RESEARCH PAPER

A Comparative Study between General Anesthesia versus Sedation by Dexmedetomidine and Ketamine with Local Infilteration for Percutaneous Transcatheter Closure of Atrial Septal Defect in Pediatric Patients

Aya Ebrahim Mashal[1*], Jehan Mohammad Darwish[2], Aymen Abd Elmaksoud Yousef[3], Mohammad Ebrahim Okab[4], Shaimaa Elsaid Shaban[5]

[1,2,3,4,5]Anesthesia, Intensive Care and Pain Medicine Department, Faculty of Medicine, Tanta University, Tanta, Egypt

***Corresponding author:**

Aya Ebrahim Mashal,

Anesthesia, Intensive Care and Pain Medicine Department, Faculty of Medicine, Tanta University, Tanta, Egypt.

Abstract

Background: A cardiac condition known as atrial septal defect (ASD) is characterized by an inadequate closure of the communication between the right and left atria. This work aimed to compare between general anesthesia (GA) versus sedation with dexmedetomidine and ketamine with local infilteration at the catheter insertion site in pediatric patients undergoing transcutaneous closure of ASD on hemodynamic changes.

Methods: This prospective randomized study involved sixty pediatric cases scheduled for elective ASD closure who were selected from Tanta University Hospitals. All cases were randomly classified into 2 equal groups: Group A (GA group) received GA and Group B (local anesthesia group) received local anesthesia.

Results: The incidence of emergency agitation was significant lower in group B (LA) than group A (GA) ($P<0.001$). The recovery time was significant decrease in group B (LA group) than group A(GA group) (P value < 0.001). Vomiting and nausea were significant increase in group A (GA group) than group B (LA group) ($P=0.037$, 0.003).

Conclusions: Both GA and sedation with dexmedetomidine and ketamine with local infiltration were comparable in maintaining hemodynamics regarding heart rate, mean blood pressure, left ventricular function and respiration and oxygen saturation at the catheter insertion site in pediatric patients undergoing transcutaneous closure of ASD.

Keywords: Atrial Septal Defect, General Anesthesia, Sedation, Dexmedetomidine, Ketamine, Local Infilteration, Percutaneous Transcatheter Closure, Pediatric Patients.

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Introduction

Atrial septal defect (ASD) is a congenital cardiac defect that affects approximately 25% of neonates and is one of the most prevalent [1]. ASD is the result of an ineffective closure of communication between the left and right atria. It includes defects that facilitate communication between both atria, as well as those that affect the true septal membrane. ASDs are classified into five categories, the most prevalent being ostium secundum defect, coronary sinus defect, sinus venosus defect, and patent foramen ovale [2].

Cases had heart defects that are less than 5 mm in size may not experience any symptoms, while those that are 8-10 mm in size necessitate intervention in pediatrics [3]. In cardiac catheterization, anesthesia management is a critical component of the procedure that has significant effects on patient safety, comfort, and patient satisfaction [2]. Sedation and general anesthesia (GA) are frequently implemented during cardiac catheterization [3]. Myocardial contractility will be diminished and respiratory mechanics will be altered invariably as a consequence of the depth of anesthesia required to tolerate the presence of a tracheal tube. Typically, GA is obtained through tracheal intubation and mechanical ventilation or spontaneous respiration. The objective of anesthetic technique is to guarantee hemodynamic stability and immobility during cardiac catheterization by administering analgesia and sedation [4, 5].

Having sympathomimetic, analgesic, and sedative properties, ketamine is an antagonist of the N-methyl-D-aspartate receptor [6]. One of its advantages is its capacity to safeguard airway reflexes while minimizing the impact on ventilatory drive. It is relatively contraindicated in patients with underlying neuropsychiatric comorbidities, such as seizures or psychoses, respiratory tract infection, increased intracranial pressure, or hypertension [7].

Dexmedetomidine is a highly selective alpha-2 adrenoreceptor agonist with sedative, anxiolytic, and analgesic effect [8], it also blunts the sympathetic nervous system response to surgical stimulation [9].

