

## Effects of Ketaminepropofol and Ketamine-Dexmedetomidine Combinations on Hemodynamic Parameters and Recovery Time in Paediatric Patients Undergoing Cardiac Catheterisation under Sedation for Various Congenital Heart Diseases

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Received: 17.09.2019 | Accepted: 24.09.2019 | Published: 30.09.2019

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## Abstract

## Original Research Article

**Background:** Ketamine is one of the commonly used inducing agents for short surgical procedures particularly in paediatric patients. Emergence reactions and vomiting caused by ketamine are opposed by the hypnotic and antiemetic properties of propofol while ketamine provides analgesia and combat the hypotension during propofol sedation.

**Objective:** To find out the effects of ketaminepropofol and ketamine-dexmedetomidine combinations on hemodynamic parameters and recovery time in paediatric patients undergoing minor procedures. **Methodology:** A prospective, randomized, controlled study was undertaken in a large tertiary hospital (Fortis Escorts Cardiac Hospital, Khulna) from January 2017 to December 2017. Informed written consent was taken from all the patients' guardians before the procedure. The patients were randomly assigned into two groups: DK and PK with 50 patients in each group by using sealed envelope method. All patients between the age group of 1 month to 10 years of either sex undergoing cardiac catheterization lab procedures were included in the study. **Results:** Mean pulse rate, Mean MAP and Mean oxygen saturation were not statistically significant ( $p > 0.05$ ) between two groups. Tachycardia, bradycardia, hypertension and hypotension were not statistically significant ( $p > 0.05$ ) between two groups. Mean recovery time was found  $39.6 \pm 7.9$  minute in DK group and  $22.3 \pm 3.5$  minute in PK group. The difference was statistically significant ( $p < 0.05$ ) between two groups. Thirty five 35(70.0%) patients were Ketamine boluses consumption in DK group and 45(90.0%) in PK group. The difference was statistically significant ( $p < 0.05$ ) between two groups. **Conclusion:** This study observed that the no significant difference were found ketamine and propofol versus ketamine and dexmedetomidine combinations on hemodynamic stability, respiratory variables and recovery time in children undergoing minor procedures in cardiac catheterization laboratory. Here use of DK combination is a safe, practical alternative, without any hemodynamic or respiratory effects during the cardiac catheterization laboratory procedure but recovery time some delayed than PK combination.

**Keywords:** ketaminepropofol, dexmedetomidine, bradycardia.

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## INTRODUCTION

Ketamine is one of the commonly used inducing agent for short surgical procedures particularly in paediatric patients. But, its utility has been restricted because of its unwanted sympathomimetic activity even though it has an excellent analgesic property with minimal respiratory depression. Added to this, it is also associated with undesirable postoperative delirium. In

the past, several drugs like Midazolam, Propofol were added to ameliorate the side effects of Ketamine [1].

Emergence reactions and vomiting caused by ketamine are opposed by the hypnotic and antiemetic properties of propofol while ketamine provides analgesia and combat the hypotension during propofol sedation [2]. Dexmedetomidine, an ultra-selective  $\alpha_2$  agonist, has anxiolytic, analgesic, amnesic and sedative properties with no risk of respiratory depression [3]. It

can effectively reduce the hemodynamic and psychomimetic actions of ketamine [4]. Dexmedetomidine has a sympatholytic effect which causes reduction of heart rate and blood pressure [5].

It attenuates stress-induced sympathoadrenal responses protecting the patients from noxious sympathetic stimulation and haemodynamic changes. A prospective observational study to evaluate the efficacy of Ketamine with Dexmedetomidine combination as an anaesthetic in paediatric day care surgeries was done.

## METHODOLOGY

A prospective, randomized, controlled study was undertaken in a large tertiary teaching hospital (Fortis Escorts Cardiac Hospital, Khulna) from January 2017 to December 2017. Informed written consent was taken from all the patients' guardians before the procedure. The patients were randomly assigned into two groups: DK and PK with 50 patients in each group by using sealed envelope method. All patients between the age group of 1 month to 10 years of either sex undergoing cardiac catheterization lab procedures were included in the study. Children with chromosomal abnormalities or other multiple congenital anomalies, drug allergy, patients requiring mechanical ventilation or inotropic support, and patients with hepatic or renal dysfunction were excluded from the study. According to hospital policy, all children were kept fasting for at least 6 h before procedure. The patients were premedicated with glycopyrrolate (10 µg/kg) and midazolam (50 µg/kg) intravenously (IV) 10 min before taking the child inside the catheterization laboratory where appropriate measures to prevent hypothermia to child were undertaken. Standard monitors including

