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INTERCOLLEGIATE BOARD for TRAINING IN INTENSIVE CARE MEDICINE

A Guide for Trainers

January 2000

OVERVIEW

The guide provides a background to the content and syllabus of training in Intensive Care Medicine. It gives a structure by which objective assessment of each stage of training may performed. The guidance tries to match training needs with service needs relevant to each stage of training: basic ("SHO"), general (Specialist Registrar, 1-2) and advanced, specialist (Additional Year, Specialist Year, 3-6) training. Thus a 3-month "SHO" trainee with the knowledge and skills of arrhythmia recognition, endotracheal intubation, defibrillation, and venous access could successfully manage the problem of cardiopulmonary arrest following ventricular fibrillation.

Despite the attempt at detail, just as in any specialty, the knowledge base of Intensive Care Medicine is constantly changing, so that it is impossible to provide a completely up-to-date learning requirement. This deficit will be particularly apparent and important for those practitioners who intend to spend the majority of their time in the ICU who will be undertaking the third tranche of training. Their training and syllabus will be developed around their particular needs, filling in gaps, and fulfilling personal specialist needs. It will also be apparent that trainees from different backgrounds may already have gained considerable experience and competence in different areas: thus a trainee anaesthetist might be expected to be competent in endotracheal intubation, while a trainee physician may have competence in use of non-invasive ventilatory technologies.

Recognising basic learning objectives, which express the breadth and the depth of knowledge at each of three stages in training, each stage should be viewed at two levels:

1) theoretical
2) practical

"Theoretical" training can mean either the scientific background necessary to understand various problems or techniques e.g. heart failure, testing for brain stem death or the knowledge necessary to perform various practical manoeuvres e.g. the anatomy of the anterior triangle of the neck and internal jugular catheterisation. "Practical" may mean either the way in which something may be done (i.e. the "recipe" for inserting an internal jugular cannula), or actually doing it (i.e. putting the cannula into a patient).

Training also occurs at three levels:

1) "learning" (being shown)
2) "competent" (gaining experience, independent action, beginning to teach)
3) "skilled" (able to perform under difficult circumstances, or on difficult patients, able to teach or demonstrate)

These standards *might* be used to indicate competence at “trainee” and at “consultant” level, and begin to give a means of judging “professional” practice.

The syllabus (see table) is set out in blocks, with each area's depth and quantity of knowledge increasing. For example, the anatomical knowledge base needed for basic training is less than for specialist training. On the other hand, there is no need for specific training in budgeting for basic level exposure, but a significant need at the highest level.

DIPLOMA in INTENSIVE CARE MEDICINE: SYLLABUS

BASIC	GENERAL	SPECIALIST
ALS	ALS, ATLS	ALS, ATLS, APLS
Anatomy	Anatomy	Anatomy
Physiology	Physiology	Physiology
Pharmacology	Pharmacology	Pharmacology
Clinical skills	Clinical skills	Clinical skills
Practical skills	Practical skills	Practical skills
Clinical management planning	Clinical management planning	Clinical management planning
Use of relevant technical equipment	Use of relevant technical equipment	Use of relevant technical equipment
Intra-hospital transport & transfer	*Inter & intra*-hospital transport & transfer	*Inte*r *& intra* -hospital transfer & transport
IT skills	IT skills	IT skills
Keeping up & presentation	Keeping up & presentation	Keeping up & presentation
Interpersonal skills	Interpersonal skills	Interpersonal skills
	Physics & Measurement	Physics & Measurement
	Specialist diseases and syndromes	Specialist diseases and syndromes
	Imaging	Imaging
	Audit	Audit
		Microbiology
		Specialist interest
		Follow up clinics
		Research & report writing
		Personnel management & selection
		Equipment selection & purchase
		Administration, business planning & budgeting

TRAINEES IN ACUTE SPECIALTIES assigned to INTENSIVE CARE MEDICINE

Three-Month Module: SHO

The aims of this module are:

- To recognise those patients who may benefit from intensive care, and the limitations of intensive care

- To understand the pathophysiology and initial management of failure of the following organ systems:
  - respiratory
  - cardiovascular
  - renal
  - central and peripheral nervous
- To have obtained competency in:
  - cardiopulmonary resuscitation, basic and advanced
  - the maintenance of a clear airway, using simple means
  - the insertion of an endotracheal tube
  - the insertion of adequate peripheral venous access, to manage major haemorrhage
  - the insertion of arterial and central venous cannulae
  - the institution of controlled mechanical ventilation
- To understand the pharmacology of medications important in intensive care medicine
  - common major analgesics
  - common sedative agents
  - common neuro-muscular blocking agents
  - common inotropic and vasodilator drugs
  - common antiarrhythmic agents
  - drugs used in cardiopulmonary resuscitation
  - intravenous fluids used in resuscitation
- To understand the limitations of monitoring systems in current use
- To recognise the importance of communication skills in dealing with patients, relatives and colleagues
- To begin development of an overall individualised management plan for patients who have sustained 2 or 3 organ failure of intermediate severity
- To be aware of the means of auditing intensive care

