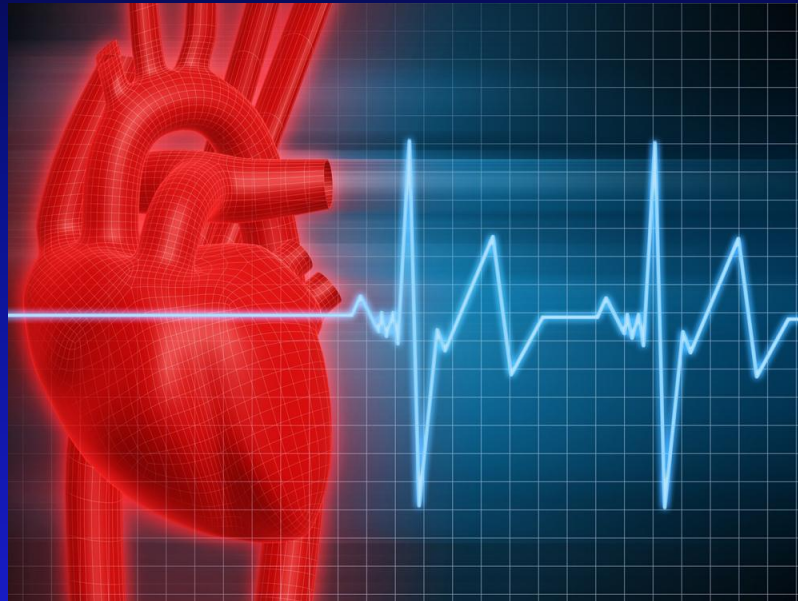


# CARDIAC ARREST ABORT TABLES FOR HYPERBARIC OXYGEN THERAPY



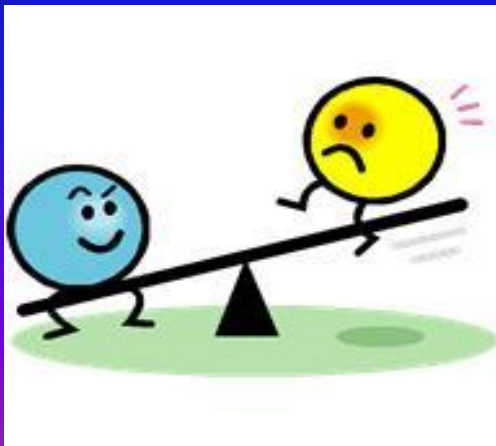
Prepared and Presented by  
Paul Doherty BSN CHRN for 2011  
CC-UHMS Conference

# BACKGROUND

- VGH's hyperbaric facility has been in existence since the 60's with regular elective patient treatments since the 80's.
- At present the unit completes, on average, 3000 elective patient treatments and 112 emergency patient treatments annually. No cardiac arrests to date in the chamber.
- Up to 1/3 of the emergency patient treatments involve critically ill patients, some direct post-op from open heart surgery.
- In a cardiac arrest, decompression decisions would have been made on the fly hoping that no mistakes were made.
- This decision making process was especially challenging for several reasons;
  - the window of opportunity for treating the patient with a cardiac arrest is small
  - the timing of the hyperbaric treatment, it may be 3 AM in the morning
  - the decompression strategy may be complicated

