Modification of Dental Care for Patients with Cardiac Disease

Madhav Kamath M[1], **Kundabala Mala**[2], **Manuel S. Thomas**[2]

[1]Associate Professor of Cardio-Thoracic Surgery and Consultant Cardio-Thoracic Surgeon, Kastrba Medical College, Mangaluru, Manipal University, Mangaluru, Karnataka, India. [2]Department of Conservative Dentistry & Endodontics, Manipal College of Dental Sciences, Mangalore, Manipal University, Karnataka, India.

Abstract

Patients suffering from cardiovascular disease are vulnerable to physical and emotional stress. If, in addition, the patients have to undergo dental treatment, it will add to their stress. Cardiac patients may collapse in the dental clinic due to various cardiac emergencies or drug interactions. Hence, patients with cardiac disease may pose a significant risk in dental clinics. Multidisciplinary approach while treating medically compromised dental patients is mandatory to reduce complications and to achieve satisfactory results. This article gives an overview of inter-relationship of cardiac and dental pathogenesis and also aims to make recommendations that need to be followed in dental clinics while treating patients with associated cardiac problems.

Introduction

Cardiovascular diseases are one of the primary reasons for mortality throughout the world. Patients who are suffering from cardiovascular disease are vulnerable to physical or emotional stress. If, in addition, the patients have to undergo dental treatment, it will add to their stress [1]. This makes treatment planning in these patients for any health problems, including dental problems, a complex issue. Cardiac patients may collapse in dental clinics due to various cardiac emergencies or drug interactions. Hence, patients with cardiac disease may pose an added risk in dental clinics.

Additionally, the results of cardiac surgery may suffer if the oral cavity is not maintained well since there is always a fear of infection affecting the heart from the oral cavity. Hence, the cardiac surgeon has to refer surgical patients to a dentist for oral prophylaxis and to treat any oral infections before cardiac surgery to prevent infective endocarditis [2]. A tailor made treatment plan should be prepared by the dentist in consultation with the patient's cardiac surgeon / cardiologist, nephrologist (in case of kidney involvement) and physician (in case of diabetic patients) before the initiation of dental treatment (*Table 1*). Therefore, a multidisciplinary approach is required to treat these patients for preventing complications and for improving the results of treatment.

The purpose of this article is to is to elucidate the inter-relationship of cardiac and dental pathosis and also to recommend a protocol that needs to be followed by dentists while managing patients with cardiac problems in dental clinics *(Figure 1*).

General Considerations during the Dental Treatment of a Cardiac Patient

Medical history and general examination

A comprehensive dental evaluation involving a thorough medical history and premedical assessment (mainly the assessment of vital signs like pulse, blood pressure, the rate and depth of respiration and temperature) at the first dental appointment is a necessity. Once the dentist discovers that the patient is hypertensive or has other cardiovascular problems, the risk associated with the proposed dental treatment should be weighed with regard to the medical conditions and/or current medications that will demand a modification in the manner in which dental care will be provided [1]. It may also be necessary to evaluate the medications taken by the patients to prevent interaction of cardiac drugs with the drugs prescribed by the dentists. Hence, it is important for the dental clinician to understand the potential complications that can occur during

Table 1. *Checklist to be prepared prior to the treatment.*

Sl. No.	Procedure	Mark
	Pre-treatment drug history	
	Cardiologist / Cardiac surgeon's consultation	
	Blood pressure monitoring-pre,during & post teatment	
	ECG readings	
	Availability of emergency drug kit	
	Availability of hemostatic drugs	
	Keeping away-electronic devices that emit electrical signals in case of patients with cardiac pacemaker and implantable cardioverter-defibrillators.	
	Requirement of N_2O anaesthesia	
	Prophylactic antibiotics (if required)	
	Selection of concentration vasoconstrictor in anaesthesia	
	Antianxiety drug administration, if required	
	Patient is in semisupine position	
	Availability of emergency telephone number (patient's Physician,Ambulence, cardiac care centre)	

Corresponding author**:** Dr. Kundabala Mala, Associate Professor of Cardio-Thoracic Surgery and Consultant Cardio-Thoracic Surgeon, Kastrba Medical College, Mangaluru, Manipal University, Mangaluru, Karnataka, India-575 001; Tel: +91 9845837187; e-mail: kundakamath@gmail.com

