Journal of Anaesthesia and Pain, 2024, Volume: 5, No.1: 20-23
https://jap.ub.ac.id
P-ISSN : 2722-3167
E-ISSN : 2722-3205

Case Report

# Dexmedetomidine as an Ambulatory Sedation Agent for Abdominal Magnetic Resonance Imaging in Pediatric Patients with Suspected Pheochromocytoma

Prataganta Iradat[1], Rudy Vitraludyono[1], Karmini Yupono[1]
[1]Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Brawijaya Univesity, Dr. Saiful Anwar Hospital, Malang, Indonesia

**ABSTRACT**

**Background:** Pheochromocytoma is a vascular tumor of chromaffin tissue, most commonly at the adrenal medulla, that produces and secretes norepinephrine and epinephrine and is a tumor that secretes catecholamines. Magnetic resonance imaging (MRI) is often used to provide clinical data and remains challenging in pediatrics. We present anesthesia management for abdominal MRI in pediatric patients with suspected pheochromocytoma.
**Case:** A 12-year-old child weighing 25 kg with a diagnosis of suspected pheochromocytoma will have an abdominal MRI for diagnosis with sedation. Intravenous sedation technique using dexmedetomidine loading dose 50 µg for 10 minutes and continued maintenance of dexmedetomidine dose 17.5 µg/hour. Durante's MRI showed stable hemodynamics. Post-MRI of the abdomen, monitoring, and evaluation were carried out in the conscious recovery room and found no complications.
**Conclusion:** The use of dexmedetomidine as a sedation agent in patients with suspected pheochromocytoma generally shows stable hemodynamics in the absence of signs of catecholamine spikes.

**Correspondence:**
Prataganta Iradat, MD
Anesthesia and Intensive Care Department, Medical Faculty, Brawijaya University- Dr Saiful Anwar Hospital
e-mail:
prataganta@gmail.com

Keywords: pheochromocytoma, sedation, dexmedetomidine, abdominal MRI

**Received:** November 2023, **Revised:** November 2023**, Accepted**: December 2023, **Published**: January 2024
**How to cite this article:** Iradat P, R Vitraludyono, K Yupono. Dexmedetomidine as an ambulatory sedation agent for abdominal magnetic resonance imaging in pediatric patients with suspected pheochromocytoma. *Journal of Anaesthesia and Pain*. 2024:5(1):20-23. doi: 10.21776/ub.jap.2024.005.01.04

## INTRODUCTION

Pheochromocytoma is a vascular tumor of chromaffin tissue (most commonly the adrenal medulla) that produces and secretes norepinephrine and epinephrine and is a tumor that secretes catecholamines and consists of cells originating from the embryonic neural crest. Pathophysiology, diagnosis, and treatment of this tumor need an understanding of catecholamine, adrenergic agonist, and antagonist pharmacology. The rare neuroendocrine tumor pheochromocytoma is the cause of hypertension in 0.5–2% of pediatric cases.[1]

Administering sedation to pediatric patients undergoing Magnetic resonance imaging (MRI) poses a substantial challenge for anesthesiologists. The enclosed environment of the MRI apparatus, characterized by a tubular configuration and the production of sufficiently loud auditory stimuli, induces fear and apprehension in children. Moreover, the inherent difficulty of children maintaining stillness for prolonged periods necessitates the implementation of deep sedation during MRI procedures.

Deep sedation is characterized by a state of unconsciousness and unresponsiveness to verbal commands induced by the deliberate depression of the nervous system. During deep sedation, possible anxiolysis, induction of anamnesis, and immobilization should be given full consideration. An anesthesiologist must also maintain hemodynamic stability, all while avoiding respiratory depression.[2]

The hemodynamic perspective for patients with pheochromocytoma is a significant challenge, and some clinical situations sometimes seem more complex and life-threatening, especially when undiagnosed. In some conditions, it's even can induce a hypertension crisis, which is life-threatening, with a published mortality rate of 80%. Pre-sedation evaluation in this patient is a key to success in anesthesia management.[3] There is still limited data regarding the etiology, diagnosis, and management of pheochromocytoma in children. So, it is necessary to carry out more research and case reports regarding patients with this disease. This case report presents anesthesia

management for abdominal MRI in pediatric patients with suspected pheochromocytoma.

## CASE

A 12-year-old boy, weighing 25 kg, with physical status American Society of Anesthesiologists (ASA) II, suspected malignancy pheochromocytoma with differential diagnosis adenoma, hypertension stage 1. Patients have complained of severe headaches and sometimes palpitation without an apparent cause, accompanied by high blood pressure, since last year. The patient has no history of asthma, history of surgery, history of routine drug consumption, and complaints of the same illness before. A family history of the disease with the same complaints is denied.

