

Original Research Article

Injection propofol and ketamine in pediatric and adult patients undergoing diagnostic radiological procedure (magnetic resonance imaging and computed tomography scan)

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ABSTRACT

Background: The purpose of this study was to evaluate the effect of propofol and ketamine in pediatric and adult patients undergoing diagnostic radiological procedure (magnetic resonance imaging (MRI) and computed tomography (CT) scan).

Methods: A comparative observation study conducted at Sri Aurobindo Medical College and PG Institute, Indore, Department of Anesthesiology after approval from Institutional ethical committee. The duration of this study was April 2019 to May 2020. Group KP: Inj. combination of ketamine and propofol (ketofol) with bolus dose of 0.50 mg/kg and 0.75 mg/kg respectively in initial 10 min followed by infusion at the rate of 0.05 ml/kg/hr till the completion of imaging.

Results: The mean age was 11.55 ± 2.80 in children and 31.34 ± 2.43 in adult. Mean weight of patients were 30.54 ± 8.86 in children and 60.21 ± 10.45 in adult. Gender distribution (male:female) were 24/16 and 26/14 children group and adult group.

Conclusions: We found that the combination of ketamine (ketofol) and propofol to be safe and well tolerated in pediatric patients and adult patients undergoing diagnostic radiological procedure (MRI and CT scan).

Keywords: Ketamine, Propofol, MRI, CT scan

INTRODUCTION

Propofol is a substituted isopropyl phenol (2,6-diisopropylphenol) that is chemically distinct from all other drugs that act as intravenous sedative-hypnotics.¹ However, adverse effects include dose-dependent injection pain, cardiorespiratory depression, and lack of analgesic properties.^{2,3} Also, it can cause unwanted responses such as hiccups, coughing, and movements.⁴ In contrast, ketamine is an N-methyl-d-aspartate receptor antagonist. It produces dissociative anesthesia. In contrast to other anesthetic agents, ketamine increases arterial blood pressure, cardiac output and heart rate. It should be avoided in patients with coronary artery disease, uncontrolled hypertension, congestive heart failure,

increased intracranial pressure, and arterial aneurysms.⁵ The incidence of its psychotomimetic effects can be reduced by coadministration of barbiturate, benzodiazepine, or propofol.⁵ It has been proved that ketamine causes slight or no cardiorespiratory depression and unlike propofol, has pain-relieving properties. Ketamine use is limited by emergence elevation of blood pressure and hallucinations and heart rate due to its sympathomimetic effects, as well as increased intracranial pressure.^{6,7} The combination of ketamine and propofol (KP) has been used for total intravenous anesthesia.⁸⁻¹⁰ Advantages of using the combination have included hemodynamic stability intraoperatively and, when compared with the use of propofol and fentanyl in combination, superior analgesia with less respiratory

depression during the early recovery phase. No disagreeable emergence phenomena were reported when using the combination. Magnetic resonance imaging (MRI) is a noninvasive, radiation-free diagnostic procedure. The frequency of MRI scans in children has increased in recent years owing to significant improvement in MRI opening up new diagnostic perspectives.¹¹ If young patients are unable to cooperate or to be at rest, either sedation or anaesthesia is required. Most children who need MRI diagnostic anaesthesia is neurological disease, vascular malformation or oncological tumor growth. Spastic and Epilepsy or mental retardation are common symptoms in these patients.^{12,13} Effectiveness of the two agents – propofol and ketamine –in combination (ketofol) has been recently demonstrated and may provide a novel induction agent with favorable hemodynamics and reduced side effects attributed to either drug.¹¹ The purpose of this study was to evaluate the effect of propofol and ketamine in pediatric and adult patients undergoing diagnostic radiological procedure (MRI and computed tomography (CT) scan).

METHODS

A comparative observation study conducted at Sri Aurobindo Medical College and PG Institute, Indore, Department of Anesthesiology after approval from Institutional Ethical committee. The duration of this study was April 2019 to May 2020. Forty children between the age group (7-18 years) and forty adult patients between the age group (18-45 years) American Society of Anaesthesiologist (ASA) I and II, undergoing MRI and CT were included in the study. Group KP: Inj. combination of ketamine (ketofol) and propofol with bolus dose of 0.50 mg/kg and 0.75 mg/kg respectively in initial 10 min followed by infusion at the rate of 0.05 ml/kg/hr till the completion of imaging. Written informed consent was obtained from all patients and parents of the children undergoing MRI and CT scan for diagnostic purposes.

Inclusion criteria

Children of age 7-18 years and adult of age 18-45 years. ASA status I and II. Both Male and Female.

