

## An analytical study of Comparison between Ketamine - Dexmedetomidine versus Ketamine - Propofol for Sedation in Children Undergoing Minor Cardiac Procedures in a Cardiac Catheterization Laboratory

Dr. Rahul Mamde<sup>1</sup>, Dr. Ambika Mamde<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Anaesthesia, DVVPF's Medical College & Hospital, Ahmednagar-414111, Maharashtra, India. <sup>2</sup>Senior Resident, Department of Pharmacology, Seth GS Medical College & KEM Hospital, Mumbai-400012, Maharashtra, India.

**Corresponding Author:** Dr. Ambika Mamde

**Email ID:** ambikamamde76@gmail.com

**Address:** Department of Pharmacology, Seth GS Medical College & KEM Hospital, Mumbai-400012, Maharashtra, India.

### Abstract :

**Background:** The management of children with heart diseases has been a major challenge for cardiac anesthesiologist. The anesthetic technique to be used should be easy, safer and provide cardiac stability throughout the operation. So interventional cardiologist prefer deep sedation with the patient breathing spontaneously and painlessly in the room. Propofol, Ketamine along with other combinations drugs have been used worldwide by cardiac anesthesiologist to achieve these goals. We carried out this study to evaluate the combination drugs for pediatric cardiac procedures which are Ketamine – Dexmedetomidine (KD) and Ketamine – Propofol (KP). **Methodology:** This study was conducted in the Department of Cardiology. A total number of 80 cases were selected, 40 from each comparative groups of Ketamine – Dexmedetomidine (KD) and Ketamine – Propofol (KP). Patient data was categorized into age, sex, procedure done and recovery time, analgesic boluses required and hemodynamic parameters during the surgery. **Results:** Mean age in KD group was  $5.24 \pm 1.25$  years and in KP group was  $4.95 \pm 1.86$  years. There were total 24 males (60%) and 16 females (40%) in KD group and total 22 males (55%) and 18 females (45%) in KP group. Most common procedures done in both the groups was ASD for device closure done in 12 patients (30%) in KD group and 13

patients (32.5%) in KP group. There was significant difference between the mean recovery time and number of ketamine boluses consumption in both the groups. ( $p < 0.05$ ) Heart rate was significantly lower in KD group at 5, 10, 15 and 20 min post induction when compared to KP group. No statistically significance was found in difference between the Mean Respiratory rate and MAP. **Conclusion:** Our study concludes that the use of KD combination is relatively safe, practical alternative, we did not find any hemodynamic or respiratory effects during the cardiac procedures but there was some delayed recovery.

**Key Words:** Pediatric Cardiac procedures, Cardiac anesthesia, Ketamine, Propofol, Dexmedetomidine.

### Introduction:

The management of children with heart diseases including congenital heart disease has been a major challenge for anesthesiologist. since decades, especially during cardiac catheterization procedures.<sup>1,2</sup>

The better anesthetic technique needed for managing the pediatric patients who are scheduled to undergo complex cardiac procedures. The technique of anesthesia for cardiac catheterization should be easy to administer, safe, and it should provide cardiovascular hemodynamic stability, adequate sedation, immobility, as well as rapid and smooth recovery with minimal complications.

Positive pressure ventilation along with the General anesthesia can alter intra- cardiac pressures and also the shunt fraction in pediatric patients. Therefore, the interventional cardiologist prefers deep sedation with the patient breathing spontaneously and painlessly in the room. Propofol, Ketamine along with other combinations drugs have been used worldwide by cardiac anesthetists to achieve these goals.<sup>3-5</sup>

In A study by Jobeir et al,<sup>5</sup> they used low-dose midazolam and/or ketamine for the pediatric cardiac catheterization procedures. They suggested that the administration of ketamine and midazolam or their combination in small doses during cardiac procedures like catheterization in children was found to be safe. Kogan et al<sup>6</sup> reported that a combination of Propofol and ketamine combination was a feasible option in spontaneously breathing children posted for cardiac catheterization.

