Dental considerations in patients with heart disease

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Abstract

Summary: Cardiovascular diseases are one of the main causes of death in the developed world, and represent the first cause of mortality in Spain. In addition to their associated morbidity, such disorders are important due to the number of affected individuals and the many patients subjected to treatment because of them.

Objective: An update is provided on the oral manifestations seen in patients with arterial hypertension, ischemic heart disease, arrhythmias and heart failure, and on the dental management of such patients.

Material and methods: A Medline-PubMed search was conducted of the literature over the last 10 years using the keywords: "cardiopathy", "dental management", "endocarditis", "hypertension" and "arrhythmia". A total of 31 articles were reviewed, of which 22 were literature reviews, three were expert committee guides, four clinical trials and two case series.

Results: The drug treatments used by these patients can give rise to oral manifestations in the form of xerostomia, lichenoid reactions, burning mouth sensation, loss of taste sensation, gingival hyperplasia and bleeding, as well as extraoral manifestations such as sialadenosis. An inadequately controlled cardiological patient constitutes a risk case in dental practice; dental surgeons therefore must take a series of aspects into account before treating such patients, in order to avoid complications.

Key words: Cardiopathy, dental management, endocarditis, hypertension and arrhythmia.

Introduction

Cardiovascular diseases are one of the main causes of mortality in the developed world (1). The two cardiovascular conditions that cause most deaths are ischemic heart disease and cerebrovascular disease, with heart failure in third place.

In addition to their associated morbidity, such disorders are important due to the number of affected individuals and the many patients subjected to treatment because of them. Patients with cardiovascular disease constitute risk cases in dental practice, particularly in the absence of adequate medical control. It is therefore important for dental surgeons to know the medical problems of each individual patient, the treatments received, and the possibilities for dental treatment (2). In addition, dental surgeons must be able to identify medical emergencies and adopt the opportune measures to avoid them or treat them quickly and effectively.

The present study offers a review of the heart diseases most often seen in dental practice, such as arterial hypertension, ischemic heart disease, arrhythmias and heart failure.

ARTERIAL HYPERTENSION

Arterial hypertension (AHT) is an important health problem due to its high incidence and prevalence in the general population and the associated increase in risk of suffering cardiovascular disease in the form of chest pain (angina), myocardial infarction and cerebrovascular events (e.g., stroke) (3). Arterial hypertension affects 6-8% of the general population and is the most common cardiovascular risk factor in Spain, with a prevalence of over 40% in patients over 35 years of age.

The blood pressure values considered to be normal were established by consensus as under 90 mmHg in the case of diastolic pressure, and under 140 mmHg in the case of systolic pressure (4). The latest revision of the guides for the evaluation and management of arterial hypertension of the *National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure* (JNC 7) introduced the term "pre-hypertension" in reference to people with a systolic blood pressure of 120-139 mmHg or with a diastolic blood pressure of 80-89 mmHg (5) (Table 1).

ISCHEMIC HEART DISEASE

Ischemic heart disease is the main cause of death in the developed world. In males and females, it represents the first cause of mortality over the age of 40 and 65 years, respectively (6). Mortality is maximum in the first hours after the triggering event, and approximately 50% of all affected individuals die before reaching hospital.

Ischemic heart disease is characterized by a reduction (partial or total) in coronary blood flow. In 90% of all cases (7), this occurs following thrombus formation secondary to an atheroma plaque that occludes the arterial lumen, though other factors such as cold, physical exercise or stress can act as coadjuvant factors or (less frequently) trigger the event themselves. Chest pain (*angina*) occurs when coronary occlusion is partial and no myocardial necrosis is produced, while *acute myocardial infarction* is observed when coronary occlusion is total and necrosis is produced as a result. In turn, sudden death may also occur, generally as a result of *arrhythmias* (6, 7).

