**Cardiovascular system (CVS)**

Successful outcome of any surgical procedure necessitates a clinical approach to a patient

with systemic disease in a stepwise manner as follows:

1. Medical history

2. Clinical examination.

In case of dental procedures, a third factor is included which is:

3. Dental aspect which include medical consultation of treating physician to diagnose any medical problem and offer the required investigation and necessary preventive measures to avoid complications during and after dental surgical procedure.

Proper history taking, careful examination, and consultation when needed will prevent most of the common mistakes that might lead to serious complications.

 A simple form of a case sheet and the most important questions:



Cardiovascular disease is a major cause of morbidity and mortality around the world, and its spectrum is wide-reaching. Included in this population of patients are people with:

***((coronary artery disease (CAD), congestive heart failure, stroke, hypertension, peripheral arterial disease, atrial fibrillation and other arrhythmias, valvular disease, and congenital heart disease)).***

- Coronary artery disease: includes stable angina or an acute coronary syndrome such as unstable angina, non–ST segment elevation myocardial infarction (NSTEMI), or ST segment elevation myocardial infarction (STEMI).

- Congestive heart failure is the end result of many cardiac disorders and is generally classified as systolic or diastolic in etiology.

- Strokeis caused by cerebral hypoperfusion, which can result from such problems as carotid disease, thromboembolism, or emboli of infectious origin.

- Arrhythmia and hypertension are not typically the primary cause of mortality, these problems often predispose to other causes of cardiovascular disease mortality, such as stroke and heart failure.

- Valvular heart disease may lead to cardiomyopathy and is found in all age groups.

- Congenital heart diseaseincludes a wide variety of disorders, ranging from valve abnormalities and coronary anomalies to cardiomyopathy and other structural abnormalities including shunts and malformations of the cardiac chambers.

**Clinical presentation**

A patient with a cardiovascular disease may present with one or more of the following clinical features:

1- chest pain

2- dyspnea

3- palpitation

4- edema

5- cyanosis

6- syncope

7- others (fatigue, cough, anorexia, loss of weight)

*It should be kept in mind that many patients with significant cardiac disease are asymptomatic.*

**Diagnostic Tests and Procedures in the Patient with Cardiovascular Disease**

1- Electrocardiography (ECG)

2- Chest radiography

3- Echocardiography

4- Myocardial perfusion scanning

5- Cardiac catheterization

6- Magnetic resonance imaging (MRI)

7- Computed tomography of the heart (CTA)

8- Serological tests (troponin T, troponin I, CKMB)

Coronary Heart Disease (CHD)

The term *coronary heart disease* (CHD) describes a number of cardiac conditions that result from the presence of atherosclerotic lesions in the coronary arteries.

The development of atherosclerotic plaque within the coronary arteries can result in

obstruction to blood flow, producing ischemia, which can be acute or chronic in nature. Atherosclerosis is a pathological process started at a young age and can be present for years in an asymptomatic form until the degree of vessel obstruction leads to ischemic symptoms.

Obstructive atherosclerotic lesions can cause:

 A- chronic symptoms of exercise- or stress-related angina; or,

 B- sudden death, unstable angina, or myocardial infarction (MI) in the case of plaque rupture and acute thrombosis.

**Pathology**

The process of atherosclerosis is known to begin at a young age. Autopsies of teenagers frequently demonstrate the presence of atherosclerotic changes in coronary arteries. Atherosclerosis is a process linked to the subintimal accumulation of small lipoprotein particles that are rich in LDL.

Subintimal deposits of LDL are oxidized, setting off a cascade of events that culminate in not

only the development of atherosclerotic plaque but also vascular inflammation.

Vascular inflammation drives progression of atherosclerosis as well as the potential rupture of plaque leading to vessel occlusion.

**Risk factors for atherosclerosis**

Two groups of risk factors are present, modifiable and nonmodifiable:



Myocardial ischemia develops when there is a mismatch of oxygen delivery and oxygen demand, so, ischemia might occur due to (1) increase oxygen demands, (2) decrease oxygen delivery, or (3) both.

