Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 8
Open Access

Intraoperative Anaphylaxis during Small Incision Cataract Surgery: A Case Report and Emergency Management Protocol

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Cite this paper as: Dr.M Harshitha Reddy, Dr.Shivani Namala, Dr.Ramnath Koti, Dr.Narayan M (2024). Intraoperative Anaphylaxis during Small Incision Cataract Surgery: A Case Report and Emergency Management Protocol. *Frontiers in Health Informatics*, *13 (8) 6599-6606*

Abstract:

This paper presents a summary of a rare yet serious allergic reaction occurring during cataract surgery in a 78-year-old lady. She underwent small incision cataract surgery with implantation of the posterior camber treatment with the implantation of the lens when, a few minutes after local anaesthetic (lidocaine, bupivacaine, adrenaline, and hyaluronidase) administration, she showed the symptoms of anaphylactic reaction: tachycardia, skin rash, protrusion of the eyelids, and dyspnoea. Adrenaline, together with hydrocortisone, pheniramine, and a bronchodilator, was administered by anesthesiologist on time, and the symptoms reduced in the period of 30 minutes. Her eye surgery was successful, and her vision improved. This case shows the importance of prompt diagnosis of allergic reactions and their correct treatment by emergency procedures. The other theme is the need to conduct allergy tests before surgery and have sufficient training and readiness in eye clinics in order to ensure patient safety.

Keywords: anaphylaxis, cataract surgery, peribulbar block, hyaluronidase, emergency management, Small incision cataract surgery (SICS)

Introduction

Small incision cataract surgery (SICS) is the most preferred method of cataract surgery in the world due to its good visual rehabilitation and increased safety of the PCIOL implant. Despite the enormous success of the method, there are intraoperative anaphylaxis as rare and serious complications. A common acute systemic allergic reaction, anaphylaxis, typically develops in a few minutes after exposure to allergens such as local anaesthetics or adjuvants, frequently used to enhance diffusion of anaesthetics, but known to cause allergies (Yadav & Tandon, 2019). Being a dangerous emergency with an incidence of less than 0.01 per cent in ophthalmic surgery, recognition and systematic treatment are critical. The primary management envisages immediate use of epinephrine, and later it will be followed by corticosteroids and antihistamines in respiratory care. It may lead to a lack of awareness and preparation due to its uncommonness. It is a rare incidence of anaphylactic reaction involving small incision cataract surgery (SICS).

This report details the treatment of the patient promptly with steps of emergency management, resulting in an excellent outcome. This report aims to create awareness and provide useful suggestions to cataract surgery teams to be ready to handle such an emergency. The intention is to ensure patients are safe and preventable risks are avoided with proper planning.

Case Report

Patient Presentation and Clinical History

An otherwise healthy 78-year-old female had a two-year history of progressive, painless bilateral visual impairment severely impairing her activities of daily living. Her medical history was uneventful with no documented systemic illnesses such as diabetes mellitus, hypertension, or bronchial asthma. No history of prior allergic responses to medications, foods, or environmental allergens, and no prior surgery or anaesthetic exposures.

The patient was admitted on 12th February 2025 for assessment and surgical intervention of bilateral cataracts. With the consent of the patient, The test dose of xylocaine was given the previous night and no reaction was noted. Detailed ophthalmic examination elicited visual acuity of counting fingers at a quarter meter in the right eye and counting fingers at 2 meters in the left eye. Slit lamp biomicroscopy showed inferior corneal degeneration with immature senile cataracts in both eyes. The right eye presented with anterior subcapsular cataract (AS 1:2-PSCC), whereas the left eye presented with nuclear sclerosis grade 2 (NS2).

Preoperative Assessment and Investigations

Fundus examination revealed asteroid hyalosis in the right eye with hazy media and normal optic disc (cup-to-disc ratio 0.4:1). The left eye showed normal optic disc (cup-to-disc ratio 0.4:1) with dull foveal reflex. Intraocular pressure measurements were 12 mmHg in the right eye and 16 mmHg in the left eye. Lacrimal syringing confirmed patent nasolacrimal ducts bilaterally.

