

HST Training Programme and Curriculum

Cardiothoracic Surgery

SAC MALTA
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Definition of Specialty

Cardiothoracic Surgery is the specialty of medicine that deals with the diagnosis, evaluation and surgical management of diseases of the heart, lungs, oesophagus and chest.

Cardiothoracic surgeons undertake surgical treatment of a wide range of serious conditions, and cardiothoracic operations tend to be major and often complex procedures. Many of these operations require support from advanced forms of technology, such as cardiopulmonary bypass, invasive monitoring and minimally invasive equipment. Because of the serious nature of the conditions and the scale of the operations, many cardiothoracic patients require care on the intensive therapy unit, and cardiothoracic surgeons are also proficient in this aspect of their patients' care.

Cardiothoracic surgeons generally work closely with their colleagues in Cardiology, Respiratory Medicine, Oncological Medicine, Anaesthesia and Intensive Care. They also have close professional relationships with other non-medical staff such as perfusionists, intensive care staff and operating department personnel.

Whilst many cardiothoracic surgeons develop proficiency in the broad range of the specialty, some tend to focus and develop expertise in more complex areas of special interest.

These include:

- Cardiac surgery
- Thoracic surgery
- Surgery of the aorta
- Transplantation and heart failure surgery
- Congenital surgery in children
- Congenital surgery in adults
- Oesophageal surgery

The Purposes of Training in the Specialty of Cardiothoracic Surgery

The purpose of the training programme is to produce trained cardiothoracic surgeons, who will have the clinical knowledge, the surgical expertise and the professional skills necessary for consultant practice in Malta.

This includes:

- Competence in the management of patients presenting with a range of symptoms and elective conditions as specified in the core syllabus for the specialty of cardiothoracic surgery.
- Competence to manage an additional range of elective and emergency conditions by virtue of appropriate training and assessment opportunities obtained during training.

- Professional competences as specified in the syllabus and derived from the CanMEDS framework and Good Medical Practice documents of the Canadian Medical Association and the General Medical Council of the UK, respectively.

The candidate commencing Higher Surgical Training (HST) in Cardiothoracic Surgery would have worked as a Basic Surgical Trainee (BST) in general surgery for 2 years and achieved the appropriate competence as required for the award of the Certificate of Completion of Basic surgical Training (CCBST). The candidates are also in possession of full MRCS qualification and permanent registration with the Malta Medical Council.

Programme Outline and Objectives

The objective of the training programme is to produce trained cardiothoracic surgeons, who will have the clinical knowledge, the surgical expertise and the professional skills necessary for consultant practice.

The syllabus, therefore, defines the requirements of the training programme in cardiothoracic surgery. It identifies distinct topics within the specialty and defines the requirements or competencies within each of these areas, at each stage of training.

Within each module, the levels of competence are further defined in the following domains:

Knowledge: e.g. basic scientific knowledge; clinical knowledge

Clinical skills: e.g. history, examination, data interpretation, patient management

Technical skills and procedures: e.g. technical procedures, operative management

Professional Skills and behaviour: transferable or generic, professional skills expected of all surgeons

The curriculum also identifies the tools that will be used to **assess competence and monitor progress**. Cardiothoracic training is now considered as competence based rather than, as in the past, determined solely by the number of years in training or by the numbers of procedures performed. The competence levels are defined for each key stage. The programme is therefore now described in terms of **initial, intermediate, and final** phases. Each phase lasts two years to reach a total of six years. At least one year (extendable to a maximum of 2 years) of the six years is to be spent overseas acquiring specialist skills that the trainee will be less exposed to, locally. One year of training abroad is mandatory. The final exit examinations may be completed during the last 2 years of training (Years 5 and 6).

Upon successful completion of the programme the Cardiothoracic Trainee will be able to demonstrate competence in all aspects of the management (including operative management) of a number of key topics.

Annual Review of Competence Progression (ARCP)

The trainee's progress will be reviewed at the end of each HST year. This review is an internal one. Panel members are appointed by the Deanery and are likely to include the following:

Postgraduate Dean or deputy

Programme Director

Chair of the Specialty Training Committee

College/Faculty representatives (e.g. from the specialty SAC)

Assigned educational supervisors (including AESs who have not been directly responsible for the trainee's placements)

Associate Directors/Deans

Academic representatives (for academic programmes only)

The following areas of training will be reviewed:

1. Theoretical Knowledge – CBDs
2. Practical Skills – Logbook, DOPs
3. Research

The following are the possible outcomes of the review:

1. Trainee is achieving progress and competencies at the expected rate
2. Development of specific competencies required – additional training time not required
3. Inadequate progress by the trainee – additional training time required
4. Released from training programme with or without specified competencies
5. Incomplete evidence presented – additional training time may be required.
6. Gained all required competencies; will be recommended as having completed the training programme and for an award of a CCT or CESR.

This review meeting will be used to outline the plan for the next training year and offer guidance accordingly.

Completion of Training

The Certificate for Completion of Specialist Training (CCST) is awarded by the Specialist Accreditation Committee (SAC) of Malta after recommendation by the Association of Surgeons of Malta following the advice of the postgraduate training personnel in the Department of Cardiothoracic surgery. Eligibility for accreditation depends on achieving ALL of the following three requirements :

- Confirmation of competence in the curriculum described below by the training consultants and/or chairperson of the Department of Cardiothoracic Surgery.
- Presentation of logbook
- Exit Examination: FRCS(CTh) or FETCS

The Syllabus

Standards for knowledge

Each topic within a stage has a competence level ascribed to it for knowledge ranging from 1 to 4 that indicates the depth of knowledge required:

- 1 - knows of
- 2 - knows basic concepts
- 3 - knows generally
- 4 - knows specifically and broadly

Standards for clinical and technical skills

The practical application of knowledge is evidenced through clinical and technical skills. Each topic within a stage has a competence level ascribed to it in the areas of clinical and technical skills ranging from 1 to 4:

- 1 - Has observed Exit descriptor; at this level the trainee:
 - Has adequate knowledge of the steps through direct observation.
 - Demonstrates that he/she can handle instruments relevant to the procedure appropriately and safely.
 - Can perform some parts of the procedure with reasonable fluency.
- 2 - Can do with assistance Exit descriptor; at this level the trainee:
 - Knows all the steps - and the reasons that lie behind the methodology.
 - Can carry out a straightforward procedure fluently from start to finish.
 - Knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).
- 3 - Can do whole but may need assistance Exit descriptor; at this level the trainee:
 - Can adapt to well known variations in the procedure encountered, without direct input from the trainer.
 - Recognises and makes a correct assessment of common problems that are encountered.
 - Is able to deal with most of the common problems.
 - Knows and demonstrates when he/she needs help.
 - Requires advice rather than help that requires the trainer to scrub.
- 4 - Competent to do without assistance, including complications. Exit descriptor, at this level the trainee:
 - With regard to the common clinical situations in the specialty, can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input.
 - The level at which one would expect a consultant surgeon in Malta to function.
 - Is capable of supervising trainees.

The explicit standards form the basis for:

- Specifying the syllabus content;
- Organising workplace (on-the-job) training in terms of appropriate case mix and case load;
- Providing the basis for identifying relevant teaching and learning opportunities that are needed to support trainees' development at each particular stage of progress; and
- Informing competence-based assessment to provide evidence of what trainees know and can do.

Early Phase (HST 1 and 2)

Training is categorised into Basic Knowledge, Clinical Skills and Technical skills & Procedures. Each of these three categories is described as for their respective modules. The modules remain consistent throughout all six years of training with advancing levels of knowledge for the syllabus within in each module for every stage.

Listed below are the Early Phase modules:

- Critical Care and Postoperative Management
- Cardiopulmonary Bypass
- Myocardial Protection
- Circulatory Support
- Ischaemic Heart Disease
- Heart Valve Disease
- Aortovascular Disease
- Cardiothoracic Trauma
- General Management of a Patient Undergoing Thoracic Surgery
- Neoplasms of the Lung
- Disorders of the Pleura
- Disorders of the Chest Wall
- Disorders of the Diaphragm
- Emphysema and Bullae
- Disorders of the Pericardium
- Disorders of the Mediastinum
- Disorders of the Airway
- Congenital Heart Disease
- Intrathoracic transplantation and surgery for heart failure
- Management of Benign Oesophageal Disorders
- Management of Oesophageal Neoplasia

Module: Critical Care and Post-operative Management

Objective

To be able to manage a post surgical patient on the critical care, high dependency and post-operative wards. To work as part of a multi-professional,

multidisciplinary team in the management of a patient requiring complex critical care. Competence in the management of uncomplicated situations should be achieved during this period. Management of complicated or difficult situations will require appropriate supervision and guidance.

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Haemodynamics: physiology and measurement
- 4 Cardiac arrhythmia
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma and surgery
- 4 GIT, renal and hepatic physiology
- 4 Nutrition
- 4 Temperature regulation

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Mediastinum, thoracic inlet and neck
- 4 Tracheobronchial tree and lungs
- 4 Chest wall and diaphragm

Pathology

- 4 Inflammation and wound healing
- 4 Myocardial infarction and complications
- 4 Endocarditis
- 4 Pericarditis
- 4 Systemic Inflammatory Response Syndrome
- 4 Bronchopulmonary infection
- 4 ARDS

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Antimicrobial treatment and policies

CLINICAL KNOWLEDGE

Clinical Skills

- 3 Cardiopulmonary resuscitation
- 3 Management of cardiac surgical patient
- 3 Management of thoracic surgical patient
- 3 Treatment of cardiac arrhythmia
- 3 Management of complications of surgery
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption
- 3 Neuropsychological consequences of surgery and critical care

History and Examination

- 4 History and examination of the post-operative and critically ill patient

Data Interpretation

- 4 Analysis and interpretation of post operative and critical care charts and documentation
- 4 Routine haematology and biochemical investigations
- 3 Chest radiograph and ECG
- 3 Echocardiography including TOE

Patient Management

- i) General management of surgical patient
 - 3 Management of fluid balance and circulating volume
 - 3 Pain control
 - 3 Wound management
 - 3 Management of surgical drains
 - 3 Antimicrobial policy and prescribing
 - 3 Management of post-operative haemorrhage
 - 3 Cardiopulmonary resuscitation (ALS)
 - 3 Management of complications of surgery
 - 3 Blood transfusion and blood products
 - 3 Wound infection and sternal disruption

- ii) Recognition, evaluation and treatment of haemodynamic abnormalities
 - 3 Evaluation and interpretation of haemodynamic data
 - 3 Practical use of inotropes and vasoactive drugs
 - 3 Use of intra aortic balloon pump

TECHNICAL SKILLS AND PROCEDURES

- i) Recognition, evaluation and treatment of cardiac arrhythmias
 - 3 Interpretation of ECG
 - 3 Use of anti-arrhythmic drugs
 - 3 Use of defibrillator
 - 3 Understanding and use of cardiac pacing

- ii) Recognition, evaluation and treatment of ventilatory abnormalities
 - 4 Interpretation of blood gas results

3 Airway management
2 Understanding of ventilatory techniques and methods
2 Understanding of anaesthetic drugs and methods

iii) Recognition, evaluation and treatment of multi-organ dysfunction
2 Renal dysfunction and support
2 GIT dysfunction, feeding and nutrition
2 Recognition and evaluation of cerebral and neuropsychological problems

PRACTICAL SKILLS

4 Arterial cannulation
4 Central venous cannulation
4 Pulmonary artery catheterisation
3 Intra aortic balloon pump insertion
3 Intra aortic balloon pump timing and management
2 Tracheostomy
2 Fibreoptic bronchoscopy
4 Chest aspiration
4 Chest drain insertion
3 Chest drain management

OPERATIVE MANAGEMENT

2 Surgical re-exploration for bleeding or tamponade

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Cardiopulmonary Bypass

Objective

To manage with supervision the clinical and technical aspects of cardiopulmonary bypass.

Knowledge

BASIC KNOWLEDGE

Physiology

3 Haemodynamics: physiology and measurement
3 Cardiac arrhythmias
3 Haemostasis, thrombosis and bleeding
3 Acid base balance
3 Pulmonary physiology, ventilation and gas exchange
3 Metabolic response to trauma and surgery
3 GIT, renal and hepatic physiology
3 Temperature regulation

Anatomy

- 3 Heart, pericardium and great vessels
- 3 Mediastinum, thoracic inlet and neck
- 3 Chest wall and diaphragm
- 3 Femoral triangle and peripheral vascular system

Pathology

- 3 Inflammation and wound healing
- 3 Systemic Inflammatory Response Syndrome
- 3 ARDS

Pharmacology

- 3 Drugs used in the treatment of hypertension, heart failure and angina
- 3 Inotropes, vasodilators and vasoconstrictors
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Analgesics
- 3 Antibiotics
- 3 Anaesthetic agents, local and general

Microbiology

- 3 Organisms involved in cardiorespiratory infection
- 3 Antimicrobial treatment and policies

SPECIFIC KNOWLEDGE

- 3 Principles and practice of CPB
- 3 Relevant equipment and technology and its application
- 3 Monitoring during CPB
- 3 Inflammatory and pathophysiological response to bypass
- 3 Pulsatile and non pulsatile flow
- 3 Effect of CPB on pharmacokinetics
- 3 Priming fluids and haemodilution
- 3 Acid base balance - pH and alpha stat
- 3 Neuropsychological consequences of CPB
- 3 Cell salvage and blood conservation

Clinical Skills

N/A

OPERATIVE MANAGEMENT

TECHNICAL SKILLS AND PROCEDURES

- 3 Median sternotomy open and close
- 3 Cannulation and institution of cardiopulmonary bypass
- 3 Safe conduct of CPB
 - problem solving and troubleshooting
- 3 Weaning from bypass and decannulation
- 2 Femoral cannulation and decannulation

1 Repeat sternotomy, with pericardial dissection, cardiac mobilisation and cannulation

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Myocardial Protection

Objective

To manage with supervision the clinical and technical aspects of intraoperative myocardial protection.

Knowledge

BASIC KNOWLEDGE

- 3 Myocardial cellular physiology
- 3 Myocardial function and dysfunction
- 3 Haemodynamics and arrhythmias
- 3 Coronary arterial and venous anatomy

SPECIFIC KNOWLEDGE

- 3 Scientific foundations of myocardial preservation
- 3 Principles and practice of myocardial preservation
- 3 Cardioplegia solutions and delivery modes.
- 3 Non-cardioplegic techniques of preservation

TECHNICAL SKILLS AND PROCEDURES

PATIENT MANAGEMENT

- 2 Myocardial management throughout the peri-operative period
- 2 Ability to adapt preservation technique to clinical situation

OPERATIVE MANAGEMENT

- 2 Relevant cannulation techniques and appropriate delivery of cardioplegia

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Circulatory Support

Objective

To manage with supervision the clinical and technical aspects of circulatory support.

Knowledge

BASIC KNOWLEDGE

- 3 Haemodynamics: physiology and measurement

- 3 Cardiac arrhythmias
- 3 Haemostasis, thrombosis and bleeding
- 3 Anatomy of the femoral triangle and peripheral vascular system

Clinical Skills

- 3 Inotropes, vasodilators and vasoconstrictors
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs

SPECIFIC KNOWLEDGE

- 3 Mechanical circulatory support in the pre-operative, peri-operative and post-operative periods
- 3 Intra aortic balloon pump - indications for use, patient selection and complications
- 3 Physiology of the balloon pump
- 2 Understanding of relevant equipment and technology
- 2 Ventricular assist devices - indications for use, patient selection and complications

PATIENT MANAGEMENT

- 2 Patient selection for mechanical circulatory support
- 3 Insertion and positioning of the intra aortic balloon pump
- 3 Management of the balloon pump including timing and trouble shooting
- 2 Care of the patient with intra aortic balloon pump, including recognition and management of complications

TECHNICAL SKILLS AND PROCEDURES

N/A

Module: **Ischaemic Heart Disease**

Objective

To evaluate and manage with appropriate supervision the surgical aspects of a patient with ischaemic heart disease including the complications of ischaemic heart disease.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Myocardial cellular physiology
- 3 Haemodynamics; physiology and measurement
- 3 Electrophysiology, including conduction disorders
- 3 Haemostasis, thrombosis and bleeding
- 3 Acid base balance
- 3 Pulmonary physiology, ventilation and gas exchange

- 3 Metabolic response to trauma
- 3 Vascular biology and reactivity

Anatomy

- 3 Heart, pericardium and great vessels
- 3 Coronary anatomy and variants
- 3 Coronary angiography
- 3 Anatomy of the peripheral vascular system and vascular conduits

Pathology

- 3 Inflammation and wound healing
- 3 Atheroma, medial necrosis and arteritis
- 3 Intimal hyperplasia and graft atherosclerosis
- 3 Myocardial infarction and complications

Clinical Skills

- 3 Systemic Inflammatory Response Syndrome

Pharmacology

- 3 Drugs used in the treatment of hypertension, heart failure and angina
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Analgesics
- 3 Antibiotics
- 3 Anaesthetic agents, local and general

Microbiology

- 3 Organisms involved in cardiorespiratory infection
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis

CLINICAL KNOWLEDGE

General

- 3 Diagnosis, investigation and treatment of heart disease
- 3 Risk assessment and stratification
- 3 Cardiopulmonary resuscitation
- 3 Cardiac arrhythmias
- 3 Complications of surgery
- 3 Renal dysfunction
- 3 Multiorgan failure
- 3 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption

Specific

- 3 Diagnosis investigation and assessment of IHD
- 3 Operative treatment - Off pump and on pump surgery

- 3 Results of surgery ? survival, graft patency, recurrence
- 3 Arterial revascularisation
- 3 Redo coronary artery surgery
- 3 Role of PCI and non operative treatment
- 3 Management of cardiovascular risk factors
- 3 Complications of myocardial infarction and ischaemic heart disease
- 3 VSD, mitral regurgitation, aneurysm.

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 3 Chest radiograph
- 3 ECG including exercise ECG
- 3 Coronary Angiography
- 3 Cardiac Catheterisation data

TECHNICAL SKILLS AND PROCEDURES

- 2 Echocardiography including 2D, Doppler and TOE and stress echo
- 2 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 3 Diagnosis and treatment of cardiac arrhythmias
- 3 Management of post cardiac surgical patient
- 3 Management of complications of surgery
- 3 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 2 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

- 4 Saphenous vein harvest
- 3 Mammary artery/radial artery harvest
- 3 Preparation for and management of cardiopulmonary bypass
- 3 Proximal coronary anastomosis
- 2 Distal coronary anastomosis

Module: **Heart Valve Disease**

Objective

To evaluate and manage, with appropriate supervision, a patient with both uncomplicated heart valve disease, including operative management.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Cardiovascular physiology including valve physiology and haemodynamics
- 3 Electrophysiology, including conduction disorders
- 3 Haemostasis, thrombosis and bleeding
- 3 Acid base balance
- 3 Pulmonary physiology, ventilation and gas exchange
- 3 Metabolic response to trauma

Anatomy

- 3 Cardiac chambers and valves, pericardium and great vessels
- 3 Anatomy of the conduction system

Pathology

- 3 Pathophysiology of valve incompetence and stenosis.
- 3 Consequences of valve disease on cardiac function and morphology
- 3 Pathophysiology of mixed valve disease and combined valve pathology (e.g. aortic and mitral)

Clinical Skills

- 3 Combined valvular and ischaemic heart disease
- 3 Atrial fibrillation and other arrhythmias

Pharmacology

- 3 Drugs used in the treatment of hypertension, heart failure and angina
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Analgesics
- 3 Antibiotics
- 3 Anaesthetic agents, local and general

Microbiology

- 3 Organisms involved in cardio respiratory infection
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis
- 3 Endocarditis and prosthetic valve endocarditis

CLINICAL KNOWLEDGE

General knowledge

- 3 Cardiopulmonary resuscitation
- 3 Care of the cardiac surgical patient
- 3 Complications of surgery
- 3 Risk assessment and stratification
- 3 Management of cardiovascular risk factors

Specific Knowledge

- 3 diagnosis investigation and assessment of valvular heart disease
- 3 timing of surgical intervention in valve disease
- 3 indications for operative management including: Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)
- 3 Valve design: materials, configuration and biomechanics.
- 3 Results of surgery – survival, valve thrombosis, endocarditis, bleeding.
- 3 Interpretation of survival and follow up data
- 3 Cardiac performance and long term functional status
- 3 Surgery for conduction problems
- 3 Surgical treatment of arrhythmias

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including drug history, identification of co morbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 3 Chest radiograph
- 3 ECG interpretation including exercise ECG
- 3 Coronary angiography
- 3 Cardiac catheterisation data including left and right heart data
- 3 Echocardiography (thoracic and transoesophageal) including 2D, Doppler and stress echo
- 2 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 3 Diagnosis and treatment of cardiac arrhythmias
- 3 Management of post cardiac surgical patient
- 3 Management of complications of surgery
- 3 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 2 Wound infection and sternal disruption
- 2 Non operative management of endocarditis
- 3 Valve selection
- 3 Anticoagulation management including complications.