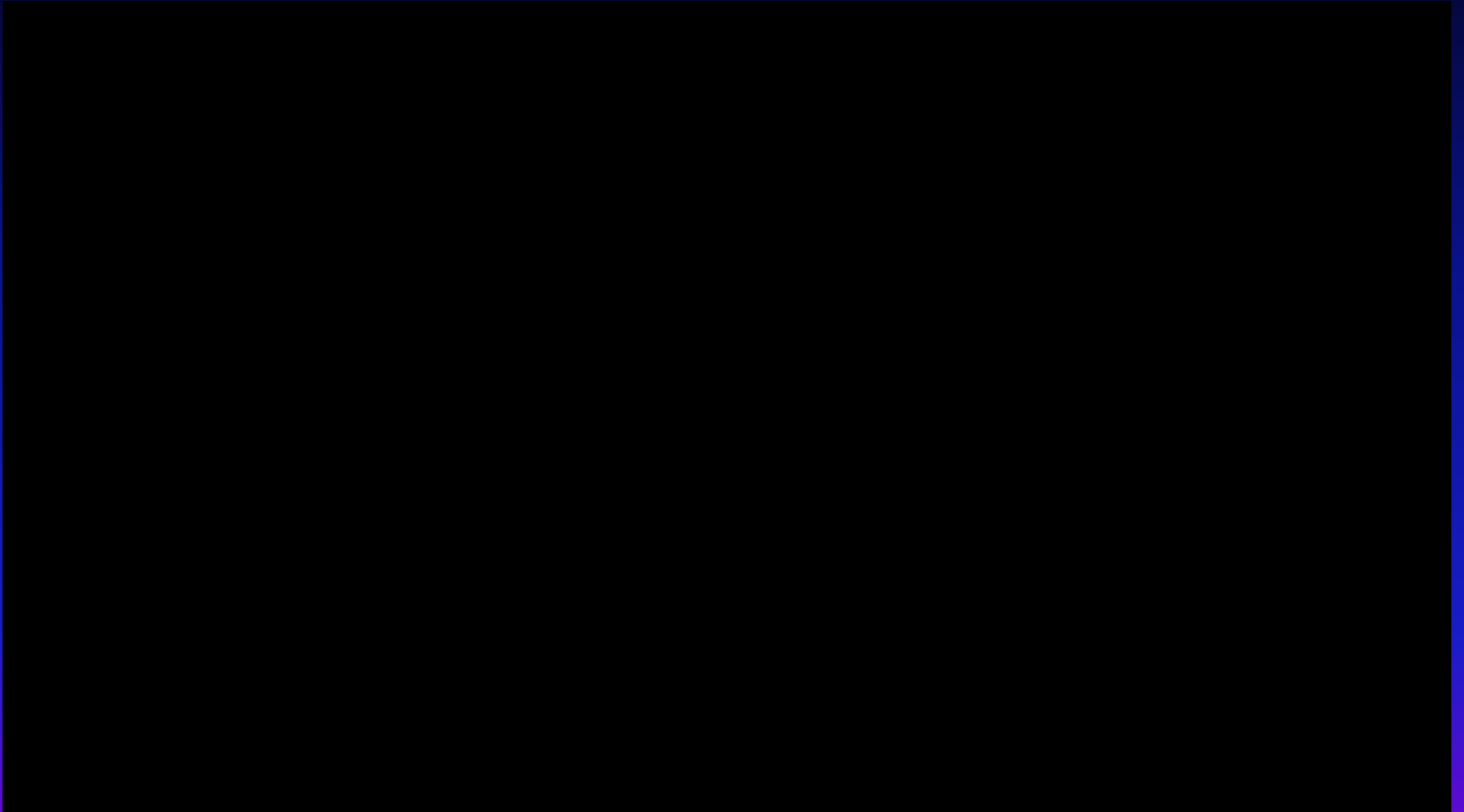
# THE AH-HA or HMM MOMENT

- Several years ago the unit was treating a patient for DCS and had completed approximately half of the treatment when the patient decided with fervor that they had had enough and wanted out.
- This situation was a catalyst for the VGH HBU.
- Started thinking about how to balance both the needs of the patient in distress as well as the inside tender's decompression needs.



- Found it would be really helpful to be able to quickly see what an inside tender's decompression requirement is at any point in a treatment.

# THE BEAN APPROACH TO CPR



# WHAT WE KNOW ABOUT CPR

- According to the AHA 2010 Guidelines several studies have shown that there is a documented 3-4% per minute decrease in survival rate in ventricular fibrillation sudden cardiac arrest with CPR.
- AHA Guidelines state that the best response should be early CPR with defibrillation in less than 3 minutes.
- The AHA guidelines do also note that many adults survive with intact neurological function if defibrillation occurs within 5-10 minutes after the sudden cardiac arrest.



# VANCOUVER GENERAL HOSPITAL HYPERBARIC UNITS APPROACH

- Can the balance of tender safety and patient need be obtained?
- The VGH HBU feel that the answer to this question is YES.
- The VGH HBU began developing set cardiac arrest abort tables for every treatment table that may be undertaken in the unit.
- Key considerations in table development
  - fastest patient egress possible to allow the code blue team access to the patient
  - Need to have the ability to know the decompression requirement for the inside tender, regardless of RF, at any point in the treatment



- Be prepared

# TIMELY PATIENT EGRESS

- The main barrier to getting a patient out quickly is the pressurized chamber itself.
- Hyperbaric chambers all have an inherent maximum rate that they may depressurize at and as the chamber comes closer to the surface the slower that rate becomes → currently takes the VGH HBU chamber approximately 6 - 8 minutes to fully depressurize from 165 feet of sea water.
- It is essential to be able to make rapid decisions about patient egress and the satisfying inside tenders decompression needs.
- Cardiac arrest abort tables allow for extremely quick decisions and actions for getting a patient safely out of the chamber without putting an inside tender at increased risk→ especially handy at 3 AM in the morning.