The trainee should be advised to begin completion of their EDUICATIONAL RECORD at the earliest opportunity, and to maintain it

THE FIRST (BASIC) PERIOD TRAINEE (SHO): THREE-MONTH TRAINING PROGRAM IN THE INTENSIVE CARE UNIT

Trainees in Intensive Care Medicine may come from a variety of parent specialities. *The training will often be undertaken within the parent specialty as part of a rotation. The objectives and contents of Intensive Care Training remain identical whatever the background.*

In order to achieve the aims and objectives laid out, the trainee must develop knowledge and skills indicated below. At this early stage, the trainee should not be expected to take a major or leading role in active management of patients, other than those who require urgent resuscitation e.g. following cardiopulmonary arrest, major haemorrhage etc. The trainee may or may not have already undergone tuition in some of the areas below: previous exposure and skill will depend also upon the parent acute specialty.

BLS/ALS

The trainee requires the theoretical and practical skills for basic and advanced cardiac life support in adults, so that they may act as an effective cardiac arrest team member. The trainee requires knowledge of current European algorithms. The required skills include defibrillation, BVM ventilation, endotracheal intubation, closed chest compression, vascular access. At least theoretical knowledge of pericardial drainage, chest drainage, cricothyroidotomy, large central vessel cannulation (e.g. internal jugular) is required. A working knowledge of automated external defibrillators (AEDs) is essential.

ANATOMY

The trainee requires anatomical knowledge of the body areas relevant to diagnosis and treatment of critically ill patient (insertion of access lines, drainage of closed cavities etc), simple local anaesthesia (other than field block). The areas include antecubital fossa, anterior triangle of the neck, femoral triangle, chest wall, abdominal wall (and surface marking of organs), heart and coronary circulation, pharynx and larynx, lumbar epidural space and spinal canal

PHYSIOLOGY

The trainee requires applied physiological knowledge of systems primarily or secondarily compromised by critical illness or which may be optimised in critically ill patients i.e. respiratory, cardiovascular, renal, haematological and central nervous systems. In addition a basic knowledge of those systems relevant to pharmacological manipulation (including the central and peripheral nervous systems).

Relevant aspects of physiology will include control of cardiac output, blood pressure and blood flows, the pathophysiology, of control and mechanics of respiration, and the pathophysiology of oxygen transport and its utilisation (and relevant parts of biochemistry), control of fluid balance and the milieu interieur, control of consciousness, and locomotor activities, including the peripheral nervous system and muscle action.

Relevant applied physiology will include the understanding of fluid challenge (to ascertain heart failure), plotting of the Starling (or equivalent) curve relationship, measurement of oxygen consumption, carbon dioxide production and respiratory quotient, oxygen therapy in acute and chronic respiratory failure, investigation and treatment of acute renal failure, and the assessment of neuromuscular function using the nerve stimulator

PHARMACOLOGY

The trainee requires knowledge of applied pharmacology (including pharmacokinetics and dynamics) of drugs used in:

1) cardiopulmonary resuscitation
2) simple local anaesthesia
3) cardiovascular support or control
    1) inotropes
    2) vasodilators
    3) vasoconstrictors
    4) antiarrhythmics
    5) diuretics
4) respiratory support
    1) oxygen
    2) respiratory stimulants
    3) bronchodilators
5) analgesics
    1) opioids
    2) NSAIDS
6) sedatives
    1) benzodiazepines
    2) anaesthetic induction agents used for continuous infusion
7) drugs used during anaesthetic practise
    1) induction agents and sedatives
    2) neuromuscular blocking agents
    3) anticholinesterases and other antidotes
8) intravenous fluids
    1) blood products
    2) artificial colloids
    3) crystalloids
9) first line antimicrobial agents commonly used on critically ill patients i.e. cephalosporins, penicillins, aminoglycocides, quinolones.
10) miscellaneous groups of drugs with require dosage/alteration (reduction in critically ill patients) i.e. those whose metabolic pathway involves hepatic or renal excretion e.g. antibiotics, sedatives.

Pharmacology should include consideration of drug interactions (physical, chemical, pharmacological and physiological)

CLINICAL SKILLS and their application

The trainee should be able to interpret physical signs and be able to examine the unconscious or sedated patient, with particular emphasis on simple visual and tactile skills (e.g. does the chest rise symmetrically, can the apex beat be felt, where is the oedema?).

The trainee should show ability to interpret and relate physiological displays to the patient being examined (e.g. pulsus paradoxus, high airway pressures).

The trainee should show ability to interpret and relate routine pathological, and imaging data to the patient e.g. sweating and hypoglycaemia, hypercapnia or awareness, enlarging pupil and temporal skull fracture.

The trainee should be able to relate (and differentiate) clinical examination to pharmacological strategies or pathology e.g. absence of movement and areflexia related to use of muscle relaxants, or neuropathy, apnoea or pin point pupils to brain stem injury or opioids.

