ADJUNCTIVE THERAPY FOR DECOMPRESSION ILLNESS (DCI): SUMMARY OF UNDERSEA AND HYPERBARIC MEDICAL SOCIETY GUIDELINES DECEMBER 2002

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INTRODUCTION

The Adjunctive Therapy ad hoc Subcommittee was formed in 1998 to investigate and review therapies that could be used in addition to or in lieu of recompression therapy. In 2000 the subcommittee was formally changed to a UHMS standing committee. The Committee goals are (a) to review the available literature on treatment of decompression sickness and gas embolism and make recommendations for therapy based on the best clinical series, case reports, and animal studies available; (b) Place special emphasis in this review on the pre-recompression phase of treatment, which may be prolonged in civilian diving, certain military operations and in space; and (c) Make recommendations for specific animal and human trials that will study the most promising new treatment modalities or otherwise enhance our ability to treat dysbaric disorders.

In addition to experts in diving medicine, the Committee has sought input from clinicians and investigators in the neurosciences who have skills and interest in the treatment and investigation of cerebral and spinal vascular disorders and trauma. The guidelines listed below, patterned on the American Heart Association paradigm, are the result of two formal meetings and considerable electronic discussion. They are intended to be used in the pre-recompression and recompression phases of treatment, but are not intended to replace recompression treatment (currently the treatment of choice). The guidelines will be regularly reviewed and updated. A full printed volume to complement this summary will be available in early 2003.

ACKNOWLEDGEMENT

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AMERICAN HEART ASSOCIATION GUIDELINES FOR CLINICAL EFFICACY

Class 1: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective

Class 2: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

Class 2A: Weight of evidence/opinion is in favor of usefulness/efficacy

Class 2B: Usefulness/efficacy is less well established by evidence/opinion

Class 3: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful

Level of Evidence A: Data derived from multiple randomized clinical trials

Level of Evidence B: Data derived from a single randomized trial or nonrandomized studies

Level of Evidence C: Consensus opinion of experts

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UHMS GUIDELINES FOR ADJUNCTIVE THERAPY OF DCI

Aspirin		
	Class	**Level**
AGE (no significant inert gas load)	2B	C
DCS: pain only/mild	2B	C
DCS: neurological	2B	C
DCS: chokes	2B	C

NSAIDs*		
	Class	**Level**
AGE (no significant inert gas load)	2B	C
DCS: pain only/mild	2B	B
DCS: neurological	2B	B
DCS: chokes	2B	C

* The only evidence thus far available applies to the use of tenoxicam, a nonselective inhibitor of cyclooxygenase (COX). NSAIDs are not currently recommended for use in the field.

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Anticoagulants, Thrombolytics, IIB/IIIA Agents*		
	Class	**Level**
AGE (no significant inert gas load)	2B	C
DCS: pain only/mild	3	C
DCS: neurological	2B	C
DCS: chokes	2B	C
DCS with leg immobility (DVT prophylaxis)	1	A

* Routine therapeutic anticoagulation or use of thrombolytics or IIB/IIIA antiplatelet agents in patients with neurological DCI is not recommended, due to concern about worsening hemorrhage in spinal cord or inner ear decompression illness. Use of these agents may also be risky in combat divers who may be required to return to action after treatment of an episode of DCI.

Low molecular weight heparin (LMWH) is suggested for all patients with inability to walk due to leg weakness caused by neurological DCI. Enoxaparin 30 mg, or its equivalent, subcutaneously every 12 hours, should be started as soon as possible after injury.

If LMWH is contraindicated, elastic stockings or intermittent pneumatic compression are suggested, although their effectiveness at preventing DVT is probably less than LMWH.

Repetitive screening for DVT while withholding anticoagulants until clot is identifiable is a strategy likely to be less efficacious than routine LMWH administration.

