

CASE REPORT

Unraveling Anesthetic Challenges of A Patient with Dilated Cardiomyopathy Posted for Lower Limb Amputation Surgery - A Case Report

Madhu Ahlawat*¹, Asha¹

Department Of Anaesthesiology, Rohtak, Haryana, India

ARTICLE INFO

Article history:

Received: July 03, 2024

Received in revised form;

September 29, 2024

Accepted:

October 20, 2024

Keywords:

dilated cardiomyopathy, general anesthesia, peripheral vascular disease, low ejection fraction.

ABSTRACT

This case report details the anesthetic management of a 64-year-old male with dilated cardiomyopathy (DCM) and a significantly reduced ejection fraction, undergoing lower limb amputation for peripheral arterial disease. Managing anesthesia in such patients poses considerable challenges due to the complexities associated with congestive heart failure. The successful administration of general anesthesia in this case can be attributed to a rigorous preoperative assessment and a meticulously devised anesthetic plan. The systematic approach included careful monitoring, fluid management, and the use of specific anesthetic agents that minimize cardiovascular stress, thereby ensuring an uneventful anesthetic course. This report emphasizes the importance of strategic planning and expert execution in the anesthesia management of patients with severe cardiomyopathy undergoing major surgical procedures.

Medical and Health Science Journal

*Correspondent Author:
madhuahlawat27@gmail.com

Introduction

Dilated cardiomyopathy is a disease that affects primarily the myocardium. In dilated cardiomyopathy, a part of the myocardium is dilated without any obvious cause. The ventricular systolic pumping function of heart is impaired, leading to progressive cardiac enlargement and hypertrophy called remodeling. The incidence of dilated cardiomyopathy is reported to be 5-8/100,000 per year, more commonly found in men compared to women, generally between 20-60 years of age.^{1,2,3} It is the third most common cause

of heart failure worldwide and has a high incidence of sudden cardiac death.^{4,5} Managing patients with dilated cardiomyopathy and reduced systolic function presents significant challenges during anesthesia, often resulting in high mortality rates. Maintaining cardiovascular stability and achieving optimal hemodynamic parameters can be challenging in such cases. Here, we present a successful case of anesthesia management for a patient with dilated cardiomyopathy and a low ejection fraction who underwent lower limb amputation.

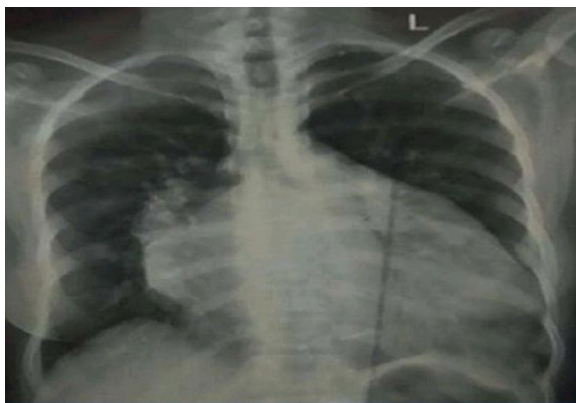


Figure 1- Chest X-ray showing massive cardiomegaly.

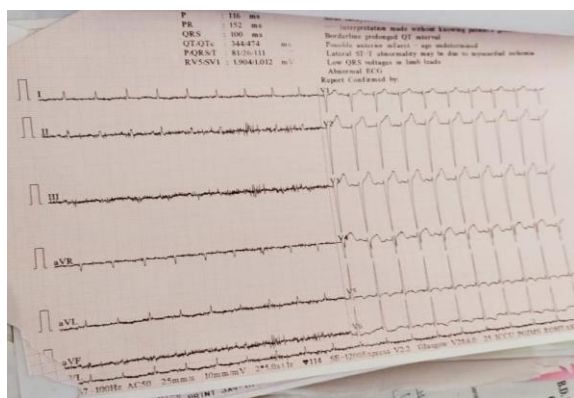


Figure 2: ECG showing sinus tachycardia, ST segment coving in V2-V5, T wave inversion in V4-V6 and poor progression of R wave.

Case Report

A 64-year male patient with a history of type 2 diabetes mellitus, hypertension and coronary artery disease was referred to our institute for lower limb amputation. He was diagnosed with dilated cardiomyopathy. He had history of dyspnea (NYHA II), but no history of nocturnal dyspnea, orthopnea and palpitations. On physical examination, there were no signs of congestive heart failure, e.g., raised JVP, ankle edema, or hepatomegaly. His heart rate was 90/min and his blood pressure was 130/70 mmHg. A 2D echo showed dilated cardiomyopathy, depressed left ventricular systolic dysfunction (EF 10%), mild MR, dilated LA/LV, and a severely hypokinetic left ventricle. X-ray of the chest showed cardiomegaly.