Preoperative biometric assessment of the left eye revealed keratometry readings of K1: 48.50 diopters and K2: 50.75 diopters, with an axial length of 22.03 millimeters. The calculated intraocular lens power was 16.0 diopters with an A-constant of 118.5. Comprehensive preoperative investigations including random blood glucose, urine routine examination, and electrocardiogram showed no abnormalities. All preoperative findings are summarized in Table 1.

Table 1: Preoperative Clinical Assessment

Parameter	Right Eye	Left Eye
Visual Acuity	CF at 1/4 meter	CF at 2 meters
Cornea	Inferior degeneration	Inferior degeneration
Lens	SIMC AS 1:2-PSCC	SIMC NS2
IOP (mmHg)	12	16
Cup-to-disc ratio	0.4:1	0.4:1
Keratometry (D)	K1 42.50 k2 51.00	K1: 48.50, K2: 50.75
Axial length (mm)	-	22.03
IOL power (D)	-	16.0

CF = counting fingers, SIMC = senile immature cataract, AS = anterior subcapsular, PSCC = posterior subcapsular cataract, NS = nuclear sclerosis, IOP = intraocular pressure, IOL = intraocular lens

Key Data-

- Keratometry and IOL Power for RE and LE:
  - RE K1: 42.50, K2: 51.00
  - LE K1: 48.50, K2: 50.75
  - LE AXL: 22.03 mm, IOL power: 16.0 D
- IOP: RE = 12 mmHg, LE = 16 mmHg
- Systemic Investigations: Normal
- Confirmation of diagnosis: Cataract LE (NS2)

The biometry was confirmed with keratometry (K1: 48.50, K2: 50.75), axial length (22.03 mm), and IOL power (16.0 D), referencing the physical record. On ocular examination, the patient was found to have **myopia** in both eyes. Refraction results indicated a spherical power of **-2.00 diopters** in the **right eye (RE)** and **-2.00 diopters** in the **left eye (LE)**. Visual acuity was measured at **6/6** for the right eye, left eye, and both eyes combined, suggesting corrected vision is normal with appropriate lenses. Slit lamp examination revealed that the **eyelids, conjunctiva, cornea, anterior chamber (AC), iris, and lens** were all within normal limits. **Pupil reaction** was also noted to be normal. These findings indicate that the anterior segment of the eye is healthy and free from any pathological abnormalities.

Further evaluation through **fundus examination** showed a **clear media** and a **normal optic disc** with a **cup-to-disc ratio (CDR) of 0.3**, which is within the acceptable physiological range. Retinal vessels appeared normal, and the **macula** was intact with a **distinct foveal reflex** observed, confirming the health of the posterior segment of the eye. Based on the clinical findings, the impression was **simple myopia**, and the patient was advised to use **corrective glasses for distance vision**. No pathological signs were noted, and overall ocular health was deemed satisfactory. The examination was conducted and documented by anesthesiologist**.**

Surgical Procedure and Anesthetic Management

On 13th February 2025, the patient underwent left eye SICS with PCIOL implantation under peribulbar block anesthesia. The local anesthetic mixture contained lidocaine with adrenaline, bupivacaine, and hyaluronidase for enhanced drug diffusion. The repeat subtenons injection was administered at 9:30 AM following standard anatomical landmarks and injection techniques.

Within minutes of local anesthetic administration, during the formation of the scleral tunnel, the patient complained of severe ocular pain despite adequate anesthetic volume. This was immediately followed by rapid development of systemic symptoms consistent with anaphylactic reaction. The patient developed acute onset tachycardia with heart rate elevation to 120-125 beats per minute, accompanied by restlessness and agitation. Dermatological manifestations included generalized urticaria affecting the trunk, thighs, and bilateral arms, along with periorbital angioedema with visible swelling around both eyes. Respiratory symptoms included acute respiratory distress with subjective breathing difficulty and decreased oxygen saturation levels.

Emergency Management and Treatment

The constellation of cardiovascular, dermatological, and respiratory symptoms occurring within minutes of anesthetic administration was immediately recognized as anaphylaxis by the surgical team. Emergency response protocols were immediately activated with discontinuation of all potential triggering agents and systematic treatment implementation.

