

Background

CO-poisoning cause serious illness and morbidity¹⁾. We present data from a 5-year experience of treating patients with carbon monoxide poisoning with hyperbaric oxygen therapy (HBOT) at a major referral centre of Copenhagen, Rigshospitalet, Denmark. Patients were transferred from all over the nation to HBOT based on the following criteria's;

- CO exposure causing or having caused unconsciousness,
- CO exposure causing neurological symptoms more than headache
- CO exposure > 25% or pregnancy
- CO exposure causing myocardial ischemia

Patients exposed to fire- or smoke inhalation, with significant metabolic acidosis and plasma lactate above 8.0 mmol/l were suspected to have a component of cyanide poisoning and were also given hydroxycobolamin^{2,3)}. Patients transferred to HBOT centre due to the above indications were treated according to the following protocol;

- Three sessions of HBOT preferably given within the first 24 hours – each session lasting 90 minutes at 285 kPa – no air breaks.
- Two sessions of HBOT administered within the following 24 hours – each session lasting 90 minutes at 285 kPa – no air breaks.

Accordingly, all patients were given a total of **5 HBOT sessions** administered within 48 hours

Methods

We did a retrospective analysis of a cohort of seriously CO poisoned patients who were unconscious requiring intubations and mechanical ventilation due to CO and/or combined smoke inhalation after exposure to fire and treated at our facility with HBOT. The cohort consisted of patients treated during a period from 01.01.2008 to 31.12.2012. Patient characteristics – See table 1 and 2:

Table 1 – Patients with burn injuries not included below:

Number of patients	51
Males/Females	39/12
Mean age – (Males/Females)	48 (46.4/52.9)
Length of Stay (LOS) in ICU	4.18
Days on mechanical ventilation	3.34

Table 2:

Patient characteristic's	CO Poisoning NO burn injuries	CO Poisoning INCLUDING burn injuries
Number of patients	51	77
Total ICU days	214	431
ICU mortality	3.9 %	13 %
30 days mortality	5.9 %	18.2 %
90 days mortality	7.8 %	19.5 %
365 days mortality	11.8 %	--
Standardized mortality ratio – SMR*)	0.18	0.54

*) SMR = 30 days mortality / SAPS II predicted.
CO poisoning: 5.9/31.9 = 0.18
CO poisoning + burn: 18.2/33.7 = 0.54

Table 3 – SAPS II and APACHE II Scores – CO poisoning patients without burn injuries:

Patient characteristic's	CO Poisoning NO burn injuries
Number of patients	51
SAPS II score (mean/±SD)	41 (±14.3)
SAPS II predicted mortality (mean/±SD)	0.32 (±0.25)
APACHE II score (mean/±SD)	20 (± 7.0)
APACHE II predicted (mean/±SD)	0.37 (±0.21)

Results

During this 5 year period, **925 patients** were hospitalized and registered with the exclusive diagnose of CO-poisoning on a national scale. Of these 925 patients, 51 patients were treated for severe CO poisoning requiring sedation and mechanical ventilation. Of the 51 patients, 50 patients were given HBOT using a protocol with a total of 5 sessions to 2.8 atm.abs. for 90 min (no airbreaks) given within the first 48 hours from admission. The numbers of ICU days were 214 with an overall ICU mortality of 3.9%. The 30 day mortality rate was 5.9% and the 90 day mortality were 7.8%. The SAPSII predicted mortality was 31.9%. The standardized mortality rate (SMR) at 30 days were 0.18.

When including burn patients – a total of 77 - the ICU mortality were 13.0%, the 30 day mortality 18.2% and 90 day mortality 19.5% with an SMR of 0.54 at 30 days and a SAPS II predicted mortality of 34 %.

Conclusion

The fraction of HBO treated patients requiring intensive care with sedation, mechanical ventilation and HBO were 5.5% as compared to the total number of National hospital admissions. The SAPS II predicted mortality (31.9%) and 30 day predicted SMR (0.18) is higher than actually observed for patients with no burn injuries. Similarly for patients with burn injuries.

References

1. Hampson NB, Piantadosi CA, Thom SR, Weaver LK. Practice recommendations in the diagnose, management and prevention of carbon monoxide poisoning. Am J Respir Crit Care Med. 2012 Dec 1;186(11):1095-1101.
2. Lawson-Smith P, Jansen EC, Hilsted L and Hyldegaard O: Effect of hyperbaric oxygen therapy on whole blood cyanide concentrations in carbon monoxide intoxicated patients from fire accidents. Scand J Trauma Resusc Emerg Med. 2010;18:32.
3. Hansen MB, Olsen NV and Hyldegaard O: Combined administration of hyperbaric oxygen and hydroxycobalamin improves cerebral metabolism after acute cyanide poisoning in rats. J Appl Physiol. 2013 Nov 1;115(9):1254-1261.