

ECHM 7th Consensus Conference (Lille, Dec 3-4, 2004)
Summary of Clinical Indications for HBO Therapy

CONDITION	ACCEPTED			NOT ACCEPTED		
	Level of Evidence			Level of Evidence		
	A	B	C	D	E	F
Type I						
CO intoxication		X				
Crush Syndrome		X				
Prevention of Osteoradionecrosis (dental extraction)		X				
Osteoradionecrosis (mandible)		X				
Soft Tissue Radionecrosis (cystitis)		X				
Decompression Accident			X			
Gas Embolism			X			
Anaerobic or Mixed Bacterial Anaerobic Infections			X			
Type II						
Diabetic Foot Lesion		X				
Compromised Skin Graft and Musculocutaneous Flap			X			
Osteoradionecrosis (other bones)			X			
Radio-induced Proctitis / Enteritis			X			
Radio-induced Lesions of Soft Tissues			X			
Surgery and Implant in Irradiated Tissue (preventive action)			X			
Sudden Deafness			X			
Ischemic Ulcer			X			
Refractory Chronic Osteomyelitis			X			
Neuroblastoma Stage IV			X			
Type III						
Post-anoxic Encephalopathy			X			
Larynx Radionecrosis			X			
Radio-induced CNS Lesions			X			
Post-vascular Procedure Reperfusion Syndrome			X			
Limb Re-implantation			X			
Burns >20 % of Surface Area and 2nd degree			X			
Acute Ischemic Ophthalmologic Disorders			X			
Selected Non-healing Wounds secondary to Inflammatory Processes			X			
Pneumatosis Cystoides Intestinalis			X			
Other indications						
Post-sternotomy Mediastinitis				X		
Stroke				X		
Sickle Cell Disease				X		
Malignant Otitis Externa				X		
Acute Myocardial Infarction				X		
Femoral Head Necrosis				X		
Retinitis Pigmentosa					X	
Tinnitus					X	
Interstitial Cystitis					X	
Facial (Bell's) Palsy					X	
Cerebral Palsy						X
Multiple Sclerosis						X
Fetoplacental Insufficiency						X

Conditions where the use of HBO₂ was supported by level A, B or C evidence were considered as accepted indications.

- **Level A** : At least 2 concordant, large, double-blind, controlled randomized studies with no or little methodological bias.
- **Level B** : Double-blind controlled, randomized studies but with methodological flaws; studies with only small samples, or only a single study.
- **Level C** : Consensus opinion of experts.

In order to make more transparent the jury discussion and decision, conditions which were not considered as accepted indications for HBO₂ are also reported with the Jury's evaluation of the existing evidence. The scale used in this table is an extension of that used for accepted indications.

- **Level D** : Only uncontrolled studies with no consensus opinion of expert = too weak evidence.
- **Level E** : No evidence of beneficial action, or methodological or interpretation bias preclude any conclusion.
- **Level F** : Existing evidence indicates against the use of HBO₂.

Specific Recommendations and Remarks

I - Carbon Monoxide (CO) Intoxication

- Carbon monoxide intoxications must be treated with normobaric oxygen as a first aid treatment (Type 1 recommendation)
- Hyperbaric Oxygen Therapy is recommended in patients with diagnosed carbon monoxide poisoning when at high risk of immediate or long term complications (Type 1 recommendation).
High risk includes :
 - Unconsciousness at or before admission
 - Clinical neurological, cardiac, respiratory or psychological symptoms or signs
 - Pregnant women
- Treatment delayed beyond 24 hours after the last exposure to poison is not recommended if the patient has become symptom-free. (Type 3 recommendation)
- In carbon monoxide poisoned patients not at high risk, there is a choice between normobaric oxygen therapy for 12 hours and HBO2. Until the results of further randomized studies are available, HBO2 remains optional in these patients (Type 3 recommendation).

II – Decompression Accidents

- Decompression Accidents are true medical emergencies that should receive the benefit of specialised treatment in dedicated centres as soon as possible. A specialized centre is considered a hospital-based recompression facility with permanent and adequately trained medical and paramedical staff.
- Treatment of decompression accidents:
 - On-site 100% oxygen first aid treatment (Type 1 recommendation)
 - On-site fluid administration (Type 1 recommendation)
 - After immediate stabilization and medical evaluation, the victims of a decompression accident should be immediately directed to the closest specialized centre (Type 1 recommendation)
 - In water recompression should never be performed as the initial recompression (Type 1 recommendation)
 - Major accidents should be treated with hyperoxygenated tables either at moderate pressure (USN TT6) or at high pressure (Cx30 Heliox). Minor decompression accidents (pain only) can be treated with only oxygen recompression tables at 2.8ATA maximum (*Note: this is based on the experience and the good results observed in commercial diving*) (Type 1 recommendation).
 - As an extension of these general principles the following specific recommendations are presented by the Jury (Table 2)
- Treatment of persistent or residual symptoms :
 - At this time a maximum of 10 additional hyperbaric treatment sessions are recommended, based on clinical response, after the initial recompression. If a clinical plateau has not been achieved by 10 treatments, and there is objective evidence of ongoing improvement, HBO2 may be continued (Type 3 recommendation)
 - Regarding neurological DCI, as with any neurological injury, conventional rehabilitation should be started as soon as possible (Type 1 recommendation). However, there are no scientifically valid data on which to base firm recommendations as to the best modalities/procedures to be adopted. Further research is required using standardised disability recording systems.