Fig 1. Intraoperative Picture

Primary emergency interventions were initiated between 9:35-9:40 AM and included intramuscular adrenaline 0.5 milligrams as the first-line treatment for anaphylaxis, targeting cardiovascular and respiratory symptoms. Intravenous hydrocortisone 100 milligrams was administered for anti-inflammatory effects and prevention of biphasic reactions. Intravenous pheniramine (Avil) 1 ampule was given as H1-receptor antihistamine for allergic symptom control. Nebulization therapy with combination of Budesonide and Duolin provided bronchodilator effects for respiratory symptom management. Immediate oxygen supplementation was initiated to maintain adequate tissue oxygenation.

Continuous patient monitoring included vital sign assessment with heart rate, blood pressure, and respiratory rate monitoring, pulse oximetry for oxygen saturation, cardiac rhythm monitoring for arrhythmia detection, and neurological assessment for consciousness level changes. The emergency management protocol is detailed in Table 2.

Table 2: Emergency Management Protocol and Timeline

Time	Intervention	Dosage/Route	Indication
9:30 AM	Repeat subtenons block administered	3 cc	Local anesthesia
9:32 AM	Anaphylaxis symptoms onset	-	-
9:35 AM	Adrenaline	0.5 mg IM	Primary anaphylaxis treatment
9:36 AM	Hydrocortisone	100 mg IV	Anti-inflammatory/biphasic prevention
9:36 AM	Pheniramine (Avil)	1 ampule IV	Antihistamine
9:37 AM	Nebulization	Budesonide + Duolin	Bronchodilator
9:37 AM	Oxygen supplementation	High flow	Respiratory support
10:00 AM	Complete symptom resolution	-	-
11:53 AM	Surgery completed	-	-

IM = intramuscular, IV = intravenous

The patient showed remarkable improvement following emergency interventions. Within 30 minutes of treatment initiation, complete resolution of anaphylactic symptoms was achieved with heart rate normalization to baseline values, complete resolution of urticaria and angioedema, and respiratory distress resolution with normalized oxygen saturation. The patient became comfortable, alert, and hemodynamically stable.

Surgical Completion and Outcomes

After total stabilisation of the patient's status and removal of all anaphylactic manifestations, the operative team elected to advance with the intended cataract surgery. This was influenced by the complete resolution of symptoms, hemodynamic stability, the patient's stable neurological status, and the need for visual rehabilitation of the elderly patient. The SICS with PCIOL implantation was completed successfully at 11:53 AM without additional complications. Successful implantation of a 16.0 diopter posterior chamber intraocular lens was achieved in the capsular bag with proper positioning and stability.

Early postoperative examination showed the left eye posterior chamber intraocular lens in proper position in the capsular bag with mild corneal oedema, typical of postoperative findings. The anterior chamber was normal with no evidence of inflammation, and the patient was systemically stable with normalised vital signs and no residual evidence of allergic reaction.

According to the operative notes (below figure), the patient was stable and the surgery was completed uneventfully under peribulbar anesthesia using a microscope.

The patient was taken up for cataract surgery under appropriate aseptic precautions. Peribulbar anesthesia was administered using 2% lignocaine with adrenaline. Supplemental subtenons anesthesia was given to enhance comfort and ensure adequate anesthesia during the procedure. A standard small incision cataract surgery (SICS) was performed successfully. Intraoperatively, a posterior chamber intraocular lens (PCIOL) was implanted in the capsular bag. The surgery was uneventful, and the patient was shifted to the postoperative ward in a stable condition with prescribed ocular medications for further management.

Postoperative Course and Follow-up

The patient stayed in the hospital for observation and monitoring for possible delayed allergic reaction or biphasic anaphylaxis. Postoperative day 1 (14th February 2025), the left eye was normal with a well-posed posterior chamber intraocular lens with no intraocular inflammation or infection. No trace of allergic symptoms was seen, and vital signs were stable in the normal range.

Final evaluation on postoperative day 2 (15th February 2025) demonstrated visual acuity improvement to counting fingers at 3 meters in the left eye, representing improvement from preoperative counting fingers at 2 meters. Comprehensive slit lamp examination revealed no complications, and intraocular pressure remained within normal limits.