ECG showed sinus tachycardia, ST segment coving in V2-V5, T wave inversion in V4-V6 and poor progression of R wave. His hemoglobin was 12gm/dl, and all biochemical markers were within normal limit. He was on treatment tab Ecosprin 75mg, Atorvastatin 20mg, Lasilactone 20/50 mg, Metoprolol 25mg, Ramipril 2mg, Dapaglifazone 100mg and Cilastazole 100mg. Patient was known diabetic for two years having blood sugar within normal limit. Cardiologist consultation was requested for patient's management, who advised continuing the above drugs. Patients and his relatives were explained about anesthetic risks and a high-risk consent was obtained.

General anesthesia was planned for the amputation of the lower limb. All emergency drugs and defibrillator were kept ready. The patient was monitored with standard American society of Anesthesiologists (ASA) monitors including electrocardiogram, noninvasive blood pressure and pulse oximetry. With all aseptic precautions, an arterial line was inserted for invasive BP monitoring. To maintain stable hemodynamics, anesthesia was induced with inj. Midazolam 1mg iv, inj. Fentanyl 160 micrograms, and inj. Etomidate 12mg iv. After checking ventilation, inj. vecuronium 6mg iv stat given. I-gel of size 4 was inserted and fixed after confirming air entry and adequate chest rise. Maintenance was done on oxygen+air+ sevoflurane. Intraoperatively, saturation was maintained at 98-99%, heart rate between 80-90/min and blood pressure 120-130 systolic, whereas diastolic between 70-80 mmHg. Blood loss was minimal. The patient received 800 mL crystalloid over 40 minutes. The patient remained hemodynamically stable throughout procedure. Other drugs given were tramadol 100 mg slow iv for analgesia, inj paracetamol 1gm iv,

and inj. dexamethasone 8 mg iv to allay postoperative nausea and vomiting. Inj. hydrocort 100 mg iv stat, in between budecort puffs (6-8 puffs), given for poor chest condition. Neuromuscular blockade was reversed with inj. glycopyrrolate 0.4mg and inj. neostigmine 2.5 mg iv, and inj. Esmolol 25 mg iv stat given to blunt sympathetic stimulation at extubation. Patient was shifted to ICU for post operative monitoring. After observing 24 hrs. in the ICU, patient was shifted to the ward.

Discussion

Dilated cardiomyopathy (DCM) presents unique challenges in anesthetic management due to its association with decreased ejection fraction and an increased risk of congestive heart failure. Patients with DCM are particularly vulnerable to changes in volume status and myocardial stress, which can precipitate acute heart failure during surgery (Smith et al., 2021).⁶ The anesthetic management of patients with dilated cardiomyopathy (DCM) undergoing surgery presents unique challenges, particularly due to the associated cardiac dysfunction and the high risk of perioperative morbidity and mortality. DCM often results in a decreased ejection fraction, leading to reduced cardiac output and the potential for congestive heart failure under stress, such as surgery (Smith et al., 2021).⁶

In the context of our 64-year-old patient undergoing lower limb amputation, the complexities were significantly heightened due to the underlying peripheral arterial disease, which itself complicates anesthetic choice and patient stability (Jones and Brown, 2022).⁷ Patients with severe systolic dysfunction are at an increased risk of perioperative morbidity and

mortality. In this case, the anesthetic management plan was focused on minimizing the risks associated with anesthesia in a patient with an EF of less than 10%. The use of balanced anesthesia with etomidate and sevoflurane allowed for a smooth induction and maintenance of anesthesia while minimizing the impact on cardiac function. The administration of general anesthesia in DCM patients requires careful selection of agents that minimize myocardial depression. Studies have suggested that the use of etomidate and ketamine might be preferred due to their lower impact on myocardial function compared to other induction agents (White and Gupta, 2020).⁸ In our case, the induction was managed with etomidate, supported by the findings of Patel et al. (2019)⁹ who reported reduced hemodynamic perturbations with this agent in cardiomyopathy patients. Patients with DCM are especially susceptible to fluid shifts and hemodynamic instabilities during surgery. Anesthetic strategy must, therefore, be meticulously planned to avoid exacerbating the patient's condition. The use of general anesthesia in this context needs to be carefully balanced. Volatile anesthetics, though commonly used, can depress myocardial function and should be administered with caution (Johnson & Roberts, 2020). Intravenous agents that preserve myocardial function, such as etomidate or ketamine, might be preferred to minimize cardiac depression (Brown & Beattie, 2019). Intraoperative management focused on maintaining hemodynamic stability. The use of invasive monitoring techniques such as arterial lines and central venous pressure monitoring are crucial in these patients to provide real-time data on blood pressure and heart function, facilitating immediate adjustments in fluid therapy and vasopressor support (Kim and Lee, 2021).¹⁰

