Education of nurses, operators and technicians in hyperbaric facilities in Europe

EBAss/ECHM Resources manual

Brussels – September 2008

Document prepared by
European Baromedical Association for Nurses, Operators and Technicians
EBAss is an international, non profit association
Registered office: 9, Sainte Anne – B 7880 FLOBECQ – BELGIUM
E-Mail: secretary@ebass.org Website: www.EBASS.org

Document approved by
European Committee for Hyperbaric Medicine
E-Mail: office@echm.org Website: www.ECHM.org

Table of contents

Purpose

The purpose of this document is to describe the training, based on the ECHM recommendations, of nurses, operators and technicians working in a hyperbaric facility in Europe.

This document is intended to be a reference document for European countries for guidelines, regulations and standards in hyperbaric medicine.

This document was written by the members of the Education Committee of the European Baromedical Association for nurses, operators and technicians (EBAss).

This document was approved by the European Committee for Hyperbaric Medicine (ECHM) on….

List of authors:
President of Education Committee:
Mc Kenna, Steve (London – UK)

Atkey, Peter (Plymouth – UK)
Campanaro, Valeria (Roma – Italy)
Chandrinou, Angeliki (Athens – Greece)
Damiens, Didier (Lille – France)
Geels, Judith (Amsterdam – The Netherlands)
Houman, Rob (Brussels – Belgium)
Kanstinger, Andreas (Murnau – Germany)
Kelner, Bert (Amsterdam – The Netherlands)
Ruggiu, Alberto (Cagliari – Italy)
Salarbux, Sheida (Amsterdam – The Netherlands)
Tzavellas, Damienos (Athens – Greece)
Van der Tol, Max (Amsterdam – The Netherlands)

1. Responsibilities

Ref: ECHM

Operators

- Operation of the internal and external devices of the Chamber.
- Control and operation of the mechanisms for compression and decompression, and for delivering gas mixtures and oxygen.
- Control and application of the safety regulations concerning prevention of fire, and oxygen toxicity.
- Calculation, application and control of compression and decompression schedules for all chamber occupants, applying decompression stops, when necessary.
- Be available for intervention inside the Chamber under pressure, in order to control or check the correct operation of determined parts of the circuits or devices.
- Adaptation and checking of the medical instruments carried by the patients before being introduced into the Chamber, in order to ensure their correct operation, and to avoid dangerous or undesirable effects.
- Control and checking of the operation of auxiliary facilities to the Chamber: air-compressors, sources of compressed air or medical gases, gas/air reserves, pneumatic circuits, control systems etc.
- Maintenance of the facility. Small repair jobs or technical interventions due to problems which occasionally might occur, and which do not require the intervention of highly specialised technical staff.
- Safe handling of technical emergency situations.
- Check the calibration of technical equipment relating to the hyperbaric facility.
- Steering, Controlling and documentation of the HBO-Treatment according to prescribed procedure.
- Duties in emergency situations (locking in and out of personnel).
- Adherence to national law of the appropriate member state.

Nurses

- Nursing measures belonging to the common pathologies of the Hyperbaric therapeutics to be applied to the patients in a hyperbaric chamber.
- Nursing assistance of patients inside the hyperbaric chamber, taking special care of the specific conditions of the hyperbaric environment.
- Where possible adaptation of conventional medical techniques and specific treatments of each illness to the hyperbaric environment, so that

other treatments the patient is habitually receiving will not need to be interrupted while in the chamber.

- In some cases, operating the external controls of a Monoplace Hyperbaric chamber according to the compression and decompression schedules established.

Care of patients including sporadic emergency treatments conducted either inside or outside of HBO chamber.

Nurses intensive care

Nursing assistance of intensive critical care patients during hyperbaric treatment.

Attendants NOT nurses:

- Patient care in non invasive, non-specialised medical activities inside and outside the chamber.
- Accompanying patients who are receiving treatment inside the Multiplace Chamber, but who do not need special assistance by doctors and nurses, but only by way of support, control, and to give them confidence.
- Other activities to develop inside or outside the Chamber, indicated by the Medical Director or the Nurse.

