CPD handbook appendix 25

Guidelines for Central Nervous System oxygen toxicity (CNS-OT) education sessions

Context

The ANZCA Continuing Professional Development (CPD) standard requires participants to complete two activities from the Emergency response category during each CPD triennium.

The purpose of this document is to assist hospital departments, private practice groups and continuing medical education providers develop and/or conduct education sessions designed for practitioners working in Diving and Hyperbaric Medicine (DHM). This activity will be suitable for medical practitioners, nursing staff and technical staff involved in DHM.

Education sessions are required to include a practical simulation component. Simulation in this context may mean bench top training in a local department, not necessarily fully immersive mannequin based simulation in a centre.

Hospital departments and private practice groups are encouraged to develop education sessions that satisfy local needs, incorporating local staff, work environment and equipment.

Background to CNS-OT activity

CNS-OT events are an uncommon but potential side effect of exposure to a high partial pressure of oxygen. They have been described to occur in the hyperbaric environment with an incidence recently published of 0.024% (2.4 per 10,000 treatments)[1]. This figure is less than previously reported in Australia[2] and may reflect a reduction in risk through modification of treatment tables or an improvement in oxygen delivery equipment that avoids re-breathing.

CNS-OT can present with prodromal symptoms such as sweating, twitching and tunnel vision, followed by a tonic-clonic seizure. It is most commonly brief and resolves spontaneously as the brain's partial pressure of oxygen is reduced. However, patients are at risk of serious harm during a CNS-OT convulsion.

The occurrence of any medical emergency in the hyperbaric environment requires consideration of several factors, which can make management difficult. The chamber is considered a "remote" environment and as such, both the patient and attendant are unable to immediately receive assistance. Consideration of the effects of rapid decompression on both the attendant and the patient need to be made.

It is a requirement of the Australian and New Zealand Standard for work in a compressed environment (AS/NZS 4774.2) that facilities have emergency protocols in place[3].

Prompt recognition and management reduce the risk of patient harm and emergency drills require practise.

Definitions and terms

For the purposes of clarifying terms that are used within this document, the following definitions are provided:

Clinical Lead

- The medical officer nominated by each department/group to oversee the provision of the education sessions conducted by that provider.
- Does not necessarily need to attend the session in person.
- Needs to be at level of consultant, and appropriately skilled and experienced to oversee the development of the session content. Ideally, the clinical lead will have medical education experience and/or credentials.
- May assume the role of lead facilitator for a particular session.

Lead Facilitator

- The doctor who oversees the conduct of a simulation education session.
- Needs to be at a level of ATY2 or higher and be appropriately skilled and experienced to deliver the content of the session.
- Ideally, the lead facilitator will have medical education experience and/or credentials.

Instructor

- A doctor with relevant hyperbaric skills and experience who conducts the individual "hands-on" skills stations/scenario rehearsals with guidance from the lead facilitator.
- Ideally, the instructors will have medical education experience and/or credentials.

Recognised emergency algorithms

At this stage, ANZCA and the DHM Special Interest Group (SIG) do not endorse any one particular algorithm. However, there are departmental specific procedures for emergencies as recommended by ASNZ 4774.2 for all accredited departments.

Suitable references to develop algorithms are:

- Cooper JS, Phuyal P, Shah N. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Oxygen Toxicity. [Updated 2020 Aug 29]; [cited 2020 October 15]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430743/

- Hampson N, Atik D. Central nervous system oxygen toxicity during routine hyperbaric oxygen therapy. Undersea Hyperb Med. 2003; 30(2):147-53.

- Bitterman N, Bitterman H. Oxygen toxicity. In: Mathieu D, editor. Handbook on hyperbaric medicine. Dordrecht (The Netherlands): Springer; 2006. p. 731-65.

Learning objectives

As a minimum, education sessions are required to provide the opportunity for participants to meet the learning objectives listed below. Objectives marked with an asterisk (*) require participants to actively engage in hands-on activities to practice this skill during the session.

By the end of the education session, participants will be able to:

1. Recognise and explain potential risk factors for CNS-OT.
2. Recognise and communicate clinical symptoms and signs that may precede a CNS-OT event.
3. Recognise and communicate the onset of a CNS-OT event.
4. Recognise other causes of seizure possibilities (e.g. hypoglycaemia, epilepsy).
5. Demonstrate the key features of initial assessment.*
6. Describe decompression requirements an understanding of decompression requirements.
7. Describe the pharmacology of anti-convulsant medications and know when it is appropriate to administer them.
8. Utilise Crisis Resource Management (CRM) principles in managing a medical emergency.*
9. Facilitate the safe removal of the patient from the chamber ensuring a patent airway prior to decompression.*
10. Provide safe management and discharge plan for the patient.
11. Formulate and explain a coherent plan to administer any future hyperoxic exposure.

Structure of education session

The education session in a hyperbaric facility is required to:

1. Provide pre-course reading relevant to the early identification and management of CNS-OT.
2. Have a minimum total duration of ninety (90) minutes and provide hands-on activities, which include scenario-based rehearsal, to achieve objectives marked with an asterisk (*).
3. Provide case-based discussion or scenario based simulation.
4. Be facilitated by an appropriately skilled clinician with experience of management of CNS-OT.
5. Be conducted by a lead facilitator and provide four (4) participants (this is usually a multi-disciplinary team). Instructors need to observe each participant while they are working through scenarios and provide verbal feedback to ensure they are achieving the objectives of the session.
6. Course directors who wish to record information relating to the performance or conduct of participants must obtain written consent and adhere to the privacy policies of their organisation and location. ANZCA and FPM do not collect this information and it is optional for the course provider and director to do so.

Session materials

Session materials, in hard copy or electronic form, need to include the following:

- Session objectives
- Session outline
- Facilitators' guide
- Session evaluation forms for feedback from participants and facilitator
- Participant list containing the date, venue, names and appointment types of participants.

References

1. Sherlock S, Way M, Tabah A. Audit of practice in Australasian hyperbaric units on the incidence of central nervous system oxygen toxicity. Diving Hyperb Med. 2018; 48(2): 73-8.

2. Banham ND. Oxygen toxicity seizures: 20 years' experience from a single hyperbaric unit. Diving Hyperb Med. 2011; 41(4): 202-10.

3. Standards Australia, Standards New Zealand. (AS/NZS 4774.2:2019) Work in compressed air and hyperbaric facilities, Part 2: Hyperbaric Oxygen facilities. Originated in Australia as AS 4774.2-2002. Jointly revised and designated as AS/NZS 4774.2:2019. Sydney (NSW) Standards Australia; 2019.