



## Original Article

# Comparison of Propofol and Thiopental in Sedation of Children for MRI Procedure

Authors

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## Abstract

**Aim:** Children who will be sedated for MRI was compared about the propofol and thiopental application.

**Material and Methods:** ASA I-II, 160 cases between 1 month and 8 years old were included. Initial systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, oxygen saturation (SPO<sub>2</sub>) values were recorded. Group I: Propofol 2 mg / kg bolus, Group II: Thiopental sodium 2 mg / kg bolus. The University of Michigan Sedation Scale (UMSS) was used to determine the sedation level. Age, sex, body weight, ASA, MRI region, total amount of drug used were recorded. The technician performing MRI evaluated the quality of the shots with a verbal scoring system ranging from 1 to 3.

**Results:** The total dose given to the males was  $43.6 \pm 20$  mg and the females were  $38.3 \pm 18$  mg. The difference was not statistically significant ( $p = 0.944$ ). In terms of processing time, the difference was statistically significant ( $p = 0.09$ ). UMSS averaged 2.81 in Group I and 2.60 in Group II, with a statistically significant difference between groups ( $p = 0.003$ ). There was a statistically significant difference between groups in terms of side effects, desaturation, prolonged sedation and nausea and vomiting ( $p < 0.05$ ).

**Conclusion:** Because of the minimal side effects and rapid induction, propofol was under the control of anesthesiologist. Unlike our previous literature, it could be used effectively and reliably even in younger infants.

**Keywords:** sedation, pediatric, MRI.

## Introduction

In children, sedation and / or analgesia is increasingly used in diagnostic procedures. While most diagnostic procedures do not place significant risk, sedation results in adverse effects in 21% of children<sup>(1,2)</sup>. Reported side effects were 5.5% respiratory problems, 13.1% unsuitable

sedation and 3.7% insufficient sedation<sup>(1,3)</sup>. Magnetic Resonance Imaging (MRI) is a widely used diagnostic method in pediatric patients. Due to the narrow and noisy environment, the prolongation of the MRI period can cause uneasiness in pediatric patients.

Sedation or anesthesia may be needed for pediatric patients because patient movements negatively affect the image quality. It may be difficult to provide adequate sedation in young children, especially those with mental retardation, using antiepileptic drugs. In addition, special monitors and anesthesia equipment that will not cause interference in the MRI environment are needed<sup>(4,5)</sup>. However, this increases the cost of the system so monitoring is limited.

Although various drugs have been used for sedation to date, they are directed to agents with minimal side effects, which can initiate rapid research effects, control sedation depth and duration<sup>(5,6)</sup>. In recent years, intravenous (IV) administration of propofol, which is used for sedation of children in MRI in many ways, is seen as a disadvantage when compared with oral sedatives such as chloral hydrate. It is stated that only sedation made with benzodiazepines may be inadequate.

In our study; children who will be sedated for MRI will receive one dose i.v. The aim of this study was to compare the propofol with thiopental application.

### Material and Methods

After the approval of the ethics committee, ASA I-II, which will be used for MRI for various reasons in our hospital, and 160 cases between 1 month and 8 years old were included. Our work was prospective, controlled and randomized. Written and verbal approvals were obtained from the families of the cases. Patients with severe hepatic, renal and gastrointestinal dysfunction, hypersensitivity to drugs used, active systemic disease, uncontrolled hypertension, elevated intracranial pressure, metabolic or electrolyte imbalance and emergency cases were excluded from the study.

All children who had previously undergone preanesthetic evaluation were allowed to take clear liquids for up to 2 hours before sedation. 36-month-olds were allowed to eat food for 8 hours, 12-36 months before 6 hours before milk. Initial

systolic-diastolic blood pressure (SBP), diastolic blood pressure (SBP), heart rate (CTA), oxygen saturation (SPO<sub>2</sub>) values were recorded after Iv cannulation in patients with MRI. After opening the cardiothoracic artery, 0.1 mg / kg iv midazolam was administered with oxygen mask at 2 l / min to all cases. For randomization, closed, opaque envelopes were randomly included in one of two groups;

Group I: Propofol 2 mg / kg bolus, additional dose of propofol 1 mg / kg if needed iv)

Group II: Thiopental sodium 2 mg / kg bolus was divided into 2 groups in order to administer an additional dose of thiopental 1 mg / kg (iv) when needed.

