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Research Article

Comparison of propofol and thiopentone along with ketamine for paediatric MRI sedation

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ABSTRACT

Background: Children are very much scared to undergo magnetic resonance imaging (MRI) brain or any body part even along with their parents for about 15 to 25 minutes. We investigated the combination of Propofol Ketamine and Thiopentone Ketamine along with Glycopyrolate and Midazolam premedication to see safe and better sedation group for paediatric MRI.
Methods: We investigated randomly 50 children of age three to five years prospectively. Children were pre-medicated with Glycopyrolate 0.01 mg/kg and Midazolam 0.05 mg/kg per body weight intravenously. Ketamine 1 mg/kg body weight was given just before shifting into the MRI machine. After body positioning either Propofol (PK group) or Thiopentone (TK group) 1 mg/kg body weight was given slowly. Children were monitored for electrocardiogram (ECG), arterial oxygen saturation (SpO_2) and respiratory rate continuously. Oxygen supplementation was through the oxygen (O_2) mask. Three parameters were studied 1) Repetition of drug 2) Respiratory distress during scan period and 3) Recovery time.
Results: The pre-interventional characteristics including age, sex, weight, ASA grade, were comparable between two groups ($p>0.050$). Repetition in PK group was high compared to TK group (40% vs 8%; $p=0.0081$). Respiratory distress was comparable in both the groups (16% vs 24%; $p=0.480$) whereas recovery time was significantly shorter for PK group (4.62 ± 0.53 vs 9.86 vs 1.28; $p<0.001$).
Conclusions: Thiopentone Ketamine combination results in lower repetition rate while Propofol Ketamine offers shorter recovery period. However, respiratory distress is almost similar.

Keywords: Ketamine, MRI, Paediatric, Sedation, Thiopentone

INTRODUCTION

Magnetic resonance imaging (MRI) requires the patient to stay still for at least 15 minutes to one hour in a noisy and claustrophobic environment. It is difficult especially in infants and children without drug induced sleep. Hence anaesthesiologists are discovering safe and successful combination of drugs.[1]

Propofol is discussed to be a best of all intravenous (I.V.) drugs for paediatric sedation because of its faster induction and quick recovery.[2] Magnetic resonance imaging scanning for children is a big challenge for anaesthesiologist for providing adequate sedation without compromising airway and haemodynamics.[3] The success of sedation during MRI is typically assessed by two factors 1) safety during sedation 2) successful completion of test that is good quality of radiological image without artefacts. It can be achieved from motion less body during scan.[4] Propofol yields faster induction and faster emergence from sedation but it may cause hypotension.[5] Thiopentone I.V bolus has been used routinely[6] but the duration of recovery and sedation is unpredictable.[7] We aimed to study the effectiveness between Propofol and Thiopentone along with Ketamine and other premedications.

METHODS

After ethical committee clearance 50 children ASA grade 1 and 2 of age three to five years scheduled for elective MRI of brain scan at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgavi, Karnataka a tertiary care teaching hospital attached to Jawaharlal Nehru Medical College, Belagavi are studied prospectively. Informed written consent from the parent obtained. Children with ASA grade 3 and above, congenital cardiac disease, raised ICP, history of allergy to anaesthetic drugs and child with upper respiratory tract infection were excluded from the study. Randomization done based on even and odd numbers. Odd number was selected for Propofol+ Ketamine (PK) group and Even number for Thiopentone+ Ketamine (TK) group. A detailed preanaesthetic evaluation was done day prior to scan. Nil by mouth status was confirmed before starting six hours for solid food and two hours for clear liquid was advised. The base line parameters heart rate (HR), respiratory rate (RR) and oxygen saturation (SpO_2) were noted. A 22 or 24 gauze branula secured after emla cream application. All the children received same premedication depending on their body weight that is, Glcopyrolate 0.01 mg/kg, Midazolam 0.05 mg/kg of body weight. Just before shifting in to the MRI room, Ketamine 1 mg/kg was given and placed on MRI coil. Oxygen of 6 litres/min flows supplemented through oxygen (O_2) mask, electrocardiogram (ECG), Spo_2 and respiratory monitors were connected and monitored. Once the child was positioned 1 mg/kg of Propofol in PK group or 1 mg/kg Thiopentone in TK group was given slowly. The level of sedation was assessed by University of Mithigun Sedation Scale (UMSS) 0=Awake Alert, 1=Minimal sedation, 2=moderately sedated, 3=deeply sedated and 4=Unarousable to stimuli. UMSS -3 was acceptable for performing MRI scan. Heart rate, RR and Spo_2 were monitored and documented at every five minutes interval.