OPERATIVE MANAGEMENT

- 2 Isolated, uncomplicated aortic valve replacement (stented biological or mechanical)
- 2 Isolated uncomplicated mitral valve replacement
- 1 Tricuspid valve surgery
- 1 Combined valve and graft surgery
- 1 Surgical strategies for managing the small aortic root

TECHNICAL SKILLS AND PROCEDURES

- 1 Aortic root surgery including stentless valves, and root replacement
- 1 Redo Valve surgery

- 1 Valve surgery for endocarditis
- 2 Techniques for surgical ablation of arrhythmias
- 1 Mitral valve repair
- 1 Alternative surgical approaches to valve surgery including thoracotomy, trans-septal approaches, and minimal access surgery

Module: **Aortovascular Disease**

Objective

To evaluate and manage uncomplicated surgical aspects of a patient with aortovascular disease, including operative management where appropriate and up to the defined competence. This module provides intermediate training in a complex sub-specialty.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Vascular biology and reactivity
- 3 Haemodynamics; physiology and measurement
- 3 Rheology and arterial pressure regulation
- 3 Haemostasis, thrombosis and bleeding
- 3 Physiology of transfusion therapy
- 3 Principles of surgical infectious disease
- 3 Acid base balance
- 3 Metabolic response to trauma
- 3 Pathophysiology and of hypothermia including the effects upon
- 3 haemoglobin, metabolic rate and pH with their management

Anatomy

- 3 Heart, pericardium and great vessels
- 3 Anatomy of the peripheral vascular system
- 3 Blood supply of the spinal cord

Pathology

- 3 Inflammation and wound healing
- 3 Atheroma, medial necrosis and arthritis
- 3 Inherited disorders of vascular biology
- 3 Systemic Inflammatory Response Syndrome

Pharmacology

- 3 Drugs used in the treatment of hypertension, heart failure and angina
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Anti-emetics
- 3 Analgesics

- 3 Antibiotics
- 3 Anaesthetic agents, local and general

Microbiology

- 3 Organisms involved in cardiorespiratory infection
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis

CLINICAL KNOWLEDGE

General

- 3 Risk assessment
- 3 Cardiopulmonary resuscitation
- 3 Cardiac arrhythmias
- 3 Complications of surgery
- 3 Renal dysfunction
- 3 Multi-organ failure
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption

Clinical Skills

- 3 Natural history of aortic disease
- 3 Diagnosis, investigation and assessment of aortic disease
- 3 Knowledge of operative treatment including spinal cord and cerebral preservation strategies
- 3 Type A dissection
- 3 Type B dissection
- 3 Traumatic aortic rupture
- 3 Thoraco-abdominal aneurysm
- 3 Results of surgery – survival, complication rates
- 3 Non-surgical management including the role of endovascular stenting
- 3 Management of cardiovascular and non-cardiovascular risk factors

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including assessment of pre-operative complications, drug history, identification of co-morbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 3 Chest radiograph
- 3 ECG including exercise ECG
- 3 Coronary Angiography
- 3 Aortography
- 3 Cardiac Catheterisation data
- 3 Echocardiography including 2D, Doppler and TOE and stress echo
- 2 CT scanning
- 2 MRI scanning

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 3 Diagnosis and treatment of cardiac arrhythmias
- 3 Management of post cardiac surgical patient
- 3 Management of complications of surgery
- 3 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 2 Wound infection and sternal disruption

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 2 Intraoperative monitoring
- 1 Spinal cord protection
- 1 Preparation for and management of cardiopulmonary bypass, including alternative, non-bypass strategies for descending aortic surgery
- 1 Hypothermic strategies including HCA, RCP and SACP
- 3 Femoral cannulation
- 1 Surgery for acute dissection of the ascending aorta
- 1 Aortic root replacement for chronic aortic root disease
- 1 Complex aortic surgery including arch surgery, descending aortic and thoraco-abdominal aortic surgery

Module: **Cardiothoracic Trauma**

Objective

To evaluate and manage, including surgical management where appropriate, and as part of a multidisciplinary team, a patient with thoracic trauma.

Knowledge

BASIC KNOWLEDGE

- 4 Anatomy of the lungs, heart, chest wall, diaphragm and oesophagus
- 4 Anatomy of the larynx, trachea and bronchial tree
- 4 Physiology of breathing and its control
- 4 Physiology of the heart and circulation

GENERAL TRAUMA MANAGEMENT

- 4 Principles of trauma management (as defined by ATLS)
- 4 Principles of emergency resuscitation following cardiac arrest

SPECIFIC KNOWLEDGE

- 3 The mechanism and patterns of injury associated with blunt, penetrating, blast and deceleration injuries to the chest
- 3 The post-ATLS, definitive care of blunt, penetrating and deceleration injuries to the chest.

- 3 The indications and use of appropriate investigations in thoracic trauma management
- 3 Pain relief in chest trauma, including epidural anaesthesia.
- 3 Indications for immediate, urgent and delayed thoracotomy in trauma

Clinical Skills

GENERAL TRAUMA MANAGEMENT (ATLS)

- 4 Assessment and management of airway, breathing and circulation

TECHNICAL SKILLS AND PROCEDURES

- 4 Maintenance of an adequate airway and respiratory support
- 4 Protection of the cervical spine
- 4 Circulatory resuscitation
- 4 Establishment of appropriate monitoring
- 4 Assessment and management of pain and anxiety

CARDIOTHORACIC TRAUMA MANAGEMENT

- 4 Examination and assessment of the of the chest, including respiratory cardiovascular and circulatory systems
- 4 Recognition and management of immediately life threatening situations: obstructed airway, tension pneumothorax, massive haemothorax, open chest wound, flail chest and cardiac tamponade
- 3 Recognition and management of potentially life threatening situations: lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding, oesophageal injury, simple pneumothorax and major vascular injury
- 3 Recognition of potentially life threatening penetrating injuries to the chest and abdomen
- 3 Interpretation of chest x-ray, ECG, arterial blood gases and echocardiography
- 3 Detection and treatment of cardiac arrhythmias
- 2 Management of the widened mediastinum including appropriate investigations and multidisciplinary consultation

PRACTICAL SKILLS

- 4 Establish an emergency airway (surgical and non-surgical)
- 4 Insertion and management of thoracic drains
- 4 Establish adequate venous access and monitoring.
- 3 Pericardiocentesis and subxiphoid pericardial window for tamponade

OPERATIVE MANAGEMENT OF THORACIC TRAUMA

- 2 Subxiphoid pericardial window for tamponade
- 3 Posterolateral, thoracotomy, anterolateral thoracotomy and thoracotomy
- 2 Bilateral Anterior Thoracotomy
- 3 Median sternotomy and closure
- 2 Repair of cardiac injuries
- 1 Repair of pulmonary and bronchial injuries
- 2 Management of the complications of chest trauma including retained haemothorax and empyema

- 1 Repair of oesophageal injuries
- 1 Repair of aortic transection

Module: **General Management of a Patient Undergoing Thoracic Surgery**

Objective

To be competent in the evaluation and management of a patient undergoing thoracic surgery including operative management, with appropriate supervision. The knowledge and clinical skills are common to all thoracic surgical conditions, and should be read in conjunction with the curriculum for specific surgical conditions.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Pulmonary physiology, ventilation and gas exchange
- 3 Haemostasis, thrombosis and bleeding
- 3 Acid base balance
- 3 Metabolic response to trauma
- 3 Digestive, renal and hepatic physiology
- 3 Nutrition

Anatomy

- 3 Tracheobronchial tree and lungs
- 3 Thoracic inlet, neck and mediastinum
- 3 Oesophagus and upper GI tract
- 3 Chest wall and diaphragm

Pathology

- 3 Inflammation and wound healing
- 3 Bronchopulmonary infections
- 3 ARDS 3 Emphysema
- 3 Pulmonary fibrosis
- 3 Pulmonary manifestations of systemic disease
- 3 Systemic manifestations of pulmonary disease
- 3 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 3 Oesophagitis, columnar-lined oesophagus stricture
- 3 Oesophageal motility disorders
- 3 Malignant and benign tumours of the oesophagus and stomach
- 3 Malignant and benign tumours of the pleura and chest wall, mediastinum and thyroid

Pharmacology

- 3 Bronchodilators
- 3 H₂-antagonists and proton pump inhibitors
- 3 Haemostatic drugs

- 3 Analgesics
- 3 Antibiotics
- 3 Anaesthetic agents, local and general

Microbiology

- 3 Organisms involved in respiratory infection including TB
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis

Clinical Skills

- 3 Management of intra pleural sepsis

CLINICAL KNOWLEDGE

Thoracic Incisions

- 3 Types of incisions and appropriate use, including lateral, anterior, muscle sparing and video-assisted approaches.

Sternotomy

- 3 Difficult access and improving exposure.
- 3 Early and late complications of thoracic incisions
- 3 Analgesia including pharmacology, effectiveness, side effects and use in combination regimens
- 3 Post-operative analgesia, including epidural, PCAS and paravertebral catheter techniques.

Bronchoscopy

- 3 The role of rigid and flexible bronchoscopy in the investigation of airway and pulmonary disease.
- 3 The anaesthetic, airway and ventilatory management during rigid and flexible bronchoscopy

Mediastinal exploration

- 3 Endoscopic, radiological and surgical approaches used to evaluate and diagnose mediastinal disease of benign, infective, primary and malignant aetiology.
- 3 Equipment for mediastinal exploration
- 3 Relevant imaging techniques, and influence on surgical approach.

HISTORY AND EXAMINATION

- 4 System specific and general history and examination, including drug history, identification of comorbidity and functional status.

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 3 Chest radiograph and ECG
- 2 CT, including contrast enhanced CT
- 2 Interpretation of imaging of the mediastinum.
- 2 MRI and PET

- 3 Respiratory function tests
- 2 Ventilation/perfusion scan
- 4 Blood gases
- 2 Oesophageal function tests and contrast studies

PATIENT MANAGEMENT

General

- 4 Cardiopulmonary resuscitation
- 3 Risk assessment, stratification and management
- 3 Management of patients making an uncomplicated or complicated recovery from thoracic operations.
- 3 Post-operative management of pain control, respiratory failure, sputum retention, haemodynamic instability and low urine output.
- 3 Treatment of cardiac arrhythmias
- 3 Pain control
- 2 Wound infection and disruption
- 3 Blood transfusion and blood products
- 2 Physiotherapy and rehabilitation
- 2 Palliative care

PRACTICAL SKILLS

- 4 Arterial cannulation
- 4 Central venous cannulation
- 4 Pulmonary artery catheterisation
- 3 Tracheostomy
- 3 Fibreoptic bronchoscopy
- 4 Chest aspiration
- 4 Chest drain insertion
- 3 Chest drain management

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

Thoracic Incisions

- 3 Correct positioning of patient for thoracic surgery
- 3 Perform and repair thoracic incisions, including lateral, anterior, muscle sparing and VATS incisions.
- 2 Difficult access and improving exposure
- 3 Perform and close sternotomy incision

Bronchoscopy

- 3 Diagnostic bronchoscopy including biopsy - rigid and flexible.
- 3 Equipment, instrumentation and preparation
- 3 Perform rigid and flexible bronchoscopy
- 3 Airway and ventilatory management
- 3 Recognise normal and abnormal anatomy.
- 2 Identify common pathologies and the surgical relevance of the findings.
- 2 Take appropriate specimens for bacteriology, cytology and histology.
- 2 Management of moderate bleeding and other common complications.

- 3 To appropriately supervise the care of patients recovering from bronchoscopy.
- 2 Post-operative bronchoscopy: indications and procedure
- 2 Tracheostomy and **mini-tracheostomy**
- 1 Bronchoscopy in situations where there is unfavourable anatomy or complex pathology and to deal with complications.

Mediastinal Exploration

- 3 Assembly of relevant equipment for mediastinal exploration
- 2 Surgical evaluation of the mediastinum using cervical, anterior and VATS approaches.
- 2 Mediastinal biopsy

Module: **Neoplasms of the Lung**

Objective

To assess and manage a patient with a neoplasm of the lung, including operative management and with appropriate supervision. Appreciation of the multidisciplinary, multimodality approach to the management of the condition.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery - general

SPECIFIC KNOWLEDGE

- 3 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 3 Epidemiology, presentation, diagnosis, staging (pre-operative, intraoperative and pathological) and treatment of lung cancer and lung metastases.
- 3 Neoadjuvant and adjuvant treatment of lung cancer
- 3 Results of treating thoracic malignancy by surgery, medical or oncological techniques, including multimodality management.
- 3 Survival, recurrence rates and relapse patterns after surgical treatment and the investigation and management of relapse.

Clinical Skills

- 3 Knowledge of palliative care techniques.
- 3 Treatment of post-operative complications of pulmonary resection such as empyema and broncho-pleural fistula.
- 3 Role of repeat surgery in recurrent and second primary malignancies of the lung.
- 3 Medical and surgical options to deal with recurrent or problematic complications of pulmonary resection.

PATIENT MANAGEMENT

As for thoracic surgery - general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 2 Interpretation of endoscopic findings.
- 3 Patient selection with assessment of function and risk.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 2 Bronchoscopic assessment including biopsy
- 2 Endoscopic and surgical techniques of lung biopsy.
- 2 Mediastinal assessment and biopsy
- 2 Intraoperative diagnosis and staging
- 1 Endoscopic management of tumours using laser and stenting
- 2 Surgery for benign and malignant conditions of the lungs, including uncomplicated lobectomy for lung cancer, wedge resection and metastasectomy.
- 2 Segmentectomy and lobectomy for benign and malignant disease.
- 1 Redo operations for repeat resections of lung metastases.
- 1 Advanced resections for lung cancer, including sleeve lobectomy, pneumonectomy and extended resections involving chest wall and diaphragm.
- 1 Repeat resections for benign and malignant conditions of the lung, including completion pneumonectomy
- 1 Management of post-operative complications such as empyema and broncho-pleural fistula.

Module: **Disorders of the Pleura**

Objective

To evaluate and manage surgical conditions of the pleura and the pleural space, including operative management and with appropriate supervision

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Anatomy and physiology of the pleura
- 3 Inflammatory, infective and malignant disease of the visceral and parietal pleura.
- 3 Pneumothorax
- 3 Pleural effusion
- 3 Empyema

Clinical Skills

- 3 Mesothelioma
- 3 Haemothorax
- 3 Chylothorax
- 3 Conditions of adjacent organs that affect the pleura
- 3 Medical and surgical management of pleural disease, including radiological, open and VATS techniques.
- 3 Techniques to deal with failures of primary treatment.

3 Advanced techniques for pleural space obliteration such as thoracoplasty and soft- tissue transfer

PATIENT MANAGEMENT

As for thoracic surgery – general

3 Interpretation of imaging of the pleura

4 Chest drains: insertion, management, removal and treatment of complications.

3 Management of patients making uncomplicated and complicated recovery from pleural interventions.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

3 Open procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy

2 VATS procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy

1 Open and VATS procedures for empyema, including techniques for decortication.

1 Open and VATS procedures in complex cases.

1 Advanced techniques of pleural space obliteration.

Module: **Disorders of the Chest Wall**

Objective

To assess and manage a patient with abnormality or disease affecting the chest wall, including surgical management where appropriate and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery - general

SPECIFIC KNOWLEDGE

3 Anatomy of the chest wall

3 Congenital, inflammatory, infective and neoplastic conditions that can affect the components of the chest wall.

3 Clinical, laboratory and imaging techniques used in the evaluation of chest wall pathology.

3 Techniques used in the diagnosis of chest wall disease, including aspiration and core biopsy, and incision and excision biopsy.

3 Pectus deformities: aetiology, physiological and psychological consequences. Surgical options for correction.

3 Techniques used to resect the sternum and chest wall, physiological and cosmetic sequelae.

3 Prosthetic materials used in chest wall surgery

- 3 The role of repeat surgery to deal with recurrent conditions and the complications of previous surgery.
- 3 Techniques of complex chest wall reconstruction involving thoracoplasty or soft-tissue reconstruction

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery - general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 3 Patient selection with assessment of function and risk.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 3 Chest wall biopsy and choice of appropriate technique.
- 3 Needle biopsy by aspiration or core techniques and the siting of open surgical biopsy.
- 3 Open and excision biopsy and resection of the chest wall for benign and malignant conditions.
- 1 Chest wall resection in combination with resection of the underlying lung.
- 2 Selection and insertion of prosthetic materials, and selection of cases in which such materials are required
- 1 Pectus correction, by both open and minimally-invasive techniques, including post-operative care and complications
- 1 Surgery for the complications of chest wall resection, and repeat surgery to resect recurrent chest wall conditions.
- 1 Complex chest wall reconstruction with thoracoplasty and, with appropriate specialist support, soft tissue reconstruction.

Module: **Disorders of the Diaphragm**

Objective

To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate, and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Anatomy and physiology of the diaphragm.
- 3 Pathology of the diaphragm.
- 3 Clinical, physiological and imaging techniques in the assessment of diaphragmatic abnormalities.

- 3 Physiological consequences of diaphragmatic herniation or paresis.
- 3 Surgical techniques used to biopsy and resect diaphragmatic tumours.
- 3 Situations in which replacement of the diaphragm is required, the materials used and their value and limitations.
- 3 Complications of diaphragmatic resection and their management.
- 3 Techniques used to electrically pace the diaphragm, and the conditions in which such treatment is appropriate.

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery – general

Specific Skills

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 3 Patient selection with assessment of function and risk.

TECHNICAL SKILLS AND PROCEDURES

- 3 Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.

OPERATIVE MANAGEMENT

- 1 Resection of the diaphragm, and adjacent structures, including appropriate selection and insertion of prosthetic materials
- 1 Complications of diaphragmatic resection.
- 1 Phrenic nerve pacing.

Module: **Emphysema and Bullae**

Objective

To fully assess and manage a patient with emphysema and bullae, including surgical management where appropriate, and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Aetiology, pathology and physiology of chronic obstructive **pulmonary** disease (COPD)
- 3 Epidemiology and public health issues
- 3 Smoking cessation measures.
- 3 Clinical, laboratory, physiological and imaging techniques.
- 3 Medical and surgical management of COPD and its complications
- 3 Selection criteria and pre-operative preparation

- 3 Surgical techniques used in the treatment of emphysema and bullae and the results of surgical treatment including relevant clinical trials.
- 3 Lung volume reduction surgery: techniques, complications and management of complications.
- 3 Experimental and developmental techniques in lung volume reduction surgery

PATIENT MANAGEMENT

- As for thoracic surgery – general
- 4 Clinical history and examination

Clinical Skills

- 3 Interpretation of laboratory, physiological and imaging techniques.
- 3 Patient selection with assessment of function and risk.
- 3 Post-operative management of patients making an uncomplicated recovery from surgery for emphysema or the complications of such diseases.

TECHNICAL SKILLS AND PROCEDURES

- 3 Management of patients following lung volume reduction surgery.

OPERATIVE MANAGEMENT

- 2 Procedures to deal with secondary pneumothorax and bullae by open techniques.
- 2 Procedures to deal with secondary pneumothorax and bullae by VATS techniques.
- 1 Lung volume reduction surgery, unilaterally and bilaterally, using open and VATS techniques.