Patients was planned to perform abdominal Magnetic resonance imaging (MRI) examination with sedation. In the pre-sedation physical examination, spontaneous breathing, patent airway with a respiratory rate of 22 times/minute was obtained, symmetrical right and left chest wall movements, both vesicular lung fields, no rhonchi or wheezing, oxygen saturation of 96% with room air. The patient's extremities were red, dry, and warm. Capillary refill time <2 seconds, pulse rate of 104 times/minute strong, regular, blood pressure was 121/74 on amlodipine and clonidine therapy. Regular I-II heart sound: there is no murmur or gallop sound. The patient's GCS was E4V5M6 with light reflex +/+ and a 3mm/3mm isochoric pupil: normal spontaneous urination and no complaints. The abdomen was not distended, and found no tenderness. Leg edema and cyanosis of the extremities are negative. The pre-sedation laboratory results can be seen in **Table 1.**

**Table 1.** Preoperative laboratory results

| Variables | Score |
|---|---|
| Hemoglobin | 11.8 |
| Leukocytes | 11,06 |
| Hematocrytes | 33% |
| Platelets | 403.000 |
| swab rapid antigen | negative |
| PT (Patient/control) | 10.1/11.1 |
| Sodium | 130 |
| Potassium | 3.44 |
| Chloride | 102 |
| Ureum | 50.7 |
| Creatinine | 0.98 |
| aPTT (Patient/control) | 27.2/24.6 |

PT: prothrombin time; aPTT: activated partial thromboplastin time

From the echocardiography examination, the cardiac function and structure were normal. The results of renal Doppler ultrasonography examination showed that there were no signs of bilateral renal artery stenosis, and bilateral adrenal masses, which were suspected of pheochromocytoma with differential diagnosis adenoma, were found.

Before the procedure, non-invasive monitors such as systolic (SBP) and diastolic blood pressure (DBP), pulse, echocardiography (ECG), and oxygen saturation are installed. Then sedation was carried out with intravenous techniques using dexmedetomidine, loading dose 50 µg for 10 minutes, and continued maintenance using dexmedetomidine 17.5 µg/hour. Abdominal MRI runs for one hour with hemodynamics, as summarized in **Figure 1**. After abdominal MRI, monitoring and evaluation are carried out in the recovery room. Hypoventilation, apnea, airway obstruction, aspiration, hypotension, bradycardia, and increased intracranial pressure are complications of deep sedation. After evaluation, no complications were found, and with a post-anaesthetic discharge scoring system (PADSS) score of > 9, the patient was discharged.

## DISCUSSION

Pheochromocytoma is a tumor that is thought to be related to a family history of medullary carcinoma of the thyroid gland or pheochromocytoma that appears in children.[3] Based on the anamnesis, there is no history of medullary carcinoma of the thyroid gland or a previous history of pheochromocytoma from the patient or his family.

Excessive levels of dopamine, adrenaline, noradrenaline, other peptides, and ectopic hormones secreted by pheochromocytoma. As a circulatory hormone, epinephrine (more than 95% derived from the adrenal medulla) acts potently against adrenergic receptors β2 of the vascularization of the skeletal muscles, causing vasodilation leading to hypotension. In contrast, norepinephrine released locally from sympathetic nerve endings between vascularization causes adrenoreceptor-α1 mediated vasoconstriction, leading to hypertension. Based on the pathology process, there will be some typical symptoms and complaints in patients. The classic triad of these diseases is headache, palpitations/tachycardia, and diaphoresis/excessive sweating.[4] In this case, patients often feel dizziness and frequent palpitations.

Clinical signs and symptoms, biochemical testing, and radiographic testing are used to make the diagnosis.[5] In the anamnesis, we obtained complaints of dizziness and palpitations. On physical examination of the patient, it found

