Use of Propofol Infusion for Sedation after Pediatric Cardiac Surgery: Propofol Bridge to Tracheal Extubation.

Iqbal Hussain Pathan[1,*], Salman Ahmed[2]

ABSTRACT:

Objective: To find out the safety and efficacy of Propofol Infusion as bridge to tracheal extubation after surgeries of congenital hearts defects in pediatric population.

Methodology: This prospective case series was planned to be conducted at the department of cardiac surgery, National Institute of Cardiovascular Diseases Karachi; during Jan 2024 to December 2025. It was planned to enroll 50 pediatric cardiac patients requiring surgery for congenital heart diseases. However, we collected data of 24 patients only who underwent for palliative or definitive correction of congenital heart defects. Two operated patients; the total Correction of Tetralogy of Fallot and closure of Ventricular Septal defect respectively developed unexplained increase in the serum lactate level in the absence of any changes in the hemodynamic. Both patients shared a common factor of having propofol infusion duration exceeding 8 hours. As the safety of the patient is top most priority, further enrollment was halted.

Results: Our study group included 24 patients, comprising 14 males (58%) and 10 females (42%). Among them, four patients underwent off-pump surgery, with three receiving palliative shunts and one undergoing PDA ligation. Serum lactate was monitored hourly for each patient.

Conclusions: Our study raised the concern with Propofol Infusion in pediatric population if used beyond 8 hours.

Key words: Congenital heart defects, Propofol, Tracheal Extubation. Propofol infusion syndrome.

Cite as: Pathan HI, Ahmed S. Use of Propofol infusion for sedation after Pediatric Cardiac Surgery: Propofol bridge to tracheal extubation. J Muhammad Med Coll. 2026; 16 (2) pp-122-25

Introduction:

Propofol is a rapid-acting intravenous (IV) general anesthetic agent. It exerts its effects through agonist activity at GABA-A receptors and positive allosteric modulation, as well as interactions with endocannabinoid receptors, NMDA receptors, and u-opioid receptors, while also acting as an antagonist on sodium channels [1, 2, 3]. Due to these effects, Propofol infusion is also utilized for sedation in intensive care units (ICUs), with its rapid reversal enabling swift tracheal extubation [4, 5]. Following cardiac surgery, children are kept sedated and paralyzed for varying periods to ensure hemodynamic stability [6] and to assess the mediastinal drain. When a child is scheduled for an extubation trial, it is essential to balance the need for optimal sedation to prevent accidental self-extubation and the dislodging of invasive lines due to agitation, while also ensuring adequate respiratory drive and airway reflexes for a successful extubation [7,8]. The strategies employed in various institutions include the use of high-dose narcotics [9], dexmedetomidine (DEX), and Propofol infusion [10].

The use of Propofol infusion for sedation in adult ICUs is well recognized [11]. However, the use of Propofol infusion as a bridge to tracheal extubation in pediatric intensive care units (PICUs) for sustaining sedation in mechanically ventilated children remains controversial [12], primarily due to concerns about metabolic acidosis, refractory bradycardia, and circulatory failures [13, 14].

We planned a prospective study to determine the safety and efficacy of use of Propofol infusion in our patients operated for congenital heart defects as bridge to tracheal extubation.

Objective:

The main goal was to evaluate propofol infusion's effectiveness as a bridge to a successful tracheal extubation in children. concurrently to assess the propofol infusion's safety for sedation in children.

Operational Definition and Inclusion/ Exclusion Criteria:

For the study purpose, effectiveness of propofol is defined as completing a successful tracheal extubation (no reintubation within six hours) without inadvertent self-extubation or invasive line dislodgment due to patient agitation. The development of unexplained persistent lactic acidosis decides safety "In the absence of hemodynamic instability," where "unexplained" refers to the rising trend of lactic acid in two consecutive reports with samples collected an hour apart.