These guidelines are extrapolated from observations in patients with traumatic spinal cord injury. Neither the efficacy nor the safety of these guidelines in neurological DCI has been specifically confirmed in patients with DCI. However, deaths have occurred in divers due to documented pulmonary thromboembolism. Furthermore, there is a recognized need for prophylaxis in traumatic spinal cord injury. Thus specific prophylaxis against DVT in spinal cord DCS has been assigned a 1A guideline.

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Surface O_2*		
	Class	**Level**
AGE (no significant inert gas load)	1	C
DCS: pain only/mild	1	C
DCS: neurological	1	C
DCS: chokes	1	C

* 100% O_2 administration can be safely administered for 12 hours with air breaks; thereafter, at the discretion of the receiving physician.

Fluid Therapy*			
	Class		**Level**
AGE (no significant inert gas load)	D5W LR/crystalloid Colloid	3 2B 2B	C
DCS: pain only/mild	D5W LR/crystalloid Colloid	3 1 1	C
DCS: neurological	D5W LR/crystalloid Colloid	3 1 1	C
DCS: chokes	D5W LR/crystalloid Colloid	3 2B 2B	C

* For intravenous administration, lactated Ringer's solution or other glucose-free isotonic crystalloid is suggested, unless otherwise indicated. Patients who have been immersed for prolonged periods may require additional fluid because of immersion-induced diuresis.

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Corticosteroids*		
	Class	**Level**
AGE (no significant inert gas load)	3	C
DCS: pain only/mild	3	C
DCS: neurological	3	C
DCS: chokes	3	C

* Corticosteroids are not recommended for the treatment of decompression illness.

Lidocaine*		
	Class	**Level**
AGE (no significant inert gas load)	2A	B
DCS: pain only/mild	3	C
DCS: neurological	2B	C
DCS: chokes	3	C

* There is insufficient evidence to support the routine use of lidocaine for DCI, and it is not a standard of care. However, if it is to be used, evidence suggests that an appropriate end-point is attainment of a serum concentration suitable for an anti-arrhythmic effect (2-6 milligrams/liter or micrograms/milliliter). Intravenous dosing of 1 mg/kg then subsequent boluses of 0.5 mg/kg every 10 minutes to a total of 3 mg/kg, while infusing continuously at 2-4 mg/minute, will typically produce therapeutic serum concentrations. Use of more than 400 mg within the first hour could be associated with major side effects unless the patient is continuously monitored in a medical unit with the appropriate facilities and personnel. In the field, intramuscular administration of 4-5 mg/kg will typically produce a therapeutic plasma concentration 15 minutes after dosing, lasting for around 90 minutes. Experience with the use of lidocaine in other settings indicates that ataxia and perioral paresthesias are common. More serious toxic effects such as seizures can also occur.

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RESEARCH PRIORITIES FOR INVESTIGATION OF DECOMPRESSION ILLNESS DECEMBER 2002

Human studies

- Development of consensus and guidelines for diagnosis of DCI/severity
- Systematic search for and evaluation of outcome in cases of decompression illness not recompressed, and compare with conventional treatment
- Detailed clinical investigation of fresh serious DCI cases
- Perfluorocarbon trial
- Trial of surface O_2 vs. recompression for pain-only bends
- Anti-platelet therapy trial
- NSAIDs trial
- Lidocaine trial

Animal studies

- Development of small animal model neurological DCI with long term outcome
- Development of large animal model neurological DCI with long term outcome
- Use of acute animal model of neurological DCI to test interventions (e.g. lidocaine, perfluorocarbons, mild hypothermia)
- O_2 toxicity with perfluorocarbons

COMMITTEE PRIORITIES FOR 2003 AND 2004

- Organize and hold a workshop directed toward the development of consistent guidelines for diagnosis of DCI and assessment of its severity (2003)
- Organize and hold a workshop to re-evaluate expected results from human trials currently underway in stroke and head injury (2004)
- Update the adjunctive treatment guidelines in the light of new developments and feedback from the diving medicine community (2003 and 2004)

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