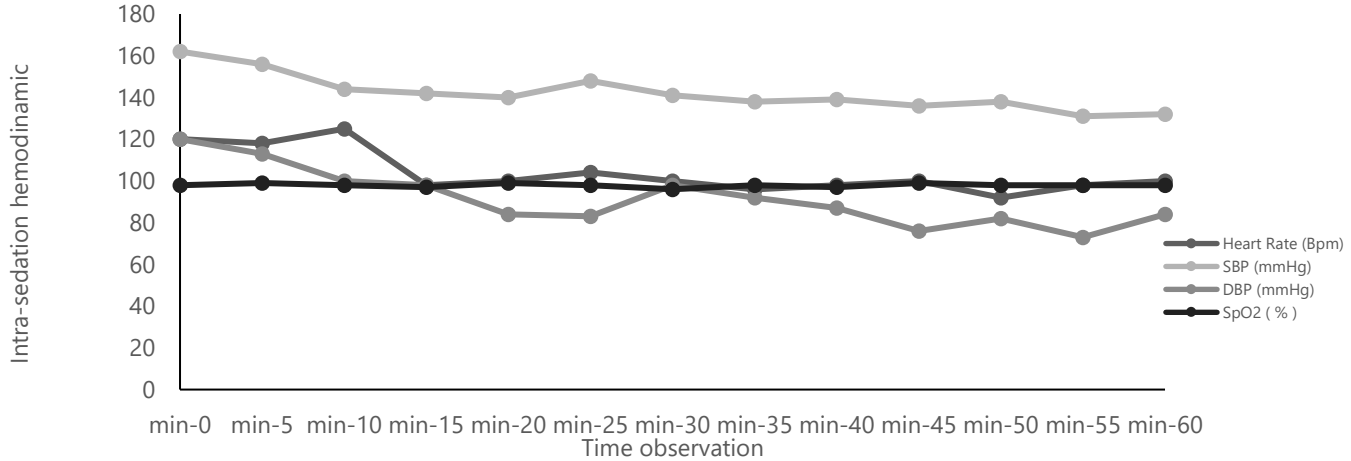


**Figure 1.** Intra-sedation hemodynamic monitoring

sustained high blood pressure with no apparent cause. Therefore, an MRI must be done to provide clinical data supporting the diagnosis.

Optimal pre-anesthesia management, including in the pediatric MRI, is essential for clinical control to prevent elevated plasma catecholamine levels. The Roizen criteria assess whether management is adequate[6]: 1. No hospitalized blood pressure results higher than 165/90 mmHg during the 48-hour pre-operative period. Blood pressure is considered satisfactory if not exceeding 165/90 mmHg. Those parameters were measured at certain intervals, such as every 5 minutes for 1 hour, in the post-anesthesia care unit 2. It is acceptable if the patient's standing arterial blood pressure is at least 80/45 mmHg and orthostatic hypotension happens. 3. Transient ST-T alterations should not be obtained from an ECG test. 4. There is just one premature ventricular contraction (PVC) every five minutes, not more.

Pre-sedation preparation in these patients has been done by maintaining preoperative blood pressure at <160/90; no orthostatic hypotension was found, and no tachycardia was found in patients. Phenoxybenzamine, an irreversible, non-specific, long-acting alpha-adrenergic blockade drug, is a drug option that can be used to control arterial blood pressure and arrhythmia in pheochromocytoma patients. The initial dose is 10mg once or twice a day and increased to 10-20 mg every 48-72 hours to control blood pressure.[1] Clonidine, dexmedetomidine, and magnesium can be used to obtain suitable levels of the α-adrenergic blockade. Patients received amlodipine therapy 1x10mg and clonidine 3x50 µg orally for hypertension control. The administration of such treatment is quite effective in maintaining the patient's blood pressure. It was proven that there were no epidotic tachycardia and arrhythmias until the day of the procedure. One day before the procedure was examined, there were no symptoms of anxiety found in the patient, so no anti-anxiety premedication was given.[6]

Non-operating room anesthesia (NORA), also called anesthesia outside the operating room, includes inpatients and outpatient surgical patients undergoing anesthesia outside the operating room. NORA requires anesthesia providers to work in hospitals with limited access to anesthesia equipment, staff, and supporting personnel. In MRI with sedation, like all NORAs, choosing the right technique depends on the patient's comorbidity. Advances in diagnostic imaging technology have increased the demand for pediatric sedation outside the operating room.[1,2]

Pediatric subjects often experience distress when confined within the tube-shaped structure of an MRI apparatus, compounded by the intimidating noise emitted during machine operation. Furthermore, the inherent challenge of children maintaining stillness for extended durations necessitates the implementation of deep sedation as an imperative requirement during MRI procedures. Deep sedation is defined as the purposeful induction of neurologically-induced depression through pharmacological means, leading to a state of profound unconsciousness in which the patient remains unresponsive to verbal stimuli. Considerations for pediatric sedation encompass the attainment of anxiolysis, induction of amnesia, immobilization, and maintaining hemodynamic stability, all while avoiding respiratory depression. Depending on the specific clinical context, the selection of sedation modalities may involve techniques such as intravenous administration or inhalation.[2]

Sevoflurane is the inhaled agent of choice in children because of its less irritative nature to the airway and its ability to provide stable hemodynamic function than other inhaled agents. Nevertheless, the use of sevoflurane as an inhaled agent in pediatric patients is associated with potential side effects, including respiratory apnea and airway obstruction.[7,8] Dexmedetomidine is an α2 adrenergic agonist that can be used for anxiolysis, sedation, and analgesia. Most commonly, dexmedetomidine is used for procedural sedation. Dexmedetomidine produces total intravenous anesthesia without accompanying respiratory depression.[9,10] Dexmedetomidine elicits a distinctive sedative reaction, denoted as "arousable sedation" or "cooperative sedation," signifying a facile transition between states of sleep and wakefulness. These sedative properties are similar to natural sleep. The recommended initial dose is 1 µg/kg intravenously for 10 minutes, followed by maintenance infusion at 0.2 to 0.7 µg/kg/hour. The administration of dexmedetomidine through intravenous sedation for MRI procedures, specifically employing loading doses ranging from 2 to 3 µg/kg, either with or without an infusion at a rate of 1–2µg/kg/h, proves efficacious in pediatric patients devoid of cardiovascular pathology.[11]