electrocardiogram and pulse-oximeter were attached. Group (DK) received: dexmedetomidine IV infusion 1 µg/kg over 10 min + ketamine 1 mg/kg IV bolus for induction and then maintenance by IV infusion of 0.5 µg/kg/h of dexmedetomidine and 1 mg/kg/h of ketamine. Group (PK) received propofol 1mg/kg and ketamine 1 mg/kg IV for induction and then maintenance by IV infusion of 100 µg/kg/min of propofol and 1 mg/kg/h of ketamine. Additional doses of ketamine 0.5 mg/kg IV bolus were administered when a child showed discomfort in both groups. Heart rate, mean blood pressure (BP), oxygen saturation (SpO<sub>2</sub>), and respiratory rate were recorded every 5 min during the procedure. Postoperatively, heart rate and SpO<sub>2</sub> were recorded every 10 min. Recovery time was noted. Scores were assigned on admission to post anesthetic room where the routine vital signs were measured. Repeated scoring was performed every 10 min till the patient recovered up to score of 6 according to the Stewards Simplified Post anesthetic Recovery Score.

For statistical analysis, a sample size of 50 in each group was calculated with an alpha error of 5% (confidence interval 95%) and power of study of 80% and data analysis was done using statistical software version 23.0. This mean and standard deviation were used for continuous data such as age, weight, duration of surgery, heart rate, BP, respiratory rate, and recovery time. Independent sample *t*-test was used to compare the statistical significance of continuous variables of both the groups. Chi-square test was used for numerical data like gender. Fischer exact test was applied for nonparametric data like ketamine consumption.

## RESULT

**Table-1: Demographic profile of the study patients (n=100)**

Demographic profile	Group DK (n=50)		Group PK (n=50)		P value
	Mean±SD		Mean±SD		
Age (years)	4.9±2.5		5.1±2.3		0.678 <sup>ns</sup>
Weight (kg)	15.6±5.9		16.5±5.4		0.428 <sup>ns</sup>
Duration of surgery (min)	44.0±11.0		41.6±11.2		0.282 <sup>ns</sup>

ns= not significant

P value reached from unpaired t-test

**Group DK= Ketamine and dexmedetomidine**

**Group PK= Ketamine and propofol**

Demographic profile were not statistically significant ( $p>0.05$ ) between two groups.

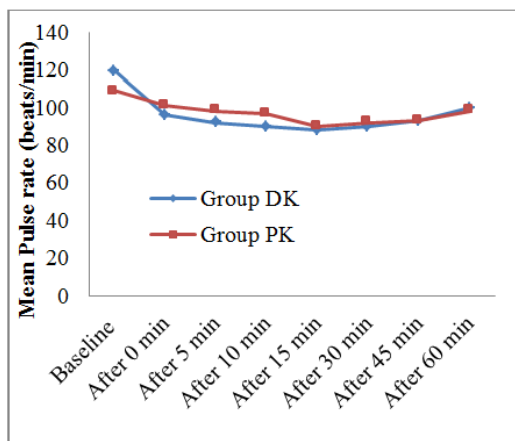
**Table-2: Type of procedure of the study patients (n=100)**

Type of procedure	Group DK (n=50)		Group PK (n=50)		P value
	n	%	n	%	
ASD for device closure	15	30.0	12	24.0	
VSD for device closure	10	20.0	11	22.0	
PDA for device closure	13	26.0	13	26.0	0.967 <sup>ns</sup>
Cath study	10	20.0	12	24.0	
Bicuspid aortic valve with severe AS	2	4.0	2	4.0	

ns= not significant

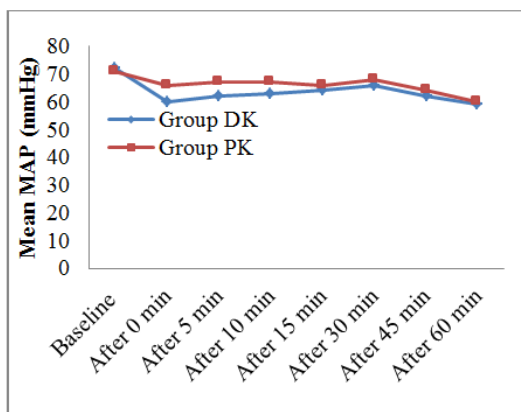
P value reached from chi square test

Table-2 shows that type of procedure was not statistically significant ( $p>0.05$ ) between two groups.



