Introduction

Traumatic brain injury (TBI) is a significant cause of premature death and disability. There are at least 10 million new head injuries worldwide annually and these account for a high proportion of deaths in young adults. In the US, 2% of the population (5.3 million citizens) are living with disability as a result of TBI and this places considerable medical, social and financial burden on both families and health systems. Any intervention that may improve the chance of a good functional outcome is therefore worthy of study.

Hyperbaric oxygen therapy (HBOT) is one such intervention. HBOT is the administration of 100% oxygen at environmental pressures greater than 1 atmosphere absolute (ATA), an absolute pressure of 101.3 kPa. This involves placing the patient in an airtight vessel and increasing the pressure within that vessel while administering 100% oxygen for respiration. In this way, it is possible to deliver a greatly increased partial pressure of oxygen to the tissues. At 2 ATA (202.6 kPa) for example, patients with reasonable cardiopulmonary function will have an arterial oxygen tension of over 1000 mmHg, and a muscle oxygen tension around 221 mmHg. Administration of HBOT is therefore based on the potential for reversing tissue hypoxia and modifying secondary neurological effects.

Following primary injury, there is ongoing injury to the brain through a variety of mechanisms including hypoxia, reduced cerebral blood flow (ischaemia), release of toxic levels of excitatory neurotransmitters, impaired calcium homeostasis and elevated levels of cytokines (secondary injury). Hypoxic neurons performing anaerobic metabolism result in acidosis, unsustainable reduction in cellular metabolic reserve, loss of the ability to maintain ionic homeostasis, free oxygen radical accumulation, degradation of cell membranes and eventual secondary cell death. When hypoxia is severe enough, these changes occur rapidly, but there is some evidence that these effects can sometimes occur over a period of days.

A therapy able to increase oxygen availability in the early period following TBI may therefore improve long-term outcome. HBOT is also thought to reduce tissue oedema by an osmotic effect, and any agent that has a positive effect on brain swelling following trauma might also contribute...

Cochrane corner

A systematic review of the use of hyperbaric oxygen therapy in the treatment of acute traumatic brain injury

Michael H Bennett, Barbara E Trytko and Benjamin Jonker

Key words

Cochrane library, brain injury, hyperbaric oxygen, reprinted from

Abstract


Introduction: We aimed to assess the randomised clinical evidence for the benefits and harms of adjunctive hyperbaric oxygen therapy (HBOT) for acutely brain-injured patients. HBOT can improve oxygen supply to the injured brain and reduce both cerebral oedema and cerebrospinal fluid pressure and might therefore result in a reduction in patient death and disability.

Methods: We performed a systematic search of the literature for randomised controlled trials and made pooled analyses of pre-determined clinical outcomes where possible using Cochrane Collaboration methodology. We included adults with serious closed head injury requiring admission to an intensive care environment and included trials must have compared a standard therapy with adjunctive HBOT to standard therapy alone following randomised allocation. We pre-determined important clinical outcomes and assessed them when reported in the primary studies.

Results: Four trials contributed to this review (382 participants, 199 receiving HBOT and 183 control). Pooled analysis suggested a significant reduction in the risk of dying when HBOT was added (RR 0.69, 95% CI 0.54 to 0.88, NNT = 7, P = 0.003), but no statistically significant increase in the chance of a favourable clinical outcome (RR 1.94, 95% CI 0.92 to 4.08, P = 0.08).

Conclusions: HBOT reduced the risk of death but did not clearly increase the chance of favourable clinical outcome. Routine application of HBOT to these patients should not be justified from this review. More research of high methodological rigour is needed in order to confirm or refute the findings of this review.

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to improved outcomes. On the other hand, oxygen in high doses is potentially toxic to normally perfused tissue, and the brain is particularly at risk. HBOT may therefore do more harm than good in some patients.

Since the 1960s, there have been scattered reports that HBOT improves the outcome following brain trauma. HBOT has been shown to reduce intracranial pressure (ICP) in brain-injured patients, improve grey matter metabolic activity on SPECT scan, and improve glucose metabolism. Some studies suggest that any effect of HBOT may not be uniform across all brain-injured patients. For example, Hayakawa demonstrated that CSFP rebounded to higher levels following HBOT than at pre-treatment estimation in some patients, while others showed persistent reductions. It is possible that HBOT has a positive effect in a sub-group of patients with moderate injury, but not in those with extensive cerebral injury. Furthermore, repeated exposure to hyperbaric oxygen may be required to attain consistent changes.