The resident anaesthetist remained inside the MRI machine room to repeat drug 0.5 mg/kg of Propofol or Thiopentone in case child moves in their respective group. Once scan completed child shifted to recovery room where oxygen, I.V fluid started and HR, RR, Spo_2 were noted. Recovery was checked with UMMS scale. Radiologist was asked to grade the quality of scan that is, excellent = No movement; Good = Minor movement; and Poor = Major movements. Failure of scan considered in either group when scan was incomplete with protocol drugs or requirement of any other drugs like fentanyl etc.

The child was shifted back to ward once child aldritch score of 9 achieved on discharge. For out patient children proper instruction were given regarding feeding after four hours of nil by mouth.

Statistical analysis

The data obtained was analysed using SPSS statistical software version 20.0. Categorical data was expressed in terms of numbers and percentages while continuous data was expressed as mean±standard deviation (SD). The comparison between two groups for categorical data was done using chi-square test and continuous data was compared using independent sample‘t’ test. A probability (p value) of <0.050 was considered statistically significant.

RESULTS

Of the 50 children studied, 30 were males and 20 were female children. In PK group, 56% were male and 44% were female children (p=1.000). The mean age in PK and TK groups was 4.5 years and 4.86 respectively (p=0.192). In PK group, 76% of the children belonged to ASA grade 1 and in TK group, 64% belonged to ASA grade 1 (p=0.538). The mean weight of the children in PK group and TK group was 11.73 and 12.6 respectively (p=0.162) (Table 1). The duration of scan was comparable in both groups (17.6 minutes in PK group and 17.16 minutes in TK group; p=0.0598). Heart rate in both the groups was also comparable. (90.6 and 89.14 in PK and TK group respectively; p=0.605) (Table 2).

Table 1: Demographic characteristics of the study population.

Variables	Subgroups	Group PK	Group TK	p value
Age (Years)	(Mean ± SD)	4.50 ± 7.79	4.86 ± 11.11	0.191
Sex	Male	14	15	1.000
	Female	11	10	
Weight (Kgs)	(Mean ± SD)	11.73 ± 1.81	12.60 ± 2.46	0.162
ASA Grade	I	19	16	0.538
	II	6	9	

Table 2: Mean MRI scan time and heart rate.

Variables	Subgroups	Group PK	Group TK	p value
Scan time (Minutes)	(Mean ± SD)	17.60 ± 3.14	17.16 ± 2.67	0.059
Heart rate (Minutes)	(Mean ± SD)	90.16 ± 3.67	89.64 ± 3.93	0.735

Our study concerned to additional dose given during scan period, respiratory distress and recovery time. Data shows that in PK group 40% of the children repeated, whereas in TK group 8% of the children drug was repeated (p=0.0081) (Table 3). Respiratory distress was comparable in both groups, it has seen in 16% in PK and 24% in TK group. Respiratory distress not observed in 84% in PK 76% in TK group (p=0.480) (Table 4). Coming to recovery period mean of 4.62 and 9.86 minutes in PK and TK group was observed respectively (p<0.0001) (Table 5).

Table 3: Comparison of PK and TK groups with additional dose given.

Additional dose	PK group		TK group	
	Number	Percentage	Number	Percentage
Yes	10	40.00	2	8.00
No	15	60.00	23	92.00
Total	25	100.00	25	100.00

x^2= 7.018; p=0.008

Table 4: Comparison of PK and TK groups with respiratory distress.