- Acute myocardial infarction (AMI)

Acute myocardial infarction is characterized by acute, sudden onset and intense pain, of an oppressive nature, located in the retrosternal or precordial region, and can irradiate to the arms, neck, back, jaw, palate or tongue. The duration is over half an hour, and the pain does not subside with rest. The condition is accompanied by intense perspiration, nausea, vomiting, dyspnea and imminent death sensation, though it can also manifest as sudden loss of consciousness, mental confusion or weakness. The triggering stimuli are emotional stress, intense physical exercise or the existence of concomitant disease or surgery. So-called silent infarctions in turn are characterized by an absence of pain, and are more common in elderly individuals, in women and in diabetic patients (6, 7).

The drugs used to treat AMI and administered for secondary prevention purposes comprise beta-blockers, calcium antagonists and the angiotensin-converting enzyme inhibitors (ACEIs) (7).

- Chest pain (angina, angor pectoris)

Stable angina is preceded by physical exertion or emotional stress (8), and consists of pain in the same loca-

CLASSIFICATION OF BLOOD PRESSURE IN ADULTS			
Classification of blood pressure		**SBP (mmHg)**	**DBP (mmHg)**
Normal		< 120	< 80
Prehypertension		120-139	80-89
AHT	Stage 1	140-159	90-99
	Stage 2	≥ 160	≥ 100

SBP: systolic blood pressure; DBP: diastolic blood pressure.

Table 1. *Classification of blood pressure in subjects over 18 years of age (National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure)*

tion and of the same intensity as in myocardial infarction, though of shorter duration (1-3 minutes). The pain moreover subsides with rest and/or the administration of sublingual nitroglycerin. In turn, *unstable* or *resting angina* (since it typically manifests under resting conditions) is characterized by more intense pain with a duration of no more than 20-30 minutes, and a poorer response to nitrates. This presentation can soon evolve towards myocardial infarction. Patients with a history of chest pain receive treatment in the form of antiplatelet drugs, nitrates and calcium antagonists (6, 7). On the other hand, so-called *Prinzmetal angina* (or variant angina) manifests at rest and is related to coronary artery spasms (6, 9).

ARRHYTHMIAS
Arrhythmias are variations in normal heart rate due to cardiac rhythm, frequency or contraction disorders (2). Atrial fibrillation is the most common type of cardiac arrhythmia (10), with a prevalence in the general population of 0.4%, though this percentage increases to 3.8% at 60 years of age and reaches 9% in individuals over 80 years of age (11). The frequency of electric pulse generation in the sinus node ranges from 60-80 beats per minute (bpm) under resting conditions and can increase to 200 bpm during physical exercise. Arrhythmias are generated when electric pulse generation proves defective.

HEART FAILURE
Heart failure (HF) is defined as the incapacity of the heart to function properly, pumping insufficient blood towards the tissues and leading to fluid accumulation within the lungs, liver and peripheral tissues. In Spain, heart failure causes about 19,000 deaths each year. The survival of the affected patients is limited, due to the aggravating factors and concomitant pathologies they typically present (7). Heart failure in turn is the end stage of other diseases such as ischemic heart disease or arterial hypertension.

Acute heart failure is triggered by cardiotoxic drugs or coronary occlusion episodes. The most common causes are severe and prolonged arterial hypertension, valve disease, ischemic heart disease and serious pericardial diseases. Acute heart failure typically manifests as acute lung edema (7). *Chronic heart failure* in turn is associated to antecedents of arterial hypertension and ischemic heart disease. Other causes are dilated myocardiopathy, valve disease, alcohol-induced heart disease, *cor pulmonale* and hypertrophic and restrictive myocardiopathy. Diabetes mellitus in turn leads to a 2.5- to 5-fold increase in the risk of developing chronic heart failure.

The management of these patients includes identification and correction of the causal factors (e.g., arterial hypertension or valve disease), and changes in lifestyle (elimination of toxic habits or modifications in diet). Drug treatment in the form of ACEIs (captopril, enala-

pril, lisinopril and quinapril) in turn can be associated to diuretics (furosemide) and vasodilators (isosorbide dinitrate and hydralazine).