2. Entry levels

	Precondition	Competence will be lost	Recovering
Common Module for Chamber Operators and hyperbaric nurses (attendant)	- medically fit for working under hyperbaric conditions - Current Basic Life Support certificate (BLS) or higher (max. 1 year old)	If the individual does not progress to the appropriate specialist module within 12 month after graduation	
Specific Module for Chamber operator	succesfull graduation of „Common Module …" medically fit	- Carries out less than 10 hyperbaric procedures or simulations a year, to operate under supervision - And carries out less than 10 hyperbaric treatments a year with patients, to operate autonomous. - no participation on a BLS course according to the European Resuscitation Council guidelines - Has not been working in a hyperbaric chamber as an operator for more than 5 years	- 10 autonomous steered treatments (under supervision). - participation on a BLS course according to the European Resuscitation Council guidelines - participate in hyperbaric operator training (hyperbaric operator module only)

Specific Module for Hyperbaric Nurse (Attendant)	- medically fit for working under hyperbaric conditions - nursing qualification - succesfully graduation „Common Module …" except in the case of recertification	- no participation on a BLS course according to the European Resuscitation Council guidelines - Has not been working in a hyperbaric chamber as a nurse for more than 5 years	- participation on a BLS course according to the European Resuscitation Council guidelines - participate in hyperbaric nurse training (hyperbaric nurse module only)
Specific Module for Hyperbaric Nurse in Intensive Care (attendant)	- medically fit for working under hyperbaric conditions - registered nurse (RN) - current qualification depending on the member states national legislation for accompany of intensive care patients - successful graduation „Module Hyperbaric Nurse"	- If the HNIC does not have the required ICU Nurse experience within the previous 18 months - If the HNIC does not work as an ICU nurse inside a hyperbaric chamber within the previous 18 months - no participation on an ALS course according to the European Resuscitation Council guidelines	- current requalification depending on the member states national legislation for accompany of intensive care patients - participate in HNIC training (HNIC module only) - participation on an ALS course according to the European Resuscitation Council guidelines
Module for hyperbaric attendant (Not Nurse)	- medically fit for working under hyperbaric conditions - Current Basic Life Support	- attends less than 10 hyperbaric-treatments a year inside the chamber with	- attends at least 3 hyperbaric treatments under supervision - participation on a BLS course ac-

	certificate (BLS) or higher (within the previous 12 months)	patients - no participation on a BLS course according to the European Resuscitation Council guidelines	cording to the European Resuscitation Council guidelines

3. The modules of education

3.1 Common Module for Operators and hyperbaric nurses (attendant)

Theory	Level	Practical	Level
Overview	L1	**Hyperbaric chamber and devices**	L2
Types of hyperbaric facilities		Set up of chamber	
History of hyperbarics		Driving chamber - pressure increase	
Hyperbaric facility organisation		Pressure decrease	
Basic Technical overview		Patient problems	
Hyperbaric Chamber Technology	L1	Locking (personnel and materials)	
Basic chamber technology		Built in breathing system (BiBS)	
Hygiene		Breathing masks and Hood-tent	
Generation of compressed Air (low and high pressure)		Illumination and communication	
Oxygen supplies, Handling of oxygen		Disinfection of chamber and associated devices	
Oxygen Hazards		Post treatment shut down	
Electrical supplies, routine and emergency		**Patient education**	L2
Physics and Physiology in a hyperbaric environment	L2	Introduction into general rules	
Concepts of pressure		Fitting of the breathing mask	
Boyle, Dalton, Henry, General Gas Laws: Pressure/Volume/Temperature etc.		Behaviour during chamber treatment	
Physio- and Pathophysiology under hyperbaric conditions	L2	Behaviour in emergency situations	
Air filled cavities, Pressure equalisation, Barotrauma, Oxygen toxicity, Arterial Gas Embolism, Decompression Illness.		Prohibited items and devices	
Monitoring	L1		
ECG, NBP, TcPCO2/TcPO_2, ExO_2 & CO_2		**Emergency training**	L2
O_2-Monitoring of the Chamber		Manual Handling	
Relative Humidity		CPR within a chamber	
Safety		Fire	
Risk Assessment and Management	L2		
Fire Protection	L3		
Prevention by limiting materials entering chamber			
Clothes and other possible fuels			
Procedures in case of fire			
Fire extinguishing systems			

