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EFFICACY AND EFFECTS OF PROPOFOL VERSUS KETAMINE IN PEDIATRIC SURGICAL CASES; A COMPARATIVE STUDY

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Abstract

Background:
Pediatric anesthesia requires careful selection of anesthetic agents to ensure adequate anesthesia while maintaining cardiovascular and respiratory stability. Propofol is widely used because of its rapid onset and short recovery time; however, it may cause hypotension and respiratory depression. Ketamine provides effective analgesia and generally maintains cardiovascular stability and airway reflexes, although it may be associated with adverse effects such as emergence reactions, hallucinations, and delirium. Despite their frequent use in pediatric anesthesia, direct comparisons of the hemodynamic and respiratory effects of propofol and ketamine remain limited.

Objective:
The aim of this study was to compare the effects of propofol and ketamine in pediatric patients undergoing elective surgery under general anesthesia, with particular emphasis on changes in blood pressure, heart rate, and respiratory depression.

Methodology:
A comparative observational cross-sectional study was conducted from February 2025 to July 2025 at selected hospitals in Khyber Pakhtunkhwa, including Pak Medical Centre and Hospital, Khyber Bazar, Peshawar. A total of 200 pediatric patients aged 3–9 years who underwent elective surgery under general anesthesia were included in the study. Data regarding demographic characteristics and perioperative effects associated with propofol and ketamine were collected and analyzed.

Results:
The study included 200 pediatric patients, of whom 167 (83.5%) were male and

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33 (16.5%) were female. The patients were aged between 3 and 9 years, with a mean age of 5.5 years. Overall, changes in blood pressure were observed in 23% of patients, with a higher proportion reported among patients receiving propofol (38%). Changes in heart rate were observed in 27% of patients receiving ketamine compared with 46% among those receiving propofol. Respiratory depression occurred in 18% of patients overall and was reported in 32% of patients receiving propofol. These findings suggest greater hemodynamic and respiratory effects with propofol compared with ketamine in the studied pediatric population.

Conclusion:

The findings indicate that ketamine may provide greater cardiovascular and respiratory stability than propofol when used as an induction agent in pediatric patients undergoing elective surgery under general anesthesia. Compared with propofol, ketamine was associated with fewer reported changes in blood pressure and heart rate and a lower incidence of respiratory depression. Ketamine may therefore be considered a favorable induction agent in selected pediatric patients; however, appropriate patient selection, monitoring, and consideration of potential adverse effects are essential.

INTRODUCTION

Background

Surgery and other painful procedures require children to be sedated or anesthetized safely and effectively. Although pediatric patients have a physiology distinct from adults, they often require deep sedation or general anesthesia because of their heightened anxiety and limited ability to cooperate (Kim, s *et al.*, 2019). Both propofol and ketamine are commonly used intravenous anesthetic agents in children. Propofol is a rapid-onset sedative-hypnotic that provides amnesia and antiemetic effects, whereas ketamine is a dissociative anesthetic with potent analgesia (Abdollahpour *et al.*, 2020, Khalila *et al.*, 2019).

Due to the different pharmacodynamics and adverse effect profiles of various medicines, a comparative analysis is clinically useful. The choice of agent has an impact on overall safety, emergence reactions, recovery time, and hemodynamic stability in pediatric anesthesia. Anaesthesiologists can optimize induction and sedation techniques for children by comparing propofol and ketamine, weighing the dangers of hypotension or psychomimetic effects against the need for a quick recovery (Kim, s *et al.*, 2019,Royal *et al.*, 2025).

Pharmacological Profile of Propofol

In order to produce drowsiness and hypnosis, propofol, an intravenous 2,6-diisopropylphenol anesthetic, primarily operates as a GABA_A receptor agonist. It is extremely lipophilic, quickly penetrates the blood-brain barrier, and causes unconsciousness in a matter of seconds (Abdollahpour *et al.*, 2020; Chidambaram *et al.*, 2015). While propofol induces profound sedation and amnesia, it offers minimal intrinsic analgesic effects in clinical practice (Heiberger *et al.*, 2018). Among its benefits are its antiemetic qualities, quick onset and offset, and extremely brief duration of action. Propofol is used in practice to induce anesthesia, provide maintenance infusion, and sedate children during procedures (such as endoscopy or emergency fracture reduction). The depth of sedation can be precisely controlled with titrated bolus or infusion regimens, ranging from moderate sedation to general anesthesia (Abdollahpour *et al.*, 2020, Chidambaram *et al.*, 2015).

Pharmacokinetics

Propofol exhibits a large volume of distribution following an IV bolus due to rapid redistribution to highly perfused tissues, followed by slower uptake into adipose tissue. It has an elimination

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half-life of 1–3 hours post-infusion and a high clearance rate in humans (approximately 25–50 mL/kg/min). (Mtubu *et al.*, 2021). Propofol clearance in pediatric patients is comparable or somewhat higher, although there is a greater volume of dispersion, particularly in newborns. A study conducted on children aged 4 to 12 years revealed a half-life of approximately 3.5 hours and a total clearance of approximately 40 mL/min/kg. Because of their larger Vd and immature metabolic capacity (UGT1A9 ontogeny), neonates and young infants may need higher weight-based doses. In children, the multi-compartment distribution is reflected in the terminal half-life of propofol (Doan *et al.*, 2018).

