

Dental management in children with tetralogy of Fallot under general anesthesia: A case report

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Abstract

Introduction: Tetralogy of Fallot (ToF) is a congenital heart disease frequently diagnosed in children. Children with ToF have a high risk of caries, especially in primary dentition. Preparation of the oral cavity must be done before heart surgery to mitigate risks, including the consideration of bacterial endocarditis associated with dental infections. Proper examination and diagnosis are needed to determine dental treatment and reduce these risks. This case report aims to explain dental management in children with ToF under general anesthesia (GA).

Case History: A five-year-old girl came to the Pediatric Dentistry Clinic at Dr. Saiful Anwar Regional General Hospital, Malang, referred by her pediatric cardiologist for oral cavity assessment prior to heart surgery. The patient was diagnosed with ToF. Intraoral examination revealed multiple cavities and remaining roots. The patient was scheduled for tooth filling and extraction under GA and was given prophylactic antibiotics before the procedure.

Discussion: Children with ToF are at high risk of bacterial endocarditis. Any dental procedure causing trauma to soft tissue or bone leading to bleeding can induce transient bacteremia. Considering these risks, dental management under GA can be conducted immediately before the heart surgery.

Conclusion: Dental management in children with Tetralogy of Fallot under general anesthesia is a good choice. With the collaboration of a multidisciplinary team, including a pediatric dentist, pediatric cardiologist, and anesthesiologist, appropriate treatment can be carried out to prevent bacterial endocarditis.

Keywords: Tetralogy of Fallot; General Anesthesia; Bacterial Endocarditis; Human and Illness

1. Introduction

Tetralogy of Fallot (ToF) is the most common form of cyanotic congenital heart disease [1,2]. The prevalence of ToF in children is approximately 3 out of 10,000 live births and represents 10% of all congenital heart disease [3,4]. ToF is characterized by four typical abnormalities: ventricular septal defect (VSD), overriding aorta, pulmonary stenosis, and right ventricular hypertrophy (RVH) [1–3]. The etiology of ToF is unknown but is related to defects in embryogenesis that occur between the 3rd and 8th weeks of pregnancy [5]. Some of the risk factors described are maternal rubella infection; use of thalidomide, phenytoin, warfarin, as well as alcoholism and smoking during pregnancy [3]. ToF has been considered a malformation associated with various genotypes, but the majority of patients are asymptomatic. This is related to the use of teratogens and trimetadione, and influencing genetic factors. A gene mutation potentially responsible for up to 4% of all ToF cases has recently been identified [6,7].

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The clinical manifestations of ToF are varied and sometimes asymptomatic, among the most frequent are cyanosis, acropachy, hypoxemic crisis, cardiovascular events, hematological, immunological, and respiratory disorders, polycythemia in tissue formation, and growth retardation [7]. Children with ToF often experience fatigue, dyspnea, and hyperpnea due to hypoxia [3]. Intraoral manifestations associated with ToF include cyanosis of the mucosa, tongue, and gingiva, along with stomatitis, increased risk of caries in early childhood, delayed tooth eruption, tooth position abnormalities, and enamel hypoplasia [4,8].

Similar to other congenital heart diseases, children with ToF have an increased risk of bacterial endocarditis. The incidence of bacterial endocarditis in ToF is 15% [1]. Bacterial endocarditis is caused by bacterial infection of the heart valves or endocardium. Oral streptococci such as *S. sanguis* and *S. mitis* are the organisms that most commonly cause bacterial endocarditis [9]. In the field of dentistry, bacterial endocarditis is closely associated with dental infections [1]. Prophylactic antibiotics are necessary before dental treatment to prevent bacterial endocarditis. Proper preparation of the oral cavity is essential before corrective heart surgery in children with ToF, considering the risk of endocarditis [8,10]. Therefore, the role of the dentist is very necessary in examining and determining treatment plans to minimize the risk of infection [9]. Currently, there are still not many published cases regarding dental treatment in pediatric patients diagnosed with ToF. The purpose of this case report is to explain dental management in children with Tetralogy of Fallot (ToF) under general anesthesia.