# INSIDE TENDER REQUIREMENTS

- Using the DCIEM Table 2M or Modified In-Water Oxygen Decompression tables the minimum decompression requirements were determined for every treatment table the VGH HBU employs.
- In an effort to increase tender safety the VGH HBU added 3 minutes to the required oxygen decompression time in the DCIEM tables for most protocols.
- Requirements for both clean tenders and tenders with a RF greater than 1.0 were calculated.
  - This process revealed that some RF's on certain dive profiles produced a decompression strategy entering into the exceptional exposure (EE) area of the table. The VGH HBU has a policy that an inside tender will not do a repetitive dive which puts them into an EE situation with the exception of the USN TT6.
- VGH HBU has restrictions on max RF's a tender can have before initiating a treatment profile,
  - i.e. for a 3.0 ATA profile for Gas Gangrene a tender needs to have a RF of 1.4 or less.

# EXAMPLE PROTOCOL

Vancouver Hospital & Health Sciences Centre	<b>Hyperbaric Unit</b>	Number:
	Topic: TT6A Cardiac Arrest Abort Protocol	Revised
Date Reviewed	Page	Approved:

1. Once the hyperbaric physician decides to abort the treatment, the chamber is brought to the first decompression stop or to the surface, as per the table below, at the maximum possible travel rate, up to a maximum of 50 feet per minute.

2. During travel the patient is managed as follows:

(a) **Two tenders inside chamber:** Provide chest compressions and ventilations according to AHA guidelines (30 and 2) while the chamber travels to the surface or to the first decompression stop.

(b) **Single tender inside chamber with intubated patient:** Leave ventilator settings unchanged and provide uninterrupted chest compressions at a rate of 100/minute while the chamber travels to the surface or to the first decompression stop.

(c) **Single tender inside chamber with non-intubated patient:** Provide uninterrupted, chest compressions at a rate of 100/minute during ascent to first deco stop.

3. If a decompression stop is required, a new tender (nurse or physician) enters the main lock through the entry lock (Lock 2) at the depth of the first decompression stop and assumes care of the patient. Once the new tender enters, he/she will interrupt chest compressions to give 2 breaths, confirm that patient is still pulseless.

4. If intravenous access is already in place give 1mg of Epinephrine IV, and then resume uninterrupted chest compressions. If no IV in place Epinephrine is not given.

5. The original inside tender or tenders enter the entry lock (Lock 2) and begin breathing oxygen via Scott mask (oxygen breathing in Lock 2 is considered bonus time and does not decrease the time required at 20 fsw).

6. The new tender and the patient in the main lock are brought to the surface at the maximum possible rate.

At the surface, the patient is removed from the main lock, the circulating staff verifies that the chamber oxygen is turned off, and the lock is returned to the depth at which the inside tender is decompressing. The inside tender enters the main lock and begins their oxygen decompression according to the table below, the back up operator will inform the decompressing tender of their decompression requirement.

TT6A (min)	70 Foot Stop	60 Foot Stop	50 Foot Stop	40 Foot Stop	30 Foot Stop	20 Foot Stop
10	-	-	-	-	-	7 min OXYGEN
15	-	-	-	-	6 min AIR	13 min OXYGEN
20	-	-	-	5 min AIR	6 min AIR	21 min OXYGEN
25	-	-	3 min AIR	5 min AIR	6 min AIR	31 min OXYGEN
30	-	-	6 min AIR	5 min AIR	7 min AIR	39 min OXYGEN
40	-	4 min AIR	5 min AIR	6 min AIR	9 min AIR	52 min OXYGEN
50	3 min AIR	4 min AIR	5 min AIR	7 min AIR	14 min AIR	66 min OXYGEN
60	4 min AIR	5 min AIR	6 min AIR	8 min AIR	23 min AIR	81 min OXYGEN
70	5 min AIR	5 min AIR	7 min AIR	12 min AIR	31 min AIR	96 min OXYGEN
> 70	Decompress on TT6A as per usual oxygen requirements					

Max ascent rate:  
50 ft/min

**Interrupted Deco:**  
- If the tenders breathe chamber air, even 1 breathe, during their oxygen deco 1 minute of oxygen deco is added.  
- For each minute of breathing chamber air 2 additional minutes of oxygen deco are added.