Dexmedetomidine is a potent  $\alpha$  2-adrenoreceptor agonist with the sedative, analgesic, and anxiolytic effects. Worldwide it has been accepted for clinically effective sedation and significantly reduced analgesic requirements of post-surgical ventilated intensive care unit adult patients.<sup>7-9</sup>

Pediatric cardiac anesthesia is one of the most demanding branches of anesthesia which requires special considerations. Newer modalities for cardiac anesthesia with quicker sedation and recovery and minimal effects are being tried and tested every day.<sup>10-12</sup>

Ard et al first described the use of Dexmedetomidine in pediatric neurosurgery in 2 children undergoing awake craniotomy.<sup>13</sup> Dexmed, Ketamine and Propofol are becoming favorite combinations of drugs for pediatric anesthetic procedures.<sup>7,11</sup>

We carried out this study to evaluate the effectiveness of combination drugs for pediatric cardiac surgeries from Ketamine – Dexmedetomidine (KD) and Ketamine – Propofol (KP).

#### **Methodology:**

This study was conducted in the Department of Cardiology. A total number of 80 cases were selected, 40 from each comparative groups of Ketamine – Dexmedetomidine (KD) and Ketamine – Propofol (KP) for the study and patient data was categorized into age, sex, procedure done, recovery time, analgesic boluses required and hemodynamic parameters during the surgery.

**Study Design:** Comparative analytical study

**Study Site:** Department of Cardiology, DVVPF's Medical College & Hospital, Ahmednagar-414111, MS, India.

**Study Duration:** 1 year

**Study Population:** Pediatric Patients with cardiac procedures

**Sampling Technique:** Convenience sampling method was used in our study. Patients were randomized using computer generated random allocation numbers. Power used for our study was 0.80. We got sample size of 40 patients in each group.

Ethical approval was taken from the institutional ethics

committee before starting the study, written informed consent was taken from the parents or guardian of the children before enrolling them in the study.

Our study included children between the age groups of 1 month to 10 years. Males and females undergoing cardiac catheterization procedures were included in our study. Patients with drug allergies, genetic abnormalities or other multiple anomalies and patients with the renal or hepatic diseases were excluded from our study.

All patients were kept overnight fasting for 6 hours before procedure. The patients were given premedication of Glycopyrrolate (10  $\mu$ g/kg) and Midaz (50  $\mu$ g/kg) IV 10 min before taking the patient inside the catheterization lab where appropriate measures to prevent hypothermia were observed. Standard monitors including ECG and pulse-ox were attached. Group (KD) received: dexmedetomidine IV infusion 1  $\mu$ g/kg over 10 min + ketamine 1 mg/kg IV bolus for induction and then maintenance by IV infusion of 0.5  $\mu$ g/kg/h of dexmedetomidine and 1 mg/kg/h of ketamine. Group (KP) received propofol 1mg/kg and ketamine 1 mg/kg IV for induction and then maintenance by IV infusion of 100  $\mu$ g/kg/min of propofol and 1 mg/kg/h of ketamine.

Additional doses of ketamine in the dose of 0.5 mg/kg IV were administered when a patient showed discomfort. Heart rate, respiratory rate, mean blood pressure (BP) and SpO<sub>2</sub> were recorded at 5 min interval during the operation. Recovery time was observed.

Stewards Simplified Postanesthetic Recovery Score was used to record recovery time.

#### **Results & Observations:**

There were a total of 40 cases in each group.

Mean age in the KD group was found to be  $5.24 \pm 1.25$  years and in the KP group it was  $4.95 \pm 1.86$  years.

There were a total of 24 males (60%) and 16 females (40%) in KD group and a total of 22 males (55%) and 18 females (45%) in KP group.

Mean weight (kg) in KD group was  $14.58 \pm 4.65$  kg and in KP group was  $15.53 \pm 6.46$  kg.

Mean duration of surgery was  $56.82 \pm 14.52$  min in KD group and  $59.16 \pm 16.27$  min in KP group.

**Table 1:** Comparison of type of procedure done in two groups

| Procedure              | KD group | KP Group | Total |
|------------------------|----------|----------|-------|
| ASD for device closure | 12       | 13       | 25    |
| PDA for device closure | 11       | 10       | 21    |
| VSD for device closure | 8        | 9        | 17    |
| Cath Study             | 9        | 8        | 17    |
| Total                  | 40       | 40       | 80    |

Most common procedures done in both the groups was ASD for device closure done in 12 patients (30%) in KD group and 13 patients (32.5%) in KP group. Followed by PDA for device closure and VSD for device closure.