The trainee should have sufficient confidence in clinical skills to be able to uncover measurement (instrumentation) errors e.g. low displayed CVP and raised JVP.

PRACTICAL SKILLS

The 3-month trainee requires certain skills immediately: ***early*** *competence* is required. Some of these skills may be developed on training manikins.
These are:
1) simple airway control*
2) bag, valve mask (BVM) ventilation*
3) closed chest cardiac compression
4) use of a defibrillator*
5) insertion of large bore peripheral cannula (antecubital, femoral)*
6) oral endotracheal intubation (Grade1 laryngoscopy)*

* there may be subsidiary teaching required:
a) recognition and use of Guedel airway, nasopharyngeal airway
b) recognition, use and theoretical aspects of anaesthetic masks, Waitress's type breathing systems, unidirectional valves e.g. Ambu E, self-reflating bags (e.g. Ambu, Laerdal)
c) recognition and use of various types of laryngoscope (adult, child, straight blade), lengths, sizes and types of endotracheal tubes and cuffs, manipulating forceps, introducers, bougies
d) recognition and use of Seldinger wire-thru-needle access (with or without dilatation)
e) arrhythmia recognition

The following skills should be learnt by the 3-month trainee. *Competence is required*:

1) VASCULAR ACCESS
1) Seldinger and dilatational techniques for either peripheral or central cannulation
2) internal jugular cannulation
3) femoral venous access
4) intra-arterial cannulation: radial, femoral

2) RESPIRATORY ACCESS
1) endotracheal intubation (Grade1,laryngoscopy)
2) insertion of laryngeal mask airway
3) strategies for difficult or failing airway control or endotracheal intubation
4) insertion of emergency chest drain via lateral (mid-axillary) or anterior routes

The trainee should observe the following:
a) tracheostomy (mini-, percutaneous dilatational, surgical)
b) bronchoscopy (flexible)
c) fibreoptic laryngoscopy
d) insertion of vascular access via subclavian route
d) insertion of pacemaker

CLINICAL MANAGEMENT PLANNING

The trainee should be able to formulate simple clinical management plans based upon integration of history, examination findings, and immediately available investigations e.g. arterial blood gases, haematocrit. Management plans should lead to goal directed therapies (or strategic organ specific goals) for straightforward (and particularly) planned admissions in patients suffering from or following:

1) uncomplicated acute respiratory failure
2) expected respiratory failure accompanying uncomplicated major abdominal or thoracic surgery
3) respiratory failure associated with moderate heart failure
4) diffuse head injury (or subarachnoid haemorrhage) requiring ventilatory support
5) chronic respiratory failure requiring non-invasive support

6) severe heart failure requiring ino-dilator therapies
7) acute renal failure
8) massive blood loss following medical or surgical injury e.g. gastro-intestinal haemorrhage, traumatic injury, major vessel rupture
9) cardiopulmonary arrest

USE OF RELEVANT TECHNICAL EQUIPMENT

The trainee should understand the use of:

1) oxygen therapy equipment (flow meters, Ventimasks. MC/Hudson masks, CPAP)
2) endotracheal suction equipment (vacuum controller, suction controller, suction catheters, sterility)
3) blood pressure measurement equipment (systemic arterial pressure (non-invasive and invasive), central venous pressure (transduced or water manometer)
4) ventilator equipment at simplest level (IPPV, oxygen concentration, CPAP)

The trainee should be shown how to use:

1) an oxygen cylinder (change a regulator/open a cylinder)
2) a flow meter
3) suction apparatus (wall/floor/gas powered)
4) the blood gas/electrolyte machine
5) a NIBP machine (and cuff size)
6) a pulse oximeter
7) an ecg recording machine (12 lead)
8) a simple monitor (ecg/respiration)
9) a transducer (and cannulae/catheters)
10) a pressure infusor ("Intraflo") system
11) a capnograph (side stream/mainstream)
12) an oxygen analyser (including calibration)
13) a syringe driver (including bolus and PCAS)
14) an infusion pump
15) a nebuliser
16) a CPAP system
17) a "transport" monitor
18) a chest drain system
19) a nerve stimulator
20) a Sengstaken/Blakemore tube
21) a Level 1 rapid infusion system
22) the local path lab computer terminal

The trainee should be shown how to:

1) perform endotracheal suction
2) extubate (translaryngeal, and tracheostomy)
3) change a tracheostomy tube
4) insert a nasogastric tube
5) take a blood sample from an arterial, venous or pulmonary artery catheter
6) milk a chest drain
7) perform in-line immobilisation for cervical injury/use of collar/turn a patient with spinal fractures
8) check a ventilator for gas leaks/replace ventilator tubing
9) leave the unit in an emergency

INTRA HOSPITAL TRANSPORT & TRANSFER

The trainee should be familiar with the problems of transport of patients to other parts of the hospital e.g. imaging

