The Intercollegiate Surgical Curriculum

Educating the surgeons of the future

Cardiothoracic Surgery Syllabus

2010

ISCP INTERCOLLEGIATE SURGICAL CURRICULUM PROGRAMME

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Overview and objectives of the Cardiothoracic Surgery Curriculum

Cardiothoracic Surgery is the speciality 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 Society for Cardiothoracic Surgery in Great Britain and Ireland represents the professional interests of the speciality and has a web site (www.scts.org) where further information can be obtained. Further information about cardiothoracic surgery, including training-related material, can be found on the excellent CTSnet site http://www.ctsnet.org/.

Tim Graham - SAC Chair
Steve Livesey - SAC Content Editor

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 the UK.

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 framework of Good Medical Practice of the General Medical Council of the UK, respectively.

The Training Pathway in the Specialty of Cardiothoracic Surgery

Entry into cardiothoracic surgery is currently extremely competitive, and there is projected to be a shortage of consultant posts for future trainees. New ways of working in cardiothoracic surgery are currently being explored and debated.

The standards and the delivery of training are overseen by the Specialist Advisory Committee (SAC) in Cardiothoracic Surgery. The SAC has a consultant member nominated by the trainees (the Cardiothoracic Dean) who is responsible for direct contact with trainees and who is available to deal with problems or questions trainees may have.

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 competences 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 behaviour and leadership skills: 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 to be seen 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 I and II, and final** phases.

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.

Special Interest Training

Some trainees may wish to develop a particular special interest in the latter stages of their training and to develop expertise and competence in these areas, beyond those normally expected at CCT.

These areas of special interest for cardiothoracic surgery are described in the syllabus. It is recognised that to develop these competencies may require an extension of the training period, and in some cases full competence will only be achieved by mentoring during the post CCT period.

Congenital Heart Disease

The assessment and management of adults and children with congenital heart disease to include:

- Competence in the operative management of common uncomplicated congenital conditions (e.g. PDA, atrial and ventricular septal defects, coarctation, shunts and PA banding)
- Exposure to and experience in more complex operative procedures (e.g. valve surgery, Tetralogy of Fallot, pulmonary atresia, Fontan procedures, extra cardiac conduits, AV canal defects.)
- Full competence in operative management of more complex cases, including secondary procedures to be developed in the post CCT period.

Surgery for Heart Failure and Intrathoracic Transplantation

- The assessment and management of a patient with heart failure including the selection criteria for various treatment options
- Operative management of heart failure including transplantation, revascularisation, ventricular reverse remodelling and mitral valve surgery
- Full competence in the operative management of more complex cases, including secondary procedures to be developed in the post CCT period

Disorders of the Oesophagus

- The assessment and management of a patient with benign and malignant oesophageal disease including reflux disorders
- Operative management of benign and malignant oesophageal disease in suitable situations
- Full competence in operative management of more complex cases to be developed in the post CCT period.

Academic Surgery

Academic surgery provides an exciting and challenging career for those who wish to combine clinical surgery with a major commitment to research and undergraduate teaching.

- Trainees interested in this career pathway will, in addition to completing clinical training in general cardiothoracic surgery acquire a high level of competency in research.
- Previously, the majority of trainees in cardiothoracic surgery completed a higher degree before embarking on formal training in the specialty – whilst this may no longer be the norm, those considering an academic career should consider applying principally to those units where there is a Chair in Cardiothoracic Surgery.

The Scope and Standards of Cardiothoracic Surgical Practice at CCT

The areas of practice in cardiothoracic surgery are:

- Critical Care and Postoperative Management
- Cardiopulmonary Bypass, Myocardial Protection and Circulatory Support
- Ischaemic Heart Disease
- Heart Valve Disease
- Aorto-vascular Disease
- Intrathoracic Transplantation and Surgery for Heart Failure
- Congenital Heart Disease
- Cardiothoracic Trauma
- Thoracic Surgery – General
- 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
- Benign Oesophageal Disease
- Malignant Oesophageal Disease

The specific requirements of each of these areas of practice are explained in depth in each topic within the syllabus.

The Configuration and Delivery of Cardiothoracic Surgical Services

Cardiothoracic surgery tends to be concentrated into large regional or teaching hospitals, where there is easy access to all medical and support facilities. There will usually be somewhere between 5 and 10 consultant surgeons in each unit, each surgeon performing approximately 200 major operations each year.

Entry into cardiothoracic surgery is currently extremely competitive and is currently by a process of national selection at ST3. The national selection currently occurs once per year.There was a moratorium on new trainees entering the specialty but this was lifted in 2006 as the requirement for future specialists in cardiothoracic surgery became clear.

Future Trends in Cardiothoracic Surgery

There are many influences on the type of work undertaken by cardiothoracic surgeons.

In cardiac surgery the predominant disease that we deal with is coronary artery disease. Although many more patients are now treated by percutaneous intervention than by cardiac surgery, the increasing age of the population has maintained the requirement for many patients to have surgical revascularisation – often for increasingly complex disease.

Changing demographics and downward pressure on waiting times are also increasing the demand for surgery for valvular heart disease.

In thoracic surgery there is some evidence that too few resections for lung cancer are being performed in the UK when compared to similar countries; this, combined with an increasing trend for the management of all patients suffering from lung cancer to be discussed at multi-disciplinary meetings, is increasing the need for surgeons who specialise in thoracic surgery.

Key Topics

1. **Critical Care and Postoperative Management**

    - The management of critically ill cardiothoracic surgical patients in the pre and post operative periods

2. **Cardiopulmonary Bypass, Myocardial Protection and Circulatory Support**

    - The management of a patient undergoing cardiopulmonary bypass
    - The management of myocardial protection during cardiac surgery
    - The management of a patient requiring circulatory support

3. **Ischaemic Heart Disease**

    - 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, ventricular 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

4. **Heart Valve Disease**

    - 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.

5. **Aortovascular Disease**

    - 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

6. **Cardiothoracic Trauma**

    - 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

7. **General Management of a Patient Undergoing Thoracic Surgery**

    - 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

8. **Neoplasms of the Lung**

    - 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

9. **Disorders of the Pleura**

    - The assessment and management of patients with pleural disease; including pneumothorax and empyema, and including both VATS and open strategies

10. **Disorders of the Chest Wall**

    - The assessment and management of patients with chest wall abnormalities, infections and tumours

11. **Disorders of the Diaphragm**

    - The assessment and management of patients disorders of the diaphragm, including trauma to the diaphragm

12. **Emphysema and Bullae**

    - 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

13. **Disorders of the Pericardium**

    - 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

14. **Disorders of the Mediastinum**

    - The assessment and management of patients with mediastinal tumours and masses; including surgical management if appropriate and utilising both VATS and open strategies

15. **Disorders of the Airway**

    - 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

Initial Stage Overview

The purpose of the initial stage (early years) (CT1 - 3) is to allow the trainee to develop the basic and fundamental surgical skills common to all surgical specialties, together with a few surgical skills relevant to Cardiothoracic Surgery.