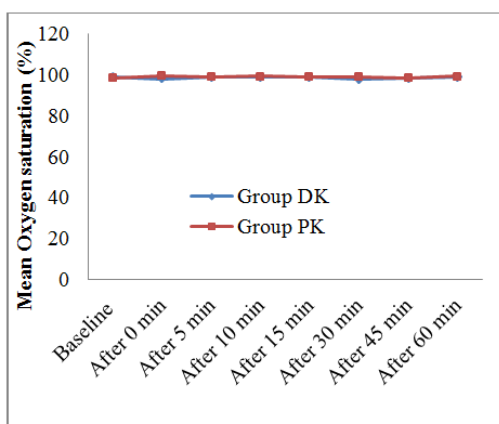
**Fig-1:** Line diagram shows pulse rate in different follow up

Mean pulse rate were not statistically significant ( $p>0.05$ ) between two groups.



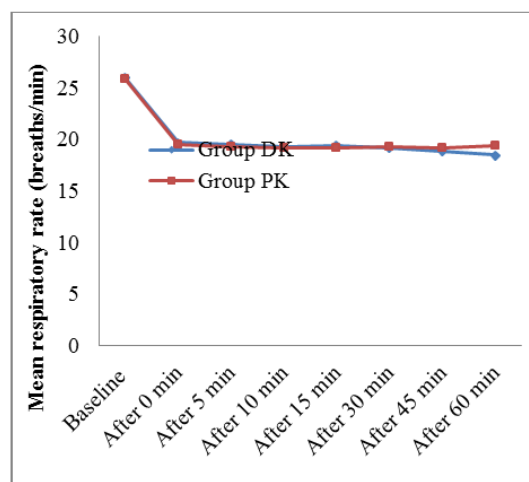
**Fig-2:** Line diagram shows MAP in different follow up

Mean MAP were not statistically significant ( $p>0.05$ ) between two groups.



**Fig-3:** Line diagram shows oxygen saturation in different follow up

Mean oxygen saturation were not statistically significant ( $p>0.05$ ) between two groups.



**Fig-4:** Line diagram shows respiratory rate in different follow up

Mean respiratory rate were not statistically significant ( $p>0.05$ ) between two groups.

**Table-3: Hemodynamic parameters of the study patients (n=100)**

Hemodynamic parameters	Group DK (n=50)		Group PK (n=50)		P value
	n	%	n	%	
Tachycardia	3	6.0	4	8.0	0.695 <sup>ns</sup>
Bradycardia	0	0.0	1	2.0	0.500 <sup>ns</sup>
Hypertension	2	4.0	1	2.0	0.379 <sup>ns</sup>
Hypotension	1	2.0	2	4.0	0.379 <sup>ns</sup>

ns= not significant

P value reached from chi square test

Tachycardia, bradycardia, hypertension and hypotension were not statistically significant ( $p>0.05$ ) between two groups.

**Table-4: Recovery time of the study patients (n=100)**

	Group DK (n=50)		Group PK (n=50)		P value
	Mean	±SD	Mean	±SD	
Recovery time (min)	39.6	±7.9	22.3	±3.5	0.001 <sup>s</sup>
Range (min-max)	31	-47	18	-28	

s= significant

P value reached from unpaired t-test

Table-4 shows that mean recovery time was found 39.6±7.9 minute in DK group and 22.3±3.5 minute in PK group. The difference was statistically significant ( $p<0.05$ ) between two groups.

**Table-5: Ketamine boluses consumption of the study patients (n=100)**

Ketamine used	Group DK (n=50)		Group PK (n=50)		P value
	n	%	n	%	
Yes	35	70.0	45	90.0	0.012 <sup>s</sup>
No	15	30.0	5	10.0	

s= significant

P value reached from chi square test

Table-5 shows that 35(70.0%) patients were Ketamine boluses consumption in DK group and 45(90.0%) in PK group. The difference was statistically significant ( $p < 0.05$ ) between two groups.

## DISCUSSION

The mean age 4.9 ( $\pm 2.5$ ) were in Group DK and 5.1 ( $\pm 2.3$ ) were in group PK. Mean duration of surgery 44.0(11.0) were in group DK and 41.6 ( $\pm 11.2$ ) were in Group PK. Demographic profile were not statistically significant ( $p > 0.05$ ) between two groups. In study of Joshi *et al.*, [6] studied the mean age in DK group was 4.84  $\pm$  2.61 years and in PK group was 5.08  $\pm$  2.22 years. The mean weight in DK group was 15.52  $\pm$  6.26 kg and in PK group was 16.56  $\pm$  5.35 kg. Mean duration of surgery/procedure in group DK and group PK was 44.04  $\pm$  10.81 min and 39.20  $\pm$  11.70 min. The difference were not statistically significant ( $p > 0.05$ ) between two groups. Mogahed and Salama also reported similar observation they showed age, sex and weight were not statistically significant ( $p > 0.05$ ) between two groups [7].

In present study observed that type of procedure was not statistically significant ( $p > 0.05$ ) between two groups. Joshi *et al.*, [6] reported that the two groups were comparable with respect to type of surgery/procedure.