Clinical reports have attributed a wide range of improvements to HBOT including cognitive and motor skills, improved attention span and increased verbalisation. These improvements are, however, difficult to ascribe to any single treatment modality because HBOT was most often applied in conjunction with intensive supportive and rehabilitative therapies.

The purpose of this review is to assess the randomised clinical evidence for the benefit or harm of adjunctive HBOT in the treatment of acute TBI. This paper is based on a Cochrane review first published in The Cochrane Library 2004, Issue 4. Chichester, UK: John Wiley & Sons, Ltd (www.thecochranelibrary.com). Copyright Cochrane Library, reproduced with permission. Cochrane reviews are regularly updated as new evidence emerges and in response to comments and criticisms. The Cochrane Library should be consulted for the most recent version of the review.

### Methods

It was our intention to identify and review all randomised controlled trials (RCTs) concerning the treatment with HBOT of any patient with TBI in the first days following injury. We included all trials using hyperbaric oxygen administered in a compression chamber above 1.5 ATA (152 kPa) and for treatment times between 30 and 120 minutes on at least one occasion. For the comparator therapy, we accepted any standard treatment regimen designed to maximise brain protection and promote recovery from TBI. We did not include studies where comparator interventions were not undertaken in a specialised acute care setting.

Specific search strategies were developed to identify eligible reports from database inception to August 2004 in MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL) and the Database of Randomised Controlled Trials in Hyperbaric Medicine (DORCTHM). The latter is a specifically targeted database of clinical evidence in the field (<http://www.hboevidence.com>).

Medical subject headings (MeSH) and main key words used were ‘hyperbaric oxygenation’, ‘head injuries, closed’, ‘head injuries, penetrating’, ‘craniocerebral trauma’ and ‘coma- post head injury’, with variants of the main key words and free text terms also applied. No restrictions to language were made. Relevant hyperbaric textbooks, journals and conference proceedings were hand searched. Experts in the field were contacted for published, unpublished and ongoing RCTs. Additional trials were identified from the citations within obtained papers.

We pre-determined the following clinically important outcomes for assessment, and all included studies must have reported at least one of these: functional outcome measures (e.g. Glasgow Outcome Scale, GOS), death, activities of daily living (ADL) or quality of life (QALY) measures. In

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomisation</td>
<td>The study is described as randomised, including using words such as ‘random’, ‘randomised’ or ‘randomly’</td>
</tr>
<tr>
<td>Additional Deduction</td>
<td>The method of randomisation is described and appropriate (e.g. use of random number table)</td>
</tr>
<tr>
<td>Double blinding</td>
<td>The study is described as double-blind</td>
</tr>
<tr>
<td>Additional Deduction</td>
<td>The method of double-blinding is described and appropriate (e.g. use of placebo or sham therapy)</td>
</tr>
<tr>
<td>Description of withdrawals</td>
<td>There is a description of any dropouts or withdrawals during the course of the study</td>
</tr>
</tbody>
</table>
addition we recorded the following indirect outcomes: intracranial pressure (ICP), magnetic resonance image (MRI) findings, computed tomography (CT) findings and cost-effectiveness. Any reported adverse events of HBOT were also recorded.

Each reviewer independently assessed the electronic search results and selected potentially relevant studies. Disagreements were settled by examination of the full paper and consensus. To assess methodological quality and detect potential sources of bias we applied the quality scale of Jadad (Table 1). We also recorded the adequacy of allocation concealment. If any relevant data were missing from trial reports, we attempted to contact the authors. To allow an intention to treat analysis we extracted the data reflecting the original allocation group where possible. Disagreements were again settled by consensus.

STATISTICAL ANALYSIS

Following agreement, the data were entered into Review Manager® 4.2.1. (Cochrane Collaboration, Oxford, UK). For dichotomous outcomes such as the proportion of participants who died, we calculated Relative Risks (RR) with 95% confidence interval (CI). A statistically significant difference from control was assumed when the 95% CI of the RR did not include the value 1.0. For continuous outcomes such as the mean change in ICP for each group, we calculated the mean difference (MD) between groups with 95% CI. We used a fixed-effects model where problematic heterogeneity between the studies was not likely and a random-effects model where such heterogeneity was likely. Heterogeneity was deemed problematic if the I² analysis suggested more than 30% of the variability in an analysis was due to systematic differences between trials rather than chance alone. Consideration was then given

Table 2

Characteristics of included studies (GOS - Glasgow outcome score)

