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To evaluate the effect of propofol or sevoflurane as induction agent on optic nerve sheath diameter in children for glaucoma surgery

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Abstract
Objective: Literature revealed variety of anaesthetic drugs to blunt stress response of induction and intubation but no standardised premedication protocol exists to minimize cerebral blood flow. ONSD (Optic Nerve Sheath Diameter) is a noninvasive method to measure intracranial pressure. Sevoflurane and Propofol are two well known induction agents in pediatric patients. This study was designed to evaluate the effect of both drugs on optic nerve sheath diameter in glaucoma surgery patients.
Methodology: Patients were induced with either Sevoflurane 4-6 %(group S, n=10) or Propofol 1.5 mg/kg (group P; n = 10) inside the operation theatre. The ONSD, haemodynamic response and adverse effects were recorded for 15 min.
Results: After intubation HR (Heart rate) in group P was significantly higher as compared to group S at 1,5and 15 min of intubation ($p<0.02$, 0.004, 0.03). ONSD measured significantly decrease at 5 min of intubation in group P ($p< 0.01$). In group P there was signifcant decrease in MBP (Mean blood pressure) at 5 and 15 min after intubation. There was no signifcant difference in postoperative nausea vomiting between the two groups.
Conclusion: Our findings suggest that Propofol is a preferable agent for induction in glaucoma surgeries.

Keywords: Sevoflurane, Propofol, Optic nerve sheath diameter

1. Introduction
Literature displays a variety of anaesthetic drug to decrease stress response of laryngoscopy during general anaesthesia (GA) [1, 2] .This stress response increase heart rate and blood pressure results in elevation on intracranial pressure (ICP) depending upon the drug used during GA. Sevoflurane is most common induction agent results in vasodilatation in cerebral vasculature and further overshoot ICP or probably concomitant increase size of optic nerve sheath diameter (ONSD). On the other hand, Propofol causes cerebral vasoconstriction and have no effect or decrease in ICP [3, 4] .More recently, advancement in the field of research has enabled the diagnosis of raised ICP much reliably by noninvasive modalities. One such noninvasive modality includes estimation of ONSD using bedside ultrasound [5] . Children undergoing glaucoma surgery are often have increase in intraocular pressure (IOP) and are required to maintain normal IOP. We aimed to compare the effects of both drugs on ONSD during peri induction time.

2. Material and methods
This study was carried out at a tertiary level hospital in India. Written informed consent was obtained from parents of the patients. A total of 20 patients in ASA physical status grade I or II, between 01 and 04 years of age, undergoing glaucoma surgery requiring GA were enrolled for this study. Patients with known allergy/Hypersensitivity to the study drug, congenital diseases, and developmental delay or with neurological disease, hydrocephalus, and history of chronic illness or known case of increased intracranial pressure were excluded from the study.

According to a computer-generated randomisation chart, the patients were assigned to one of the two treatment groups. Patients in group S (n=10) received Sevoflurane 4-6% and patients in group P received Propofol 1.5 mg/kg for induction under GA. The patient was allowed to be with the parents during administration of the drug. Standardized opioids and GA was used in both patients. Both group received Inj Ondansetron 0.15mg/kg before extubation. ONSD was measured using a 6- to 12-MHz linear probe of the ultrasound machine. After induction and intubation, patients' eyes were covered with transparent plaster. A water-soluble ultrasound-transmission jelly was applied over the probe. The probe was gently placed over the eyelid paying careful attention not to exert excessive pressure. The optic nerve was focused in the center 3mm behind the globe for measurement. The ONSD was measured at 1, 5 and 15 min after intubation. Mean of three readings of ONSD was taken as the final value. Other haemodynamic variables were also recorded. All patients were ventilated with a tidal volume of 6 mL/kg and respiratory rate set to keep the partial pressure of carbon dioxide ($PaCO_2$) at 30–35 mmHg. Comparison between two study groups was done with the help of Levene's test for equality of variances and t test for equality of means. Analysis of their significance was done by using the p values obtained through student t-test. For statistical comparison, the difference was considered significant when the p-value was found to be less than 0.05.

3. Observation and Results
Demographic parameters and clinical characteristics were comparable between the groups. The baseline

haemodynamic (HR and MBP) parameters were normal and comparable in both the groups (Table 1). Oxygen saturation was maintained throughout the observation period.