Module: **Disorders of the Pericardium**

Objective

To fully assess and manage a patient with disease of the pericardium or pericardial space, including surgical management where appropriate, and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Anatomy of the pericardium.
- 3 Pathology of the pericardium.
- 3 Pathophysiological consequences of pericardial constriction and tamponade.
- 3 Clinical, echocardiographic and imaging techniques used to detect pericardial disease and assess its consequences.
- 3 Techniques for pericardial drainage using guided needle aspiration
- 3 Surgical drainage by sub-xiphoid, thoracotomy or VATS approaches.
- 3 Surgical techniques for pericardiectomy.

- 3 Materials used for pericardial replacement, their value and limitations and the situations in which used.
- 3 Post-operative complications following resection of the pericardium and its prosthetic replacement.

PATIENT MANAGEMENT

Clinical Skills

As for thoracic surgery – general

TECHNICAL SKILLS AND PROCEDURES

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques, including echocardiography.
- 3 Recognition and assessment of pericardial tamponade and constriction.
- 3 Techniques for pericardial drainage using guided needle aspiration
- 3 Recognition of pericardial herniation and cardiac strangulation.
- 3 Patient selection with assessment of function and risk.
- 3 Management of patients making an uncomplicated or complicated recovery from pericardial surgery.

OPERATIVE MANAGEMENT

- 3 Uncomplicated pericardial fenestration procedures
- 2 Pericardial fenestration in complex cases.
- 2 Pericardiectomy for relief of constriction
- 2 Resection of the pericardium and replacement, in appropriate situations, with prosthetic materials.
- 1 Competence in dealing with the complications of pericardial resection and replacement.

Module: **Topic Disorders of the Mediastinum**

Objective

To fully assess and manage a patient with benign and malignant disease of the mediastinum, including surgical management where appropriate, and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Anatomy of the mediastinum
- 3 Congenital, benign, infective and malignant (primary and secondary) conditions of the mediastinum.
- 3 Systemic conditions associated with the mediastinum.
- 3 Clinical, laboratory, electromyographic and imaging techniques used in the diagnosis and assessment of patients with mediastinal disease

- 3 Myasthenia gravis: medical, surgical and peri-operative management
- 3 Staging of thymoma and grading of myasthenia

Clinical Skills

- 3 Benign and malignant conditions, which do not require surgical biopsy or resection.
- 3 Oncological treatment of malignant diseases of the mediastinum, including multidisciplinary care.
- 3 Surgical techniques for the treatment of myasthenia gravis, mediastinal cysts and tumours, complications and results.
- 3 Retrosternal goitre and its management

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 3 Patient selection with assessment of function and risk.
- 3 Post-operative management of patients including recognition and management of post-operative complications .

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 3 Selection of appropriate routes for biopsy and excision of mediastinal tumours and cysts.
- 3 Biopsy of mediastinal masses.
- 2 Excision of the thymus for myasthenia gravis.
- 2 Resection of mediastinal cysts and tumours masses.
- 1 Resection of mediastinal cysts and tumours, including extended resections involving adjacent structures.

Module: **Disorders of the Airway**

Objective

To assess and manage a patient with disease of the major airways, including surgical management where appropriate, and with appropriate supervision.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 3 Anatomy of the larynx, trachea and bronchus.
- 3 Physiology of the normal airway.
- 3 Pathophysiology of disease and its effects on lung function.
- 3 Endoscopic appearances in health and disease.

- 3 Congenital, inflammatory, infective, benign and neoplastic diseases of the airways.
- 3 Symptoms, signs of airway disease.
- 3 Clinical, physiological and imaging tests undertaken to diagnose and assess airway disease.
- 3 Techniques for surgical resection of the trachea.
- 3 Bronchoplastic procedures and the limitations of these techniques.
- 3 Medical and oncological treatments available to deal with airway diseases.
- 3 Endoscopic techniques used to deal with benign and malignant conditions, including disobliteration and stenting.
- 3 Presentation, investigation and management of anastomotic complications following airway surgery.
- 3 Presentation, evaluation and treatment of fistulae in the aerodigestive tract, due to benign, malignant and iatrogenic causes.
- 3 Role of open and endoscopic procedures in dealing with problems.

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 3 Recognition, diagnosis and assessment of airway obstruction.

Clinical Skills

- 3 Patient selection with assessment of function and risk.
- 3 Post-operative care of patients making an uncomplicated recovery from major airway surgery.
- 4 Post-operative care of patients making a complicated recovery from airway surgery.

OPERATIVE MANAGEMENT

- 2 Endoscopic assessment of a patient with airways disease
- 1 Sleeve resection of the trachea for simple benign conditions, including appropriate anastomotic techniques.

TECHNICAL SKILLS AND PROCEDURES

- 1 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastomotic techniques.
- 1 Techniques for the relief of major airways obstruction including stenting.
- 1 Airway resection for tumours and complex benign conditions, and techniques for airway reconstruction, anastomosis and laryngeal release.
- 1 Repeat resections for recurrence and the complications of prior resection.
- 1 Management of fistulae in the aerodigestive tract by surgical and endoscopic techniques. Professional Skills Please see the Professional Skills and Behaviour » Intermediate section for these

Module: **Congenital Heart Disease**

Objective

To understand and gain experience in some of the aspects of children and adults with heart disease, including operative management where appropriate. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

- 2 Relevant general physiology of childhood
- 2 Foetal circulation and circulatory changes at birth
- 2 Haemodynamics; physiology and measurement including shunt calculations
- 2 Physiology of pulmonary vasculature
- 2 Myocardial cellular physiology in immature myocardium
- 3 Electrophysiology, including conduction disorders
- 3 Haemostasis, thrombosis and bleeding
- 3 Acid base balance
- 3 Pulmonary physiology, ventilation and gas exchange
- 3 Metabolic response to trauma
- 3 Vascular biology and reactivity
- 3 Physiology of Cardiopulmonary Bypass including low flow and circulatory arrest.
- 3 Ph and alpha stat CPB management

Anatomy

- 2 Embryology of the heart
- 3 Anatomy of the heart, pericardium and great vessels
- 3 Pulmonary anatomy
- 3 Coronary anatomy and variants
- 3 Anatomy of the peripheral vascular system and vascular conduits including aortopulmonary shunts
- 2 Sequential cardiac analysis and terminology of cardiac malformations

Pathology

- 3 Inflammation and wound healing
- 3 Systemic Inflammatory Response Syndrome
- 3 Effect of growth and pregnancy

Pharmacology

- 2 Drugs used in the treatment of congenital heart disease
- 3 Inotropes
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Analgesics

- 3 Antibiotics
- 3 Anaesthetic agents, local and general
- 3 Hypotensive agents (systemic and pulmonary).

Microbiology

- 3 Organisms involved in cardiorespiratory infection
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis

CLINICAL KNOWLEDGE

General

- 2 Diagnosis, investigation and treatment of congenital heart disease
- 2 Results of surgery - survival, common complications and management.
- 2 Late complications of surgery for congenital heart disease
- 2 Role of interventional cardiology.
- 2 Role of mechanical assist (IABP, VAD and ECMO)
- 2 Indications for referral for transplantation
- 2 Risk assessment and stratification
- 3 Cardiopulmonary resuscitation
- 3 Cardiac arrhythmias
- 3 Renal dysfunction
- 3 Multi-organ failure

Clinical Skills

- 2 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption
- 3 Types of cardiac prosthesis and indications for use

SPECIFIC KNOWLEDGE

The anatomy, pathophysiology natural history and management of the following conditions or procedures

- 3 Patent ductus arteriosus
- 3 Atrial septal defect
- 3 Ventricular septal defect
- 3 Coarctation
- 3 PA banding and shunts
- 2 Transposition of the great arteries - switch procedure
- 2 Tetralogy of Fallot/Pulmonary atresia plus VSD
- 2 Fontan procedure
- 1 Rastelli procedure
- 1 Hypoplastic left heart
- 1 Norwood procedure
- 1 Truncus arteriosus
- 1 Double outlet right ventricle
- 1 Pulmonary atresia plus VSD and MAPCAs
- 1 Pulmonary atresia and intact septum
- 2 Single ventricle

- 2 Partial and complete atrioventricular septal defects
- 2 Aortic valve disease including Ross procedure
- 2 Mitral valve disease
- 2 Tricuspid valve disease including Ebsteins abnormality
- 2 Extra cardiac conduits
- 1 Interrupted aortic arch
- 2 Total anomalous pulmonary venous drainage
- 2 Extra Corporeal Membrane Oxygenation
- 2 Transplantation

HISTORY AND EXAMINATION

- 2 Cardiovascular system and general history and examination of child or adult with congenital heart disease

DATA INTERPRETATION

- 3 Routine haematology and biochemical investigations
- 3 Chest radiograph and ECG
- 2 Cardiac catheterisation data including interpretation of haemodynamic data, shunt and resistance calculations
- 2 Echocardiography in congenital heart disease, including 2D, Doppler and TOE

PATIENT MANAGEMENT

- 2 Principles of paediatric intensive care
- 2 Management of adults and children following congenital heart surgery
- 2 Management of complications of surgery

TECHNICAL SKILLS AND PROCEDURES

- 3 Cardiopulmonary resuscitation
- 3 Diagnosis and treatment of cardiac arrhythmias
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

- 2 Sternotomy - open and close
 - 2 Thoracotomy - open and close
 - 2 Preparation for and management of cardiopulmonary bypass including partial bypass
 - 1 Approaches for ECMO, cannulation and management.
- Surgical management of the following common uncomplicated conditions: (level 1 - a higher level of operative competence is not required during this module) -
 Patent ductus arteriosus - Atrial septal defect - Ventricular septal defect -
 Coarctation - PA banding and shunts

Module: **Intrathoracic transplantation and surgery for heart failure**

Objective

To be able to evaluate and manage, with appropriate supervision, some of the aspects of patients with heart failure, including operative management where appropriate. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Pathophysiology

- 3 Haemodynamics of heart failure.
- 3 Molecular mechanisms underlying heart failure.

Knowledge

- 3 Mechanisms and outcomes of respiratory failure.
- 3 Causes of cardiac failure.
- 3 Causes of respiratory failure.

Immunology

Clinical Skills

- 3 Major and minor histocompatibility antigen systems.
- 3 Mechanisms of immune activation and pathological consequences for transplanted organs.

Pharmacology

- 3 Modes of action of commonly used drugs in heart failure:

CLINICAL KNOWLEDGE

- 3 Indications for, contraindications to and assessment for heart transplantation.
- 3 Indications for, contraindications to and assessment for lung and heart/lung transplantation.
- 3 Indications for ECMO
- 3 Indications for VAD
- 3 Criteria for brain stem death, management of the brain-dead donor, criteria for matching donor and recipient.
- 3 Management of patients after intrathoracic organ transplantation, including complications
- 3 Results of heart transplantation, lung transplantation and non-transplant interventions for heart failure.
- 2 Resynchronisation therapy: techniques and indications

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 3 ECG including exercise ECG
- 3 Coronary angiography
- 3 Cardiac catheterisation data
- 2 Echocardiography including 2D, Doppler and TOE and stress echo
- 2 MR assessment of ventricular function and viability
- 2 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 3 Management of brain-dead donor

TECHNICAL SKILLS AND PROCEDURES

- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 3 Management of complications of surgery
- 2 Management of rejection
- 3 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 3 Wound infection and sternal disruption
- 3 Diagnosis and treatment of cardiac arrhythmias

OPERATIVE MANAGEMENT

Transplantation

- 2 Donor Retrieval
- 2 Ex-vivo donor organ management
- 1 Implantation of heart
- 1 Implantation of lung
- 1 Implantation of heart/lung block

Surgery for heart failure

- 2 Surgical revascularisation for ischaemic cardiomyopathy
- 1 Ventricular reverse remodelling surgery
- 1 Mitral valve repair for cardiac failure
- 2 Cannulation for ECMO
- 1 Implantation of epicardial electrodes for resynchronisation therapy
- 1 Implantation of extracorporeal VAD
- 1 Implantation of intracorporeal VAD

Module: **Management of Benign Oesophageal Disorders**

Objective

To evaluate and manage surgical aspects of benign oesophageal disorders. This module is intended for a trainee to gain initial exposure to this sub-specialty

either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Gastric and oesophageal cellular physiology
- 3 Mechanical and cellular defence mechanisms in oesophagus
- 3 Oesophageal mucosal injury and modulation
- 3 Effects of acid pepsin and biliary reflux
- 3 Oesophago-gastric physiology and assessment including pH monitoring
- 3 Oesophageal motility measurement in achalasia, diffuse spasm and non-specific motility syndromes

Anatomy

- 3 Embryology of the foregut.
- 3 The oesophagus and its anatomical relationships from cricopharyngeus to cardia, including details of blood supply and lymphatic drainage.
- 3 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.
- 3 Anatomy of the colon, including its anatomical relationships, blood supply and lymphatic drainage.

Pathology

- 3 Inflammation and wound healing.
- 3 Oesophageal injury response and variations in response.
- 3 The inflammation, metaplasia, dysplasia cancer sequence.
- 3 Neurological deficits / aetiology of oesophageal dysmotility disorders.
- 3 Para-oesophageal hernias

Pharmacology

- 3 Drugs used in the treatment of gastro-oesophageal reflux disorder and oesophageal dysmotility.

Microbiology

- 3 The role of Helicobacter Pylori in gastritis and gastroesophageal reflux disorder.
- 3 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

- 4 Diagnosis, investigation and treatment of benign oesophageal disorders.
- 4 Radiology, endoscopy, 24 hour pH monitoring and oesophageal function tests.
- 4 Risk assessment and stratification.
- 4 Open, laparoscopic and thoracoscopic surgery of the oesophagus.
- 4 Relative merits of conservative and operative treatment.
- 4 Alternative management of achalasia including dilatation and Botox injection.
- 4 The indications for surgery in paraoesophageal hernia.

Clinical Skills

4 Endoscopic dilatation techniques

HISTORY AND EXAMINATION

4 General and specific history and examination including previous surgery, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

4 Routine haematology and biochemical investigation

3 Interpretation of oesophageal motility and pH monitoring data

4 Chest radiograph and contrast imaging

4 Cardio-pulmonary assessment including exercise tests

PATIENT MANAGEMENT

3 Management of post thoracotomy or laparotomy surgical patient

3 Management of complications of surgery

3 Diagnosis and management of oesophageal perforation or anastomotic leak.

4 Blood transfusion and blood products

3 Wound infection and wound disruption

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

2 Oesophago-gastro-duodenoscopy.

2 Rigid oesophagoscopy

2 Oesophageal dilatation

2 Open and laparoscopic fundoplication and cardiomyotomy

2 Mobilisation of oesophagus, stomach and colon

1 Oesophageal anastomosis

Module: **Management of Oesophageal Neoplasia**

Objective

To evaluate and manage aspects of a patient with oesophageal neoplasia, including operative intervention where appropriate. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

3 Gastric and oesophageal cellular physiology

Clinical Skills

3 Mechanical and cellular defence mechanisms in oesophagus

3 Oesophageal mucosal injury and modulation

3 Effects of acid pepsin and biliary reflux

Anatomy

- 3 The oesophagus and its anatomical relationships from cricopharyngeus to cardia including details of blood supply and lymphatic drainage.
- 3 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.
- 3 Anatomy of the colon, including its blood supply and its anatomical relationships
- 3 Pathology
- 3 Inflammation and wound healing.
- 3 Oesophageal injury response and variations in response.
- 3 The aetiology and epidemiology of oesophageal cancer
- 3 Metaplasia-dysplasia sequence.

Pharmacology

- 3 Adjuvant and neoadjuvant chemotherapy.

Microbiology

- 3 The role of Helicobacter Pylori in gastritis and gastroesophageal reflux disorder.
- 3 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

- 4 Diagnosis, investigation and treatment of oesophageal disorders.
- 4 Radiology, endoscopy and oesophageal function tests.
- 4 Risk assessment and stratification.
- 4 Diagnostic tests, including contrast oesophageal imaging, CT Scanning, abdominal ultrasonography, endoscopic ultrasonography and PET scanning.
- 4 Treatment options and outcomes of treatment
- 4 Oesophageal resection
- 4 Palliative procedures
- 4 Other therapies including radiotherapy, laser, stent and photodynamic therapy
- 4 Screening and prevention.

HISTORY AND EXAMINATION

- 4 General and specific history and examination including previous surgery, drug history, and identification of comorbidity and risk assessment.

DATA INTERPRETATION

TECHNICAL SKILLS AND PROCEDURES

- 4 Routine haematology and biochemical investigations
- 3 Interpretation of Chest radiograph, contrast swallow and CT Scan
- 4 Cardio-pulmonary assessment including exercise tests.

PATIENT MANAGEMENT

- 3 Management of post thoracotomy or laparotomy surgical patient.
- 3 Management of complications of surgery

- 4 Blood transfusion and blood products
- 3 Wound infection and wound disruption
- 2 Diagnosis and management of oesophageal perforation or anastomotic leak.

OPERATIVE MANAGEMENT

- 2 Oesophago-gastro-duodenoscopy
- 2 Assessment by thoracoscopy laparoscopy and mediastinoscopy
- 2 Rigid oesophagoscopy and bronchoscopy
- 2 Oesophageal dilatation and stent placement
- 2 Mobilisation of oesophagus, stomach and colon
- 1 Oesophageal resection
- 1 Oesophageal reconstruction including interposition techniques

Intermediate (II) Phase of training (HST3 & HST4)

The intermediate (II) phase of training will consist of an indicative period of two years. Whilst the emphasis remains on gaining experience and competence in the generality of cardiothoracic surgery, trainees may be starting to develop sub-specialty interests and undertaking modules relevant to this.

The curriculum for each of the modules is defined (see syllabus). Aims and levels of competence to be attained within each module by the end of this stage are identified.

The Intermediate Stage curriculum is divided into the following modules:

- Critical Care and Postoperative Management
- Cardiopulmonary Bypass
- Myocardial Protection
- Circulatory Support
- Ischaemic Heart Disease
- Heart Valve Disease
- Aortovascular Disease
- Cardiothoracic Trauma
- General Management of a Patient Undergoing Thoracic Surgery
- Neoplasms of the Lung
- Disorders of the Pleura
- Disorders of the Chest Wall
- Disorders of the Diaphragm
- Emphysema and Bullae
- Disorders of the Pericardium
- Disorders of the Mediastinum
- Disorders of the Airway
- Congenital Heart Disease
- Intrathoracic transplantation and surgery for heart failure
- Management of Benign Oesophageal Disorders
- Management of Oesophageal Neoplasia

Module: **Critical Care and Post-operative Management**

Objective

To be able to manage a post surgical patient on the critical care, high dependency and post operative wards. To work as part of a multi-professional, multidisciplinary team in the management of a patient requiring complex critical care

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Haemodynamics: physiology and measurement
- 4 Cardiac arrhythmia
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma and surgery
- 4 GIT, renal and hepatic physiology
- 4 Nutrition
- 4 Temperature regulation

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Mediastinum, thoracic inlet and neck
- 4 Tracheobronchial tree and lungs
- 4 Chest wall and diaphragm

Pathology

- 4 Inflammation and wound healing
- 4 Myocardial infarction and complications
- 4 Endocarditis
- 4 Pericarditis
- 4 Systemic Inflammatory Response Syndrome
- 4 Bronchopulmonary infection
- 4 ARDS

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Antimicrobial treatment and policies

Clinical Skills

CLINICAL KNOWLEDGE

- 4 Cardiopulmonary resuscitation
- 4 Management of cardiac surgical patient
- 4 Management of thoracic surgical patient
- 4 Treatment of cardiac arrhythmia
- 4 Management of complications of surgery
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption
- 4 Neuropsychological consequences of surgery and critical care

HISTORY AND EXAMINATION

- 4 History and examination of the post-operative and critically ill patient

DATA INTERPRETATION

- 4 Analysis and interpretation of post operative and critical care charts and documentation
- 4 Routine haematology and biochemical investigations
- 4 Chest radiograph and ECG
- 3 Echocardiography including TOE

PATIENT MANAGEMENT

- General management of surgical patient
- 4 Management of fluid balance and circulating volume
- 4 Pain control
- 4 Wound management
- 4 Management of surgical drains
- 4 Antimicrobial policy and prescribing
- 4 Management of post-operative haemorrhage
- 4 Cardiopulmonary resuscitation (ALS)
- 4 Management of complications of surgery
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Recognition, evaluation and treatment of haemodynamic abnormalities

- 4 Practical use of inotropes and vasoactive drugs
- 4 Use of intra aortic balloon pump

Recognition, evaluation and treatment of cardiac arrhythmias

- 4 Interpretation of ECG
- 4 Use of anti-arrhythmic drugs
- 4 Use of defibrillator
- 4 Understanding and use of cardiac pacing

Recognition, evaluation and treatment of ventilatory abnormalities

4 Interpretation of blood gas results

4 Airway management

3 Understanding of ventilatory techniques and methods

3 Understanding of anaesthetic drugs and methods

Recognition, evaluation and treatment of multi-organ dysfunction

3 Renal dysfunction and support

3 GIT dysfunction, feeding and nutrition

3 Recognition and evaluation of cerebral and neuropsychological problems

PRACTICAL SKILLS

4 Arterial cannulation

4 Central venous cannulation

4 Pulmonary artery catheterisation

4 Intra aortic balloon pump insertion

4 Intra aortic balloon pump timing and management

TECHNICAL SKILLS AND PROCEDURES

4 Tracheostomy

4 Fibreoptic bronchoscopy

4 Chest aspiration

4 Chest drain insertion

4 Chest drain management

OPERATIVE MANAGEMENT

4 Surgical re-exploration for bleeding or tamponade

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Cardiopulmonary Bypass

Objective

To manage the clinical and technical aspects of cardiopulmonary bypass. During this module competence in the management of uncomplicated situations is obtained. Management of complex or difficult situations may require further training and supervision.