Adverse Effects

Propofol commonly causes respiratory depression and dose-dependent hypotension**.** It reduces myocardial contractility and systemic vascular resistance, often leading to bradycardia and transient drops in blood pressure. In one pediatric study, 92% of children sedated with propofol experienced a transient (>2 minutes) decrease in systolic blood pressure, typically without compromising perfusion. In a randomized trial involving pediatric cardiac catheterization, propofol was linked to significantly greater hypotension (>20% reduction in mean arterial pressure) compared to ketamine (7 out of 10 vs. 1 out of 10 patients, $p < 0.05$) (Liu *et al.*, 2023).

Additional respiratory side effects during propofol sedation included intermittent assisted ventilation (˜0.8%), airway maneuvers (3%), and transient hypoxemia (5%) (Gani *et al.*, 2019). Other notable adverse effects include injection site pain (10–20%), hyperlipidemia with prolonged infusion, and the rare but serious propofol infusion syndrome, characterized by metabolic acidosis, rhabdomyolysis, and cardiac failure in critically ill children.

Despite these risks, propofol is associated with a lower incidence of emergence agitation and offers antiemetic properties compared to ketamine (Abdollahpour *et al.*, 2020; Havidich et al., 2012). However, due to its potential for significant respiratory and cardiovascular depression, strict monitoring is essential during administration (Heiberger *et al.*, 2018).

Pharmacological Profile of Ketamine

Ketamine is a dissociative anesthetic derived from phencyclidine, characterized by its unique mechanism and clinical effects. It exerts significant analgesic and amnestic properties through noncompetitive antagonism of NMDA (N-methyl-D-aspartate) glutamate receptors, thereby disrupting cortical and subcortical integration (Khalila et al., 2019). At sedative doses, ketamine induces a trance-like dissociative state in which the patient appears awake with open eyes but remains unaware of their surroundings and insensitive to pain (Simonini et al., 2022).This dissociative anesthesia happens suddenly at threshold dosages (˜1–1.5 mg/kg IV) and is not on the typical sedative continuum (moderate vs. profound) Strong analgesia, preservation of pharyngeal reflexes, spontaneous breathing, and muscular tone are important clinical characteristics of ketamine anesthesia (Royal *et al.*, 2025). Additionally, ketamine has sympathomimetic effects, which means that it usually raises blood pressure and heart rate slightly through the indirect production of catecholamines. Because of these characteristics, ketamine is beneficial for children with reactive airways, hemodynamic instability, or hypovolemia (Royal *et al.*, 2025, Simonini *et al.*, 2022).

Pharmacokinetics

Ketamine enters the central nervous system quickly; its full effects take minutes to manifest after an IV initiation. It has a relatively low protein binding (10 50%) and a high apparent volume of distribution (3–5 L/kg) (Fang *et al.*, 2020). Hepatic CYP3A4/CYP2B6 is the primary enzyme responsible for the metabolism of ketamine, producing norketamine (active) and other polar metabolites. Children usually have an elimination half-life of 2–4 hours which is shorter than that of adults because of their quicker clearance. For instance, young children may require higher or more frequent dosages due to their higher than adult ketamine clearance (˜20 mL/kg/min) (Mertero *et al.*, 2001, Khara *et al.*,

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2023). Oral bioavailability is low (16–29%) because of first-pass metabolism, whereas intramuscular bioavailability is approximately 93% with a peak at 5–15 minutes (Ismail *et al.*, 2024). Children metabolize ketamine more quickly than adults, therefore dosage needs to be modified appropriately (Sincoli *et al.*, 2022).

Adverse Effects

The adverse effect profile of ketamine and propofol is very different. Although it usually maintains blood pressure and airway patency, if administered too quickly, it may result in increased secretions and, in rare cases, laryngospasm or apnea (Pancekausikaite *et al.*, 2018). About 6–12% of patients may experience psychotomimetic emerging symptoms (delirium, vivid dreams, and hallucinations) when the anesthetic wears off (Sethj *et al.*, 2021). When benzodiazepines are taken together, these symptoms, which are more prevalent in older kids and adults, can be lessened.

Nystagmus, disorientation, lightheadedness, and postoperative nausea and vomiting are some common side effects of ketamine. Ketamine is used carefully in patients with glaucoma or head injuries because it may cause increases in intracranial or intraocular pressure. Crucially, ketamine has potent analgesia, which lessens the need for opioids during uncomfortable procedures. Its cardiovascular stimulatory effect may be harmful to kids who have ischemic heart disease or pulmonary hypertension (Simonini *et al.*, 2022).

