ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 09 | September - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CHANGES IN INTRAOCULAR PRESSURE IN PATIENTS UNDERGOING SURGERY IN THE PRONE POSITION

Anaesthesiology

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ABSTRACT

Introduction: Patients undergoing surgery in the prone position are at risk for postoperative vision loss associated with increased intraocular pressure. The purpose of this study is to estimate the magnitude of the increase in intraocular pressure at specific perioperative time points in adult patients. **Methods:** 80 patients were operated between June 1st 2022 to 31st May, 2023 in the Neurosurgery OR complex in Cardiothoracic and Neuroscience Center, Gauhati Medical College & Hospital and Down Town Hospital, Guwahati. The change in the intraocular pressure was observed for the patients. Intraocular pressure was monitored in the supine position first and then in the prone position at specific perioperative time periods. **Results:** IOP of both eyes in the prone position was significantly higher than IOP after anesthesia in the supine position ($p < 0.01$). **Conclusions:** Intraocular pressure increases of this magnitude demonstrate the need for implementing interventions to reduce the risk for postoperative vision loss in patients undergoing surgery in the prone position.

KEYWORDS

Anesthesia, IOP, Prone position.

INTRODUCTION:

Different surgical postures are needed for various surgical locations, procedures, and techniques. Prone position is a commonly used position in neurosurgical practice for getting access to prolapsed intervertebral disc pathology be it the cervical, dorsal or lumbar region. Postoperative vision loss, which may be partial or complete and unilateral or bilateral, is a serious complication of surgery in the prone position[1, 2]. Postoperative vision loss is a postoperative complication with an incidence of 0.015% to 0.2% of post-surgical complications[3]. IOP rises when the patient is prone, and the magnitude of this rise is correlated with how long the patient spends in the prone posture[4]. According to the American Academy of Ophthalmology, normal IOP is 10 to 21 mm Hg[5]. Intraocular pressure higher than 21 mm Hg pose a risk for glaucoma, detached retina, and postoperative vision loss[1,2]. In this study, IOP measurements were performed at different time points in the prone position to understand the IOP change pattern and related factors that might provide evidence for nursing interventions.

MATERIALS AND METHOD:

This study was carried out in the Neurosurgery OR complex in Cardiothoracic and Neuroscience Center, Gauhati Medical College & Hospital and Down Town Hospital, Guwahati from June 1st 2022 to 31st May, 2023.

Inclusion Criteria: Age 18-60 years, good cardiopulmonary function without metabolic diseases, serious circulatory diseases, respiratory diseases, and infectious diseases, patients with ASA ratings I to II, duration of surgery over 1 h (excluding anesthesia time).

Exclusion Criteria: Ocular diseases or history of conjunctivitis, intra-bulbar infection, high power myopia etc., preoperative seated IOP higher than 21mmHg, goiter and hyperthyroidism, used intraocular pressure drugs within 2 weeks, such as glaucoma eye drops and oral medication, intraoperative mechanical ventilation with mean airway pressure higher than 25 cmH2O (1 cm H2O=0.098 kPa), patients with multiple systemic trauma, fracture, shock, or Injury Severity Score (ISS)>18, patients with systemic diseases, such as chronic obstructive bronchitis, emphysema, liver and kidney dysfunction, cardiac insufficiency, and autoimmune diseases.

All participants were treated with tracheal intubation general anesthesia and the anesthesia process was the same. Following induction, IOP at different intervals were checked and recorded with the first being in the supine position using a Tonopen tonometer. The patient was then put in the prone position and IOP measured at every 30 minutes interval till the surgery was completed. All information was collected in standard format.

Statistical Analysis:

SPSS19.0 statistical software was applied for processing. Mean ± standard deviation ($x \pm s$) and range of IOP were analyzed. The change of IOP over time was analyzed by repeated-measures ANOVA; t-test or ANOVA was used for comparison between groups at a single time point. The difference was considered statistically significant at $P < 0.05$.

RESULTS:

A total of 80 patients were enrolled in this study. The age range was 18–60 years with mean age of 51.5±17.9. 43 patients were male (53.75%) and 37 were female (46.25%) in the study.

Table 1: Patient characteristics

Sex Male Female	 43(53.75) 37(46.25)
Age(Mean ± SD)	51.5±17.9 years
Preoperative Sitting position Eye Pressure Left Right	 18.1±2.7 mm Hg 18.3±3.2 mm Hg
Duration of surgery	2.8±1.1 hours

During the surgical procedure, position change occurred during three stages: once supine after induction, prone position and then again supine after end of surgery and extubation of patient.