The University of Michigan Sedation Scale (UMSS) was used to determine the sedation level (Table 1). Patients were considered to have adequate sedation level if they had UMSS 2- 3 and patients were taken to MRI. Additional doses were planned if adequate sedation levels were not achieved in both groups or if there was an increase in alertness during the procedure. SKB, DBP, KTA, SpO<sub>2</sub> and sedation levels were continuously monitored at intervals of 5 min from the beginning of the procedure. After the first drug administration, UMSS 2-3 sedation, ie; time to delivery of the patient to the ready level of the MRI unit, duration of the induction, duration of the time spent in the MRI chamber, duration of the procedure until the end of the procedure and the level of the sedation to 1 point were recorded at the desired level (2/3 points) points) were determined as the total sedation duration. Age, sex, body weight, ASA, MRI region, total amount of drug used at the end of the procedure were recorded. The radiology technician performing the MRI evaluated the quality of the shots with a verbal scoring system ranging from 1 to 3 (Table 2).

It may be encountered during the process; paradoxical reaction (restlessness, aggression, agitation), allergic reaction, bradycardia, hypotension (less than 20% of baseline), nausea-vomiting were recorded. In case of desaturation, it

is planned to apply 0,01 mg / kg atropine in case of jaundice, oral airway placement, respiratory support with mask, bradycardia if necessary.

After the MRI procedure, the satisfaction of the parents during the entire procedure was assessed with a 4-point verbal scale (Table 3). The patients were followed up for half an hour in the wake-up unit. Patients who did not have problems in their beds were discharged to their homes.

### Statistical Analysis

Statistical analysis of the study was performed using SPSS version 13.0. Normal distribution of data was checked by Kolmogorov-Smirnov test. For non-normal distributed data, Kruskal-Wallis was used for four groups and Mann-Whitney U test for two group comparisons. For normal distributed data, ANOVA was used for four groups and t-test for two group comparisons. Pearson Chi-Square test and Fisher's Exact Chi-square tests were used for analysis of categorical data. Paired t-test and Wilcoxon test were performed for interval comparison. Statistically, the significance was as described below.

### Results

The mean age of the children ranged from 1 month to 8 years and the mean age was  $30.9 \pm 21.1$  months. 89 (55.6%) of the patients were male, 71 (44.4%) were female and mean weights were determined as  $15.7 \pm 6.4$  kg. It was observed that 112 (70%) of the cases had ASA I. There was no statistically significant difference between groups in terms of age ( $p = 0.176$ ), gender ( $p = 0.791$ ), weight ( $p = 0.532$ ) and ASA score ( $p = 0.574$ ).

Of the MRIs, 106 (66.25%) were cranial, 20 (12.5%) were diffuse, 12 (7.5%) were allspinal, 8 (5%) were abdomen, 8 (5%) were lumbosacral, 6 (3.75%) belonged to the extremities and there were no statistically significant difference between the groups in terms of the pullout zones ( $p > 0.05$ ).

In group I, the duration of induction was  $1.01 \pm 0.64$  min, the duration of the procedure was  $23.4 \pm 9.5$  min, the duration of sedation was  $31.71 \pm 12.40$  min, the duration of the procedure was

$15.02 \pm 5.61$  min and those in group II were  $2.14 \pm 1.08$  min,  $24.0 \pm 9.2$  min,  $36.91 \pm 10.33$  min,  $20.71 \pm 7.81$  min (Table 4) (p values).

In our study 160 doses required an additional dose of 46 (28.75%) twice, 6 (3.75%) twice and 4 (2.5%) three times, while 104 (65%) did not require an additional dose. 67 (83.75%) of the patients in group I did not require additional doses. In group II, this number was 39 (48.75%) and the difference was statistically significant ( $p < 0.001$ ).

It was determined that the total dose (46.5 mg) administered in Group II was higher than Group I (35.6 mg) (Table 4). When assessed according to genders; The total dose given to the males was  $43.6 \pm 20$  mg and the females were  $38.3 \pm 18$  mg. The difference was not statistically significant ( $p = 0.944$ ). In terms of processing time;  $22.1 \pm 6.9$  min in males and  $24.1 \pm 8.1$  min in females. The difference was statistically significant ( $p = 0.09$ ).

