The world as it is

ANZHMG statement on the administration of mild hyperbaric oxygen therapy

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Key words
Mild hyperbaric therapy, hyperbaric oxygen therapy, hyperbaric facilities, medical conditions and problems, evidence, medical society, policy

Executive summary

(ANZHMG statement on the administration of mild hyperbaric oxygen therapy. *Diving and Hyperbaric Medicine*. 2010;40(2):78-82.)
'Mild' hyperbaric therapy (MHT) and hyperbaric oxygen therapy are easily confused. Essentially the difference lies in the effective oxygen dose. Oxygen is an extremely useful and efficacious drug in a wide range of medical conditions. MHT does not typically provide more available oxygen to the body than is possible with oxygen administration at one atmosphere (sea level), and there is no known therapeutic benefit of mild compression alone. There is, therefore, no documented, biologically plausible evidence for the use of MHT over delivery of oxygen by a simple facemask at one atmosphere of pressure. MHT is advocated for a wide range of clinical conditions, in particular for chronic neurological conditions and as part of a suite of 'wellbeing' therapies. The Australia and New Zealand Hyperbaric Medicine Group, a standing sub-committee of the South Pacific Underwater Medicine Society, is not aware of any reliable clinical evidence for therapeutic benefit from mild hyperbaric therapy and does not recommend the use of this modality for any medical purpose.

Introduction

Hyperbaric oxygen therapy (HBOT) is an established treatment for a number of health conditions. It is available at approximately 18 centres around Australia and New Zealand, including both public hospitals and private facilities. More recently, a number of centres have opened that offer an apparently similar therapy using low-pressure treatments. The term 'mild hyperbaric therapy' (MHT) is the one most often used to describe this form of treatment. For the purpose of this document, we suggest this term is more or less synonymous with 'mild hyperbaric oxygenation', 'low-pressure hyperbaric therapy' and related terms. These terms all signify a form of therapy that differs substantially from conventional HBOT. The purpose of this document is to clearly define the relative places of these two therapies within the context of medical practice in general.

The Australia and New Zealand Hyperbaric Medicine Group (ANZHMG), a standing sub-committee of the South Pacific Underwater Medicine Society, is the local specialist group of the medically qualified providers of HBOT. Because, at times, our activities are confused with those of 'alternative' practitioners, this statement is issued in order to allow third parties to accurately identify and characterise the form of therapy being offered to them.

Definitions

Whilst not universally accepted in the current confusion of terms in this area, the definitions below will serve as a practical and workable means by which to distinguish the practice of HBOT from the various forms taken under the umbrella term 'mild hyperbaric therapy'.

HYPERBARIC OXYGEN THERAPY (HBOT)

The Undersea and Hyperbaric Medical Society (UHMS) is the leading world body representing practitioners in this area and defines HBOT as: "*A treatment in which a patient breathes 100% oxygen while inside a treatment chamber at a pressure higher than sea level pressure (i.e., >1 atmosphere absolute or Ata)*".[1]

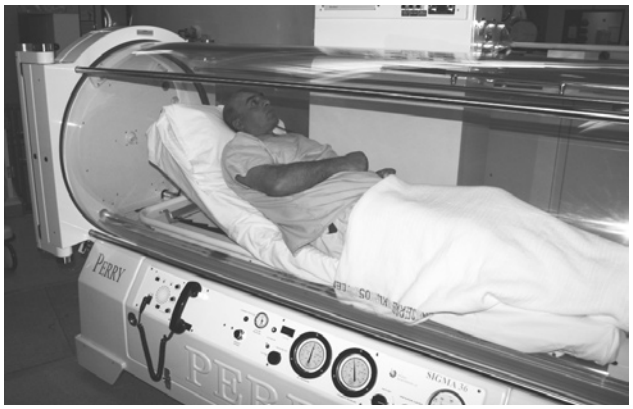
The treatment chamber referred to is an air-tight vessel variously called a hyperbaric chamber, recompression chamber or decompression chamber, depending on the clinical and historical context. Such chambers may be capable of compressing a single patient (a monoplace chamber) or multiple patients and attendants as required (a multiplace chamber) (Figures 1 and 2). These chambers typically operate at pressures above 202.6 kPa (2 Ata) for periods of 60 to 120 minutes for each session of treatment, with the patient breathing 100% oxygen.

MILD HYPERBARIC THERAPY (MHT)

There are many definitions and each individual practitioner or retailer tends to develop their own variant. One compromise definition that covers almost all of this activity is "*a*

Footnote: For a simple pressure conversion chart to assist with interpretation of different pressure measurements in this document, please refer to the appendix.

Figure 1
A monoplace chamber (Prince of Wales Hospital)



treatment, usually administered in an inflatable portable chamber, in which a patient breathes air or oxygen-enriched air at pressures between 1.2 and 1.5 Ata (slightly higher than sea level pressure)".

