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Comparison of Propofol vs Ketamine Induction on Intraocular Pressure: A Randomized Clinical Study

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Abstract

Background: Anesthetic agents used for induction of anaesthesia influence intraocular pressure (IOP), a crucial factor in ocular surgeries in conditions like glaucoma and ocular injuries. While propofol and ketamine are both widely utilized, they exhibit contrasting effects on IOP, warranting a comparative evaluation[1].
Objective: To assess and compare the effects of propofol and ketamine on IOP during and after induction of anesthesia and determine the statistical significance of these changes.
Methods: A prospective, randomized, single-blinded clinical study was conducted on 60 ASA I–II patients undergoing elective non- ophthalmic surgeries. Patients were allocated to receive either propofol (2 mg/kg) or ketamine (2 mg/kg) as inducing agents. IOP was measured at baseline, and at 1, 3, and 5 minutes post-induction using a handheld Schiotz indentation tonometer. Statistical significance was assessed using paired and unpaired t-tests.
Results: Propofol significantly reduced mean IOP at all post-induction time points ($p < 0.001$), whereas ketamine resulted in a mild increase, which was not statistically significant ($p = 0.09$). Intergroup differences were statistically significant ($p < 0.001$).
Conclusion: Propofol significantly reduces IOP following induction, supporting its use in patients with ocular concerns. Ketamine may increase IOP slightly, though not significantly, and hence can be used specially in paediatric patients where ketamine is safer[2].

Keywords: Propofol, Ketamine, Intraocular Pressure, Anesthesia Induction, Ophthalmic Safety.

INTRODUCTION

Intraocular pressure (IOP) is a vital physiologic parameter that is tightly regulated and sensitive to systemic and local factors. Elevated IOP is a major modifiable risk factor for glaucomatous optic neuropathy and plays a critical role in determining surgical outcomes during ocular and neuro-ophthalmologic procedures including conditions like corneal trauma[3]. Therefore, the anesthetic technique and agent selection during induction must account for their potential impact on IOP.

Several pharmacological agents used during anesthesia have been reported to influence IOP in various ways[4]. Among the commonly used intravenous induction agents, propofol and ketamine exhibit distinct pharmacodynamic effects. Propofol, a short-acting alkylphenol, is known to cause a reduction in IOP, likely secondary to systemic hypotension and central nervous system depression[5]. Conversely, ketamine, a phencyclidine derivative, has sympathomimetic properties and has been associated with increased IOP in some studies.

While propofol is preferred in settings where reduced IOP is beneficial, ketamine is often used for its hemodynamic stability, analgesic properties and excellent profile in paediatric population[6]. However, its effects on IOP remain debated, with some evidence indicating negligible or even reduced IOP under certallent in conditions[7]. Hence, the present study was designed to compare the effects of propofol and ketamine on IOP following induction of general anesthesia, with the aim of generating evidence to guide anesthetic choice in patients at risk of IOP-related complications.

MATERIALS AND METHODS

Study Design

We planned a prospective, randomized, single-blinded controlled study conducted over a six-month period after obtaining ethical clearance from the institutional review board. Informed consent was obtained from all patients.

Patient Selection

Sixty adult patients, aged between 18 and 60 years, with ASA physical status I or II, scheduled for elective non-ophthalmic surgery under general anesthesia, were included. Exclusion criteria comprised known glaucoma or ocular disease, history of raised intracranial pressure, systemic hypertension, use of medications affecting IOP, and known allergy to propofol or ketamine.

Randomization and Intervention

Patients were randomly divided into two groups of 30 each using a computer-generated sequence:

Group P received intravenous propofol 2 mg/kg

Group K received intravenous ketamine 2 mg/kg

Standard monitoring including ECG, non-invasive blood pressure, pulse oximetry, and end-tidal CO_2 was established. paracaine drops were instilled in eyes to produce local anaesthesia. All patients were preoxygenated with 100% oxygen for 3 minutes prior to induction. The premedication protocol was similar to all the patients irrespective of group and included standard doses of Inj Midazolam and Inj Fentanyl. The study drug was administered over 60 seconds, and no other drugs were given until all IOP readings were obtained.