Exclusion criteria

Presence of congenital heart disease, Anatomic airway abnormalities, sleep apnea. History of intolerance or allergies to propofol and ketamine. A recent upper/lower respiratory infection. An episode of acute asthma in the preceding 2 weeks.

Procedure

During pre-anaesthetic check-up, patients were assessed for fitness and instructions to be followed were given. Study protocol was explained to patients relative who

satisfied the inclusion criteria. Informed consent was obtained from parents who were willing to get their children included in this study. Fasting guideline were followed in this study in accordance with standard practice guidelines on fasting proposed by the ASA.¹⁴ The patients were shifted to MRI suite accompanied by parents monitors were attached which included electrocardiogram (ECG), non-invasive blood pressure (NIBP) and saturation of peripheral oxygen (SPO2) monitoring. Base line heart rate (HR), respiratory rate (RR), NIBP and SPO2 values were recorded. For securing IV-line, topical EMLA cream (5% lidocaine and 5% prilocaine) was applied 30 minutes prior to the procedure to minimize pain and discomfort to the patients and IV line was secured with 20 G or 22 G cannula. DNS was used as maintenance fluid, according to 4-2-1 formula.¹⁵ All the patients were premeditated with inj. Glycopyrrolate (0.01 mg/kg IV). The patients were oxygenated at the rate of 2-4l/min via oxygen face mask and the study drug was started as per the protocol. All the vital parameters (HR, NIBP, RR, and SPO2) were recorded at 10 min (T1 at 10 min, T2-20min, T3- 30 min, T4-40 min, T5-50 min, T6-60 min, to T7-70 min) interval starting from baseline (T0) till ending of imaging. After the imaging sequence was completed, the infusion was stopped and the child was transferred to a recovery room where they were observed by a recovery nurse and all the complications, vital parameters and side effects after the procedure were noted. Recovery score was assessed with modified Aldrette scoring of 8 (MAS8).

Statistical analysis

The data were analyzed statistically using the statistical package for the social sciences (SPSS) system version 17.0. The tests used to carry out statistical analysis in this study are student's T test and ANOVA (one-way analysis of normal variance). All statistical tests, a p value of less than 0.05 was considered as significant.

RESULTS

The mean age was 11.55 ± 2.80 in children and 31.34 ± 2.43 in adult. Mean weight of patients were 30.54 ± 8.86 in children and 60.21 ± 10.45 in adult. Gender distribution (male:female) were 24/16 and 26/14 children group and adult group (Table 1). There was no significant difference according to gender distribution. The mean duration of imaging for patients were 66.68 ± 5.875 minutes in children group and 67.34 ± 5.937 minutes in adult group. The time of MAS8 in two group following sedation for MRI was 13.27 ± 1.485 minutes and 3.60 ± 1.297 minutes in children and adult group. Mean duration of imaging for patients were 3.86 ± 0.98 minutes in children and 4.61 ± 1.057 minutes in adult. The time to MAS8 in the two groups following sedation for CT were 6.72 ± 1.23 minutes in children and 3.53 ± 0.742 minutes in adult group respectively (Table 1).

The average value of the vital parameters from baseline to the end of imaging in patients who received propofol and ketamine infusion. Hemodynamic parameters in both groups were maintained throughout imaging. HR, RR, SPO2, SBP, DBP and MBP changes were not significant difference (Table 2). Comparison of events and use of

rescue drug among the two groups of MRI and CT were seen in Table 3. The episode of nausea was treated with inj. Ondansetron in dose of 0.01 mg/kg. There were no episodes of fall in BP and seizure in both the group. None of the patients required rescue drug and need of post imaging hospitalization (Table 3).

Table 1: Demographic variables.

	Children (n=40)	Adult (n=40)	P value
Mean age	11.55±2.80	31.34±2.43	
Weight (kg)	30.54±8.86	60.21±10.45	
Male	24 (60%)	26 (65%)	0.644
Female	16 (40%)	14 (35%)	
Duration of imaging and recovery in MRI			
MRI Time (min)	66.68±5.875	67.34±5.937	0.760
MAS8 Time (min)	13.27±1.485	13.60±1.511	
Duration of imaging and recovery in CT			
CT Time (min)	3.86±0.98	4.61±1.057	0.06
MAS8 Time (min)	6.72±1.23	6.63±1.35	

Table 2: Vital parameters (mean ±SD) in group KP.

