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HYPERVENTILATION: A PHYSIOLOGICAL APPROACH TO MANAGING INTRAOPERATIVE INTRAOCULAR PRESSURE SPIKES IN CATARACT SURGERY

Ophthalomology

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ABSTRACT

Background: Intraoperative intraocular pressure (IOP) spikes during cataract surgery can cause significant surgical challenges and postoperative complications. **Aim:** To evaluate hyperventilation as a physiological method to lower intraoperative IOP spikes. **Methods:** An interventional study on all adult patients undergoing cataract surgery under peribulbar anesthesia over 6 months was conducted to include patients with raised IOP spikes. Patients with preoperative raised IOP, on anti-glaucoma medications, with impaired hearing, or non-cooperative were excluded to ultimately include 91 subjects. Intraoperative IOP rise was suspected via signs such as increased scleral rigidity and unstable anterior chamber. Hyperventilation was induced by instructing subjects to take 30 quick deep breaths over 90 seconds. If IOP remained elevated beyond 3 minutes, intravenous mannitol was administered. **Results:** Ninety-one subjects experienced IOP spikes, with slight male predominance. Scleral rigidity was universal; unstable anterior chamber was the next most common finding. Hyperventilation normalized IOP within one minute in most subjects; seven needed three minutes, and two were refractory, requiring mannitol. **Conclusion:** Hyperventilation is a rapid, safe, and effective physiological intervention for intraoperative IOP spikes, potentially reducing dependence on pharmacological measures.

KEYWORDS

Cataract Surgery, Raised IOP Spikes, Hyperventilation, Physiological Approach, Non-invasive Approach

INTRODUCTION

Transient intraoperative intraocular pressure (IOP) spikes, may disrupt the surgical field and increase the risk of complications such as choroidal effusion, suprachoroidal hemorrhage, iris prolapse, and reduced visualization. Causes include ophthalmic visco-surgical device (OVD) use, pupil dilation, corticosteroids, surgical trauma, and pre-existing glaucoma, but spikes can also occur idiopathically.

Current pharmacological management, such as intravenous mannitol, carries risks including dyselectrolytemia, hypotension, fluid overload, and is contraindicated in patients with cardiac, renal, or pulmonary compromise.

In contrast, hyperventilation offers a non-invasive, rapid, and cost-free method by lowering carbon dioxide (CO_2) levels, which reduces central venous pressure (CVP) and choroidal vascular volume, thereby decreasing IOP.

Breathing exercises have already been recommended with promising results for lowering IOP in established glaucoma patients as described by Dada et al[1].

This study evaluates the efficacy of hyperventilation in reducing intraoperative IOP spikes during cataract surgery.

MATERIALS AND METHODS

This interventional study was conducted in a tertiary care center in Southern Assam among all adult subjects undergoing cataract surgery under peribulbar anesthesia over a period of 6 months (November 2024 to May 2025) after informed consent and in accordance with the Helsinki Declaration.

Inclusion Criteria: All adult subjects undergoing cataract surgery under peribulbar anesthesia experiencing intraoperative IOP spikes were included in the study.

Exclusion Criteria: Preoperative raised IOP, anti-glaucoma medication use, impaired hearing, non-cooperative subjects were excluded.

91 subjects experiencing intra op IOP spike were ultimately included in the study.

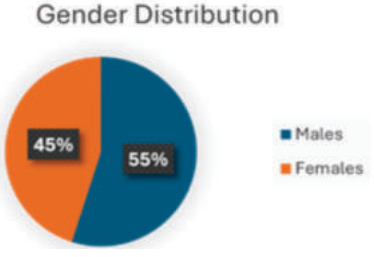
Procedure

Raised IOP was suspected intraoperatively through tactile signs such as increased scleral rigidity and unstable anterior chamber. Upon detection, subjects were instructed to take 30 rapid deep breaths over 90 seconds. IOP response was monitored by tactile feedback and surgical visualization. Subjects unresponsive after 3 minutes received intravenous mannitol.

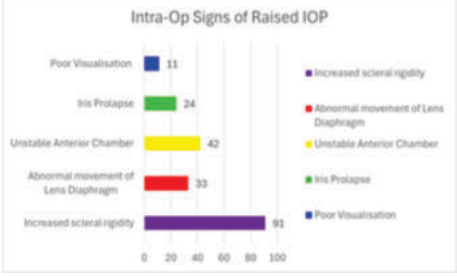
Data Collection: Demographic details, intraoperative findings, time to IOP normalization, and requirement of mannitol were recorded.

RESULTS

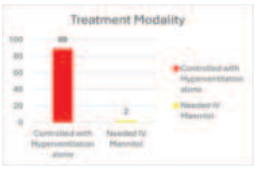
Incidence of IOP spikes was found to be 22.5% among all cataract surgeries performed in the study duration with slight male predominance. Scleral rigidity was observed in all cases. Unstable anterior chamber was the second most common. With hyperventilation 82 subjects normalized within 1 min while 7 subjects normalized within 3 minutes. 2 subjects who came out to be refractory were administered intravenous mannitol.



Graph 1: Gender Distribution of Incidence of Raised IOP Spike in Study Population



Graph 2: Signs of Raised IOP Observed in the Study Population



Graph 3a **Graph 3b**

Graph 3 Parameters of Normalization of IOP: (a) Treatment Modality and (b) Time Taken to Normalize

DISCUSSION

This study demonstrates that hyperventilation can quickly and effectively normalize intraoperative IOP spikes in most subjects, aligning with physiological studies linking CO_2 reduction to decreased IOP as supported by Hvidberg A et.al[2] and A D Petounis et al[3].

Hyperventilation is advantageous because:

1. It is non-invasive and cost-free.
2. It avoids systemic risks of pharmacological agents like mannitol.
3. It can be applied immediately during surgery without additional equipment.

The mechanism likely involves CO_2 washout leading to hypocapnia, reduced CVP, and reduced choroidal vascular volume, thereby lowering IOP as supported by Kaufmann et al[4].

CONCLUSION

Hyperventilation is a rapid, non-invasive and effective physiological intervention for intraoperative IOP spikes during cataract surgery, reducing reliance on pharmacological interventions.

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REFERENCES

1. Dada T, Gwal RS, Mahalingam K, Chandran DS, Angmo D, Gupta S, Velpandian T, Deepak KK. Effect of "365 Breathing Technique" on Intraocular Pressure and Autonomic Functions in Patients With Glaucoma: A Randomized Controlled Trial. J Glaucoma. 2024 Mar 1;33(3):149-154. doi: 10.1097/IJG.0000000000002356.
2. Hvidberg, A., Kessing, S. V., & Fernandes, A. (1981). Effect of changes in PCO2 and body positions on intraocular pressure during general anaesthesia. Acta ophthalmologica, 59(4), 465–475. https://doi.org/10.1111/j.1755-3768.1981.tb08331.x
3. Petounis, A. D., Chondreli, S., & Vadaluka-Sekioti, A. (1980). Effect of hypercapnea and hyperventilation on human intraocular pressure general anaesthesia following acetazolamide administration. The British journal of ophthalmology, 64(6), 422–425. https://doi.org/10.1136/bjo.64.6.422
4. Kaufmann, H., Schotte, J.F., & Holtmann, H.W. (1971). Ocular Tension During Hyperventilation. Ophthalmic Research, 2, 261-265. doi:10.1159/000264571