Inclusion Criteria includes patients operated for congenital heart defects and these patients maintained on Propofol infusion for sedation during the period of mechanical ventilation. Patients aged more than 15 years, patients with any of history of allergy (irrespective of trigger stimuli), patients requiring ventilation beyond 24 hours were excluded. In cases where intensivist suspects hemodynamics instability concerns or changes plan for early extubation (within 24 hours) were also excluded from the study.

1. Associate Professor of cardiac surgery. Section head pediatric Cardiac surgery. Department of cardiac surgery. Gambat institute of medical sciences
2. Consultant Cardiothoracic Surgeon . Dept: Cardiothoracic Surgery. Shifa International Hospitals Ltd., Islamabad.

Corresponding Author :
Email: driqbalnicvd@gmail.com.

Received: 21.12.2025 Revised: 12.01.2026
Accepted: 22.01.2026 Published online : 20.03.2026

Methodology:

This study was conducted prospectively in Cardiac surgery ICU, department of cardiac surgery PAQSJ institute of medical sciences, Gambat from 01-02-2024 to 05-07-2024. We plan to enroll 50 patients however during period of study 27 patients found eligible as per inclusion and exclusion criteria.

Vancomycin infusion is administered one hour in the ward before the shift to the operating theater. Young children are sedated prior to transfer. Induction is performed using a Propofol dose of 3 mg/kg and a nalbuphine dose of 0.1 mg/kg, along with the muscle relaxant Atracurium at a dose of 0.5 mg/kg, while isoflurane is utilized for the maintenance of anesthesia. Following induction, invasive lines are placed.

Close heart procedure like Patent Ductus Arteriosus (PDA) ligation and Modified Blalock-Taussig-Thomas (mBTT) and Central Shunts were caried out without cardiopulmonary bypass support. While intracardiac repairs require establishment of cardiopulmonary bypass with the help of heart lung machined with desired Activated Clotting Time (ACT) of 450 sec with heparin and its effect was reversed by protamine after surgery. Our choice of positive inotropes includes adrenaline, milrinone and nor adrenaline. Patients are shifted to Pediatric intensive care unit (PICU) with Propofol infusion at the dose 50 mics/kg/mint. Our target is to extubate patient within six hours after shifting to PICU depending on surgical consideration like bleeding or ionotropic score[16] and serum lactate level in addition to the respiratory parameters.

Results:

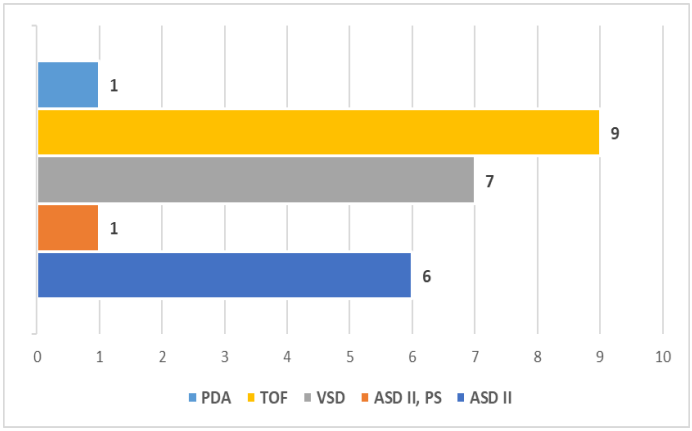
This study initially consists of 27 patients however; 3 patients were excluded from the study due persistent escalation of ionotropic – and requirement of addition of vasopressor support in postoperative period. Therefore, the data of 24 patients was considered finally. Among these 14(58%) were male and 10 (42%) were female with average age of 8.4 years. The general demographic characters and operative and post operative characteristics are shown in table 1.

