

Managing an unconscious OC or CC Diver Underwater

Note: The following are talking notes for a presentation given by Bill Ripley at the November 2008 VBTech meeting. As such, it is being placed on the VBTech website for member reference. Since it is not intended for publication, credit to various sources have not been cited. However, substantial content came from Cedric Verdier's website and from posts on Rebreather World.

First Aid, CPR and other out-of-the-water actions are not discussed.

If you take only these 5 points with you tonight:

1. If you take 3 minutes to get diver with an unprotected air way to surface (i.e. reg out) it is all over in practice.
2. If you take 3 minutes to get non-breathing diver to surface it is all over.
3. If you can not guarantee the diver is breathing, get them to surface.
 - Who cares what they are breathing or their deco obligation.
 - What they are breathing is the most likely reason they went unconscious.
 - So get them to surface & breathing air ASAP.
4. Every second you screw around it is more likely they will die.
 - DCS can kill but drowning is faster.
 - DCS can be treated post event, death is harder to rectify.
5. **Drowning is the biggest risk** at this point.
 - Manage that and you will have a hope.

What can cause being unconscious under water?

- Gas Issues:
 - Wrong fill.
 - Wrong gas mix.
 - Contaminated gas.
 - Not enough gas.
- Equipment failure.
- Health:
 - Fitness
 - Medications
- Procedural:
 - Not monitoring
 - Depth & Gauges
 - Breathing rate
 - Gas supply

FYI:

- Hypercapnia (too much CO₂ – unconscious above 10%)
- Hypoxia (too little O₂ – PO₂ less than .10 ATM – 30 seconds of cushion)
- Hyperoxia (too much O₂ – Oxygen Toxicity – 2 to 6 minutes of cushion)

What can you do -- ON SHORE -- to discourage it?

- Run thru emergency situations before dives.
- Get in good physical shape.
- Understand prescriptions and/or OTC drugs.
- Practice staying calm in stressful situations.
- Analyze gas.
- Know where gas came from
 - Reliable fill station, etc?
- Clearly mark tanks (regs if needed).
- Don't dive with broken gear.
 - Annual service not a recommendation but a requirement.
- Don't dive with loaded CNS Clock.
- Be set up to be neutrally buoyant.
- Dive with Buddy when you can.
 - Buddy is close by, ready to help.
 - Buddy can help with bubble checks & equipment.
- Be sure Buddy knows how your rig works.
 - **It's your job** to understand what your Buddy is diving!
 - **It's your job** that you Buddy understands what you are diving!
- Fully discuss with your Buddy how to handle emergencies, including death.
- Use necklace on regulator(s) or FFM.
- Think how each piece of your gear can be used in an emergency.

CC

- Use a pre-dive checklist.
- Calibrate your rig.
- Use fresh batteries.
- Check for current limiting cells.
- Properly pack scrubber.
- Don't push scrubber.
- Properly pre-breathe scrubber.
- Use a BOV = no need to change mouthpieces underwater.
- Carry enough bail out.
- Use breathable diluents when possible.

How can you spot an unconscious diver underwater?

- No motion with bubbles = OC
- No motion with no bubbles = CC
- No motion:
 - Sinking
 - On bottom
 - Floating away

What can you do when you find an unconscious diver underwater?

Bring the victim to the surface as quickly and safely as possible.

Hyperoxia: Grand Mal Convulsions have 3 Phases

1. **Tonic phase** – Victim's body rigidity - lasts 1 min +/- - wrong time to surface as diver probably not breathing – the “dangerous” phase.
2. **Clonic phase** – Victim has true convulsions – airways not blocked.
 - a. Seizures last for a few minutes.
3. **Post-Ictal phase** – Victim stops trashing around + resumes breathing.
 - a. Can wake up or not.

Belief that convulsing diver must be held underwater till convulsions stopped is a misconception & possibly a dangerous one.

Airway not spasmed shut during the Clonic (jerking) phase as popularly believed by divers.

Still, most – who don't see this often - wait until the convulsions have stopped.

STEP 1: STABILIZE THE VICTIM

- Unconscious close to the bottom, move him to stable position.
- Mid-water, maintain depth (catching the ascent line, etc.).
- Get another diver's help, if possible

STEP 2: ASSESS THE SITUATION

A. The victim

- Oxygen Toxicity Seizure?
 - Without FFM or Neckstrap, drowning is the major concern.
- Victim breathing?
 - No bubbles, no chest movement, no CL movement, must get to the surface for CPR.
 - If no boat or shore = in water mouth-to-mouth only option.