Knowledge

BASIC KNOWLEDGE

Physiology

4 Haemodynamics: physiology and measurement

4 Cardiac arrhythmias

4 Haemostasis, thrombosis and bleeding

4 Acid base balance

- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma and surgery
- 4 GIT, renal and hepatic physiology
- 4 Temperature regulation

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Mediastinum, thoracic inlet and neck
- 4 Chest wall and diaphragm
- 4 Femoral triangle and peripheral vascular system

Pathology

- 4 Inflammation and wound healing
- 4 Systemic Inflammatory Response Syndrome
- 4 ARDS

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Antimicrobial treatment and policies

SPECIFIC KNOWLEDGE

- 4 Principles and practice of CPB
- 4 Relevant equipment and technology and its application
- 4 Monitoring during CPB
- 4 Inflammatory and pathophysiological response to bypass
- 4 Pulsatile and non pulsatile flow
- 4 Effect of CPB on pharmacokinetics
- 4 Priming fluids and haemodilution
- 4 Acid base balance – pH and alpha stat
- 4 Neuropsychological consequences of CPB
- 4 Cell salvage and blood conservation

Clinical Skills

N/A

OPERATIVE MANAGEMENT

- 4 Median sternotomy open and close
- 4 Cannulation and institution of cardiopulmonary bypass

TECHNICAL SKILLS AND PROCEDURES

- 4 Safe conduct of CPB – problem solving and troubleshooting
- 4 Weaning from bypass and decannulation
- 4 Femoral cannulation and decannulation
- 3 Repeat sternotomy, with pericardial dissection, cardiac mobilisation and cannulation

Module: **Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support**

Sub-category: Myocardial Protection

Objective

To manage the clinical and technical aspects of intraoperative myocardial protection. Competence in the management of routine situations will be obtained in this module. Management of complex or difficult situations will require further training and supervision.

Knowledge

BASIC KNOWLEDGE

- 4 Myocardial cellular physiology
- 4 Myocardial function and dysfunction
- 4 Haemodynamics and arrhythmias

Clinical Skills

- 4 Coronary arterial and venous anatomy

SPECIFIC KNOWLEDGE

- 4 Scientific foundations of myocardial preservation
- 4 Principles and practice of myocardial preservation
- 4 Cardioplegia solutions and delivery modes.
- 4 Non-cardioplegic techniques of preservation

PATIENT MANAGEMENT

- 4 Myocardial management throughout the peri-operative period
- 3 Ability to adapt preservation technique to clinical situation

OPERATIVE MANAGEMENT

TECHNICAL SKILLS AND PROCEDURES

- 3 Relevant cannulation techniques and appropriate delivery of cardioplegia

Module: **Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support**

Sub-category: Circulatory Support

Objective

To manage the clinical and technical aspects of cardiopulmonary bypass, myocardial protection and circulatory support. Competence in the management of routine situations will be obtained in this module. Management of complex or difficult situations will require further training and supervision.

Knowledge

BASIC KNOWLEDGE

- 4 Haemodynamics: physiology and measurement
- 4 Cardiac arrhythmias
- 4 Haemostasis, thrombosis and bleeding
- 4 Anatomy of the femoral triangle and peripheral vascular system
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs

SPECIFIC KNOWLEDGE

- 4 Mechanical circulatory support in the pre-operative, peri-operative and post-operative periods
- 4 Intra aortic balloon pump - indications for use, patient selection and complications

Clinical Skills

- 4 Physiology of the balloon pump
- 3 Understanding of relevant equipment and technology
- 3 Ventricular assist devices: indications for use, patient selection and complications

PATIENT MANAGEMENT

- 4 Patient selection for mechanical circulatory support
- 4 Insertion and positioning of the intra aortic balloon pump
- 4 Management of the balloon pump including timing and trouble shooting
- 4 Care of the patient with intra aortic balloon pump, including recognition and management of complications

TECHNICAL SKILLS AND PROCEDURES

N/A

Module: **Ischaemic Heart Disease**

Objective

To evaluate and manage the surgical aspects of a patient with ischaemic heart disease including the complications of ischaemic heart disease. Competence in the management of routine and uncomplicated situations will be obtained in this module. Management of complex or difficult situations will require further training or supervision

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Myocardial cellular physiology
- 4 Haemodynamics; physiology and measurement
- 4 Electrophysiology, including conduction disorders
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma
- 4 Vascular biology and reactivity

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Coronary anatomy and variants
- 4 Coronary angiography
- 4 Anatomy of the peripheral vascular system and vascular conduits

Pathology

- 4 Inflammation and wound healing
- 4 Atheroma, medial necrosis and arteritis
- 4 Intimal hyperplasia and graft atherosclerosis
- 4 Myocardial infarction and complications
- 4 Systemic Inflammatory Response Syndrome

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis

CLINICAL KNOWLEDGE

General

- 4 Diagnosis, investigation and treatment of heart disease
- 4 Risk assessment and stratification
- 4 Cardiopulmonary resuscitation
- 4 Cardiac arrhythmias
- 4 Complications of surgery
- 4 Renal dysfunction
- 4 Multiorgan failure
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Specific

- 4 Diagnosis investigation and assessment of IHD

Clinical Skills

- 4 Operative treatment - Off pump and on pump surgery
- 4 Results of surgery ? survival, graft patency, recurrence
- 4 Arterial revascularisation
- 4 Redo coronary artery surgery
- 4 Role of PCI and non operative treatment
- 4 Management of cardiovascular risk factors
- 4 Complications of myocardial infarction and ischaemic heart disease VSD, mitral regurgitation, aneurysm.

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG including exercise ECG
- 4 Coronary Angiography
- 4 Cardiac Catheterisation data
- 4 Echocardiography including 2D, Doppler and TOE and stress echo
- 4 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Isolated, first time coronary artery surgery (May include both off pump and on pump options and arterial revascularisation strategies)
- 2 Repeat coronary artery surgery
- 2 Complications of ischaemic heart disease including post infarction VSD, mitral regurgitation and left ventricular aneurysm

Module: **Heart Valve Disease**

Objective

To evaluate and manage a patient with heart valve disease, including operative management. Competence in the management of uncomplicated cases will be achieved by the end of this module. Management of complex or difficult situations will require further training and supervision

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Cardiovascular physiology including valve physiology and haemodynamics
- 4 Electrophysiology, including conduction disorders
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma

Anatomy

- 4 Cardiac chambers and valves, pericardium and great vessels
- 4 Anatomy of the conduction system

Pathology

- 4 Pathophysiology of valve incompetence and stenosis.
- 4 Consequences of valve disease on cardiac function and morphology
- 4 Pathophysiology of mixed valve disease and combined valve pathology (eg aortic and mitral)
- 4 Combined valvular and ischaemic heart disease
- 4 Atrial fibrillation and other arrhythmias

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs

Clinical Skills

- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardio respiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis
- 4 Endocarditis and prosthetic valve endocarditis

CLINICAL KNOWLEDGE

General knowledge

- 4 Cardiopulmonary resuscitation
- 4 Care of the cardiac surgical patient
- 4 Complications of surgery
- 4 Risk assessment and stratification
- 4 Management of cardiovascular risk factors

Specific Knowledge

- 4 Diagnosis investigation and assessment of valvular heart disease
- 4 Timing of surgical intervention in valve disease
- 4 Options for operative management including: Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)
- 4 Valve design: materials, configuration and biomechanics.
- 4 Results of surgery - survival, valve thrombosis, endocarditis, bleeding.
- 4 Interpretation of survival and follow up data
- 4 Cardiac performance and long term functional status
- 4 Surgery for conduction problems
- 4 Surgical treatment of arrhythmias

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including drug history, identification of co morbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations

TECHNICAL SKILLS AND PROCEDURES

- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG interpretation including exercise ECG
- 4 Coronary angiography
- 4 Cardiac catheterisation data including left and right heart data
- 3 Echocardiography (thoracic and transoesophageal) including 2D, Doppler and stress echo
- 3 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption
- 4 Non operative management of endocarditis
- 4 Valve selection
- 4 Anticoagulation management including complications.

OPERATIVE MANAGEMENT

- 2 Tricuspid valve surgery
- 1 Surgical strategies for managing the small aortic root
- 1 Aortic root surgery including stentless valves, and root replacement
- 1 Redo Valve surgery
- 1 Valve surgery for endocarditis
- 1 Mitral valve repair
- 1 Alternative surgical approaches to valve surgery including thoracotomy, trans-septal approaches, and minimal access surgery
- 2 Combined valve and graft surgery
- 2 Techniques for surgical ablation of arrhythmias
- 4 Isolated, uncomplicated aortic valve replacement (stented biological or mechanical)
- 4 Isolated uncomplicated mitral valve replacement

Module: **Aortovascular Disease**

Objective

To evaluate and manage uncomplicated surgical aspects of a patient with aortovascular disease, including operative management where appropriate and up to the defined competence. This module provides intermediate training in a complex sub-specialty.

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Vascular biology and reactivity
- 4 Haemodynamics; physiology and measurement
- 4 Rheology and arterial pressure regulation
- 4 Haemostasis, thrombosis and bleeding
- 4 Physiology of transfusion therapy
- 4 Principles of surgical infectious disease
- 4 Acid base balance
- 4 Metabolic response to trauma

4 Pathophysiology and of hypothermia including the effects upon haemoglobin, metabolic rate and pH with their management

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Anatomy of the peripheral vascular system
- 4 Blood supply of the spinal cord

Pathology

- 4 Inflammation and wound healing
- 4 Atheroma, medial necrosis and arthritis
- 4 Inherited disorders of vascular biology
- 4 Systemic Inflammatory Response Syndrome

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs

Clinical Skills

- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Anti-emetics
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis

CLINICAL KNOWLEDGE

General

- 4 Risk assessment
- 4 Cardiopulmonary resuscitation
- 4 Cardiac arrhythmias
- 4 Complications of surgery
- 4 Renal dysfunction
- 4 Multi-organ failure
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Specific

- 4 Natural history of aortic disease
- 4 Diagnosis, investigation and assessment of aortic disease
- 4 Knowledge of operative treatment including spinal cord and cerebral preservation strategies • Type A dissection • Type B dissection • Traumatic aortic rupture • Thoraco-abdominal aneurysm

- 4 Results of surgery – survival, complication rates
- 4 Non-surgical management including the role of endovascular stenting
- 4 Management of cardiovascular and non-cardiovascular risk factors

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including assessment of pre-operative complications, drug history, identification of co-morbidity and risk

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG including exercise ECG
- 4 Coronary Angiography
- 4 Aortography
- 4 Cardiac Catheterisation data
- 4 Echocardiography including 2D, Doppler and TOE and stress echo
- 4 CT scanning
- 4 MRI scanning

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

- 3 Intraoperative monitoring
- 2 Spinal cord protection
- 2 Preparation for and management of cardiopulmonary bypass, including alternative, non-bypass strategies for descending aortic surgery
- 2 Hypothermic strategies including HCA, RCP and SACP

TECHNICAL SKILLS AND PROCEDURES

- 3 Femoral cannulation
- 1 Surgery for acute dissection of the ascending aorta
- 2 Aortic root replacement for chronic aortic root disease
- 1 Complex aortic surgery including arch surgery, descending aortic and thoraco-abdominal aortic surgery

Module: **Cardiothoracic Trauma**

Objective

To evaluate and manage as part of a multidisciplinary team, a patient with thoracic trauma. To include appropriate surgical management

Knowledge

BASIC KNOWLEDGE

- 4 Anatomy of the lungs, heart, chest wall, diaphragm and oesophagus
- 4 Anatomy of the larynx, trachea and bronchial tree
- 4 Physiology of breathing and its control
- 4 Physiology of the heart and circulation

GENERAL TRAUMA MANAGEMENT

- 4 Principles of trauma management (as defined by ATLS)
- 4 Principles of emergency resuscitation following cardiac arrest

SPECIFIC KNOWLEDGE

- 4 The mechanism and patterns of injury associated with blunt, penetrating and deceleration injuries to the chest
- 4 The post-ATLS, definitive care of blunt, penetrating and deceleration injuries to the chest.
- 4 The indications and use of appropriate investigations in thoracic trauma management
- 4 Pain relief in chest trauma, including epidural anaesthesia.
- 4 Indications for immediate, urgent and delayed thoracotomy in trauma

Clinical Skills

GENERAL TRAUMA MANAGEMENT (ATLS)

- 4 Assessment and management of airway, breathing and circulation
- 4 Maintenance of an adequate airway and respiratory support
- 4 Protection of the cervical spine
- 4 Circulatory resuscitation
- 4 Establishment of appropriate monitoring
- 4 Assessment and management of pain and anxiety

CARDIOTHORACIC TRAUMA MANAGEMENT

- 4 Examination and assessment of the of the chest, including respiratory cardiovascular and circulatory systems
- 4 Recognition and management of immediately life threatening situations: obstructed airway, tension pneumothorax, massive haemothorax, open chest wound, flail chest and cardiac tamponade
- 4 Recognition and management of potentially life threatening situations: lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding, oesophageal injury, simple pneumothorax and major vascular injury
- 4 Recognition of potentially life threatening penetrating injuries to the chest and abdomen
- 4 Interpretation of chest x-ray, ECG, arterial blood gases and echocardiography

- 4 Detection and treatment of cardiac arrhythmias
- 4 Management of the widened mediastinum including appropriate investigations and multidisciplinary consultation

PRACTICAL SKILLS

- 4 Establish an emergency airway (surgical and non-surgical)
- 4 Insertion and management of thoracic drains
- 4 Establish adequate venous access and monitoring.
- 4 Pericardiocentesis and subxiphoid pericardial window for tamponade

OPERATIVE MANAGEMENT OF THORACIC TRAUMA

- 3 Subxiphoid pericardial window for tamponade
- 4 Posterolateral thoracotomy, anterolateral thoracotomy and thoracotomy
- 3 Bilateral Anterior Thoracotomy
- 4 Median sternotomy and closure
- 3 Repair of cardiac injuries
- 3 Repair of pulmonary and bronchial injuries
- 3 Management of the complications of chest trauma including retained haemothorax and empyema
- 2 Repair of oesophageal injuries
- 1 Repair of aortic transection

Module: **General Management of a Patient Undergoing Thoracic Surgery**

Objective

To be competent in the evaluation and management of a patient undergoing thoracic surgery. The knowledge and clinical skills are common to all thoracic surgical conditions, and should be read in conjunction with the curriculum for specific surgical conditions.

Knowledge

BASIC KNOWLEDGE

- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Metabolic response to trauma
- 4 Digestive, renal and hepatic physiology
- 4 Nutrition

Anatomy

- 4 Tracheobronchial tree and lungs
- 4 Thoracic inlet, neck and mediastinum
- 4 Oesophagus and upper GI tract
- 4 Chest wall and diaphragm

Pathology

- 4 Inflammation and wound healing
- 4 Bronchopulmonary infections
- 4 ARDS
- 4 Emphysema
- 4 Pulmonary fibrosis
- 4 Pulmonary manifestations of systemic disease
- 4 Systemic manifestations of pulmonary disease
- 4 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 4 Oesophagitis, columnar-lined oesophagus stricture
- 4 Oesophageal motility disorders
- 4 Malignant and benign tumours of the oesophagus and stomach
- 4 Malignant and benign tumours of the pleura and chest wall, mediastinum and thyroid

Pharmacology

- 4 Bronchodilators
- 4 H₂ antagonists and proton pump inhibitors
- 4 Haemostatic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in respiratory infection including TB
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis
- 4 Management of intra pleural sepsis

CLINICAL KNOWLEDGE

Thoracic Incisions

- 4 Types of incisions and appropriate use, including lateral, anterior, muscle sparing and video-assisted approaches.

Sternotomy

- 4 Difficult access and improving exposure.
- 4 Early and late complications of thoracic incisions
- 4 Analgesia including pharmacology, effectiveness, side effects and use in combination regimens
- 4 Post-operative analgesia, including epidural, PCAS and paravertebral catheter techniques.

Bronchoscopy

- 4 The role of rigid and flexible bronchoscopy in the investigation of airway and pulmonary disease.
- 4 The anaesthetic, airway and ventilatory management during rigid and flexible bronchoscopy

Mediastinal exploration

4 Endoscopic, radiological and surgical approaches used to evaluate and diagnose mediastinal disease of benign, infective, primary and malignant aetiology.

4 Equipment for mediastinal exploration

4 Relevant imaging techniques, and influence on surgical approach.

HISTORY AND EXAMINATION

4 System specific and general history and examination, including drug history, identification of comorbidity and functional status.

Clinical Skills

DATA INTERPRETATION

4 Routine haematology and biochemical investigations

4 Chest radiograph and ECG

TECHNICAL SKILLS AND PROCEDURES

3 CT, including contrast enhanced CT

3 Interpretation of imaging of the mediastinum.

3 MRI and PET

4 Respiratory function tests

3 Ventilation/perfusion scan

4 Blood gases

3 Oesophageal function tests and contrast studies

PATIENT MANAGEMENT

General

4 Cardiopulmonary resuscitation

4 Risk assessment, stratification and management

4 Management of patients making an uncomplicated or complicated recovery from thoracic operations.

4 Post-operative management of pain control, respiratory failure, sputum retention, haemodynamic instability and low urine output.

4 Treatment of cardiac arrhythmias

4 Pain control

3 Wound infection and disruption

4 Blood transfusion and blood products

4 Physiotherapy and rehabilitation

2 Palliative care

PRACTICAL SKILLS

4 Arterial cannulation

4 Central venous cannulation

4 Pulmonary artery catheterisation

4 Tracheostomy

4 Fibreoptic bronchoscopy

4 Chest aspiration

- 4 Chest drain insertion
- 4 Chest drain management

OPERATIVE MANAGEMENT

Thoracic Incisions

- 4 Correct positioning of patient for thoracic surgery
- 4 Perform and repair thoracic incisions, including lateral, anterior, muscle sparing and VATS incisions.
- 3 Difficult access and improving exposure
- 4 Perform and close sternotomy incision

Bronchoscopy

- 4 Diagnostic bronchoscopy including biopsy - rigid and flexible.
- 4 Equipment, instrumentation and preparation
- 4 Perform rigid and flexible bronchoscopy
- 4 Airway and ventilatory management
- 4 Recognise normal and abnormal anatomy.
- 4 Identify common pathologies and the surgical relevance of the findings.
- 4 Take appropriate specimens for bacteriology, cytology and histology.
- 4 Management of moderate bleeding and other common complications.
- 4 To appropriately supervise the care of patients recovering from bronchoscopy.
- 4 Post-operative bronchoscopy: indications and procedure
- 4 Tracheostomy and mini-tracheostomy
- 3 Bronchoscopy in situations where there is unfavourable anatomy or complex pathology and to deal with complications.