ENDOCARDITIS
Infectious endocarditis (IE) is an infrequent condition resulting from the association of morphological alterations of the heart and bacteremia of different origins. It has been estimated that 14-20% of all cases of IE have a buccodental origin (12). Transient bacteremia is observed not only in dental treatments such as tooth extractions (51-85%) (13) or periodontal surgery (36-88%), but also during tooth brushing (26%) or when chewing gum (17-51%). The mortality rate is 5-11% (13). Approximately 50% of all cases of infectious endocarditis are caused by *Streptococcus viridians* (13-15). Infectious endocarditis is infrequent in young individuals, except intravenous drug abusers, which represent a high risk group (12). In these latter subjects, infectious endocarditis is a serious problem, with an estimated incidence of 1.5-3.3 per 1000 intravenous drug abusers (16), and an associated 5-10% mortality rate. These figures are decreasing, however, probably as a result of changing habits aimed at avoiding infection with the human immunodeficiency virus (HIV) (17). Recurrent infectious endocarditis is also commonly observed in these individuals (16).

Due to the important morbidity and mortality involved, antibiotic prophylaxis is considered necessary when planning dental treatment in individuals at risk (12), though according to Farbod et al. (15), daily activities such as tooth brushing twice a day for one year produces far greater bacteremia than that associated with tooth extraction. The percentage of patients with endocarditis who have received recent dental treatment varies greatly (3-40%), depending on the literature source (9).

No studies have shown prophylaxis to be beneficial (14), and there is no evidence that prophylaxis with penicillin is effective (18). In this context, although there is no firm scientific evidence, the morbidity and mortality associated with infectious endocarditis, as well as medical-legal considerations, justify the generalized recommendation to provide antibiotic prophylaxis. Authors such as Carmona et al. (19) and Poveda et al. (13) agree that at least from the medical-legal perspective, it is prudent to administer antibiotic prophylaxis in those patients with a history of infectious endocarditis or who carry prosthetic heart valves.

Objectives
The present study consists of a literature review of the oral manifestations that can be seen in patients with arterial hypertension, ischemic heart disease, arrhythmias and heart failure, and of the dental management of such patients.

Material and methods

A Medline-PubMed search was conducted of the literature over the last 10 years using the MeSH validated keywords: "cardiopathy", "dental management", "endocarditis", "hypertension" and "arrhythmia". The search was limited to articles in English or Spanish, and published in the last 10 years. A total of 31 articles were reviewed, of which 22 were literature reviews, three were expert committee guides, four clinical trials and two case series.

Results

ARTERIAL HYPERTENSION

1. Oral manifestations

Antihypertensive drugs are able to induce a series of adverse effects with the oral cavity, as can be seen in table 2 (3). In such situations, patients can present oral manifestations in the form of xerostomia, lichenoid reactions, burning mouth sensation, loss of taste sensation or gingival hyperplasia, as well as extraoral manifestations such as sialadenosis.

2. Dental management

A well controlled hypertensive patients does not pose a risk in clinical practice. Consultation with the supervising physician is advisable in order to know the degree of hypertension control and the medication prescribed at that time. The patient is to be instructed to take his or her medication as usual on the day of dental treatment. Prior to such treatment, the patient blood pressure should be recorded, and if the values are found to be high, the visit should be postponed until adequate pressure control is achieved (4). It is preferable for the visits to be brief and in the morning. The prescription of anxiolytic agents may prove necessary in particularly anxious patients (5-10 mg of diazepam the night before and 1-2 hours before the appointment) before dental treatment, or alternatively sedation with nitrous oxide may be considered. A good local anesthetic technique should be performed, avoiding intravascular injection and using a maximum of two anesthetic carpules with vasoconstrictor. If more anesthesia is needed, it should be provided without vasoconstrictor. Absorbable suture are to be avoided with adrenalin (3). During treatment, sudden changes in body position should be avoided, as they can cause orthostatic hypotension as a side effect of the blood pressure-lowering drugs.

When the patient does not present good blood pressure control, it is best to refer him or her to the physician in order to ensure adequate control before dental treatment. In the case of emergency dental visits, treatment should be conservative, with the use of analgesics and antibiotics. Surgery is to be avoided until adequate blood pressure control has been secured.