The first two points outline the CPR response

Steps 3 – 6 are as follows:

3. If a decompression stop is required a relief staff will lock into the treatment lock at the first deco stop and take over CPR.

4. If IV in place epinephrine may be given.

5. Inside tenders move to the transfer lock at the first deco stop, begin oxygen breathing. This is bonus time as the deco clock does not start here.

6. The treatment lock will travel immediately to the surface for patient removal.

Once empty the treatment lock is pressurized to meet the transfer lock at the first deco stop and the inside tenders enter the treatment lock to begin their deco. The deco clock now starts.

# USN TT6A ABORT PROTOCOL DECO

TT6A CLEAN TENDER REQUIRED FOR USN TT6A						
(min)	70 Foot Stop	60 Foot Stop	50 Foot Stop	40 Foot Stop	30 Foot Stop	20 Foot Stop
10	-	-	-	-	-	7 min OXYGEN
15	-	-	-	-	6 min AIR	13 min OXYGEN
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> 70	Decompress on TT6A as per usual oxygen requirements					

- The VGH HBU's deepest treatment profile has a rather complex decompression strategy for an abort situation.

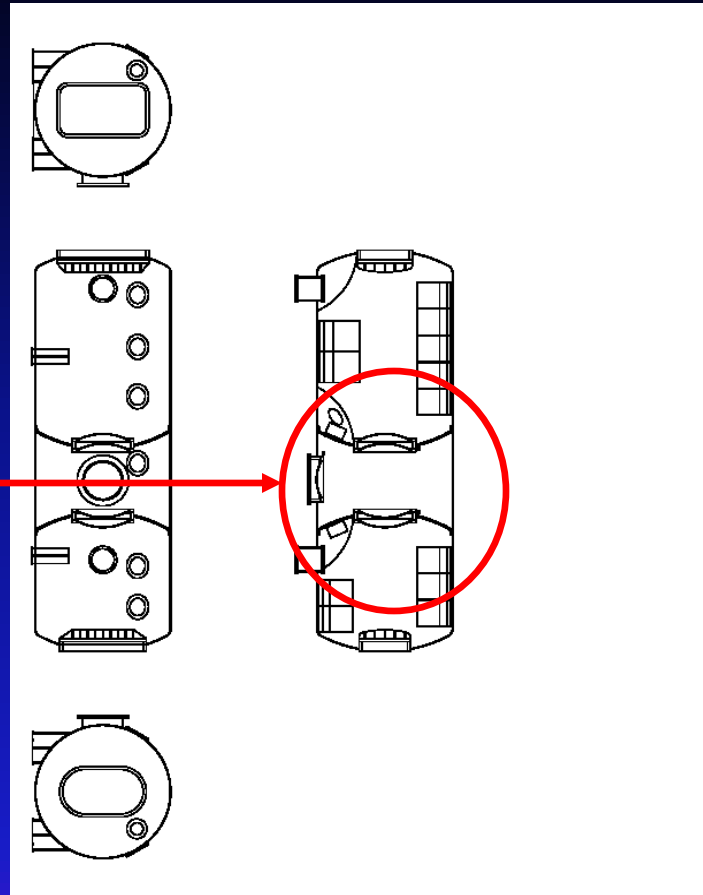
# WHAT WE HAVE LEARNED

- The first experience in using the protocol was for an emergency ICU patient that needed to be brought out as their condition was deteriorating.

- The first challenge that arose was ensuring the correct doors were in the right position in the transfer lock to allow the treatment lock to surface without pulling the transfer lock with it.

- Now have labels on the doors indicating proper alignment.

- Verbally review the door configuration for an abort prior to an emergency treatment



- Not enough to have the protocols, but must review them regularly in order to have a smooth transition and maintain the benefit of making quick decisions.

- Abort protocols are not only applicable to cardiac arrest and may be used for any event requiring an early termination of a treatment such as Protocols for Fire Management, Natural Disasters, Mechanical Failures, and Aggressive Patients.