1) the physiological consequences of movement (acceleration)
2) the environmental problems (space, vibration, temperature) on the patient and transport equipment
3) minimal monitoring during transfer
4) pre-transfer assessment and resuscitation
5) routine in-transfer care
6) in-transfer emergency care

INFORMATION TECHNOLOGY/COMPUTER SKILLS

Trainees should become familiar with aspects of information technology necessary for future career i.e. word processing, data base management, as well as use of CD-ROM, e-mail and access to Internet medical home pages etc

KEEPING UP & PRESENTATION

The trainee must be shown the relevant monographs related to intensive care and the method of searching the library journal stock, preferably via a computerised system e.g. CD-ROM, either locally or nationally via modem/e-mail/net

Presentation skills (and skills in clinical examination) should be demonstrated by the trainee in case presentation before at least one business round each week and for at least one teaching round each month. A presentation of an agreed topic should be made at least monthly.

The trainee should develop skill in summarising complex patients both historically and systematically. The trainee must develop skills of integrating or importing using a local computer graphics package, and word processing.

TRAINEES IN ACUTE SPECIALTIES assigned to INTENSIVE CARE MEDICINE

Six-Month General Module (SpR1-4)

The aims of this module are:

- To recognise those patients in whom support is appropriate (or inappropriate)
- To become familiar and confident with the techniques of support of cardiovascular, respiratory, renal and nervous systems, and of gut and nutritional support, with the recognition and need for other support, viz. hepatic, haematological and immunological
- To develop the clinical and technical skills necessary to achieve support of the major systems
- To understand the pathophysiologies of impending and actual organ failure, and develop knowledge of relevant pharmacological, mechanical, and nursing/paramedical therapies
- To develop communication skills appropriate for patients, their relatives, medical, nursing, paramedical and other hospital groups
- To become familiar with audit of intensive care, including some of its costs
- To develop a questioning and critical mind related to the patient's illness and therapies
- To obtain ALS and ATLS certification
- To have competed project work on one broad topic, and an audit project
- To recognise that each patient and his illness is unique

The trainee should be advised to begin completion of their EDUCATIONAL RECORD at the earliest opportunity, and to maintain it

THE SECOND (GENERAL) PERIOD TRAINEE (SpR): SIX-MONTH TRAINING PROGRAM IN THE INTENSIVE CARE UNIT

The purpose of this period is to begin to consolidate the general exposure to the discipline, and take an active part in management of patients. The areas covered are related to the period spent in the Intensive Care Unit, and not in the "alternate" discipline i.e. anaesthesia, medicine

ALS/ATLS

The trainee must gain formal ALS training at theoretical and practical level. Training can occur at any time prior to the end of the 6-month exposure, and may have been gained during another part of the whole clinical training. Every effort should be made to attend nationally approved (Resuscitation Council/RCS) courses. Trainees should be competent in adult resuscitation and reach certificated provider level or above. Practical skills needed include endotracheal intubation, chest drainage, large bore/central vein cannulation, cut down, peritoneal lavage, and some knowledge of insertion of a tracheostomy. Organisational skills should be developed by these courses.

The trainee should gain some experience and training in basic paediatric and neonatal life support, particularly as they apply to sudden death (or airway obstruction including epiglottitis).

ANATOMY

The trainee requires additional detailed anatomical knowledge of the body areas relevant to diagnosis and treatment of critically ill patient (insertion of arterial and venous access lines, intracranial pressure monitors, secondary airway control (tracheostomy), insertion of variceal tamponade devices, drainage of closed cavities), and anatomical knowledge related to techniques used to provide pain relief e.g. the epidural space. Detailed neuroanatomical knowledge is needed to provide the theoretical background to many treatments or assessment e.g. neuroanatomy of brain and spinal cord sufficient to understand testing for brain stem death, the use of clonidine for pain relief, assessment of nerve conduction.

In addition to previous areas, anatomical areas to be covered include wrist, ankle, subclavian area, neck related to tracheostomy, bronchial tree, oesophagus and stomach, and pathological anatomy of liver disease, chest wall, lungs and bronchial tree, abdominal wall, vertebral column, brachial plexus, spinal cord, brain and brain stem including skull, dura, and subarachnoid space), sympathetic and parasympathetic nervous system.

PHYSIOLOGY

The trainee requires understanding of the applied physiology of systems primarily or secondarily compromised by critical illness or requiring to be optimised in critically ill patients i.e. respiratory, cardiovascular, renal, haematological (including coagulation) and central nervous systems. The trainee requires basic knowledge of those systems relevant to pharmacological manipulation (i.e. as above plus central and peripheral nervous systems).

Detailed knowledge of required includes control of cardiac output, blood pressure and flows and the related pathophysiology: of control and mechanics of respiration (particularly work of breathing), and the pathophysiology of oxygen transport and utilisation (and relevant parts of physio-biochemistry): control of fluid balance and the milieu interieur: control of consciousness, and locomotor activities, including the peripheral nervous system and muscle action. The physiological aspects of absorption and nutrition should be mastered.