In comparison to other sedatives, it has a shorter elimination half-life and a lower risk of respiratory depression [10]. It is a safe sedative for pediatric patients; however, it can induce bradycardia and hypotension in a dose-dependent manner [11, 12].

The purpose of this work was to compare between GA versus sedation with dexmedetomidine and ketamine with local infilteration at the catheter insertion site in pediatric patients undergoing transcutaneous closure of ASD on hemodynamic changes.

Patients and Methods

This prospective randomized study involved sixty pediatric cases age 3-8 years old from both genders, American society of anesthesiologists (ASA) physical status II-III, who were scheduled for elective ASD closure who were selected from Tanta University Hospitals in the period from May 2023 to May 2025. An informed written consent was obtained from every child parent. The study was done after approval from the Ethics Committee of the Faculty of Medicine, Tanta University Hospitals (approval code:). The registration number of the the current study was Clinical trail gov ID: NCT06431178

Exclusion criteria were patients with multiple congenital anomalies, with congestive heart failure, with organ dysfunction liver or renal disease or pulmonary disease, recent chest infection, airway abnormalities and any patient in local anaesthesia group need general anaesthesia to continue the procedure.

Randomization:

All cases were randomly classified into 2 equal groups through computer -generated randomization using sealed opaque envelope:

- Group A (GA group) (n= 30): received GA.
- Group B (local anesthesia group) (n= 30): received local anesthesia.

Preoperative evaluation:

The medical and surgical history of patient was assessed, clinical examination of the patient was performed, laboratory investigation included complete blood picture, bleeding, clotting time and baseline echo were assessed in all patients. Oral midazolam (0.5) mg/kg was given to each child 30 min before procedure for peaceful separation from parents.

Intraoperative evaluation:

Monitoring HR and rhythm by ECG, peripheral oxygen saturation (SPO2), temperature by temperature probe, non invasive blood pressure (NIBP) using pulse oximeter, and end tidal carbon dioxide using capnogram were measured intra operatively for each patient.

Group A: general anesthesia group (GA group):

Induction of GA was done by 6% sevoflurane with a face mask. An intravenous line (22-g cannula) was inserted then fentanyl 1mcg-kg was given. Endotracheal tube was used to intubate the patient. Anesthesia was maintained by 2% sevoflurane inhalation in an oxygen air compination 1:1 throught the operation. Crystalloid solution was given to replenish fluid according “4/2/1-rule”. Awake extubation was performed in accordance with the recovery criteria for minors at the conclusion of the surgery eg: eye opening, patient movement other than coughing, purposeful movement, hemodynamic, respiratory, neurological stability, normothermia, SpO2 greater than 95% and tidal volume greater than 5ml/kg [3].

Group B: local anesthesia group (LA group):

A nasal cannula was used to administer oxygen at a rate of 2 to 3 L/minute. An intravenous line (22-g cannula) was implanted. The sedation regimen involved loading dose of dexmedetomidine (1 mcg/kg) and ketamine (1mg/kg) over 10 minutes. The patient received an infusion of dexmedetomidine at 0.7 mcg/kg per hour and ketamine 0.5 mg/kg/hr as maintenance sedation. Local infilteration of xylocaine 2% at dose 2mg/kg was given for vascular access in cardiac catheterization. Crystalloid solution was given to replenish fluid according “4/2/1-rule”. After completion of the procedure the infusion pump stopped to ensure that the patient is fully awake according to recovery criteria in children eg: eye opening, patient movement other than coughing, purposeful movement, hemodynamic, respiratory, neurological stability, normothermia, SpO2 greater than 95%.

In both groups normothermia was obtained to patients and temperatue probe was used as a monitoring. In both groups patients transferred to pediatric post anesthesia care unit (PACU) for basic monitoring. Patients admitted to PACU if hemodynamically unstable or any unexpected complications occur.

