



ORIGINAL RESEARCH PAPER

A COMPARATIVE STUDY OF COMBINATION OF INTRAVENOUS (I/V) KETAMINE + PROPOFOL (KETOFOL) AND I/V PROPOFOL ALONE FOR ANAESTHESIA IN PEDIATRIC PATIENTS UNDERGOING MAGNETIC RESONANCE IMAGING (MRI)

Anaesthesiology

KEY WORDS: ketamine, propofol, magnetic resonance imaging (MRI), ketofol (KP)

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ABSTRACT

BACKGROUND: Increasing need of reaching to accuracy of diagnosis has increased the number of investigations like MRI where some patients become uncooperative by various reasons. To carry out these investigations successfully general anesthesia is employed to make patient cooperative especially pediatric age group.

OBJECTIVE: The objectives of the study are to compare the cardiovascular, respiratory parameters, recovery profile and incidence of adverse events in both ketofol (KP) and propofol (P) group.

RESULTS: the results in both the groups were clinically and statistically significant. Ketofol maintains better hemodynamic stability and has better recovery profile.

CONCLUSION: Ketofol results in greater hemodynamic stability with fewer side effects and is safe and hence can replace propofol as an induction agent for short duration procedures.

INTRODUCTION

The goal of PSA is to provide an adequate level of sedation while minimizing pain and anxiety, maximizing amnesia, minimizing the potential for adverse drug-related events, controlling behaviour, and maintaining a stable cardiovascular and respiratory status. The ideal pharmacologic agent for PSA would accomplish all of these goals, and would have a quick onset and offset, be safe in all age groups, be inexpensive, and be equally efficacious in multiple routes of administration. The combination of Propofol and Ketamine, ticks most of the goals, by combining the properties of both drugs^{1,2}.

Sedation is frequently necessary for children 1 to 7 yr of age undergoing magnetic resonance imaging (MRI) to ensure examinations that is of diagnostic quality. Because procedural sedation is unable to guarantee patient compliance in these cases, adequate level of sedation is required^{3,4}. The success of sedation for MRI has typically been measured by two factors: the safety of the sedation procedure (lack of adverse events) and the effectiveness of the procedure.⁵

The main goals of paediatric sedation/general anaesthesia (S/GA) are to encompass anxiety relief, pain control and control of excessive movement⁶.

Hence the goal of our study is to find out an appropriate anaesthetic regime that maintains better hemodynamic stability, has fewer side effects and provides better sedation, which could be employed in remote locations to carry out hassle free procedures.

MATERIALS&METHOD:

Source of data: the study was conducted between October 2015 to October 2016. Thirty children between age of 1-12 years, ASA I and II, undergoing MRI were included in the study. Computer generated blocks will randomize patients. Randomization was done under two groups of 15 children each as under:

Group- P1: Inj. Propofol (1%) bolus dose of .75 mg/kg in the initial 10 minutes, followed by infusion at the rate of 0.6ml/kg/hr in MRI compatible infusion pump till the completion of imaging.

Group- KP1: Inj. Ketamine + Propofol(ketofol) with bolus dose of 0.50mg/kg and 0.75mg/kg respectively in initial 10 min followed by infusion at the rate of 0.05ml/kg/hr till the completion of imaging.

Anaesthesia technique for procedure:

Pre anaesthetic check up done for all the children undergoing MRI and were kept NPO according to the fasting guidelines⁷. Children were shifted to MRI suite accompanied by parents. Monitors were attached and baseline HR, RR, NIBP and SPO2 values were recorded. All the patients were pre medicated with inj. Glycopyrrolate (0.01mg/kg IV) and were oxygenated with oxygen 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, T4-40min, T5-50 min, T6-60 min, to T7-70 min) interval starting from baseline (T0) till completion 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 vital parameters, complications and side effects after the procedure were noted. Recovery score was assessed with Modified Aldrette Scoring of 8 (MAS8).

STATISTICAL ANALYSIS:

The data generated after the assessment of subjects in the two groups were tabulated and analysed 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 ANOVA (one way analysis of normal variance) and Student's T-test. For all statistical tests, a p value of <0.05 was considered as significant.

RESULTS:

A total of 30 children were recruited in the study. The two groups were comparable with respect to demographic profile like age, weight and gender. The mean duration of imaging in both the group was also comparable in both the groups.

Table 1 show that the time to achieve MAS of eight in both the groups following sedation for MRI was 13.27±1.486 minutes and 3.60±1.298 minutes in **Group-KP1** and **Group-P1** respectively. The difference in recovery time between the groups was statistically significant (pvalue=0.0001).