Mediastinal Exploration

- 4 Assembly of relevant equipment for mediastinal exploration
- 4 Surgical evaluation of the mediastinum using cervical, anterior and VATS approaches.
- 4 Mediastinal biopsy Professional Skills Please see the Professional Skills and Behaviour » Intermediate section for these

Module: **Neoplasms of the Lung**

Objective

To fully assess and manage an uncomplicated patient with a neoplasm of the lung, including operative management where appropriate. Appreciation of the multidisciplinary, multimodality approach to the management of the condition.

Knowledge

BASIC KNOWLEDGE

Clinical Skills

As for thoracic surgery - general

SPECIFIC KNOWLEDGE

- 4 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 4 Epidemiology, presentation, diagnosis, staging (pre-operative, intraoperative and pathological) and treatment of lung cancer and lung metastases.
- 4 Neoadjuvant and adjuvant treatment of lung cancer
- 4 Results of treating thoracic malignancy by surgery, medical or oncological techniques, including multimodality management.
- 4 Survival, recurrence rates and relapse patterns after surgical treatment and the investigation and management of relapse.
- 4 Knowledge of palliative care techniques.
- 4 Treatment of post-operative complications of pulmonary resection such as empyema and broncho-pleural fistula.
- 4 Role of repeat surgery in recurrent and second primary malignancies of the lung.
- 4 Medical and surgical options to deal with recurrent or problematic complications of pulmonary resection.

PATIENT MANAGEMENT

As for thoracic surgery - general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Interpretation of endoscopic findings.
- 4 Patient selection with assessment of function and risk.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Bronchoscopic assessment including biopsy
- 4 Endoscopic and surgical techniques of lung biopsy.
- 4 Mediastinal assessment and biopsy
- 2 Endoscopic management of tumours using laser and stenting
- 4 Intraoperative diagnosis and staging
- 4 Surgery for benign and malignant conditions of the lungs, including uncomplicated lobectomy for lung cancer, wedge resection and metastasectomy.
- 4 Segmentectomy and lobectomy for benign and malignant disease.
- 2 Redo operations for repeat resections of lung metastases.
- 2 Advanced resections for lung cancer, including sleeve lobectomy, pneumonectomy and extended resections involving chest wall and diaphragm.
- 2 Repeat resections for benign and malignant conditions of the lung, including completion pneumonectomy
- 2 Management of post-operative complications such as empyema and broncho-pleural fistula.

Module: **Disorders of the Pleura**

Objective

To fully evaluate and manage uncomplicated surgical conditions of the pleura and the pleural space

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy and physiology of the pleura
- 4 Inflammatory, infective and malignant disease of the visceral and parietal pleura.
- 4 Pneumothorax
- 4 Pleural effusion
- 4 Empyema

Knowledge

Clinical Skills

- 4 Mesothelioma
- 4 Haemothorax
- 4 Chylothorax
- 4 Conditions of adjacent organs that affect the pleura
- 4 Medical and surgical management of pleural disease, including radiological, open and VATS techniques.
- 4 Techniques to deal with failures of primary treatment.
- 4 Advanced techniques for pleural space obliteration such as thoracoplasty and soft- tissue transfer

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Interpretation of imaging of the pleura
- 4 Chest drains: insertion, management, removal and treatment of complications.
- 4 Management of patients making uncomplicated and complicated recovery from pleural interventions.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Open procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy
- 4 VATS procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy
- 3 Open and VATS procedures for empyema, including techniques for decortication.
- 2 Open and VATS procedures in complex cases.
- 1 Advanced techniques of pleural space obliteration, with appropriate specialist assistance. Professional Skills Please see the Professional Skills and Behaviour » Intermediate section for these

Module: **Disorders of the Chest Wall**

Objective

To assess and manage a patient with abnormality or disease affecting the chest wall, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

4 Anatomy of the chest wall

4 Congenital, inflammatory, infective and neoplastic conditions that can affect the components of the chest wall.

4 Clinical, laboratory and imaging techniques used in the evaluation of chest wall pathology.

4 Techniques used in the diagnosis of chest wall disease, including aspiration and core biopsy, and incision and excision biopsy.

4 Pectus deformities: aetiology, physiological and psychological consequences. Surgical options for correction.

4 Techniques used to resect the sternum and chest wall, physiological and cosmetic sequelae.

4 Prosthetic materials used in chest wall surgery

4 The role of repeat surgery to deal with recurrent conditions and the complications of previous surgery.

4 Techniques of complex chest wall reconstruction involving thoracoplasty or soft-tissue reconstruction

PATIENT MANAGEMENT

As for thoracic surgery – general

Clinical Skills

4 Clinical history and examination

4 Interpretation of laboratory, physiological and imaging techniques.

TECHNICAL SKILLS AND PROCEDURES

4 Patient selection with assessment of function and risk.

OPERATIVE MANAGEMENT

4 Chest wall biopsy and choice of appropriate technique.

4 Needle biopsy by aspiration or core techniques and the siting of open surgical biopsy.

4 Open and excision biopsy and resection of the chest wall for benign and malignant conditions.

3 Chest wall resection in combination with resection of the underlying lung.

3 Selection and insertion of prosthetic materials, and selection of cases in which such materials are required

3 Pectus correction, by both open and minimally-invasive techniques, including post-operative care and complications

- 2 Surgery for the complications of chest wall resection, and repeat surgery to resect recurrent chest wall conditions.
- 1 Complex chest wall reconstruction with thoracoplasty and, with appropriate specialist support, soft tissue reconstruction.

Module: **Disorders of the Diaphragm**

Objective

To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy and physiology of the diaphragm.
- 4 Pathology of the diaphragm.
- 4 Clinical, physiological and imaging techniques in the assessment of diaphragmatic abnormalities.
- 4 Physiological consequences of diaphragmatic herniation or paresis.
- 4 Surgical techniques used to biopsy and resect diaphragmatic tumours.
- 4 Situations in which replacement of the diaphragm is required, the materials used and their value and limitations.
- 4 Complications of diaphragmatic resection and their management.
- 4 Techniques used to electrically pace the diaphragm, and the conditions in which such treatment is appropriate.

PATIENT MANAGEMENT

As for thoracic surgery – general

Specific Skills

- 4 Clinical history and examination

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Patient selection with assessment of function and risk.
- 4 Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.

OPERATIVE MANAGEMENT

- 2 Resection of the diaphragm, and adjacent structures, including appropriate selection and insertion of prosthetic materials
- 2 Complications of diaphragmatic resection.
- 2 Phrenic nerve pacing.

Module: **Topic Disorders of the Diaphragm**

Objective

To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

4 Anatomy and physiology of the diaphragm.

4 Pathology of the diaphragm.

4 Clinical, physiological and imaging techniques in the assessment of diaphragmatic abnormalities.

4 Physiological consequences of diaphragmatic herniation or paresis.

4 Surgical techniques used to biopsy and resect diaphragmatic tumours.

4 Situations in which replacement of the diaphragm is required, the materials used and their value and limitations.

4 Complications of diaphragmatic resection and their management.

4 Techniques used to electrically pace the diaphragm, and the conditions in which such treatment is appropriate.

PATIENT MANAGEMENT

As for thoracic surgery – general

Specific Skills

4 Clinical history and examination

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

4 Interpretation of laboratory, physiological and imaging techniques.

4 Patient selection with assessment of function and risk.

4 Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.

OPERATIVE MANAGEMENT

2 Resection of the diaphragm, and adjacent structures, including appropriate selection and insertion of prosthetic materials

2 Complications of diaphragmatic resection.

2 Phrenic nerve pacing.

Module: **Disorders of the Pericardium**

Objective

To fully assess and manage a patient with disease of the pericardium or pericardial space, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy of the pericardium.
- 4 Pathology of the pericardium.
- 4 Pathophysiological consequences of pericardial constriction and tamponade.
- 4 Clinical, echocardiographic and imaging techniques used to detect pericardial disease and assess its consequences.
- 4 Techniques for pericardial drainage using guided needle aspiration

Clinical Skills

- 4 Surgical drainage by sub-xiphoid, thoracotomy or VATS approaches.
- 4 Surgical techniques for pericardiectomy.
- 4 Materials used for pericardial replacement, their value and limitations and the situations in which used.
- 4 Post-operative complications following resection of the pericardium and its prosthetic replacement.

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques, including echocardiography.
- 4 Recognition and assessment of pericardial tamponade and constriction.
- 4 Techniques for pericardial drainage using guided needle aspiration
- 4 Recognition of pericardial herniation and cardiac strangulation.
- 4 Patient selection with assessment of function and risk.
- 4 Management of patients making an uncomplicated or complicated recovery from pericardial surgery.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Uncomplicated pericardial fenestration procedures
- 3 Pericardial fenestration in complex cases.
- 3 Pericardiectomy for relief of constriction
- 3 Resection of the pericardium and replacement, in appropriate situations, with prosthetic materials.
- 3 Competence in dealing with the complications of pericardial resection and replacement.

Module: **Disorders of the Mediastinum**

Objective

To fully assess and manage a patient with benign and malignant disease of the mediastinum, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

Clinical Skills

SPECIFIC KNOWLEDGE

4 Anatomy of the mediastinum

4 Congenital, benign, infective and malignant (primary and secondary) conditions of the mediastinum.

4 Systemic conditions associated with the mediastinum.

4 Clinical, laboratory, electromyographic and imaging techniques used in the diagnosis and assessment of patients with mediastinal disease

4 Myasthenia gravis: medical, surgical and peri-operative management

4 Staging of thymoma and grading of myasthenia

4 Benign and malignant conditions, which do not require surgical biopsy or resection.

4 Oncological treatment of malignant diseases of the mediastinum, including multidisciplinary care.

4 Surgical techniques for the treatment of myasthenia gravis, mediastinal cysts and tumours, complications and results.

4 Retrosternal goitre and its management

PATIENT MANAGEMENT

As for thoracic surgery – general

4 Clinical history and examination

3 Interpretation of laboratory, physiological and imaging techniques.

4 Patient selection with assessment of function and risk.

4 Post-operative management of patients including recognition and management of post-operative complications .

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

4 Selection of appropriate routes for biopsy and excision of mediastinal tumours and cysts.

4 Biopsy of mediastinal masses.

4 Excision of the thymus for myasthenia gravis.

4 Resection of mediastinal cysts and tumours masses.

3 Resection of mediastinal cysts and tumours, including extended resections involving adjacent structures.

Module: **Disorders of the Airway**

Objective

To assess and manage a patient with disease of the major airways, including surgical management where appropriate.

Knowledge

BASIC KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy of the larynx, trachea and bronchus.
- 4 Physiology of the normal airway.
- 4 Pathophysiology of disease and its effects on lung function.
- 4 Endoscopic appearances in health and disease.
- 4 Congenital, inflammatory, infective, benign and neoplastic diseases of the airways.
- 4 Symptoms, signs of airway disease.
- 4 Clinical, physiological and imaging tests undertaken to diagnose and assess airway disease.
- 4 Techniques for surgical resection of the trachea.
- 4 Bronchoplastic procedures and the limitations of these techniques.
- 4 Medical and oncological treatments available to deal with airway diseases.
- 4 Endoscopic techniques used to deal with benign and malignant conditions, including disobliteration and stenting.
- 4 Presentation, investigation and management of anastomotic complications following airway surgery.
- 4 Presentation, evaluation and treatment of fistulae in the aerodigestive tract, due to benign, malignant and iatrogenic causes.
- 4 Role of open and endoscopic procedures in dealing with problems.

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 3 Interpretation of laboratory, physiological and imaging techniques.
- 4 Recognition, diagnosis and assessment of airway obstruction.
- 4 Patient selection with assessment of function and risk.
- 4 Post-operative care of patients making an uncomplicated recovery from major airway surgery.
- 4 Post-operative care of patients making a complicated recovery from airway surgery.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 3 Endoscopic assessment of a patient with airways disease

- 2 Sleeve resection of the trachea for simple benign conditions, including appropriate anastomotic techniques.
- 2 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastomotic techniques.
- 2 Techniques for the relief of major airways obstruction including stenting.
- 1 Airway resection for tumours and complex benign conditions, and techniques for airway reconstruction, anastomosis and laryngeal release.
- 1 Repeat resections for recurrence and the complications of prior resection.
- 1 Management of fistulae in the aerodigestive tract by surgical and endoscopic techniques.

Module: **Congenital Heart Disease**

Objective

To be able to evaluate and manage, with appropriate supervision, some of the aspects of children and adults with heart disease, including operative management where appropriate. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Relevant general physiology of childhood
- 3 Foetal circulation and circulatory changes at birth
- 3 Haemodynamics; physiology and measurement including shunt calculations
- 3 Physiology of pulmonary vasculature
- 3 Myocardial cellular physiology in immature myocardium

Knowledge

- 3 Electrophysiology, including conduction disorders
- 3 Haemostasis, thrombosis and bleeding
- 3 Acid base balance
- 3 Pulmonary physiology, ventilation and gas exchange
- 3 Metabolic response to trauma
- 3 Vascular biology and reactivity
- 3 Physiology of Cardiopulmonary Bypass including low flow and circulatory arrest.
- 3 Ph and alpha stat CPB management

Anatomy

- 3 Embryology of the heart
- 3 Anatomy of the heart, pericardium and great vessels
- 3 Pulmonary anatomy
- 3 Coronary anatomy and variants
- 3 Anatomy of the peripheral vascular system and vascular conduits including aortopulmonary shunts

3 Sequential cardiac analysis and terminology of cardiac malformations

Pathology

- 3 Inflammation and wound healing
- 3 Systemic Inflammatory Response Syndrome
- 3 Effect of growth and pregnancy

Pharmacology

- 3 Drugs used in the treatment of congenital heart disease
- 3 Inotropes
- 3 Anti-arrhythmic drugs
- 3 Haemostatic drugs
- 3 Antiplatelet, anticoagulant and thrombolytic drugs
- 3 Analgesics
- 3 Antibiotics
- 3 Anaesthetic agents, local and general
- 3 Hypotensive agents (systemic and pulmonary).

Microbiology

- 3 Organisms involved in cardiorespiratory infection
- 3 Organisms involved in wound infection
- 3 Antibiotic usage and prophylaxis
- 3 Antisepsis

CLINICAL KNOWLEDGE

General

- 3 Diagnosis, investigation and treatment of congenital heart disease
- 3 Results of surgery – survival, common complications and management.

Clinical Skills

- 3 Late complications of surgery for congenital heart disease
- 3 Role of interventional cardiology.
- 3 Role of mechanical assist (IABP, VAD and ECMO)
- 3 Indications for referral for transplantation
- 3 Risk assessment and stratification
- 3 Cardiopulmonary resuscitation
- 3 Cardiac arrhythmias
- 3 Renal dysfunction
- 3 Multiorgan failure
- 3 Cardiac rehabilitation
- 3 Blood transfusion and blood products
- 3 Wound infection and sternal disruption
- 3 Types of cardiac prosthesis and indications for use

Specific Knowledge

The anatomy, pathophysiology natural history and management of the following conditions or procedures

- 4 Patent ductus arteriosus

- 4 Atrial septal defect
- 4 Ventricular septal defect
- 4 Coarctation
- 3 PA banding and shunts
- 3 Transposition of the great arteries – switch procedure
- 3 Tetralogy of Fallot/Pulmonary atresia plus VSD
- 2 Fontan procedure
- 2 Rastelli procedure
- 2 Hypoplastic heart
- 2 Norwood procedure
- 2 Truncus arteriosus
- 2 Double outlet right ventricle
- 2 Pulmonary atresia plus VSD and MAPCAs
- 2 Single ventricle
- 2 Partial and complete atrioventricular septal defects
- 2 Valve lesions
- 2 Extra cardiac conduits
- 2 Interrupted aortic arch
- 2 Total anomalous pulmonary venous drainage
- 2 Extra Corporeal Membrane Oxygenation
- 2 Transplantation

HISTORY AND EXAMINATION

- 3 Cardiovascular system and general history and examination of child or adult with congenital heart disease

DATA INTERPRETATION

- 3 Routine haematology and biochemical investigations
- 2 Chest radiograph and ECG

TECHNICAL SKILLS AND PROCEDURES

- 2 Cardiac catheterisation data including interpretation of haemodynamic data, shunt and resistance calculations
- 2 Echocardiography in congenital heart disease, including 2D, Doppler and TOE

PATIENT MANAGEMENT

- 2 Principles of paediatric intensive care
- 2 Management of adults and children following congenital heart surgery
- 2 Management of complications of surgery
- 3 Cardiopulmonary resuscitation
- 3 Diagnosis and treatment of cardiac arrhythmias
- 4 Blood transfusion and blood products
- 3 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

- 2 Sternotomy – open and close
- 2 Thoracotomy – open and close
- 2 Preparation for and management of cardiopulmonary bypass including partial bypass

2 Approaches for ECMO, cannulation and management.

Surgical management of the following common uncomplicated conditions: (level 1 - a higher level of operative competence is not required during this module)

- Patent ductus arteriosus
- Atrial septal defect
- Ventricular septal defect
- Coarctation
- PA banding and shunts

Module: Intrathoracic transplantation and surgery for heart failure

Objective

To be able to evaluate and manage, with appropriate supervision, some of the aspects of patients with heart failure, including operative management where appropriate. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Pathophysiology

- 3 Haemodynamics of heart failure.
- 3 Molecular mechanisms underlying heart failure.
- 3 Mechanisms and outcomes of respiratory failure.
- 3 Causes of cardiac failure.
- 3 Causes of respiratory failure.

Immunology

- 3 Major and minor histocompatibility antigen systems.
- 3 Mechanisms of immune activation and pathological consequences for transplanted organs.

Pharmacology

- 3 Modes of action of commonly used drugs in heart failure:

Knowledge

Clinical Skills

CLINICAL KNOWLEDGE

- 3 Indications for, contraindications to and assessment for heart transplantation.
- 3 Indications for, contraindications to and assessment for lung and heart/lung transplantation.
- 3 Indications for ECMO
- 3 Indications for VAD

- 3 Criteria for brain stem death, management of the brain-dead donor, criteria for matching donor and recipient.
- 3 Management of patients after intrathoracic organ transplantation, including complications
- 3 Results of heart transplantation, lung transplantation and non-transplant interventions for heart failure.
- 2 Resynchronisation therapy: techniques and indications

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph

TECHNICAL SKILLS AND PROCEDURES

- 3 ECG including exercise ECG
- 3 Coronary angiography
- 3 Cardiac catheterisation data
- 2 Echocardiography including 2D, Doppler and TOE and stress echo
- 2 MR assessment of ventricular function and viability
- 2 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 3 Management of brain-dead donor
- 4 Management of post cardiac surgical patient
- 3 Management of complications of surgery
- 2 Management of rejection
- 3 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 3 Wound infection and sternal disruption
- 3 Diagnosis and treatment of cardiac arrhythmias

OPERATIVE MANAGEMENT

- Transplantation
- 3 Trans venous myocardial biopsy
- 2 Donor Retrieval
- 2 Ex-vivo donor organ management
- 1 Implantation of heart
- 1 Implantation of lung
- 1 Implantation of heart/lung block

Surgery for heart failure

- 2 Surgical revascularisation for ischaemic cardiomyopathy
- 1 Ventricular reverse remodelling surgery

- 1 Mitral valve repair for cardiac failure
- 2 Cannulation for ECMO
- 1 Implantation of epicardial electrodes for resynchronisation therapy
- 1 Implantation of extracorporeal VAD
- 1 Implantation of intracorporeal VAD

Module: **Management of Benign Oesophageal Disorders**

Objective

To evaluate and manage surgical aspects of benign oesophageal disorders. This module is intended for a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Gastric and oesophageal cellular physiology
- 3 Mechanical and cellular defence mechanisms in oesophagus
- 3 Oesophageal mucosal injury and modulation
- 3 Effects of acid pepsin and biliary reflux
- 3 Oesophago-gastric physiology and assessment including pH monitoring
- 3 Oesophageal motility measurement in achalasia, diffuse spasm and non-specific motility syndromes

Anatomy

- 3 Embryology of the foregut.
- 3 The oesophagus and its anatomical relationships from cricopharyngeus to cardia, including details of blood supply and lymphatic drainage.
- 3 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.
- 3 Anatomy of the colon, including its anatomical relationships, blood supply and lymphatic drainage.