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artru 1976²⁸</td>
<td>Method of randomisation not stated. No blinding reported. Jadad score 2.</td>
<td>60 participants, 31 HBOT and 29 control. Inclusion depended on availability of chamber. Stratified into nine categories of severity and pathology.</td>
<td>Control: ‘Standard care’ included hyperventilation and frusemide. HBOT: above plus 2.5 ATA oxygen for 1 hour daily for 10 days, followed by 4 days rest and repeat if not responding.</td>
<td>Death Unfavourable outcome Adverse effects</td>
</tr>
<tr>
<td>Ren 2001²⁶</td>
<td>Method of randomisation not stated. No blinding. Jadad score 1.</td>
<td>55 participants, 35 HBOT and 20 control. Included: closed head injury with GCS &lt; 9. Randomised on day 3 post admission after condition stabilised.</td>
<td>Control: Standard care plus dehydration, steroids and antibiotics. HBOT: above plus 2.5 ATA for a total of 400 to 600 minutes every 4 days, repeated 3 or 4 times.</td>
<td>Favourable GOS Change in GCS</td>
</tr>
<tr>
<td>Rockswold 1992²⁷</td>
<td>Method of randomisation not clear, medical assessors blind. Jadad score 2.</td>
<td>168 participants, 84 HBOT and 84 control. Included: closed head injury with GCS &lt; 10 for &gt; 6 hrs, &lt; 24 hrs.</td>
<td>Control: ‘Intensive neurosurgical care according to a comprehensive protocol’. HBOT: above plus 1.5 ATA oxygen for 1 hour every 8 hours for 2 weeks or until waking or death (ave 21 treatments).</td>
<td>Death Favourable outcome (GOS 1 or 2) ICP Adverse events</td>
</tr>
</tbody>
</table>
to the appropriateness of pooling and meta-analysis. Number-needed-to-treat (NNT) with 95% CI was calculated when the relative risk estimates were statistically significant.

We planned sensitivity analyses for missing data and study quality. We also considered subgroup analysis based on age, oxygen dose, comparator therapy used, and the nature and severity of injury.

Results

THE INCLUDED STUDIES

The search in August 2004 yielded 23 articles of which seven were considered to be possible randomised human trials dealing with the treatment of TBI with HBOT. Two were excluded because they were incomplete reports of included trials,23,24 and one because it enrolled only participants with non-acute injuries.25 Four publications therefore met our inclusion criteria.26-29 One trial29 used a sequential system for allocation that may not have been truly random. The total number of participants enrolled was 382, 199 receiving HBOT and 183 control.

All four trials enrolled participants with closed head injury, but inclusion criteria varied. Rockswold27 accepted those with a Glasgow Coma Score (GCS) of less than 10 for between six and 24 hours, Ren28 accepted participants with a GCS of less than nine for up to three days after trauma. The other two older trials did not specify inclusion criteria, other than ‘closed head injury and comatose’.28,29 Treatment pressures (1.5 to 2.5ATA, or 152 to 253.3 kPa), time schedule (60 to 90 min), and number of sessions (10 to 40) of HBOT differed between studies. Similarly, there was some variation in comparator therapies and the time to final assessment. Individual study characteristics are given in Table 2.

No study described the method of randomisation, clearly concealed allocation from the individual responsible for randomisation or employed a sham therapy. Study quality was generally assessed as low and was not used as a basis for sensitivity analysis.

CLINICAL OUTCOMES

Statistical pooling was not possible for many of the pre-planned outcome measures due to lack of suitable data. Problems included the small number of studies, modest number of patients, and the variability in outcome measures employed. The data are summarised in Table 3.

PRIMARY OUTCOMES

Good functional outcome

Good functional outcome was defined in these studies as any one of the following: GOS < three,26 ‘return of consciousness’,21 ‘complete recovery’28 or classified as ‘independent’.27 Two trials reported this outcome early (0 to 4 weeks) following the course of therapy28,29 and involved 159 participants. 29 (36%) were described as having a good outcome in the HBOT group versus 11 (14%) in the control group. Pooled analysis suggests however, that there is no significant difference between groups (RR with HBOT: 2.66, 95% CI 0.73 to 9.69).
There was evidence of significant heterogeneity between these studies ($I^2 = 72\%$) and this result is performed using a random effects model (Figure 1).

Ren reported a significant improvement in the chance of a good outcome at six months' review (RR 2.8, 95% CI 1.4 to 5.5, $P = 0.004$), while at one year, Rockswold did not (RR 0.98, 95% CI 0.73 to 1.3, $P = 0.87$). When combining all trials at final outcome, 109 participants (51%) in the HBOT group had a good outcome versus 61 (34%) of controls, however this difference was not statistically significant (RR 1.94, 95% CI 0.92 to 4.08, $P = 0.08$). This result is very likely to be subject to important heterogeneity between trials ($I^2 = 81\%$) and should be interpreted very cautiously.