Certain nonsteroidal antiinflammatory drugs (NSAIDs), such as ibuprofen, indomethacin or the naproxen, can interact with antihypertensive drugs (beta-blockers, diuretics, ACEIs) (20), thereby lowering their antihypertensive action. Normally more than five days of treatment with both types of drugs are required for interactions to manifest (20, 21); as a result, NSAIDs should not be prescribed for longer than this five-day period.

- *Local anesthesia with vasoconstrictor*

The existing controversy over the use of local anesthesia with a vasoconstrictor is explained by the possible

ANTIHYPERTENSIVE DRUGS	GENERIC NAME	TRADE NAME	SIDE EFFECTS
DIURETICS	Thiazides, furosemide, ethacrinic acid, spironolactone	Esidrex®, Hidrosaluretil®, Seguril®, Salidur®, Aldactone®	Xerostomia, nauseas
ADRENERGIC BLOCKING AGENTS	Clonidine, methyldopa, propanolol, rauwolfia alkaloids	Catapresan®, Aldomet®	Xerostomia, depression, sedation, sialadenosis
	Methyldopa, propanolol,	Aldomet®, Sumial®	Lichenoid reaction
ANGIOTENSIN-CONVERTING ENZYME INHIBITORS (ACEIs)	Captopril, enalapril	Capoten®, Tensoprel®, Renitec®	Lichenoid reaction, burning mouth, loss of taste
CALCIUM ANTAGONISTS	Nifedipine, amlodipine, verapamil , diltiazem	Adalat®, Cordilán®, Norvasc®, Astudal®, Amlor®, Veratensin®	Gingival hyperplasia, xerostomia
OTHERS VASODILATORS	Hydralazine, nitroprusside, minoxidil	Hydraprés®, Lonitén®	Cephalgia, nauseas

Table 2. Oral adverse effects of antihypertensive treatment.

adverse effects of these substances upon blood pressure and/or heart rate (22). However, different studies have shown that no significant increases in arterial pressure are induced by the use of anesthesia with a vasoconstrictor in dental treatments. Silvestre et al. (23) observed no significant changes in systolic blood pressure before, during or after dental extractions – the lowest pressures being recorded at the end of the procedure, and the highest at the time of extraction. In a recent publication, Laragnoit et al. (24), in coincidence with other studies in patients with heart diseases, reported that the administration of 2% lidocaine with epinephrine (1: 100,000) induces no significant changes in the hemodynamic parameters during dental treatment – this suggesting that its use is safe in minor dental operations, provided a good anesthetic technique is performed and the treatment prescribed by the cardiologist is maintained (25). Patients with cardiovascular disease are at a greater risk of massive endogenous adrenalin release secondary to deficient local anesthesia than of reaction to the small amount of vasoconstrictor used in local anesthetics (9). In effect, pain is responsible for endogenous catecholamine release, and this in turn can give rise to hemodynamic alterations. Pain control is essential during dental procedures, and epinephrine affords excellent bleeding control in the context of local anesthesia (24). Nevertheless, vasoconstrictor use should be limited, taking care not to exceed 0.04 mg of adrenaline (2 carpules containing 1.8 ml of anesthetic with adrenalin 1: 100,000) (7).

- Hypertensive emergencies

In the case of a hypertensive emergency (>120/210 mmHg), the emergency service should be activated by dialing 112, and furosemide should be administered (40 mg, via the oral route). If this proves insufficient to restore pressure control, captopril should be administered (25 mg via the oral or sublingual route). If the blood pressure fails to decrease within 30 minutes after these measures, the patient should be referred to the nearest Hospital Emergency Department.

ISCHEMIC HEART DISEASE

1. Oral manifestations

If the patient is receiving anticoagulant or antiplatelet treatment, bleeding may occur, manifesting as hematomas, petechiae or gingival bleeding.