2. Case History

A five-year-old girl came to the Pediatric Dentistry Clinic at Dr. Saiful Anwar Regional General Hospital, Malang, referred by her pediatric cardiologist for oral cavity assessment before heart surgery. The patient was diagnosed with Tetralogy of Fallot (ToF). Physical examination revealed fatigue and cyanosis of the lips (Figure 1). Intraoral examination identified dental caries in teeth 52, 62, 73, 81 and root remains in teeth 51, 61, 75, 84, 85 (Figure 2a – Figure 2e). The patient was referred for a panoramic photo. A panoramic radiology examination is carried out to confirm the diagnosis and determine a treatment plan (Figure 3). The diagnosis for this patient was reversible pulpitis in teeth 52, 62, 73, 81, 83, and radix gangrene in teeth 51, 61, 75, 84, 85, which required filling and tooth extraction to prevent focal infection during heart surgery.



Figure 1 Extraoral photograph



Figure 2 Intraoral photographs. Figure 2a: occlusal view of maxillary dentition. Figure 2b: occlusal view of mandibular dentition. Figure 2c: lateral view on the right side. Figure 2d: frontal view. Figure 2e: lateral view on the left side



Figure 3 Panoramic radiograph showed radiolucency in teeth 52, 62, 73, 81, 83 reaching the dentin, and in teeth 51, 61, 75, 84, 85 reaching the pulp chamber

Before the procedure, a complete blood count and thorax examination were conducted. All examinations showed normal and controlled conditions. The pediatric dentist responded to a consultation from the pediatric cardiologist. After receiving approval from the pediatric cardiologist, the patient consulted with an anesthesiologist. The anesthesiologist approved and agreed that the patient could undergo oral cavity preparation procedures with general anesthesia (GA). The patient was admitted to the hospital one day before the procedure and instructed not to eat or drink 6 hours before the procedure. Intravenous prophylactic antibiotics, Ampicillin 500 mg, were given 60 minutes before the procedure. Then, the patient was taken to the operating room, where general anesthesia was administered by the anesthesiologist.

Before the procedure, the pediatric dentist performed extraoral asepsis with povidone-iodine and alcohol, then covered the patient with a sterile drape, except for the operating area. A mouth opener was inserted into the patient's oral cavity to facilitate the operator's work area. For teeth 52, 62, 73, 81, 83 diagnosed with reversible pulpitis, Glass Ionomer Cement (GIC) GC® Fuji IX filling treatment was carried out (Figure 4a and Figure 4b). Next, radix gangrene was removed from teeth 51, 61, 75, 84, 85 (Figure 4b – Figure 4e), followed by suturing on the sockets of teeth 84 and 85 (Figure 4c). Finally, topical fluoride (3M Clinpro® 5% Sodium Fluoride White Varnish) was applied to all teeth. The procedure took approximately 1.5 hours. The patient was given intravenous Ampicillin 250 mg 6 hours after the procedure. The parents

were instructed to maintain the patient's oral hygiene, have her consume a soft diet, avoid eating or drinking hot or warm foods, refrain from playing with or sucking on the extraction site, and avoid gargling too vigorously.