When evaluated in terms of sedation; In UMSS 48 (30%) patients were 'moderately sedated' and in 111 (69.3%) patients 'Deep sedation', 1 (0.63%) patients were not awake (UMSS 4). In UMSS 2, 46 (57.5%) patients were UMSS 3 and 1 (1.25%) in group I, while UMSS 2 in 15 patients (18.75%), UMSS 3 in 65 patients (81.25% the patient was UMSS 4. UMSS averaged 2.81 in Group I and 2.60 in Group II, with a statistically significant difference between groups ( $p = 0.003$ ).

In Group I, 8 (10%) patients were flawless, 69 (86.25%) patients had minor defects and 3 (3.75%) patients were unable to complete the shots. In Group II, these rates were 8 (10%), 58 (72.5%) and 14 (17.5%) respectively. There was a statistically significant difference between groups in terms of patients who could not be withdrawn ( $p = 0.01$ ).

Family satisfaction; In group I, 3 (7%, 8.75%) were 1, 67 (83.75%) and 2, 6 (7.5%) respectively, whereas these values were 5 (6,25% 85.0) and 7 (8.75%), respectively, and there was no statistical difference between the groups in terms of this parameter ( $p = 0.760$ ).

When SAP values were examined, there was a statistically significant difference ( $p = 0.03$ ) between groups only in SAP25 (neither way). There was no difference at other time intervals. When DBP, HR and SpO2 data were examined, no statistically significant difference was found between the groups ( $p > 0.05$ ).

When evaluated in terms of side effects; In Group I, 4 (5%) patients were bradycardia, 5 (6.25%) patients were desaturated, 4 (5%) patients had prolonged sedation and 2 (2.5%) patients had nausea and vomiting. In Group II, these rates were determined as 5 (6.25%), 3 (3.75%), 9 (11.25%) and 10 (12.5%) cases, respectively. There was a statistically significant difference between groups in terms of side effects, desaturation, prolonged sedation and nausea and vomiting ( $p < 0.05$ ) (Table 5).

**Table 1:** University of Michigan Sedation Scale (UMSS)

0: Fully awake
1: Sleepy (Minimal sedative)
2: Can be awakened by mild stimulation (moderate sedative)
3: Can be awakened by physical stimulation (deep sedation)
4: The patient can not wake up.

**Table 2:** Shooting quality

1: Excellent (Shot flawless)
2: Minor defect (Shooting completed)
3: Bad (Shooting not completed)

**Table 3:** Family satisfaction

1: Not satisfied
2: Somewhat satisfied
3: Satisfied moderately
4: Very satisfied

**Table 4** Distribution of durations by groups

VARIABLES	Group I	Group II	P value
Duration of induction (min)	1.01±0.64	2.14±1.08	0.024*
Duration of procedure (min)	23.4±9.5	24.0±9.2	0.247
Duration of recovery (min)	15.02±5.6	20.71±7.8	0.036*
Total duration of sedation (min)	31.71±12.40	36.91±10.33	0.042*
Total drug dosage (mg)	35.6	46.5	0.047*

**Table 5** Distribution of side effects according to groups

PARAMETERS	Group I (n=80)	Group II (n=80)	P value
Bradycardia	4 (%5)	5 (%6.25)	0.345
Desaturation	5 (%6.25)	3 (%3.75)	0.025*
Prolonged sedation	4 (%5)	9 (%11.25)	0.035*
Nausea and vomiting	2 (%2.5)	10 (%12.5)	0.017*

**Discussion**

Recent advances in diagnostic and interventional radiology have also increased the number of procedures requiring sedation and / or analgesia, especially in children. Although the main goals of pediatric sedation vary according to the imaging method, the American Academy of Pediatrics defines sedation targets for diagnostic and treatment procedures as follows: to safeguard the patient, to reduce physical anxiety and pain, to reduce anxiety and psychological trauma, to provide amnesia, and to ensure that the patient is discharged afterwards<sup>(7)</sup>.

Sedation and analgesia applied at appropriate conditions and doses increase both the patient and the physician comfort and therefore the success of the procedure, otherwise they can cause serious risks. For this reason, adequate resources and equipment for safe and effective sedation and various medicines have been started to be used in different ways in children. Haslam et al.<sup>(8)</sup> reported that during the radiological procedures in children, midazolam (92%), morphine (42%), diazepam (33%), midazolam (58%), diazepam (33%), morphine (20%), lorazepam in Canada, midazolam, diazepam, fentanyl, Derbent et al<sup>(9)</sup>, the fentanyl in Turkey (89), sevoflurane (77%), thiopental (47%), midazolam (24%), ketamine (9.6%) and propofol (8%).

