CASE REPORT

Bali Journal of Anesthesiology (*BJOA*) 2017, Volume 1, Number 3: 70-72
E-ISSN: 2549-2276

Published by DiscoverSys

Case series: deep sedation for paedatric patients with pericardial effusion

Ratna Farida Soenarto, Jefferson Hidayat, Hendy Armanda Zaintama

ABSTRACT

Background: Pericardial effusion is an abnormal fluid accumulation in the pericardial space that potentially compromises cardiovascular function, thus it needs a prompt treatment. Pericardial effusion evacuation in paediatrics can be done by subxyphoid pericardiotomy, which requires patient's cooperation. General anaesthesia for paediatrics with pericardial effusion has been reported unfavourable. This case series reports safe anaesthesia procedures done for pericardiocentesis through both sedation and general anaesthesia.

Case Presentations: Cases were taken from Cipto Mangunkusumo Hospital, Jakarta, Indonesia. 6 patients underwent sedation and 3 patients underwent general anaesthesia. Both groups used ketamine, midazolam and fentanyl. Sevoflurane was used as inhalation agent for maintenance. Blood pressure, heart rate, and SpO_2 were recorded before and after pericardiocentesis. In both groups, there were no significant different between systolic and diastolic blood pressure, heart rate, and SpO_2 before and after the procedure ($p>0.05$). Immobilization through sedation or general anaesthesia is required to perform an optimal pericardiotomy. Anaesthetic agents were chosen based on their minimal effects toward myocardial depression. Fluids balance before and after the procedure was crucial to prevent hemodynamic instability during effusion evacuation.

Conclusion: Both sedation and general anaesthesia were safe for pericardiocentesis, with concern toward anaesthetic agents that were minimally depressive to myocardium, combined with opioid analgesics and other sedative agents, with balanced anaesthesia principle. Optimal intravenous fluid therapy with echocardiography monitoring is crucial. Sedation is more advantageous for patients requiring pericardiocentesis without preoperative preparation for general anaesthesia.

Keywords: paediatrics, pericardiocentesis, pericardial effusion, sedation, anaesthesia

Cite This Article: Soenarto, R.F., Hidayat, J., Zaintama, H.A. 2017. Case series: deep sedation for paedatric patients with pericardial effusion. *Bali Journal of Anesthesiology* 1(3): 70-72. DOI:10.15562/bjoa.v1i3.33

Department of Anesthesiology and Intensive Care, Faculty of Medicine, Universitas Indonesia Jakarta, Indonesia

INTRODUCTION

Pericardial effusion is an abnormal fluid accumulation in the pericardial space. The etiology of this condition varies from neoplasm, collagen vascular diseases, kidney diseases, viral and bacterial infections to idiopathic.[1-3] In normal condition, the pericardial space is filled with 10-50 ml fluid that was produced by the pericardium layer. Fluid accumulation more than this limit in an acute time scene might lead to cardiac compression, hampering the filling of cardiac chambers, obstructing ejection process, and in the end decreasing cardiac output (cardiac tamponade).[4]

Classic clinical picture of cardiac tamponade is known as the Beck's triad[5] (neck veins distension, hypotension, "distant" cardiac sounds). Cardiac tamponade is considered as a life threatening condition, thus it needs prompt treatment.[4]

Immediate therapy for severe pericardial effusion is fluid evacuation by means of surgery or the less invasive pericardiocentesis. In 2012, Rawlinson and Bagshaw stated that anaesthesia in paediatric patients with pericardial effusion was associated with unfavourable physiological changes and the occurrence of major side effects.[6] Medical procedures done as therapy are surgical intervention in which most patients underwent general anaesthesia with endotracheal tube intubation. Ketamine is commonly used as an induction agent.[3]

Pericardiocentesis with echocardiography assistance serves as an alternative therapy for immediate pericardial effusion treatment. This procedure requires patient immobilization although it is less invasive, thus it requires deep sedation. This case series reports anaesthesia procedures done for pericardiocentesis with general anaesthesia and without endotracheal intubation.

CASE REPORT

Data was collected retrospectively from nine paediatric patients that underwent pericardiocentesis in Integrated Cardiac Service Unit, Cipto Mangunkusumo National Hospital, Jakarta, Indonesia in 2015-2016. Six patients underwent sedation and 3 patients underwent general anaesthesia (Table 1). All patients underwent pericardiocentesis without proper preparation, including fasting. All patients received peripheral vein access with maintenance fluids.