Hemodynamic Stability

One important difference between ketamine and propofol is that they have diametrically opposed effects on hemodynamics. Propofol is a strong myocardial depressant and vasodilator. Propofol commonly results in bradycardia and hypotension in pediatric patients. As mentioned, the majority of kids who are sedated with propofol have a brief decrease in blood pressure (typically more than 20% from baseline) (Gani et al., 2019). Ketamine, on the other hand, typically causes sympathetic activation, which raises blood pressure and heart rate (Royal *et al.*, 2025, Simonini *et al.*, 2022). In the 1992 Anesthesia & Analgesia trial, this difference was notable: only 10% of ketamine patients experienced significant hypotension upon induction, compared to 70% of propofol patients Propofol tended to decrease mean arterial pressure, but ketamine increased it, according to a meta-analysis of pediatric sedation (Snyed *et al.*, 2004).

Therefore, propofol should be used with caution in children with inadequate cardiac reserve, while ketamine may be recommended when hemodynamic support is required (e.g., hypovolemia, sepsis). However, patient context is important since ketamine-induced tachycardia and hypertension can also strain the heart .Both drugs have the potential to induce respiratory depression: ketamine (infrequently) by airway blockage from secretion or excessive sedation, and propofol through central respiratory drive suppression. In actuality, ketamine is safer in unsupervised situations because it maintains airway reflexes (Royal *et al.*, 2025).

Sedation Depth and Emergence Reactions

Propofol causes a quick, seamless, and reversible unconsciousness. Children usually wake up minutes after stopping infusion, indicating that it has a very short recovery period (Chidambaram *et al.*, 2015; Kim *et al.*, 2019). The mean time to full recovery in the comparative experiment was around 24 minutes for propofol and 139 minutes for ketamine. Propofol has been recognized as having advantages in pediatric procedural sedation, including faster awakening and high patient satisfaction (Chidambaram *et al.*, 2015; Havidich *et al.*, 2012). Additionally, emerging delirium and postoperative nausea/vomiting are less common with propofol. Propofol is widely used for induction because it can provide deep degrees of drowsiness that are comparable to general anesthesia.However, this deep sedation risk necessitates airway support capability. Because propofol has no analgesic effect, painful stimuli must be managed with adjunct opioids or local anesthetics during sedation or anesthesia (Havidich *et al.*, 2012).

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The "dissociative" sedation produced by ketamine is qualitatively different. The patient is amnestic and insensitive to pain, even if their eyes may be open. Compared to propofol, the onset and recovery are slower (many minutes), but they are still predictable. When quick turnover is required, children's slower rate of awareness recovery may be a drawback (Kim *et al.*, 2019). The emerging phenomenon is a special consideration: some patients may experience agitation, vivid dreams, or hallucinations as ketamine effects fade (Sethj *et al.*, 2021). Older kids and teenagers are more likely to experience this. On the other hand, a calm, rational recovery is typically the result of propofol's quick washout. While ketamine may occasionally cause unpleasant emergence, propofol sedation has actually been demonstrated to have an incidence of emerging agitation comparable to other sedatives. Overall, propofol yields more predictable rapid recovery, while ketamine's depth of anesthesia comes with potential psychologic after-effects (Havidich *et al.*, 2012).

Safety Profile and Side Effects

Ketamine and propofol share some similarities and key differences in their safety profiles in pediatric patients. The main concerns with propofol are cardiorespiratory depression and hypotension, which require continuous monitoring and often supplemental oxygen. While mild desaturation and hypotension are commonly observed with propofol use, data from the Pediatric Sedation Research Consortium indicate a low incidence of serious adverse events.Propofol infusion syndrome is a danger associated with prolonged infusions,
however it is more common in intensive care units than with short-term procedural sedation. In addition, propofol injection discomfort and, in rare cases, allergic reactions to its lipid emulsion can occur (Gani *et al.*, 2019)

The two main issues with ketamine are secretory and mental (nightmares, hallucinations). Adjunctive benzodiazepines and peaceful recovery can help reduce agitation during an emergency. Glycopyrrolate, an antisialagogue, is sometimes administered alongside ketamine to reduce excessive salivation**,** which can lead to laryngospasm in susceptible pediatric patients. Unlike propofol, ketamine generally preserves respiratory drive and maintains blood pressure. However, its side effects—such as tachycardia and increased pulmonary vascular resistance can be harmful in infants with congenital heart disease or pulmonary hypertension.

Despite its relative safety, ketamine still carries some respiratory risks. It may cause apnea in patients with airway obstruction or in cases of overdose. Overall, ketamine is often regarded as one of the safest agents for pediatric sedation outside the operating room due to its wide therapeutic margin**.** Nonetheless, propofol has also demonstrated a strong safety profile in large-scale pediatric studies (Havidich *et al.*, 2012)

Clinical Use in Pediatric Anesthesia

Although they have different indications, propofol and ketamine are both essential components of pediatric anesthesia in practice. Due to its quick onset and recovery, propofol is the most often used IV induction drug in children (Chidambaram *et al.*, 2015). It is frequently used to maintain anesthesia and provide deep sedation during brief procedures (such as minor surgery or CT/MRI) that are monitored. Propofol is also used under strict protocols by pediatric intensivists and emergency physicians for sedation (e.g., fracture reduction) (Green *et al.*, 2011). Propofol doesn't have analgesia, so if the child is in pain, it needs to be taken with ketamine or opioids. Regulations governing the use of propofol in children differ, and despite years of expertise, it is still off-label for sedation in some areas (Omara *et al.*, 2019).