Table No 1. Demographic, Intraoperative and Post Operative Characteristics (n=24)

Gender	M 14(58%): F 10 (42%)
Age average ,median	8.54 y; 7y
Palliative correction	4(13%)
Definitive correction	21 (87%)
Close heart surgery	4(17%)
Open heart surgery	20(87%)
Cardiopulmonary bypass time	Average 120min with 80min median
Cross clamp time	Average 68 min with 38 min median
Ionotropic score	8.8 with median score of 6
Invasive ventilation time	Average 356.25 with median 134 min

Our four patients underwent off pump surgeries including three patients for palliative shunts for hypoplastic pulmonary arteries with the diagnosis of tetralogy of Fallot and one patient underwent PDA ligation. Our 20 patients underwent open heart surgeries for definitive correction of their congenital heart defects with diagnosis as mentioned in chart 1. Our youngest patient is of 3 years diagnosed case of TOF underwent total correction and oldest of 15 years underwent ASD closure. Our two patients were shifted to the PICU with planned overnight ventilation due to severe pulmonary artery hypertension. We have to halt our study due to observation of unexplained raised serum lactate level in two of our patients. Our first case was 3rd enrolled case while second was 21st case. Later on, after a departmental discussion it was decided to halt further enrolment of patient to avoid any unwanted consequences.

Fig No 1. Diagnosis of patients (n=24)



ASD=Atrial Septal Defect, PS=Pulmonary Stenosis, VSD=Ventricular Septal Defect, TOF=Tetralogy of Fallot, PDA=Patent ductus arteriosus

The description of these both cases for academic purpose is as follows.

1) A 3-year-old child weighing 9 kg was diagnosed with tetralogy Fallot. The child had trans-atrial and trans-pulmonary correction; the surgical process proceeded smoothly, with clamp and bypass times of 80 and 142 minutes, respectively. With a double inotrope support of milrinone and adrenaline and an ionotropic score of 15, he was shifted to the PICU. Child was shifted with the Propofol dose of 450mics per minute (50mics per kg per minute). The patient's initial lactate level upon arrival was 4.5 mmol/l, and the ABG report showed a persistently low Po2, which caused the patient's extubation to be delayed. His four-hourly lactate pattern was 4.5, 3.2, 2.5, and 4.8 (mmol/l). After an hour when repeated it was 6.5 mmol/l, and therefore it was decided to discontinued the propofol infusion. After an hour of propofol discontinuation it was 3.5 mmol/l. The patient was scheduled to wean off of the ventilator, accepting the substandard Po2. The postoperative echo, which was performed in the morning, showed no abnormalities and no right to left shunt at the heart level. The patient's PICU course was uneventful, and at the 5th post operative day the SpO2 was 91%.

2) A 14-year-old child weighing 24 kg having perimembraneous ventricular septal defect (VSD) having significant pulmonary artery hypertension underwent surgery. The VSD closed with clamp and bypass times of 31 and 78 minutes, respectively, the intraoperative course went smoothly. With a ionotropic score of 13, he was shifted to the PICU and given double inotrope support with milrinone and adrenaline. Propofol was administered to the child in the PICU at a rate of 1200 mics per minute (50 mics per kilogram). In accordance with the pulmonary hypertension care guideline, the child was scheduled for overnight ventilation. The patient's initial lactate level upon arrival was 6.3 mmol/l. His lactate pattern was 4,3.2,2.5,2,2.8,7.6 every three hours. When repeated after an hour it was 8.5 mmol/

l, and therefore the propofol infusion was discontinued After an hour of propofol infusion, the serum lactate was 7.2 mmol/l, followed by 5.3 mmol/l, a falling pattern was observed. An unremarkable postoperative echo was performed in the morning. As a result, weaning off the ventilator was scheduled, and the patient was discharged on 6th post operative day with double pulmonary vasodilator medication. The remainder of the postoperative course was uneventful.