All measurement verified by an investigator who was not aware about the study design or intervention including demographic data include (age, sex , and body weight of the patients) was recorded, hemodynamic parameters including mean arterial blood pressure (MAP), ejection fraction (EF), respiratory rate (RR), heart rate (HR), and O2 saturation were measured at baseline, after induction, 10 min after catheter insertion site, and 30 min during procedure and post emergence in both groups. The emergence delirium incidence evaluated using the pediatric anaesthesia emergence delirium scale (PAED): Each behavior is rated on a 5-point scale, usually ranging from "Not at all" (0) to "Extremely" (4). The first three items (eye contact, purposeful actions, and awareness of surroundings) are reverse-scored, meaning a higher score indicates a less agitated state. The severity of emergence agitation is more likely to be indicated by a higher total PAED score, which can range from 0 to 20 [13]. The PAED scale was monitored promptly upon emergence and continuously at 10-minute intervals until the patient was discharged from the PACU. The transthoracic echocardiography was conducted with a GE :6vt-Dprobe (3.0-8.0)Mhz. EF was calculated as percentage of blood volume ejected from ventricle during systole and is derived from end-diastolic volume (EDV) and end-systolic volume (ESV) using formula [14]:

$$EF = \frac{EDV - ESV}{EDV} \times 100\%$$

Outcomes:

The primary outcome was to evaluate hemodynamic changes occuring intra and postoperatively in GA versus sedation with dexmedetomidine and ketamine in pediatric cases underwent ASD closure in cardiac catheterization.

The secondary outcomes were the assessment of the recovery time, lengh of hospital stay, and post operative complications (as arrythmia, hypotension, bradycardia, nausea and vomiting).

Sample size justification:

Epi-Info, a statistical program developed by the World Health Organization and the Center for Disease Control and Prevention in Atlanta, Georgia, USA in 2002, was employed to calculate the sample size and power analysis. The following set of criteria was used to calculate the sample size: The best treatment groups anticipated normal hemodynamics in 95% of patients, while the least favorable treatment groups anticipated normal hemodynamics in 65% of patients, with a 95% confidence limit and an 80% power of the investigation. The sample size was determined to be N=28 in each cohort in accordance with the aforementioned criteria. In order to account for the incomplete results, the researcher increased the sample size to 30 cases in each category.

Statistical analysis:

Based on the parameters described above, a sample size of N=28 was calculated for each cohort. The researcher doubled the sample size to 30 cases per category to address the issue of incomplete results. The unpaired student t-test was employed to evaluate the quantitative parametric values of mean and standard deviation (SD). Groups of dependent variables representing various measurements of the same attribute can be analyzed using repeated measures ANOVA. The qualitative variables, presented as percentages and reported as frequencies, were analyzed using the Chi-square test or Fisher's exact test, as appropriate. Statistical significance was determined by a two-tailed P value less than 0.05.

Results

In this study, 87 cases were assessed for eligibility, 15 cases did not meet the criteria,4 cases converted from local to general anaesthesia and 8 cases rejected to participate in the investigation. The remaining 60 cases were randomly assigned to 2 categories, each containing 30 cases. Follow-up and analysis were conducted on all 60 cases. **Figure 1**

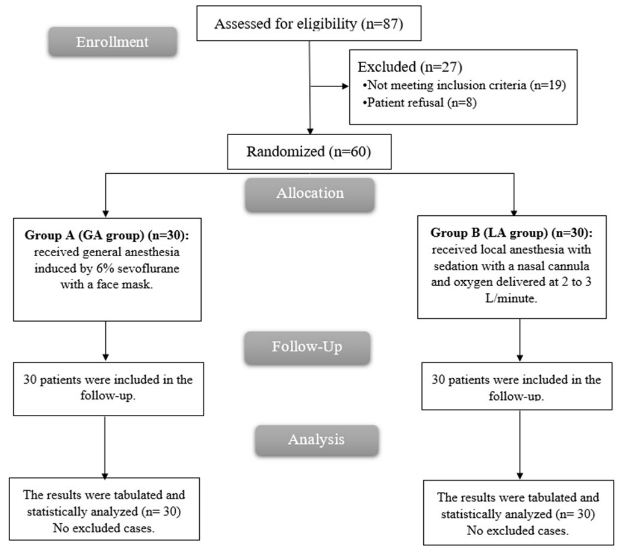


Figure 1: CONSORT flowchart of the enrolled patients

There was insignificant difference between 2 groups concerning baseline characteristics including (sex, weight, age, ASA physical status and surgery duration). **Table 1**