2. Dental management

A patient who has suffered acute myocardial infarction is at a high risk of suffering another infarction episode or severe arrhythmias. It has been reported that over 70% of all recurrences take place in the first month after the initial vascular event (26). In dental practice a minimum safety period of 6 months has been established before any oral surgical procedure can be carried out. However, studies in recent years have underscored the need to revise these criteria. At present, the evaluation of exercise testing in the first 6 days after infarction is considered essential for risk assessment and prognosis. If such testing is well tolerated by the patient, the risk is taken to be low. No ideal minimum time has been established, though many authors consider 4-6 weeks after infarction to be a prudent period (6). In this time, dental treatment should be limited to emergency procedures aimed at affording pain relief: extractions, the drainage of abscesses and pulpectomies, preferably carried out in the hospital setting. After this safety period, the treatment decision should be established on the basis of the situation and medical condition of each individual patient (7, 9).

Consultation with the supervising physician is advised (26) in order to know the type of heart disease (angina or infarction), its severity, the time elapsed from the cardiological event, the clinical complications, and the treatment received by the patient. In turn, the patient should continue taking the prescribed medication as usual. If nitrates are used, the patient should bring them to each visit to the dental clinic (8), in case chest pain develops. Authors such as Silvestre et al. (6) mention the possibility of administering nitrite as a preventive measure before local anesthesia (27). In the case of very anxious patients, premedication can be administered to lessen anxiety and stress (5-10 mg of diazepam the night before and 1-2 hours before treatment). Some authors use inhalatory sedation in the form of nitrous oxide / oxygen (8). The visits should be brief (less than 30 minutes) and should be programmed for during the day – avoiding the early morning hours, which is when heart attacks are most frequent, as well as the late afternoon hours, when tiredness and stress are greater (6). As has been commented above, a good anesthetic technique is required, taking care not to inject the solution into a blood vessel, and using a maximum of two carpules with vasoconstrictor. In turn, if anesthetic reinforcement is needed, it should be provided without a vasoconstrictor (28). The patient should be placed in the position most comfortable for him or her (semi-supine), and should get up carefully in order to avoid orthostatic hypotension. Depending on the patient, blood pressure and pulsioxymetric monitoring may be required before and during dental treatment (26). If the patient is receiving anticoagulants, the international normalized ratio (INR) on the day of treatment should be determined, and treatment should be provided within the recommended limits (< 3.5), with local hemostasis if surgery is planned (26, 28). If the patient is receiving antiplatelet medication, excessive local bleeding is to be controlled. The local hemostatic measures that can be used comprise bone wax, sutures, gelatin of animal origin (Gelfoam®), regenerated oxidized cellulose (Surgicel®), collagen, platelet rich plasma, thrombin (Thrombostat®), fibrin sealants (Tissucol®), electric or laser scalpels, antifibrinolytic agents such as tranexamic acid (Amchafibrin®)

DENTAL MANAGEMENT IN PATIENTS WITH ISCHEMIC HEART DISEASE
- Consultation → type of heart disease, severity, time elapsed from the cardiological event, clinical complications, _treatment_ received. · Take the prescribed medication as usual · If _nitrates_ are used, the patient should bring them - Take as a preventive measure before local anesthesia - Take in case chest pain develops If surgery is needed ⌐ · _Anticoagulated patient_ → determine INR on the day of treatment ⌐ · _Antiplatelet patient_ → local hemostatic measures
- Before 4-6 weeks after infarction → only emergency procedures - Very anxious patients → premedication (5-10 mg of diazepam the night before and 1-2 hours before treatment) - Brief visits (less than 30 minutes) → avoiding early morning hours and late afternoon hours
- Anesthesia → not to inject into a blood vessel → a maximum of two carpules with vc · If anesthetic reinforcement is needed: anesthesia without vc
- Patient in semi-supine position
- Patient should get up carefully → to avoid orthostatic hypotension
- Monitoring may be required: blood pressure and pulsioxymetric

vc: vasoconstrictor

Table 3. _Summary of dental management in patients with ischemic heart disease._

or epsilon-aminocaproic acid (Caproamin®) (3). Table 3 summarizes the management of these patients.