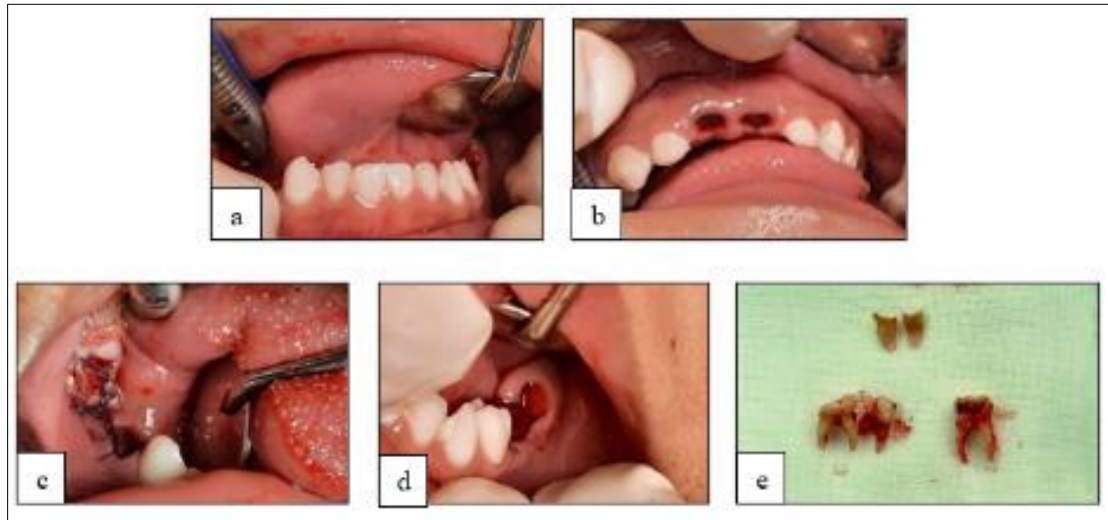


Figure 4 Comprehensive dental treatments performed under GA. Figure 4a: restoration of 73, 81, 83 with GIC. Figure 4b: restoration of 52, 62 with GIC. Figure 4c: extraction and suturing in region 84, 85. Figure 4d, 4e: extraction of 51, 61, 75, 84, 85

The next day, the patient said there were no complaints. There was no fever, nausea, and vomiting. The patient was able to eat and drink well so she was allowed to go home. The patient and parents were given instructions to maintain oral hygiene, avoid to eat or drink hot or warm foods, not to play with or suck on the extraction site, and not to gargle too vigorously. The patient was prescribed amoxicillin syrup 125mg/5 ml and ibuprofen syrup 100mg/5 ml. The patient was scheduled for control at the Pediatric Dentistry Clinic one week later.

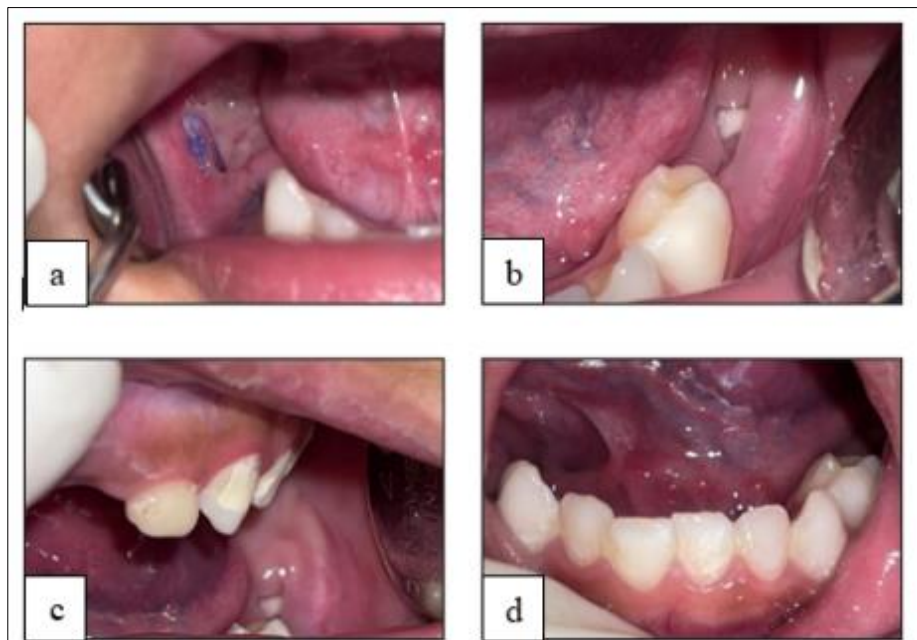


Figure 5 Intraoral photograph after one week. Figure 5a: sutures in the 84 and 85 regions were well intact. Figure 5b: the extraction wound was in good condition. Figure 5c, 5d: restoration GIC in teeth 52, 62, 73, 81, 83 were in good condition

At one week follow-up, the patient's parents said the patient had no complaints. There was no bleeding or swelling in the extraction wound, and the sutures in the 84 and 85 regions were well intact (Figure 5a and Figure 5b). The GIC fillings in teeth 52, 62, 73, 81, 83 were in good condition (Figure 5c and Figure 5d). the patient and parents were

instructed to maintain oral hygiene, brush their teeth twice a day with toothpaste containing fluoride, consume nutritious food and drink lots of water, have regular check-ups with the dentist, and apply topical fluoride every 3 months.