Table 1: Baseline characteristics of the studied groups

		Group A (GA group) (n=30)	Group B (LA group) (n=30)	P value
Age (years)		5.7±1.47	5.53±1.43	0.658
Sex	Male	17 (56.67%)	14 (46.67%)	0.483
	Female	13 (43.33%)	16 (53.33%)	
Weight (kg)		19.8±1.19	19.33±1.12	0.123
ASA physical status	ASA I	16 (53.33%)	18 (60%)	0.602
	ASA II	14 (46.67%)	12 (40%)	
Duration of surgery (min)		38.97±5.96	40.7±6.77	0.297

Data are presented as mean ± SD or frequency (%). ASA: American society of anesthesiologists.

The RR was insignificantly different after induction, 10 min after catheter insertion, 30 min during procedure except at post emergence RR was significant increase in group A than group B. The RR in group A (GA group) was significant increase at post emergence than baseline RR ($P<0.05$). The RR in group B (LA group) was insignificantly different in all measurments compared to baseline. **Table 2**

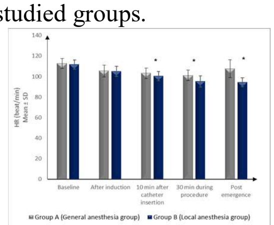
Table 2: Respiratory rate (breath/min)

	Group A (GA group) (n=30)	Group B (LA group) (n=30)	P value
Respiratory rate			
Baseline	21.53±1.25	21.73±1.17	0.525
After induction	21.13±1.63	21.33±1.81	0.604
10 min after catheter insertion	21.03±1.85	21.12±1.72	0.826
30 min during procedure	21.07±1.64	21.24±1.91	0.676
Post emergence	23±1.26	22.86±2.19	**<0.001***
P value within the group	**P1< 0.063, P2< 0.061, P3< 0.075, P4<0.001***	**P1< 0.063, P2< 0.059, P3 <0.053, P4<0.083***	--

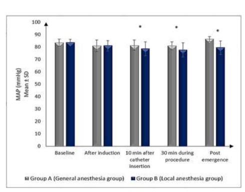
Data are presented as mean ± SD or number. *significant as P-value ≤ 0.05. P 1: p value between baseline and after induction, P2: p between Baseline and 10 min after catheter insertion, P3:p between Baseline and 30 min during procedure and P4:p between Baseline and Post emergence.

Figure 2A shows HR changes of the 2 groups(b/min).

Figure 2B shows MAP (mmHg) changes of the studied groups.



A



B

Figure 2:(A): Heart rate changes of the studied groups(b/min) and (B): MAP (mmHg) changes of the studied groups

In group A (GA group) and group B (LA group); there was an insignificant difference between SpO_2 at baseline and SpO_2 at all-time measurements (at 10 min after catheter insertion, at 30 min during procedure and post emergence). **Table 3**

Table 3: SpO2 (%) changes of the studied groups

	Group A (GA group) (n=30)	Group B (LA group) (n=30)	P value
Baseline	98.20±0.85	97.97±0.81	0.280
After induction	98.30±1.06	98.07±1.20	0.427
10 min after catheter insertion	98.40±1.22	98.30±1.44	0.773
30 min during procedure	98.00±1.11	98.27±1.17	0.370
Post emergence	98.13±0.90	98.03±1.43	0.746
P value within the group	**P1 <0.476, P2<0.184, P3<0.184, P4<0.645**	**P1 <0.178, P2<0.204, P3<0.801, P4<0.801**	--

Data are presented as mean ± SD or number. *significant as P-value ≤ 0.05. P 1: p value between baseline and after induction, P2: p between Baseline and 10 min after catheter insertion, P3:p between Baseline and 30 min during procedure and P4:p between Baseline and Post emergence.