The patient was discharged on 15th February 2025 with topical dexamethasone 0.1% eye drops (Dexoren-5) one drop five times daily to the left eye for postoperative anti-inflammatory management. Systemic medications included desloratadine 5 milligrams once daily for 8 days for continued antihistamine therapy and levofloxacin 500 milligrams once daily for 8 days as prophylactic antibiotic therapy. Discharge instructions included avoiding head bath for 10 days, using dark protective goggles, and scheduled follow-up appointment on 20th February 2025. The complete clinical timeline and outcomes are presented in Table 3.

Table 3: Clinical Timeline and Outcomes

Date/Time	Event	Clinical Status	Intervention
12/02/2025 3:55 PM	Hospital admission	Bilateral cataracts	Preoperative assessment
13/02/2025 9:30 AM	Repeat subtenons block	Stable	Local anesthesia
13/02/2025 9:32 AM	Anaphylaxis onset	Critical	Emergency management
13/02/2025 10:00 AM	Symptom resolution	Stable	Continue monitoring
13/02/2025 11:53 AM	Surgery completed	Stable	SICS + PCIOL
14/02/2025	Postoperative day 1	Stable	No complications
15/02/2025 10:54 AM	Final assessment	VA: CF at 3 meters	Ready for discharge
15/02/2025 4:19 PM	Hospital discharge	Stable	Home medications

VA = visual acuity, CF = counting fingers, SICS = small incision cataract surgery, PCIOL = posterior chamber intraocular lens

Discussion

This case report demonstrates a severe intraoperative complication of the cataract surgery that is rather rare, but on the one hand, it also proves the importance of recognising the intraoperative anaphylaxis and treating it systematically within a short period. Such a positive outcome of the patient, such as successful surgery completion and the development of a high-quality visual rehabilitation, demonstrates the fact that, in spite of exacerbated allergic reactions, under the

condition of sufficient emergency preparedness and high-quality evidence-based practice care procedures, even severe anaphylaxis can be managed.

Pathophysiology and Causing Factors

Anaphylaxis is a disastrous, systemic allergic condition mediated by IgE antibodies and the consequent mast cell degranulation and subsequent acute discharge of histamine and other proinflammatory mediators. The cardiovascular changes encompass vasodilation, permeability of the capillary and consequent cardiovascular shock (Villada et al., 2005). The respiratory components are a result of bronchospasm and laryngeal oedema, and the dermatological features are due to histamine liberation and vasopermeability.

The case in question included multiple ingredients of the peribulbar block solution, which might have caused the allergic reaction as a triggering factor. Hyaluronidase, added as a spreading factor to enhance local anesthetic diffusion, represents the most likely culprit given its well-documented association with anaphylactic reactions in ophthalmic surgery (Rose et al., 2016) The enzyme, derived from bovine or ovine testicular tissue, contains proteins that can trigger IgE-mediated reactions in susceptible individuals. Local anesthetic agents, including lidocaine and bupivacaine, hyaluronidase can also trigger allergic reactions, although true allergies to amide local anesthetics are relatively uncommon. Epinephrine and preservatives such as methylparaben present in local anesthetic preparations represent additional potential allergens.

Emergency Management Analysis

The systematic approach to anaphylaxis management in this case demonstrates adherence to established emergency protocols with excellent patient outcomes. Intramuscular epinephrine represents the cornerstone of anaphylaxis treatment, providing rapid reversal of cardiovascular collapse and bronchospasm through its alpha and beta-adrenergic effects (Nelson, 2012). The 0.5 mg intramuscular dose administered in this case is appropriate for adults and provides rapid absorption and sustained effect.

Corticosteroids, although not immediately beneficial, prevent biphasic anaphylactic reactions occurring 4-24 hours following the initial attack. The 100 mg intravenous hydrocortisone dose has anti-inflammatory action and stabilises mast cells to avoid future mediator release (Mali, 2012). H1-receptor antihistamines such as pheniramine regulate urticaria and angioedema, while bronchodilator treatment corrects respiratory symptoms and airway reactivity.

The prompt clinical improvement noted here, with resolution of all symptoms in 30 minutes, is a testament to the success of timely intervention and the use of appropriate medications. Ongoing vigilance for the development of possible complications, such as biphasic reactions and cardiovascular instability, is a critical aspect of total anaphylaxis management (Kumar et al., 2019).