MHT is often delivered in a 'shop-front' facility, usually under the supervision of a non-medical person, but the chambers can be hired or purchased for use at home. While any hyperbaric chamber is capable of delivering MHT, most MHT is delivered in vessels constructed specifically for this purpose. These chambers are usually built of pliable material and are easily transported and inflated at the point of treatment. One such vessel is illustrated in Figure 3.

What are the important differences between HBOT and MHT?

While constructed of different materials, the differences in the type of compression vessel are less important than the pressure that can safely be generated inside.

MHT implies low pressure therapy: almost always less than 151 kPa (1.5 Ata), while HBOT, although possible at any pressure above 101.3 kPa (1 Ata), is almost universally

Figure 3
An inflatable chamber suitable for the administration of MHT (photo by Bruce McKeeman)

Figure 2
A chamber designed to treat multiple patients (The Karolinska Institute, Stockholm; photo by Peter Kronlund)

delivered at between 203 and 304 kPa (2.0–3.0 Ata).

The most important difference, however, is that during HBOT the patient breathes 100% oxygen in order to deliver greatly increased oxygen pressure to the target tissues in the body; far more oxygen than can be delivered in any other way. On the other hand, MHT is delivered with air, or air mixed with added oxygen at low pressures such that, although oxygen pressures are higher than breathing air alone at sea level pressure, they do not exceed the pressure of oxygen that can be given by the administration of 100% oxygen at 101.3 kPa (1 Ata). For example, in most Australian hospital-based hyperbaric facilities, the standard treatment for a chronic, non-healing foot ulcer in a diabetic patient involves breathing 100% oxygen at 243 kPa (2.4 Ata). Therefore, each breath taken contains oxygen at a partial pressure approaching 243 kPa (1,824 mmHg) and the arterial oxygen pressure will reach something around 203 kPa (1,500 mmHg).

In contrast, a typical MHT session will involve pressurisation to 131 kPa (1.3 Ata) breathing 30% oxygen for about one hour. Under these conditions, each breath has an inspired oxygen pressure of 40 kPa (296 mmHg) and the arterial pressure is likely to reach a more modest 30 kPa (230 mmHg). This is the same oxygen pressure that can be attained by breathing about 35% oxygen at sea level. To put it another way: this amount of oxygen can easily be achieved without the use of the chamber at all.

There are many well-proven effects of increased oxygen levels in the blood and tissues. The administration of oxygen outside a chamber is a very common and familiar treatment in any healthcare system. There is, however, very little evidence indeed that mild compression while breathing oxygen-enriched (to a modest degree) air is any more useful than oxygen alone in a slightly higher concentration at ambient pressure; as in the example above. The latter is certainly much cheaper and more widely available. The

Table 1
ANZHMG accepted indications for hyperbaric oxygen therapy; these indications are reviewed annually. At the time of writing, the ANZHMG proposes that, after review of the evidence, the indications below are appropriate.

Broad indication	Specific indication
Bubble injury	Decompression illness
	Arterial gas embolism (diving/iatrogenic/misadventure)
Acute ischaemic conditions	Compromised flaps/grafts
	Crush injury/compartment syndrome
	Reperfusion injuries
	Sudden sensorineural hearing loss
	Avascular necrosis
Infective conditions	Clostridial myonecrosis
	Necrotizing fasciitis non clostridial
	Myonecrosis necrotizing cellulitis
	Malignant otitis externa
	Refractory mycoses
	Refractory osteomyelitis
	Intracranial abscess
Radiation tissue injury	Osteoradionecrosis
	established
	prophylactic
	Soft tissue radiation injury
	established
	prophylactic
Problem wounds	Chronic ischaemic problem wounds
	Diabetic: ulcers/gangrene/post surgical
	Non-diabetic problem wounds:
	pyoderma gangrenosum
	refractory venous ulcers
	post-surgical problem wounds
Toxic gas poisoning	Carbon monoxide poisoning:
	moderate/severe
	delayed sequelae
Ocular ischaemic pathology	Cystoid macular oedema
	Retinal artery/vein occlusion
Miscellaneous	Thermal burns
	Bells palsy
	Frostbite
Adjuvant to radiotherapy	Adjunct to radiotherapy in treatment of solid tumours

proponents of MHT claim that in addition to the extra oxygen, the mild compression has some benefit in oxygen delivery that remains unexplained and unproven.

What are HBOT and MHT used for?

As suggested above, HBOT is a legitimate therapy prescribed and administered in a hospital or specialised clinic setting under the direction of a medical doctor. There is an increasing body of evidence to support the use of HBOT in a range of serious medical conditions. Those for which the ANZHMG believes there is sufficient evidence to justify routine clinical use are summarized in Table 1.

