

EUROPEAN BOARD OF CARDIOVASCULAR PERFUSION

Preparation Outline for Examination Candidates EBCP Certification Sub-committee

INTRODUCTION

The European Board of Cardiovascular Perfusion (EBCP) provides this outline as an aid to candidates preparing for the EBCP examination for certification. Most of the topics listed in this outline will be covered in the multiple-choice written examination. This outline is a summary of the detailed Examination Syllabus in Basic and Clinical Science provided by the EBCP to institutions applying for accreditation of their perfusion-training programme.

1. Anatomy and Pathophysiology

1.1. *General Anatomy*

- a. Cell structure and genetic control
- b. Tissue structure, composition and function
- c. The general structure of arteries, veins and microcirculation
- d. The lymphatic system
- e. Skeletal, smooth and cardiac muscle
- f. The endocrine system

1.2. *Embryology and the Anatomy of the new born*

- a. The embryonic period and foetal development of the cardiovascular and respiratory systems
- b. Congenital malformations of the cardiovascular and respiratory systems
- c. Cardiovascular and respiratory changes at birth

1.3. *Cardiac and Respiratory Anatomy*

- a. The major structures of the thorax
- b. The structure of the heart: Chambers, valves and coronary circulation
- c. The upper respiratory tract and larynx
- d. The tracheo-bronchial tree
- e. The lungs: Alveolar structure, pulmonary circulation

1.4. *The Nervous system and Neuropathology*

- a. The basic organisation of the central and peripheral nervous systems
- b. The brain and the spinal cord
- c. The autonomic nervous system: Sympathetic and parasympathetic divisions, ganglia
- d. Cerebral trauma
- e. Cerebrovascular disease: Thrombosis and emboli, permanent stroke, transient ischaemic attack (TIA), subarachnoid and intracerebral haemorrhage
- f. Brain oedema

1.5. *Congenital Heart Disease and Surgical Treatment*

- a. Atrial septal defects
- b. Ventricular septal defects

- c. Persistent atrioventricular canal defects
- d. Patent ductus arteriosus
- e. Coarctation of the aorta
- f. Aortic stenosis
- g. Hypoplastic left heart syndrome
- h. Right ventricular outflow obstructions
- i. Tetralogy of Fallot
- j. Tricuspid atresia
- k. Ebstein anomaly of the tricuspid valve
- l. Transposition of the great arteries
- m. Total and partial anomalous pulmonary venous return
- n. Univentricular heart
- o. Malposition of the heart
- p. Anomalous left coronary artery arising from the pulmonary artery
- q. Cardiac Transplantation

1.6. *Acquired Heart Disease and Surgical Treatment*

- a. Atherosclerosis
- b. Ischaemic heart disease
- c. Valvular heart disease
- d. Cardiac hypertrophy and hypertensive heart disease
- e. Cor pulmonale and pulmonary hypertension
- f. Myocarditis
- g. Cardiomyopathies
- h. Pericardial disease
- i. Endocrines and the heart
- j. Heart tumors
- k. Arrhythmias and conduction disorders
- l. Diseases of the aorta: Aneurysms and dissections
- m. Cardiac Transplantation

1.7. *Diseases of the Respiratory system*

- a. Congenital anomalies
- b. Carcinoma
- c. Infections
- d. Adult respiratory distress syndrome: ARDS
- e. Transfusion related acute lung injury: TRALI
- f. Chronic obstructive pulmonary disease: COPD
- g. Pulmonary hypertension
- h. Lung Transplantation
- i. Lung reduction surgery

1.8. *The Abdomen and the Kidneys*

- a. The major structures of the abdomen: Kidneys, liver, pancreas and gastrointestinal tract
- b. Glomerulo-nephritis, nephrosis
- c. Renal hypertension: Renin-angiotensin system
- d. Renal insufficiency: Chronic and acute renal failure
- e. Renal transplantation
- f. Hepatitis: A, B and C
- g. Liver cirrhosis and portal hypertension
- h. Heart failure and the liver
- i. Hepatic failure
- j. Liver transplantation
- k. Diabetes mellitus: metabolic effects and complications

1.9. *The Immune system*

- a. The concept of immunity: Non-specific and specific
- b. B-lymphocytes: antibodies, the complement system
- c. Allergy and anaphylaxis
- d. T-lymphocytes and histocompatibility
- e. Autoimmune diseases

1.10. *Inflammation*

- a. Vaso-active mediators, complement system and inflammatory cascades, arachidonic acid metabolism
- b. Injury produced by polymorphonuclear leukocytes
- c. Increase in vascular permeability
- d. Systemic manifestations of inflammation
- e. Acute and chronic inflammation

1.11. *Death and Dying*

- a. The concept of death
- b. Organ donation and transplantation

2. Physiology

2.1. *Cellular Membrane Function*

- a. Membrane structure and function
- b. Membrane transport of non-electrolytes (diffusion and osmosis)
- c. Membrane transport of electrolytes (membrane potentials)