When hemodynamic stability and analgesia are top concerns, ketamine is frequently selected. Ketamine is a common induction agent for pediatric trauma, septic shock, and situations where IV access is not available (it can be administered intramuscularly). Ketamine
is utilized for unpleasant treatments (fracture reduction, burn debridement, laceration repair) in emergency rooms and procedural suites, particularly when patient participation is poor (simonini *et al.*, 2022). Ketamine sedation is safe

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and effective for brief, uncomfortable treatments in children, according to the Royal Children's Hospital (Melbourne) sedation guideline (Hayes *et al.*, 2021). Ketamine is also used in anesthesia practice for refractory pain and analgesia (as part of balanced anesthesia). Ketamine, in contrast to propofol, has analgesic and amnestic properties that frequently lessen the requirement for opioids. One modern trend is ―ketofol‖ (propofol–ketamine combination) to balance the hypnotic and analgesic effects while smoothing hemodynamics. Both agents are used with other drugs: propofol is often co-administered with fentanyl or midazolam for synergistic sedation, and ketamine with midazolam to blunt emergence reactions (Tosum *et al.*, 2020).

Pediatric-specific considerations include age-related dosing and metabolism. Younger children generally require higher mg/kg doses of both drugs due to faster clearance and larger Vd (Simcol *et al.*, 2022, Lee *et al.*, 2021). Airway and respiratory issues are also paramount; while ketamine generally preserves tone, propofol requires securing the airway. Finally, institutional protocols and resource factors (availability of anesthesiologists, monitoring capability) influence agent choice. For instance, some procedural sedation guidelines advise that propofol and ketamine administration be performed only by trained personnel with airway management skills (ASA and AAP guidelines) (Hang *et al.*, 2019).

AIM

The aim of this study was that comparative effects of propofol vs ketamine in paediatrics patient undergoing surgery.

OBJECTIVES

To determine the efficacy and safety of Propofol and Ketamine in pediatric patients undergoing surgery.

To find out hemodynamic stability and recovery characteristics associated with both anesthetic agents.

SIGNIFICANCE

This study evaluates the recovery characteristics of children administered propofol or ketamine. This study aims to determine which of these drugs is safer and has fewer complications in paediatrics patients. The said study also investigates that propofol or ketamine produce more stability including blood pressure (B.P) and heart rate, Respiratory Depression.

CHAPTER: 3

MATERIAL AND METHODS

Study Setting:

Comparative observational cross-sectional study was conducted to compare the effects of propofol and ketamine in pediatric patients undergoing elective surgery under general anesthesia. The study was carried out from **February 2025 to July 2025** at selected hospitals in Khyber Pakhtunkhwa, including **Hayatabad medical complex, Peshawar**. A total of **200 pediatric patients aged 3–9 years** were included. Patients were evaluated according to the anesthetic agent used, either propofol or ketamine. The primary outcomes assessed were changes in **blood pressure, heart rate, and respiratory depression**. Demographic and clinical data were collected from the patients and relevant hospital records and analyzed to determine differences between the two groups

Study design:

The study is an observational cross-sectional study

Sample size:

200 patients was used for this study. Propofol (n) =100

Ketamine (n) =100

The sample size calculation in this study is based on Cochran's formula:

$N=z^2*p*(1-p)/e^2$

Where *N* is the required sample size, Z represents the Z-value corresponding to the desired confidence level, *p* is the estimated proportion of the population with the characteristic of interest, and *e* is the margin of error. For this study, a 95% confidence level was assumed, giving a Z-value of 1.96. A conservative estimated proportion (*p*) of 0.5 was used to ensure maximum variability, and the margin of error (*e*) was set at 0.05 (5%). Substituting these values

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into the formula yields N=200. This suggests a sample size of approximately 384 participants would be required for a large population. However, considering feasibility and resource limitations, a total sample size of 200 participants (100 per group) was chosen. This adjusted sample size still provides sufficient statistical power to detect clinically significant differences in hemodynamic and respiratory outcomes between propofol and ketamine, while reducing the risk of Type II error in a comparison of two independent groups.

Inclusion Criteria

Patients undergoing elective surgeries requiring general anesthesia.
Planned use of Propofol or Ketamine for induction/maintenance.
Pediatric patients aged 3-9 years.
American Society of Anesthesiologists (ASA) physical status I-II.

Exclusion Criteria

Patients with a history of hypertension, heart disease, or respiratory disease or other significant comorbidities that may interfere with hemodynamic stability.
Emergency surgeries or need for rapid-sequence induction.
Patients with known allergies to anesthetic agents.

Materials required for the research

Drugs Used: Propofol, Ketamine
Patient Population: Pediatric patients undergoing surgery
Equipment: Anesthesia monitoring devices, infusion pumps, oxygen supply, resuscitation equipment
Data Collection Tools: Patient records, anesthesia charts, pain assessment scales
Software: Statistical analysis software (SPSS or similar).