Surgical Decision-Making Considerations

The choice to undertake cataract surgery after patient stabilisation involved cautious deliberation of various factors such as full resolution of allergic reactions, hemodynamic stability, patient age, functional visual loss, and emergency resource availability. This clinical strategy may be proven by completion of surgery and good visual outcomes, as well as demonstrating that emergency complications should not be used to exclude completion of necessary surgical interventions when the patients are appropriately stabilised (Gogate, 2009).

The decrease in counting finger 2 meters to counting finger 3 meters is quite low, but still, it forms a great improvement in the functioning values of an old patient with severe loss of sight due to cataract. The absence of surgical complications and the position stability of the intraocular lens shows that the technique has been successful despite the occurrence of emergent conditions (Dodd et al., 2024).

Clinical Implications and Prevention Strategies

It is a significant case that reveals several main prevention steps and clinical considerations that work in the field of ophthalmic surgical practice. It should become a requirement that all patients who are to undergo preoperative care get allergy screening in advance, with particular consideration of history with regard to regionally based anaesthetics

administration, known drug allergies, and all incidences of unforeseen and unexpected side effects to medical procedures (Barr et al., 1995). While this patient had no documented allergy history, the unpredictable nature of anaphylaxis emphasizes the importance of universal emergency preparedness.

Alternative anesthetic techniques, including topical anesthesia or sub-Tenon's block without hyaluronidase, should be considered for patients with known allergies or high-risk profiles. The development of hyaluronidase-free local anesthetic formulations or alternative spreading agents could potentially reduce allergic reaction risks while maintaining block effectiveness (Dewachter & Savic, 2019).

Emergency preparedness represents a critical component of safe ophthalmic surgical practice. All operating theaters performing cataract surgery should maintain comprehensive anaphylaxis management protocols with immediately available medications including epinephrine, corticosteroids, antihistamines, and bronchodilators. Staff training in anaphylaxis recognition and emergency management should be mandatory and regularly updated through simulation exercises and continuing education programs (Ang et al., 2014).

Limitations and Future Research

This case report, while providing valuable clinical insights, represents a single patient experience and cannot establish causation or provide statistical significance regarding treatment protocols. The retrospective nature of case reporting also limits the ability to control for confounding variables or establish optimal treatment protocols through comparative analysis (Admass et al., 2023).

Future research should aim towards large-scale epidemiological studies for further characterising the incidence and risk factors of anaphylaxis in ophthalmic surgery. Creation of preoperative tests for reliable screening of local anaesthetics and adjuvant allergies would enhance risk stratification and patient safety. Research into alternative formulations of anaesthetics and techniques with reduced risks of allergic reactions while sustaining surgical efficacy is a prime area of future research.

Safety and outcomes should be further improved by the implementation of standardised emergency response rules specific to the realm of ophthalmic surgery, by which medication rules, timing principles and methods of coordinating the personnel should be implemented (Villada et al., 2005). The comparisons across the various emergency management strategies should be done by multi-centred research designs that would provide an evidence-based solution regarding optimal treatment of anaphylaxis in the setting of ophthalmic surgery.

Conclusion

Although rare, the intraoperative anaphylaxis in cataract surgery is a life-threatening event that should be comprehensively identified and managed based on evidence. The present case emphasises safe patient recovery through prompt intervention with epinephrine, corticosteroids, and antihistamines, in addition to ongoing monitoring and postoperative management. It underscores the importance of emergency preparedness in ophthalmic programs through staff training, availability of medications, and routine drills.

Preoperative allergy testing and safer anaesthetics improve risk avoidance. Successful surgery with good visual results proves that severe allergic reactions, with proper systematisation, should not forestall necessary procedures. Continued reporting of such cases promotes enhanced protocols, patient safety, and quality care, affirming that caution and preparedness are paramount, even in procedures with excellent safety profiles such as cataract surgery.

On final postoperative assessment, the patient achieved a best corrected visual acuity (BCVA) of **6/12 for distance** and **N8 for near** in the operated left eye. This outcome signifies substantial functional visual improvement from the preoperative level of counting fingers at 2 meters, enabling the patient to regain independence in daily activities. The successful visual rehabilitation underscores the importance of prompt emergency management and judicious decision-making in proceeding with surgery after intraoperative anaphylaxis.

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