Practice of fire extinguishing **Treatment profiles and decompression tables for patients and personnel**	L1	Evacuation	
Total: 16 Hr		Total: 16 Hr	

3.2 Specific Module for Chamber operator

Theory	Level	Practical	Level
Control panel Chamber steering, Chamber monitoring, Computer control, manual steer , Steering at the pneumatic control panel Communication, Video monitoring O_2, CO_2, Temperature & Relative Humidity – Monitoring, Patient Monitoring	L3	**Hyperbaric chamber** Daily checking, Starting and tag-out Set up of the hyperbaric chamber Steering of the chamber (Computer, manual, pneumatic) Documentation of the HBO-treatment Take care of an ASA 1 (otherwise healthy) patient, Locking (personnel)	L3
Prescriptions and documentation Awareness of relevant national laws Records of chamber operations Equipment maintenance records	L3	**Maintenance of the chamber** Technical failures, (emergency power supply), Built in breathing system (BiBS), Technical monitoring, Compressors, Emergency power supply	L3
Clinical-HBO Therapeutic effects of the HBO Indications	L2	**Recognition and necessary behaviour in emergency situations** Medical Emergencies (infiltrate and exit of personnel), Obscure operating states (in case of fire, loss of computer control, loss of gas supply etc.)	L3
Complications Barotrauma, Oxygen-Intoxication	L3	**Depending on the job activities** Carrying out of more than 30 hyperbaric treatments	
Total: 16 Hr		Total: 32 Hr	

3.3 Specific Module for Hyperbaric Nurses (Attendant)

Theory	Level	Practical	Level
Effects of the HBO Therapy and oxygen Oedema reduction by vasoconstriction 'Squashing' of gas bubbles in case of gas embolism, Bacteriostatic effects (anaerobic organisms), Competitive displacement of CO Activation of fibroblast proliferation and collagen synthesis, Activation of osteoclasts Angio-neogenesis, Activation of macrophages	L2	**Pre-examination of patients** Suitability for HBO-Treatment (ECG, Pulmonary function etc.)	L3
		Practice of assisting patients with HBO-Treatments Before treatment Preparation of the chamber, Checking patients During treatment Accompanying of patients, Caring during chamber treatment Specification of medication under hyperbaric conditions (for example - infusion), Drainage (z.B. Redon, Colostomy etc.) After Treatment Documentation	L3
Physiology of hyperbaric exposure Functional Anatomy, Breathing, Ears Decompression, Thermoregulation, Immersion	L2		
Hyperbaric Pathophysiology and complications Theory of decompression Acute decompression Illness Toxic effects of oxygen (Acute & Chronic) Effects of inert gas (HPNS)	L2	**Emergency training** Practice of resuscitation in hyperbaric environment Infiltrating into the chamber in case of emergency Leading and assistance of patients in event of emergency Behaviour during technical problems	L3
Suitability and contraindications for hyperbaric exposure Patients , HBO-staff	L3		
HBO: Indications by UHMS and ECHM Indication in case of emergency, Approved Uses	L3	Evidence of more than 30 accompanied hyperbaric	

Caring and leading of patients during chamber treatment Psychology, Professional-client relations Nursing & Medical records Patient Care Plans **Hygiene in hyperbaric facilities** Specialities of disinfection in hyperbaric environment Requirements of disinfection and cleaning of the chamber fixtures and fittings MRSA and other infectious diseases in HBO Self protection	L3 L3	treatments under supervision (3 monitored attended treatments during practical training)	
Total: 16 Hr		Total: 32 Hr	