Data analysis

SPSS will be used for data analysis in this study. Very common of variables that can be analyzed in SPSS are Categorical Variables, Continuous Variables, Ordinal Variables, and Derived Variables. SPSS will provide
specific procedures and tests suitable for analyzing relevant of variables to this study

CHAPTER: 4
RESULTS

200 patients were included in the study 100 ketamine and 100 propofol. Among all these patients 167 were male and only 33 were female. All these patients were between the ages of 3 to 9 years children's. Average age of patients was 5.5 years. In this study the intraoperatively ketamine and propofol were used. Among all the patients change in blood pressure occurs in 23% patients in propofol it was 38%. Among all the patients change in heart rate occurs in 27% patients with ketamine and in propofol it was 46%. While the rest of the details are shown in the Figure 1 and 2.

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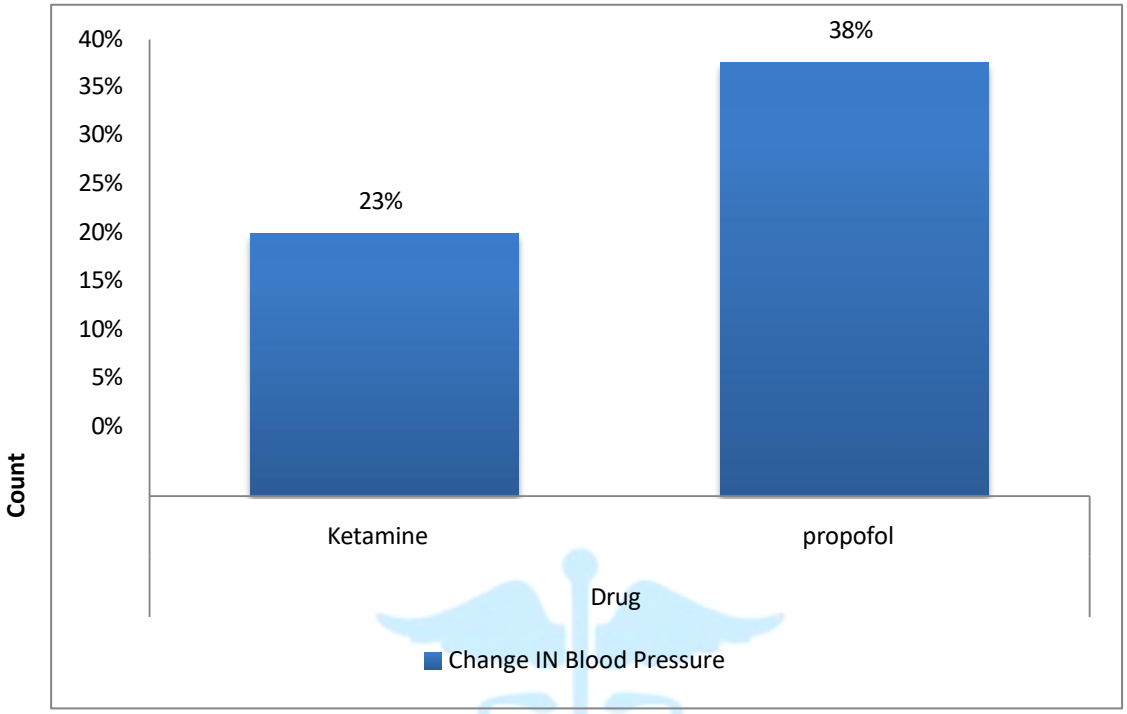
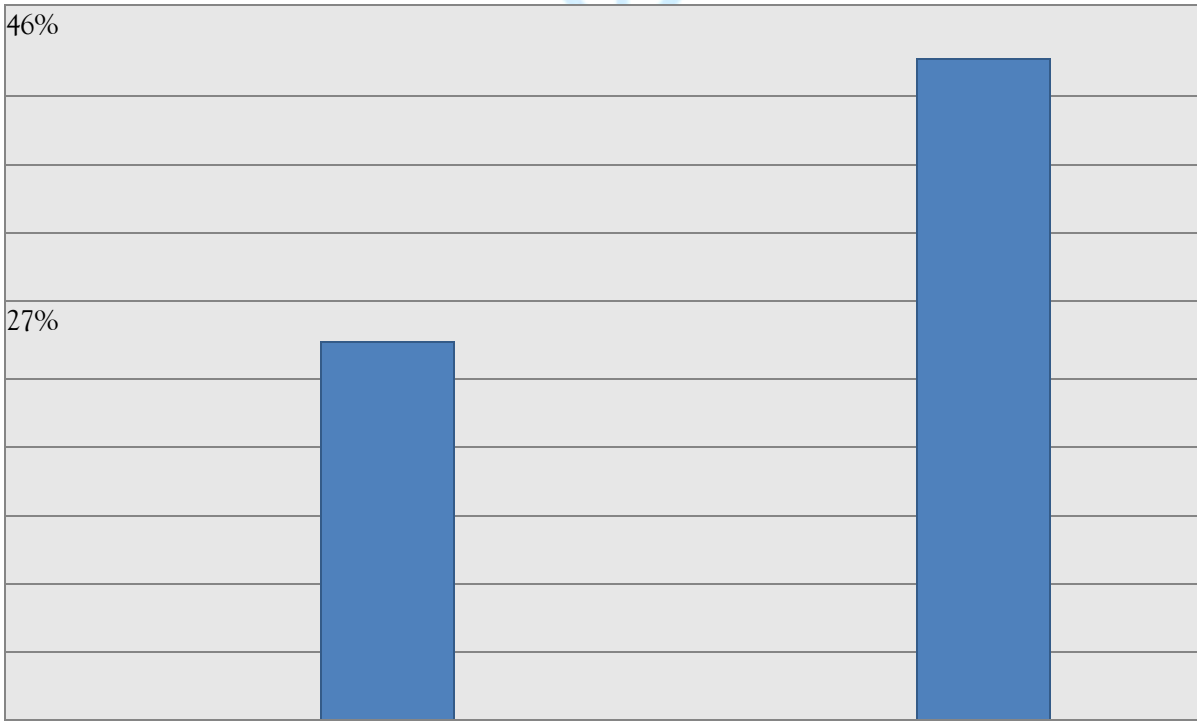