Sedation at a dose of 50 µg (2 µg/kg) followed by maintenance syringe dexmedetomidine 17.5 µg/hour (0.7 µg/kg/hour). At the beginning of the MRI, there was an increase in blood pressure (162/102) and heart rate (130 times/minute). However, by the tenth minute, blood pressure and heart rate declined. Throughout the entirety of the MRI procedure, the patient's hemodynamics remain stable. It is noteworthy that an initial elevation in blood pressure may occur at the commencement of the procedure, attributed to the side effects associated with the use of dexmedetomidine. The administration of a loading dose of dexmedetomidine induces a transient increase in blood pressure accompanied by a reflexive reduction in heart rate. This phenomenon is primarily attributed to vasoconstriction resulting from the activation of peripheral α-2B receptors in vascular smooth muscle, constituting an initial physiological response. However, when the vasodilating effect of central α -2A receptors dominates, hypotension will occur as a subsequent response. Increased sympathetic tone, baroreceptor reflexes, and vagal activity mediate dexmedetomidine dose-dependent bradycardia development.[12,13]

After abdominal MRI, monitoring and evaluation are carried out in the recovery room. No complications associated with deep sedation, including hypoventilation, apnea, airway obstruction, aspiration, hypotension, bradycardia, and heightened intracranial pressure. The patient had a post-anesthetic discharge scoring system (PADS) score of >9 and was discharged.

## CONCLUSION

Sedation using dexmedetomidine in patients with suspected pheochromocytoma underwent MRI generally shows stable hemodynamics with no signs of catecholamine spikes.


## ACKNOWLEDGMENT

-


## CONFLICT OF INTEREST

The author declares there is no conflict of interest.

## REFERENCES


1. Butterworth JF, Mackey DC, Wasnick JD. *Morgan & Mikhail's Clinical Anesthesiology*, 6th edition. New York: Mc Graw Hill Education: 2018
2. Gupta B, Lalit G. Kamna K. Anesthesia Considerations for Pheochromocytoma. *International Research Journal of Pharmacy and Medical Sciences*. 2018;1(1): 29-33.
3. Pani N, Jana T, Mohanty R, et al. Pheochromocytoma: Anaesthetic Challenges. *Orissa Medical Journal*. 2016; 36(1):62-67.
4. Pacak K. Preoperative management of the pheochromocytoma patient. *J Clin Endocrinol Metab*. 2007;92(11):4069-4079. doi:10.1210/jc.2007-1720
5. Kim DD, Matsui C, Gozzani JY, Mathias LAST. Pheochromocytoma Anesthetic Management. *OJAnes*. 2013;3:152-155.
6. Shailaja S, Ray A, Ray S, Kirubakaran R. Dexmedetomidine for procedural sedation in children. *Cochrane Database Syst Rev*. 2017; 2017(2):CD010886. doi:10.1002/14651858.CD010886.pub2
7. Jung S. Drug selection for sedation and general anesthesia in children undergoing ambulatory magnetic resonance imaging *Yeungnam Univ J Med*. 2020;37(3):159-168.
8. Lei H, Chao L, Miao T, et al. Serious airway-related adverse events with sevoflurane anesthesia via facemask for magnetic resonance imaging in 7129 pediatric patients: A retrospective study. *Paediatr Anaesth*.2019;29(6):635-639. doi:10.1111/pan.13601
9. Flood P, Rathmell JP, Shafer S. *Stoelting's Pharmacology and Physiology in Anesthetic Practice,* 5th edition. United States of America : Walters Kluwer; 2015,
10. Davis PJ, Cladis FP, Motoyama EK. *Smith's Anesthesia for infants and children*, 8th edition. United States of America: Elsevier; 2011
11. Dean B Andropulous, George A. Gregory. *Gregory's Pediatric Anesthesia*, Sixth edition. United States of America; 2020
12. Lee S. Dexmedetomidine: present and future directions. *Korean J Anesthesiol*. 2019;72(4):323-330. doi:10.4097/kja.19259
13. Suprobo GP, Yupono K, Vitraludyono R. The use of dexmedetomidine on pediatrics undergoing magnetic resonance imaging (MRI) examination. *Journal of Anaesthesia and Pain.* 2021:2(2):76-81. doi:10.21776/ub.jap.2021.002.02.05