Session Learning Outcomes

This session aims to:

- Comprehend how and why the symptoms and signs of cardiovascular disorders appear.
- Describe the aetiology, pathology and principles of treatment for disorders of heart rate, rhythm and conduction.
- Understand the complications of cardiovascular disorders.
- Understand the use of various diagnostic tests and procedures of cardiovascular system.
THE HEART

THE HEART

THE HEART

THE HEART VALVES

Superior view (the atria have been removed)

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THE CIRCULATION OF BLOOD

Diagram of blood flow

1. Left ventricle
2. Aorta and systemic arteries
3. In systemic capillaries, blood loses O2 and gains CO2
4. Superior vena cava
5. Right atrium (deoxygenated blood)
6. Right ventricle
7. Pulmonary trunk and pulmonary arteries
8. In pulmonary capillaries, blood loses CO2 and gains O2
9. Pulmonary veins (oxygenated blood)
10. Left atrium

THE CORONARY CIRCULATION

Arch of aorta

Ascending aorta

Pulmonary trunk

LEFT CORONARY

Left auricle

CIRCUMFLEX BRANCH

ANTERIOR INTER-VENTRICULAR BRANCH

POSTERIOR INTER-VENTRICULAR BRANCH

Right atrium

RIGHT CORONARY

MARGINAL BRANCH

Right ventricle

Anterior view of coronary arteries

Figure 20-8a Principles of Anatomy and Physiology, 11/e
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THE CONDUCTIVE TISSUE

Frontal plane

1. SINOATRIAL (SA) NODE
2. ATRIOVENTRICULAR (AV) NODE
3. ATRIOVENTRICULAR (AV) BUNDLE (BUNDLE OF HIS)
4. RIGHT AND LEFT BUNDLE BRANCHES
   Right ventricle
5. PURKINJE FIBERS

Anterior view of frontal section

THE CARDIAC CYCLE

## CLINICAL EXAMINATION OF CVS

<table>
<thead>
<tr>
<th>Observation</th>
<th>Breathinglessness, body weight/BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulses</td>
<td>Rate, rhythm, volume</td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
</tr>
<tr>
<td>Face, mouth, eyes and hand</td>
<td>Pallor, cyanosis, finger clubbing</td>
</tr>
<tr>
<td>Auscultation</td>
<td>Heart sounds, murmur</td>
</tr>
<tr>
<td>Abdomen</td>
<td>Ascites, hepatomegaly</td>
</tr>
<tr>
<td>Legs</td>
<td>Peripheral pulses, oedema</td>
</tr>
</tbody>
</table>
# CARDIAC FUNCTION

## Non-invasive Investigations

- Electrocardiography (ECG)
  - Exercise (Stress) ECG
  - Ambulatory ECG
- Echocardiography
- Plain x-rays
- Ultrasonic examination
- Magnetic resonance imaging
- Doppler Studies
  - Amplifies & records sounds made by blood flowing in the peripheral vessels
ANGIOGRAPHY

Arrow indicates a sub-total occlusion

TESTS OF CARDIAC FUNCTION

Invasive Methods of Assessment

- **Nuclear Imaging with radio-labeled chemicals**
  - Hot Spot Imaging
  - Cold Spot Imaging
- **Cardiac catheterization**
  - Performed under local anaesthetic & within a sterile environment
- **Coronary Angiography**
# CLINICAL PRESENTATIONS OF HEART DISEASE

## Chest pain

- **Characteristic** - onset, radiation, location, provocation, characteristic of pain
- **Cardiac causes** - MI, angina pectoris, pericarditis, dissecting aortic aneurysm, mitral valve prolapse
- **Other causes** - Lung disease (pneumonia, pleurisy, carcinoma, pneumothorax), psychogenic, oesophageal disease, musculoskeletal.
## CLINICAL PRESENTATIONS OF HEART DISEASE