III - Gas Embolism

- Hyperbaric Oxygen Therapy is strongly recommended, whatever the presentation of air embolism (Type 1 recommendation)

IV - Anaerobic or Mixed Anaerobic-aerobic Bacterial Infections

1- **Necrotizing soft tissue infections**

- Hyperbaric Oxygen Therapy is strongly recommended in the treatment of anaerobic or mixed bacterial necrotizing soft tissue infections (myonecrosis, necrotizing fasciitis, etc...). HBO2 therapy should be integrated in a treatment protocol comprising adequate surgical and antibiotic therapy (Type 1 recommendation).
- The sequential order for HBO2, antibiotics and surgery is a function of the condition of the patient, the surgical possibilities and hyperbaric oxygen availability. (Type 1 recommendation)

2- **Selected cases of organ abscess including intracranial, pleuro-pulmonary, and liver abscess**

- Selection criteria may include failure of an appropriate conventional initial therapy, high surgical risk, compromised general condition of the patient. (Type 1 recommendation)

V - Acute Soft Tissue Ischemia

- HBO2 is recommended in post traumatic crush injury following open fracture Gustilo type III B and C (Type 1 recommendation)
- HBO2 is optional in reperfusion syndromes following invasive vascular procedure (Type 3 recommendation)
- HBO2 is recommended in compromised skin grafts and myo-cutaneous flaps (Type 2 recommendation)
- HBO2 is optional in the re-implantation of traumatically amputated limb segment (Type 3 recommendation)
- In every case, the measurement of transcutaneous oxygen pressure is recommended as an index for the definition of the indication and of the evolution of treatment (Type 1 recommendation)

VI - Radio-induced Lesions

HBO2 is indicated in :

Type 1 recommendation

- Radionecrosis of the mandible
- Radio-induced cystitis resistant to conservative treatment
- Tooth extraction in irradiated tissues (preventive action)

Type 2 recommendation

- Radionecrosis of other bones
- Radio-induced proctitis/enteritis
- Radio-induced lesions of soft-tissues
- Surgery and implants in heavily irradiated tissues (preventive action)

Type 3 recommendation

- Laryngeal radionecrosis
- Central nervous system radionecrosis

VII – Delayed wound healing

1- Ischemic lesions (ulcer or gangrene) without the possibility of revascularization, or lesions persisting after optimal revascularization:

- In the diabetic patient, the use of HBO2 is recommended in the presence of a Chronic Critical Ischemia as defined by the European Consensus Conference on Critical Ischemia (*note 1*), if perilesional transcutaneous oxygen pressures measured under hyperbaric conditions (2.5 ATA, 100% Oxygen) are higher than 100 mmHg (Type 2 recommendation)
- In the arteriosclerotic patient, the use of HBO2 is recommended in case of a Chronic Critical Ischemia (*note 1*), if perilesional transcutaneous oxygen pressures measured under hyperbaric conditions (2.5 ATA, 100% Oxygen) are higher than 50 mmHg (Type 2 recommendation)

Note 1 : Chronic Critical Ischemia:

periodical pain, persistent at rest, needing regular analgesic treatment for more than twoweeks, or ulceration or gangrene of foot or toes with ankle systolic pressure <50 mmHg in the non-diabetic or toe systolic pressure <30 mmHg in the diabetic (Second European Consensus on Critical Ischemia: Circulation 1991, 84, IV, 1-26)

2- Selected non-healing wounds secondary to inflammatory processes

- HBO2 may be used in selected non-healing wounds secondary to inflammatory processes, but only in association with optimized conventional treatment (Type 3 recommendation)

VIII - Osteomyelitis

- HBO2 is recommended in chronic refractory osteomyelitis defined as osteomyelitic lesions persisting for more than six weeks after adequate antibiotic treatment and at least one operative procedure (Type 2 recommendation).
- In cranial (excluding mandible) and sternal osteomyelitis, HBO2 should be started simultaneously with antibiotics and surgical treatment (Type 2 recommendation).

IX - Post-anoxic Encephalopathy

- HBO2 is optional for the treatment of cerebral anoxia (Type 3 recommendation)

X - Burns

- HBO2 is optional when burns exceed 20% of body surface and are of second degree or more (Type 3 recommendation).
- If burned areas (excepted for head, hands, perineum) are less than 20% of body surface, HBO2 is not recommended (Type 1 recommendation)

XI - Sudden Deafness

- Multiple treatment modalities have been proposed for sudden deafness with no high level evidence for any of those. HBO2 remains recommended in sudden deafness (Type 2 recommendation) until the results of the on-going European randomized controlled study are published.

XII - Ophthalmologic Disorders

- HBO2 is optional in acute ophthalmologic ischemia (type 3 recommendation).

XIII – Neuroblastoma Stage IV

- Although there has been no randomized controlled study published, there is convincing accumulation of data showing a beneficial action of HBO2 combined with conventional therapy. HBO2 should be considered in combination with other accepted treatment for patients with Neuroblastoma Stage IV (Type 2 recommendation).

XIV – Pneumatosis Cystoides Intestinalis.

- HBO2 treatment may be used in selected cases of pneumatosis cystoides intestinalis as an alternative to surgery when there are no signs of acute complications, such as perforation, peritonitis and bowel necrosis (Type 3 recommendation).