Pathology

- 3 Inflammation and wound healing.
- 3 Oesophageal injury response and variations in response.
- 3 The inflammation, metaplasia, dysplasia cancer sequence.
- 3 Neurological deficits / aetiology of oesophageal dysmotility disorders.
- 3 Para-oesophageal hernias

Pharmacology

- 3 Drugs used in the treatment of gastro-oesophageal reflux disorder and oesophageal dysmotility.

Microbiology

- 3 The role of Helicobacter Pylori in gastritis and gastroesophageal reflux disorder.
- 3 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

- 4 Diagnosis, investigation and treatment of benign oesophageal disorders.
- 4 Radiology, endoscopy, 24 hour pH monitoring and oesophageal function tests.
- 4 Risk assessment and stratification.
- 4 Open, laparoscopic and thoracoscopic surgery of the oesophagus.
- 4 Relative merits of conservative and operative treatment.
- 4 Alternative management of achalasia including dilatation and Botox injection.
- 4 The indications for surgery in paraoesophageal hernia.
- 4 Endoscopic dilatation techniques

HISTORY AND EXAMINATION

- 4 General and specific history and examination including previous surgery, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigation
- 3 Interpretation of oesophageal motility and pH monitoring data
- 4 Chest radiograph and contrast imaging
- 4 Cardio-pulmonary assessment including exercise tests

PATIENT MANAGEMENT

- 3 Management of post thoracotomy or laparotomy surgical patient
- 3 Management of complications of surgery
- 3 Diagnosis and management of oesophageal perforation or anastomotic leak.
- 4 Blood transfusion and blood products
- 3 Wound infection and wound disruption

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 2 Oesophago-gastro-duodenoscopy.
- 2 Rigid oesophagoscopy
- 2 Oesophageal dilatation
- 2 Open and laparoscopic fundoplication and cardiomyotomy
- 2 Mobilisation of oesophagus, stomach and colon
- 1 Oesophageal anastomosis

Module: **Management of Oesophageal Neoplasia**

Objective

To evaluate and manage aspects of a patient with oesophageal neoplasia, including operative intervention where appropriate. This module is intended for

a trainee to gain initial exposure to this sub-specialty either as part of general cardiothoracic training or as an introduction to further advanced training in this area.

Knowledge

BASIC KNOWLEDGE

Physiology

- 3 Gastric and oesophageal cellular physiology
- 3 Mechanical and cellular defence mechanisms in oesophagus
- 3 Oesophageal mucosal injury and modulation
- 3 Effects of acid pepsin and biliary reflux

Anatomy

- 3 The oesophagus and its anatomical relationships from cricopharyngeus to cardia including details of blood supply and lymphatic drainage.
- 3 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.
- 3 Anatomy of the colon, including its blood supply and its anatomical relationships
- 3 Pathology
- 3 Inflammation and wound healing.
- 3 Oesophageal injury response and variations in response.
- 3 The aetiology and epidemiology of oesophageal cancer
- 3 Metaplasia-dysplasia sequence.

Pharmacology

- 3 Adjuvant and neoadjuvant chemotherapy.

Microbiology

- 3 The role of Helicobacter Pylori in gastritis and gastroesophageal reflux disorder.
- 3 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

- 4 Diagnosis, investigation and treatment of oesophageal disorders.
- 4 Radiology, endoscopy and oesophageal function tests.
- 4 Risk assessment and stratification.
- 4 Diagnostic tests, including contrast oesophageal imaging, CT Scanning, abdominal ultrasonography, endoscopic ultrasonography and PET scanning.
- 4 Treatment options and outcomes of treatment
- 4 Oesophageal resection
- 4 Palliative procedures
- 4 Other therapies including radiotherapy, laser, stent and photodynamic therapy
- 4 Screening and prevention.

HISTORY AND EXAMINATION

- 4 General and specific history and examination including previous surgery, drug history, and identification of comorbidity and risk assessment.

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 3 Interpretation of Chest radiograph, contrast swallow and CT Scan
- 4 Cardio-pulmonary assessment including exercise tests.

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

PATIENT MANAGEMENT

- 3 Management of post thoracotomy or laparotomy surgical patient.
- 3 Management of complications of surgery
- 4 Blood transfusion and blood products
- 3 Wound infection and wound disruption
- 2 Diagnosis and management of oesophageal perforation or anastomotic leak.

OPERATIVE MANAGEMENT

- 2 Oesophago-gastro-duodenoscopy
- 2 Assessment by thoracoscopy laparoscopy and mediastinoscopy
- 2 Rigid oesophagoscopy and bronchoscopy
- 2 Oesophageal dilatation and stent placement
- 2 Mobilisation of oesophagus, stomach and colon
- 1 Oesophageal resection
- 1 Oesophageal reconstruction including interposition techniques

Final Stage (HST 5 & 6)

The final phase of training will consist of an indicative period of two years. These two years may be spent overseas either in one centre or in multiple centres according to the training required. By the end of this phase trainees will have been successful in the intercollegiate examination. Trainees will have developed sufficient experience and competence in the generality of cardiothoracic surgery to be eligible for the award of a CCT. They may be provided with the opportunity to develop an area of special interest during this period through the selection of appropriate modules. The choice of overseas placement will include this area of special interest and agreed by the trainee and the requirements of the department.

The list of specialist index conditions is detailed below. This list defines the requirements for the award of a CCT and in cardiothoracic surgery. All trainees (including those who are developing additional special interests and those who are taking academic pathway) will be required to meet these standards.

- The management of critically ill cardiothoracic surgical patients in the pre and post operative periods.
- The management of a patient undergoing cardiopulmonary bypass
- The management of myocardial protection during cardiac surgery

- The management of a patient requiring circulatory support
- The assessment and management of patients with coronary heart disease, including elective and emergency presentations. To include competence in both primary and secondary procedures, and where appropriate to include off pump and on pump strategies and arterial revascularisation
- The preliminary assessment and initial management of patients with complications of myocardial infarction, including mitral regurgitation, aneurysm and septal defects. To include operative management in appropriate situations. Full competence in operative management of complex cases to be developed in the post CCT period
- The assessment and management of patients with valvular heart disease; including both isolated and combined aortic and mitral valve disease.
- The assessment and management of patients with combined coronary and valvular heart disease, including operative management. Full competence in operative management of complex cases including mitral valve repair and secondary procedures to be developed in the post CCT period.
- The preliminary assessment and initial management of patients with acute dissection of the ascending aorta. To include operative management in appropriate situations. Full competence in operative management of complex cases to be developed in the post CCT period
- The assessment and management of patients with minor and major cardiothoracic trauma. To include operative management in appropriate situations. Full competence in the operative management of complex cases including great vessel injury to be developed in the post CCT period
- Patient selection and determination of suitability for major thoracic surgery and the pre and postoperative management of a thoracic surgical patient.
- The assessment and management of a patient by bronchoscopy including foreign body retrieval
- The assessment and management of a patient by mediastinal exploration
- Competence in performing appropriate thoracic incisions
- The assessment and management of lung cancer, including the scientific basis of staging systems and techniques used in the determination of stage and fitness for surgery
- An understanding of the role of surgical treatment in the multidisciplinary management of lung cancer and other intrathoracic malignant diseases, including an appreciation of the principles of other treatment modalities and their outcomes
- The assessment and management of patients with pleural disease; including pneumothorax and empyema, and including both VATS and open strategies
- The assessment and management of patients with chest wall abnormalities, infections and tumours
- The assessment and management of patients' disorders of the diaphragm, including trauma to the diaphragm
- The assessment and management of patients with emphysematous and bullous lung disease; including surgical management if appropriate and utilising both VATS and open strategies. Full competence in operative management of complex cases, including lung reduction surgery, to be developed in the post CCT period.

- The assessment and management of patients with disorders of the pericardium and pericardial cavity; including surgical management if appropriate and utilising both VATS and open strategies
- The assessment and management of patients with mediastinal tumours and masses; including surgical management if appropriate and utilising both VATS and open strategies
- The assessment and management of patients with disorders of the major airways. Including operative management in suitable cases. Full competence in operative management of complex cases, including tracheal resection, to be developed in the post CCT period.

The Modules for the final years are as follows:

- Critical Care and Postoperative Management
- Cardiopulmonary Bypass
- Myocardial Protection
- Circulatory Support
- Ischaemic Heart Disease
- Heart Valve Disease
- Aortovascular Disease
- Cardiothoracic Trauma
- General Management of a Patient Undergoing Thoracic Surgery
- Neoplasms of the Lung
- Disorders of the Pleura
- Disorders of the Chest Wall
- Disorders of the Diaphragm
- Emphysema and Bullae
- Disorders of the Pericardium
- Disorders of the Mediastinum
- Disorders of the Airway
- Congenital Heart Disease
- Intrathoracic transplantation and surgery for heart failure
- Management of Benign Oesophageal Disorders
- Management of Oesophageal Neoplasia

Module: Critical Care and Post-operative Management

Objective

To be able to manage a post surgical patient on the critical care, high dependency and post operative wards. To work as part of a multi-professional, multidisciplinary team in the management of a patient requiring complex critical care

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Haemodynamics: physiology and measurement
- 4 Cardiac arrhythmia
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma and surgery
- 4 GIT, renal and hepatic physiology
- 4 Nutrition
- 4 Temperature regulation

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Mediastinum, thoracic inlet and neck
- 4 Tracheobronchial tree and lungs
- 4 Chest wall and diaphragm

Pathology

- 4 Inflammation and wound healing
- 4 Myocardial infarction and complications
- 4 Endocarditis
- 4 Pericarditis
- 4 Systemic Inflammatory Response Syndrome
- 4 Bronchopulmonary infection
- 4 ARDS

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs

Clinical Skills

- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Antimicrobial treatment and policies

CLINICAL KNOWLEDGE

- 4 Cardiopulmonary resuscitation
- 4 Management of cardiac surgical patient
- 4 Management of thoracic surgical patient
- 4 Treatment of cardiac arrhythmia

- 4 Management of complications of surgery
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption
- 4 Neuropsychological consequences of surgery and critical care

HISTORY AND EXAMINATION

- 4 History and examination of the post-operative and critically ill patient

DATA INTERPRETATION

- 4 Analysis and interpretation of post operative and critical care charts and documentation
- 4 Routine haematology and biochemical investigations
- 4 Chest radiograph and ECG
- 3 Echocardiography including TOE

PATIENT MANAGEMENT

- General management of surgical patient
- 4 Management of fluid balance and circulating volume
- 4 Pain control
- 4 Wound management
- 4 Management of surgical drains
- 4 Antimicrobial policy and prescribing
- 4 Management of post-operative haemorrhage
- 4 Cardiopulmonary resuscitation (ALS)
- 4 Management of complications of surgery
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Recognition, evaluation and treatment of haemodynamic abnormalities

- 4 Evaluation and interpretation of haemodynamic data
- 4 Practical use of inotropes and vasoactive drugs
- 4 Use of intra aortic balloon pump

Recognition, evaluation and treatment of cardiac arrhythmias

- 4 Interpretation of ECG
- 4 Use of anti-arrhythmic drugs
- 4 Use of defibrillator
- 4 Understanding and use of cardiac pacing

Recognition, evaluation and treatment of ventilatory abnormalities

TECHNICAL SKILLS AND PROCEDURES

- 4 Interpretation of blood gas results
- 4 Airway management
- 3 Understanding of ventilatory techniques and methods
- 3 Understanding of anaesthetic drugs and methods

Recognition, evaluation and treatment of multi-organ dysfunction

- 3 Renal dysfunction and support

3 GIT dysfunction, feeding and nutrition
3 Recognition and evaluation of cerebral and neuropsychological problems

PRACTICAL SKILLS

4 Arterial cannulation
4 Central venous cannulation
4 Pulmonary artery catheterisation
4 Intra aortic balloon pump insertion
4 Intra aortic balloon pump timing and management
4 Tracheostomy
4 Fibreoptic bronchoscopy
4 Chest aspiration
4 Chest drain insertion
4 Chest drain management

OPERATIVE MANAGEMENT

4 Surgical re-exploration for bleeding or tamponade

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Cardiopulmonary Bypass

Objective

To manage the clinical and technical aspects of cardiopulmonary bypass, myocardial protection and circulatory support.

Knowledge

BASIC KNOWLEDGE

Physiology

4 Haemodynamics: physiology and measurement
4 Cardiac arrhythmias
4 Haemostasis, thrombosis and bleeding
4 Acid base balance
4 Pulmonary physiology, ventilation and gas exchange
4 Metabolic response to trauma and surgery
4 GIT, renal and hepatic physiology
4 Temperature regulation

Anatomy

4 Heart, pericardium and great vessels
4 Mediastinum, thoracic inlet and neck
4 Chest wall and diaphragm
4 Femoral triangle and peripheral vascular system

Pathology

4 Inflammation and wound healing

- 4 Systemic Inflammatory Response Syndrome
- 4 ARDS

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Antimicrobial treatment and policies

SPECIFIC KNOWLEDGE

- 4 Principles and practice of CPB
- 4 Relevant equipment and technology and its application
- 4 Monitoring during CPB
- 4 Inflammatory and pathophysiological response to bypass
- 4 Pulsatile and non pulsatile flow
- 4 Effect of CPB on pharmacokinetics
- 4 Priming fluids and haemodilution
- 4 Acid base balance – pH and alpha stat
- 4 Neuropsychological consequences of CPB
- 4 Cell salvage and blood conservation

Clinical Skills

N/A

OPERATIVE MANAGEMENT

- 4 Median sternotomy open and close
- 4 Cannulation and institution of cardiopulmonary bypass Technical Skills and Procedures
- 4 Safe conduct of CPB – problem solving and troubleshooting
- 4 Weaning from bypass and decannulation
- 4 Femoral cannulation and decannulation
- 4 Repeat sternotomy, with pericardial dissection, cardiac mobilisation and cannulation

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-category: Myocardial Protection

Objective

To manage the clinical and technical aspects of cardiopulmonary bypass, myocardial protection and circulatory support.

Knowledge

BASIC KNOWLEDGE

- 4 Myocardial cellular physiology
- 4 Myocardial function and dysfunction
- 4 Haemodynamics and arrhythmias
- 4 Coronary arterial and venous anatomy

Clinical Skills

N/A

SPECIFIC KNOWLEDGE

- 4 Scientific foundations of myocardial preservation
- 4 Principles and practice of myocardial preservation
- 4 Cardioplegia solutions and delivery modes.
- 4 Non-cardioplegic techniques of preservation

PATIENT MANAGEMENT

- 4 Myocardial management throughout the peri-operative period
- 4 Ability to adapt preservation technique to clinical situation

OPERATIVE MANAGEMENT

TECHNICAL SKILLS AND PROCEDURES

- 4 Relevant cannulation techniques and appropriate delivery of cardioplegia

Module: Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support

Sub-Category: Circulatory Support

Objective

To manage the clinical and technical aspects of cardiopulmonary bypass, myocardial protection and circulatory support.

Knowledge

BASIC KNOWLEDGE

- 4 Haemodynamics: physiology and measurement
- 4 Cardiac arrhythmias
- 4 Haemostasis, thrombosis and bleeding
- 4 Anatomy of the femoral triangle and peripheral vascular system

Clinical Skills

- 4 Inotropes, vasodilators and vasoconstrictors
- 4 Anti-arrhythmic drugs

- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs

SPECIFIC KNOWLEDGE

- 4 Mechanical circulatory support in the pre-operative, peri-operative and post-operative periods
- 4 Intra aortic balloon pump – indications for use, patient selection and complications
- 4 Physiology of the balloon pump
- 4 Understanding of relevant equipment and technology
- 4 Ventricular assist devices – indications for use, patient selection and complications

PATIENT MANAGEMENT

- 4 Patient selection for mechanical circulatory support
- 4 Insertion and positioning of the intra aortic balloon pump
- 4 Management of the balloon pump including timing and trouble shooting
- 4 Care of the patient with intra aortic balloon pump, including recognition and management of complications

TECHNICAL SKILLS AND PROCEDURES

N/A

Module: **Ischaemic Heart Disease**

Objective

To evaluate and manage all the surgical aspects of a patient with ischaemic heart disease including the complications of ischaemic heart disease.

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Myocardial cellular physiology
- 4 Haemodynamics; physiology and measurement
- 4 Electrophysiology, including conduction disorders

Knowledge

- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma
- 4 Vascular biology and reactivity

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Coronary anatomy and variants

- 4 Coronary angiography
- 4 Anatomy of the peripheral vascular system and vascular conduits
- Pathology
- 4 Inflammation and wound healing
- 4 Atheroma, medial necrosis and arteritis
- 4 Intimal hyperplasia and graft atherosclerosis
- 4 Myocardial infarction and complications
- 4 Systemic Inflammatory Response Syndrome

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis

CLINICAL KNOWLEDGE

General

- 4 Diagnosis, investigation and treatment of heart disease
- 4 Risk assessment and stratification
- 4 Cardiopulmonary resuscitation
- 4 Cardiac arrhythmias
- 4 Complications of surgery
- 4 Renal dysfunction

Clinical Skills

- 4 Multiorgan failure
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Specific

- 4 Diagnosis investigation and assessment of IHD
- 4 Operative treatment - Off pump and on pump surgery
- 4 Results of surgery - survival, graft patency, recurrence
- 4 Arterial revascularisation
- 4 Redo coronary artery surgery
- 4 Role of PCI and non operative treatment
- 4 Management of cardiovascular risk factors
- 4 Complications of myocardial infarction and ischaemic heart disease VSD, mitral regurgitation, aneurysm.

HISTORY AND EXAMINATION

4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

4 Routine haematology and biochemical investigations

4 Interpretation of haemodynamic data

4 Chest radiograph

4 ECG including exercise ECG

4 Coronary Angiography

4 Cardiac Catheterisation data

4 Echocardiography including 2D, Doppler and TOE and stress echo

4 Nuclear cardiology

PATIENT MANAGEMENT

4 Cardiopulmonary resuscitation

4 Diagnosis and treatment of cardiac arrhythmias

4 Management of post cardiac surgical patient

4 Management of complications of surgery

4 Cardiac rehabilitation

TECHNICAL SKILLS AND PROCEDURES

4 Blood transfusion and blood products

4 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

4 Isolated, first time coronary artery surgery (May include both off pump and on pump options and arterial revascularisation strategies)

4 Repeat coronary artery surgery

3 Complications of ischaemic heart disease including post infarction VSD, mitral regurgitation and left ventricular aneurysm

Module: **Heart Valve Disease**

Objective

To evaluate and manage a patient with both uncomplicated and complicated heart valve disease, including operative management.

Knowledge

BASIC KNOWLEDGE

Physiology

4 Cardiovascular physiology including valve physiology and haemodynamics

4 Electrophysiology, including conduction disorders

4 Haemostasis, thrombosis and bleeding

- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma

Anatomy

- 4 Cardiac chambers and valves, pericardium and great vessels
- 4 Anatomy of the conduction system

Pathology

- 4 Pathophysiology of valve incompetence and stenosis.
- 4 Consequences of valve disease on cardiac function and morphology
- 4 Pathophysiology of mixed valve disease and combined valve pathology (eg aortic and mitral)
- 4 Combined valvular and ischaemic heart disease
- 4 Atrial fibrillation and other arrhythmias

Pharmacology

- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardio respiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis
- 4 Endocarditis and prosthetic valve endocarditis

CLINICAL KNOWLEDGE

General knowledge

- 4 Cardiopulmonary resuscitation
- 4 Care of the cardiac surgical patient
- 4 Complications of surgery
- 4 Risk assessment and stratification
- 4 Management of cardiovascular risk factors

Specific Knowledge

- 4 Diagnosis investigation and assessment of valvular heart disease
- 4 Timing of surgical intervention in valve disease
- 4 Options for operative management including: Valve replacement/repair (mechanical, biological stented and stentless grafts, homografts and autografts)
- 4 Valve design: materials, configuration and biomechanics.
- 4 Results of surgery – survival, valve thrombosis, endocarditis, bleeding.
- 4 Interpretation of survival and follow up data
- 4 Cardiac performance and long term functional status

- 4 Surgery for conduction problems
- 4 Surgical treatment of arrhythmias

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including drug history, identification of co morbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG interpretation including exercise ECG
- 4 Coronary angiography
- 4 Cardiac catheterisation data including left and right heart data
- 4 Echocardiography (thoracic and transoesophageal) including 2D, Doppler and stress echo
- 4 Nuclear cardiology

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption
- 4 Non operative management of endocarditis
- 4 Valve selection
- 4 Anticoagulation management including complications.