3.4 Specific Module for Hyperbaric Nurses in Intensive Care (attendant)

Theory	Level	Practical	Level
Physiology and Pathophysiology under hyperbaric conditions e.g, Heart-circulation, Lungs, Kidney-function	L3	**Respirators & Ventilators applicable for use under hyperbaric conditions** An awareness of the different types and their capabilities	L3
Extended Monitoring Expiratory oxygen measurement e.g, Online Blood gas analysis, $TcPCO_2$, IBP, Camino-Sonde	L3	**Working practices** at a top level hyperbaric facility	L2
Legal prescription for operation of medical devices in hyperbaric chambers National or EU policies, EN norms,…	L2	**Hygiene** Preparation specialities of breathing devices and accessories	L3
Medication e.g, Effects under hyperbaric conditions, Specific procedures & requirements for giving of medication under hyperbaric conditions	L3	The infectious patient	
Drainage systems e.g, Redon, Bülau, Ventrikel, VAC etc.	L3	**Giving critical intensive care of patients** (incl. 5 accompany of intensive critical care patients) e.g, Cuff pressure control, Bülau-Drainage	L3
Special requirements for mandatory ventilation in hyperbaric environment Volume measurement, Oxygen measurement, Open lung manoeuvre	L3	Intracranial pressure control, Complications	
Case examples and discussion of the examples e.g, CO Intoxication, Burns and smoke inhalation injury, Brain abscess, Anaemia Decompression illness, Emphysema	L2		
Total: 8 Hr		Total: 32 Hr	

3.5 Module for hyperbaric attendant (Not Nurse)

Theory	Level	Practical	Level
Hyperbaric Chamber Technology	L1	**Hyperbaric chamber**	L3
Physics in a hyperbaric environment	L1	**and devices**	
Physio- and Pathophysiology under hyperbaric conditions	L1	- Locking (personnel and material)	
Safety		- Built in breathing	
Fire Protection	L1	system (BiBS)	
Prevention by limiting materials entering chamber	L2	- Breathing masks and Hood-tent	
Clothes and other possible fuels	L2	- Illumination and	
Procedures in case of fire	L2	communication	
Fire extinguishing systems	L2	**Patient education**	L2
Practice of fire extinguishing	L3	**Chamber hygiene**	L2
		Emergency training	L2
Treatment profiles and decompression tables for patients and personnel	L1		
Total: 8 Hr		Total: 8 Hr	

4. Level of Knowledge

Source:
CERTIFICATION SCHEME FOR WELDING AND INSPECTION PERSONNEL
DOKUMENT NO.CSWIP-DIV-9-03
Requirements for General Inspectors of Offshore Facilities
3rd. Edition November 2004
Appendix 1: Examination Syllabus, S. 9
http://www.cswip.com/pdfs/cswipdiv903.pdf

"The level of knowledge required by the candidate varies according to topic. To ensure comprehension by all parties the following terms have been defined to demonstrate an increasing level of knowledge.

DEFINITIONS

OUTLINE KNOWLEDGE:
The candidate must be familiar with the subject in outline terms.
He/She should know that the topic exists and what it is applied to. In the context of hyperbaric methods/techniques the candidate would be expected to know the „what it is, what it does" but would not be expected to know the finer points of application of the technique.

KNOWLEDGE:
The candidate must have a working knowledge of the subject and be able to apply it.

DETAILED KNOWLEDGE:
The candidate must have a depth of knowledge sufficient to enable him/her to exercise judgment."

Level 1 = Outline Knowledge = L 1
Level 2 = Knowledge = L 2
Level 3 = Detailed Knowledge = L 3

5. Resources manuals

Handbook on hyperbaric medicine / Ed. Daniel Mathieu / Springer (HHM)
Recommendations of the ECHM consensus conferences (REC)
European Code of good practice of hyperbaric oxygen therapy (CGP)
EN 14931 (EN)

6. Levels of lecturer's competence

For level 1 (Outline Knowledge) and Level 2 (Knowledge) depending the topic (medical or technical) a recognised operator or nurse, member of a HBO team.