Table 1: Demographic profile and baseline clinical characteristics (expressed as mean ± SD or as expressed otherwise) of patients in both the group, ASA- American society of anaesthesia, M-Male-Female

Patient data	Group S (n=10) mean±SD	Group P (n=10) mean±SD	P value
Age (yr)	2.5±1.7	2.9±1.2	0.5
Weight (kg)	12.2± 3.5	14.2±3.6	0.2
Gender M/F	7/3	9/1	
ASA (I/II)	9/1	10/0	

Table 2: Systemic haemodynamic parameters (values expressed as mean± SD or number) at various time points in two groups.HR-Heart Rate, MBP- Mean blood Pressure, and ONSD-Optic nerve sheath diameter

Value/Groups	Group P	Group S	p value
HR			
0 min	134±14.5	129.9±17.4	0.57
1 min	139± 13.4	124±13.2	0.02
5 min	142.2±12.9	121.5±15.2	0.004
15 min	136±16.4	120.2±14.2	0.03
MBP			
0 min	68.7±4.4	69.6±2.8	0.59
1 min	62.7±5.5	70±3.3	0.002
5 min	64.1±3.9	69.2±2.9	0.003
15 min	67.6±3.4	69.2±2.2	0.2
ONSD			
0 min	3.2±1.2	3.4±0.5	0.63
1 min	3.1±0.5	3.3±0.5	0.38
5 min	2.9±0.3	3.2±0.2	0.01
15 min	3±0.5	3.3±0.3	0.12

After intubation HR increase significantly from baseline values in group P as compared to group S (Table 2). In group S (n = 10) there was no observable change in HR, SBP and ONSD. The HR in group P was significantly higher as compared to group S at 1,5and 15 min of intubation ($p<0.02$, 0.004, 0.03). ONSD measured significantly decrease at 5 min of intubation in group P ($p< 0.01$).There was no signifcant change in value of ONSD at 1 and 15 min after intubation. SpO2 was 100% throughout the study period. PCO2 in both the groups was maintained between 30 and 35 mmHg. No patient developed significant hypotension. One patient in group S developed PONV postoperatively; however no drug intervention was required in either patient. No PONV observed in Group P patients.

4. Discussion

Our study showed that Propofol causes marked hypotension, tachycardia and decrease in ONSD at different interval of time after intubation. The mean values of ONSD for patients in the P group were significantly lower at 5 min of intubation than that in the S group. The probable cause would be propofol induced hypotension results in reflex tachycardia. Literature revealed that the change in ONSD correspond to ICP changes [7]. The cerebrospinal fluid surrounded over optic nerve is directly in communication with subarachnoid space of brain. Hence, ICP is directly proportional to the ONSD. In our study the site of measurement of ONSD was 3 mm behind the globe, the reason being that the most distensible region of optic nerve is 3mm behind the papilla in the globe [8]. We measured optic nerve diameter after 1 min of induction to 15 min, as the distensibility allows the optic nerve sheath to inflate within a few minutes of exposure to elevated ICP.

We noticed observable differences in ONSD between the sevoflurane and Propofol groups. Propofol constricts cerebral vasculature and also known as cerebral protective agent in literature. Literature revealed that Propofol decreased the cerebral metabolic rate (CMR) by 25-30 %, and ICP by 20%, in patients with normal ICP [9] .Use of Propofol for induction and Maintanace agent in patients with cerebral dysregulation believed to confer a neuroprotective effect against mild ischemic insults.

We considered paediatric patients undergoing glaucoma for our study as opthalmoplegia and normal intracranial and intraocular pressure were the prerequisites of such surgeries. Postoperative nausea and vomiting (PONV) which is most common unwanted complication in eye surgery were also evaluated in this study. Elevated ICP or IOP can be contributing cause of PONV.

The limitation of this study was that patients having pre-existing intracranial pathology were excluded from the study. Therefore, the effects on ICP in patients with intracranial pathology could not be evaluated in this study. Patients with pre-existing elevated ICP or cerebral ischemia may experience different results in terms of ONSD.

In conclusion, Propofol induction decreases the diameter of the optic nerve sheath in patients with normal intracranial pressure for glaucoma surgery. The mean ONSD in the Propofol group was significantly less than that in the sevoflurane group during the post intubation period. Our findings suggest that Propofol is a preferable agent for induction in glaucoma surgeries. We suggest a large sample size study to be conducted to establish the preferable induction agent.

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6. References

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