OPERATIVE MANAGEMENT

- 4 Isolated, uncomplicated aortic valve replacement (stented biological or mechanical)
- 4 Isolated uncomplicated mitral valve replacement
- 4 Tricuspid valve surgery
- 4 Combined valve and graft surgery
- 4 Surgical strategies for managing the small aortic root
- 4 Aortic root surgery including stentless valves, and root replacement
- 4 Redo Valve surgery
- 4 Valve surgery for endocarditis
- 4 Techniques for surgical ablation of arrhythmias
- 3 Mitral valve repair
- 3 Alternative surgical approaches to valve surgery including thoracotomy, trans-septal approaches, and minimal access surgery

Module: Aortovascular Disease

Objective

To evaluate and manage uncomplicated surgical aspects of a patient with aortovascular disease, including operative management where appropriate and up to the defined competence. This level of competence is that required of a consultant cardiothoracic surgeon and is defined in the list of key conditions. It is expected that full competence in all aspects of aortovascular surgery would only be obtained in the post CCT period by those with a sub specialty interest

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Vascular biology and reactivity
- 4 Haemodynamics; physiology and measurement
- 4 Rheology and arterial pressure regulation
- 4 Haemostasis, thrombosis and bleeding
- 4 Physiology of transfusion therapy
- 4 Principles of surgical infectious disease
- 4 Acid base balance
- 4 Metabolic response to trauma
- 4 Pathophysiology and of hypothermia including the effects upon haemoglobin, metabolic rate and pH with their management

Anatomy

- 4 Heart, pericardium and great vessels
- 4 Anatomy of the peripheral vascular system
- 4 Blood supply of the spinal cord

Pathology

- 4 Inflammation and wound healing
- 4 Atheroma, medial necrosis and arthritis
- 4 Inherited disorders of vascular biology
- 4 Systemic Inflammatory Response Syndrome
- 4 Pharmacology
- 4 Drugs used in the treatment of hypertension, heart failure and angina
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Anti-emetics
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in cardiorespiratory infection

- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis

CLINICAL KNOWLEDGE

General

- 4 Risk assessment
- 4 Cardiopulmonary resuscitation
- 4 Cardiac arrhythmias
- 4 Complications of surgery
- 4 Renal dysfunction
- 4 Multiorgan failure
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

Specific

- 4 Natural history of aortic disease
- 4 Diagnosis, investigation and assessment of aortic disease
- 4 Knowledge of operative treatment including spinal cord and cerebral preservation strategies • Type A dissection • Type B dissection • Traumatic aortic rupture • Thoraco-abdominal aneurysm
- 4 Results of surgery – survival, complication rates

Clinical Skills

- 4 Non-surgical management including the role of endovascular stenting
- 4 Management of cardiovascular and non-cardiovascular risk factors

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including assessment of pre-operative complications, drug history, identification of co-morbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG including exercise ECG
- 4 Coronary Angiography
- 4 Aortography
- 4 Cardiac Catheterisation data
- 4 Echocardiography including 2D, Doppler and TOE and stress echo
- 4 CT scanning
- 4 MRI scanning

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery

- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Intraoperative monitoring
- 4 Spinal cord protection
- 4 Preparation for and management of cardiopulmonary bypass, including alternative, non-bypass strategies for descending aortic surgery
- 4 Hypothermic strategies including HCA, RCP and SACP
- 4 Femoral cannulation
- 3 Surgery for acute dissection of the ascending aorta
- 3 Aortic root replacement for chronic aortic root disease
- 2 Complex aortic surgery including arch surgery, descending aortic and thoraco-abdominal aortic surgery

Module: **Cardiothoracic Trauma**

Objective

To evaluate and manage, including surgical management where appropriate, and as part of a multidisciplinary team, a patient with thoracic trauma. Competence in operative management of thoracic trauma is required of all CCT holders in cardiothoracic surgery. All trainees should maintain their ATLS certification and senior trainees are encouraged to become ATLS instructors.

Knowledge

BASIC KNOWLEDGE

- 4 Anatomy of the lungs, heart, chest wall, diaphragm and oesophagus
- 4 Anatomy of the larynx, trachea and bronchial tree
- 4 Physiology of breathing and its control
- 4 Physiology of the heart and circulation

GENERAL TRAUMA MANAGEMENT

- 4 Principles of trauma management (as defined by ATLS)
- 4 Principles of emergency resuscitation following cardiac arrest

SPECIFIC KNOWLEDGE

- 4 The mechanism and patterns of injury associated with blunt, penetrating and deceleration injuries to the chest
- 4 The post-ATLS, definitive care of blunt, penetrating and deceleration injuries to the chest.
- 4 The indications and use of appropriate investigations in thoracic trauma management
- 4 Pain relief in chest trauma, including epidural anaesthesia.
- 4 Indications for immediate, urgent and delayed thoracotomy in trauma

Clinical Skills

GENERAL TRAUMA MANAGEMENT (ATLS)

- 4 Assessment and management of airway, breathing and circulation
- 4 Maintenance of an adequate airway and respiratory support
- 4 Protection of the cervical spine
- 4 Circulatory resuscitation

TECHNICAL SKILLS AND PROCEDURES

- 4 Establishment of appropriate monitoring
- 4 Assessment and management of pain and anxiety

CARDIOTHORACIC TRAUMA MANAGEMENT

- 4 Examination and assessment of the of the chest, including respiratory cardiovascular and circulatory systems
- 4 Recognition and management of immediately life threatening situations: obstructed airway, tension pneumothorax, massive haemothorax, open chest wound, flail chest and cardiac tamponade
- 4 Recognition and management of potentially life threatening situations: lung contusion, bronchial rupture, blunt cardiac injury, intrathoracic bleeding, oesophageal injury, simple pneumothorax and major vascular injury
- 4 Recognition of potentially life threatening penetrating injuries to the chest and abdomen
- 4 Interpretation of chest x-ray, ECG, arterial blood gases and echocardiography
- 4 Detection and treatment of cardiac arrhythmias
- 4 Management of the widened mediastinum including appropriate investigations and multidisciplinary consultation

PRACTICAL SKILLS

- 4 Establish an emergency airway (surgical and non-surgical)
- 4 Insertion and management of thoracic drains
- 4 Establish adequate venous access and monitoring.
- 4 Pericardiocentesis and subxiphoid pericardial window for tamponade

OPERATIVE MANAGEMENT OF THORACIC TRAUMA

- 4 Subxiphoid pericardial window for tamponade
- 4 Postero-lateral, thoracotomy, antero lateral thoracotomy and thoraco-laparotomy
- 4 Bilateral Anterior Thoracotomy
- 4 Median sternotomy and closure
- 4 Repair of cardiac injuries
- 4 Repair of pulmonary and bronchial injuries
- 4 Management of the complications of chest trauma including retained haemothorax and empyema
- 3 Repair of oesophageal injuries
- 3 Repair of aortic transection

Module: **General Management of a Patient Undergoing Thoracic Surgery**

Objective

To be fully competent in the evaluation and management of a patient undergoing thoracic surgery. The knowledge and clinical skills are common to all thoracic surgical conditions, and should be read in conjunction with the curriculum for specific surgical conditions.

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Metabolic response to trauma
- 4 Digestive, renal and hepatic physiology
- 4 Nutrition

Anatomy

- 4 Tracheobronchial tree and lungs
- 4 Thoracic inlet, neck and mediastinum
- 4 Oesophagus and upper GI tract
- 4 Chest wall and diaphragm

Pathology

- 4 Inflammation and wound healing
- 4 Bronchopulmonary infections
- 4 ARDS
- 4 Emphysema
- 4 Pulmonary fibrosis
- 4 Pulmonary manifestations of systemic disease
- 4 Systemic manifestations of pulmonary disease
- 4 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 4 Oesophagitis, columnar-lined oesophagus stricture
- 4 Oesophageal motility disorders
- 4 Malignant and benign tumours of the oesophagus and stomach
- 4 Malignant and benign tumours of the pleura and chest wall, mediastinum and thyroid

Pharmacology

- 4 Bronchodilators

Clinical Skills

- 4 H2 antagonists and proton pump inhibitors

- 4 Haemostatic drugs
- 4 Analgesics
- 4 Antibiotics
- 4 Anaesthetic agents, local and general

Microbiology

- 4 Organisms involved in respiratory infection including TB
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis
- 4 Management of intra pleural sepsis

CLINICAL KNOWLEDGE

Thoracic Incisions

- 4 Types of incisions and appropriate use, including lateral, anterior, muscle sparing and video-assisted approaches.

Sternotomy

- 4 Difficult access and improving exposure.
- 4 Early and late complications of thoracic incisions
- 4 Analgesia including pharmacology, effectiveness, side effects and use in combination regimens
- 4 Post-operative analgesia, including epidural, PCAS and paravertebral catheter techniques.

Bronchoscopy

- 4 The role of rigid and flexible bronchoscopy in the investigation of airway and pulmonary disease.
- 4 The anaesthetic, airway and ventilatory management during rigid and flexible bronchoscopy

Mediastinal exploration

- 4 Endoscopic, radiological and surgical approaches used to evaluate and diagnose mediastinal disease of benign, infective, primary and malignant aetiology.
- 4 Equipment for mediastinal exploration
- 4 Relevant imaging techniques, and influence on surgical approach.

HISTORY AND EXAMINATION

- 4 System specific and general history and examination, including drug history, identification of comorbidity and functional status.

TECHNICAL SKILLS AND PROCEDURES

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Chest radiograph and ECG
- 4 CT, including contrast enhanced CT
- 4 Interpretation of imaging of the mediastinum.

- 4 MRI and PET
- 4 Respiratory function tests
- 4 Ventilation/perfusion scan
- 4 Blood gases
- 4 Oesophageal function tests and contrast studies

PATIENT MANAGEMENT

General

- 4 Cardiopulmonary resuscitation
- 4 Risk assessment, stratification and management
- 4 Management of patients making an uncomplicated or complicated recovery from thoracic operations.
- 4 Post-operative management of pain control, respiratory failure, sputum retention, haemodynamic instability and low urine output.
- 4 Treatment of cardiac arrhythmias
- 4 Pain control
- 4 Wound infection and disruption
- 4 Blood transfusion and blood products
- 4 Physiotherapy and rehabilitation
- 3 Palliative care

PRACTICAL SKILLS

- 4 Arterial cannulation
- 4 Central venous cannulation
- 4 Pulmonary artery catheterisation
- 4 Tracheostomy
- 4 Fibreoptic bronchoscopy
- 4 Chest aspiration
- 4 Chest drain insertion
- 4 Chest drain management

OPERATIVE MANAGEMENT

Thoracic Incisions

- 4 Correct positioning of patient for thoracic surgery
- 4 Perform and repair thoracic incisions, including lateral, anterior, muscle sparing and VATS incisions.
- 4 Difficult access and improving exposure
- 4 Perform and close sternotomy incision

Bronchoscopy

- 4 Diagnostic bronchoscopy including biopsy - rigid and flexible.
- 4 Equipment, instrumentation and preparation
- 4 Perform rigid and flexible bronchoscopy
- 4 Airway and ventilatory management
- 4 Recognise normal and abnormal anatomy.
- 4 Identify common pathologies and the surgical relevance of the findings.
- 4 Take appropriate specimens for bacteriology, cytology and histology.
- 4 Management of moderate bleeding and other common complications.
- 4 To appropriately supervise the care of patients recovering from bronchoscopy.

- 4 Post-operative bronchoscopy: indications and procedure
- 4 Tracheostomy and mini-tracheostomy
- 3 Bronchoscopy in situations where there is unfavourable anatomy or complex pathology and to deal with complications.

Mediastinal Exploration

- 4 Assembly of relevant equipment for mediastinal exploration
- 4 Surgical evaluation of the mediastinum using cervical, anterior and VATS approaches.
- 4 Mediastinal biopsy

Module: **Neoplasms of the Lung**

Objective

To fully assess and manage a patient with a neoplasm of the lung, including operative management where appropriate and including complicated situations. Appreciation of the multidisciplinary, multimodality approach to the management of the condition.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery - general

SPECIFIC KNOWLEDGE

- 4 Benign and malignant tumours of trachea, bronchus and lung parenchyma
- 4 Epidemiology, presentation, diagnosis, staging (pre-operative, intraoperative and pathological) and treatment of lung cancer and lung metastases.
- 4 Neoadjuvant and adjuvant treatment of lung cancer
- 4 Results of treating thoracic malignancy by surgery, medical or oncological techniques, including multimodality management.
- 4 Survival, recurrence rates and relapse patterns after surgical treatment and the investigation and management of relapse.
- 4 Knowledge of palliative care techniques.
- 4 Treatment of post-operative complications of pulmonary resection such as empyema and broncho-pleural fistula.
- 4 Role of repeat surgery in recurrent and second primary malignancies of the lung.
- 4 Medical and surgical options to deal with recurrent or problematic complications of pulmonary resection.

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery - general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Interpretation of endoscopic findings.

4 Patient selection with assessment of function and risk.

OPERATIVE MANAGEMENT

4 Bronchoscopic assessment including biopsy

4 Endoscopic and surgical techniques of lung biopsy.

4 Mediastinal assessment and biopsy

3 Endoscopic management of tumours using laser and stenting

TECHNICAL SKILLS AND PROCEDURES

4 Intraoperative diagnosis and staging

4 Surgery for benign and malignant conditions of the lungs, including uncomplicated lobectomy for lung cancer, wedge resection and metastasectomy.

4 Segmentectomy and lobectomy for benign and malignant disease.

4 Redo operations for repeat resections of lung metastases.

3 Advanced resections for lung cancer, including sleeve lobectomy, pneumonectomy and extended resections involving chest wall and diaphragm.

3 Repeat resections for benign and malignant conditions of the lung, including completion pneumonectomy

3 Management of post-operative complications such as empyema and broncho-pleural fistula.

Module: **Disorders of the Pleura**

Objective

To fully evaluate and manage surgical conditions of the pleura and the pleural space, including complicated situations.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

4 Anatomy and physiology of the pleura

4 Inflammatory, infective and malignant disease of the visceral and parietal pleura.

4 Pneumothorax

4 Pleural effusion

4 Empyema

Clinical Skills

4 Mesothelioma

4 Haemothorax

4 Chylothorax

4 Conditions of adjacent organs that affect the pleura

4 Medical and surgical management of pleural disease, including radiological, open and VATS techniques.

4 Techniques to deal with failures of primary treatment.

4 Advanced techniques for pleural space obliteration such as thoracoplasty and soft-tissue transfer

PATIENT MANAGEMENT

As for thoracic surgery – general

4 Interpretation of imaging of the pleura

4 Chest drains: insertion, management, removal and treatment of complications.

4 Management of patients making uncomplicated and complicated recovery from pleural interventions.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

4 Open procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy

4 VATS procedures for uncomplicated pleural problems e.g. pneumothorax, effusion, haemothorax including drainage, biopsy, pleurodesis and pleurectomy

4 Open and VATS procedures for empyema, including techniques for decortication.

3 Open and VATS procedures in complex cases.

3 Advanced techniques of pleural space obliteration, with appropriate specialist assistance.

Module: **Disorders of the Chest Wall**

Objective

To assess and manage a patient with abnormality or disease affecting the chest wall, including surgical management where appropriate, and including complex cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

4 Anatomy of the chest wall

4 Congenital, inflammatory, infective and neoplastic conditions that can affect the components of the chest wall.

4 Clinical, laboratory and imaging techniques used in the evaluation of chest wall pathology.

4 Techniques used in the diagnosis of chest wall disease, including aspiration and core biopsy, and incision and excision biopsy.

4 Pectus deformities: aetiology, physiological and psychological consequences. Surgical options for correction.

4 Techniques used to resect the sternum and chest wall, physiological and cosmetic sequelae.

4 Prosthetic materials used in chest wall surgery

- 4 The role of repeat surgery to deal with recurrent conditions and the complications of previous surgery.
- 4 Techniques of complex chest wall reconstruction involving thoracoplasty or soft-tissue reconstruction

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Patient selection with assessment of function and risk.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Chest wall biopsy and choice of appropriate technique.
- 4 Needle biopsy by aspiration or core techniques and the siting of open surgical biopsy.
- 4 Open and excision biopsy and resection of the chest wall for benign and malignant conditions.
- 4 Chest wall resection in combination with resection of the underlying lung.
- 4 Selection and insertion of prosthetic materials, and selection of cases in which such materials are required
- 4 Pectus correction, by both open and minimally-invasive techniques, including post-operative care and complications
- 4 Surgery for the complications of chest wall resection, and repeat surgery to resect recurrent chest wall conditions.
- 3 Complex chest wall reconstruction with thoracoplasty and, with appropriate specialist support, soft tissue reconstruction.

Module: **Disorders of the Diaphragm**

Objective

To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate, and including complicated cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy and physiology of the diaphragm.
- 4 Pathology of the diaphragm.
- 4 Clinical, physiological and imaging techniques in the assessment of diaphragmatic abnormalities.

- 4 Physiological consequences of diaphragmatic herniation or paresis.
- 4 Surgical techniques used to biopsy and resect diaphragmatic tumours.
- 4 Situations in which replacement of the diaphragm is required, the materials used and their value and limitations.
- 4 Complications of diaphragmatic resection and their management.
- 4 Techniques used to electrically pace the diaphragm, and the conditions in which such treatment is appropriate.

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery – general

Specific Skills

TECHNICAL SKILLS AND PROCEDURES

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Patient selection with assessment of function and risk.
- 4 Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.

OPERATIVE MANAGEMENT

- 4 Resection of the diaphragm, and adjacent structures, including appropriate selection and insertion of prosthetic materials
- 4 Complications of diaphragmatic resection.
- 4 Phrenic nerve pacing.

Module: **Emphysema and Bullae**

Objective

To fully assess and manage a patient with emphysema and bullae, including surgical management where appropriate, and including complicated cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Aetiology, pathology and physiology of chronic obstructive airways disease (COPD)
- 4 Epidemiology and public health issues
- 4 Smoking cessation measures.
- 4 Clinical, laboratory, physiological and imaging techniques.
- 4 Medical and surgical management of COPD and its complications
- 4 Selection criteria and pre-operative preparation

- 4 Surgical techniques used in the treatment of emphysema and bullae and the results of surgical treatment including relevant clinical trials.
- 4 Lung volume reduction surgery: techniques, complications and management of complications.
- 4 Experimental and developmental techniques in lung volume reduction surgery

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.

Clinical Skills

- 4 Patient selection with assessment of function and risk.
- 4 Post-operative management of patients making an uncomplicated recovery from surgery for emphysema or the complications of such diseases.
- 4 Management of patients following lung volume reduction surgery.

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Procedures to deal with secondary pneumothorax and bullae by open techniques.
- 4 Procedures to deal with secondary pneumothorax and bullae by VATS techniques.
- 3 Lung volume reduction surgery, unilaterally and bilaterally, using open and VATS techniques.

Module: **Disorders of the Pericardium**

Objective

To fully assess and manage a patient with disease of the pericardium or pericardial space, including surgical management where appropriate, and including complicated cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy of the pericardium.
- 4 Pathology of the pericardium.
- 4 Pathophysiological consequences of pericardial constriction and tamponade.
- 4 Clinical, echocardiographic and imaging techniques used to detect pericardial disease and assess its consequences.
- 4 Techniques for pericardial drainage using guided needle aspiration
- 4 Surgical drainage by sub-xiphoid, thoracotomy or VATS approaches.
- 4 Surgical techniques for pericardiectomy.

