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CASE REPORT OPEN ACCESS

Anaesthetic management in a patient undergoing tooth extraction with a comorbid double outlet right ventricle: A case report

Bakti RK[1ID], Utariani A[1ID], Semedi BP[1ID]

[1]*Department of Anaesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia*

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Abstract
Background: This article presents a case of a patient undergoing tooth extraction with general anaesthesia with a comorbidity of double outlet right ventricle (DORV), highlighting anaesthesia considerations for this rare congenital malformation.
Case presentation: A 9-year-old female patient was referred to the Department of Oral and Maxillofacial Surgery as preparation for open heart surgery. The patient was diagnosed with chronic multiple apical periodontitis, hence was scheduled for teeth extraction surgery with general anaesthesia. The patient had congenital heart disease (CHD) and a previous brain abscess. Optimal anaesthetic management of patients in a complex case necessitates understanding the patient's pathophysiology and multiple pre-anaesthesia visits before and after surgery.
Conclusion: With more CHD patients having non-cardiac surgeries, there's a need for tailored anaesthesia management. As evidence-based guidelines in this patient group are lacking, understanding CHD physiology helps plan anaesthesia. Anaesthesiologists must adapt management to each patient's needs for safety.

Keywords: Anaesthesia, Double Outlet Right Ventricle (DORV), Tooth extraction, Non-cardiac surgery, Unrepaired

Background

Double outlet right ventricle (DORV) is defined as a group of rare congenital cardiac anomalies caused by malformation of the conotruncus, resulting in disturbance of cardiac outflow. It occurs in approximately < 1% of all congenital heart disease (CHD) (1). Symptoms include progressive cyanosis, murmurs, tachypnoea and failure to thrive in affected children. If left untreated, pulmonary hypertension can develop over time, leading to irreversible shunting and cyanosis known as Eisenmenger's syndrome (2). Prognosis depends on the stability of pulmonary and systemic circulations (3). With improved prognosis rate, diagnostic and therapeutic modalities, more patients with congenital disease, such as CHD, will present for elective or emergency non-cardiac surgery (4). Paediatric patients with complex heart defects necessitating urgent surgery require thorough oral cavity clearance to prevent focal infections. In infected tissue with large areas, teeth extraction is carried out surgically, by making an incision in the gum and removing damaged tissue. Hence, general anaesthesia may be needed (5). Understanding physiology according to the type of CHD in a patient will help in anaesthetic management, to predict the effects of anaesthetic drugs and strategies for maintaining hemodynamic

Correspondence:
Bakti Retti K
Department of Anaesthesiology and Reanimation, Faculty of Medicine
Universitas Airlangga, Surabaya
Indonesia
+628155083305, retti.kartika.bakti-2022@fk.unair.ac.id

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stability in surgery (6). Currently, there are no evidence-based recommendations for anaesthetic management of patients with CHD undertaking non-cardiac surgery (7). This article is written to describe a case of a CHD that underwent non-cardiac surgery and discuss the challenges of its anaesthetic management.

Case Presentation

A 9-year-old female patient was referred to the Department of Oral and Maxillofacial Surgery related to preparation for heart surgery. Chronic multiple apical periodontitis was discovered; the patient was subsequently scheduled for teeth extraction (Figure 1).



Figure 1. Patient with chronic multiple apical periodontitis

At the age of 4, the patient was first diagnosed with tetralogy of Fallot (TOF) after presenting with symptoms of shortness of breath and fatigue, along with cyanosis of the fingernails that had been present since birth. Two years later, the patient developed right-sided hemiplegia, headaches and decreased consciousness, necessitating a craniotomy to evacuate an intracranial abscess. In her eighth year, she underwent cardiac catheterisation, and a BT-shunt was planned once her condition improved.

From the history taking, it was known that the mother had severe preeclampsia, and the patient was born through a C-section. The patient also has a history of recurring colds, feeding difficulty, and slower growth compared to other children. The patient has a history of taking a beta blocker.