If the patient develops chest pain during dental treatment, the procedure should be suspended immediately, and a sublingual nitrite tablet should be administered (0.4-0.8 mg), together with nasal oxygen (3 liters/minute). If the pain subsequently subsides, continuation of treatment can be considered, or alternatively an appointment can be made for some other day. If the pain fails to subside after 5 minutes, a second sublingual tablet should be administered. If the pain fails to disappear 15 minutes after onset, acute myocardial infarction is to be suspected, and the patient must be transferred to a hospital center (7, 9), as shown in figure 1.

ARRHYTHMIAS

1. Oral manifestations

Many antiarrhythmic drugs have side effects such as gingival hyperplasia or xerostomia.

2. Dental management

Consultation with the supervising physician is advised in order to know the current condition of the patient and the type of arrhythmia involved, as well as the medication prescribed (10). It must be checked that the patient uses the medication correctly. Anxiolytics can be used to lessen stress and anxiety (10, 11). Short visits in the morning are to be preferred. Patient monitoring, with recording of the pulse, is indicated before starting treatment. It is very important to limit the use of a vasoconstrictor in local anesthesia, with the administration of no more than two carpules. The treatment planned should not be too

long or complicated. According to Becker (29), although modern pacemakers are more resistant to electromagnetic interferences, caution is required when using electrical devices (e.g., ultrasound and electric scalpels) that might interfere with pacemakers – particularly the older models, since most such devices developed in the last 30 years are bipolar and are generally not affected by the small electromagnetic fields generated by dental equipment. It is therefore important to know the type of pacemaker, the degree of electromagnetic protection of the generator, and the nature of the arrhythmia (9). Pacemakers and automatic defibrillators pose a low risk of infectious endocarditis, and do not need antibiotic coverage before dental treatment (9).

If important arrhythmia develops during dental treatment, the procedure should be suspended, oxygen is to be provided, and the patient vital signs are to be assessed: body temperature (normal values: 35.5-37ºC), pulse (normal values: 60-100 bpm), respiratory frequency (normal values in adults: 14-20 cycles or respirations per minute), blood pressure (normal values: systolic blood pressure under 140 mmHg and diastolic blood pressure under 90 mmHg). Sublingual nitrites are to be administered in the event of chest pain. The patient should be placed in the Trendelenburg position, with vagal maneuvering where necessary (Valsalva maneuver, massage in the carotid pulse region, etc.). The dental team should be prepared for basic cardiopulmonary resuscitation and initiation of the emergency procedure for evacuation to a hospital center, if necessary.
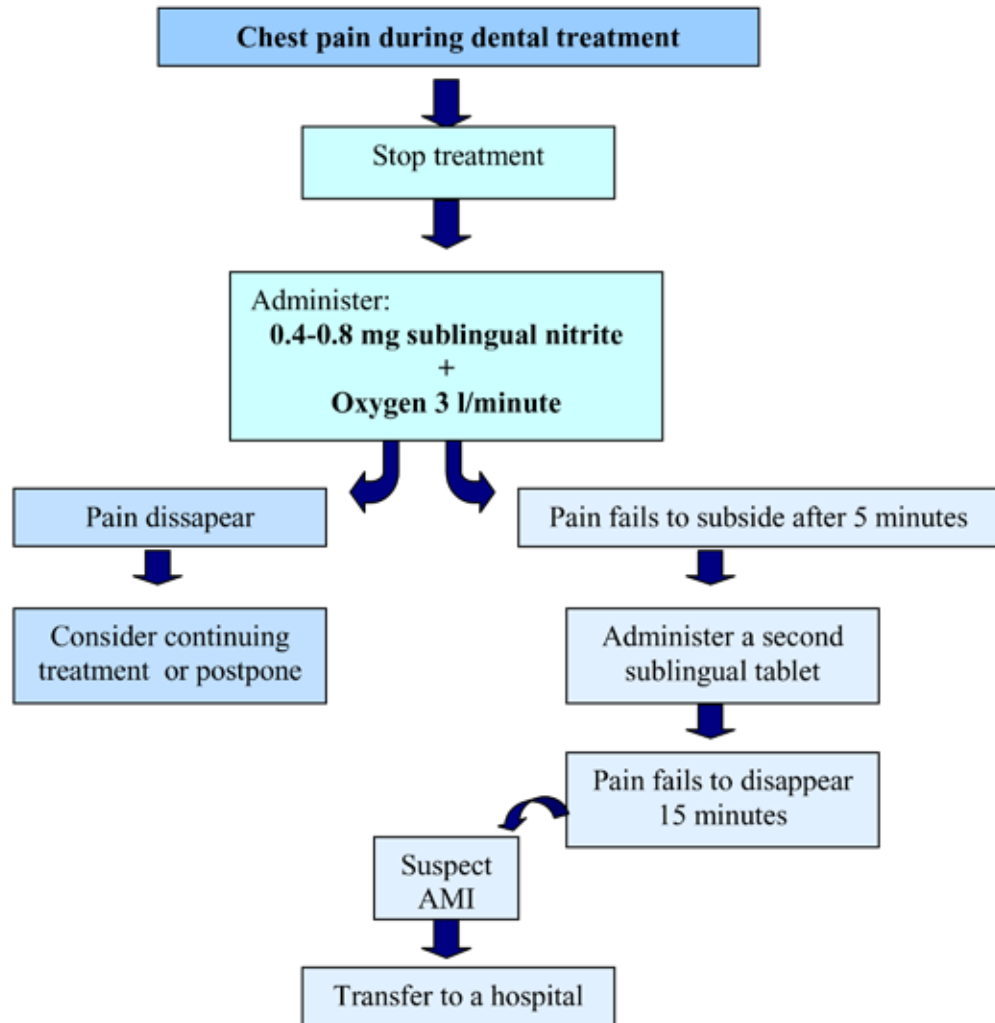
AMI: acute myocardial infarction