**Table 2:** Mean recovery time and Number of ketamine boluses consumption

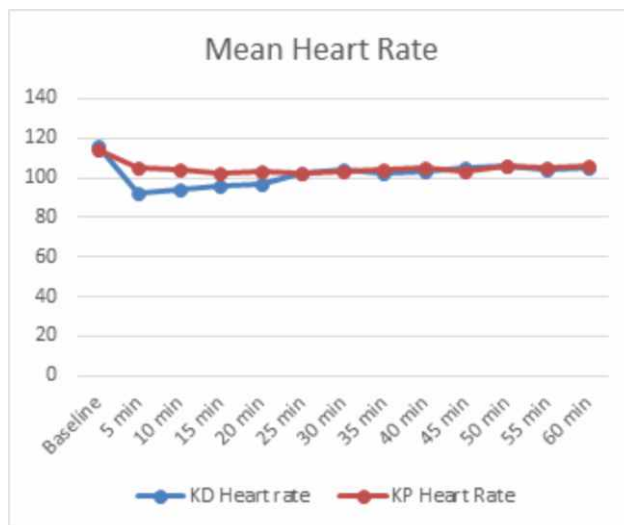
| Procedure                    | KD group     | KP Group     | P Value |
|------------------------------|--------------|--------------|---------|
| Mean recovery Time (min)     | 44.52 ± 9.52 | 26.74 ± 5.82 | < 0.001 |
| Ketamine boluses consumption | 29           | 35           | 0.021   |

There was significant difference between the mean recovery time and number of ketamine boluses consumption in both the groups. ( $p < 0.05$ )

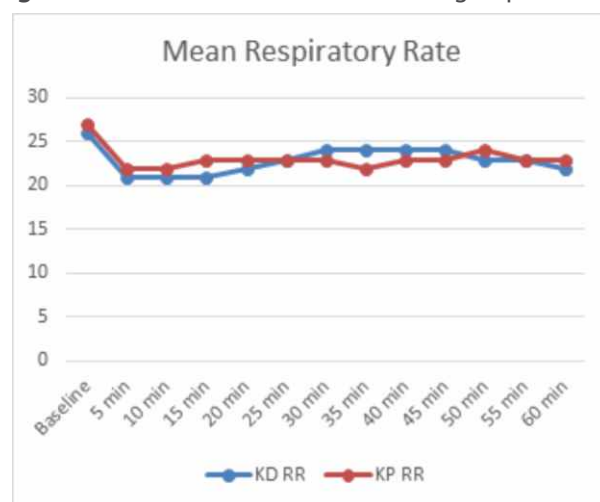
Mean recovery Time (min) in KD group was  $44.52 \pm 9.52$  min and in KP group was  $26.74 \pm 5.82$  min. KP group has significantly lower recovery time as compared to KD group. ( $p < 0.001$ )

The Ketamine boluses consumption in KD group was 29 out of 40 patients (72.5%) significantly lower than in KP group of 35 patients (87.5%). ( $p = 0.021$ )

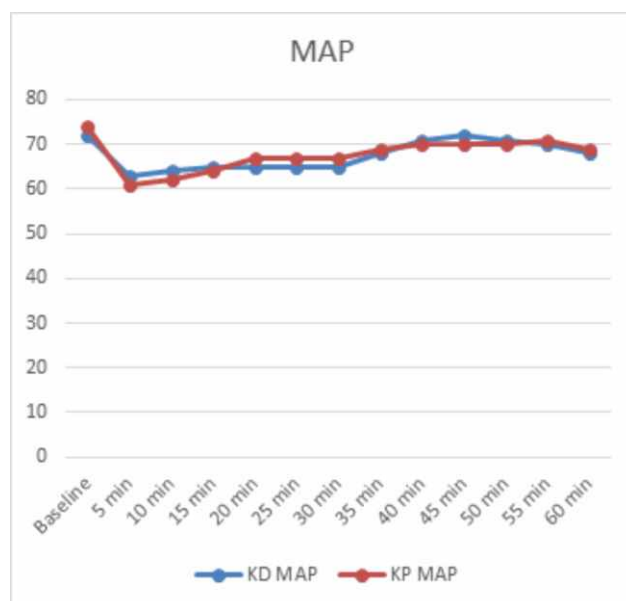
Heart rate was significantly lower in KD group at 5, 10, 15 and 20 min post induction when compared to KP group. After 20 min the heart rates were lower in both the groups without being statistically significant ( $p = 0.014$ ) (Figure 1). No statistically significance was found in difference between the Mean Respiratory rate, MAP (Figure 2, 3). Mean SPO<sub>2</sub> in both the groups throughout the surgeries was maintained 100%.