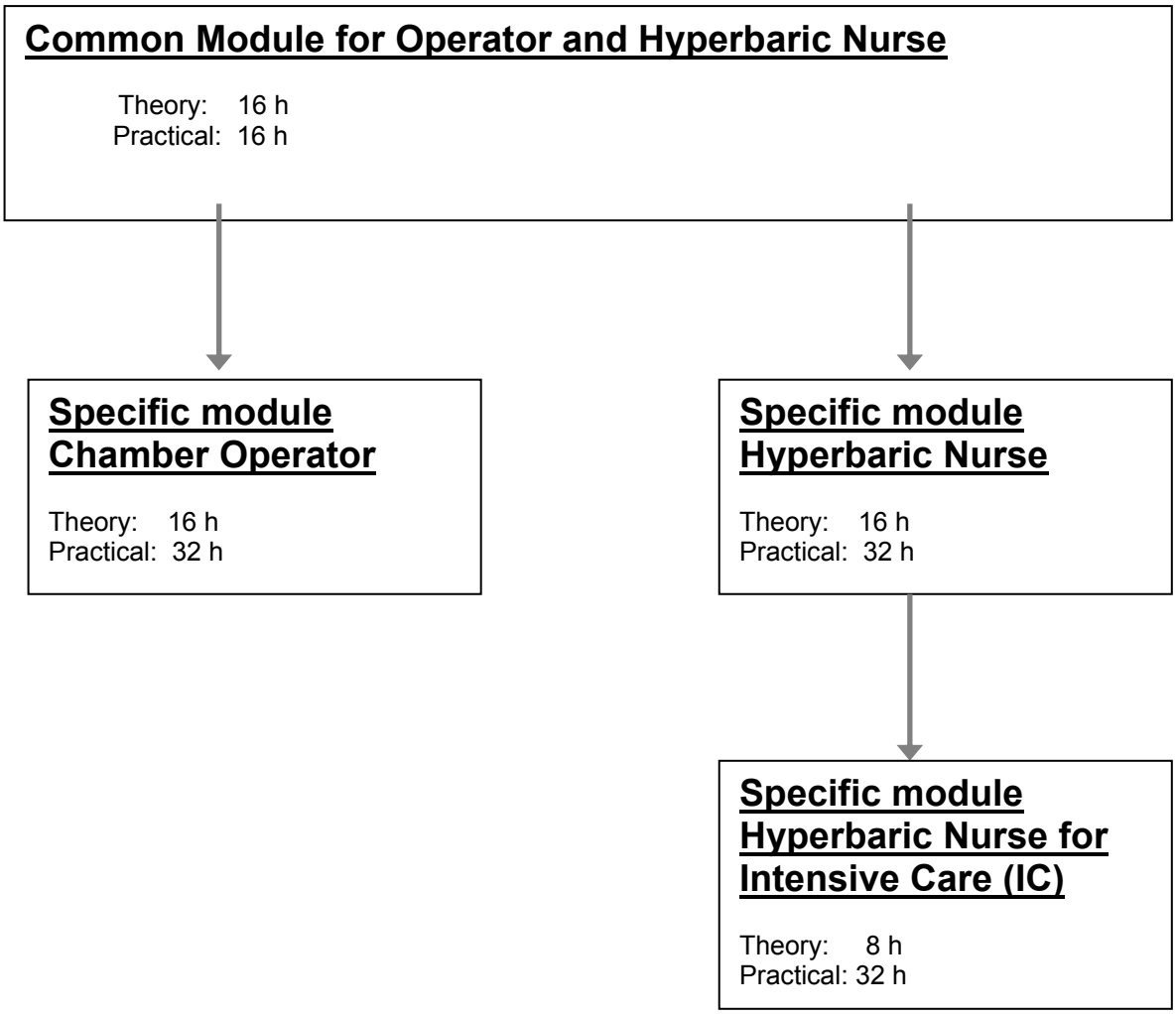
For level 3 (Detailed Knowledge) on medical topic, a hyperbaric physician (ECHM level IIb) or, under the responsibilities of the hyperbaric physician (level IIb), a registered nurse specialised on HBO.
For level 3 (Detailed Knowledge) on technical and safety topics, a safety manager or a medical director (ECHM level III).

7. Examination of the candidates

The examination of the candidate is in two steps: theory and practical.
The theory examination is based on multiple choice questions each with four possible answers as recommended by ECB/EBAss. All questions will be at the required level for the qualification according to the EBAss resource manual.
Before progressing to the practical examination, the candidate needs more than 70% of the points for the theory examination.
The practical examination is a practical situation/problem that the candidate will be required to solve. The recommended situations are listed by EBAss.
Following successful completion of the above the candidate can apply for certification of the ECB/EBAss.

In order to guarantee to the candidates, the same level of knowledge, EBAss recommend the use of EBAss questions and scenario.

Annex: Principles of the Modules



Module for Attendant (not nurse)

Theory: 8 h
Practical: 8 h

European Baromedical Association for Nurses, Operators and Technicians
EBAss is an international, non profit association
Registered office: 9, Sainte Anne – B 7880 FLOBECQ – BELGIUM
E-Mail: secretary@ebass.org Website: www.EBASS.org