The physical examination revealed normal growth (height, 128 cm; weight, 42 kg), perioral cyanosis, tachypnoea (26-38 breaths per minute) with low oxygen saturation (55-75% on room air), pulse rate of 130-140 bpm, visible murmurs, and clubbing fingers on all extremities (Figure 2). VACTERL evaluation revealed just cardiac abnormalities: ventricular septal defect (VSD), atrial septal defect (ASD) and DORV, other aspects appeared normal.



Figure 2. The physical examination revealed clubbing fingers and low oxygen saturation

Blood tests showed erythrocytosis with a haemoglobin level of 20.3 mg/dL and a haematocrit level of 61.3%. Other blood tests showed no abnormalities. Chest x-ray showed CHD with enlarged atrium and ventricle, while trans-thoracal echocardiography (TTE) revealed a VSD, ASD,

overriding aorta (>50%), severe pulmonary stenosis (PS), patent ductus arteriosus (PDA), Computed tomography on the thorax region showed VSD, ASD, DORV, infundibular PS, RA dilatation, PDA, major aortopulmonary collateral arteries (MAPCA), and McGoon ratio 1.98. Cardiac catheterisation was performed. Right ventriculography showed VSD subaortic with a diameter of 10.93 mm, overriding aorta, with a diameter of the right pulmonary artery of 13.43mm. The patient was diagnosed with multiple chronic apical periodontitis and pulp necrosis (Figure 1). The patient was scheduled for teeth extraction. The patient was assessed as physical status ASA 3 due to cyanotic heart disease with collateral blood vessels, and a history of brain abscess evacuation. Premedication in the form of midazolam (2 mg) and prophylactic antibiotics (cefazolin 2 g) was administered intravenously. Induction was performed with intravenous fentanyl (100 µg), ketamine (60 mg), and atracurium (20 mg). Anaesthesia was maintained with sevoflurane (2%).

During the operation, the patient was given intravenous crystalloid fluid (200 ml), paracetamol (750 mg), ibuprofen (300 mg), and a continuous norepinephrine pump 0,5 mcg/kg/min. The operation lasted 1.3 hours, with stable respiratory and hemodynamic parameters (arterial blood pressure 107/76mmHg; heart rate 112 bpm; respiratory rate 20 bpm; saturation 78% and FiO2 of 30%). Intraoperative bleeding was estimated at 20 ml. The patient was moved to the ICU for post-operative monitoring and moved to a low-care unit after stabilisation. She was discharged 2 days later with oral antibiotics and analgesics.

Discussion

Dental and oral care are critical for children with congenital heart disease (CHD) to prevent infections such as bacterial endocarditis, which poses a significant risk in these patients (8). Bacteraemia resulting from dental treatments involving soft tissue bleeding can lead to the adherence of bacteria to heart defects, increasing the likelihood of endocarditis (9). For children with complex CHD, including Double Outlet Right Ventricle (DORV), dental procedures must balance infection prevention with maintaining hemodynamic stability.

The preoperative assessment of patients with CHD is vital to ensuring safe surgical outcomes. DORV is characterised by the outflow of both great arteries from the right ventricle, leading to parallel circulation and cyanosis. In patients with DORV, maintaining a delicate balance between systemic DORV with 1.9 McGoon ratio, and normal left ventricular function (ejection fraction, 69.8%).

vascular resistance (SVR) and pulmonary vascular resistance (PVR) is essential to prevent circulatory instability (10). This is particularly critical during procedures that may disrupt baseline hemodynamic parameters. The physiological classification of CHD provides valuable insights into the functional implications of defects like DORV. In this case, the patient's circulation required maintaining near-equal pulmonary and systemic blood flow with an oxygen saturation target of 80-85% (11). An increase in PVR could worsen hypoxia, while a drop in SVR might compromise systemic perfusion. Therefore, the preoperative plan emphasised hemodynamic stability through comprehensive risk stratification, consultation with a paediatric cardiologist, and optimising the patient's baseline condition.

Patients with DORV are at a significantly higher risk for infective endocarditis, especially during invasive dental procedures (12). The American Heart Association recommends antibiotic prophylaxis for high-risk patients undergoing dental surgeries involving bleeding or manipulation of gingival tissues. In this case, cefazolin (50 mg/kg body weight) was administered one hour before the procedure and repeated at 8 and 16 hours postoperatively to mitigate infection risk (13). This regimen was selected based on the patient's cardiac condition and the nature of the surgical intervention.