IOP Measurement

IOP was measured using a handheld Schiotz indentation tonometer by a blinded anesthesiologist. Measurements were recorded at baseline (before induction), and at 1, 3, and 5 minutes post-induction in the supine position. Each measurement was repeated twice, and the average was recorded. The same device and observer were used throughout the study to minimize interobserver and interdevice variability.

Statistical Analysis

Data were entered and analyzed using SPSS version 25. Descriptive statistics were presented as mean ± standard deviation (SD). Within-group comparisons (baseline vs. post-induction) were performed using paired t-tests, while between-group comparisons used unpaired t-tests. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

The two groups were comparable with respect to demographic variables including age, sex, weight, and baseline hemodynamic parameters. No significant differences were observed, indicating successful randomization and homogeneity of the study population.

Intraocular Pressure Changes

The baseline IOP in Group P was 16.2 ± 2.4 mmHg, which decreased significantly to 10.8 ± 2.1 mmHg at 5 minutes post-induction ($p < 0.001$). In Group K, baseline IOP was 16.1 ± 2.6 mmHg, which slightly increased to 17.0 ± 2.8 mmHg at 5 minutes, although this increase was not statistically significant ($p = 0.09$).

The reduction in IOP in the propofol group was statistically significant at all time points compared to baseline. The ketamine group demonstrated a mild elevation in IOP, which did not achieve statistical significance. However, the intergroup differences were statistically significant at all post-induction time intervals ($p < 0.001$).

DISCUSSION

This study provides robust evidence supporting the differential effects of propofol and ketamine on intraocular pressure. Propofol produced a consistent and statistically significant reduction in IOP, whereas ketamine demonstrated a non-

significant increase. These findings are important in clinical scenarios where IOP modulation is critical, such as in patients with glaucoma, ocular trauma, or those undergoing intraocular surgeries.

Propofol's IOP-lowering effect is attributed to its systemic hypotensive action, reduced central sympathetic outflow, and relaxation of extraocular muscles. These findings corroborate with prior research by Eames et al.[1] and Marana et al. [2], who reported similar IOP-lowering trends with propofol induction.

Ketamine, on the other hand, is known to elevate blood pressure and central sympathetic activity, which may lead to increased ocular blood flow and aqueous humor production. While some studies such as those by Corssen and Domino [3] observed elevated IOP with ketamine, others reported variable or negligible effects depending on dose and measurement technique [4,5]. In our study, although the IOP increased, the change was not statistically significant suggesting recommendation to use it in ocular cases when absolutely indicated.

Clinical implications of these findings are considerable. In ophthalmic surgeries, minimizing IOP fluctuations is essential to prevent complications such as vitreous prolapse or optic nerve damage[8,9,10]. Propofol, with its favorable IOP profile, should be the preferred induction agent in such cases[11]. Ketamine, despite its safety in hemodynamically unstable patients, should be avoided in those with preexisting ocular pathology or elevated IOP[12].

Additionally, the IOP differences observed between the two agents were consistent and significant at all time points, suggesting a true pharmacologic effect rather than transient physiologic variability[13].

Limitations

While the study sample was adequate for detecting significant differences, further multicenter trials with larger populations may enhance generalizability. IOP was measured only in the supine position and under non-paralytic conditions, which may not replicate surgical scenarios involving muscle relaxants or varied positions. Furthermore, long-term effects of these agents on IOP were not assessed.

CONCLUSION

This study demonstrates that propofol significantly reduces intraocular pressure following induction of anesthesia, whereas ketamine causes a mild, non-significant increase. These findings support the preferential use of propofol in clinical settings where IOP control is critical. Anesthesiologists should consider these effects when selecting induction agents, especially in patients with ocular comorbidities or undergoing ophthalmic procedures.

Ethical Considerations

Ethical approval was obtained from the institutional review board. Written informed consent was obtained from all participants.

Conflict of Interest

The authors declare no conflict of interest.

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