Subgroup analysis by treatment pressure suggested the application of a high treatment pressure (2.5 ATA or 253.3 kPa) was associated with a better outcome than the application of a low treatment pressure (1.5 ATA or 152 kPa) (high pressure RR 2.07, 95% CI 1.15 to 3.72, $P = 0.003$, low pressure RR 2.12, 95% CI 0.35 to 12.78, $P = 0.11$). This result is unconvincing given the high probability of important heterogeneity remaining between the two low pressure trials ($I^2 = 89\%$) and the similar estimate of RR in these two groups.

**Mortality**

Three trials reported this data at some time (Holbach at 12 days, Artru and Rockswold 1992 at 12 months) involving 327 participants. There was significantly increased mortality with control therapy (RR 1.46, 95% CI 1.13 to 1.87, $P = 0.003$). Heterogeneity between studies was low ($I^2 = 0\%$). The NNT to avoid one death by applying HBOT was 7, 95% CI 4 to 22 (Figure 2).

No trials reported on activities of daily living, quality of life measures, CT or MRI findings, progress of GCS or cost-effectiveness.

**SECONDARY OUTCOMES**

**Intracranial pressure**

Only Rockswold reported the effects of therapy on ICP.rockswold reported the effects of therapy on ICP. The effect of HBOT was complicated by a change in the experimental protocol during the period of recruitment. While overall there was no difference in the mean maximum ICP between the two groups (MD 3.1 mmHg lower with HBOT, 95% CI -9.6 mmHg to +3.4 mmHg), the authors noted higher than expected ICP in the early HBOT participants. As this was likely to represent pain from middle ear barotrauma (MEBT), the last 46 participants recruited to
HBOT had pre-compression myringotomy tubes inserted to allow free equalisation of middle ear pressures. Comparing the standard care group with the HBOT subjects with and without myringotomy, there is a significant lowering of ICP with HBOT plus myringotomy, but no difference without myringotomy (MD with myringotomy -8.2 mmHg, 95% CI -14.7 mmHg to -1.7 mmHg, P = 0.01; without myringotomy MD +2.7 mmHg, 95% CI -5.9 mmHg to +11.3 mmHg, P = 0.54).

Adverse effects

Rockswold reported generalised seizures in two participants in the HBOT group versus none in the control group (RR 0.2, P = 0.3) and a further two with haemotympanum from MEBT (RR 0.2, P = 0.03).

Two trials reported participants with significant pulmonary effects. Rockswold reported ten individuals with rising oxygen requirements and infiltrates on chest x-ray, while Artru reported five patients with respiratory symptoms including cyanosis and hyperpnoea so severe as to imply ‘impending hyperoxic pneumonia’. Overall, therefore, 15 patients (13% of those receiving HBOT) had severe pulmonary complications while no such complications were reported in the standard therapy arm. This difference is statistically significant (RR 0.06, 95% CI 0.01 to 0.47, P = 0.007). There was no indication of heterogeneity between trials (I² = 0%) and this analysis suggests we might expect to treat eight patients with HBOT in order to cause this adverse effect in one individual (NNH 8, 95% CI 5 to 15).

Discussion

This review has included data from four trials and we believe these represent all randomised human trials in this area, both published and unpublished, at the time of searching the databases. We found some evidence that HBOT reduces mortality following closed head injury, but cannot be confident that the addition of HBOT to standard therapy increases the chance of recovery to independence. The single trial looking at ICP as a proxy for beneficial effects did suggest that ICP was lower immediately following HBOT when patients had received middle ear ventilation tubes. These tubes avoid MEBT on compression – a highly painful and stimulating condition that might be expected to raise ICP, regardless of the underlying brain injury. Any clinical benefit may come at the cost of significant pulmonary complications. These complications are rare in general hyperbaric practice and may be related specifically to the head injuries suffered by these patients.

Only 382 participants were available for evaluation using our planned comparisons, and meta-analysis was not appropriate or possible for a number of these. Other problems for this review were the poor methodological quality of these trials, variability and poor reporting of entry criteria, the variable nature and timing of outcomes, poor reporting of both outcomes and methodology and the long time period spanned by the four trials (27 years). In particular, there is a possibility of bias due to different times to entry in these small trials, as well as from non-blinded management decisions in all trials.

We had planned to perform subgroup analyses with respect to age, oxygen dose, nature of comparative therapies and the severity of injury. The paucity of eligible trials and poor reporting suggested the majority of these analyses would not be informative, and we only performed subgroup analysis with respect to treatment pressure for the proportion of individuals achieving a good outcome. No standard severity index was employed uniformly across these trials, no standard injury pattern was established, and only Rockswold and Ren described the time at which the inclusion criteria were applied.

