Heart Failure and HBO

CHF Strategies

Prediction

Can we reliably predict who will develop symptomatic heart failure (shortness of breath)?

Heart Failure and HBO

RESEARCH ARTICLE

Safety of hyperbaric oxygen therapy in patients with heart failure: A retrospective cohort study

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Heart Failure and HBO

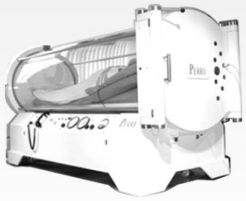
- **Acute pulmonary edema associated with HBO therapy is rare.**
- **Ejection Fractions alone are unreliable.**
- **No HBO specific predictors are available to identify who will go into heart failure.**
- **BNP levels offer promise but have not been studied within the heart failure pop.**

Yildiz S, BNP levels increase after HBO in diabetics. Clin Invest Med 2008;10: E231-234

Grassi P, BNP in Healthy Subjects After HBO Aviat Space Environ Med 2007; 78:52–3.

Heart Failure and HBO

- **BNP levels increase with wall tension and volume overload**



Yildiz S, BNP levels increase after HBO in diabetics. Clin Invest Med 2008;10: E231-234

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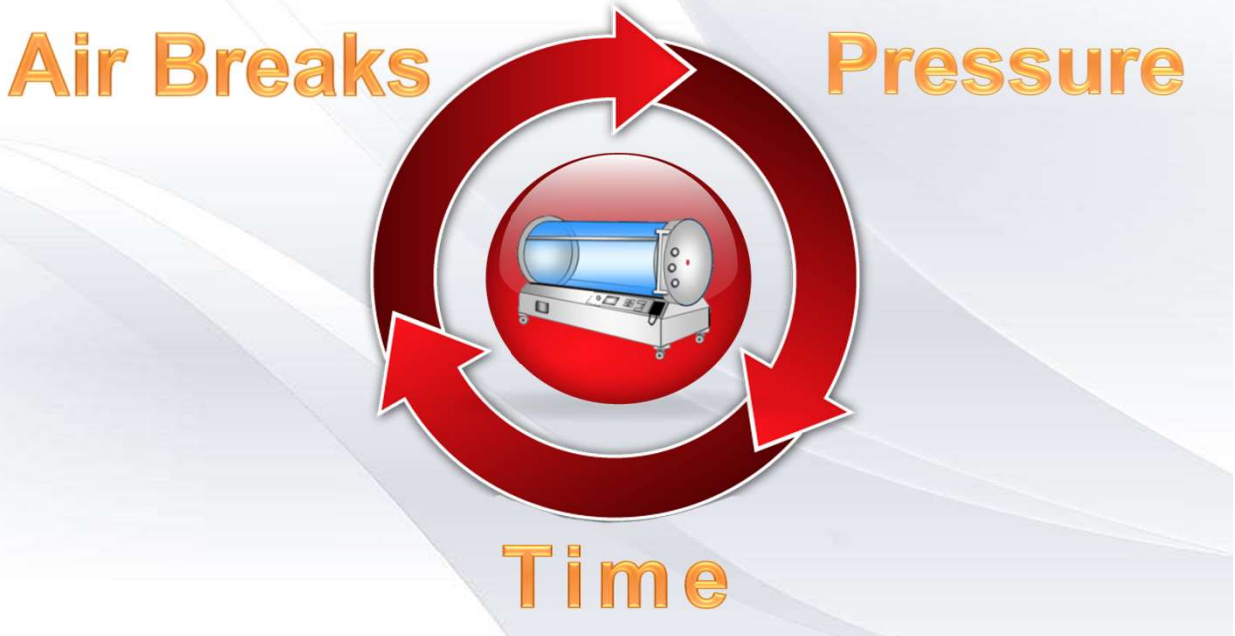
Known Physiology

1. HBO increases systemic vascular resistance and correspondingly a reduction in cardiac output.
2. Increase in pulmonary capillary wedge pressure occurs with high concentrations of normobaric oxygen in NY Heart Association class III or class IV heart failure patients (EF= 15 to 20%).
3. Oxygen radicals consume endothelial-derived nitric oxide, which decrease diastolic left ventricular distensibility.

Known Physiology

1. Systemic vascular resistance decreases rapidly when placed on air.
2. Systemic vascular resistance decreases with a reduction in pressure
3. "Flash" pulmonary edema does not mean there is an instantaneous transition from normal breathing to frothy, pink, sputum. It is a process which begins with decreased pulmonary compliance.

THREE KEY CONSIDERATIONS



CHF Strategies

Step-1 ⇨ MEDICAL STATUS

Is the patient medically optimized?

- Taking medications regularly?
- Recent change in exercise tolerance or PND?
- Consider weekly weights. Weight gain ≥ 5kg?
- Refer to PMD for weight gain | Medications

✔ **Yes** **Patient is Optimized**

→ **Begin HBO**

CHF Strategies

Listen ⇨ GENERAL APPROACH

Communication

The most important element of case management is the early warning of Shortness of Breath!

Reminder before each treatment to notify if SOB.

Pulmonary edema takes time to evolve.

CHF Strategies

General Approach

If the patient becomes short of breath, place them on air, decompress, and evaluate.

- Placing the pt on air provides an immediate treatment of the problem, which is an elevated after load (inc SVR).
- In the typical pt there will be bibasilar rales which usually clear in 30 min as fluid redistributes.

CHF Strategies

Step-2 Pressure & Air-breaks

Is Treatment Pressure ≥ 2.4 ATA?

- Reduce pressure to 2.0 ATA

Is Treatment Pressure = 2.0 ATA?