Parameters	T0	T1	T2	T3	T4	T5	T6	T7	P value
HR	82.68± 16.84	83.32± 15.08	83.19± 13.38	82.46± 15.34	83.19± 16.02	82.28± 14.41	83.12± 15.44	84.59± 15.77	0.69
RR	20.26± 4.65	19.46± 5.03	19.21± 4.20	20.12± 3.23	20.79± 3.35	20.12± 3.05	20.92± 3.02	21.19± 2.81	0.98
SPO2	99.48± 0.50	99.06± 0.69	99.01± 0.74	99.01± 0.66	98.92± 0.71	99.06± 0.58	98.86± 0.65	99.01± 0.36	0.05
SBP	89.86± 13.32	90.06± 13.72	88.79± 11.14	92.01± 10.47	89.21± 11.73	88.79± 11.72	90.12± 11.59	89.46± 12.14	0.96
DBP	52.52± 13.89	50.39± 14.93	50.06± 14.45	50.13± 13.62	50.47± 13.83	51.01± 13.39	53.01± 12.25	51.52± 12.53	0.34
MBP	64.96± 13.31	63.62± 13.97	62.97± 12.79	64.09± 12.08	63.36± 12.60	63.59± 12.77	65.36± 11.78	64.43± 11.87	0.45

HR: heart rate; RR: respiratory rate; SPO2: Saturation of peripheral oxygen; SBP: systolic bold pressure; DBP: diastolic blood pressure; MBP: mean blood pressure

Table 3: Comparison of adverse events and use of rescue drug among the two groups of MRI or CT.

	Children (n=40)	Adult (n=40)	P value
Comparison of adverse events and use of rescue drug among the two groups of MRI			
Nausea	8	7	0.774
Vomiting	10	11	0.901
Seizures	0	0	NS
Airway required	0	0	NS
Shoulder roll hypotension	5	6	0.745
Incidence of hypotension	0	0	NS
Rescue drug used	0	0	NS
Requiring admission in hospital (post imaging)	0	0	NS
Comparison of adverse events and use of rescue drug among the two groups of CT			
Nausea	5	4	0.723
Vomiting	7	5	0.531
Seizures	0	0	NS
Airway required	0	0	NS
Shoulder roll hypotension	0	0	NS
Incidence of hypotension	0	0	NS
Rescue drug used	0	0	NS
Requiring admission in hospital (Post Imaging)	0	0	NS

DISCUSSION

There was no significant difference according to gender. The study revealed that patients who received ketamine + propofol (Ketofol) had greater hemodynamic stability with no significant adverse effects. The present study shows that fall in SBP, DBP, MBP and RR was less with Ketofol and HR and SpO₂ were comparable in both the groups. In a study by Smischney et al to assess the hemodynamic effects of Ketofol in fixed dose combination versus propofol during induction of GA, they observed that Ketofol was associated with less fall in SBP, DBP, MBP in first 10 minutes after induction of anaesthesia when compared to propofol.¹⁶ This correlates with our study which shows lesser fall in SBP, DBP, MBP with Ketofol in first 10 minutes after induction. Arora et al and Akin et al also did a study which showed similar results. The oxygen saturation (SPO₂) and HR were maintained around baseline in both the groups. The variation in SpO₂ and HR was not statistically significant in both the groups.^{17,18} Dabis et al in their study on assessment of different concentration of ketofol on procedural operation found a recovery time of 8.2±6.7 minutes.¹⁹ In this study the recovery time in patients, who received combination of propofol and ketamine infusion in children and adult were 13.27±1.485 vs 13.60±1.511 minutes MRI and 6.72±1.23 vs 6.63±1.35 minutes in CT. In the present study shoulder rolls were used in 5 and 6 patients in Group children and adult respectively in MRI. There was no statistical difference between the shoulder roll use between the two groups (P value=0.745). Nausea was present in both groups 8, 7 patients in MRI and 5, 4 patients in CT. vomiting was present in both groups 10, 11 patients in MRI and 7, 5 in CT. Shoulder roll and nasal airways were tried to relieve the airway obstruction. We ensured a stable respiratory pattern, before performing MRI. All the patients in this study were managed with these airway support measures, none of the patients required bag mask ventilation or laryngeal mask airway or endotracheal intubation for successful conduct of MRI. The results of a study by Khajavi et al revealed that injecting a bolus dose of KP is not only an acceptable sedative option but may be superior to the other commonly used combination of propofol-fentanyl for sedation of patients during colonoscopy. In addition, the KP combination may be the factor that contributed to the low incidence of psychotomimetic reactions of ketamine that occurs during administration of large doses of ketamine.^{20,21}

CONCLUSION

The combination of propofol and ketamine has several benefits because of great hemodynamic stability, good recovery and advantage of ketamine when used as anaesthetic agent for induction. This combination was found to be safe and well tolerated in pediatric patients and adult patients.

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