While 13% of participants in two of these trials suffered significant pulmonary complications, this is unusual, and HBOT is generally regarded as a relatively benign intervention. There are few major adverse effects (pulmonary barotrauma, drug reactions, injuries or death related to chamber fire), and a number of more minor complications that may occur commonly. Visual disturbance, usually reduction in visual acuity secondary to conformational changes in the lens, is very commonly reported – perhaps as many as 50% of those having a course of 30 treatments. While the great majority of patients recover spontaneously over a period of days to weeks, a small proportion of patients continue to require correction to restore sight to pre-treatment levels. The second most common adverse effect associated with HBOT is barotrauma, usually MEBT, although other sites include the respiratory sinuses and dental cavities. Most episodes of barotrauma do not require the therapy to be abandoned. Less commonly, perhaps once every 5,000 treatments, HBOT may be associated with acute neurological toxicity manifesting as seizure.

While we have made every effort to locate further unpublished data, it remains possible that this review is subject to a positive publication bias, with generally favourable trials more likely to achieve reporting. With regard to long-term outcomes following HBOT and any effect on the quality of life for these patients, we have located no relevant data.

Conclusions

We conclude there is limited evidence that HBOT reduces mortality in patients with acute TBI, but no clear evidence of improved functional outcome. The small number of studies, the modest numbers of patients, and the methodological and reporting inadequacies of the primary studies included in this review demand a cautious interpretation. We do not believe routine use of HBOT for these patients is justified by this review.
There is a case for large randomised trials of high methodological rigour in order to define the true extent of benefit (if any) from the administration of HBOT. Specifically, more information is required on the subset of disease severity or classification most likely to benefit from this therapy and the oxygen dose most appropriate. Any future trials would also need to consider appropriate sample sizes with power to detect expected differences, appropriate and carefully defined comparator therapy, use of an effective sham therapy, effective and explicit blinding of outcome assessors, appropriate outcome measures including all those listed in this review, careful elucidation of any adverse effects and the cost-utility of the therapy.

Acknowledgements

We acknowledge the assistance provided by the Cochrane Injuries Group, and particularly of Katharine Ker and Paul Chinnock, in the production of this review.

The results of a Cochrane review can be interpreted differently, depending on people’s perspectives and circumstances. Please consider the conclusions presented carefully. They are the opinions of review authors, and are not necessarily shared by The Cochrane Collaboration.

References

The poetry doctor

Beware below blues

The sea is full of danger.
For me it is a fact
For whenever I go diving
I always get attacked.

The lion fish is lurking
Looking oh so tame
As I guide it with my hand
To fit my photo frame.

The jelly fish drifts passively,
Its tentacles so slim,
Yet as I swim through their mass
They wrap around my limbs.

The octopus just ogles me,
So serene and calm
As I admire its blue rings
Whilst it nestsles in my palm.

The cone shell waits so patiently.
It shows no fire or fear
As I pick and pocket it
As a souvenir.

The stone fish sits so stoically
With camouflage so neat
As I walk the shallow reef
With unprotected feet.

The hydroid seems so innocent
So soft and fine and thin
As I gently fin past it
And brush my ankle skin.

As the sharks patrol the reef
I watch them with alarm
As they speed at me bare teethed
My speared fish underarm.

I am so scared to dive below.
It’s full of dangerous things.
Please tell me how I can avoid
These bites and spines and stings?

I wrote this after brushing my ankle on a stinging hydroid.
These stings always give me grief and afterwards I thought
how stupid I am not to wear bootees every dive. A few days
later I was bitten by a red back spider as I put my boot on in
my shed. I was immensely grateful for the four ampoules of
antivenene used to ease this particular reminder of how
important it is to be cautious both in and out of the water.

John Parker
<www.thepoetrydoctor.com>
SPUMS notices and news

South Pacific Underwater Medicine Society Diploma of Diving and Hyperbaric Medicine

Requirements for candidates

In order for the Diploma of Diving and Hyperbaric Medicine to be awarded by the Society, the candidate must comply with the following conditions:

1. The candidate must be medically qualified, and be a financial member of the Society of at least two years’ standing.
2. The candidate must supply evidence of satisfactory completion of an examined two-week full-time course in Diving and Hyperbaric Medicine at an approved Hyperbaric Medicine Unit.
3. The candidate must have completed the equivalent (as determined by the Education Officer) of at least six months’ full-time clinical training in an approved Hyperbaric Medicine Unit.
4. The candidate must submit a written proposal for research in a relevant area of underwater or hyperbaric medicine, and in a standard format, for approval by the Academic Board before commencing their research project.
5. The candidate must produce, to the satisfaction of the Academic Board, a written report on the approved research project, in the form of a scientific paper suitable for publication.