The trainee demonstrate an understanding of the this knowledge by its application: derivation and application of such concepts as shunt, dead space, ventilation perfusion mismatching, dissociation curve shifts (congenital or acquired), oxygen consumption, nutritional assessment. The trainee should be able to apply the physiological knowledge to problems of chronic heart or respiratory failure and difficulties with weaning from inotropes or

ventilators

The trainee requires knowledge of applied physiology of the hepatic, exo- and endo-crine systems and the changes in chronic and acute disease. Aspects include the consequences of endocrine and exocrine under- or over activity (e.g. gut failure, thyrotoxic crisis). The physiology of coagulation (and its congenital diseases). Application of this knowledge should include the means of assessment of organ function, using dynamic testing e.g. liver (MEGX), gut (lactulose/mannitol, xylose), thyroid (TSH)

PHARMACOLOGY

The trainee should now understand the consequences of the deranged pharmacokinetics and pharmacodynamics of critically ill patients and should apply this knowledge to the practicalities of prescribing in the ICU. The trainee should now recognise the consequences of the use of therapies designed often for short term use in metabolically normal patients, and that new problems or side effects will be uncovered related to the drug or its cogeners (e.g. solubilising agents, solvents). The trainee must now know how to acquire information about new agents, or side effects (including overdose) of those drugs in use

The trainee's pharmacopoeia is now wide and must include drugs used in:

1) cardiopulmonary resuscitation, including second and third line drugs (magnesium, esmolol)
2) local anaesthesia (including opioids for extradural and intrathecal use)
3) cardiovascular support or control
    1) inotropes (including sympathomimetics, phosphodiesterase inhibitors, glucagon, digoxin etc)
    2) vasodilators (nitrates, sympathetic blockers, central blockers, calcium channels blockers)
    3) vasoconstrictors (sympathomimetics)
    4) antiarrhythmics
    5) diuretics
4) respiratory support
    1) oxygen and therapies
    2) respiratory stimulants
    3) bronchodilators
    4) nitric oxide, almitrine, prostacycline
5) analgesics
    1) opioids
    2) NSAIDS
    3) unusual agents e.g. clonidine, amitryptiline, tramadol
6) sedatives
    1) benzodiazepines
    2) anaesthetic induction agents used for continuous infusion
7) anti-epileptic agents (including those for continuous infusion or second line drugs)
8) antidepressants
9) major tranquillisers
10) anaesthetic agents
    1) induction agents
    2) inhalational agents (desflurane, sevoflurane, isoflurane)
    3) neuromuscular blocking agents (depolarising and non-depolarising)
    4) anticholinesterases
        a) neostigmine
        b) pyridostigmine, edrophonium
        c) nerve agents and poisons (sarin)
    5) other antidotes (naloxone, flumazenil)
11) intravenous fluids
    1) blood products
    2) artificial colloids
    3) crystalloids

12) nutritional agents
    1) parenteral: carbohydrates, fats, nitrogen
    2) enteral: including enriched or special preparations (elemental, glutamine, arginine, omega-3 enriched)
    3) vitamins, minerals (micronutrients)
13) steroids
14) first line, second line or unusual antimicrobial agents commonly used on critically ill patients i.e. treatment of TB, protozoa (malaria, PCP) fungi (candida), viruses (herpes) etc
15) a miscellaneous groups of drugs with require dosage/alteration (reduction in critically ill patients) i.e. those whose metabolic pathway involves hepatic or renal excretion e.g. antibiotics, sedatives.
16) pathopharmacology of drugs used socially e.g. cannabis, "Ecstasy", other amphetamines, ketamine, fentanyl derivatives, cocaine, heroin, barbiturates, benzodiazepines
17) pathopharmacology of common or unusual drugs used for self-poisoning including aspirin, tricyclics, lithium, methanol, ethylene glycol, aminophylline, digoxin, anticholinesterases, paraquat
17) gastro-intestinal protectives e.g. H2 receptor antagonists, proton pump inhibitors, sucralfate etc.
18) unusual agents (aprotinin, DDAVP, "Digibind", fomepizole (ethylene glycol))

CLINICAL SKILLS

The trainee should now have competence in examining and assessing the critically ill patient, and in interpreting the physiological monitors in the light of those findings. The trainee should be able to synthesise the findings both clinically, and on physiological monitors/charts. This should include cardiovascular, respiratory, neurological and fluid balance. The trainee should be able to recognise inconsistencies and know how to pursue the finding e.g. peripheral oedema with negative fluid balance (chart error or DVT?), high airway pressures and good air entry (uncharted alteration of ventilator) etc.