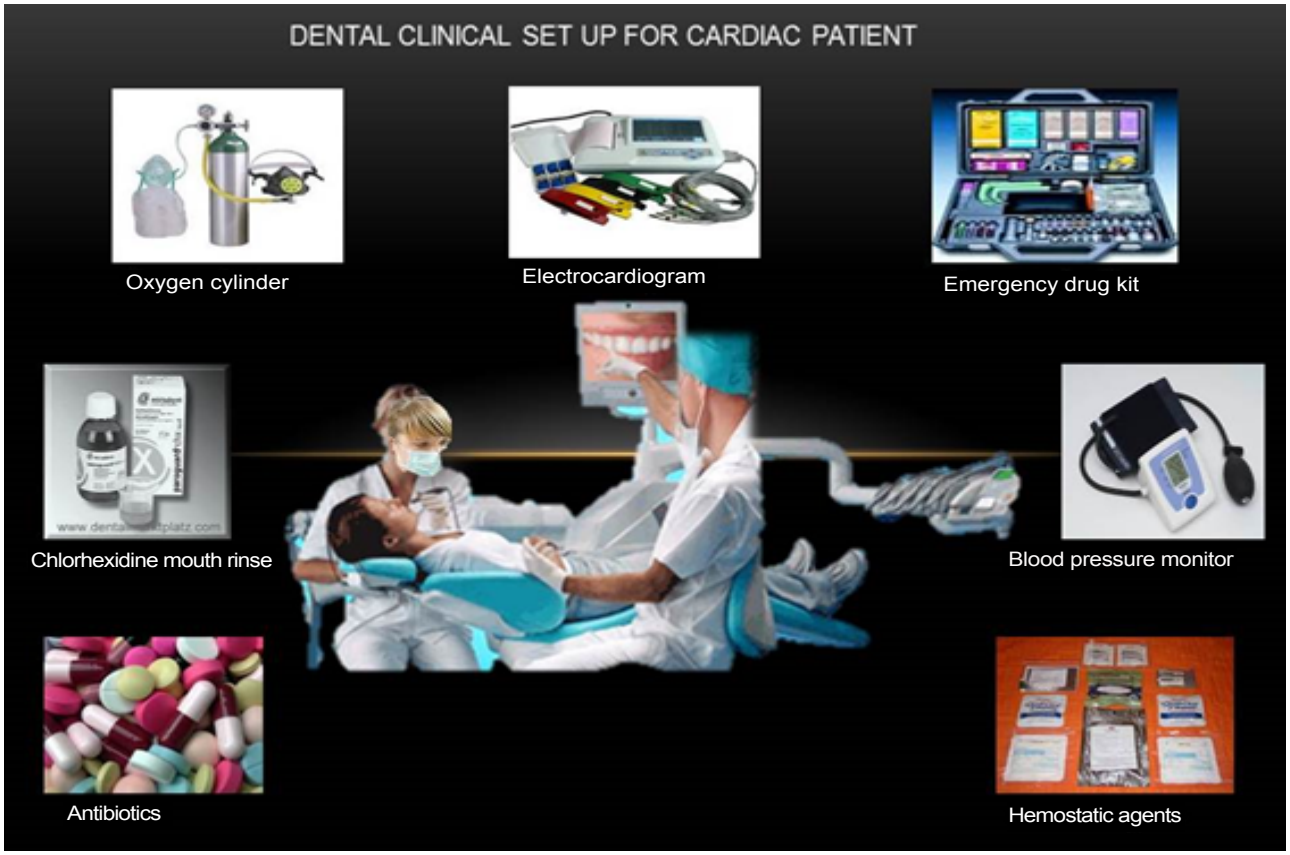

Figure 1. *Clinical setup proposed for managing cardiac patient emergencies.*

dental treatment of a patient with heart disease and when pre-treatment or post-treatment medication or emergency care is indicated.

Physician consultation and consent

Patients may sometimes be confused or ill-informed about or be unaware of the specifics of their particular cardiovascular problem, especially when blood pressure values outside the normal range are first noticed by the dental clinician. In these situations, consultation with the patient's physician is mandatory before the initiation of dental treatment. It is important for a physician/cardiologist referral before initiating any elective dental surgical procedure in a cardiovascular patient. A green signal from the patients' physician is important when treating medically compromised patients for the safety of the patient from medical complications as well as the safety of the dentist from medico-legal complications. The proposed treatment should be reviewed, and medical recommendations should be documented [1]. In addition, a careful preoperative dental evaluation is recommended so that required dental treatment can be completed before cardiac surgery whenever possible. Such measures may reduce the incidence of dental emergencies during the critical post-operative period after cardiac surgery as well as decrease the incidence of late postoperative endocarditis.