*Correspondence to:
Ratna Farida Soenarto, Department of Anesthesiology and Intensive Care, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jl. Salemba Raya 6, Jakarta 10430, Indonesia
fida.soenarto@gmail.com

Anaesthetic agents used in both groups are ketamine, midazolam and fentanyl. Sevoflurane as inhalation anaesthetic agent was used as maintenance in patients with general anaesthesia.

All patients underwent pericardiocentesis and effusion fluid aspiration was done gradually. Subxyphoid puncture was done using local anaesthetic infiltration even though patients have been sedated. Using Seldinger technique, cardiac catheter was inserted into the pericardium space and was connected with a three-way stopcock that enables the aspiration of effusion fluid done gradually in regards of the velocity and the volume. Observation towards blood pressure, heart rate and SpO_2 was done during the procedure. Data recorded include blood pressure changes, heart rate, and SpO_2 before and after sedation and also before and after general anaesthesia. Data analysis was done by SPSS.

As shown in Table 2, there were no significant changes (CI 95%) in the systolic and diastolic blood pressure in both time points (before procedure and end of procedure) in both sedation group and general anaesthesia group. There were also no significant changes in the heart rate and SpO_2 in both groups.

Table 1 **Patients' Characteristics**

Patients	Sedation	General Anesthesia
Age (years)	8.3 (0.7–16) **	3.8 (0.5 – 7) **
Sex		
Female	4	2
Male	2	1
Body weight (kg)	37.9 (7.7–68)**	11.8 (5.1 – 18.5)**
Anesthesia agents :		
Ketamine	4	3 (100%)
Midazolam	3	1
Fentanyl	6 (100%)	2
Prodecure duration (minutes)	64.17 ±19.17	46.67 ± 17.67

** Data was presented in median (min-max)

DISCUSSION

Theoretically, pericardial effusion decreases cardiac output and causes tissues hypoperfusion. Increased stroke volume cannot guarantee cardiac output improvement since myocardial contractility is hampered mechanically. On the other hand, a decrease in the stroke volume might worsen the condition. Thus, ideally, evacuation of effusion fluid should be done promptly.

Evacuation of effusion fluid procedure in paediatric patients causes additional problems. Given the current condition of limited cardiac output, a minimally invasive strategy is regarded to be more favourable. Pericardiocentesis with subxyphoid needle puncture is a minimally invasive treatment that requires immobilization of the patients. Since paediatric patients have poor cooperation, this procedure needs a condition that could guarantee the operators to work safely. In general, a particular anaesthesia intervention is needed to achieve such condition, namely deep sedation. Deep sedation is a depressed consciousness during which patients are able to respond to painful stimulation.[7] This condition is preferred when adequate immobilization with cardiovascular stability is desired. The risk of deep sedation includes impaired independent ventilation and airway reflex.

Most of anaesthetic agents cause myocardial depression and vasodilatation. In the condition of hampered contractility, anaesthesia potentially worsens patients' hemodynamic. This case series showed that pericardiocentesis can be done safely under both sedation and general anaesthesia. Anaesthetic drugs used in most cases were combination of fentanyl (as analgesic agent), midazolam and low dose of ketamine (1 mg/kgBW). Ketamine was chosen due to its minimal effect on cardiovascular depression and vasodilatation.

A relatively stable hemodynamic state at the start of anaesthesia/sedation could change when the effusion fluid is evacuated. Rapid evacuation of effusion fluid is harmful to the cardiovascular function. Patients with slowly evolving cardiac tamponade are mostly not in euvolemic condition.

Table 2 **Observation of Blood Pressure Changes, Heart Rate, and SpO_2**

	Sedation			General Anaesthesia		
Parameter	Before procedure	End of procedure	p-value	Before procedure	End of procedure	p-value
Systolic BP (mmHg)	121.8 (±14.2)	123.8 (±14.4)	0.896*	85 (±13.3)	86.7 (±11.11)	0.928*
Diastolic BP (mmHg)	71.5 (±11.5)	75 (±7.5)	0.240*	52.5 (45 – 60)	53.3 (±6.1)	0.826*
Heart Rate (bpm**)	124.7 (±28.6)	105.8 (±15.8)	0.304*	116 (±18.0)	110 (±13.0)	0.774*
SpO_2 (%)	97.7 (±1.9)	99(±0.5)	0.146*	94.3 (±4.0)	96.7 (±1.6)	0.423*