### Breathlessness or Dyspnoea

- Unpleasant subjective awareness of the sensation of breathing
- Cardiac causes - acute pulmonary oedema, pulmonary embolism, congestive cardiac failure (CCF), congenital heart disease
- Respiratory causes - asthma, chronic obstructive pulmonary disease (COPD), Acute respiratory distress syndrome (ARDS), bronchial carcinoma
- Other forms - orthopnea, paroxysmal nocturnal dyspnoea (PND)
CLINICAL PRESENTATIONS OF HEART DISEASE

Hypertension

- Systolic BP rises with age and the incidence of cardiovascular disease is closely related to BP
- Hypertension will be discussed in session 21
CLINICAL PRESENTATIONS OF HEART DISEASE

**Syncope** (faint) Sudden loss of consciousness

**Presyncope** – lightheadedness and near collapse

- Cardiac causes - Arrhythmia, left ventricular dysfunction, aortic stenosis, hypertrophic obstructive cardiomyopathy
- Neurogenic causes - epilepsy, transient ischaemic attack (TIA)
- Metabolic causes - hypoglycemia,
- Inappropriate vasodilation - postural hypotension
CLINICAL PRESENTATIONS OF HEART DISEASE

Palpitation
Abnormal subjective awareness of the heartbeat

- **Causes** - ectopic beats, atrial fibrillation, paroxysmal tachycardia
- **Other causes** - anaemia, anxiety and excitement
# CLINICAL PRESENTATIONS OF HEART DISEASE

<table>
<thead>
<tr>
<th>Cardiac arrest and sudden cardiac death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common causes</strong></td>
</tr>
<tr>
<td>• Coronary artery disease (CAD) (85%)</td>
</tr>
<tr>
<td>• Structural heart disease</td>
</tr>
<tr>
<td>• No structural heart disease</td>
</tr>
</tbody>
</table>
## Abnormal heart sounds and murmurs

- May be first clinical manifestation of heart disease
- Clinical evaluation is helpful
- Echocardiogram is often necessary to confirm
## DISORDERS OF HEART RATE, RHYTHM AND CONDUCTION

Cardiac arrhythmia is a disturbance of the electrical rhythm of the heart

- Often a manifestation of structural heart disease
- Present with palpitation, dizziness, syncope, chest discomfort or breathlessness

### Sinus rhythm

- Sinus arrhythmias in autonomic neuropathy
- Sinus bradycardia ( <60/min ) in MI, sinus node disease, hypothermia, hypothyroidism
- Sinus tachycardia ( > 100/min ) in anxiety, fever, anaemia, heart failure, thyrotoxicosis
THE CONDUCTIVE TISSUE


Anterior view of frontal section
# ATRIAL TACHYARRHYTHMIAS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atrial ectopic beats</strong></td>
<td>(extra systoles, premature beats)</td>
</tr>
<tr>
<td></td>
<td>• Usually asymptomatic, treatment rarely necessary</td>
</tr>
<tr>
<td><strong>Atrial tachycardia</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increased atrial automaticity, SA node disease, digoxin toxicity</td>
</tr>
<tr>
<td><strong>Atrial flutter</strong></td>
<td>(atrial rate = 300/min)</td>
</tr>
<tr>
<td></td>
<td>• Associated with AV block</td>
</tr>
<tr>
<td><strong>Atrial fibrillation</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• CAD, valvular heart disease, hypertension, cardiomyopathy</td>
</tr>
</tbody>
</table>
ATRIAL TACHYARRHYTHMIAS

Atrial atopic beat

Atrial Tachycardia
ATRIAL TACHYARRHYTHMIAS

Normal Sinus Rhythm

Sinus Tachycardia

Sinus Bradycardia
VENTRICULAR TACHYARRHYTHMIAS

Ventricular ectopic beats (extra systoles, premature beats)
- Frequently found in healthy people, incidence increases with age
- Also in MI, heart failure, digoxin toxicity

Ventricular tachycardia
- CAD, cardiomyopathies
VENTRICULAR TACHYCARDIA’S

Supraventricular tachycardia

Ventricular tachycardia
PREMATURE VENTRICULAR COMPLEX
## SINOATRIAL DISEASE (SICK SINUS SYNDROME)