Discussion:

Propofol is utilized as induction agent for general anesthesia in adults as well as Pediatric patients with well-established safety.[15] Propofol can be used to help wean patients off of other infusions, such as opiates and benzodiazepines, before extubation. This helps to maintain respiratory drive and airway reflexes for a successful extubation while striking a balance between the need for the desired level of sedation to prevent self-extubation due to agitation.8 Nevertheless, its use in pediatric intensive care units has been largely controversial. First time the concern raised about the use of Propofol infusion for sedation of critically ill children was reported in 1992 when 5 children with airway infection in PICU were sedated with Propofol infusion and these children developed metabolic acidosis and myocardial failure resulting in their death16. Another report published in 1998 involving 18 pediatric patients sedated with Propofol infusion developed severe metabolic acidosis, and cardiac arrest17. However, these both reports includes children that were critically ill and Propofol infusion was planned to use for variable periods. Contrary to these reports; in a prospective study by Sruti Uppuluri et al involving 33 patients use of Propofol infusion for average of 8 hours remained unremarkable18. Another study showed use of Propofol as a bridge to extubation in 30% of the patients admitted in various PICUs in Germany19.There is currently more trend is observed of utilizing Propofol as bridge to tracheal extubation when planned for short period of the time while a decline in utilization of the agents with prolong and often unpredictable effect 20. Our two patients in the current investigation experienced unexplained lactic acidosis. Age, gender, and diagnosis did not correlate. The length of infusion beyond 12 hours was the only correlation found. Additionally, an instantaneous decrease in serum lactate levels with the suspension of propofol infusion suggests a connection between propofol and lactemia.

Conclusion:

Two of the patients in our trial experienced abrupt, inexplicable increases in their lactate levels, which led to the suspension of additional patient enrollment due to patient safety concerns. We do not have enough data to comment on or recommend using propofol as a bridge to extubation. For further evaluation-controlled trial with large sample is required.

References:

1. Orser BA, Bertlik M, Wang LY, MacDonald JF. Inhibition by propofol (2,6 di-isopropylphenol) of the N-methyl-D-aspartate subtype of glutamate receptor in cultured hippocampal neurones. Br J Pharmacol. 1995 Sep;116(2):1761-8. doi: 10.1111/j.1476-5381.1995.tb16660.x. PMID: 8528557; PMCID: PMC1909100.
2. Kingston S, Mao L, Yang L, Arora A, Fibuch EE, Wang JQ. Propofol inhibits phosphorylation of N-methyl-D-aspartate receptor NR1 subunits in neurons. Anesthesiology. 2006 Apr;104(4):763-9. doi: 10.1097/00000542-200604000-00021. PMID: 16571972.
3. Sheridan RL, Keaney T, Stoddard F, Enfanto R, Kadillack P, Breault L. Short-term propofol infusion as an adjunct to extubation in burned children. J Burn Care Rehabil. 2003 Nov-Dec;24(6):356-60. doi: 10.1097/01.BCR.0000095505.56021.27. PMID: 14610418.
4. Marinella MA. Propofol for sedation in the intensive care unit: essentials for the clinician. Respir Med. 1997 Oct;91(9):505-10. doi: 10.1016/s0954-6111(97)90082-2. PMID: 9415349.
5. Fong JJ, Kanji S, Dasta JF, Garpestad E, Devlin JW. Propofol associated with a shorter duration of mechanical ventilation than scheduled intermittent lorazepam: a database analysis using Project IMPACT. Ann Pharmacother. 2007 Dec;41(12):1986-91. doi: 10.1345/aph.1K296. Epub 2007 Oct 23. PMID: 17956957.
6. Epstein R, Ohliger SJ, Cheifetz IM, Malay S, Shein SL. Trends in Time to Extubation for Pediatric Postoperative Cardiac Patients and Its Correlation With Changes in Clinical Outcomes: A Virtual PICU Database Study. Pediatr Crit Care Med. 2022 Jul 1;23(7):544-554. doi: 10.1097/PCC.0000000000002950. Epub 2022 Apr 18. PMID: 35435884.
7. Achauer BM, Mueller G, Vanderkam VM. Prevention of accidental extubation in burn patients. Ann Plast Surg. 1997 Mar;38(3):280-2. doi: 10.1097/00000637-199703000-00016. PMID: 9088468.
8. Pesiri AJ. Two-year study of the prevention of unintentional extubation. Crit Care Nurs Q. 1994 Nov;17(3):35-9. doi: 10.1097/00002727-199411000-00006. PMID: 8000935.
9. Amula V, Vener DF, Pribble CG, Riegger L, Wilson EC et al. Changes in Anesthetic and Postoperative Sedation-Analgesia Practice Associated With Early Extubation Following Infant Cardiac Surgery: Experience From the Pediatric Heart Network Collaborative Learning Study. Pediatr Crit Care Med. 2019 Oct;20(10):931-939. doi: 10.1097/PCC.0000000000002005. PMID: 31169762; PMCID: PMC6776694.
10. Sun Y, Ye H, Xia Y, Li Y, Yuan X, Wang X. Clinical efficacy of dexmedetomidine in the diminution of fentanyl dosage in pediatric cardiac surgery. Minerva Pediatr. 2017 Jun;69(3):181-187. doi: 10.23736/S0026-4946.16.04240-7. Epub 2015 Sep 1. PMID: 26329656.
11. Paramsothy J, Gutlapalli SD, Ganipineni VDP, Mulango I, Okorie IJ et al. Propofol in ICU Settings: Understanding and Managing Anti-Arrhythmic, Pro-Arrhythmic Effects, and Propofol Infusion Syndrome. Cureus. 2023 Jun 15;15(6):e40456. doi: 10.7759/cureus.40456. PMID: 37456460; PMCID: PMC10349530.
12. Hatch DJ. Propofol in paediatric intensive care. Br J Anaesth. 1997 Sep;79(3):274-5. doi: 10.1093/bja/79.3.274. PMID: 9389838.
13. S. S. Barnes, R. S. Greenberg, S. R. Kudchadkar. Propofol infusion in children. Anesthesia; 2016; 71(8). doi:10.1111/anae.13556
14. Scott Hemphill, Luke McMenamin, Mark C. Bellamy, Philip M. Hopkins. Propofol infusion syndrome: a structured literature review and analysis of published case reports. British Journal of Anaesthesia. 2019;122 (4) pp.448-459. doi: 10.1016/j.bja.2018.12.025