**Angina Pectoris and Stable Ischemic Heart Disease**

Angina pectoris is a clinical manifestation of obstructive CAD, which in turn is usually the result of atherosclerotic plaque formation over a number of years.

*Angina pectoris is clinical syndrome of temporary ischemia in part or all of the myocardium, resulting in diminished oxygen supply which presents as brief paroxysmal retrostemal chest pain precipitated by fatigue, stress, and heavy meal, and subsides within 2-5 min after rest or the use of nitroglycerin (GTN).*

The episode of chest pain may be described as painful chest discomfort of burning sensation with pressure, or tightness and pain radiated to the left shoulder, neck, left arm (with numbness and tingling), chin and teeth of the mandible (usually the left side), or the epigastrium.

**Physical examination**

Usually unremarkable, but should include:

1- evidence of risk factors: hyperlipidemia, hypertension.

2- evidence of valvular heart disease.

3- conditions that may precipitate angina: anemia, thyrotoxicosis.

4- evidence of arterial disease: carotid bruit.

**Investigation**

- The most reliable ECG finding is the demonstration of reversible ST segment depression with or without T inversion while the patient is experiencing pain (whether spontaneously or induced by exercise).

Exercise tolerance test is performed using a treadmill or bicycle ergometer while monitoring patient's ECG.

- Other investigations were mentioned previously.

**Management**

I- Drug therapy

 **1- Antiplatelet therapy**

 A- Aspirin: 75-325 mg daily

 B- Clopidogrel: 75 mg daily can be used instead of aspirin.

 **2- Antianginal drug therapy**

 A- Nitrates: these are venodilators, GTN is used sublingually for relief of acute symptoms, while isosorbide dinitrate is used orally for long term prophylaxis of symptoms.

 B- β- adrenergic blockers: reduce myocardial oxygen demand, examples include atenolol and metoprolol.

 C- Calcium channel blockers: these are coronary vasodilators that reduce oxygen demand and contractility. They can be used instead of beta blockers.

Examples include: amlodipine, diltiazem, verapamil.

 **3- Hypolipidemic drugs**

Statin group is most commonly used worldwide.

II- Invasive treatment

 **1- Percutaneous coronary intervention (cardiac catheterization)**

The coronary stenosis is managed with either ballooning only or with inserting a metallic stent at the site of stenosis. These techniques provide symptomatic treatment, and reduce acute complications.

**2- Coronary artery bypass graft (CABG)**

 During CABG, a healthy artery or vein from the body is connected, or grafted, to the blocked coronary artery. The grafted artery or vein bypasses the blocked portion of the coronary artery. This creates a new path for oxygen-rich blood to flow to the heart muscle. Internal mammary artery or saphenous vein can be used in this procedure.

III- Correction of aggravating conditions and risk factors

Obesity, smoking, diabetes mellitus, and all risk factors mentioned above should be managed properly.

Clinical Tips

 - Patients with unstable angina and those with MI within less than 3 months should have dental treatment in hospital.

 - Patients with stable angina and those with more than 3 months post-MI may be treated in primary care center.

 - Sublingual GTN can used preoperatively.

 - Prophylactic sedatives premedication, usually 5-l0 mg diazepam (Valium) orally, one hour before the surgical procedure.

 - Avoid adrenaline-containing LA and adrenaline containing gingival retraction cords especially if patient is taking non-selective beta-blocker (e.g. propanolol).

The combination of aspirin with other antiplatelet drugs increases the chances of signiﬁcant postoperative bleeding.

0 - Dental procedures should be stopped if there is chest pain, dyspnea, a rise in

heart rate > 40 bpm, ST-segment elevation, arrhythmias, or a rise systolic

BP > 20 mmHg, then patient given sublingual GTN and oxygen, kept sitting

upright, with vital signs monitoring. The pain should relieve in 2-3 min;

then the patient accompanied home. If chest pain is not relieved within 3

min, MI is a possible and medical help should be summoned. Pain persists

after three doses of GTN every 5 minutes, lasts more than 15 minutes, or is

Acute coronary syndrome (ACS)

ACS comprises a spectrum of clinical presentations, ranging from unstable angina to NSTEMI or STEMI.(ST elevation and nonST elevation myocardial infarction).