Figure: 1 Show Change in Blood Pressure



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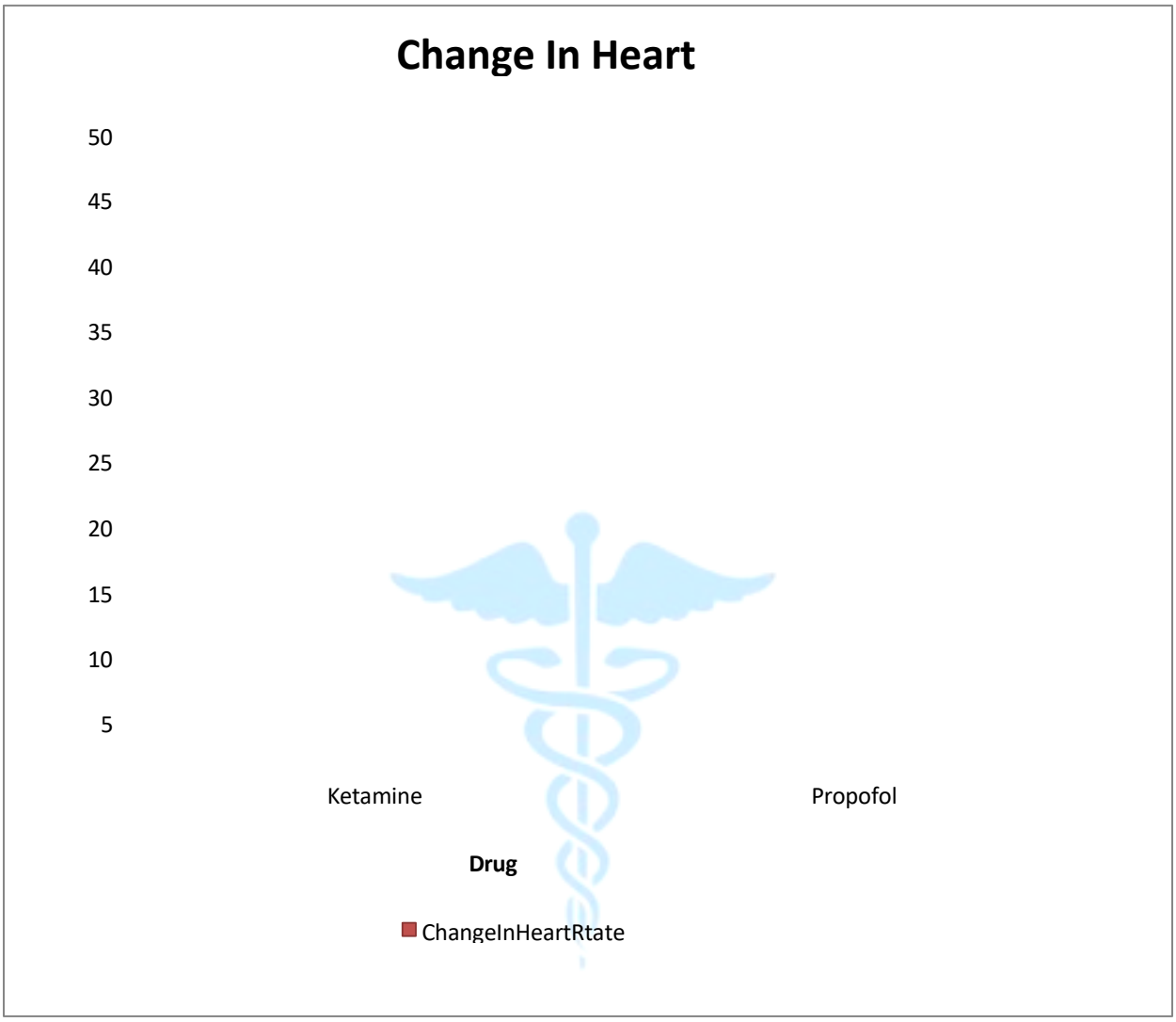