PRACTICAL SKILLS

The 6 month general trainee should have the following skills:

1) ALS SKILLS
    1) endotracheal intubation#
    2) defibrillation/countershock#
    3) basic vascular access#
2) VASCULAR ACCESS
    1) Seldinger and dilatational techniques for either peripheral or central cannulation#
    2) internal jugular cannulation#
    3) femoral venous access#
    4) intra-arterial cannulation: radial, femoral#
3) RESPIRATORY ACCESS
    1) endotracheal intubation (Grade1, 2 laryngoscopy)#
    2) insertion of laryngeal mask airway#
    3) strategies for difficult or failing airway control or endotracheal intubation with some experience of Grade 3 intubation#
    4) insertion of emergency chest drain#

The following should be learnt
    a) setting up of basic monitoring equipment: NIBP, pulse oximeter, pressure transducer (and associated kit)#
    b) subclavian vascular access for insertion of multiple large vascular catheters: pulmonary artery catheters (PAC), haemodialysis/filtration lines, pacemakers#
    c) insertion of a PAC (and interpretation of findings)#
    d) bronchoscopy (fibre)#

e) naso-tracheal intubation
f) fibreoptic laryngoscopy
g) insertion of Sengstaken Blakemore tube
h) tracheostomy (mini-, percutaneous, {surgical if surgeon})
i) insertion of pacemaker
j) pericardial aspiration (if possible)
k) paracentesis/insertion of peritoneal dialysis catheter/washout (ATLS)

(# competence at 6 months required)

The following should be observed:

1. transfer & transport of critically ill patients (requiring at least IPPV and invasive monitoring) within and between (intra/inter) hospitals
2. airway control in paediatrics
3. airway control in neonates
4. vascular access in babies (including interosseous infusion)
5. renal replacement therapies including haemodialysis and haemofiltration (and its variants)
6. plasma exchange
7. bronchoalveolar lavage
8. insertion of naso-jejunal tube
9. insertion of PEG/PEJ
10. insertion of ICP monitoring device
11. cardiopulmonary bypass in adults
12. brain stem death testing
13. organ retrieval
14. imaging of critically ill patients in unusual environments (computed tomography (CT) and magnetic resonance imaging (MRI) suites
15. lung biopsy

CLINICAL MANAGEMENT PLANNING

The trainee should, by the end of this period, be able to formulate a clear diagnostic trail for the diagnosis of individual organ failures e.g. insertion of PAC and interpretation of derived parameters, and then set up a targeted treatment plan. The plan should be such that it can be delivered throughout a 24-hour period i.e. can be implemented despite changes in staffing skills and availability.

Plans should be able to be drawn up for complex 3 or more organ failures. The trainee should understand the controversies or contradictions of therapies for complex organ failure e.g. need for fluid loading in incipient renal failure when the patient has a lung permeability defect e.g. ALI

USE OF RELEVANT TECHNICAL EQUIPMENT

The trainee should understand the use of:

1) ventilators (and ventilatory techniques) in use in the ICU (IPPV, IRV, BIPAP, PSV, APRV, PEEP, prone positioning)#
2) routine weaning techniques included in ventilators (IMV, SIMV, PSV, BIPAP, APRV)#
3) routine non-invasive monitoring equipment#
4) routine invasive monitoring equipment#
5) cardiac output monitors#
6) transport ventilators and other transfer equipment#
7) CPAP systems#
8) laboratory equipment for measurement of blood gases, electrolytes, coagulation#

(# competence at 6 months required)

The trainee should be shown how to use :

a. renal replacement (haemofiltration, haemodialysis and similar equipment)
b. high flow blood infusion equipment (Level 1)
c. bronchoscope injectors
d. jet ventilators and oscillators (if available)
e. double lumen endotracheal tubes
f. warming and cooling equipment (blankets, mattresses (air/water)
g. MAST (or equivalent) suits

The following should be demonstrated to the trainee:

1) echocardiography: transthoracic & oesophageal
2) USS examination of abdomen and guided aspiration
3) ultrasound diagnosis of DVT

The trainee should tour the haematology, pathology and microbiology laboratories and shown the technology/techniques used when dealing with routine specimens received from the ICU. Examples include Coulter counter, coagulation measurement, multichannel chemistry analysers (SMAC), routine plating and microscopy of sputum, urine etc. Laboratory specialist techniques may also be of interest e.g. examination of BAL

INFORMATION TECHNOLOGY & COMPUTER SKILLS

The trainee should be competent in use of word processing, and database management, and use at least one graphics package. The trainee should be able to create and interrogate small databases used for simple audit.

It is sensible for the trainee to become familiar with a major statistics package e.g. SPSS

KEEPING UP & PRESENTATION

The trainee should demonstrate that information technology is being mastered. Presentations should be made with up to date information within 1 week of request. The trainee should be able to present with some skill straightforward case reports or reviews using overheads driven by computer graphics

The trainee should be prepared for a range of professional examinations: The means of examination may include writing, OSCEs, vivas and for the Diploma of Intensive Care Medicine, a dissertation. Guidance on professional writing should be obtained during this period, this guidance differing from that used for examination essay writing.

The trainee should be shown the essentials of professional letters writing and report writing.