Table 1: Duration of imaging and recovery time in two MRI groups			
Patient Characteristics	Group KP1	Group P1	P VALUE
MRI Time (min)	66.67±5.876	67.33±5.936	0.760
MAS8 Time (min)	13.27±1.486	3.60±1.298	0.0001

Table 2 shows vital parameters in **Group- KP1** from T0 to the end of imaging (T7) in patients who received propofol+ ketamine infusion. SBP, DBP, MBP, HR, SpO2 and RR changes were not

statistically significant with p value of 0.96, 0.34, 0.45, 0.69, 0.05 and 0.98 respectively.

Table 2: showing vital parameters(mean \pm SD) in Group KP1

(n=15)	T0	T1	T2	T3	T4	T5	T6	T7	P value
SBP	89.87 \pm 13.33	90.07 \pm 13.73	88.80 \pm 11.15	92.00 \pm 10.48	89.20 \pm 11.72	88.80 \pm 11.73	90.13 \pm 11.60	89.47 \pm 12.13	0.96
DBP	52.53 \pm 13.90	50.40 \pm 14.94	50.07 \pm 14.46	50.13 \pm 13.63	50.47 \pm 13.84	51.00 \pm 13.40	53.00 \pm 12.26	51.53 \pm 12.54	0.34
MBP	64.97 \pm 13.32	63.627 \pm 13.98	62.98 \pm 12.78	64.10 \pm 12.07	63.37 \pm 12.61	63.60 \pm 12.78	65.37 \pm 11.79	64.44 \pm 11.88	0.45
HR	82.67 \pm 16.83	83.33 \pm 15.09	83.20 \pm 13.39	82.47 \pm 15.33	83.20 \pm 16.01	82.27 \pm 14.42	83.13 \pm 15.45	84.60 \pm 15.76	0.69
SPO2	99.47 \pm 0.51	99.07 \pm 0.70	99.00 \pm 0.75	99.00 \pm 0.65	98.93 \pm 0.70	99.07 \pm 0.59	98.87 \pm 0.64	99.00 \pm 0.37	0.05
RR	20.27 \pm 4.66	19.47 \pm 5.04	19.20 \pm 4.19	20.13 \pm 3.24	20.80 \pm 3.36	20.13 \pm 3.06	20.93 \pm 3.01	21.20 \pm 2.80	0.98

Table 3 shows vital parameters in **Group- P1**, starting from T0 to the end of imaging (T7) in patients who received propofol infusion. SBP, DBP, MBP, HR, SPO2 and RR change were statistically

significant with p value of 0.00, 0.001, 0.001, 0.30, 0.50 and 0.001 respectively.

Table 3: showing vital parameters(mean \pm SD) in Group P1

(n=15)	T0	T1	T2	T3	T4	T5	T6	T7	P value
SBP	95.53 \pm 8.10	92.53 \pm 8.93	94.07 \pm 8.42	93.33 \pm 8.44	94.20 \pm 7.63	93.60 \pm 6.71	94.00 \pm 6.62	95.60 \pm 6.66	0.00
DBP	53.73 \pm 9.82	47.20 \pm 9.60	50.73 \pm 5.457	50.33 \pm 9.13	52.07 \pm 7.43	54.60 \pm 9.03	51.40 \pm 7.14	53.13 \pm 6.89	0.001
MBP	67.66 \pm 8.45	62.313 \pm 8.65	65.16 \pm 5.75	64.66 \pm 8.45	66.11 \pm 6.85	67.60 \pm 8.07	65.58 \pm 6.09	67.21 \pm 6.36	0.001
HR	92.00 \pm 9.62	93.20 \pm 9.49	92.40 \pm 8.91	93.33 \pm 11.24	94.13 \pm 11.07	92.00 \pm 9.04	90.60 \pm 9.54	89.73 \pm 10.46	0.30
SPO2	99.40 \pm 0.63	98.93 \pm 0.70	98.60 \pm 0.73	98.60 \pm 0.73	98.67 \pm 0.61	98.60 \pm 0.63	98.93 \pm 0.25	98.93 \pm 0.25	0.50
RR	21.87 \pm 2.77	20.53 \pm 2.66	20.80 \pm 2.90	21.73 \pm 1.98	22.53 \pm 1.59	22.27 \pm 2.49	21.60 \pm 1.88	21.47 \pm 1.59	0.001

Table 4 shows the incidence of adverse events and need for rescue drugs in both the groups and was comparable. There was increase in incidence of nausea and vomiting in group KP1 but was statistically insignificant ($p>0.05$). The episodes of nausea were treated with inj. Ondansetron in dose of 0.01mg/kg and absence of vomiting in propofol group is due to its antiemetic action.

