Hyperbaric oxygen therapy in the management of carbon monoxide poisoning, osteoradionecrosis, burns, skin grafts and crush injury

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Authors' objectives
To investigate whether hyperbaric oxygen therapy is effective in the treatment of carbon monoxide poisoning, osteoradionecrosis, thermal burns, skin graft and crush injury.

Searching
The following databases were searched from 1968 onwards (search terms listed): MEDLINE, EMBASE, HSE line, Cochrane Library, the Controlled Clinical Trials Register, Healthstar, HTA, TOXLINE and Current Awareness in Clinical Toxicology. Additional internet searches were carried out using the term 'hyperbaric oxygen'. Experts in the fields were contacted and citations were checked. No language exclusion or study design limits were applied.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs).

Specific interventions included in the review
Hyperbaric oxygen therapy.

Participants included in the review
Patients with either carbon monoxide poisoning, osteoradionecrosis, thermal burns, skin grafts/flaps or crush injury were included in the review.

Outcomes assessed in the review
Carbon monoxide poisoning: regaining consciousness, reduction of delayed neurological symptoms, survival.

Osteoradionecrosis: wound healing, incidence.

Thermal burns: relief of hypoxia, decrease in fluid losses, limiting burn wound extension and conversion, treatment of oedemas, promotion of wound closure, length of stay.

Skin flaps/grafts: acceleration of angiogenesis, promotion of healing, graft survival.

Crush injury: wound healing, major surgery, tome of healing, length of stay.

How were decisions on the relevance of primary studies made?
The author does not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
Validity was not formally assessed. However, the author does comment on blinding, loss to follow-up and sample size in the results section.

Data extraction
Data were extracted from the included studies by one reviewer using a predetermined form. Data were extracted on: author, centre, title, journal reference, data, whether the study was an RCT, method of randomisation, research question, whether the study was blinded, treatment, comparator, inclusion criteria, exclusions, loss to follow-up, length
of trial, time from exposure to treatment, outcome measures, results and statistical tests.

**Methods of synthesis**

How were the studies combined?

A narrative synthesis is presented.

How were differences between studies investigated?

Differences between the studies were not formally investigated although differences were discussed narratively.

**Results of the review**

Thirteen RCTs (n=1961). Of these 6 RCTs were on carbon monoxide poisoning (n=1638), two on osteoradionecrosis (n=84), three on thermal burns (n=153) and one each for skin grafting/flaps (n=48) and crush injury (n=36).

**Carbon monoxide poisoning (n=6 studies):**

One double blind study reported a negative effect of hyperbaric oxygen therapy, two studies, one double blind and one non-blind, reported no effect. Three studies, two of which were non-blind, reported a positive effect. Overall the best quality studies found no effect.

**Osteoradionecrosis (n=2 studies):**

One study with only 12 participants reported significant improvement in healing in the intervention group. A second larger non-blind RCT (n=74) found a significant reduction in the rate of osteoradionecrosis in the intervention group compared to penicillin treatment.

**Thermal Burns (n=3):**

A small blinded RCT (n=16) found a significant reduction in healing time in the hyperbaric oxygen group compared to placebo. A second larger non-blind RCT (n=125) found no difference in length of stay, mortality or number of surgeries between the two treatment groups. A third blinded small RCT (n=12) created standard burn wounds in health volunteers, this study found improvements in the hyperbaric oxygen group at the start of the study but these were no longer found at the end of the study.

**Skin grafts (n=1):**

A non-blind RCT of 48 patients found improved survival in the hyperbaric oxygen group, particularly in participants aged more than 40.

**Crush injury (n=1):**

A double-blind RCT of 36 patients found a significant effect on wound healing in the hyperbaric oxygen group.

**Cost information**

The study reports on charges for treatment and cost hyperbaric oxygen units.

**Authors' conclusions**

While hyperbaric oxygen therapy is widely accepted as the appropriate treatment for gas embolism and decompression sickness, there is no convincing evidence that it is of benefit for the treatment of carbon monoxide poisoning (severe or moderate), osteoradionecrosis, burns, skin grafts or crush injury. However there is a physiological case for an effect of hyperbolic oxygen therapy in conditions involving hypoxia such as osteoradionecrosis and wound healing. An extension of this review to include all controlled trials on wound healing would be warranted.
CRD commentary
A reasonable review of the area. A thorough literature search was conducted. The author reports that no language exclusions were applied, however, in the implications section it was stated that "27 foreign language papers were identified which should now be included in the review". The failure to include these studies could have seriously biased the conclusions of the review. Inclusion and exclusion criteria were clearly stated. The author states that one author extracted data from the studies, it would have been better had this been done by two authors to minimise the change of error in the data extraction process. Validity was not formally reviewed, however, the author does comment on factors relating to study quality, especially blinding. Study details are reported. The results could have been presented more appropriately within the text of the report. The author simply describes the results of each study and does not try to bring these together to form an overall summary (although the results are summarised to some extent in the overall summary of evidence), this means that the results were difficult to follow. The author's conclusions follow from the results presented but the limitations discussed above, especially the exclusion of 27 foreign language papers, should be considered when interpreting these conclusions.

Implications of the review for practice and research
Research: The author states that "27 foreign language papers were identified which should now be included in the review. An extension of this review to include all controlled trials and wound healing would be warranted".

Bibliographic details

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.