Additional information

The candidate must contact the Education Officer to advise of their intended candidacy, seek approval of their courses in Diving and Hyperbaric Medicine and training time in the intended Hyperbaric Medicine Unit, discuss the proposed subject matter of their research, and obtain instructions before submitting any written material or commencing a research project.

All research reports must clearly test a hypothesis. Original basic or clinical research is acceptable. Case series reports may be acceptable if thoroughly documented, subject to quantitative analysis, and the subject is extensively researched and discussed in detail. Reports of a single case are insufficient. Review articles may be acceptable if the world literature is thoroughly analysed and discussed, and the subject has not recently been similarly reviewed. Previously published material will not be considered.

It is expected that all research will be conducted in accordance with the joint NHMRC/AVCC statement and guidelines on research practice (available at http://www.health.gov.au/nhmrc/research/general/nhmrcavc.htm or the equivalent requirement of the country in which the research is conducted. All research involving humans or animals must be accompanied by documented evidence of approval by an appropriate research ethics committee. It is expected that the research project and the written report will be primarily the work of the candidate.

The Academic Board reserves the right to modify any of these requirements from time to time. The Academic Board consists of: Dr Chris Acott, Education Officer, Professor Des Gorman and Associate Professor Mike Davis.

All enquiries should be addressed to the Education Officer: Dr Chris Acott, 30 Park Avenue Rosslyn Park South Australia 5072 Australia E-mail: <cacott@optusnet.com.au>

Key words
Qualifications, underwater medicine, hyperbaric oxygen, research

Minutes of the SPUMS Executive Committee Teleconference held on 9 October 2005

Opened: 0900 hr

Present: Drs C Acott (President), S Sharkey (Secretary), G Williams (Public Officer), D Smart (ANZHMG Representative), M Davis (Editor), C Lee (Committee Member), D Vote (Committee Member)

Apologies: Drs R Walker (Immediate Past-President), A Patterson (Treasurer)

1 Minutes of the previous meeting (31 July 2005)
Moved that the minutes be accepted as a true record. Proposed Dr Sharkey, seconded Dr Vote, carried.

2 Matters arising from the previous minutes
2.1 The issue of formalising the functions required of the SPUMS Administrator is progressing. Current roles and functions are to be reviewed by the Committee at the next meeting with a view to formalising this arrangement in the form of an independent contractor agreement. ACTION: All.
2.2 Finalisation of the final figures from the 2004 ASM remained outstanding in view of the absence of the Treasurer for further comment. Action: Dr Patterson to advise of final accounts for 2004 ASM in particular whether the refunds had been reflected in the P&L.

2.3 The irregularities in the 2005 ASM financial reports require investigation. ACTION: Dr Patterson to pursue this issue with the Convenor and Administrator.

2.4 Audit of SPUMS equipment being progressed. ACTION: Dr Sharkey.

2.5 Confirmation of status of overseas representatives required. ACTION: Dr Sharkey.

3 Annual Scientific Meeting 2006

3.1 Preliminary timetable was proposed and agreed. AGM on the Wednesday night, Gala Night on the Friday night with workshops on the Monday, Tuesday and Thursday nights.

3.2 Registration fees: $450 members; $570 non-members; $180 partners.

3.3 CME points from relevant colleges are being sought.

3.4 Proposed workshops include variety of airway and ventilation procedures. Assistance in workshop delivery by Anaesthetic members is welcome. Proposed presentations include diabetes, PFOs and other shunts, asthma, breath-hold diving and immersion physiology, obesity, airway devices and resuscitation, reverse dive profiles, evolving problem sessions (FTD and emergency management of diving presentations).

3.5 Dr Williams advised that Consumer Affairs had agreed to slight delay in this year’s AGM outside the rules.

3.6 2007 Scientific Meeting to be held in New Zealand – Convenor Dr M Davis; Co-convenor Dr S Mitchell. Meeting is confirmed for the third week in April 2007, venue is Tutakaka. The conference will have a predominantly physiological theme. Organisation of the 2007 conference is being progressed by Dr Davis.

4 Journal report

4.1 Discussions occurred regarding the issues relating to profit reduction due to lower membership numbers over last year. This included recognition of certain obstacles to be overcome for these reductions to be lessened. E.g., need to write personally to all old non-renewed members; need the new website to be up and running; possible need for the journal amalgamation to go ahead. In view of membership reduction and therefore financial considerations, Dr Davis declined the offer of an honorarium increase as editor at present.