It has also been reported that MRI and CT in small children have chlorpromazine in France, low doses of ketamine and propofol in Pakistan, and pentobarbital in nursing sedation and propofol in anesthesia surveillance in America<sup>(10)</sup>.

Mallory et al.<sup>(11)</sup> found that prolonged sedation, nausea-vomiting, allergic complications, unplanned hospital admissions were less in the propofol group, consistent with our study of 7079

patients aged 6 months to 6 years who gave thiopental or propofol for sedation on MRI, they also observed shorter compilation times. Although both groups did not distinguish the cases with ideal sedation, they reported that the treatment was canceled due to the weak sedation in the thiopental group and as a result more effective sedation was formed with propofol.

Adas et al.<sup>(12)</sup> found that the duration of readiness for MRI was  $2.34 \pm 1.10$  min in the thiopental group,  $17.06 \pm 7.81$  min in the treatment time and  $20.91 \pm 7.14$  min in the rest periods in ASA I-III MRI- , the total treatment time was  $40.31 \pm 9.61$  min. In the propofol group, these values were determined as  $0.98 \pm 0.54$  min,  $18.39 \pm 10.06$  min,  $17.34 \pm 4.28$  min and  $36.70 \pm 10.44$  min, respectively. Because of the short preparation and recovery period in the propofol group, they also reported that this agent may be an alternative to thiopental in sedation interventions.

It is noteworthy that during the studies performed with propofol as a sedation agent in MRI, the age interval is generally 6 months and over to support the literature information. Exceptions were Dalal et al.<sup>(13)</sup>, 258 infantile group of oral chloral hydrate which required sedation for MRI, group of iv bolus thiopental followed by nurse, and group of other group followed by iv propofol infusion at least in cardiopulmonary hydrate group side effects (2.9%) were observed. Concomitant with our results, thiopental (13.4%) and propofol (13.6%) groups did not differ in terms of this side effect. They also reported that the shortest propofol group (53.9 min) determined the readiness for MRI to be  $9.1 \pm 6.7$  min in the propofol group, 12.7 min in the thiopental group and  $23.5 \pm 13.4$  min in the chloral hydrate group. Recovery times were also observed in the shortest propofol group. We believe that these processes are compatible with us, but they may be a little longer, depending on the lower use of initial and additional doses, the administration of oral midazolam without intravenous route, and the administration of propofol as an infusion. The same investigators observed sedation failure due

to mobility during MR withdrawal in 22% of the chloral hydrate group, 12.2% of the thiopental group and 1.4% of the propofol group. In our study, it was also found that the attraction could not be completed because of more mobility in the thiopental group.

Pershad et al.<sup>(14)</sup> determined the drug doses to be  $4.25 \text{ mg / kg} \pm 1.86$ ,  $8.3 \text{ mg / kg / hour}$  and average recovery time of  $27.1 \pm 15.84$  min in the study of propofol administration in 52 pediatric patients requiring emergency sedation in an emergency unit. As we observed in our cases, none of the patients encountered respiratory problems or hypotension requiring ventilation support. Propofolone is also a safe alternative to sedation in children.

It is known that propofol suppresses laryngeal and pharyngeal reflexes and suppresses ventilation and makes temporary apnea. Even if sleeping and anesthetized children are thought to have increased airway collapse, we determined the rate of respiratory depression observed by Pershad et al as 5.8% as 6.25% in our study. This problem was also resolved by manually positioning the airway and increasing mask oxygen support.

Kedareshvara et al.<sup>(15)</sup> found that when they administered a group of propofol and a group of thiopental with  $1 \text{ mg / kg}$  of ketamine after midazolam premedication to the children undergoing MRI, they determined the collection time in the propofol group to be shorter but the additional dose requirements were higher. We think that this result, which is different from ours, may be due to the low dose of propofol used.

In conclusion, because of the minimal side effects and rapid induction and compilation, propofol was under the control of anesthesiologist and we concluded that, unlike our previous literature, it could be used effectively and reliably even in younger infants.

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