The outcome of early years training is to achieve the competences required of surgeons entering ST3. These competences include:

- Competence in the management of patients presenting with a range of symptoms and elective and emergency conditions as specified in the core syllabus for surgery.
- Competence in the management of patients presenting with an additional range of elective and emergency conditions, as specified by the Cardiothoracic Surgery specialty component of the early years syllabus.
- Professional competences as specified in the syllabus and derived from Good Medical Practice documents of General Medical Council of the UK

By the end of CT2/3, trainees, including those following an academic pathway, will have acquired to the defined level:

- Generic skills to allow team working, and management of cardiothoracic patients
- perform as a member of the team caring for surgical patients
- receive patients as emergencies and review patients in clinics and initiate management and diagnostic processes based on a reasonable differential diagnosis
- manage the perioperative care of their patients and recognise common complications and either be able to deal with them or know to whom to refer
- be safe and useful assistant in the operating room
- perform some simple procedures under minimal supervision and perform more complex procedures under direct supervision

In addition they will have attained the knowledge, skills and behaviour as defined in the following (common) modules of the syllabus:

Module 1: Basic Science Knowledge relevant to surgical practice (These can all be contextualised within the list of presenting symptoms and conditions outlined in module 2)

- Anatomy
- Physiology
- Pharmacology - in particular safe prescribing
- Pathological principles underlying system specific pathology
- Microbiology
- Diagnostic and interventional radiology

Module 2: Common surgical conditions

- To assess and initiate investigation and management of common surgical conditions which may confront any patient whilst under the care of surgeons, irrespective of their speciality.
- To have sufficient understanding of these conditions so as to know what and to whom to refer in a way that an insightful discussion may take place with colleagues whom will be involved in the definitive management of these conditions.
- This defines the scope and depth of the topics in the generality of clinical surgery required of any surgeon irrespective of their ST3 defined speciality

Module 3 Basic surgical skills

- To prepare oneself for surgery
- To safely administer appropriate local anaesthetic agents
- To handle surgical instruments safely
- To handle tissues safely
- To incise and close superficial tissues accurately

- To tie secure knots
- To safely use surgical diathermy
- To achieve haemostasis of superficial vessels.
- To use a suitable surgical drain appropriately.
- To assist helpfully, even when the operation is not familiar.
- To understand the principles of anastomosis
- To understand the principles of endoscopy

Module 4: The principles of assessment and management of the surgical patient

- To assess the surgical patient
- To elicit a history that is relevant, concise, accurate and appropriate to the patient's problem
- To produce timely, complete and legible clinical records.
- To assess the patient adequately prior to operation and manage any pre-operative problems appropriately.
- To propose and initiate surgical or non-surgical management as appropriate.
- To take informed consent for straightforward cases.

Module 5: Peri-operative care of the surgical patient

- To manage patient care in the peri-operative period.
- To assess and manage preoperative risk.
- To take part in the conduct of safe surgery in the operating theatre environment.
- To assess and manage bleeding including the use of blood products.
- To care for the patient in the post-operative period including the assessment of common complications.
- To assess, plan and manage post-operative fluid balance
- To assess and plan perioperative nutritional management.

Module 6: Assessment and early treatment of the patient with trauma

- To safely assess the multiply injured patient.
- To safely assess and initiate management of patients with
- traumatic skin and soft tissue injury
- chest trauma
- a head injury
- a spinal cord injury
- abdominal and urogenital trauma
- vascular trauma
- a single or multiple fractures or dislocations
- burns

Module 7: Surgical care of the paediatric patient

- To assess and manage children with surgical problems, understanding the similarities and differences from adult surgical patients.
- To understand common issues of child protection and to take action as appropriate.

Module 8: Management of the dying patient

- To manage the dying patient appropriately.
- To understand consent and ethical issues in patients certified DNAR (do not attempt resuscitation)
- To manage the dying patient in consultation with the palliative care team.

Module 9: Organ and tissue transplantation

- To understand the principles of organ and tissue transplantation.
- To assess brain stem death and understand its relevance to continued life support and organ donation.

Module 10: Professional behaviour and leadership skills

- To provide good clinical care
- To be a good communicator
- To teach and to train
- To keep up to date and know how to analyse data
- To understand and manage people and resources within the health environment
- To promote good Health

- To understand the ethical and legal obligations of a surgeon

In addition they will have attained the knowledge, skills and behaviour as defined in the following (cardiothoracic specific) modules of the syllabus:

1. Management of a post surgical patient on the critical care, high dependency and post operative wards. To be able to manage, with appropriate supervision, such a patient.

2. Management of a cardiac surgical patient including operative management as appropriate and with supervision

3. Evaluation and management of a patient undergoing thoracic surgery including operative management with supervision where appropriate

4. To understand the science, technology and practical applications of cardiopulmonary bypass, myocardial protection and circulatory support.

Initial Stage Topics

Module 1	**Basic sciences**
Objective	• To acquire and demonstrate underpinning basic science knowledge appropriate for the practice of surgery, including:- • Applied anatomy: Knowledge of anatomy appropriate for surgery • Physiology: Knowledge of physiology relevant to surgical practice • Pharmacology: Knowledge of pharmacology relevant to surgical practice centred around safe prescribing of common drugs • Pathology: Knowledge of pathological principles underlying system specific pathology • Microbiology: Knowledge of microbiology relevant to surgical practice Imaging: • Knowledge of the principles, strengths and weaknesses of various diagnostic and interventional imaging methods
Knowledge	Applied anatomy: • Development and embryology • Gross and microscopic anatomy of the organs and other structures • Surface anatomy • Imaging anatomy This will include anatomy of thorax, abdomen, pelvis, perineum, limbs, spine, head and neck as appropriate for surgical operations that the trainee will be involved with during core training (see Module 2). Physiology: General physiological principles including: • Homeostasis • Thermoregulation • Metabolic pathways and abnormalities • Blood loss and hypovolaemic shock • Sepsis and septic shock • Fluid balance and fluid replacement therapy • Acid base balance • Bleeding and coagulation • Nutrition This will include the physiology of specific organ systems relevant to surgical care including the cardiovascular, respiratory, gastrointestinal, urinary, endocrine and neurological systems. Pharmacology: • The pharmacology and safe prescribing of drugs used in the treatment of surgical diseases including analgesics, antibiotics, cardiovascular drugs, antiepileptic, anticoagulants, respiratory drugs, renal drugs, drugs used for the management of endocrine disorders (including diabetes) and local anaesthetics. • The principles of general anaesthesia • The principles of drugs used in the treatment of common malignancies Pathology: General pathological principles including: • Inflammation • Wound healing • Cellular injury • Tissue death including necrosis and apoptosis • Vascular disorders • Disorders of growth, differentiation and morphogenesis • Surgical immunology • Surgical haematology