- 4 Materials used for pericardial replacement, their value and limitations and the situations in which used.
- 4 Post-operative complications following resection of the pericardium and its prosthetic replacement.

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination

Clinical Skills

- 4 Interpretation of laboratory, physiological and imaging techniques, including echocardiography.
- 4 Recognition and assessment of pericardial tamponade and constriction.

TECHNICAL SKILLS AND PROCEDURES

- 4 Techniques for pericardial drainage using guided needle aspiration
- 4 Recognition of pericardial herniation and cardiac strangulation.
- 4 Patient selection with assessment of function and risk.
- 4 Management of patients making an uncomplicated or complicated recovery from pericardial surgery.

OPERATIVE MANAGEMENT

- 4 Uncomplicated pericardial fenestration procedures
- 4 Pericardial fenestration in complex cases.
- 4 Pericardiectomy for relief of constriction
- 4 Resection of the pericardium and replacement, in appropriate situations, with prosthetic materials.
- 4 Competence in dealing with the complications of pericardial resection and replacement.

Module: **Disorders of the Mediastinum**

Objective

To fully assess and manage a patient with benign and malignant disease of the mediastinum, including surgical management where appropriate, and including complicated cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy of the mediastinum
- 4 Congenital, benign, infective and malignant (primary and secondary) conditions of the mediastinum.
- 4 Systemic conditions associated with the mediastinum.

- 4 Clinical, laboratory, electromyographic and imaging techniques used in the diagnosis and assessment of patients with mediastinal disease
- 4 Myasthenia gravis: medical, surgical and peri-operative management
- 4 Staging of thymoma and grading of myasthenia
- 4 Benign and malignant conditions, which do not require surgical biopsy or resection.
- 4 Oncological treatment of malignant diseases of the mediastinum, including multidisciplinary care.
- 4 Surgical techniques for the treatment of myasthenia gravis, mediastinal cysts and tumours, complications and results.
- 4 Retrosternal goitre and its management

Clinical Skills

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Patient selection with assessment of function and risk.
- 4 Post-operative management of patients including recognition and management of post-operative complications .

TECHNICAL SKILLS AND PROCEDURES

OPERATIVE MANAGEMENT

- 4 Selection of appropriate routes for biopsy and excision of mediastinal tumours and cysts.
- 4 Biopsy of mediastinal masses.
- 4 Excision of the thymus for myasthenia gravis.
- 4 Resection of mediastinal cysts and tumours masses.
- 4 Resection of mediastinal cysts and tumours, including extended resections involving adjacent structures.

Module: **Disorders of the Airway**

Objective

To assess and manage a patient with disease of the major airways, including surgical management where appropriate, and including complicated cases.

Knowledge

GENERAL KNOWLEDGE

As for thoracic surgery – general

SPECIFIC KNOWLEDGE

- 4 Anatomy of the larynx, trachea and bronchus.
- 4 Physiology of the normal airway.
- 4 Pathophysiology of disease and its effects on lung function.

- 4 Endoscopic appearances in health and disease.
- 4 Congenital, inflammatory, infective, benign and neoplastic diseases of the airways.
- 4 Symptoms, signs of airway disease.
- 4 Clinical, physiological and imaging tests undertaken to diagnose and assess airway disease.
- 4 Techniques for surgical resection of the trachea.
- 4 Bronchoplastic procedures and the limitations of these techniques.
- 4 Medical and oncological treatments available to deal with airway diseases.
- 4 Endoscopic techniques used to deal with benign and malignant conditions, including disobliteration and stenting.
- 4 Presentation, investigation and management of anastomotic complications following airway surgery.
- 4 Presentation, evaluation and treatment of fistulae in the aerodigestive tract, due to benign, malignant and iatrogenic causes.
- 4 Role of open and endoscopic procedures in dealing with problems.

PATIENT MANAGEMENT

As for thoracic surgery – general

- 4 Clinical history and examination
- 4 Interpretation of laboratory, physiological and imaging techniques.
- 4 Recognition, diagnosis and assessment of airway obstruction.

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

- 4 Patient selection with assessment of function and risk.
- 4 Post-operative care of patients making an uncomplicated recovery from major airway surgery.
- 4 Post-operative care of patients making a complicated recovery from airway surgery.

OPERATIVE MANAGEMENT

- 4 Endoscopic assessment of a patient with airways disease
- 4 Sleeve resection of the trachea for simple benign conditions, including appropriate anastomotic techniques.
- 4 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastomotic techniques.
- 4 Techniques for the relief of major airways obstruction including stenting.
- 3 Airway resection for tumours and complex benign conditions, and techniques for airway reconstruction, anastomosis and laryngeal release.
- 3 Repeat resections for recurrence and the complications of prior resection.
- 3 Management of fistulae in the aerodigestive tract by surgical and endoscopic techniques.

Module: **Congenital Heart Disease**

Objective

This module is aimed at the trainee who has completed training in the generality of cardiothoracic surgery and wishes to specialise in congenital heart disease. Following completion of this module the trainee will be fully competent in the clinical and operative management of uncomplicated congenital heart disease. It is expected that subsequent professional development in the post CCT period will provide competence in all aspects of congenital heart disease, including complex problems.

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Relevant general physiology of childhood
- 4 Foetal circulation and circulatory changes at birth
- 4 Haemodynamics; physiology and measurement including shunt calculations
- 4 Physiology of pulmonary vasculature
- 4 Myocardial cellular physiology in immature myocardium
- 4 Electrophysiology, including conduction disorders
- 4 Haemostasis, thrombosis and bleeding
- 4 Acid base balance
- 4 Pulmonary physiology, ventilation and gas exchange
- 4 Metabolic response to trauma
- 4 Vascular biology and reactivity
- 4 Physiology of Cardiopulmonary Bypass including low flow and circulatory arrest.
- 4 Ph and alpha stat CPB management

Anatomy

- 4 Embryology of the heart
- 4 Anatomy of the heart, pericardium and great vessels
- 4 Pulmonary anatomy
- 4 Coronary anatomy and variants
- 4 Anatomy of the peripheral vascular system and vascular conduits including aortopulmonary shunts
- 4 Sequential cardiac analysis and terminology of cardiac malformations

Pathology

- 4 Inflammation and wound healing
- 4 Systemic Inflammatory Response Syndrome
- 4 Effect of growth and pregnancy

Pharmacology

- 4 Drugs used in the treatment of congenital heart disease
- 4 Inotropes
- 4 Anti-arrhythmic drugs
- 4 Haemostatic drugs
- 4 Antiplatelet, anticoagulant and thrombolytic drugs
- 4 Analgesics

- 4 Antibiotics
- 4 Anaesthetic agents, local and general
- 4 Hypotensive agents (systemic and pulmonary).

Microbiology

- 4 Organisms involved in cardiorespiratory infection
- 4 Organisms involved in wound infection
- 4 Antibiotic usage and prophylaxis
- 4 Antisepsis

CLINICAL KNOWLEDGE

General

- 4 Diagnosis, investigation and treatment of congenital heart disease
- 4 Results of surgery - common complications and management.
- 4 Late complications of surgery for congenital heart disease
- 4 Role of interventional cardiology.
- 4 Role of mechanical assist (IABP, VAD and ECMO)
- 4 Indications for referral for transplantation
- 4 Risk assessment and stratification
- 4 Cardiopulmonary resuscitation
- 4 Cardiac arrhythmias
- 4 Renal dysfunction
- 4 Multiorgan failure
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products
- 4 Wound infection and sternal disruption
- 4 Types of cardiac prosthesis and indications for use

Specific Knowledge

The anatomy, pathophysiology natural history and management of the following conditions or procedures

Clinical Skills

- 4 Patent ductus arteriosus
- 4 Aortopulmonary window
- 4 Atrial septal defect
- 4 Ventricular septal defect
- 4 Coarctation
- 4 PA banding
- 4 Aortopulmonary and venous shunts
- 4 Transposition of the great arteries - switch procedure
- 3 Congenitally corrected TGA
- 4 Single ventricle/univentricular heart
- 4 Tetralogy of Fallot/Pulmonary atresia plus VSD
- 4 Pulmonary atresia and intact septum
- 4 Hypoplastic left heart and Norwood procedure
- 4 Truncus arteriosus
- 4 Double outlet right ventricle
- 4 Pulmonary atresia plus VSD and MAPCAs

- 4 Partial and complete atrioventricular septal defects
- 4 Anomalies of the pulmonary venous drainage (partial and total)
- 4 Anomalies of systemic venous drainage
- 4 Congenital aortic valve disease (including supra-valve stenosis)
- 4 LV outflow tract obstruction
- 4 Sinus of valsalva aneurysm
- 4 Congenital mitral valve disease
- 4 Congenital tricuspid valve disease (including Ebsteins abnormality)
- 4 Anomalies of the coronary arteries (including ALCAPA)
- 4 Vascular rings
- 3 Cardiac tumours
- 4 Pericardial disease
- 4 Extra cardiac conduits
- 4 Interrupted aortic arch
- 4 Extra Corporeal Membrane Oxygenation and VAD
- 4 Transplantation for congenital heart disease

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination of child or adult with congenital heart disease

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Chest radiograph and ECG
- 3 Cardiac catheterisation data including interpretation of haemodynamic data, shunt and resistance calculations
- 3 Echocardiography in congenital heart disease, including 2D, Doppler and TOE

PATIENT MANAGEMENT

- 4 Principles of paediatric intensive care
- 4 Management of adults and children following congenital heart surgery
- 4 Management of complications of surgery
- 4 Cardiopulmonary resuscitation
- 4 Diagnosis and treatment of cardiac arrhythmias
- 4 Blood transfusion and blood products

TECHNICAL SKILLS AND PROCEDURES

- 4 Wound infection and sternal disruption

OPERATIVE MANAGEMENT

- 4 Sternotomy - open and close, including resternotomy
- 4 Thoracotomy - open and close
- 4 Preparation for and management of cardiopulmonary bypass including partial bypass
- 4 Approaches for ECMO, cannulation and management.

Surgical management of the following common uncomplicated conditions:

- 4 Patent ductus arteriosus
- 4 Atrial septal defect

- 4 Ventricular septal defect
- 4 Coarctation
- 3 Aortopulmonary window
- 4 Vascular ring
- 4 Aortopulmonary and venous shunts
- 4 PA banding

Surgical management of the following conditions requiring advanced procedures:

- 3 Partial atrioventricular septal defect
- 2 Aortic and mitral valve surgery including Ross procedure
- 3 Open aortic valvotomy
- 3 Open pulmonary valvotomy
- 2 Tricuspid valve surgery including Ebsteins
- 2 Tetralogy of Fallot/Pulmonary atresia plus VSD
- 2 Fontan procedures
- 2 Extra cardiac conduits and their replacement
- 2 Complete atrioventricular septal defect

Surgical management of the following conditions requiring complex procedures:

- 1 Interrupted aortic arch
- 1 Total anomalous pulmonary venous drainage
- 1 Transposition of the great arteries (switch procedure)
- 1 Rastelli procedure 1 Norwood procedure
- 1 Truncus arteriosus repair
- 1 Double outlet right ventricle
- 1 Pulmonary atresia plus VSD and MAPCAs

Module: Intrathoracic transplantation and surgery for heart failure

Objective

To be able to evaluate and manage patients with heart failure, including operative management where appropriate. This module is intended to be completed by the trainee who has developed a specific interest in this sub-specialty, with a view to becoming a specialist transplant/heart failure surgeon.

Knowledge

BASIC KNOWLEDGE

Pathophysiology

- 4 Haemodynamics of heart failure.
- 4 Molecular mechanisms underlying heart failure.

Clinical Skills

- 4 Mechanisms and outcomes of respiratory failure.
- 4 Causes of cardiac failure.
- 4 Causes of respiratory failure.

Immunology

- 4 Major and minor histocompatibility antigen systems.
- 4 Mechanisms of immune activation and pathological consequences for transplanted organs.

Pharmacology

- 4 Modes of action of commonly used drugs in heart failure:

CLINICAL KNOWLEDGE

- 4 Resynchronisation therapy: techniques and indications
- 4 Indications for, contraindications to and assessment for heart transplantation.
- 4 Indications for, contraindications to and assessment for lung and heart/lung transplantation.
- 4 Indications for ECMO
- 4 Indications for VAD
- 4 Criteria for brain stem death, management of the brain-dead donor, criteria for matching donor and recipient.
- 4 Management of patients after intrathoracic organ transplantation, including complications
- 4 Results of heart transplantation, lung transplantation and non-transplant interventions for heart failure.
- 3 Resynchronisation therapy: techniques and indications

HISTORY AND EXAMINATION

- 4 Cardiovascular system and general history and examination including conduit, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of haemodynamic data
- 4 Chest radiograph
- 4 ECG including exercise ECG
- 4 Coronary angiography
- 4 Cardiac catheterisation data
- 4 Echocardiography including 2D, Doppler and TOE and stress echo
- 3 MR assessment of ventricular function and viability

TECHNICAL SKILLS AND PROCEDURES

- 2 Nuclear cardiology

PATIENT MANAGEMENT

- 4 Cardiopulmonary resuscitation
- 4 Management of brain-dead donor
- 4 Management of post cardiac surgical patient
- 4 Management of complications of surgery
- 4 Cardiac rehabilitation
- 4 Blood transfusion and blood products

- 4 Wound infection and sternal disruption
- 3 Diagnosis and treatment of cardiac arrhythmias

OPERATIVE MANAGEMENT

Transplantation

- 4 Trans venous myocardial biopsy
- 4 Donor Retrieval
- 4 Ex-vivo donor organ management
- 4 Implantation of heart
- 3 Implantation of lung
- 3 Implantation of heart/lung block

Surgery for heart failure

- 4 Surgical revascularisation for ischaemic cardiomyopathy
- 4 Ventricular reverse remodelling surgery
- 4 Mitral valve repair for cardiac failure
- 4 Cannulation for ECMO
- 4 Implantation of epicardial electrodes for resynchronisation therapy
- 3 Implantation of extracorporeal VAD
- 3 Implantation of intracorporeal VAD

Module: **Management of Benign Oesophageal Disorders**

Objective

To evaluate and manage all the surgical aspects of benign oesophageal disorders including the complications of benign oesophageal disorders. This module is intended to be completed by trainees with a sub-specialty interest in oesophageal surgery

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Gastric and oesophageal cellular physiology
- 4 Mechanical and cellular defence mechanisms in oesophagus
- 4 Oesophageal mucosal injury and modulation
- 4 Effects of acid pepsin and biliary reflux
- 4 Oesophago-gastric physiology and assessment including pH monitoring
- 4 Oesophageal motility measurement in achalasia, diffuse spasm and non-specific motility syndromes

Anatomy

- 4 Embryology of the foregut.
- 4 The oesophagus and its anatomical relationships from cricopharyngeus to cardia, including details of blood supply and lymphatic drainage.
- 4 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.

4 Anatomy of the colon, including its anatomical relationships, blood supply and lymphatic drainage.

Pathology

4 Inflammation and wound healing.

4 Oesophageal injury response and variations in response.

4 The inflammation, metaplasia, dysplasia cancer sequence.

4 Neurological deficits / aetiology of oesophageal dysmotility disorders.

4 Para-oesophageal hernias

Pharmacology

4 Drugs used in the treatment of gastro-oesophageal reflux disorder and oesophageal dysmotility.

Microbiology

4 The role of Helicobacter Pylori in gastritis and gastroesophageal reflux disorder.

4 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

4 Diagnosis, investigation and treatment of benign oesophageal disorders.

4 Radiology, endoscopy, 24 hour pH monitoring and oesophageal function tests.

4 Risk assessment and stratification.

4 Open, laparoscopic and thoracoscopic surgery of the oesophagus.

4 Relative merits of conservative and operative treatment.

Clinical Skills

4 Alternative management of achalasia including dilatation and Botox injection. 4

The indications for surgery in paraoesophageal hernia.

4 Endoscopic dilatation techniques

HISTORY AND EXAMINATION

4 General and specific history and examination including previous surgery, drug history, identification of comorbidity and risk assessment

DATA INTERPRETATION

4 Routine haematology and biochemical investigation

4 Interpretation of oesophageal motility and pH monitoring data

4 Chest radiograph and contrast imaging

4 Cardio-pulmonary assessment including exercise tests

PATIENT MANAGEMENT

4 Management of post thoracotomy or laparotomy surgical patient

4 Management of complications of surgery

4 Diagnosis and management of oesophageal perforation or anastomotic leak.

4 Blood transfusion and blood products

4 Wound infection and wound disruption

OPERATIVE MANAGEMENT

- 4 Oesophago-gastro-duodenoscopy.
- 4 Rigid oesophagoscopy
- 4 Oesophageal dilatation

TECHNICAL SKILLS AND PROCEDURES

- 4 Open and laparoscopic fundoplication and cardiomyotomy
- 4 Mobilisation of oesophagus, stomach and colon
- 4 Oesophageal anastomosis

Module: Management of Oesophageal Neoplasia

Objective

To evaluate and manage all the aspects of a patient with oesophageal neoplasia, including operative intervention where appropriate. This module is intended to be completed by trainees with a sub-specialty interest in oesophageal surgery

Knowledge

BASIC KNOWLEDGE

Physiology

- 4 Gastric and oesophageal cellular physiology
- 4 Mechanical and cellular defence mechanisms in oesophagus
- 4 Oesophageal mucosal injury and modulation
- 4 Effects of acid pepsin and biliary reflux

Anatomy

- 4 The oesophagus and its anatomical relationships from cricopharyngeus to cardia including details of blood supply and lymphatic drainage.
- 4 Anatomy of the stomach, including its anatomical relationships, blood supply and lymphatic drainage.
- 4 Anatomy of the colon, including its blood supply and its anatomical relationships

Pathology

- 4 Inflammation and wound healing.
- 4 Oesophageal injury response and variations in response.
- 4 The aetiology and epidemiology of oesophageal cancer
- 4 Metaplasia-dysplasia sequence.

Pharmacology

- 4 Adjuvant and neoadjuvant chemotherapy.

Microbiology

- 4 The role of Helicobacter Pylori in gastritis and gastrooesophageal reflux disorder.
- 4 The rationale of bacterial eradication treatment

CLINICAL KNOWLEDGE

- 4 Diagnosis, investigation and treatment of oesophageal disorders.
- 4 Radiology, endoscopy and oesophageal function tests.
- 4 Risk assessment and stratification.
- 4 Diagnostic tests, including contrast oesophageal imaging, CT Scanning, abdominal ultrasonography, endoscopic ultrasonography and PET scanning.
- 4 Treatment options and outcomes of treatment
- 4 Oesophageal resection
- 4 Palliative procedures
- 4 Other therapies including radiotherapy, laser, stent and photodynamic therapy
- 4 Screening and prevention.

HISTORY AND EXAMINATION

- 4 General and specific history and examination including previous surgery, drug history, and identification of comorbidity and risk assessment.

DATA INTERPRETATION

- 4 Routine haematology and biochemical investigations
- 4 Interpretation of Chest radiograph, contrast swallow and CT Scan
- 4 Cardio-pulmonary assessment including exercise tests.

Clinical Skills

TECHNICAL SKILLS AND PROCEDURES

PATIENT MANAGEMENT

- 4 Management of post thoracotomy or laparotomy surgical patient.
- 4 Management of complications of surgery
- 4 Blood transfusion and blood products
- 4 Wound infection and wound disruption
- 4 Diagnosis and management of oesophageal perforation or anastomotic leak.

OPERATIVE MANAGEMENT

- 4 Oesophago-gastro-duodenoscopy
- 4 Assessment by thoracoscopy laparoscopy and mediastinoscopy
- 4 Rigid oesophagoscopy and bronchoscopy
- 4 Oesophageal dilatation and stent placement
- 4 Mobilisation of oesophagus, stomach and colon
- 4 Oesophageal resection
- 4 Oesophageal reconstruction including interposition techniques