The LV systolic function was insignificantly different between both groups at all time measurements (baseline, after induction, at 10 min after catheter insertion, at 30 min during procedure and post emergence). In group A (GA group) and group B (LA group), LV systolic function was insignificantly different at all time measurements (after induction, at 10 min after catheter insertion, at 30 min during procedure and post emergence) compared to baseline LV systolic function. **Table 4**

Table 4: LV systolic function (%) changes of the studied groups

	Group A (GA group) (n=30)	Group B (LA group) (n=30)	P value
Baseline	65.17±4.99	64.27±5.51	0.510
After induction	64.90±5.19	64.67±6.18	0.875

10 min after catheter insertion	64.90±5.18	64.73±6.16	0.910
30 min during procedure	64.80±5.22	64.57±5.41	0.865
Post emergence	64.83±4.98	64.53±5.28	0.822
P value within the group	**P1 <0.058, P2<0.088, P3<0.062, P4<0.096**	**P1 <0.083, P2<0.095, P3<0.071, P4<0.088**	--

Data are presented as mean ± SD or number. *significant as P-value ≤ 0.05. P 1: p value between baseline and after induction, P2: p between Baseline and 10 min after catheter insertion, P3:p between Baseline and 30 min during procedure and P4:p between Baseline and Post emergence.

The emergency agitation not occurred in both at baseline. Whereas in group A : emergency agitation occurred at Immediate after extubation in 8 (26.67%%) patients, 5 (16.67%) at 10 min after extubation,3 (10%) at 20 min after extubation and 1(3.33%) at 30 min after extubation in group A (GA) while in group B: 1 (3.33%) patient at Immediate after extubation and not occurred at the rest of measurements. The incidence of emergency agitation was significantly decrease in group B (LA) than group A (GA) (P<0.001). The mean recovery time was 19.67±3.35 min in group A (GA group), and was 11.03±1.47 min in group B (LA group). The recovery time was significant decrease in group B (LA group) than group A(GA group) (P value < 0.001). The hospital stay length and the other postoperative complications incidence (arrhythmia, hypotension and bradycardia) were insignificant different between 2 groups. Vomiting and nausea were significant increase in group A (GA group) than group B (LA group) (P=0.037, 0.003). **Table 5**

Table 5: Emergency agitation,recovery time, length of hospital stay and postoperative complications of the studied groups

		Group A (GA group) (n=30)	Group B (LA group) (n=30)	P value
		N%	N%	
Emergency agitation	**Baseline**	0 (0%)	0 (0%)	**<0.001***
	Immediate after extubation	8 (26.67 %)	1 (3.33%)	
	10 min after extubation	5 (16.67 %)	0 (0%)	
	20 min after extubation	3 (10%)	0 (0%)	
	30 min after extubation	1 (3.33%)	0 (0%)	
Recovery time		19.67±3.35	11.03±1.47	**<0.001***
Length of hospital stay (hrs)		28.1 ±10.46	25.33±10.6	0.313
Postoperative complications	**Vomiting**	8 (26.67 %)	2 (6.67%)	**0.037***
	Nausea	10 (33.33 %)	2 (6.67%)	**0.003***
	Arrhythmia	0 (0%)	0 (0%)	---
	Hypotension	1 (3.33%)	2 (6.67%)	0.553
	Bradycardia	0 (0%)	1 (3.33%)	1.000

Data are presented as frequency (%). * significant as P-value ≤ 0.05.

Discussion

In pediatric patients, transcatheter closure of ASDs is a minimally invasive procedure that provides an alternative to open-heart surgery. This approach involves the percutaneous insertion of a closure device to seal the defect, resulting in shorter hospital stays and reduced recovery times. The procedure's success heavily relies on effective anesthesia management to ensure patient immobility and hemodynamic stability [13].