Figure 1. Management of patients with ischemic heart disease in the event of chest pain during dental treatment.

HEART FAILURE

1. Oral manifestations

Due to the drug treatments used by patients with heart failure, a series of oral manifestations can be observed. In this context, ACEIs (captopril, enalapril) can produce lichenoid reactions, burning mouth sensation and a loss of taste sensation, while diuretics (furosemide) can produce xerostomia.

2. Dental management

Consultation with the supervising physician is advised in order to know the current condition of the patient and the medication prescribed. The patient should be receiving medical care, and heart failure should be compensated. Dental treatment is to be limited to patients who are in stable condition, since these individuals are at an important risk of developing serious arrhythmias and even sudden death secondary to cardiopulmonary arrest. In patients with heart failure, including those presenting palpitations, asthenia or dyspnea, it is important to only

provide emergency care, and to do so in the hospital setting. Anxiety and stress are to be avoided during the visits, which in turn should be brief (less than 30 minutes) and are to be programmed for the morning hours. The patient should be placed in the semi-supine position in a chair, with control of body movements (which should be slow), in order to avoid orthostatic hypotension. In patients administered digitalis agents (digoxin, methyl-digoxin), the vasoconstrictor dose is to be limited to two anesthetic carpules, since this drug combination can favor the appearance of arrhythmias. Aspirin (acetylsalicylic acid) can lead to sodium and fluid retention, and therefore should not be prescribed in patients with heart failure.

In the event of an emergency (i.e., lung edema), and after contacting the emergency service, the patient should be placed seated with the legs lowered, and receiving nasal oxygen at a rate of 4-6 liters/minute. Sublingual nitroglycerin tablets are indicated (0.4-0.8 mg), and the dose

SITUATION		AGENT	SINGLE DOSE 30-60 min BEFORE PROCEDURE	
			ADULTS	CHILDREN
Standard general prophylaxis (oral)		Amoxicillin	2gr	50 mg/kg (maximum 2 gr)
Unable to take oral medica-tion		Ampicillin Cefazolin or Ce-ftriaxone	2 gr im or iv 1gr im or iv	50 mg/kg im or iv 50 mg/kg im or iv
Allergic to penicillins	Oral	Cephalexin * Clindamycin Azithromycin or Clarithromycin	2gr 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
	Unable to take oral medication	Cefazolin or Ce-ftriaxone Clindamycin	1g im or iv 600 mg im or iv	50 mg/kg im or iv 20 mg/kg

im: intramuscular; iv: intravenous

* Another first or second generation cephalosporin can be used via the oral route, at equivalent doses. Cephalosporins should not be used in patients with a history of anaphylaxis, angioedema or urticaria in response to penicillins or ampicillin.