According to Zhang et al. (2020),¹¹ the precise control of volume status and avoidance of fluid overload are essential to prevent exacerbation of heart failure in DCM patients during surgery. Postoperative care for DCM patients should include careful monitoring in a high-acuity setting, such as an intensive care unit, to promptly address potential complications such as arrhythmias, significant fluid shifts, and acute heart failure episodes (Clark and Thompson, 2021).¹² In our case, the patient's postoperative course was uneventful, underscoring the efficacy of our anesthetic and perioperative management strategy. This case highlights the importance of a tailored anesthetic regimen that considers the pathophysiological alterations in DCM. Advanced planning and interdisciplinary collaboration are crucial to manage these high-risk patients effectively, as echoed by the guidelines proposed by Green et al. (2022)¹³ for surgical interventions in patients with severe cardiomyopathies. Patients with DCM are especially susceptible to fluid shifts and hemodynamic instabilities during surgery. Anesthetic strategy must, therefore, be meticulously planned to avoid exacerbating the patient's condition. The use of general anesthesia in this context needs to be carefully balanced. Volatile anesthetics, though commonly used, can depress myocardial function and should be administered with caution.¹⁴ Intravenous agents that preserve myocardial function, such as etomidate or ketamine, might be preferred to minimize cardiac depression.¹⁵ Invasive monitoring techniques such as arterial and central venous pressure monitoring can be crucial for managing unstable patients with DCM. These monitoring tools assist in real-time optimization of preload, afterload, and myocardial contractility during the operative period. Moreover,

the management of these patients does not conclude with the end of the surgery; postoperative care is equally critical. Ensuring adequate analgesia while avoiding respiratory depression is vital to prevent unnecessary strain on cardiac function.¹⁶

Patients with poor ejection fraction may deteriorate from induction of anesthesia until extubation and the postoperative period, so early recognition and immediate intervention of hemodynamic instability with appropriate vasoactive or inotropic medication is required. Ventricular arrhythmias may also occur which are life-threatening, so all emergency drugs such as lignocaine and amiodarone should be kept ready.¹⁷ As patients are on diuretics from pre-operative period, they tend to be dehydrated, which can cause intraoperative hypotension. Preloading is not possible in these patients as it may lead to congestive heart failure, so adequate fluid management is important in these patients. Also, blood products should be made arranged prior to expecting blood loss. Arrhythmias can also occur when patients are on diuretics due to decreased magnesium or potassium, so one should be watchful for dyselectrolytes. Most of the anesthetic drugs are cardio depressant therefore selection of drugs that have minimal cardio-depressant, therefore, selection of drugs that have minimal cardio-depressant effect is of the utmost importance. Etomidate is the ideal induction agent for these patients, as propofol and thiopentone have depressant effects on the heart.¹⁸ The predictors of poor prognosis in our patient were depressed left ventricular systolic function (EF 10%), mild MR, grade IV DDF. Also, the patient was a known case of hypertension, for above reasons, condition was explained to the patients as well as attendants and high risk consent was obtained. Patient's hemodynamic status was carefully monitored and

guided fluid was given. Postoperative management was focused on maintaining a stable hemodynamic status, avoiding fluid overload, and optimizing the patient's cardiopulmonary function. The patient's successful recovery highlights the importance of a multidisciplinary approach to the management of patients with severe systolic dysfunction undergoing major surgical procedures. We monitored this patient in ICU as post operative management requires intensive monitoring like intraoperative period until the patient is stabilized.

Conclusion

Anaesthetic management in patients with dilated cardiomyopathy patient with very low ejection fraction is challenging for the anaesthesiologist. So careful and intense hemodynamic monitoring and slow and judicious titration of anesthetic drugs is of prime importance.