Respiratory distress	PK group		TK group	
	Number	Percentage	Number	Percentage
Yes	4	16.00	6	24.00
No	21	84.00	19	76.00
Total	25	100.00	25	100.00

x^2= 0.500; p=0.480

Table 5: Comparison of PK and TK groups with mean recovery time.

Groups	n	Mean	SD
PK Group	25	4.62	0.53
TK group	25	9.86	1.28

t=-18.945; p=0.0001

DISCUSSION

Our study aimed to find out whether PK or TK group is safe and better sedation combination for paediatric MRI. In order to avoid adverse effect of Ketamine i.e. increased secretions Glycopyrolate is used and Midazolam is given to counter the emergence reaction of Ketamine. The Ketamine 1mg/kg body wt maintain airway intact and decreases the requirement of Thiopentone and Propofol in order to keep the child motion less.

Kain Z et al demonstrated both I.V Propofol and Thiopentone can be used safely in children undergoing MRI.[8] Propofol is associated with significant shorter recovery and discharge time and it requires less PACU admission. Our study showed repetition of drug is more in Propofol Ketamine (PK) group compared to TK group. Respiratory distress was comparable in both the groups. Recovery time was faster in Propofol Ketamine group. The conventional doses of Propofol used for induction and maintenance of sedation for paediatric MRI 2-6 mg/kg and 100-200 µgm/kg/min respectively.[9] These doses sometimes cause adverse effect like apnoea, injection site pain, involuntary movement and hypotension.[10] Tomatir et al reported that, use of small dose of Ketamine 0.5 mg/kg allows successful scan completion with lower induction and maintenance doses of propofol beside haemodynamic stability.[11] Eirch et al in their observational study found single dose of ketamine 0.5 mg/kg reduced propofol requirement for paediatric MRI compared to propofol and propofol ketamine group with faster recovery after scan completion.[12] Study has shown combination of Propofol and Ketamine is a better sedation with less side effects than using either drug alone.[13] Another advantage of Ketamine is small dose removes injection site pain and reduces unintentional movement seen with propofol.[14] Sethi et al[15] in their study used Midazolam as a premedication to calm the child and allay any anxiety while waiting for their scan and it may increase the success rate of sedation. Ketamine I.M used in combination with dexmeditomedine might avoid the adverse effects like bradycardia and hypotension of dexmeditomedine.[16] Vomiting is common with ketamine; Green et al reported the incidence of vomiting as 3.5% in age less than 5 years.[17] Taman TF[18] studied dexmeditomidine combined with Ketamine I.M. route and reported that it is a better sedation than I.M dexmeditomedine or ketamine alone with regard to onset of sedation, haemodynamic stability sedation failure rate. The goals of sedation is not only adequate sedation but also control anxiety, minimize psychological trauma, maximize the potential for amnesia control unintentional movement and provide quick recovery which can be achieved by selecting appropriate drugs in the lowest possible but just adequate dose for the procedure.[19] According to recent guidelines, sedating and hypnosis alone have to be preferred for non pain full procedure.[19] The potential for adverse events may be increased when three or more drugs administered in combination.[19] Hence we used premedications glycopyrolate and midazolam to counter adverse effect of ketamine. Ketamine used for quick induction and maintain air way, beside it decreases the requirement of propofol and thiopentone.

Ideal paediatric sedative drug should also ensure rapid anaesthetic induction and recovery while producing minimal side effects such as nausea and vomiting and dysphorea.[20] Propofol may depress ventilation, suppress pharyngeal and laryngeal reflex and cause transient apnoea.[21] Koroglu reported incidence of desaturation with Propofol during MRI.[22] Upper air way collapsibility is markedly increased in both sleeping and anesthetized children.[23] Propofol and barbiturate can exacerbate upper air way obstruction and increase the risk of respiratory depression/apnoea.[24] In contrast to other drugs, Ketamine is shown to preserve hypopharyngeal size in adults.[25]

CONCLUSIONS

Our study shows repetition of drug is more in Propofol+Ketamine group compare to Thiopentone+Ketamine group. Respiratory distress is comparable in both groups. Recovery time is significantly shorter in Propofol+Ketamine group.

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