



EFSUMB

EUROPEAN FEDERATION OF SOCIETIES FOR ULTRASOUND IN MEDICINE AND BIOLOGY
'Building a European Ultrasound Community'

MINIMUM TRAINING REQUIREMENTS FOR THE PRACTICE OF MEDICAL ULTRASOUND IN EUROPE

Appendix 13: Intensive Care Ultrasound

This curriculum is intended for physicians who perform intensive care ultrasound scans. Because this usually is a focused assessment, herein only special aspects concerning intensive care ultrasound are discussed. For regular examinations of organ systems requirements can be found in the respective syllabi / recommendations.

This curriculum includes standards for theoretical and practical skills. Standard skills are graded into 3 levels based on experience and difficulty of the scan or procedure. A level 1 competence should be obtained by anyone performing intensive care ultrasound.

Level 1 Training and Practice

- It is recommended that trainees should perform a minimum of 300 examinations over a 6 month period under supervision. This training should be supervised by a Level 2 Practitioner. In certain circumstances it may be appropriate to delegate some of this supervision to an experienced Level 1 Practitioner with at least two years of regular practical experience. However trainees will acquire the necessary skills at different rates and the end point of training should be judged by an assessment of all competencies. Examinations should encompass the full range of conditions listed in the knowledge base.
- During the course of training the competency assessment sheet should be completed as this will determine in which area or areas the trainee can practice independently.
- A log book, listing the types of examinations undertaken, should be kept.
- The trainee should learn how to communicate both normal and abnormal findings to the patient, the family of the patient and to colleagues.
- The trainee should attend a course program preferably at the beginning of the training period. This should include a basic course and an advance course. He or she should read appropriate textbooks and literature.

Level 1 Knowledge Base

Physics and technology, ultrasound techniques and administration, psychological aspects, ethical aspects and quality control.

Approaches to:

- Basic thoracic ultrasound
- Basic abdominal ultrasound for intensive care physicians
- Basic vascular ultrasound for intensive care physicians
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In detail:

- chest: pleural effusion, pneumothorax, pericardial effusion
- abdomen: free fluid (ascites), gall bladder stones and bile ducts occlusion, splenic enlargement, hydronephrosis, stomach and bowel distension.
- vascular: aortic aneurysma, thrombosis of central veins for CV catheterizations, occlusion of arteries for invasive blood pressure measurements.
- Invasive procedures: puncture techniques under ultrasound guidance

Level 1 Competencies to be acquired

- Lung: Detect pleural effusions with ultrasound, be able to compare findings by ultrasound with other imaging modalities of the thorax. Be able to depict the pleural space (motion of the pleura) and to perform basic scans of lung ultrasound with regard to its pathologic changes.



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- Abdomen: Recognize: hepatic and portal venous anatomy, abnormalities of the gallbladder, size of the spleen, intestinal obstruction, normal or full stomach, free fluid or fluid collections, hydronephrosis, aortic abnormalities.
- Heart: Recognize: volume overload or depletion, diameter of the vena cava, right and left ventricular size, pericardial effusion
- Vascular: ultrasound guided vascular access: central venous and arterial pressure lines (IJV, subclavian and femoral vein, radial and femoral artery).

All: understand the principles for further investigation of more comprehensive assessment or the need to call for more experienced physicians.

Level 2 Training and Practice

A period of at least 1 year after having acquired level 1 competency should be accomplished which should include:

- A minimum of 500 ultrasound examination per year.
- 300 clinical interventional procedures in a centre under the supervision of at least a level 2 practitioner.
- completed clinical residency
- during the course of training the competency assessment sheet should be completed.

Level 2 Knowledge Base

Intensive Care Ultrasound Training Competency

- Diagnosis of basic problems in thoracic abdominal ultrasonography, vascular anatomy and pathology e.g. cardiac insufficiency (heart failure), valve dysfunctions and their impact on organ manifestations, respiratory insufficiencies and emergencies that require prompt treatment
- Interventional procedures, e.g. vascular access, thoracic access, abdominal access, regional anaesthesia blocks
- Technologies and interventional procedures in the use of ultrasound
- Role of ultrasound compared to other imaging modalities e.g. magnetic resonance imaging, CT scan etc.

Level 2 Competencies to be acquired

The level 2 intensive care physician should be able to diagnose and treat intensive care emergencies fast and successfully. This includes invasive puncture techniques in all relevant organ systems in the setting of an ICU.

- Heart: be able to detect: Fast focused and more comprehensive than level 1 competency exam of the heart (apical, parasternal, subcostal view - all transthoracic): Recognize signs of pulmonary embolism (RA/RA dilation and dysfunction, tricuspid regurgitation, mid-to severe pulmonary hypertension, possibly opening of PFO with right to left shunt); differential diagnosis of hyperdynamic left ventricular function (LV underfilling, increased contractility, decreased afterload), perform a comprehensive regional wall motion assessment (this includes 3 different levels - basal, mid and apical- of the parasternal view), assess the amount of pericardial fluid in regard with cardiac contractility and the understanding of surgical intervention, assess the respiratory variation of the inferior vena cava (this includes 2D and M-mode). Be able to treat and adapt heart failure with catecholamines or other inotropic substances based on regular heart examination by ultrasound.
- Lung: be able to drain pleural effusions with prior measurement of the pleural effusion extend or direct drainage with ultrasound guidance, detect a (tension-) pneumo- or hemothorax and to place chest tubes, to recognize ultrasound signs of ARDS, lung edema, detect abnormalities of the diaphragm, to detect and differentiate subpleural lung consolidations