Table 4 : Comparison of adverse events and use of rescue drug among the two groups of MRI

Events	Group KP1	Group P1	P value
Airway use	0	2	0.41
Shoulder roll use	4	0	0.82
Incidence of hypotension	0	0	NS
Rescue drug use	0	0	NS
Nausea	3	0	0.63
Vomiting	4	1	0.73
Seizures	0	0	NS

DISCUSSION:

The primary aim of the study was to compare the hemodynamic profile and incidence of post imaging adverse effects of propofol alone and combination of propofol and ketamine. The study revealed the following results:

The time to achieve MAS of eight is 13.27 \pm 1.486 minutes and 3.60 \pm 1.298 minutes in **Group-KP1** and **Group-P1** respectively. The difference in recovery time between the groups was statistically significant ($p<0.05$)

The change in SBP, DBP, MBP & RR was more in **Group P1** ($p<0.05$) as compared to **Group KP1** where it was maintained around the baseline. The difference in SBP, DBP& MBP was statistically significant when comparison is made among the two groups.

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 ($p>0.05$).

The study revealed that patients who received ketamine + propofol (Ketofol) had greater hemodynamic stability with no significant adverse effects. Our 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 al⁸ 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. This correlates with our study which shows lesser fall in SBP, DBP, MBP with Ketofol in first 10 minutes after induction.

Arora et al⁹ and Akin et al¹⁰ also did a study which showed similar results.

In our study, RR showed decreasing trend in **Group P1** whereas in **Group KP1** RR was maintained around baseline. Christopher et al¹¹ in their study comparing Dexmedetomidine + midazolam with propofol for maintenance of anaesthesia in children undergoing MRI found that respiratory responses to both Dexmedetomidine - midazolam and propofol were similar and unchanged over time. This result is in contrast to our study which showed fall in RR in propofol group

In our study episodes of PONV were seen in Ketofol groups but the variation was not statistically significant. Daabiss et al¹² studied the effect of different concentrations of ketamine +propofol for procedural sedation. They included 100 children undergoing minor surgical procedures and randomized in two groups. Group 1 received ketamine+propofol in ratio of 1:1 and group 2 received ketamine+propofol in ratio of 4:1. They observed that PONV was more in group which received Ketofol containing ketamine in greater proportion.

CONCLUSION:

There is definite advantage of Ketofol over Propofol when used as anaesthetic agent for induction as it results in greater hemodynamic stability and is safe without any significant adverse effects and hence can replace propofol as an anaesthetic induction agent for short duration procedures.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for research authorship, and/or publication of this article.

Acknowledgement

We thank all the colleagues working in our different departments helping us gain such promising results for our patients.

REFERENCE

1. Roelofse JA. The evolution of ketamine applications in children. Paediatric Anaesthesia. 2010; March: 20(3), 240-245. 3)
2. David H, Shipp J. A randomized controlled trial of ketamine/propofol versus propofol alone for emergency department procedural sedation. Ann Emerg Med

- 2011;57:435-441).
3. Lawson GR. Sedation of children for magnetic resonance imaging. *Arch Dis Child* 2000;82:150-2.
4. Hasan RA, Shayevitz JR, Patel V. Deep sedation with propofol for children undergoing ambulatory magnetic resonance imaging of the brain: Experience from a paediatric intensive care unit. *Paediatric Critical Care Med* 2003;4:454-8
5. Bluemke DA, Breiter SN. Sedation procedures in MR imaging: safety, effectiveness, and nursing effect on examinations. *Radiology* 2000;216:645-52.
6. Cravero JP, Blike GT. Review of paediatric sedation. *AHU & A* 2004;99: 1355-64.
7. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures-An updated report by the American Society of Anaesthesiologists committee on standards and practice parameters. *Anesthesiology* 2011; (114):495- 511.
8. Smischney N, Beach M, Loftus R, Dodds T, Koff M. Ketamine/propofol admixture (ketofol) is associated with improved hemodynamics as an induction agent: a randomized, controlled trial. *The Journal of Trauma and Acute Care Surgery*. 2012; 73(1): 94-101.
9. Arora S, Martin CL, Fernandez MM, Wagner JG, Hertbert M. Combining ketamine and propofol (ketofol) for emergency sedation in emergency department. *Ann Emergency Med* 2007; 50(3):s121
10. Akin A, Esmaglu A, Guler G, Demircioglu R, Narin N, Boyaci A. Propofol and propofol-ketamine in paediatric patients undergoing cardiac catheterization. *Paediatric Cardiology* 2005; 26: 553-7.
11. Heard C, Burrows F, Johnson K, Joshi P, Houck J, Lerman J. A Comparison of Dexmedetomidine-Midazolam with Propofol for Maintenance of Anaesthesia in Children Undergoing Magnetic Resonance Imaging. *Paediatric Anaesthesiology*. 2008; 107(6)
12. Daabiss M, Elsherbiny M, Alotibi R. Assessment of different concentrations of Ketofol in procedural operation. *Br J Med Pract* 2009;2(1):27-31