Data was presented in mean ± standard deviation (SD); *p-value was analyzed using paired T-test, p significant value is 0.05; **bpm = beats per minute

When the cardiac chambers start expanding due to the loss of mechanical obstruction (as caused by the effusion) the hypovolemic condition will become evident. Cardiac chambers become smaller due to a decrease in the filling, leading to decreased cardiac output (Frank-Starling law). Hence, intravenous fluid therapy before and after pericardicentesis procedure is very important. Echocardiography assistance in this procedure was very helpful since it monitored patients' circulation volume directly.

In the Integrated Cardiac Service Unit of Cipto Mangunkusumo Hospital, paediatric cardiologists did the pericardiocentesis procedures in paediatric patients. A good cooperation between the operators and the anaesthesiologists is crucial to achieve and maintain patient's stability. By cardiac catheters used to aspirate the effusion, the operator enable the adjustment of aspiration's velocity. Anaesthesiologists can also help the adjustment rate according to patient's hemodynamic state.

Moreover, patients' pre-procedural state was relatively good, which may affect good outcome. There were no patients came in with shock, since all patients received an emergency treatment beforehand in the Emergency Department or in the wards of Cipto Mangunkusumo Hospital. In addition, diagnosis establishment was made promptly. Early diagnosis of pericardial effusion was possible thanks to the echocardiography assessment. Pericardial effusion diagnosis with echocardiography is IC recommendation class,[4,8] which is an accurate, sensitive, can be done from bedside and non-invasive.[9] The availability of echocardiography device might be the reason of the low number of pericardial effusion case found in the Integrated Cardiac Service Unit of Cipto Mangunkusumo Hospital. Outside this hospital, it is possible that not all patients presented with hemodynamic instability or respiratory distress are suspected with pericardial effusion and followed by echocardiography assessment. The actual incidence rate of pericardial effusion might be higher if echocardiography assessment was done to all patients with these particular complaints.

CONCLUSIONS

The evacuation of pericardial effusion could be done safely through pericardiocentesis, using a cardiac catheter to do a gradual aspiration. Pericardiocentesis procedure was carried out safely under either sedation or general anaesthesia, with concerns towards anaesthetic agents that has a minimal effect on myocardial depression, combined with opioid analgesic and other sedative agents, with balance anaesthesia principle. An optimal intravenous fluid therapy with direct monitoring of echocardiography is very important. The combination of pericardiocentesis procedures with sedation might be more advantageous for patients without preparation for elective general anaesthesia.

REFERENCES

1. Kuhn B, Peters J, Marx GR, Breitbart RE. Etiology, management, and outcome of pediatric pericardial effusions. Pediatr Cardiol. 2008:29:90-4.
2. Goswami S, Kachulis B, Mulaikal TA, Shanewise JS. Cardiac physiology. In: Flood P, Rathmell JP, Shafer S, editors. Stoelting's Pharmacology and physiology in anesthetic practice. 5th ed. Philadelphia: Lippincott, William, Wilkins. 2015. p 392-417.
3. Shakti D, Hehn R, Gauvreau K, Sundel RP, Newburger JW. Idiopathic pericarditis and pericardial effusion in children: contemporary epidemiology and management. J Am Heart Assoc. 2014;3:e001483.
4. The European Association for Cardio-Thoracic Surgery. 2015 ESC guidelines for the diagnosis and management of pericardial diseases. European Heart Journal. doi:10.1093/eurheartj/ehv318. Cited March 3, 2016.
5. Sternbach G. Claude Beck: cardiac compression triads. J Emerg Med. 1988;6:417-9.
6. Rawlinson E, Bagshaw O. Anesthesia for children with pericardial effusion: a case series. Paediatr Anaesth. 2012;22(11):1124-31.
7. American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists. Anesthesiology. 2002;96:1004-17.
8. Sagrista-Sauleda J, Merce AS, Soler-Soler J. Diagnosis and management of pericardial effusion. World J Cardiol. 2011:3:135-43.
9. Bagri NK, Yadav DK, Agarwal S, Aier T, Gupta V. Pericardial effusion in children: experience from tertiary care center in Northern India. Indian Pediatrics. 2014:51:211-3.