Figure: 2 Show Change in Heart Rate

Table: 1 Associations to blood pressure, heart rate and respiratory depression

S. No	Drugs	Change in Blood pressure	Change in Heart Rate	Respiratory Depression
1	Ketamine	23%	27%	18%
2	Propofol	38%	46%	32%
3	P Value	0.021	0.005	0.022

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Among all the patients respiratory depression occurs in 18% patients and with propofol it was 32%. According to all observed parameters of ketamine show strong associations to blood pressure, heart rate and respiratory depression. The difference between both procedures was tightly significant in each parameter with P value less than 0.05 which show on table 1 and Figure 3 below.

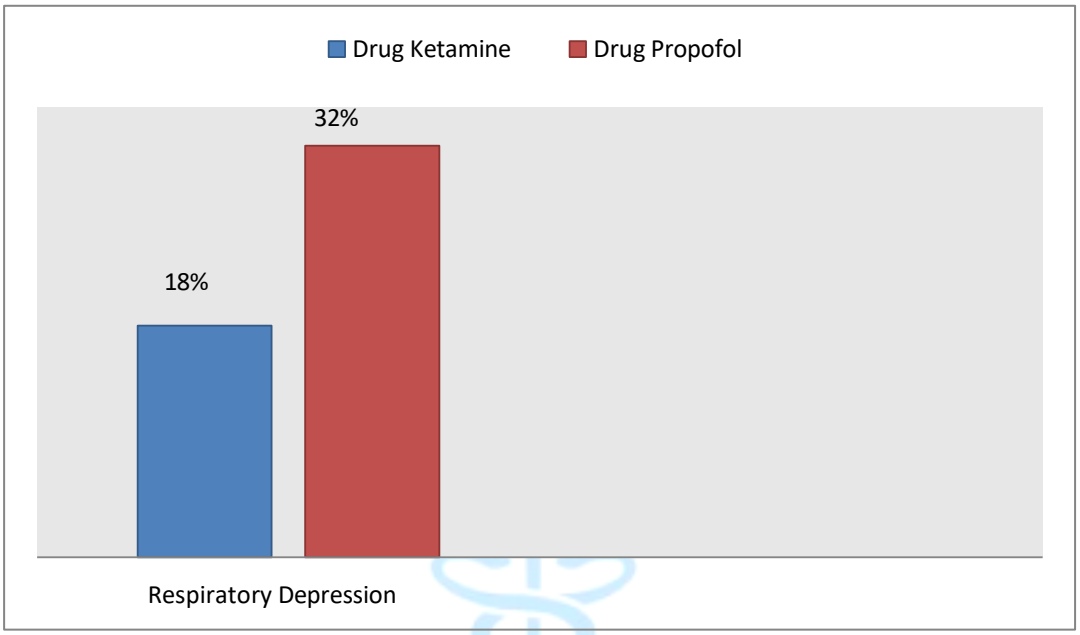


Figure: 3 show strong associations to blood pressure, heart rate and respiratory depression

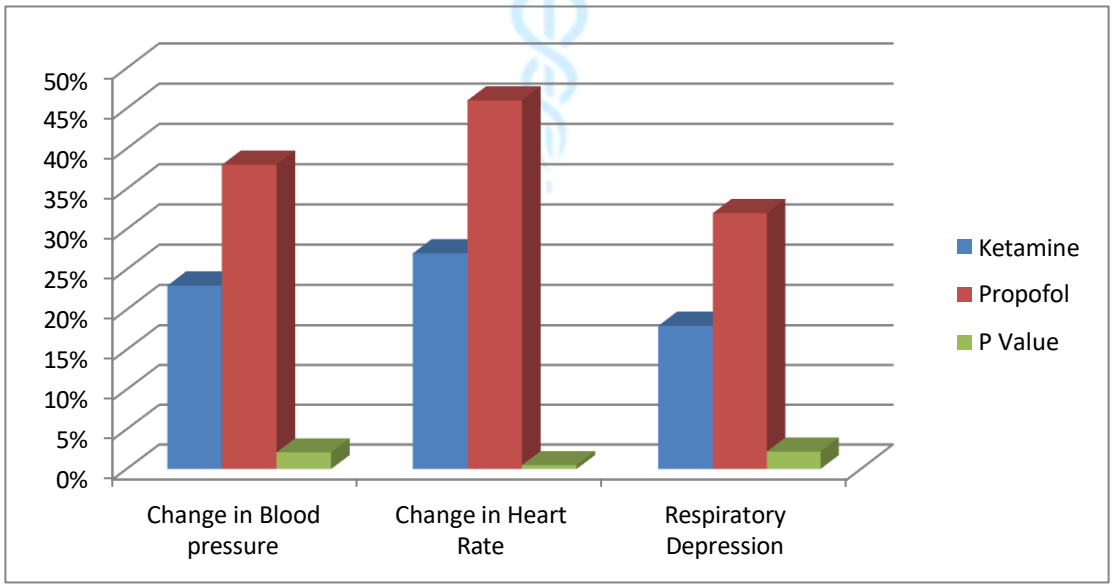


Figure: 4 Graph chart showing overall blood pressure, heart rate and respiratory depression