	• Surgical biochemistry • Pathology of neoplasia • Classification of tumours • Tumour development and growth including metastasis • Principles of staging and grading of cancers • Principles of cancer therapy including surgery, radiotherapy, chemotherapy, immunotherapy and hormone therapy • Principles of cancer registration • Principles of cancer screening • The pathology of specific organ systems relevant to surgical care including cardiovascular pathology, respiratory pathology, gastrointestinal pathology, genitourinary disease, breast, exocrine and endocrine pathology, central and peripheral, neurological systems, skin, lymphoreticular and musculoskeletal systems Microbiology: • Surgically important micro organisms including blood borne viruses • Soft tissue infections including cellulitis, abscesses, necrotising fasciitis, gangrene • Sources of infection • Sepsis and septic shock • Asepsis and antisepsis • Principles of disinfection and sterilisation • Antibiotics including prophylaxis and resistance • Principles of high risk patient management • Hospital acquired infections Imaging: • Principles of diagnostic and interventional imaging including x-rays, ultrasound, CT, MRI. PET, radiounucleotide scanning

Module 2	**Common Surgical Conditions**	
Objective	This section assumes that trainees have general medical competences consistent with a doctor leaving Foundation in the UK. It also assumes an ongoing commitment to keeping these skills and knowledge up to date as laid out in GMP. It is predicated on the value that surgeons are doctors who carry our surgery and require competence. To demonstrate understanding of the relevant basic scientific principles for each of these surgical conditions and to be able to provide the relevant clinical care as defined in modules assessment and management as defined in Modules 1 and 4.	
Topics	Presenting symptoms or syndromes • Abdominal pain • Abdominal swelling • Change in bowel habit • Gastrointestinal haemorrhage • Rectal bleeding • Dysphagia • Dyspepsia • Jaundice	To include the following conditions • Appendicitis • Gastrointestinal malignancy • Inflammatory bowel disease • Diverticular disease • Intestinal obstruction • Adhesions • Abdominal hernias • Peritonitis • Intestinal perforation • Benign oesophageal disease • Peptic ulcer disease • Benign and malignant hepatic, gall bladder and pancreatic disease • Haemorrhoids and perianal disease • Abdominal wall stomata
	Breast disease • Breast lumps and nipple discharge • Acute Breast pain	To include the following conditions • Benign and malignant breast lumps • Mastitis and breast abscess
	Peripheral vascular disease Presenting symptoms or syndrome • Chronic and acute limb ischaemia • Aneurismal disease • Transient ischaemic attacks • Varicose veins • Leg ulceration	To include the following conditions • Atherosclerotic arterial disease • Embolic and thrombotic arterial disease • Venous insufficiency • Diabetic ulceration
	Cardiovascular and pulmonary disease	To include the following conditions • Coronary heart disease • Bronchial carcinoma • Obstructive airways disease • Space occupying lesions of the chest
	Genitourinary disease Presenting symptoms or syndrome • Loin pain • Haematuria • Lower urinary tract symptoms • Urinary retention • Renal failure • Scrotal swellings • Testicular pain	To include the following conditions • Genitourinary malignancy • Urinary calculus disease • Urinary tract infection • Benign prostatic hyperplasia • Obstructive uropathy
	Trauma and orthopaedics Presenting symptoms or syndrome • Traumatic limb and joint pain and deformity • Chronic limb and joint pain and	To include the following conditions • Simple fractures and joint dislocations • Fractures around the hip and ankle • Basic principles of Degenerative joint disease

	deformity • Back pain	• Basic principles of inflammatory joint disease including bone and joint infection • Compartment syndrome • Spinal nerve root entrapment and spinal cord compression • Metastatic bone cancer • Common peripheral neuropathies and nerve injuries
	Disease of the Skin, Head and Neck Presenting symptoms or syndrome • Lumps in the neck • Epistaxis • Upper airway obstructions	To include the following conditions • Benign and malignant skin lesions • Benign and malignant lesions of the mouth and tongue
	Neurology and Neurosurgery Presenting symptoms or syndrome • Headache • Facial pain • Coma	To include the following conditions • Space occupying lesions from bleeding and tumour
	Endocrine Presenting symptoms or syndrome • Lumps in the neck • Acute endocrine crises	To include the following conditions • Thyroid and parathyroid disease • Adrenal gland disease • Diabetes

Module 3	**Basic surgical skills**
Objective	• Preparation of the surgeon for surgery • Safe administration of appropriate local anaesthetic agents • Acquisition of basic surgical skills in instrument and tissue handling. • Understanding of the formation and healing of surgical wounds • Incise superficial tissues accurately with suitable instruments. • Close superficial tissues accurately. • Tie secure knots. • Safely use surgical diathermy • Achieve haemostasis of superficial vessels. • Use suitable methods of retraction. • Knowledge of when to use a drain and which to choose. • Handle tissues gently with appropriate instruments. • Assist helpfully, even when the operation is not familiar. • Understand the principles of anastomosis • Understand the principles of endoscopy

Knowledge	Principles of safe surgery • Preparation of the surgeon for surgery • Principles of hand washing, scrubbing and gowning • Immunisation protocols for surgeons and patients Administration of local anaesthesia • Choice of anaesthetic agent • Safe practise Surgical wounds • Classification of surgical wounds • Principles of wound management • Pathophysiology of wound healing • Scars and contractures • Incision of skin and subcutaneous tissue: o Langer's lines o Choice of instrument o Safe practice • Closure of skin and subcutaneous tissue: o Options for closure o Suture and needle choice • Safe practice • Knot tying o Range and choice of material for suture and ligation o Safe application of knots for surgical sutures and ligatures • Haemostasis: o Surgical techniques o Principles of diathermy • Tissue handling and retraction: o Choice of instruments • Biopsy techniques including fine needle aspiration cytology • Use of drains: o Indications o Types o Management/removal • Principles of anastomosis • Principles of surgical endoscopy
Clinical Skills	4 Preparation of the surgeon for surgery • Effective and safe hand washing, gloving and gowning • Administration of local anaesthesia • Accurate and safe administration of local anaesthetic agent 4 Preparation of a patient for surgery • Creation of a sterile field • Antisepsis • Draping
Technical Skills and Procedures	4 Preparation of the surgeon for surgery • Effective and safe hand washing, gloving and gowning 4 Administration of local anaesthesia • Accurate and safe administration of local anaesthetic agent 4 Incision of skin and subcutaneous tissue: • Ability to use scalpel, diathermy and scissors 4 Closure of skin and subcutaneous tissue: • Accurate and tension free apposition of wound edges 4 Knot tying:

	• Single handed • Double handed • Instrument • Superficial • Deep 3 Haemostasis: • Control of bleeding vessel (superficial) • Diathermy • Suture ligation • Tie ligation • Clip application • Transfixion suture 4 Tissue retraction: • Tissue forceps • Placement of wound retractors 3 Use of drains: • Insertion • Fixation • Removal 3 Tissue handling: • Appropriate application of instruments and respect for tissues • Biopsy techniques 4 Skill as assistant: • Anticipation of needs of surgeon when assisting