**Fig 1:** Mean heart rate between the two groups



**Fig 2:** Mean Respiratory Rate between the two groups



**Fig 3:** Mean Arterial Pressure between the two groups

## Discussion:

Pediatric cardiac catheterization procedures are different from the adults in many ways as there are different disease patterns in patients, requirements for the operation, sedation or GA to prevent movement in all patients and complete evaluation of anatomically abnormal heart.<sup>8,9</sup>

In our study, we compared the KD and KP drug combinations on the hemodynamic stability and the recovery time in total 80 patients undergoing cardiac operations and procedures.

We observed that there were a total of 24 males (60%) and 16 females (40%) in KD group and a total of 22 males (55%) and 18 females (45%) in KP group. Tosun Z et al<sup>14</sup> had 58% males and 42% females in their study, similar to ours.

Mean weight (kg) in KD group was  $14.58 \pm 4.65$  kg and in KP group was  $15.53 \pm 6.46$  kg.

Mean duration of surgery was  $56.82 \pm 14.52$  min in KD group and  $59.16 \pm 16.27$  min in KP group. There was no any significant difference between the basic study parameters indicating homogeneity of the two groups, similar results were observed by Ali NP et al<sup>15</sup> with mean weight of the participants  $13.98 \pm 6.53$  kg and mean duration of  $55.36 \pm 13.21$  minutes.

Most common procedures done in both the groups was ASD for device closure done in 12 patients (30%) in KD group and 13 patients (32.5%) in KP group. Followed by PDA for device closure and VSD for device closure.

Joshi VS et al<sup>16</sup> also observed that ASD, VSD & PDA were the three most common procedures done in their patients.

We observed a significant difference between the mean recovery time and number of ketamine boluses consumption in both the groups. ( $p < 0.05$ ) Joshi VS et al<sup>16</sup> observed the same in their study.

Mean recovery Time (min) in KD group was  $44.52 \pm 9.52$  min and in KP group was  $26.74 \pm 5.82$  min. KP group has significantly lower recovery time as compared to KD group. ( $p < 0.001$ )

In a study conducted by Heard C et al<sup>17</sup> which compared the Dexmed -Midaz with the Propofol for maintenance

of anesthesia in the children undergoing MRI suggested that the time to full recovery was significantly longer after Dexmed administration than after Propofol by 15 min.

The Ketamine boluses consumption in KD group was 29 out of 40 patients (72.5%) significantly lower than in KP group of 35 patients (87.5%). ( $p = 0.021$ )

Joshi VS et al<sup>16</sup> observed that ketamine was used in 70% cases of KD group and 93.33% cases of KP group, similar to our study.

Similar study done by Tosun Z et al<sup>14</sup> which compared these drugs for the children undergoing some minor cardiac procedures in cardiac catheterization section, showed that the consumption of ketamine in Dexmed group was more than that of the Propofol group ( $p < 0.05$ ).

Heart rate was significantly lower in KD group at 5, 10, 15 and 20 min post induction when compared to KP group. After 20 min the heart rates were lower in both the groups without being statistically significant ( $p = 0.014$ ) Similar findings were seen by Joshi VS et al<sup>16</sup> who observed that Heart rate was significantly lower in KD group at 5, 10, 15, 20 and 25 min post induction as compared to KP group.

Side effects like hypotension, bradycardia, convulsions, hiccups, shivering, oxygen desaturation, laryngospasm, agitation, raised oral secretions, vomiting, nausea were not seen in any patient from either of the groups. Many other previous studied have found the use of Dexmed Ketamine and propofol having less side effects in children.<sup>18-21</sup>

## Conclusion:

We studied hemodynamic stability, respiratory variables, and recovery time in children undergoing minor cardiac procedures in cardiac catheterization laboratory using either of the KD of KP combination drugs. We conclude that the use of KD combination is relatively safe, practical alternative, we did not find any hemodynamic or respiratory effects during the cardiac procedures but there was some delayed recovery. We recommend multicentric studies with larger sample size to further evaluate our hypothesis.



**Conflict of interest:** None

**Source of Funding:** This was a self-funded study.

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