3. Discussion

Tetralogy of Fallot (ToF) is the most common form of cyanotic congenital heart disease, accounting for approximately 10% of all cases of congenital heart disease in children [2,11,12]. The four main characteristics of ToF include the presence of a hole in the wall between the ventricles (ventricular septal defect) so oxygen-poor blood is mixed with oxygen-rich blood. The presence of obstruction from the right ventricle to the lungs (pulmonary stenosis) is the most important feature. In addition, the aorta runs directly (overriding) over the ventricular septal defect so the right ventricular muscle thickens [8]. One of the clinical manifestations that is often seen in children with ToF is fingernails and lips which can turn blue or cyanotic if the child experiences fatigue due to heavy physical activity, high anxiety, and crying for a long time [8,10].

Similar to other congenital heart diseases, ToF often leads to severe complications, such as bacterial endocarditis associated with dental infections [1]. Poor dental conditions are commonly observed in children with ToF due to disturbances in enamel development (impaired enamel mineralization). These children are at high risk of developing caries, especially in primary dentition [1]. This may also be caused by certain medications for heart disease which contain high concentrations of sugar. Xerostomia and gingival hypertrophy also often occur. It increases the risk of caries and periodontal disease. Preventive measures such as fissure sealant and topical fluoride application can be provided to prevent the severity of caries. The working mechanism of Clinpro White Varnish involves fluoride being applied to teeth, contact with saliva and causes Fluor Tri Calcium Phosphate to release calcium, phosphate, and fluoride. This process results in tooth surface becoming fluorapatite, forming large crystals and sealing open dentine tubules. Fluoride varnishes are professionally applied fluoride treatments that are typically administered two to four times per year, depending on an individualized caries risk assessment of a child. These varnishes can adhere to tooth surfaces for a relatively long time, ensuring efficient and effective fluoride release [13,14].

Any dental procedure that can cause damage to soft tissue or bone leading to bleeding can cause transient bacteremia [4,8]. Thus, efforts are needed to prevent bacterial endocarditis by using prophylactic antibiotics [10]. Bacteremia frequently occurs after invasive dental procedures such as extraction, scaling, and endodontic treatment. In the case above, the patient was referred for preparation of the oral cavity before heart surgery. Teeth diagnosed with reversible pulpitis must be filled and radix gangrene must be extracted, so as not to become a source of infection for infective endocarditis [4]. The patient was given prophylactic antibiotics in the form of Ampicillin 500 mg given 60 minutes before the procedure. In addition to prophylactic antibiotics, the risk of bacterial endocarditis can be minimized through preventive dental procedures. This includes routine dental examinations, administering fluoride, modifying diet to minimize the risk of dental caries and periodontal disease, and maintaining oral hygiene at home [8,9].

General anesthesia (GA) is often indicated in cases involving lack of patient cooperation and the presence of multiple comorbidities. GA requires multidisciplinary collaboration to address each stage of the procedure, including determining the indication for GA, preoperative evaluation, premedication, intraoperative management, and post-operative care. Treatment is performed by a multidisciplinary team, including a pediatric dentist, pediatric cardiologist, and anesthesiologist [9]. The patient's controlled systemic condition is the reason for using GA for dental treatment. With a comprehensive dental care approach under GA, all necessary procedures can be completed in a single visit, thereby reducing the child's anxiety and ensuring the child can undergo immediate heart surgery [4].

4. Conclusion

Dental care management in children with Tetralogy of Fallot under general anesthesia is a good choice. With the collaboration of a multidisciplinary team, including a pediatric dentist, pediatric cardiologist, and anesthesiologist, appropriate treatment can be carried out to prevent bacterial endocarditis.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this document.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from patient included in the study.

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