Module 4	**The assessment and management of the surgical patient**
Objective	To demonstrate the relevant knowledge, skills and attitudes in assessing the patient and manage the patient, and propose surgical or non-surgical management.
Knowledge	The knowledge relevant to this section will be variable from patient to patient and is covered within the rest of the syllabus – see common surgical conditions in particular (Module 2). As a trainee develops an interest in a particular speciality then the principles of history taking and examination may be increasingly applied in that context.
Clinical Skills	4 Surgical history and examination (elective and emergency) 3 Construct a differential diagnosis 3 Plan investigations 3 Clinical decision making 3 Team working and planning 3 Case work up and evaluation; risk management 3 Active participation in clinical audit events 3 Appropriate prescribing 3 Taking consent for intermediate level intervention; emergency and elective 3 Written clinical communication skills 3 Interactive clinical communication skills: patients 3 Interactive clinical communication skills: colleagues

Module 5	**Peri-operative care**
Objective	To assess and manage preoperative risk To manage patient care in the peri-operative period To conduct safe surgery in the operating theatre environment To assess and manage bleeding including the use of blood products To care for the patient in the post-operative period including the assessment of common complications To assess, plan and manage post-operative fluid balance To assess and plan perioperative nutritional management
Knowledge	Pre-operative assessment and management: • Cardiorespiratory physiology • Diabetes mellitus and other relevant endocrine disorders • Fluid balance and homeostasis • Renal failure • Pathophysiology of sepsis – prevention and prophylaxis • Thromboprophylaxis • Laboratory testing and imaging • Risk factors for surgery and scoring systems • Pre-medication and other preoperative prescribing • Principles of day surgery Intraoperative care: • Safety in theatre including patient positioning and avoidance of nerve injuries • Sharps safety • Diathermy, laser use • Infection risks • Radiation use and risks • Tourniquet use including indications, effects and complications • Principles of local, regional and general anaesthesia • Principles of invasive and non-invasive monitoring • Prevention of venous thrombosis • Surgery in hepatitis and HIV carriers • Fluid balance and homeostasis Post-operative care: • Post-operative monitoring • Cardiorespiratory physiology • Fluid balance and homeostasis • Diabetes mellitus and other relevant endocrine disorders • Renal failure • Pathophysiology of blood loss • Pathophysiology of sepsis including SIRS and shock • Multi-organ dysfunction syndrome • Post-operative complications in general • Methods of postoperative analgesia To assess and plan nutritional management • Post-operative nutrition • Effects of malnutrition, both excess and depletion • Metabolic response to injury • Methods of screening and assessment of nutritional status • Methods of enteral and parenteral nutrition Haemostasis and Blood Products: • Mechanism of haemostasis including the clotting cascade • Pathology of impaired haemostasis e.g. haemophilia, liver disease, massive haemorrhage • Components of blood • Alternatives to use of blood products • Principles of administration of blood products

	• Patient safety with respect to blood products Coagulation, deep vein thrombosis and embolism: • Clotting mechanism (Virchow Triad) • Effect of surgery and trauma on coagulation • Tests for thrombophilia and other disorders of coagulation • Methods of investigation for suspected thromboembolic disease • Principles of treatment of venous thrombosis and pulmonary embolism including anticoagulation • Role of V/Q scanning, CTpulmonary angiography, D-dimer and thrombolysis • Place of pulmonary embolectomy • Prophylaxis of thromboembolism: • Risk classification and management of DVT • Knowledge of methods of prevention of DVT, mechanical and pharmacological Antibiotics: • Common pathogens in surgical patients • Antibiotic sensitivities • Antibiotic side-effects • Principles of prophylaxis and treatment Metabolic and endocrine disorders in relation perioperative management • Pathophysiology of thyroid hormone excess and deficiency and associated risks from surgery • Causes and effects of hypercalcaemia and hypocalcaemia • Complications of corticosteroid therapy • Causes and consequences of Steroid insufficiency • Complications of diabetes mellitus • Causes and effects of hyponatraemia • Causes and effects of hyperkalaemia and hypokalaemia
Clinical Skills	3 Pre-operative assessment and management: • History and examination of a patient from a medical and surgical standpoint • Interpretation of pre-operative investigations • Management of co morbidity • Resuscitation • Appropriate preoperative prescribing including premedication 3 Intra-operative care: • Safe conduct of intraoperative care • Correct patient positioning • Avoidance of nerve injuries • Management of sharps injuries • Prevention of diathermy injury • Prevention of venous thrombosis 3 Post-operative care: • Writing of operation records • Assessment and monitoring of patient's condition • Post-operative analgesia • Fluid and electrolyte management • Detection of impending organ failure • Initial management of organ failure • Principles and indications for Dialysis • Recognition, prevention and treatment of post-operative complications 3 Haemostasis and Blood Products: • Recognition of conditions likely to lead to the diathesis • Recognition of abnormal bleeding during surgery • Appropriate use of blood products • Management of the complications of blood product transfusion

	3 Coagulation, deep vein thrombosis and embolism • Recognition of patients at risk • Awareness and diagnosis of pulmonary embolism and DVT • Role of duplex scanning, venography and d-dimer measurement • Initiate and monitor treatment of venous thrombosis and pulmonary embolism • Initiation of prophylaxis 3 Antibiotics: • Appropriate prescription of antibiotics 3 Assess and plan preoperative nutritional management • Arrange access to suitable artificial nutritional support, preferably via a nutrition team including Dietary supplements, Enteral nutrition and Parenteral nutrition 3 Metabolic and endocrine disorders • History and examination in patients with endocrine and electrolyte disorders • Investigation and management of thyrotoxicosis and hypothyroidism • Investigation and management of hypercalcaemia and hypocalcaemia • Peri-operative management of patients on steroid therapy • Peri-operative management of diabetic patients • Investigation and management of hyponatraemia • Investigation and management of hyperkalaemia and hypokalaemia
Technical Skills and Procedures	2 Central venous line insertion 4 Urethral catheterisation

Module 6	**Assessment and management of patients with trauma (including the multiply injured patient)**
Objective	Assess and initiate management of patients with chest trauma • who have sustained a head injury • who have sustained a spinal cord injury • who have sustained abdominal and urogenital trauma • who have sustained vascular trauma • who have sustained a single or multiple fractures or dislocations • who have sustained traumatic skin and soft tissue injury • who have sustained burns • Safely assess the multiply injured patient. • Contextualise any combination of the above • Be able to prioritise management in such situation as defined by ATLS, APLS etc
Knowledge	General • Scoring systems for assessment of the injured patient • Major incident triage • Differences In children Shock • Pathogenesis of shock • Shock and cardiovascular physiology • Metabolic response to injury • Adult respiratory distress syndrome • Indications for using uncross matched blood Wounds and soft tissue injuries • Gunshot and blast injuries • Stab wounds • Human and animal bites