2.2. *General Circulation Principles*

- a. Haemodynamics: Physics of blood, blood flow and pressure
- b. Blood volume and fluid spaces of the body
- c. Intrinsic regulations of the circulation
- d. Blood flow through specific areas: Cerebral, renal and skin circulation

2.3. *Respiratory Physiology*

- a. Ventilation of the lungs
- b. Transport of oxygen and carbon dioxide to the tissues
- c. Regulation of respiration
- d. Ventilation/perfusion relationship

2.4. *Renal Physiology and Acid Base Management*

- a. Glomerular filtration and tubular function
- b. Plasma clearance
- c. Regulation of acid-base balance

2.5. *Cardiac Physiology*

- a. Rhythmic excitation of the heart
- b. The mechanical performance of the heart
- c. The sensory systems involved in cardiovascular regulation
- d. Electrocardiography

2.6. Haematology

- a. Blood cells
- b. Blood coagulation
- c. Immunity
- d. Allergy
- e. Transfusion

3. Pharmacology

3.1. Basic Pharmacological Concepts

- a. Drug-receptor interactions
- b. Pharmacokinetic considerations in the use of cardiovascular drugs

3.2. Clinical Pharmacology

- a. Inotropic agents
- b. Antiarrhythmic drugs
- c. Antianginal agents
- d. Drugs affecting skeletal muscle
- e. Anaesthetics
- f. Analgesics
- g. Antithrombotic agents
- h. Diuretic therapy in congestive heart failure

3.3. Solutions: Composition and Therapy

- a. Volume and tonicity
- b. Specific electrolytes
- c. Blood substitutes

4. Perfusion Technology

4.1. Historical Perspectives

4.2. ECC Techniques

- a. The components of the cardiopulmonary bypass circuit
- b. Priming composition and methods
- c. Clinical management of cardiopulmonary bypass
- d. Temperature management during cardiopulmonary bypass
- e. Arterial blood gas strategies: a and ph-stat
- f. Supplementary measurements: Online blood gas measurement systems, cerebral saturation measurement, myocardial ph-measurement
- g. Coagulation management
- h. Emergencies during cardiopulmonary bypass
- i. Special CPB techniques for specific operations
- j. Legal and ethical aspects

4.3. Myocardial Protection

- a. Basic goals and concepts in myocardial protection
- b. Applied clinical methods
- c. Adaptation of applications to patient needs

4.4. Pathological Effects of Cardiopulmonary Bypass

- a. Effects of hypothermia
- b. The inflammatory response
- c. Fluid balance and interstitial fluid accumulation
- d. Nervous system
- e. Renal function
- f. The lungs
- g. The liver

4.5. General Physics

- a. Natural laws pertaining to gas and fluid flow
- b. Dynamics of gas and fluid flow
- c. Materials and material properties
- d. Applied circulatory and respiratory dynamics

4.6. Applied Microbiology

- a. Microbes: the nature of and relation to infection and immunity
- b. Microbes: destruction and inhibition of growth
- c. Aseptic technique
- d. Methods and principles of sterilisation techniques

4.7. Mechanical Circulatory Support

- a. Indications for use of circulatory support systems
- b. Intra-aortic Balloon Pump Counterpulsation (IABP)
- c. Ventricular assist devices (VAD)
- d. Methods of Extracorporeal Membrane Oxygenation (ECMO/ECLS/PECLA)
- e. Implantable devices (Berlin Heart Incor, TCI, Novacor etc.)

4.8. Blood Conservation and Salvage

- a. Risks of blood transfusion
- b. Blood conservation techniques

4.9. Related Technologies

- a. Non-invasive radiological techniques
- b. Echocardiography
- c. Invasive cardiac diagnosis
- d. Magnetic resonance imaging
- e. Nuclear cardiology
- f. Blood and blood gas analysis techniques

4.10. Clinical Evaluation of Research Data

- a. Principles of designing a study
- b. Principles of publication
- c. Critical evaluation of research data
- d. Statistical considerations

SUGGESTED READING FOR THE EBCP EXAMINATION

A. Essential Textbooks in:

Anatomy, physiology, pathology, embryology, medical biochemistry, immunology, basic pharmacology.

B. Clinical Studies - Further suggested reading in:

Flow dynamics, clinical cardiopulmonary bypass, specific aspects of clinical cardiopulmonary bypass, books on mechanical support of the heart, cardiac surgical pathophysiology and principles of surgical management, interpretation of diagnostic data, monitoring principles, perioperative care of the cardiac surgical patient, cardiac anaesthesia.

C. Journals

Since cardiopulmonary bypass is a rapidly evolving field, ongoing education by reading professional journals is mandatory to keep up with the latest technologies and principles. The following journals (or equivalent national or regional journals) are recommended for supplemental reading:

Perfusion

Journal of Extracorporeal Technology

Journal of Cardiothoracic and Vascular Anaesthesia

European Journal of Cardio-thoracic Surgery

Journal of Thoracic and Cardiovascular Surgery

Annals of Thoracic Surgery

Artificial Organs