Stress reduction protocol

Dental treatment has the potential to induce stress. Such stress can be either physiological (pain) or psychological (anxiety, fear). The body responds to the stress by increased release of catecholamines (epinephrine and norepinephrine) from the adrenal medulla into the cardiovascular system. This, in turn, can increase the workload on the heart (that is, increased heart rate and strength of myocardial contraction and an increased myocardial oxygen requirement) in patients with hypertension or coronary artery disease [3]. Therefore patients with some forms of cardiovascular disease are vulnerable to physical or emotional stress that may be encountered during dental treatment [1]. The various steps taken to minimize the stress encountered during dental treatment procedure, referred to as stress reduction protocol, are as follows;

- Patients should be given reassurance to prevent or reduce anxiety.
- Medically compromised patients are better able to tolerate stress when rested. Therefore, the ideal time to schedule dental treatment is in the morning [3].
- Angina-prone patients who experience greater than normal stress from the thought of dental work benefit from the administration of oral anxiolytics or nitrous oxide [1,4].
- Patients should be seated comfortably (semi-supine) in the dental chair [4].
- Pain control is critical for lessening the chances of angina in ischemic heart disease patients by producing and maintaining profound local anesthesia in the surgical area via the use of longer-acting anesthetics, such as bupivacaine, or by using an anesthetic containing a vasoconstrictor, after careful aspiration [4,5].
- Intermittent rest should be provided to the patient for reducing fatigue.
- A medically compromised patient should not undergo unduly long appointments [3].

Caution with the use of vasoconstrictors

Incorporation of a vasoconstrictor to local anesthetic provides better pain control, which in turn reduces anxiety and stress usually associated with dental treatment [6]. But the commonly used vasoconstrictors such as epinephrine and neocobefrin can

cause a rise in heart rate [7]. Hence, the use of vasoconstrictor should be limited in individuals with cardiac disease, taking care not to exceed 0.04 mg of adrenaline (4.5ml of standard local anaesthetic solution containing 0.009mg of Adrenaline tartrate per ml). In turn, if anesthetic reinforcement is needed, it should be provided without a vasoconstrictor [4]. It is also important to eliminate intravascular administration therefore careful aspiration before any injection is mandatory [5].

The epinephrine present in some of the gingival retraction cords can be absorbed into the systemic circulation and consequently can affect the cardiovascular system [8]. Epinephrine impregnated retraction cords are said to contain 0.2 to 1 mg of racemic epinephrine per inch of cord depending on the diameter and the brand. One inch of the retraction cord with 0.2 mg of racemic epinephrine is capable of exposing the patient to the maximum dose of 0.2 mg (200 µg) for a healthy adult and nearly five times the recommended amount of 0.04 mg (40 µg) for a cardiac patient [9]. Hence the use of alternative gingival displacement medicaments are recommended in patients with cardiovascular problems.

Vasoconstrictor is an absolute contraindication in patients with unstable angina pectoris or in patients with uncontrolled hypertension, refractory arrhythmias, recent myocardial infarctions (less than 6 months), recent stroke (less than 6 months), recent coronary bypass surgery (less than 3 months), and uncontrolled congestive heart failure [7]. Furthermore, since vasoconstrictors can interact with certain antihypertensive medications, they should be used only after consultation with the patient's physician [1].

Emergency Drugs and Training in the Management of Medical Emergencies

The best way to manage a medical emergency in a dental practice is to take necessary precautions in order to avoid it. As mentioned previously, prevention can be accomplished by taking a thorough medical history with appropriate alteration of the dental treatment as required [10]. In spite of all the steps taken, if a medical emergency occurs, the dentist must be well prepared to manage such an unfortunate event. This includes the basic skills of cardiopulmonary resuscitation. Only after the airway, breathing and circulation (the ABCs of CPR) are addressed, should the dentist consider the use of emergency drugs which should be kept in the emergency kit in the clinic [10]. Some of the emergency equipments and drugs which should be present in the kit include oxygen (for most of the emergencies except hyperventilation), nitroglycerine (acute angina or myocardial infarction) and aspirin (myocardial infarction) [10]. It is crucial to know when to seek medical assistance and there should be a provision to shift the patients to a well-equipped hospital at the earliest for definitive care [11].