Table 4. *Prophylactic antibiotic protocol for infectious endocarditis, recommended by the American Heart Association (AHA).*

may be repeated every 5 or 10 minutes if blood pressure is maintained (7). Acute lung edema manifests as sudden onset or progressive dyspnea, cough with expectoration, cyanosis, skin coldness, intense perspiration and critically ill sensation. The patient typically refers suffocation and laryngeal irritation, and the condition may simulate an asthma attack.

PREVENTION OF ENDOCARDITIS

The most widely accepted endocarditis prevention protocols are those of the American Heart Association (AHA) and the British Society of Antimicrobial Chemotherapy (BSAC). The difference between the two protocols centers on the amount of amoxicillin to be administered (2 and 3 grams according to the AHA and BSAC, respectively) (12). The present study focuses on the protocol of the AHA (Table 4), which was modified in 2007 with the purpose of further clarifying when prophylaxis for infectious endocarditis is recommendable or not, and of offering more uniform and coherent global recommendations.

Infectious endocarditis is not an emergency condition in the dental clinic, though its associated mortality is high. The disease is to be suspected when the patient presents unexplained fever for over one week together with heart murmurs. The symptoms are fever, chills, nocturnal perspiration, a generally worsened condition, lessened appetite, fatigue, weakness and discomfort, and tend to manifest 10-15 days after the causal or triggering event or intervention. Symptoms of heart failure may also be seen. The typical clinical sign is the appearance of petechiae with a clear center on the skin of the flexure zones of the extremities, supraclavicular region, conjunctival

mucosa of the lower eyelids, and hard palate.

According to the AHA (30), antibiotic prophylaxis for dental procedures is only indicated in patients with heart disorders related to a very high risk of developing endocarditis:

- Prosthetic heart valves.
- Previous infectious endocarditis.
- Congenital heart disease, only in the following situations:
    o Untreated cyanotic congenital heart disease, including shunts and ducts.
    o Congenital heart defects fully repaired with material or prostheses placed through surgery or with catheters, during the first 6 months after the operation.
    o Repaired congenital heart disease, though with residual defects associated to prosthetic materials.
- Heart transplant patients who develop cardiac valve disease.

Prophylaxis is recommended in all dental procedures involving the manipulation of gingival tissue, the periapical region of the teeth, or perforations of the oral mucosa, such as extractions, endodontic treatment surpassing the periapical limits, the placement of retraction sutures, biopsies, suture removal, the placement of brackets, or buccal cleaning operations, among other.

Prophylaxis in turn is not recommended in the routine injection of anesthetic solutions in non-infected tissues, dental X-rays, the placement of removable dentures or orthodontic devices, loss of temporal teeth, or bleeding

secondary to lip or oral mucosa traumatisms (30).

- Recommendations

Although not based on scientific evidence, the American College of Cardiology recommends that "individuals at risk of developing bacterial endocarditis should observe the best hygiene possible". Other authors consider that maintaining good oral health is probably more important for the prevention of endocarditis than the prophylactic administration of antibiotics before certain dental operations (31).

It has been seen that bacteremia may develop after traumatic ulcer formation associated with removable dentures. Periodic controls are thus advised to prevent them from developing (12).

Some investigators such as Blanco in 2004 consider that it is advisable to perform rinses with 0.12% chlorhexidine for at least 30 seconds, before any dental treatment, since this produces an important reduction in bacteremia of oral origin (12, 15).

If the patient has failed to correctly follow the prophylactic treatment regimen, antibiotics are to be administered as soon as possible, since this has been shown to be effective when carried out in the two hours following the development of bacteremia (12).

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