Tooth extraction in a patient with DORV presents unique challenges due to the need for precise hemodynamic control during the procedure. General anaesthesia was chosen to minimise the stress response and ensure patient comfort, with specific modifications tailored to the patient's pathophysiology. Intravenous induction was performed using incremental doses of fentanyl and ketamine. Ketamine was selected for its favourable hemodynamic profile, as it helps maintain SVR while avoiding myocardial depression. Fentanyl provided effective analgesia, attenuating nociceptive responses and minimising sympathetic activation. Deep anaesthesia and acidosis, which can disrupt the balance between SVR and PVR, were carefully avoided. Sevoflurane was utilised for anaesthesia maintenance due to its relatively minimal impact on myocardial contractility and SVR. The volatile anaesthetic was titrated to maintain hemodynamic stability and avoid rapid changes in systemic vascular dynamics. Non-depolarising muscle relaxants, such as atracurium, were administered to provide neuromuscular blockade without adverse hemodynamic effects

(14).
Hydration was ensured through preoperative IV fluid administration to prevent hypovolemia and reduce the risk of polycythaemia-related complications. During the procedure, systemic volume was maintained judiciously to support cardiac preload. Continuous IV vasoconstrictors, such as phenylephrine, were prepared for administration if required to address drops in SVR. The anaesthesia team closely monitored blood pressure, oxygen saturation, and end-tidal CO2 to detect and respond promptly to hemodynamic changes. After surgery, the patient was monitored in a high-care unit until they returned to their preoperative baseline. Postoperative care emphasised preventing infection, maintaining hemodynamic stability, and ensuring adequate analgesia

Conclusions
Classifying CHD using a physiological approach is essential for planning anaesthesia management in patients with complex conditions like DORV. Understanding the underlying pathophysiology, including the balance of systemic and pulmonary vascular resistance, is crucial for intraoperative anaesthesia strategies and maintaining hemodynamic stability. The multidisciplinary approach and customised anaesthetic plan successfully ensured patient safety during a dental procedure, highlighting the importance of individualised care for CHD patients undergoing non-cardiac surgeries.

List of Abbreviations
ASD: Atrial Septal Defect
CHD: Congenital Heart Disease
DORV: Double Outlet Right Ventricle
IV: Intravenous
MAPCA: Major Aortopulmonary Collateral Arteries
PDA: Patent Ductus Arteriosus
PS: Pulmonary Stenosis
PVR: Pulmonary Vascular Resistance
SVR: Systemic Vascular Resistance
TEE: Trans-Thoracal Echocardiography
TOF: Tetralogy of Fallot
VSD: Ventricular Septal Defect

Declaration
Ethics approval and consent to participate
Written informed consent for publication was obtained from the patient whose management is being reported.

Consent for publication
All the authors gave consent for the publication of the work under the Creative Commons Attribution Non-Commercial 4.0 license.

Availability of data and materials
The essential data supporting the findings of this study are available within the article. Additional data are available on request from the corresponding author due to confidentiality reasons.

Competing interests
The authors declare that they have no competing interests.

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Author contributions
All the authors were involved in the management of the patients and conceptualising the report. BR and UA wrote the first manuscript. BR and SB corrected the manuscript. All the authors agreed on the final manuscript. The manuscript has been read and approved by all the authors.