- Add air-breaks using "30-10" schedule

Comp	30 min-O2	10 min-air	30 min-O2	10 min-air	30 min-O2	Decomp

Patient still symptomatic during HBO?

✔ **Yes** **Advance to step 3** (adjust time)

CHF Strategies

Step-3 ⇨ TIME

Reduce oxygen time by 15 min

Comp | 25 min-O2 | 10 min-air | 25 min-O2 | 10 min-air | 25 min-O2 | Decomp

Patient still symptomatic during HBO?

✔ Yes

Reduce oxygen time by additional 15 min

Comp | 20 min-O2 | 5 min-air | 20 min-O2 | 5 min-air | 20 min-O2 | Decomp

Patient still symptomatic during HBO?

✔ Yes **Advance to step 4 (adjust pressure)** ⇨

CHF Strategies

Step-4 ⇨ PRESSURE

Reduce pressure to 1.8 ATA | 60 min O_2 time

Comp | 20 min-O2 | 5 min-air | 20 min-O2 | 5 min-air | 20 min-O2 | Decomp

Patient still symptomatic during HBO?

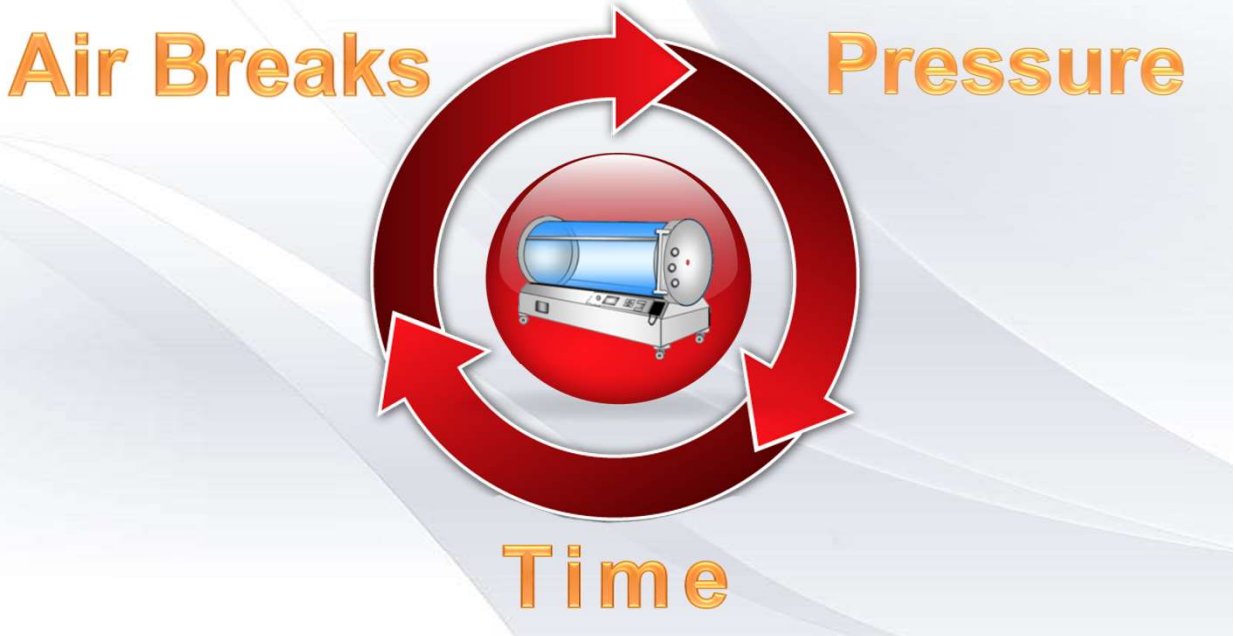
✔ Yes

STOP **Oxygen times less than 60 min with pressures less than 1.8 ATA may be sub-therapeutic.**

SUMMARY

- Acute heart failure with HBO therapy is rare.
- Pulmonary edema evolves over many minutes (not seconds)
- Ejection Fractions are unreliable predictors of HBO induced HF.
- No specific predictors are available to identify who will go into heart failure during HBO therapy.
- Check medical optimization
- Follow daily/weekly weights measured in the center
- Monitor – by checking for SOB several times during treatment
- Modify future treatment profiles if SOB occurs

THREE MODIFIERS



Linked Refs with Abstracts

- Yildiz S, Uzun G, Uz O, Ipcioglu OM, Kardesoglu E, Ozcan O. N-terminal pro-B-type natriuretic peptide levels increases after hyperbaric oxygen therapy in diabetic patients. Clin Invest Med. 2008 Oct 1;31(5):E231-5.
- Grassi P, Buscema G, Rinaldi A, Gobbato PE, Berlot G. B-type natriuretic peptide in healthy subjects after exposure to hyperbaric oxygen at 2.5 ATA. Aviat Space Environ Med. 2007 Jan;78(1):52-3.
- Vincent J, Ross MK, Pollock NW. Effect of hyperbaric oxygen treatment on patients with reduced left ventricular ejection fraction. Diving Hyperb Med. 2021 Sep 30;51(3):256-263.
- Leitman M, Efrati S, Fuchs S, Hadanny A, Vered Z. The effect of hyperbaric oxygenation therapy on myocardial function. Int J Cardiovasc Imaging. 2020 May;36(5):833-840.
- Schiavo S, Brenna CTA, Albertini L, Djaiani G, Marinov A, Katznelson R. Safety of hyperbaric oxygen therapy in patients with heart failure: A retrospective cohort study. PLoS One. 2024 Feb 8;19(2):e0293484.