CHAPTER: 5 DISCUSSIONS

The present study compared the effects of propofol and ketamine as induction agents in pediatric patients undergoing elective surgery under general anesthesia, with particular emphasis on hemodynamic and respiratory outcomes. The findings suggest that ketamine was associated with greater hemodynamic and

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respiratory stability than propofol in the studied pediatric population. Changes in blood pressure were reported in 23% of patients receiving ketamine compared with 38% of those receiving propofol. Similarly, changes in heart rate occurred in 27% of patients in the ketamine group compared with 46% in the propofol group. Respiratory depression was also less frequently observed with ketamine (18%) than with propofol (32%). The reported differences were statistically significant, with p-values <0.05, indicating a significant association between the induction agent used and the observed perioperative outcomes.

The greater changes in blood pressure and heart rate observed with propofol may be explained by its known cardiovascular effects. Propofol can produce a reduction in systemic vascular resistance and may cause dose-dependent hypotension, particularly in pediatric patients. It can also cause respiratory depression, including a reduction in respiratory drive and transient apnea following induction. These effects emphasize the importance of close cardiovascular and respiratory monitoring during induction with propofol.

In contrast, ketamine is known for its sympathomimetic properties, which can help maintain cardiovascular stability by increasing sympathetic activity, heart rate, and blood pressure. Ketamine also generally preserves spontaneous respiration and airway reflexes more effectively than propofol. These pharmacological characteristics may explain the lower frequency of changes in blood pressure, heart rate, and respiratory depression observed among patients receiving ketamine in the present study. The findings are consistent with the pharmacological profiles and previously reported clinical effects of these two anesthetic agents (Khan et al., 2025).

The findings of the present study have important clinical implications for pediatric anesthesia. Selection of an induction agent should be individualized according to the patient's clinical condition, cardiovascular status, respiratory status, type of surgery, and anesthetic requirements. Although propofol remains a commonly used induction agent because of its rapid onset, smooth induction, and relatively short recovery time, its potential to cause hypotension and respiratory depression should be considered. Ketamine may be particularly advantageous in pediatric patients in whom preservation of cardiovascular stability and spontaneous respiration is a priority.

However, the findings should be interpreted in the context of the study design and patient population. Differences in patient characteristics, surgical procedures, doses of anesthetic agents, baseline hemodynamic status, and other perioperative medications may influence cardiovascular and respiratory outcomes. Therefore, these factors should be considered when interpreting the observed differences between propofol and ketamine. Further prospective studies with larger and more balanced groups, standardized drug dosages, and controlled perioperative conditions are recommended to confirm these findings and establish more definitive evidence regarding the comparative safety and effectiveness of ketamine and propofol in pediatric anesthesia (Lee et al., 2024).

Overall, the present study indicates that ketamine may provide better hemodynamic and respiratory stability than propofol during induction of general anesthesia in selected pediatric patients. Nevertheless, both agents have specific advantages and potential adverse effects, and the choice of anesthetic should be based on individual patient characteristics and clinical requirements rather than on the use of one agent universally.

CHAPTER: 6 CONCLUSION & RECOMMENDATIONS

Conclusion

In conclusion, the comparative analysis of propofol and ketamine as induction agents for pediatric patients undergoing surgery under general anesthesia reveals significant differences in their hemodynamic effects. Ketamine demonstrates favorable outcomes with less change in blood pressure, heart rate, and respiratory depression compared to propofol. These findings underscore the importance of

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carefully considering individual patient characteristics and surgical requirements when selecting an induction agent. Ketamine emerges as a preferred choice in cases prioritizing hemodynamic stability and minimizing respiratory depression, while propofol may still be suitable for scenarios requiring rapid onset and smooth induction. However, further research and clinical trials are necessary to validate these findings and refine anesthesia protocols for pediatric patients.

Recommendations:

Clinicians should carefully consider the hemodynamic effects of each agent when selecting an induction agent, based on individual patient characteristics and surgical requirements.

Ketamine may be preferred when maintaining hemodynamic stability and minimizing respiratory depression are priorities.

Propofol may be more suitable in scenarios requiring rapid onset and smooth induction.

Further research and clinical trials are warranted to validate current findings and refine anesthesia protocols for pediatric patients.

Future studies should also investigate long-term outcomes such as postoperative recovery and complications.

Ensuring the safety and efficacy of anesthesia induction agents in pediatric populations remains a critical focus.

: Limitation

The study may be susceptible to selection bias, as the choice of induction agent could have been influenced by unaccounted patient characteristics or surgical factors.

The findings of the study may not be generalizable to all pediatric populations, as factors such as age, comorbidities, and surgical complexity can significantly impact anesthesia management and outcomes.

The study primarily focuses on intraoperative hemodynamic effects, potentially overlooking the long-term clinical implications of anesthesia induction agent choice, such as postoperative recovery and complications.

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