During this period, trainees intending to sit the Diploma should begin assembling their dissertation, and considering examples of cases for the ETR

PHYSICS & MEASUREMENT

The trainee must gain sufficient grounding in physics as to be able to understand aspects of physiology (e.g. flows of gases and liquids) and measurement (e.g. measurement of pressure, damping, resonance) as is needed for care of the patient. The physics grounding must be of sufficient depth to enable the trainee to recognise measurement error.

Aspects to be covered include:

1) Pressure, volume and the gas laws
2) Physics of flow of gases and liquids
3) Electro magnetic radiation
4) Electrical energy
5) Sound and vibration
6) Recording equipment and signal processing
7) Measurement of flow and volume
8) Measurement of pressure in gases and liquids
9) Statistics relevant to intensive care

As a result of this background the trainee should have sufficient understanding of the following equipment to be aware of its problems and pitfalls (this is separate from the need to understand how to use it).

VENTILATORS
Airway pressure and flow measurement (low pressure transducers, siting of transducers, pneumotachographs and simple flow meters)
Metabolic measurement (VO_2, VCO_2)
Mechanics measurements (including p0.1)
Oxygen blenders and measuring devices (pressure regulators, paramagnetic analysers, polarographs, fuel cells etc)

CARDIOVASCULAR EQUIPMENT
Transducers (damping, resonance, signal degradation, zero drift and calibration)
Sphygmomanometry and oscillotonometry
Cardiac output measurement (dye, thermal (heat & cold), thermal dye, impedance, echo, ultrasound transoesophageal (Doppler))
Flow measurement (Doppler, electromagnetic)
Pulse oximetry

ICU LABORATORY PHYSICS and MEASUREMENT
PO_2, PCO_2 and pH electrodes
Transmission (Co-)oximetry
Ion selective electrodes (sodium, potassium, chloride calcium)
Lactate
Photo electrodes
Oncometry
Osmometry

IMAGING EQUIPMENT outside ICU
Ultrasound
X-ray and CT
MR

SPECIALIST DISEASES AND SYNDROMES

The trainee must have specific knowledge of a number of syndromes or diseases where the severity or symptom complex causes the patient to be admitted to the ICU.

A) ORGAN SYSTEM FAILURES (ACUTE or ACUTE on CHRONIC)
1) Respiratory failure
2) Cardiovascular failure
3) Renal failure
4) Hepatic failure
5) Brain failure

6) Coagulation failure
7) Gut failure
8) Immunological failure

B) SPECIFIC SYNDROMES or COMPLICATIONS
1) Sepsis
2) ARDS
3) Massive transfusion
4) Hypothermia
5) Post cardiopulmonary arrest management
6) DIC

C) SPECIALIST DISEASES commonly needing Intensive Care
1) polyneuropathies (GBS, CIP)
2) tetanus
3) botulism
4) myasthenia (including Eaton Lambert, and muscle relaxant myopathy)
5) poisonings (tricyclics, ecstasy, lithium, aminophylline, paracetamol, methanol, ethylene glycol, beta blocker, calcium channel antagonist, digoxin,)
6) purpura fulminans (and meningococcal septicaemia)
7) epiglottitis (including adult)
8) DIC (cause indeterminate)
9) necrotising fasciitis
10) Goodpasture's syndrome and HUS
11) burns (respiratory)
12) malignant hyperthermia and heat stroke
13) diffuse head injury
14) COLD
15) sleep apnoea (and surgery)
16) thyroid storm
17) myxoedema
18) Addison's disease
19) phaechromocytoma
20) malaria
21) status epilepticus
22) eclampsia/PET/HELLP

The trainee must know the methods of and indications for:

1) RESPIRATORY SUPPORT
- institution of airway control#
- institution of IPPV#
- PEEP#
- weaning and techniques#
- tracheostomy#
- *indications* for unusual support (ECMO, transplant)#

2) CARDIOVASCULAR SUPPORT
- invasive monitoring#
- PAC insertion#
- cardiac output monitoring and control#
- use of inotropes, constrictors, dilators#
- pacemaker insertion/arrhythmia control
- *indications* for balloon pumping

3) RENAL REPLACEMENT THERAPIES
- PD
- C(A)-(V)-(V)-H-(D)#
- HD#
- haemoperfusion
- plasma pheresis or exchange

4) NUTRITIONAL SUPPORT
- EN# (including post-pyloric nutrition)
- PN (TPN)#
- metabolic measurement
- enterostomy
- hormonal manipulation

5) HEPATIC SUPPORT
- variceal therapies#
- coma treatment & support#

6) BRAIN SUPPORT
- control of ICP#
- triple H therapy
- vasomotor manipulation
- brain (stem) death testing