	• Nature and mechanism of soft tissue injury • Principles of management of soft tissue injuries • Principles of management of traumatic wounds • Compartment syndrome Burns • Classification of burns • Principle of management of burns Fractures • Classification of fractures • Pathophysiology of fractures • Principles of management of fractures • Complications of fractures • Joint injuries Organ specific trauma • Pathophysiology of thoracic trauma • Pneumothorax • Head injuries including traumatic intracranial haemorrhage and brain injury • Spinal cord injury • Peripheral nerve injuries • Blunt and penetrating abdominal trauma • Including spleen • Vascular injury including iatrogenic injuries and intravascular drug abuse • Crush injury • Principles of management of skin loss including use of skin grafts and skin flaps
Clinical Skills	General 4 History and examination 3 Investigation 3 Referral to appropriate surgical subspecialties 4 Resuscitation and early management of patient who has sustained thoracic, head, spinal, abdominal or limb injury according to ATLS and APLS guidelines 4 Resuscitation and early management of the multiply injured patient 3 Specific problems • Management of the unconscious patient • Initial management of skin loss • Initial management of burns • Prevention and early management of the compartment syndrome
Technical Skills and Procedures	2 Central venous line insertion 3 Chest drain insertion 2 Diagnostic peritoneal lavage 4 Urethral catheterisation 2 Suprapubic catheterisation

Module 7	**Surgical care of the Paediatric patient**
Objective	To assess and manage children with surgical problems, understanding the similarities and differences from adult surgical patients To understand the issues of child protection and to take action as appropriate
Knowledge	• Physiological and metabolic response to injury and surgery • Fluid and electrolyte balance • Thermoregulation Safe prescribing in children • Principles of vascular access in children • Working knowledge of trust and Local Safeguarding Children Boards (LSCBs) and Child Protection Procedures • Basic understanding of child protection law • Understanding of Children's rights • Working knowledge of types and categories of child maltreatment, presentations, signs and other features (primarily physical, emotional, sexual, neglect, professional) • Understanding of one personal role, responsibilities and appropriate referral patterns in child protection • Understanding of the challenges of working in partnership with children and families • Recognise the possibility of abuse or maltreatment • Recognise limitations of own knowledge and experience and seek appropriate expert advice • Urgently consult immediate senior in surgery to enable referral to paediatricians • Keep appropriate written documentation relating to child protection matters • Communicate effectively with those involved with child protection, including children and their families
Clinical Skills	3 History and examination of the neonatal surgical patient 3 History and examination of paediatric surgical patient 3 Assessment of respiratory and cardiovascular status 3 Undertake consent for surgical procedures (appropriate to the level of training) in paediatric patients

Module 8	**Management of the dying patient**
Objective	Ability to manage the dying patient appropriately. To understand consent and ethical issues in patients certified DNAR (do not attempt resuscitation) Palliative Care: Good management of the dying patient in consultation with the palliative care team.
Knowledge	Palliative Care: • Care of the terminally ill • Appropriate use of analgesia, antiemetics and laxatives Principles of organ donation: • Circumstances in which consideration of organ donation is appropriate • Principles of brain death Understanding the role of the coroner and the certification of death
Clinical Skills	3 Palliative Care: • Symptom control in the terminally ill patient 3 Principles of organ donation: • Assessment of brain stem death • Certification of death

Module 9	**Organ and Tissue transplantation**
Objective	To understand the principles of organ and tissue transplantation
Knowledge	• Principles of transplant immunology including tissue typing, acute, hyperactute and chronic rejection • Principles of immunosuppression • Tissue donation and procurement • Indications for whole organ transplantation

Requirement to meet the ST3 in Cardiothoracic Surgery

In order to meet the job specifications of an ST3 trainee an early year's trainee must take a clear role in the cardiothoracic team, managing clinic, cardiac intensive care and ward based patients under supervision, including the management of acute admissions. They will need to be able to take part in an outpatient clinic and see patients themselves with the consultant available for advice.

Therefore in early years training, IN ADDITION to the generic competencies for all surgeons, it is necessary to address the specifics of a developing interest in Cardiothoracic surgery during these years. This means spending 6-12 months in cardiothoracic surgery in a service which gives trainees access to the appropriate learning opportunities. Also by the time a trainee enters ST3 they need to be familiar with the operating room environment both with respect to elective and emergency cases.

Trainees must attend MDT and other Departmental meetings and ward rounds, prepare operating lists (and actually perform some surgery under appropriate supervision. They must manage all patients in a ward environment, preoperatively and post operatively. This includes recognising and initiating the management of common complications and emergencies, over and above those already laid out in the generic curriculum, particularly module 2.

The range of conditions a trainee needs to manage are laid out below and in the depth demonstrated in a text book such as Chikwe J, Beddow E, Glenville B. Cardiothoracic Surgery Oxford University Press 2006.

Early Years training in Cardiothoracic Surgery	
Objective	To acquire experience in the management of a post surgical patient on the critical care, high dependency and post operative wards. To be able to manage, with appropriate supervision, such a patient. To participate under supervision in the operative management of cardiothoracic patients
Knowledge	Basic science relevant to the management of patients with cardiothoracic disease (including anatomy, physiology, pharmacology, pathology and radiology) Principles of management of patients presenting with the common elective and emergency cardiothoracic disease, including post operative and intensive care Specific knowledge relating to the principles of cardiopulmonary bypass and myocardial management and their consequences. Includes an understanding of the relevant equipment and technology
Clinical Skills	History and examination of the post-operative and critically ill patient Analysis and interpretation of post operative and critical care charts and documentation. Recognition, evaluation and treatment of haemodynamic abnormalities: Recognition, evaluation and treatment of ventilatory abnormalities: Recognition, evaluation and treatment of multiorgan dysfunction:
Technical Skills and Procedures	**Practical Skills:** 4 Use of defibrillator 2 Practical use of inotropes and vasoactive drugs 2 Principles of the use of intra aortic balloon pump 1 Echocardiography including TOE 3 Arterial cannulation 2 Central venous cannulation 2 Pulmonary artery catheterisation **Operative Management:** 3 Saphenous vein harvest 2 Median Sternotomy 3 Chest aspiration 3 Chest drain insertion and management

Assessment

The speciality elements of the early years will all be assessed primarily in the workplace and then scrutinised in the Annual Review of Competency Progression. All these documents would be included in a portfolio which would contribute as evidence in subsequent applications to enter ST3.

Specific evidence includes

Assessment type	Subject
DOPS a selection of types and numbers of each type according to learning agreements	Arterial cannulation Central venous cannulation Pulmonary artery catheterisation Saphenous vein harvest Chest aspiration Chest drain insertion and management Median Sternotomy
Case Based Discussion	One per attachment
CEX	Clinical examination of the cardiovascular system Clinical examination of the respiratory system Interpretation of an ECG in a clinical context
PBAs	None at this level
Training Supervisors report	Evidenced by the above WPBAs
ARCP for each specified training interval	As per local Deanery specifications
MRCS	Generic syllabus

Intermediate Stage Overview

Clinical placements during the intermediate stage (ST3-6) will be purely in Cardiothoracic Surgery. The purpose of the intermediate stage is to allow the trainee to develop further the skills necessary for independent cardiothoracic practice. These will include skills in general cardiothoracic surgery and in emergency cardiothoracic surgery. They will also be an introduction to some specialist areas of Cardiothoracic Surgery.