Considerations in Dental Patients with Hypertension

High blood pressure, a sign of hypertension, is defined as having systolic blood pressure of more than 140 mm Hg or diastolic blood pressure of more than 90 mm Hg. Patients with hypertension are at an increased risk of suffering from angina pectoris, myocardial infarction, stroke and heart failure. All of these are medical emergencies which can occur during and after dental care [4,12].

No patient in dental clinics should be treated when diastolic pressure is over 100mm Hg. and systolic pressure is above 180mm Hg. Routine dental treatment should be deferred until acceptable blood pressure levels are achieved, and the patient should be referred for medical evaluation. Antihypertensive drugs may cause certain oral side-effects. The Calcium channel blocker Nifedipine is shown to cause gingival overgrowth. Certain antihypertensives may cause licheniod reaction [12]. Xerostomia is another side-effect common to most of the antihypertensives. Orthostatic hypotension occurs to varying degrees in most of the patients taking antihypertensive medicines [4]. Therefore, dentists should avoid making sudden changes in the patients' body position during treatment [12]. Prolonged use of certain nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, indomethacin or naproxen is shown to reduce the effectiveness of certain antihypertensive drugs (beta-blockers, diuretics, ACEIs) [4,7]. Excessive bleeding especially is a possibility in hypertensive patients. Therefore aggressive dental surgical procedures should be performed with great caution in these patients [12].

Considerations in Dental Patients with Ischemic Heart Disease (IHD)

Dental patients with previous history of angina or a myocardial infarction are approached similarly. Taking steps to reduce the anxiety and stress during dental treatment is prudent in patients prone for IHD [4]. Patients who have a history of myocardial infarction less than 6 months prior to dental consultation should be deterred from elective dental care because of their increased susceptibility to repeat infarctions and other cardiovascular complications. Dental treatment should be reserved for emergency situations intended to provide odontogenic pain relief [7]. Patients with angina in the ambulatory setting should not be sedated, as it impairs their ability to report angina. Dentist should regularly check the patient's heart rate and BP during long appointments [5]. Patients on nitrates should be asked to bring their medication for each dental visit to be taken in the event of an angina attack [4].

It should also be remembered that IHD can rarely be felt as an orofacial pain complaint. Such a referred pain of cardiac origin can lead to a diagnostic dilemma for the clinicians. An improper diagnosis can result in unnecessary dental treatment and more significantly, it can delay the proper treatment of the cardiac problem and that may lead to myocardial infarction. Differentiating the site of pain from the source of pain is important so that the treatment will be properly directed towards the source of pain [13].

Anticoagulants and antiplatelet drugs used in the prevention of atherothrombosis can be associated with increased perioperative bleeding during dental surgical procedures [14]. However stopping these drugs can result is serious thromboembolic complications. Hence it is advisable not to discontinue these medications when performing minor surgical procedures [14,15]. If the patient is receiving antiplatelet medication, excessive local bleeding is to be

controlled [4]. If the patient is receiving anticoagulants, the International Normalized Ratio (INR) on the day of treatment should be determined. Minor oral surgical procedures can be carried out with an INR of less than 4.0, with additional aid of local hemostasis [7]. Patients with an INR greater than 4.0 should not undergo any dental surgical procedure without being referred to their cardiologist for medication alteration, expert opinion and consent [14].

Considerations in Dental Patients with Cardiac Arrhythmias

The general considerations during dental treatment of a cardiac patient (physician consultation, patient monitoring, stress reduction and limited use of vasoconstrictors) should be strictly adhered to. Patients with dysrhythmias may be managed with electronic devices that emit electrical signals (cardiac pacemaker and implantable cardioverter-defibrillators). These devices have been shown to be sensitive to electromagnetic signals produced by dental instruments like electrosurgical unit, electric pulp tester, electronic apex locator, etc.. Though the newer models (bipolar devices with electromagnetic shielding) are generally not affected by the small electromagnetic fields generated by dental equipment, caution should be observed when operating ultrasonic scalers, ultrasonic cleaning systems, select composite curing lights in the vicinity of individuals who have pacemakers or implantable cardioverter-defibrillators [4,16].