In the current study, the HR, MAP at 10 min after catheter insertion, at 30 min during procedure and post emergence was significantly lower in LA group compared to GA group. The LV systolic function and SpO_2 were insignificantly different between 2 groups at all-time measurements. There were insignificant difference regarding the surgery duration, the hospital stay length between 2 groups. The recovery time was significant decrease in group B than group A. Regarding postoperative complications, vomiting and nausea were significant increase in group A (GA group) than group B (P=0.037, 0.003). There was an insignificant difference between 2 groups regarding the arrhythmia incidence, hypotension and bradycardia. Fashina et al.,[15] revealed that the two cohorts did not exhibit any significant differences in terms of demographic factors, as age, weight, procedure indication, and physiological complexity, as well as outcomes such as hospital stay and sheath time. This was due to that, The cardiovascular stability was preserved by achieving a balance between the cardiostimulatory effects of ketamine and the sympathoinhibitory impacts of dexmedetomidine.

Consequently, the analgesia was satisfactory, and there was no postoperative agitation [16].

In coherence with our data., Tosun et al., [9] showed that the HR in DEX plus ketamine group was significantly lower after induction and throughout procedure than propofol-ketamine group. Tobias, [17] stated that the salivation, hypertension, tachycardia, and emergence phenomena that are caused by ketamine are prevented by DEX, conversely, ketamine may mitigate the bradycardia and hypotension that have been demonstrated to be induced by DEX. In alignment with our data, Li et al., [18] meta-analysis stated that bradycardia incidence was 2% and oxygen desaturation incidence was 3% with DEX and ketamine. In coherence with our data, Joshi et al., [19] demonstrated that the RR in group DK and group PK did not differ significantly from baseline to the 60th minute. The pediatric patients in the DEX-ketamine group were secure on HR for the first 25 minutes following induction, when contrasted with propofol-ketamine. McVey and Tobias, [20] showed that in conservative with our study as SpO_2 remained $\geq$ 95% during procedure in all patients after administration of the bolus dose of ketamine and DEX.

Dexmedetomidine displays analgesic, sedative, and antihypertensive properties as an alpha-2 adrenergic agonist. Consequently, it may be beneficial in the context of surgery when combined with local anesthetics [21]. Dexmedetomidine was administered concurrently with low-dose ketamine, resulting in significant decreases in SBP and DBP. The mean reduction from baseline was approximately 25–30%. These findings are consistent with DEX's acknowledged sympatholytic effects, which may exceed the modest pressor activity of ketamine at the concentrations used. Although DEX also resulted in a decrease in HR, the reduction was only modest, suggesting that ketamine may have partially attenuated the bradycardia induced by DEX [22].

On contrary, McVey and Tobias, [20] was disagree showed significant increase in HR. The difference to our study may be explained by different doses and timing of dexmedetomidine as they gave it for 3 minutes as loading dose compared to ours for 10 minutes. A meta-analysis by Li et al., [18] showed that there was no change in MAP during Dexmedetomidine in combination with ketamine sedation. In disaggrement of our study Joshi et al., [19] found which recovery was prolonged in dexmedetomidine-ketamine group, however, they were compared to the propofol-ketamine group, while we compared with GA. Thiele et al.,[23] stated that left ventricular EF was indifferent between GA and local anesthesia in cardiac catheterization.

The administration of dexmedetomidine as an adjuvant to total intravenous anesthesia in healthy patients, in conjunction with propofol and remifentanil, did not lead to any impairment of systolic or diastolic LV and RV function. In healthy cases, In the presence of propofol and remifentanil, dexmedetomidine was not found to impair systolic or diastolic LV and RV function when used as an adjuvant to total intravenous anesthesia. It was demonstrated that it can be utilized as a co-adjuvant in healthy patients without compromising myocardial function. The induction of cyclic adenosine monophosphate and adenosine-induced coronary vasodilation has also been linked to myocardial protection in the context of DEX use [24].

In agreement with group B, Desai et al., [25] the fact that the study was designed to assess the efficacy of conscious sedation with dexmedetomidine alone for percutaneous transcatheter closure of ASDs in comparison to general anesthesia with an endotracheal tube may have contributed to the mean anesthesia duration of 71.75 + 21.08 minutes.