Entry into ST3

Entry into ST3 will usually involve a competitive selection process. The current person specifications for entry into ST3 in general surgery are shown on the Modernising Medical Careers website. The essential components are completion of the common component of the core surgical training programme (as evidenced by successful ARCP, WBA and completion of the MRCS examination) and completion of the specialty components of the early years training as evidenced by a successful ARCP and completion of the appropriate WBA.

Intermediate (I) Phase of training (ST3 &ST4)

The intermediate (I) phase of training will consist of an indicative period of two years. These two years should in turn consist of four modules, each of 6 months. Trainees will be expected to have completed at least one module in cardiac surgery and one module in thoracic surgery by the end of this phase.

The purpose of this stage is to **acquire and develop experience and competence in the generality of cardiothoracic surgery.**

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.

Intermediate (1) 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

Click on Workplace Based Assessments to view the assessment forms including DOPS and PBAs

Topics

Topic	Critical Care and Post-operative Management
Category	Critical Care and Post-operative Management
Sub-category:	None
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 4Cardiac arrhythmia 4 Haemostasis, thrombosis and bleeding 4 Acid base balance 4 Pulmonary physiology, ventilation and gas exchange 4 Metabolic response to trauma and surgery 4GIT, renal and hepatic physiology 4Nutrition 4Temperature regulation Anatomy 4Heart, pericardium and great vessels 4Mediastinum, thoracic inlet and neck 4Tracheobronchial tree and lungs 4Chest wall and diaphragm Pathology 4Inflammation and wound healing 4Myocardial infarction and complications 4Endocarditis 4Pericarditis 4Systemic Inflammatory Response Syndrome 4Bronchopulmonary infection 4ARDS Pharmacology 4Drugs used in the treatment of hypertension, heart failure and angina 4Inotropes, vasodilators and vasoconstrictors 4Anti-arrhythmic drugs

	4Haemostatic drugs 4Antiplatelet, anticoagulant and thrombolytic drugs 4Analgesics 4Antibiotics 4Anaesthetic agents, local and general Microbiology 4Organisms involved in cardiorespiratory infection 4Antimicrobial treatment and policies CLINICAL KNOWLEDGE 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 3Wound infection and sternal disruption 3 Neuropsychological consequences of surgery and critical care
Clinical Skills	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 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 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 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 Recognition, evaluation and treatment of ventilatory abnormalities (level as indicated) 4Interpretation of blood gas results 3Airway management 2Understanding of ventilatory techniques and methods 2Understanding of anaesthetic drugs and methods Recognition, evaluation and treatment of multiorgan dysfunction (level as indicated) 2Renal dysfunction and support 2GIT dysfunction, feeding and nutrition 2Recognition and evaluation of cerebral and neuropsychological problems
Technical Skills and Procedures	PRACTICAL SKILLS (level as indicated) 4 Arterial cannulation 4Central 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Cardiopulmonary Bypass**
Category	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
Technical Skills and Procedures	OPERATIVE MANAGEMENT 3Median sternotomy open and close 3Cannulation and institution of cardiopulmonary bypass 3 Safe conduct of CPB - problem solving and troubleshooting 3Weaning from bypass and decannulation 2Femoral cannulation and decannulation 1 Repeat sternotomy, with pericardial dissection, cardiac mobilisation and cannulation
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Myocardial Protection**
Category	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
Clinical Skills	PATIENT MANAGEMENT 2 Myocardial management throughout the peri-operative period 2 Ability to adapt preservation technique to clinical situation
Technical Skills	OPERATIVE MANAGEMENT

and Procedures	2 Relevant cannulation techniques and appropriate delivery of cardioplegia
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Circulatory Support**
Category	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 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
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Ischaemic Heart Disease**
Category	Ischaemic Heart Disease
Sub-category:	None
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 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.
Clinical Skills	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 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
Technical Skills and Procedures	OPERATIVE MANAGEMENT 4 Saphenous vein harvest 3 Mammary artery/radial artery harvest 3 Preparation for and management of cardipulmonary bypass 3 Proximal coronary anastamosis 2 Distal coronary anastamosis
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Heart Valve Disease**
Category	Heart Valve Disease
Sub-category:	None
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 (eg aortic and mitral) 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 agnosis investigation and assessment of valvular heart disease 3 ming of surgical intervention in valve disease 3 tions 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

Clinical Skills	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.
Technical Skills and Procedures	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 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, transseptal approaches, and minimal access surgery
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Aortovascular Disease**
Category	Aortovascular Disease
Sub-category:	None
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 subspeciality.*
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 Multiorgan failure 3 Blood transfusion and blood products 3 Wound infection and sternal disruption Specific 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
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Cardiothoracic Trauma**
Category	Cardiothoracic Trauma
Sub-category:	None
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 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
Technical Skills and Procedures	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 Postero-lateral, thoracotomy, antero lateral thoracotomy and thoraco-laparotomy 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**General Management of a Patient Undergoing Thoracic Surgery**
Category	General Management of a Patient Undergoing Thoracic Surgery
Sub-category:	None
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 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.
Clinical Skills	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
Technical Skills and Procedures	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

	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 minitracheostomy 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Neoplasms of the Lung**
Category	Neoplasms of the Lung
Sub-category:	None
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	GENERAL 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. 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.
Clinical Skills	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Pleura**
Category	Disorders of the Pleura
Sub-category:	None
Objective	*To evaluate and manage surgical conditions of the pleura and the pleural space, including operative management and with appropriate supervision*
Knowledge	GENERAL 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 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
Clinical Skills	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Chest Wall**
Category	Disorders of the Chest Wall
Sub-category:	None
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	GENERAL 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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Diaphragm**
Category	Disorders of the Diaphragm
Sub-category:	None
Objective	*To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate, and with appropriate supervision.*
Knowledge	GENERAL 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. 3 Management of patients making an uncomplicated or complicated recovery from diaphragmatic resection.
Technical Skills and Procedures	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Emphysema and Bullae**
Category	Emphysema and Bullae
Sub-category:	None
Objective	*To fully assess and manage a patient with emphysema and bullae, including surgical management where appropriate, and with appropriate supervision.*
Knowledge	GENERAL KNOWLEDGE As for thoracic surgery – general SPECIFIC KNOWLEDGE 3 Aetiology, pathology and physiology of chronic obstructive airways 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
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. 3 Post-operative management of patients making an uncomplicated recovery from surgery for emphysema or the complications of such diseases. 3 Management of patients following lung volume reduction surgery.
Technical Skills and Procedures	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Pericardium**
Category	Disorders of the Pericardium
Sub-category:	None
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	GENERAL 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.
Clinical Skills	PATIENT MANAGEMENT As for thoracic surgery – general 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.
Technical Skills and Procedures	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. 1Competence in dealing with the complications of pericardial resection and replacement.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Mediastinum**
Category	Disorders of the Mediastinum
Sub-category:	None
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	GENERAL 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 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
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. 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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Airway**
Category	Disorders of the Airway
Sub-category:	None
Objective	*To assess and manage a patient with disease of the major airways, including surgical management where appropriate, and with appropriate supervision.*
Knowledge	GENERAL 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 anastamotic 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.
Clinical Skills	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. 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.
Technical Skills and Procedures	OPERATIVE MANAGEMENT 2 Endoscopic assessement of a patient with airways disease 1 Sleeve resection of the trachea for simple benign conditions, including appropriate anastamotic techniques. 1 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastamotic 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, anastamosis 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 skills