In this study showed that the mean pulse rate were not statistically significant ( $p > 0.05$ ) between two groups at base line after 0, 5, 10, 15, 30, 45, 60 minutes. Joshi *et al.*, [6] reported heart rate was significantly lower in DK group at 5, 10, 15, 20, 25 min post induction in comparison to PK group. Later on, the heart rate continued to be lower in both the groups but it was not statistically significant. Tosun *et al.*, [8] reported that the heart rate in Group 1 was significantly lower (average 10–20 beats/min) than Group 2 after induction and throughout the procedure. Morray *et al.*, assessed the hemodynamic effects of ketamine in children with congenital heart disease [9].

In this study showed that mean MAP were not statistically significant ( $p > 0.05$ ) between two groups at baseline after 0, 5, 10, 15, 30, 45, 60 minutes. In Bangladeshi study by Ali *et al.*, [10] which compared DK and PK as anesthetic agents in pediatric cardiac catheterization, clinical outcome of both groups was similar and there was no significant difference in the

recovery patterns and hemodynamic status. Joshi *et al.*, [6] reported that mean arterial pressure was no significant difference between both groups. They reported a decrease in diastolic, systolic and mean blood pressure after induction but there was no significant difference between the two groups as regards mean blood pressure during the procedure [8].

In this study showed the mean oxygen saturation were not statistically significant ( $p > 0.05$ ) between two groups at baseline after 0, 5, 10, 15, 30, 45, 60 minutes. Joshi *et al.*, [6] there was no significant difference between mean SpO<sub>2</sub> in group DK and group PK from baseline to 60<sup>th</sup> min.

In current study observed Tachycardia, bradycardia, hypertension and hypotension were not statistically significant ( $p > 0.05$ ) between two groups. Mogahed and Salama reported 6 (20%) patients in group KD exhibited nausea and vomiting in comparison to 5 (16.7%) patients in group KP ( $P = 0.739$ ) [7]. Tewari *et al.*, [11] reported similar observation they showed there was no statistical difference in the nature of the cardiac lesions being addressed between the treatment arms. There was no difference in the variation of cardiorespiratory and haemodynamic parameters in patients between the two treatment arms in both the stratified categories.

In this study showed that mean recovery time was found 39.6  $\pm$  7.9 minute in DK group and 22.3  $\pm$  3.5 minute in PK group. The difference was statistically significant ( $p < 0.05$ ) between two groups. Joshi *et al.*, [6] recovery was significantly delayed in DK group (40.88  $\pm$  8.19) versus 22.28  $\pm$  3.63 min in PK group ( $P < 0.05$ ). Tosun *et al.*, [8] the effects of DK and PK combinations on hemodynamics, sedation level and the recovery period in pediatric patients undergoing cardiac catheterization were studied. The study conducted by Heard *et al.*, which compared the Dexmedetomidine-Midazolam with propofol for maintenance of anesthesia in children undergoing magnetic resonance imaging suggested that the time to full recovery was significantly longer after dexmedetomidine administration than after propofol by 15 min. Mogahed and Salama observed recovery time in group KP (15.5  $\pm$  3.9 min) was shorter than that in group KD (17.2  $\pm$  4.8 min) but not reach statistical significance ( $p = 0.138$ ) [7]. They also reported shorter recovery time in group PF in comparison to group PK [13].

In this study observed that 35(70.0%) patients were Ketamine boluses consumption in DK group and 45(90.0%) in PK group. The difference was statistically significant ( $p < 0.05$ ) between two groups. Joshi *et al.*, [6] reported actual ketamine consumption was (2.02 mg/kg/h) in DK group, whereas in PK group, it was (1.25 mg/kg/h). Ketamine boluses consumption was significantly higher in DK group (09 patients in DK vs.

02 patients in PK) ( $P \leq 0.05$ ). Similar study by Tosun *et al.*, [8] which compared the same drugs for children undergoing minor cardiac procedures in cardiac catheterization laboratory, showed that ketamine consumption in dexmedetomidine group was more than the propofol group (2.03 vs. 1.25 mg/kg/h). This may be due to higher ketamine doses used on group KD (2.02 mg/kg/h) than in group PK (1.25 mg/kg/h) [6].

## CONCLUSION

This study observed that the no significant difference were found ketamine and propofol versus ketamine and dexmedetomidine combinations on hemodynamic stability, respiratory variables and recovery time in children undergoing minor procedures in cardiac catheterization laboratory. Here use of DK combination is a safe, practical alternative, without any hemodynamic or respiratory effects during the cardiac catheterization laboratory procedure but recovery time some delayed than PK combination.

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