There was a significant increase in the IOP in the prone position of both the left and right eye. From the beginning of the operation until the patients left the operating room, 60% of patients in the prone position had an IOP exceeding 24mm Hg. This was found to be higher with the longer the duration of surgery.

Table 2: Blood pressure and vital signs of patients admitted to the room

Variables	Prone position
Eye pressure (mean ± sd) Left Right	 20.0±3.2 20.2±3.4
Heart rate	79.2±14.2
SBP	136±28.7
DBP	83.4±71.5

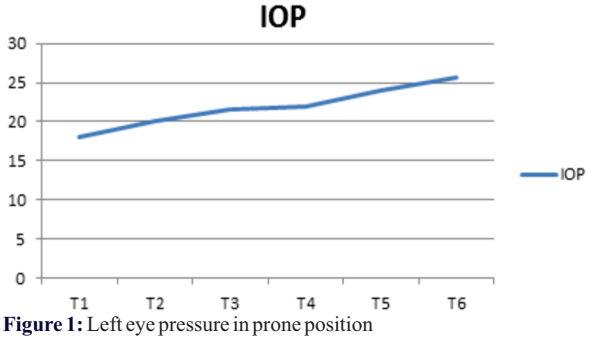

Figure 1: Left eye pressure in prone position

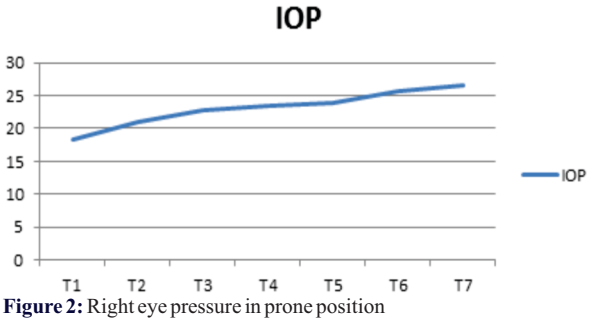

Figure 2: Right eye pressure in prone position

None of the patients in our study developed complications of visual difficulty or vision loss postoperatively.

DISCUSSION:

In our study, IOP was measured in prone position for all the cases. Postural position for the surgery played a role in IOP change. The self-regulation system, venous and arterial systems, and brain reflexes are only a few of the intricate regulatory processes the body uses to maintain hemodynamic stability after postural alterations. Healthcare professionals required to be aware of the pattern of IOP variations in various surgical positions because this regulation mechanism was compromised by anaesthesia.

The mean (SD) IOP for the general population has been reported as 15.5 (2.5) mm Hg. An IOP of 23 mm Hg is 3 standard deviations above the reported mean (ie, 15.5 mm Hg + 2.5 mm Hg + 2.5 mm Hg + 2.5 mm Hg = 23 mm Hg) and has thus been considered as a marker of abnormally elevated IOP[6]. Yoshimura et al conducted a study to evaluate predictive factors associated with increased IOP during spine surgery in the prone position[7]. The researchers found that a preoperative IOP of 23 mm Hg or greater was predictive of a postoperative IOP of 30 mm Hg or greater.

Sun et al[8] in their study on effect of different position on intraocular pressure observed mean age in patients undergoing surgery in prone position to be 62.8 ± 12.3 years. Preoperative sitting position eye pressure in left and right eye were found to be 19.4 ± 3.2 mm Hg and 19.6 ± 2.1mm Hg respectively. In our study, preoperative sitting position eye pressure in left and right eye were found to be18.1±2.7 mm Hg and 18.3±3.2 mm Hg respectively.

Mean duration of surgery was 3.5 ± 1.2 hours in the study by Sun et al. Mean duration of surgery in our study was found to be 2.8±1.1 hours. They observed an IOP of more than 24 mmHg in 48.5% of patients from the beginning of surgery to their exit from the OR. In our study we observed similar results with more than 80% patients having an increased IOP compared to the baseline in the supine position with more than 60% having IOP greater than 24mm Hg.

Implications For Practice:

A patient with elevated IOP is more likely to develop glaucoma, develop a detached retina, or lose a portion or all of their vision[9, 10]. Positioning the patient in a 5- to 10-degree reverse Trendelenburg prone position may be a simple intervention to prevent some instances of postoperative vision loss. This position has been shown to decrease IOP in patients undergoing spine surgery[11, 12]. Reducing the length of time the patient is in the prone position may also help to mitigate the increase in IOP. A series of quicker operations rather than a single lengthy procedure may assist lower the patient's risk for permanent visual loss following surgery.