Topic	**Congenital Heart Disease**
Category	Congenital Heart Disease
Sub-category:	None
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 subspeciality 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 Fetal 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 Multiorgan failure 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 Ebstiens abnormality 2 Extra cardiac conduits 1 Interrupted aortic arch 2 Total anomalous pulmonary venous drainage 2 Extra Corporeal Membrane Oxygenation 2 Transplantation
Clinical Skills	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 3 Cardiopulmonary resuscitation 3 Diagnosis and treatment of cardiac arrhythmias 3 Blood transfusion and blood products 3 Wound infection and sternal disruption
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Intrathoracic transplantation and surgery for heart failure**
Category	Intrathoracic Transplantation and Surgery for Heart Failure
Sub-category:	None
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 subspeciality 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 histocompatability 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
Clinical Skills	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 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
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these

	skills

Topic	**Management of Benign Oesophageal Disorders**
Category	Disorders of the Oesophagus
Sub-category:	None
Objective	*To evaluate and manage surgical aspects of benign oesophageal disorders. This module is intended for a trainee to gain initial exposure to this subspeciality 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
Clinical Skills	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 anastamotic 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these

	skills

Topic	**Management of Oesophageal Neoplasia**
Category	Disorders of the Oesophagus
Sub-category:	None
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 subspeciality 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.
Clinical Skills	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. 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 anastamotic leak.
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Intermediate (II) Stage

Intermediate (II) Phase of training (ST5 &ST6)

The intermediate (II) phase of training will consist of an indicative period of two years. These two years should in turn consist of four modules, each of 6 months. By the end of this phase trainees will be expected to have completed at least one year in cardiac surgery and one year in thoracic surgery.

Whilst the emphasis remains on gaining experience and competence in the generality of cardiothoracic surgery, trainees may be starting to develop subspecialty 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.

Intermediate (II) 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

Click on Workplace Based Assessments to view the assessment forms including DOPS and PBAs

Topics

Topic	**Critical Care and Post-operative Management**
Category	Critical Care and Post-operative Management
Sub-category:	None
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 multiprofessional, 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 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
Clinical Skills	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 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 multiorgan dysfunction 3 Renal dysfunction and support 3 GIT dysfunction, feeding and nutrition 3 Recognition and evaluation of cerebral and neuropsychological problems
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Cardiopulmonary Bypass**
Category	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
Technical Skills and Procedures	OPERATIVE MANAGEMENT 4 Median sternotomy open and close 4 Cannulation and institution of cardiopulmonary bypass 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Myocardial Protection**
Category	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

	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
Clinical Skills	PATIENT MANAGEMENT 4 Myocardial management throughout the peri-operative period 3 Ability to adapt preservation technique to clinical situation
Technical Skills and Procedures	OPERATIVE MANAGEMENT 3 Relevant cannulation techniques and appropriate delivery of cardioplegia
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Circulatory Support**
Category	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

	4 Physiology of the balloon pump 3 Understanding of relevant equipment and technology 3 Ventricular assist devices: indications for use, patient selection and complications
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Ischaemic Heart Disease**
Category	Ischaemic Heart Disease
Sub-category:	None
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

	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.
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Heart Valve Disease**
Category	Heart Valve Disease
Sub-category:	None
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

	4 Analgesics 4 Antibiotics 4 Anaesthetic agents, local and genera 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
Clinical Skills	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 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.
Technical Skills and Procedures	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, transseptal 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Aortovascular Disease**
Category	Aortovascular Disease
Sub-category:	None
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 subspeciality.*
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

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

Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Cardiothoracic Trauma**
Category	Cardiothoracic Trauma
Sub-category:	None
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
Technical Skills and Procedures	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 Postero-lateral, thoracotomy, antero lateral thoracotomy and thoraco-laparotomy 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**General Management of a Patient Undergoing Thoracic Surgery**
Category	General Management of a Patient Undergoing Thoracic Surgery
Sub-category:	None
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

	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 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.
Clinical Skills	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 4 Chest radiograph and ECG

	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
Technical Skills and Procedures	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 minitracheostomy 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 skills

Topic	**Neoplasms of the Lung**
Category	Neoplasms of the Lung
Sub-category:	None
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	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.
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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Pleura**
Category	Disorders of the Pleura
Sub-category:	None
Objective	*To fully evaluate and manage uncomplicated surgical conditions of the pleura and the pleural space*
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 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
Clinical Skills	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 skills

Topic	**Disorders of the Chest Wall**
Category	Disorders of the Chest Wall
Sub-category:	None
Objective	*To assess and manage a patient with abnormality or disease affecting the chest wall, including surgical management where appropriate.*
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. 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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Diaphragm**
Category	Disorders of the Diaphragm
Sub-category:	None
Objective	*To assess and manage a patient with disease or abnormality of the diaphragm, including surgical management where appropriate.*
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 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.
Technical Skills and Procedures	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Emphysema and Bullae**
Category	Emphysema and Bullae
Sub-category:	None
Objective	*To fully assess and manage a patient with emphysema and bullae, including surgical management where appropriate.*
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
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 making an uncomplicated recovery from surgery for emphysema or the complications of such diseases. 3 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. 2 Lung volume reduction surgery, unilaterally and bilaterally, using open and VATS techniques.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Pericardium**
Category	Disorders of the Pericardium
Sub-category:	None
Objective	*To fully assess and manage a patient with disease of the pericardium or pericardial space, including surgical management where appropriate.*
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.
Clinical Skills	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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Mediastinum**
Category	Disorders of the Mediastinum
Sub-category:	None
Objective	*To fully assess and manage a patient with benign and malignant disease of the mediastinum, including surgical management where appropriate.*
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 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.
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Disorders of the Airway**

Category	Disorders of the Airway
Sub-category:	None
Objective	*To assess and manage a patient with disease of the major airways, including surgical management where appropriate.*
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 anastamotic 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 anastamotic techniques. 2 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastamotic 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, anastamosis 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 skills

Topic	**Congenital Heart Disease**
Category	Congenital Heart Disease
Sub-category:	None
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 subspeciality 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 Fetal 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 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.