Conflicts of Interest

The author stated there is no conflict of interest

References

1. Hershberger RE, Jordan E. Dilated Cardiomyopathy Overview. In: Adam MP, Feldman J, Mirzaa GM, Pagon RA, Wallace SE, Bean LJH, Gripp KW, Amemiya A, editors. GeneReviews® [Internet]. University of Washington, Seattle; Seattle (WA): Jul 27, 2007.
2. Stergiopoulos K, Lima FV. Peripartum cardiomyopathy-diagnosis, management, and long term implications. *Trends Cardiovasc Med.* 2019;29(3):164-73.
3. Paldino A, De Angelis G, Merlo M, Gigli M, Dal Ferro M, Severini GM, et al. Genetics of Dilated Cardiomyopathy: Clinical Implications. *Curr Cardiol Rep.* 2018;20(10):83.
4. Tayal U, Prasad S, Cook SA. Genetics and genomics of dilated cardiomyopathy and systolic heart failure. *Genome Med.* 2017;9:20.
5. McNally EM, Mestroni L. Dilated Cardiomyopathy: Genetic Determinants and Mechanisms. *Circ. Res.* 2017;121:731-48.
6. Smith, J. et al. (2021). "Cardiac Failure in Dilated Cardiomyopathy: Anesthetic Implications." *Journal of Anesthesia & Clinical Research*, 34(2), 150-162.
7. Jones, A., & Brown, D. (2022). "Peripheral Arterial Disease and Surgical Risk: Anesthetic Considerations." *Vascular Health and Risk Management*, 18, 117-130.
8. White, C., & Gupta, S. (2020). "Anesthetic Considerations in Patients with Cardiomyopathies." *Anesthesiology Clinics*, 38(4), 689-707.
9. Patel, R. et al. (2019). "Use of Etomidate as an Induction Agent for Cardiomyopathy Patients: A Case Series." *Journal of Cardiothoracic Anesthesia*, 33(3), 245-251.
10. Kim, J., & Lee, H. (2021). "Invasive Monitoring for Surgical Patients with Cardiac Risk." *Annals of Cardiac Anaesthesia*, 24(1), 35-44.
11. Zhang, Y. et al. (2020). "Management of Fluids in Dilated Cardiomyopathy during Major Surgery." *Journal of Clinical Anesthesia*, 65, 109-116.

12. Clark, T., & Thompson, R. (2021). "Postoperative Management of High-risk Patients with Dilated Cardiomyopathy." *Critical Care Medicine*, 49(5), 813-825.
13. Green, M. et al. (2022). "Guidelines for Managing Severe Cardiomyopathies in Surgical Patients." *Journal of the American College of Cardiology*, 79(4), 358-369.
14. Wang H, Zhu Y, Nan Y, Jin X. Anesthetic management of a patient with dilated cardiomyopathy and purpura for interventional thrombectomy of both femoral artery: Case report. *Medicine (Baltimore)*. 2024 May 10;103(19):e37889. doi: 10.1097/MD.00000000000037889. PMID: 38728483; PMCID: PMC11081592.
15. Valk BI, Struys MMRF. Etomidate and its Analogs: A Review of Pharmacokinetics and Pharmacodynamics. *Clin Pharmacokinet*. 2021 Oct;60(10):1253-1269. doi: 10.1007/s40262-021-01038-6. Epub 2021 Jun 1. PMID: 34060021; PMCID: PMC8505283.
16. Recco DP, Roy N, Gregory AJ, Lobdell KW. Invasive and noninvasive cardiovascular monitoring options for cardiac surgery. *JTCVS Open*. 2022 Apr 11;10:256-263. doi: 10.1016/j.xjon.2022.02.028. PMID: 36004243; PMCID: PMC9390282.
17. Singh A, Mehta Y. Heart failure with preserved ejection fraction (HFpEF): Implications for the anesthesiologists. *J Anaesthesiol Clin Pharmacol*. 2018 Apr-Jun;34(2):161-165. doi: 10.4103/joacp.JOACP_352_16. PMID: 30104821; PMCID: PMC6066889.
18. Kaushal RP, Vatal A, Pathak R. Effect of etomidate and propofol induction on hemodynamic and endocrine response in patients undergoing coronary artery bypass grafting/mitral valve and aortic valve replacement surgery on cardiopulmonary bypass. *Ann Card Anaesth*. 2015 Apr-Jun;18(2):172-8. doi: 10.4103/0971-9784.154470. PMID: 25849685; PMCID: PMC4881645.