7) HAEMATOLOGIC SUPPORT
- therapies of massive bleeding (component therapy, fibrinolysis control e.g. aprotinin etc)
- blood substitutes
- haemodilution

competence at 6 months required

INTRA HOSPITAL TRANSPORT AND TRANSFER

The trainee should become familiar with the problems of transport
1) the physiological consequences of movement (acceleration)
2) the environmental problems (space, vibration, temperature) on the patient and transport equipment
3) minimal monitoring and transfer
4) pre-transfer assessment and resuscitation
5) routine in-transfer care
6) choice and problems of transfer and transport equipment
7) in-transfer emergency care

The trainee should be able to manage patients in unusual environments *within* the hospital e.g. darkened imaging suites (e.g. angiography, ultrasound), CT machine, and magnetic environments (MR).#

The trainee should be able to collect and further resuscitate patients due for transfer from resuscitation areas wherever found in the hospital, although most commonly the CCU, the A&E department and theatre anaesthetic rooms, operating theatres or recovery areas. The trainee should have competence in these areas.#

If possible the trainee should observe the paramedic system in action at the roadside to gauge the problems of retrieval, resuscitation and monitoring ("stay-play-monitor-stroll/run" versus "scoop-run-and-hope").

competence at 6 months

IMAGING

Trainees should receive tuition in interpretation of a variety of images. As a minimum this must include interpretation and commentary on:
1) the portable CXR: supine and erect#
2) the departmental CXR#
3) plain abdominal films: supine, erect and lateral#
4) cervical spine X-ray#
5) lumbar spine
6) pelvis
7) long bones
8) lateral skull
9) CT brain#
10) CT thorax#
11) CT abdomen (kidney, pancreas)
12) transthoracic echo cardiography to demonstrate pericardial effusion#
13) transthoracic echo cardiography to show dyskinesia, vegetations, dilated ventricles
14) trans oesophageal echo cardiography to demonstrate ventricular functional failure
15) ultra sound abdomen showing biliary tract abnormalities (obstruction) and subphrenic collections#
16) ultra sound abdomen showing pancreatic swelling/pseudocyst/abscess#
17) ultra sound abdomen showing renal outlines and urinary tract#
18) Doppler ultra sound showing blood flow to brain (carotid), kidneys, gut
19) Doppler ultra sound examination to exclude/diagnose venous obstruction/thrombosis of subclavian, internal jugular, femoral, popliteal veins (DVT)
20) dipyridamole-thallium scanning
21) ventilation-perfusion scanning#
22) labelled white cell scanning
23) pulmonary angiography
24) coronary angiography
25) mesenteric/splanchnic angiography (for bleeding)

competence in reviewing at 6 months

AUDIT

The trainee should become closely involved and undertake basic audits. Training ICUs will have extensive records of value in audit trails. The trainee should become involved in quality assurance of this data.

The trainee will be instructed in the basic audit trail in the unit, usually by the audit assistant. At least one major audit system (e.g. APACHE) will be demonstrated, and the trainee expected to deliver an audit based from this database

THE THIRD (SPECIALIST) PERIOD TRAINEE: TRAINING FOR THE CONSULTANT WHO INTENDS TO SPEND THE MAJORITY OF TIME PRACTICING INTENSIVE CARE MEDICINE

Training cannot be structured in the same way as for the first two exposures. The purpose of this period is to build on previous exposure and to fill in gaps but at the same time commence speciality training in Intensive Care Medicine

The trainee should gain experience in specialist (as opposed to general) ICUs, recognising that many general ICUs also look after specialist problems.

The specific areas of specialty exposure are:
1) Neuro
2) Cardiac
3) Paediatric
4) Liver
5) Trauma
6) Follow up clinics
6) Neonate (purely for observational purposes)

The trainee should also develop insights into aspects of high dependency care and its interface with the intensive care.

At this stage in training, considerable self-directed learning is needed to upgrade the knowledge and practical experience of the modules already gained and to develop special areas of competence. Areas of competence should include special procedures (e.g. echocardiography) or special illness complexes (e.g. meningococcal septicaemia): these areas may be driven by a research interest e.g. incidence of myocardial contusion following blunt chest trauma requires skill in echocardiography etc. The number of trainees should be few and individual programs should be tailored.

INFORMATION TECHNOLOGY & COMPUTER SKILLS

The trainee must be competent in computer skills necessary to provide both clinical and management information. A trainee director should be prepared to set up a home page on the Internet, acting as a local or national resource for at least one aspect of care.

MANAGEMENT and allied TRAINING

This part of the third exposure cannot be neglected despite extremely strong clinical pressures: a consultant expected to spend the majority of time in the intensive care unit must be an able manager at appointment. As a result a significant period must be spent gaining managerial experience. This will require external course work together with the standard "shadowing" techniques routinely used in management training. Management skills to be learnt include business planning, budgeting and simple accountancy, staffing, NHS (or Trust) structures, time management, managing meetings, managing conflict etc.

The trainee should begin assembling protocols and guidelines necessary for the future role in clinical management of patients. The trainee should recognise that the role will include training future trainees at least the first and second exposure levels and must begin preparations, often using in-house presentations as test-beds for future teaching