Unstable angina represents:

A- the new onset of angina at rest or on minimal exertion, or

B- an increase in frequency of previously stable anginal symptoms, particularly at rest.

ACS manifesting as MI, either NSTEMI or STEMI, is differentiated from unstable angina by: 1- prolonged symptoms

2- characteristic ECG changes

3- the presence of biomarkers in blood.

Unstable angina may be a predictor of either NSTEMI or STEMI, and the diagnosis of unstable angina identifies a patient who requires careful assessment and treatment.

**Pathophysiology**

- unstable angina and NSTEMI could occur secondary to the following mechanisms:

1- plaque rupture with subsequent thrombosis causing **subtotal** occlusion of the coronary artery.

2- prolonged and severe coronary vasospasm.

3- progressive mechanical obstruction following PCI.

- STEMI, an occlusive thrombus is almost always present at the site of rupture or erosion of an atheromatous plaque.

The major difference between STEMI and NSTEMI is that STEMI is associated with complete loss of blood supply to a certain region in the myocardium due complete occlusion of a major artery while NSTEMI and unstable angina are associated with subtotal occlusion of a major artery or complete occlusion of a minor one..

**Clinical features**

- Pain is major presenting symptom.

Pain in acute MI is very severe and associated with pallor. Painless or silent MI is relatively common in old age or diabetic patients.

- Dyspnea, vomiting, and collapse might be present.

 Diagnosis

1- Specific ECG changes

STEMI: initially there is an ST elevation followed by appearance of Q wave and T inversion.

NSTEMI and unstable angina: ST depression and T wave changes.

Clinical tips

Never forget that initial ECG is normal in up to 50% of patients with acute MI.

2- Cardiac biomarkers

Troponin T and I are the most important cardiac biomarkers. They are positive in MI few hours after presentation while they are negative in unstable angina.

These biomarkers are useful for prognosis as well.

Treatment

1- Analgesia: intravenous morphine

2- Antiplatelets: aspirin plus clopidogrel

(glycoprotein IIb/IIIa receptor antagonists may be used for recurrent ischemia, diabetic patient, or in case of highly elevated troponin)

3- Anticoagulants: heparin, usually low molecular weight heparin, is given for 7 days.

Fondaparinux (a selective factor Xa inhibitor) and Bivalirudin (a direct thrombin inhibitor)

are alternatives to heparin.

4- Anti ischemic: nitrates, β blockers, or calcium channel blockers.

5- Reperfusion therapy: only in STEMI, with intravenous alteplase (tPA).

Complication of ACS

1- Arrhythmia: which might be fatal as in ventricular fibrillation.

2- Acute heart failure

3- pericarditis

4- Embolism

5- Ventricular aneurysm

Clinical tips

- Patients with heart disease should take their medications as usual on the day of the dental procedure.

- Cardiac events are most likely to occur in the early morning, patients with cardiac disease should be treated in the late morning or early afternoon.

- Dental care should be provided with good analgesia and limited epinephrine dose.

- Conscious sedation with nitrous oxide and oxygen can be given in the

hospital with the physician approval.

- No need for prophylactic antibiotic cover to prevent endocarditis.

- Patients within 6 months of MI: elective major surgery should be deferred but emergency dental treatment under LA can be given with physician opinion ﬁrst.

- Symptomatic patients with previous MI (6 - 12 months): elective simple dental care is carried out safely but elective surgery is deferred.

- Asymptomatic patients with previous MI (> 12 months): elective simple dental care can be carried out safely and elective surgery under LA can be done with: medical consultation, preoperative GTN, effective LA supplemented with analgesia, monitoring of BP, ECG, pulse and oxygen saturation.