	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
Clinical Skills	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

	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
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Intrathoracic transplantation and surgery for heart failure**
Category	Intrathoracic transplantation and surgery for heart failure
Sub-category:	None
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 subspeciality 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 histocompatability 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
Clinical Skills	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 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
Technical Skills and Procedures	OPERATIVE MANAGEMENT Transplantation 3 Transvenous 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
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Management of Benign Oesophageal Disorders**
Category	Disorders of the Oesophagus
Sub-category:	None
Objective	*To evaluate and manage surgical aspects of benign oesophageal disorders. This module is intended for a trainee to gain initial exposure to this subspeciality 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
Clinical Skills	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 anastamotic 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

Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Topic	**Management of Oesophageal Neoplasia**
Category	Disorders of the Oesophagus
Sub-category:	None
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 subspeciality 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.
Clinical Skills	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. 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 anastamotic leak.
Technical Skills and Procedures	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 interpostion techniques
Professional Skills	Please see the Professional Skills and Behaviour » Intermediate section for these skills

Final Stage

Final Phase of training (ST7 &ST8)

The final phase of training will consist of an indicative period of two years. These two years should in turn consist of four modules, each of 6 months. 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 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 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 curriculum is flexible and can accommodate the needs of trainees following an academic pathway. This is achieved by having individualised learning agreements. Academic trainees will be expected to demonstrate that they have achieved all the essential requirements of the CCT, but may choose not to undertake any optional additional training in the final stage. It is however acknowledged that academic trainees will need longer training pathways to achieve the essential competencies.

Click on Workplace Based Assessments to view the assessment forms including DOPS and PBAs

Topics

Topic	**Critical Care and Post-operative Management**
Category	Critical Care and Post-operative Management
Sub-category:	None
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 multiprofessional, 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 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
Clinical Skills	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

	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 multiorgan dysfunction 3 Renal dysfunction and support 3 GIT dysfunction, feeding and nutrition 3 Recognition and evaluation of cerebral and neuropsychological problems
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Cardiopulmonary Bypass**
Category	Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support
Sub-category:	None
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
Technical Skills and Procedures	OPERATIVE MANAGEMENT 4 Median sternotomy open and close 4 Cannulation and institution of cardiopulmonary bypass 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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Myocardial Protection**
Category	Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support
Sub-category:	None
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 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
Clinical Skills	PATIENT MANAGEMENT 4 Myocardial management throughout the peri-operative period 4 Ability to adapt preservation technique to clinical situation
Technical Skills and Procedures	OPERATIVE MANAGEMENT 4 Relevant cannulation techniques and appropriate delivery of cardioplegia
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Circulatory Support**
Category	Cardio-pulmonary Bypass, Myocardial Protection and Circulatory Support
Sub-category:	None
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

	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
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Ischaemic Heart Disease**
Category	Ischaemic Heart Disease
Sub-category:	None
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 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 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.
Clinical Skills	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) 4 Repeat coronary artery surgery 3 Complications of ischaemic heart disease including post infarction VSD, mitral regurgitation and left ventricular aneurysm
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Heart Valve Disease**
Category	Heart Valve Disease
Sub-category:	None
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
Clinical Skills	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 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.
Technical Skills and Procedures	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, transseptal approaches, and minimal access surgery
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Aortovascular Disease**
Category	Aortovascular Disease
Sub-category:	None
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 speciality 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

	4 Non-surgical management including the role of endovascular stenting 4 Management of cardiovascular and non-cardiovascular risk factors
Clinical Skills	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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Cardiothoracic Trauma**
Category	Cardiothoracic Trauma
Sub-category:	None
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 cardiothoraic 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

	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
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**General Management of a Patient Undergoing Thoracic Surgery**

Category	General Management of a Patient Undergoing Thoracic Surgery
Sub-category:	None
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

	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.
Clinical Skills	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 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
Technical Skills and Procedures	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 minitracheostomy 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 » Final section for these skills

Topic	**Neoplasms of the Lung**
Category	Neoplasms of the Lung
Sub-category:	None
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.
Technical Skills and Procedures	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 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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Pleura**
Category	Disorders of the Pleura
Sub-category:	None
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 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
Clinical Skills	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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Chest Wall**
Category	Disorders of the Chest Wall
Sub-category:	None
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	OPERAITVE 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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Diaphragm**
Category	Disorders of the Diaphragm
Sub-category:	None
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

	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.
Technical Skills and Procedures	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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Emphysema and Bullae**
Category	Emphysema and Bullae
Sub-category:	None
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
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 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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Pericardium**
Category	Disorders of the Pericardium
Sub-category:	None
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.
Clinical Skills	PATIENT MANAGEMENT As for thoracic surgery – general 4 Clinical history and examination 4 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 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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Mediastinum**
Category	Disorders of the Mediastinum
Sub-category:	None
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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Disorders of the Airway**
Category	Disorders of the Airway
Sub-category:	None
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 anastamotic 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 4 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 4 Endoscopic assessment of a patient with airways disease 4 Sleeve resection of the trachea for simple benign conditions, including appropriate anastamotic techniques. 4 Sleeve resection of the main bronchi, including lobectomy where appropriate, for malignant disease, including appropriate anastamotic 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, anastamosis 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.
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Congenital Heart Disease**
Category	Congenital Heart Disease
Sub-category:	None

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 Fetal 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

	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
Clinical Skills	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

	4 Wound infection and sternal disruption
Technical Skills and Procedures	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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Intrathoracic transplantation and surgery for heart failure**
Category	Intrathoracic transplantation and surgery for heart failure
Sub-category:	None
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 subspecialty, 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.

	4 Mechanisms and outcomes of respiratory failure. 4 Causes of cardiac failure. 4 Causes of respiratory failure. Immunology 4 Major and minor histocompatability 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 Indictations 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
Clinical Skills	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

	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
Technical Skills and Procedures	OPERATIVE MANAGEMENT Transplantation 4 Transvenous 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
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Management of Benign Oesophageal Disorders**
Category	Disorders of the Oesophagus
Sub-category:	None
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 subspeciality 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.

	4 Alternative management of achalasia including dilatation and botox injection. 4 The indications for surgery in paraoesophageal hernia. 4 Endoscopic dilatation techniques
Clinical Skills	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 anastamotic leak. 4 Blood transfusion and blood products 4 Wound infection and wound disruption
Technical Skills and Procedures	OPERATIVE MANAGEMENT 4 Oesophago-gastro-duodenoscopy. 4 Rigid oesophagoscopy 4 Oesophageal dilatation 4 Open and laparoscopic fundoplication and cardiomyotomy 4 Mobilisation of oesophagus, stomach and colon 4 Oesophageal anastomosis
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills

Topic	**Management of Oesophageal Neoplasia**
Category	Disorders of the Oesophagus
Sub-category:	None

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 subspeciality 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 gastroesophageal 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.
Clinical Skills	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. 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 anastamotic leak.
Technical Skills and Procedures	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 interpostion techniques
Professional Skills	Please see the Professional Skills and Behaviour » Final section for these skills