A useful publication on the evidence for the major indications for HBOT can be purchased from the UHMS web site (<www.uhms.org>).[1] Much information is freely available on the internet. For example, all the randomised trial evidence is summarised at <www.hboevidence.com>, and a detailed examination of many of the indications listed in Table 1 may be found in a doctoral thesis linked from the front page of the same site.[2–12]

The uses for which MHT has been advocated are much wider and this therapy is often offered along with a suite of 'natural' therapies, massage and lifestyle advice. It would be a very difficult task to locate all the claims made for MHT, but Table 2 lists some of those offered in a collection of several internet web site advertisements.

There is very little if any evidence that MHT (or indeed HBOT) has meaningful beneficial effects for the great majority of these indications. For many indications (see Table 2), there has simply been no objective investigation of potential benefit and any such claim is either entirely speculative or based on personal experience. For others, there is good evidence that HBOT and MHT do not positively affect these conditions. For the remainder, the clinical evidence is unclear.

The ANZHMG is not aware of convincing evidence for the effectiveness of MHT for any indication listed in Table 2 and, therefore, does not agree that MHT has any place as a therapeutic modality. Medical science is a process of

Table 2
Summary of proposed indications and evidence for mild hyperbaric therapy
(RCT = randomized controlled trial; Cochrane review = formal systematic analysis of all randomized trials)

Broad indication	Specific indication	Notes on evidence
Paediatric neurological disorders	Cerebral palsy	RCT evidence indicates no difference MHT versus HBOT Not tested against oxygen alone Wide agreement there is no therapeutic effect[2,3]
	Autism spectrum disorder	RCT evidence of more improvement in MHT group (but actual outcome measured was not different) Not tested against oxygen alone Benefit unlikely but possible[4,5]
	ADHD/ADD	No formal evidence
Injury healing	Surgical trauma	No formal evidence
	Traumatic brain injury	Acute – Cochrane review suggests no established benefit for HBOT[6] No formal evidence for MHT Chronic – RCT underway for HBOT
Nervous system dysfunction	Multiple sclerosis	Cochrane review shows no benefit for HBOT[7] No formal evidence MHT
	Parkinson's disease	No formal evidence
	Chronic fatigue syndrome	No formal evidence
	Stroke	Cochrane review suggests no benefit in acute stroke from HBOT[8]
	Altzheimer's disease	No formal evidence
	Optic neuritis	No formal evidence
	Headache and migraine	Cochrane review suggests benefit from HBOT and 100% oxygen at 1 ATA[9]
Infections	Sinusitis	No formal evidence
	Osteomyelitis	Some poor comparative evidence for HBOT, nil for MHT
	Human immunovirus (HIV)	Poor evidence from case series for HBOT
	Lyme disease	Poor evidence for HBOT only
Enhanced immunity	No specific claim	
Skin disorders	No specific claim	
Athletic performance	Enhanced performance	Conflicting evidence for HBOT
	Muscle stiffness	Cochrane review shows that HBOT does not improve post-exercise stiffness[10]
	Improved strength	Low-grade evidence is conflicting for HBOT
	Improved recovery	
	Strengthened heart and lungs	Not tested
Arthritis	(type not specified)	No evidence
Cancer	Basal cell carcinoma	No formal evidence
	Various unspecified	HBOT may enhance radiotherapy[11]
Wellbeing	Relieving tension and stress	No formal evidence for any claims
	Improving cognitive function	
	Detoxifying the blood	
	Retard aging	
	Improving sleep pattern	
	Improving digestion	

hypothesis testing and modification of our understanding. The use of HBOT for many of these indications is under active investigation and it is likely that some individual indications will be shown to be appropriate at some future date whilst others will not.

Conclusion

Oxygen is a very useful and efficacious drug in a wide range of medical conditions. MHT does not typically provide more available oxygen to the body than oxygen administration at one atmosphere, and there is no known therapeutic benefit of mild compression alone. It is therefore difficult to understand how MHT might have therapeutic benefits.

MHT is advocated for a wide range of clinical conditions, in particular for chronic neurological conditions and as part of a suite of 'wellbeing' therapies.

The ANZHMG is not aware of any reliable clinical evidence for therapeutic benefit from mild hyperbaric therapy and does not recommend its use for any medical purpose.

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Appendix

Pressure conversion chart; note the term 'atmospheres absolute' is used to emphasise the use of total pressures including the air pressure at sea level: thus 1 Ata = 760 mmHg = 101.3 kPa = sea level pressure

Atmospheres (Ata)	Kilopascals (kPa)	mmHg	Metres' seawater (msw)
1.0	101	760	10.07
1.2	121	912	12.08
1.4	141	1604	14.10
1.6	162	1216	16.11
1.8	183	1368	18.13
2.0	203	1520	20.14
2.2	223	1672	22.15
2.4	243	1824	24.17
2.6	263	1976	26.18
2.8	284	2128	28.20
3.0	304	2280	30.21