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- Abdomen: Compared to level 1 competency perform a more comprehensive ultrasound examination of the abdomen including all solid organs within the abdomen. To be able to perform ultrasound guided drainage of peritoneal fluid collections, in the pelvic cavity be able to place suprapubic catheters with ultrasound guidance, measure and detect masses, hematoma or fluid collections in the pelvic cavity.
- Vascular: Be able to perform ultrasound guided vascular access of all possible site (including catheterization of the innominate vein, radial and ulnar artery at the level of the mid-forearm, brachial artery). Recognize: reverse flow and steal phenomena of the carotid vessels, occlusions of veins and arteries, aortic aneurysms, fistula and understand the principle of surgical intervention
- Other: Percutaneous tracheotomy, peripheral nerve blocks to obtain a sympathicolysis of the extremities

Level 3 Training and Practice

At Level 3 Practitioners are likely to spend the majority of their time in intensive care medicine also undertaking ultrasound processing and/or teaching, research and development and will be an 'expert' in this area.

Maintenance of Skills: All Levels

Having been assessed as competent to practise there will be a need for continued medical education (CME) and continued professional development and maintenance of practical skills.

Practitioners should:

- Include ultrasound in their ongoing continued medical education (CME) and continued professional development (CPD)
- Audit their practice
- Participate in multidisciplinary meetings
- Keep up to date with relevant literature

An intensive care specialist will need to continue to perform ultrasound scans throughout the remainder of the training programme. Such further ultrasound practice may be intermittent, but no more than 3 months should elapse without the trainee using his/her scanning skills.

A medical practitioner scanning

- at Level 1 should perform at least 300 ultrasound examinations per year and have regular meetings with ultrasound colleagues
- to maintain level 2 status the practitioner should perform at least 500 examinations per year,
- at Level 3 the practitioners are supposed to spend much of their time in ultrasound research and education practices in addition to clinical scanning.

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APPENDIX 13: INTENSIVE CARE ULTRASOUND ASSESSMENT SHEET

Trainee



Trainer



LEVEL 1 Knowledge Base & Recommended Contents of Theoretical Course

A basic and advanced course is required preferably at the beginning of the training period. This should include:

- Physics and technology, ultrasound techniques and administration, lung ultrasound, cardiac ultrasound, abdominal ultrasound and vascular ultrasound for intensive care
- Diagnostic procedures
- Invasive procedures: Puncture techniques under ultrasound
- Psychological aspects
- Ethical aspects
- Quality control

Competencies/Skills to be acquired Level 1

A formal theoretical and practical examination should take place at the end of training. To be competent to perform/diagnose etc the following competence is demanded:

	Trainer Signature	Date		Trainer Signature	Date
Systematic examination of the abdominal area			Systematic examination of the vascular system		
• Stomach	_____	_____	• Vascular systematics of arteries and veins	_____	_____
• Liver and gallbladder	_____	_____	• Flow measurements	_____	_____
• Vessels	_____	_____	• Interventional procedures for vessels	_____	_____
• Kidneys, spleen	_____	_____			
• Urinary Bladder	_____	_____			
• Intraoperative area	_____	_____			
 Systematic examination of the thoracic area					
• Lung: normal lung and atelectasis, pneumonia, edema	_____	_____			
• Pleura : normal pleura effusion/ pneumothorax	_____	_____			
• Diaphragma	_____	_____			
• Pericard: normal pericard and pericardial effusion	_____	_____			
• Demonstration of the cardiac function	_____	_____			
• Demonstration of the function of the valves	_____	_____			

A log book of documented cases should be kept.

APPENDIX 13: INTENSIVE CARE ULTRASOUND ASSESSMENT SHEET

Trainee



Trainer Signature

Date

Trainer



Trainer Signature

Date

Level 2 Knowledge Base & Recommended contents of Theoretical Course

• Technologies and interventional procedures in the use of ultrasound

• Safety of ultrasound

• Literature search, internet databases, etc.

• Role of ultrasound compared to other imaging modalities, e.g. magnetic resonance imaging CT Scan etc.

• Diagnosis in thoracic, abdominal ultrasonography, vascular anatomy and pathology

• Interventional procedures, vascular access, thoracic access, abdominal access, regional anaesthesia blocks

• Quality control

• Psychology and ethics

Competencies/Skills to be acquired Level 2

Be able to: Diagnose intensive care emergencies and have knowledge of their management: critical cardiac emergencies, critical pulmonal emergencies and critical abdominal emergencies.

I) Produce sufficient and fast diagnosis in all relevant organ systems

• Abdominal US : ascites, free fluid

• diagnosis of vascular aneurysms

• Thoracic US : pneumo- or hemothorax, ARDS, edema of the lung, subpleural lung consolidations

• Vascular US : thrombosis, embolus, vena cava diameter, doppler-flow

• Nerval US : neuroaxial and peripheral nerve imaging

II) Interventional procedures

• Vascular access in children and adults (both venous & arterial)

• Vascular access for different instrumentations (ECMO, balloon-pump)

• Pleural puncture and pericardial puncture

• Abdominal procedures (puncture of ascites, urinary bladder)

• Puncture of the stomach for percutaneous gastrostoma placement

• Pre-examination of the trachea for DPT percutaneous tracheotomie

• Pain Management : Single shot or continuous catheter techniques (peripheral or neuroaxial nerve blocks)

The Level 2 Intensive Care Physician should be able to hold a documentation of 200 completed cases.

A log book of well documented cases (e.g pneumothorax, pleural effusion, cardiac examination, abdominal examination etc.) should be kept.