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References
1. Gottschalk I, Abel JS, Menzel T, Herberg U, Breuer J, Gembruch U, Geipel A, Brockmeier K, Berg C, Strizek B. Prenatal diagnosis, associated findings and postnatal outcome of fetuses with double outlet right ventricle (DORV) in a single center. Journal of Perinatal Medicine. 2019 Apr 1;47(3):354-64. https://doi.org/10.1515/jpm-2018-0316
2. Junghare SW, Desurkar V. Congenital heart diseases and anaesthesia. Indian journal of anaesthesia. 2017 Sep 1;61(9):744-52. https://doi.org/10.4103/ija.IJA_415_17
3. Di Carlo D, Putotto C, Versacci P, Marino B. Surgery for complex forms of atrioventricular septal defect: Early survival and probability of cure. JOURNAL OF RARE DISORDERS. DIAGNOSIS & THERAPY. 2018;4(6: 23):1-7. https://doi.org/10.21767/2380-7245.100191
4. Kaemmerer H, Bauer U, Pensl U, Oechslin E, Gravenhorst V, Franke A, Hager A, Balling G, Hauser M, Eicken A, Hess J. Management of emergencies in adults with congenital cardiac disease. The American journal of cardiology. 2008 Feb 15;101(4):521-5. https://doi.org/10.1016/j.amjcard.2007.09.110
5. Krohner RG. Anesthetic considerations and techniques for oral and maxillofacial surgery.

International anesthesiology clinics. 2003 Jul 1;41(3):67-89. https://doi.org/10.1097/00004311-200341030-00007
6. Thiene G, Frescura C. Anatomical and pathophysiological classification of congenital heart disease. Cardiovascular Pathology. 2010 Sep 1;19(5):259-74. https://doi.org/10.1016/j.carpath.2010.02.006
7. Cannesson M, Earing MG, Collange V, Kersten JR, Riou B. Anesthesia for noncardiac surgery in adults with congenital heart disease. Anesthesiology. 2009 Aug 1;111(2):432-40. https://doi.org/10.1097/ALN.0b013e3181ae51a6
8. Marelli AJ, Mackie AS, Ionescu-Ittu R, Rahme E, Pilote L. Congenital heart disease in the general population: changing prevalence and age distribution. Circulation. 2007 Jan 16;115(2):163-72. https://doi.org/10.1161/CIRCULATIONAHA.106.627224
9. Li X, Kolltveit KM, Tronstad L, Olsen I. Systemic diseases caused by oral infection. Clinical microbiology reviews. 2000 Oct 1;13(4):547-58. Pollard MA, Curzon ME. Dental health and salivary Streptococcus mutans levels in a group of children with heart defects. International journal of paediatric dentistry. 1992 Aug;2(2):81-5. https://doi.org/10.1111/j.1365-263X.1992.tb00014.x
10. Yuki K, Casta A, Uezono S. Anesthetic management of noncardiac surgery for patients with single ventricle physiology. Journal of anesthesia. 2011 Apr;25:247-56. https://doi.org/10.1007/s00540-010-1081-4
11. Klugman D, Laussen PC, Wessel DL. Pediatric cardiac intensive care. Comprehensive Surgical Management of Congenital Heart Disease. Taylor & Francis Group, Boca Raton, London, New York. 2014 Jan 1;37.
12. Tutarel O. Endocarditis prophylaxis in adult congenital heart disease. International Journal of Cardiology Congenital Heart Disease. 2021 Aug 1;4:100141. https://doi.org/10.1016/j.ijcchd.2021.100141
13. Warnes, Carole A., Roberta G. Williams, Thomas M. Bashore, John S. Child, Heidi M. Connolly, Joseph A. Dearani, Pedro Del Nido et al. "ACC/AHA 2008 guidelines for the Management of Adults with Congenital Heart Disease: executive summary: a report of the American College of Cardiology/American Heart Association task force on practice guidelines (writing committee to develop guidelines for the Management of Adults with Congenital Heart Disease): developed in collaboration with the American Society of Echocardiography, Heart Rhythm Society, International Society for Adult Congenital Heart Disease, Society for Cardiovascular Angiography ...." *Circulation* 118, no. 23 (2008): 2395-2451. https://doi.org/10.1161/CIRCULATIONAHA.108.190811
14. Kerai S, Gaba P, Gupta L, Saxena KN. Anaesthetic management of a child with unrepaired complete atrioventricular canal defect, double outlet ventricle and pulmonary stenosis for non-cardiac surgery. Indian Journal of Anaesthesia. 2022 Oct 1;66(Suppl 6):S342-4. https://doi.org/10.4103/ija.ija_1063_21