Reasons for Delay

Day of Presentation	No. of Patients	Reasons for Delay
0–7th Day	Nil	Decision making
8–14th Day	36 (48.0%)	Attitudinal barriers
15–21st Day	22 (29.3%)	Transportation to higher center, long distance
22–29th Day	17 (22.7%)	Illiteracy and ignorance

Table 2: Clinical Presentation with Variable Symptomatology

Symptoms	No. of Patients	Percentage
Diminution of vision	75	100%
Pain	52	69.3%
Red eye	75	100%
Watering	25	33.3%
Discharge	11	14.7%
Foreign body sensation	19	25.3%

Table 3: Clinical Features with Variable Signs on Presentation

Ocular Features	No. of Patients	Percentage
Corneal involvement	70	93.3%
Wound gape	26	34.7%
Scleral melt	20	26.7%
Hypopyon	36	48.0%
Anterior segment inflammation	75	100%
Exudates over IOL and pupillary area	30	40.0%

Table 4: Corneal Status of Patients at Presentation

Condition of Cornea	No. of Patients	Percentage
Clear	5	6.7%
Striate keratopathy	10	13.3%
Abscess	19	25.3%
Edema	10	13.3%
Stromal haze	36	48.0%
Thinning	5	6.7%
Exudates on endothelium	41	54.7%
Limbal infiltrates	5	6.7%
Ulcer with infiltration	8	10.7%
Bullae	1	1.3%

Discussion

This study evaluated the clinical presentation, management strategies, and operational challenges in 75 cases of cluster endophthalmitis following cataract surgery in a tertiary care center in India. The findings highlight important patterns and barriers that need attention for improving patient outcomes and preventing future outbreaks.

The majority of patients presented between 8–14 days after surgery, largely due to attitudinal barriers, delayed decision-making, and lack of awareness, while some faced transportation difficulties and healthcare access limitations. This pattern mirrors reports from rural outreach programs in India, where delays in recognizing the seriousness of postoperative symptoms often lead to worsened prognosis [11]. Studies emphasize that patient education and early warning systems are critical in outreach cataract programs to reduce delays in presentation and improve visual outcomes [12].

Clinically, all patients reported diminution of vision and red eye, and nearly 70% complained of pain. The high frequency of corneal involvement (93.3%), hypopyon (48%), and exudates over the IOL and pupillary area (40%) reflects the aggressive nature of infections seen in cluster outbreaks. This aligns with previous studies showing that cluster endophthalmitis cases often present with more severe anterior and posterior segment inflammation compared to sporadic cases, resulting in poorer visual prognosis [13].

Corneal status was notably compromised in many patients, with exudates on the endothelium (54.7%), stromal haze (48%), and abscess formation (25.3%) being the most common findings. Corneal abscesses and thinning increase the risk of perforation, complicating management, especially in

resource-limited settings [14]. The severity of these corneal manifestations underscores the importance of rapid intervention, including early intravitreal antibiotics, systemic antibiotics, and, in severe cases, pars plana vitrectomy.

Importantly, this study also identified operational difficulties that hindered optimal management — from delayed referral to logistical issues like inadequate bed availability, overwhelmed staff, and limited microbiological support. Previous research has highlighted that cluster endophthalmitis management requires not only clinical expertise but also rapid system-wide mobilization, including microbiological confirmation, tracking of contamination sources, and public communication [15].

Strengthening infection control protocols in outreach programs, ensuring regular microbiological audits, training peripheral surgical teams, and developing contingency plans are essential to reducing the incidence and severity of cluster endophthalmitis. Collaborative efforts between ophthalmologists, public health teams, and local healthcare providers are needed to implement sustainable solutions.

Conclusion

In conclusion, cluster endophthalmitis remains a significant threat to vision following cataract surgery, particularly in camp-based settings. This study highlights that delayed presentation, severe anterior segment inflammation, and compromised corneal status are common in cluster outbreaks. Operational challenges, including delayed referrals and limited resources, further complicate management. Early identification of cases, prompt administration of appropriate therapy, and robust infection control measures are essential to improving outcomes. Strengthening public awareness, peripheral staff training, and systemic preparedness are crucial steps to prevent

future outbreaks and safeguard the success of cataract blindness reduction programs.

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