4.2 Journal name update will take place in the New Year with the new volume. This will include the Australian National Library being informed and EMBASE Indexing.

4.3 CD production has been discussed with the printer. A searchable PDF CD covering the past 5 years is possible for A$900; additional to this, John’s 30 volumes will incur a small fee resulting in approximately $1000 total price. A charge per CD could be added onto the membership fees and would incur a small profit – this could be available during 2006. A master CD by SNAP printers could be available for burning further CD copies – the commercial production option was preferred. Proposal approved.

4.4 New Zealand account status: NZ$2,800. The software update can be paid for from this account.

4.5 Outstanding contributions to the Journal are required urgently.

5 Education Officer’s report

5.1 No new diplomas have been awarded.

6 Correspondence

6.1 Letter received from ANZCA SIG requesting that an ANZCA SIG member sits on the SPUMS Education Board for authorisation of the SPUMS Diploma – for Special Interest Group members of ANZCA. The request was endorsed by the majority of the Committee.

7 Other business

7.1 The Committee were informed that the current Treasurer had advised his desire to resign from the position on completion of this calendar year. The Committee would prefer that he remain in this position but wish him well in his future endeavours if he is unable to remain. Successor is yet to be determined. With respect to Dr Patterson’s current role in acting as Convenor of the 2006 ASM, he also advised that he would be happy to hand over that task if the Committee can find someone to assume this role.

7.2 Australian Standards Report: Dr Smart reported on the proceedings of the recent AS meetings. This report is included as an annex to these minutes.

7.3 ANZHMG phone conferences (one per year) agreed to be paid for by SPUMS.

7.4 HTNA prize dually awarded to Helen Mullins from Fremantle: A review of visual acuity changes in patients receiving more than 20 treatments; Anne Sydes from Wesley: A case series of pyoderma gangrenosum.

7.5 Congratulations extended to Des Gorman who has recently accepted the appointment as Head of School of Medicine at the University of Auckland.

Closed: 1052 hr

The database of randomised controlled trials in hyperbaric medicine maintained by Dr Michael Bennett and colleagues at the Prince of Wales Diving and Hyperbaric Medicine Unit is at:

<www.hboevidence.com>
Combined meeting of Australian Standards SF017 Occupational Diving and CS083 Recreational Diving

Held on Monday 19 September 2005

A combined meeting was held at Australian Standards in Sydney to discuss a number of International Standards drafts which have been proposed from the International Standards Organisation (ISO) covering the health and training of recreational divers at the following levels:
1. Supervised diver – to 12 metres
2. Autonomous diver
3. Dive leader (divemaster)
4. Instructor level 1 (Assistant instructor)
5. Instructor
6. A broader standard covering providers of training

The Australian equivalent is the recreational 4005 series.

The ISO standards cover terms and definitions, competencies, prerequisites, theoretical knowledge, personal and specific scuba skills and assessment of the recreational divers. The standards also were very light on defining the amount of theory required. Surprisingly these standards did not even define that they were designed to train people on air.

The International Standards presented to the Committee were significantly lacking in detail and inconsistent regarding the need for diving medicals prior to undertaking a course. For example there were three different wordings regarding health requirements with the lowest standards applicable for entry-level divers. The following are quoted from the draft standards:

- Supervised Diver and Autonomous Diver: “Documented evidence shall be obtained that the student has been medically screened as suitable for recreational diving by means of an appropriate questionnaire or medical examination. In case of any doubt or at the scuba instructor’s discretion, students shall be referred to proper medical resources. If the student is not examined by a physician the student shall be obliged to confirm by signature that he or she has understood the written information given by the scuba instructor on diseases and physical conditions which may pose diving related risks.”

- Dive Leader (divemaster): “Documented evidence shall be obtained that the student has been medically screened as suitable for recreational diving. NOTE In some countries and training organisations a medical examination is mandatory.”

- Scuba instructor candidates shall be medically screened as suitable for diving according to procedures laid down by a competent medical authority. If such procedures are not specified scuba instructor candidates shall provide evidence of a diver medical examination not older than one year unless the medical doctor who has carried out the examination specifies longer validity.”

After working through the documents word by word, the CS083 Australian Committee rejected the documents, with a detailed submission forwarded to ISO. The ISO standards fell far short of the existing 4005 series Australian Standards in their detail relating to definitions, emergency equipment and procedures, risk assessment, and the standards of supervision required for the divers. The Committee’s position was that all divers covered by the standards required diving medicals.