Because IOP increases during prone position, intraoperative monitoring of IOP either continuously or at established intervals or time points seems prudent. Yoshimura et al34 suggested that measuring IOPs after 1 hour of surgery in the prone position could provide an opportunity for implementing interventions to prevent additional increases in IOP[7]. Preventing direct pressure and assessing and monitoring the patient's eyes at regular intervals throughout the procedure may help to reduce the incidence of postoperative vision loss. Avoiding specific headrests or positioning devices that may increase pressure on the eye (e.g., horseshoe-shaped, Wilson frame) or using skull pins or tongs to position the head may also help to prevent pressure on the orbits and reduce the risk for postoperative vision loss. Administering specific medications or anesthetics may also be effective in reducing IOP or mitigating the intraoperative increase in IOP. Compared to patients getting general anaesthesia, Inar et al[13] discovered that patients undergoing lumbar disc surgery while lying on their backs under spinal anaesthesia saw a markedly lower increase in IOP. Preoperative ophthalmologic examinations may be helpful in identifying patients at risk for postoperative vision loss. Increases in IOP may be more harmful in older patients, patients with risk factors for postoperative vision loss, or in patients who are predisposed to developing diabetes or glaucoma than in younger, healthier patients.

CONCLUSION:

Between the beginning of anesthesia induction and the termination of the prone position, intraocular pressure significantly rises. The IOP increases significantly within 10 minutes after the patient is placed into the prone position and continues to increase significantly while the patient is in prone position. Henceforth interventions need to be implemented to prevent post-operative vision loss. Implementing the recommended interventions presents no harm to the patient, but may benefit the patient by reducing the risk for increased IOP that may lead to glaucoma, detached retina, or postoperative vision loss.

REFERENCES:

1. Emery SE, Daffner SD, France JC, et al. Effect of head position on intraocular pressure during lumbar spine fusion: a randomized, prospective study. J Bone Joint Surg Am. 2015; 97(22):1817–1823. [PubMed] [Google Scholar]
2. Lee LA, Newman N. Postoperative visual loss after anesthesia for nonocular surgery. Up-to-date. 20182018 https://www.uptodate.com/contents/postoperative-visual-loss-after-anesthesia-for-nonocular-surgery
3. Li ZH, Zeng JC. Advances of postoperative visual loss after spinal surgery with prone position[J]. Chinese Journal of Spine and Spinal Cord. 2014; 24(2):179–82.
4. Yoshimura K, Hayashi H, Tanaka Y, Nomura Y, Kawaguchi M. Evaluation of predictive factors associated with increased intraocular pressure during prone position spine surgery. J Anesth. 2015; 29(2):170–174.
5. American Academy of Ophthalmology. Intraocular pressure. 20182018 https://www.aao.org/bcscsnippetdetail.aspx?id=f010bbf6-3f3e-486b-b5cd-0ad86ddb9d74
6. Carey TW, Shaw KA, Weber ML, DeVine JG. Effect of the degree of reverse Trendelenburg position on intraocular pressure during prone spine surgery: a randomized controlled trial. Spine J. 2014; 14(9):2118–2126.
7. Yoshimura K, Hayashi H, Tanaka Y, Nomura Y, Kawaguchi M. Evaluation of predictive factors associated with increased intraocular pressure during prone position spine surgery. J Anesth. 2015; 29(2):170–174.
8. Sun, Y., Wang, J., Wang, W. et al. Effect of different surgical positions on intraocular pressure: a cross-sectional study. BMC Ophthalmol 22, 318 (2022).
9. Kwee MM, Ho YH, Rozen WM. The prone position during surgery and its complications: a systematic review and evidence-based guidelines. Int Surg. 2015; 100(2):292–303.
10. Amorim Correa JL, Acioly MA. The enigma of orbital compartment syndrome after lumbar spine surgery in the prone position: case report and literature review. World Neurosurg. 2018; 110:309–3147.
11. Fukui K, Tempelhoff R, Cheng MA. Intraocular pressure during prone position surgery: effects of time and head elevation [abstract] J Neurosurg Anesthesiology. 2005; 17(4):251.
12. Fukui K, Ahmad M, McHugh T, Tempelhoff R, Cheng MA. The effect of head elevation on intraocular pressure in anesthetized patients undergoing prone position spine surgery [abstract] J Neurosurg Anesthesiol. 2004; 16(4):358.
13. Pinar HU, Kaşdoğan ZEA, Başaran B, Çöven İ, Karaca Ö, Doğan R. The effect of spinal versus general anesthesia on intraocular pressure in lumbar disc surgery in the prone position: a randomized controlled trial. J Clin Anesth. 2018; 46:54–58.