A previous study suggested that DEX is a desirable sedative option, particularly for small infants, due to its sympatholytic effect, shortened recovery period, minimal effect on respiration and the preservation of systemic vascular and venous resistance, as well as its capacity to decrease oxygen consumption [26]. The N-methyl-d-aspartate receptor antagonism has been proposed as cause of ketamine's advantageous effects. Furthermore, its interaction with voltage-gated sodium channels, ketamine is employed as an adjuvant due to its opioid receptor agonistic properties. The primary advantage of ketamine in pediatric cases is its ability to raise HR while simultaneously acting as both a sedative and analgesic. This preserves rate-dependent cardiac output [27]. It is intriguing that the cardio-stimulatory effects of ketamine are counterbalanced by the sympathoinhibitory effects of DEX, resulting in a hemodynamic profile that is consistent with the typical physiological spectrum. Another frequently employed sedative agent is midazolam, a very short-acting benzodiazepine which possesses hypnotic, anxiolytic, and anticonvulsant properties. Additionally, it induces anterograde amnesia [28].

Furthermore, Mester et al. [29] A benzodiazepine that is extremely short-acting and also has hypnotic, anxiolytic, and anticonvulsant properties is midazolam, another sedative agent that is frequently used. Furthermore, it induces anterograde amnesia. After review of literature by Tobias [17], He demonstrated which the DEX and ketamine combination can mitigate the common adverse impacts of ketamine, including salivation, hypertension, tachycardia,and emergence disturbance. Conversely, ketamine may prevent hypotension and bradycardia, which are caused by DEX. Additionally, ketamine speeds the onset of sedation, so that the delayed onset time is eliminated when DEX is used as the sole agent [30]. The most effective regimen involves administering a bolus dose of DEX (1 μg/kg) and ketamine (1–2 mg/kg) for sedative, with supplemental doses of ketamine

(0.5–1 mg/kg) as needed, despite the diverse regimens that have been introduced in the literature [17].

Furthermore, general anesthesia achieves maximal RSS (RSS 6, unarousable) rapidly in pediatric ASD patients, ensuring complete immobility for procedures like cardiac catheterization. DEX + ketamine sedation targets RSS 4-5 (deep sleep with brisk response to light stimuli), providing reliable procedural conditions with faster recovery and hemodynamic stability [31].

However, Li et al., [18] The meta-analysis confirmed that the sedation outcomes of ketamine and dexmedetomidine for pediatric sedation are superior to those of dexmedetomidine or ketamine. This is accomplished by minimizing beginning of sedation and recovery, while simultaneously ensuring respiratory and hemodynamic stability, with a decrease number of adverse events. Conversely, Ogawa et al.,[32] retrospectively including cases under GA and cases under sedation. The groups exhibited varying baseline characteristics at the patient and hospital levels. The proportion of cases had severe complications was considerably increase in GA group than in sedation group after adjustment. The study's potential limitations included its single-center design and its relatively small sample size, and lack of comparison between dexmedetomidine and ketamine in different groups &doses and variable such as postoperative behaviors in pediatric populations.

Conclusions

Combination of dexmedetomidine and ketamine in local infiltration was effective and safe as regarding hemodynamics with low incidence of vomiting and nausea. Both GA and sedation with dexmedetomidine and ketamine with local infiltration were comparable in maintaining hemodynamics regarding HR, mean blood pressure, left ventricular function and respiration and SpO2 at the catheter insertion site in pediatric patients undergoing transcutaneous closure of ASD.

Therefore, the study recommends that using combination of dexmedetomidine and ketamine with local infiltration instead of GA in pediatric patients undergoing transcutaneous closure of ASD, utilizing the same study methodology on further studies larger sample size and multiple centers and comparing between dexmedetomidine and ketamine in different groups.

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Conflict of Interest: Nil

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ASA	American society of anesthesiologists
ASD	Atrial septal defect
BP	Blood pressure
EF	Ejection fraction
GA	General anesthesia
HR	Heart rate
MAP	Mean arterial pressure
NIBP	non invasive blood pressure
RR	Respiratory rate
SpO_2	Oxygen saturation