15. Propofol injection: Product information [Internet]. Canada.ca. 2025. Available from: https://health-products.canada.ca/dpd-bdpp/info?lang=eng&code=92203.
16. Parke TJ, Stevens JE, Rice AS, Greenaway CL, Bray RJ, Smith PJ, Waldmann CS, Verghese C. Metabolic acidosis and fatal myocardial failure after propofol infusion in children: five case reports. BMJ. 1992 Sep 12;305(6854):613-6. doi: 10.1136/bmj.305.6854.613. PMID: 1393073; PMCID: PMC1883365.
17. Bray RJ. Propofol infusion syndrome in children. Paediatr Anaesth. 1998;8(6):491-9. doi: 10.1046/j.1460-9592.1998.00282.x. PMID: 9836214.
18. Uppuluri S, Villarreal EG, Dorsey V, Yousaf F, Farias JS et al. Propofol in the Pediatric Intensive Care Unit, a Safe and Effective Agent in Reducing Pain and Sedation Infusions: A Single-Center Retrospective Study. Cureus. 2022 Aug 12;14(8):e27925. doi: 10.7759/cureus.27925. PMID: 36120285; PMCID: PMC9464424.
19. Kruessell, Markus A. MD; Udink ten Cate, Floris E. A. MD, PhD; Kraus, Anna-Julia; Roth, Bernhard MD; Trieschmann, Uwe MD. Use of propofol in pediatric intensive care units: A national survey in Germany. Pediatric Critical Care Medicine. 2012 13(3):p e150-e154: 10.1097/PCC.0b013e3182388a95
20. Bhalala US, Patel A, Thangavelu M, Sauter M, Appachi E. Propofol Infusion Is a Feasible Bridge to Extubation in General Pediatric Intensive Care Unit. Front Pediatr. 2020 May 28;8:255. doi: 10.3389/fped.2020.00255. PMID: 32548082; PMCID: PMC7271836.

Authors' Contribution	
Iqbal Hussain Pathan	Conceive, data collection, manuscript writing
Salman Ahmed	Review of Literature