Considerations in Dental Patients with Valvular Disease

Patients with valvular diseases may be susceptible to an infection on or near the heart valves caused by a bacteremia, termed as infective or bacterial endocarditis. Though this is not an emergency condition in the dental clinic, the bacteremia associated with dental treatment can contribute to this potentially fatal disease in patients with valvular heart disease [4]. Therefore patients with pathologic valve disease are to be managed in close consultation with their physicians, especially to determine the need for antibiotic premedication [17].

The risk of antibiotic-associated adverse events may exceed the benefit, if any, from prophylactic antibiotic therapy. Therefore antibiotic premedication is reserved for patients with cardiac conditions associated with the highest risk of adverse outcome from endocarditis during dental procedures involving manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa [18]. The highest risk of Infective Endocardidtis (IE) are for patients with prosthetic cardiac valves, those with a history of IE or significant congenital heart disease, or cardiac transplant recipients who develop cardiac valvulopathy [18,19]. The antibiotic regimen as per the guidelines from the American Heart Association before a dental procedure in patients with high risk for IE is given in *Table 2*.

Maintaining good oral hygiene and eradicating dental disease is shown to decrease the frequency of bacteremia from routine daily activities.Hence the importance of oral health should be emphasized especially in patients with valvular diseases. Moreover, all the standard infection control protocols should be followed such as sterilizatioin of instruments, barrier techniques, fumigating the dental clinic and disinfecting the surgical area. Antimicrobial mouth rinses (0.2% chlorhexidine) given before any dental treatment is shown to reduce bacteremia of oral origin [2,4]. Edentulous patients may develop bacteremia from ulcers caused by ill-fitting dentures. Denture wearers should be encouraged to have periodic examinations or to return to the practitioner if discomfort develops [2].

Apart from considerations in preventing the occurance of IE, dentists treating patients with prosthetic valves must consider management of peri-procedural anticoagulation, since thromboembolism is a devastating and often catastrophic complication of valve replacement surgery. Dental procedures with significant bleeding require careful anticoagulation management [17]. Intramuscular injections of prophylactic antibiotics should be avoided in patients who are receiving anticoagulant therapy [18].

Considerations in Dental Patients with Heart Failure

Dental treatment should be limited to emergency care, preferably in a hospital setting, in patients with heart failure. Placing a patient with poorly compensated heart failure in supine position can cause shortness of breath and

***Table 2**. Antibiotic regimens for a dental procedure.*

Situation	Drug	Regimen: Single dose 30 to 60 min before procedure	
		For adults	For children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin OR Cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillins or ampicillin — Oral	Cephalexin* OR Clindamycin OR Azithromycin or clarithromycin	2 g 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone* OR Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM/IV 20 mg/kgIM/IV
* Cephalosporins should not be used in a person with a history of anaphylaxis, angioedema or urticaria with penicillins or ampicillin.			

can precipitate pulmonary edema, thus complicating dental treatment procedures [17].

It is advisable to avoid vasoconstrictors in patients receiving digitalis as it can precipitate cardiac arrhythmias [1]. Since aspirin can lead to sodium and fluid retention, it is prudent to avoid it in patients with heart failure. Medications used by patients with heart failure can be associated with certain side effects of dental significance like xerostomia, lichenoid reaction, and orthostatic hypotension [4].

Chronic Dental Infection as a Consideration for Cardiovascular Diseases

Recent research indicates a low-to-moderate degree association between chronic dental infection and Cardiovascular Disease (CVD) [20]. Oral infection (periodontal disease/ apical periodontitis) have been associated with the slow progression of artherosclerosis [21]. In a pilot study to determine the of correlation of dental pulp stones with cardiovascular disease, it was observed that the presence of pulp stones was associated with a 4.4-fold increase in the risk of CVD in these patients [22]. A more focused and rigorous scientific research effort is however essential to demonstrate a definitive relationship between chronic dental infection and CVD [21]. But with whatever findings that are available in the literature, it is judicious for oral health professionals to educate patients at risk of cardiovascular diseases with poor oral health and encourage oral disease prevention and treatment [20].

Conclusion

A multidisciplinary approach while treating medically compromised dental patients is mandatory to reduce complications and to improve the prognosis. Patients with serious medical conditions may require modification in the manner in which dental care will be delivered or modifications in the dental treatment plan itself. Several medical conditions have oral manifestations and must be carefully considered when arriving at an accurate dental diagnosis. At the same time, the cardio-thoracic surgeon should consult a dental surgeon prior to any cardiac surgery to prevent infection from the oral cavity seeding structures within the heart.

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