There are some interesting processes taking place in relation to the International Standards. The ISO series we examined evolved from the European Standards Committee, with some origins from the tourism and leisure sector. There is also an attempt to fast-track the ISO standards. There also appears to be some pressure on Australian Standards as an organisation to adopt international standards, even when our own standards have greater detail and have been more thoroughly worked.

Australia is only a single voting member in a larger body containing over 20 countries. It is likely that, although our objections to the ISO documents will be heard, we will be unable to influence the final ISO standards published. Once ISO standards are published there is likely to be political pressure for Australia to adopt them because they cover areas in common with Australian Standards such as the 4005 series. The only option we have if ISO does not listen to our input, will be to provide appendices and additions to the standards to suit the Australian conditions.

It is of note that the AS2299.3 covering professionals working in the recreational industry did not have an International Standards equivalent and the detail covered in this standard is far in excess of the detail covered in the International Standard No.6.

Overall, I have significant concerns about the International Standards process allowing adequate Australian input given our substantial experience in recreational diving in this country.

Dr David Smart
SPUMS Representative, Australian Standards (Occupational)
Standards Australia Meeting
SF017
Held on Tuesday 20 September 2005

Topics discussed
Revision of Australian Standard 2299.1 Occupational Diving Standard Occupational Practice
Review of draft 2815.5 Training and Certification of Occupational Divers Part 5 Dive Supervisor

The main areas covered under the Occupational Diving Operations were:

1. Recompression chamber support:
   In the absence of clear evidence outlining how recompression chamber support should be provided to the on-shore and off-shore industries as well as scientific diving, an expert consensus was agreed to. The situations for commercial diving requiring a chamber within two hours were defined. A second time period greater than two hours for chamber support was defined with some restrictions on diving practices applying. This simplified the Standard from 3 columns to 2 in relation to chamber support. The scientific diving community was also provided with risk assessment guidelines which would define the situation where scientific diving required a chamber in less than two hours, for example: risk of entanglement, use of specialised tools, decompression diving, diving greater than 30 metres and risk of rapid ascents. A detailed risk assessment form was also developed for assessing risk in relation to diving in accordance with AS2299.1. The medical fitness to dive form has been slightly revamped but would not be significantly different from the existing 2299 form.

2. The AS2299.1 (2005) form will also be released for public comment, probably at the end of the year.

3. This meeting also reported that the AS2299.4 has been released as an official standard and is available to the public for purchase. This covers film and photographic diving.

4. Review of the Training and Certification of Occupational Divers Part 5 Dive Supervisor:
   This occurred at the meeting and a consensus was agreed to allow this form to be released for public document and public comment.

Future business of the Committee will require a review of the AS2815.1.2.3.4 series and a further review of the Scientific Standard 2299.2.

Dr David Smart
SPUMS Representative, Australian Standards (Occupational)

SPUMS Annual General Meeting 2006

Notice of the Annual General Meeting of SPUMS to be held at The Pearl South Pacific Resort, Pacific Harbour, Fiji, at 1800 hrs, Wednesday 7 June 2006

Agenda

Apologies:
Minutes of the previous meeting:
Unratified minutes of the previous meeting will be posted on the meeting notice board and appeared in the SPUMS J, 2005; 35: 97-101.

Matters arising from the minutes:
Annual reports:
President’s Report.
Secretary’s Report
Education Officer’s Report
Presidents’ Committee Report

Annual Financial Statement and Treasurer’s Report:
Proposal regarding subscription fees for 2006:
That the annual subscription rates for membership of the Society be set at AUD130.00 plus GST for Full Members and AUD70.00 plus GST for Associate Members with effect from January 2007.

Proposed: Dr A Patterson; Seconded: Dr C Acott

Reasons:
Rising costs of running the Society and producing its Journal make the increase in subscription rates inevitable.
The subscription rates have been held at present levels for some four years, in the face of inexorable increases in costs. The proposed new subscription rates reflect a very modest rise compared with CPI increases or inflation over the same period. I commend the new rates to members.

Election of office bearers:
Nominations have been called for the positions of Treasurer and one committee member.

Appointment of the Auditor:
Business of which notice has been given:
1. Motions re Consumer Affairs-required amendments to constitution to comply with Victorian State legislation.
   Proposed: Dr Williams	Seconded: Dr Sharkey

2. Motion re adoption of model rules for publishing of Minutes
   Proposed: Dr Walker	Seconded: Dr Sharkey

3. Motion re additional membership category for retired members
   Proposed: Dr Walker	Seconded: Dr Sharkey

4. Nomination of Martin Sayer as Full Member
   Proposed: Dr Davis	Seconded: Dr Acott