- Most common in elderly
- Also called sinus node dysfunctioning
- May be due to fibrosis, degenerative changes and/or ischaemia of the SA node
- Leads to variety of arrhythmias
ATRIOVENTRICULAR AND BUNDLE BRANCH BLOCK

**AV block**
- First degree block – AV conduction is delayed and usually asymptomatic
- Second degree block – dropped beats occur because some impulses fail to conduct to ventricles
- Third degree block – AV conduction failed completely and atria and ventricles beat independently

**Bundle branch block**
- Interruption of the right or left branch of the bundle of His
ATRIOVENTRICULAR AND BUNDLE BRANCH BLOCK

1st Degree heart block

Bundle Branch Block
## COMPLICATIONS OF CARDIOVASCULAR DISEASE

### Acute circulatory failure - cardiogenic shock

- Shock clinical syndrome due to circulatory failure leading to inadequate delivery of oxygen to tissue
- Features - hypotension, tachycardia, cold and clammy skin, rapid shallow breathing, drowsiness and confusion
- Causes
  - MI, pulmonary embolism, pericardial tamponade, myocarditis, endocarditis of mitral valve
## COMPLICATIONS OF CARDIOVASCULAR DISEASE

### Heart failure

<table>
<thead>
<tr>
<th>Definition</th>
<th>The state that occurs when the heart is unable to maintain sufficient cardiac output to meet the demands of the individual body.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Almost all form of heart disease can lead to heart failure.</td>
</tr>
<tr>
<td></td>
<td>Increased incidence with increased age.</td>
</tr>
</tbody>
</table>

Almost all forms of heart disease can lead to heart failure.
### CAUSES OF HEART FAILURE

**Aetiology:**

- Reduced ventricular contractility (Myocardial dysfunction)
- Ventricular volume overload
- Ventricular outflow obstructions
- Ventricular inflow obstructions
- Arrhythmia
- Diastolic dysfunction
### DIFFERENT TYPES OF HEART FAILURE

<table>
<thead>
<tr>
<th>Various terms are used in clinical practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biventricular or congestive heart failure</strong></td>
</tr>
<tr>
<td>• Right heart failure results from preexisting left heart failure</td>
</tr>
<tr>
<td><strong>Left heart failure</strong></td>
</tr>
<tr>
<td>• Causes include ischaemic heart disease (IHD), systemic hypertensive nephropathy (HTN), mitral and aortic valve disease, cardiomyopathies</td>
</tr>
<tr>
<td><strong>Right heart failure</strong></td>
</tr>
<tr>
<td>• Causes include left heart failure, chronic lung disease, tricuspid and pulmonary valve disease, left to right shunt</td>
</tr>
<tr>
<td><strong>Chronic heart failure</strong> can be compensated or decompensated</td>
</tr>
</tbody>
</table>
### PATHOPHYSIOLOGY OF HEART FAILURE

**Initially** compensatory physiological changes to maintain cardiac output

- Increased heart rate, Ventricular dilation, Hypertrophy, Salt retention, Sympathetic stimulation

**Leads to**

- Increased venous return,
- Increased congestion of viscera and lungs
- Dyspnoea
CLINICAL FEATURES OF HEART FAILURE

Dependent upon causes and onset

• Dyspnoea / orthopnoea, pink frothy sputum
• Fatigue, restlessness, poor exercise tolerance, low BP, cold peripheries, oliguria, uraemia, peripheral oedema, marked weight loss.

Complications

• Impaired liver function, thromboembolism and arrhythmia amongst others
MANAGEMENT OF HEART FAILURE

General measures
- Education and diet changes
- Moderate alcohol intake
- No smoking
- Moderate exercise

Drug therapy
- Diuretics, vasodilators, angiotensin converting enzyme (ACE) inhibitors, beta blockers, digoxin, amiodarone

Heart transplantation
Readings and Resources

Resources:

- **Set Textbooks:**

- **Additional textbooks:**
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