B. The Equipment

- Victim wearing a drysuit or wetsuit?
- Victim wearing a FFM or neckstrap to protect airway?
- Pressure gauges indicate a problem?
- On CC with no BOV, is the loop content safe to breathe?
 - Check pO2 readings during the ascent.
- Mouthpiece still in mouth?
- Water in Mask?
- On CC with no BOV, is unit eCCR or mCCR?
 - If eCCR do gauges, DIVA, HUD indicate unit functioning to get to surface?
- Any scooter (DPV) to assist in moving you and victim?

C. The Diving Environment

- **Any physical problem to delay ascent?**
 - Strong current:
 - Consider swim to ascent line vs. drifting from boat if no DPV.
 - Overhead environment (cave, ice, wreck penetration):
 - May delay ascent as you will have to swim to exit point.
- **Any physiological concern to delay ascent?**
 - If breathing victim with protected airway (FFM, neckstrap) w/ significant decompression obligation:
 - You should consider performing required stops.
 - If not breathing or without protected airway:
 - You should be thinking about immediate ascent.
 - You could have decompression obligation = **3 options:**
 1. Ascend with victim at the surface
 - Provide 1st aid or hand over victim to surface support
 - Follow a **missed deco** procedure.
 2. Hand victim to another diver
 - With no or less decompression obligation.
 3. Send victim to surface on their own
 - Hoping surface support will be efficient & fast enough.

This is a personal decision, based on factors that have to be quickly considered by a highly stressed you, such as:

- Victim's apparent state (not breathing for very long time, etc).
- Decompression obligation & perceived risk of DCS.
- Accepted risk (could depend on relationship with victim).
- Efficiency & availability of surface support.
- Surface condition (rough seas where the victim will not be seen, etc).
- Surfacing away from boat be prepared to incur deco hit:
 - No point going to surface if no intention of staying with the diver until the boat is contacted and on hand.
 - Not prepared for deco hit, let him go.

- Within shouting distance of boat
 - May decide to go up & scream for the help.
 - Establish positive buoyancy face up for the victim before leaving (say 1 minute on surface).
 - Then descend to do deco

If strong seas, strong current & expect to surface well away from the boat:

- **Victim's chance of survival is very small.**
- **You have to consider your own position.**
- **With a serious deco obligation you will definitely up end with 2 victims out of contact with the boat, not one.**

The longer it takes for the victim to get on board & get treatment:

- **Less likely his chance of survival.**
- **Higher chance you will become potentially a second fatality if you go to the surface.**
- **At some point you have to make that trade off and let him go to protect yourself.**

STEP 3: ASCENDING TO THE SURFACE

A. Open the Airway

- Open victim's airway
 - Keep neck slightly extended (chin up)
 - So air in lungs can escape as it expands (preventing lung overexpansion injury).

B. Controlling the Ascent

- Use what works for you to get control:
 - In front or behind victim.
 - With harness.
 - Arm around chest.
 - Consider a panicked-diver situation if victim regains consciousness.
- Remove victim's weight belt or equipment (lights, etc.)
 - If progress to surface impeded.
- You should not release own weight belt or inflate his BC:
 - If you lose victim with no weights and over-inflated BC, you could lose his control.
- Open victim's airway & leave the mouthpiece in.
- If mouthpiece not in, **do not attempt to replace it.**
 - Opening the mouth only allows water in & drowning.
 - Seal the mouth & ascend immediately.

- Some try to seal second stage against the lips so if breathing resumes air will be inspired vs. water.
- o CC w/ BOV switch to OC or switch to surface position
 - o To prevent flooding loop = creating negative buoyancy.
- o Turn off victim's gas bottles (diluent + O₂) to help with buoyancy control on the ascent.
- If CC **AND** mouthpiece still in Switch to BOV, if any.
- If CC **AND** mouth piece still in with no BOV:
 - o Flush loop w/ diluent to lower PO₂.
 - o Check pO₂ readings for safe mix during ascent.
 - o If eCCR allow unit to operate itself, if possible.
 - o If eCCR ascend slowly so unit can keep up with PO₂/ambient pressure changes.

Hypoxia

- o Check pO₂ as it will drop when ascending to the shallows.

Hyperoxia

Breathing high O₂ content in loop could also be beneficial to decompression.

- o If Mixed-gas diving
 - OC mix has to be breathable all the way up to the surface.
 - Tank volume has to be sufficient – most DIL tanks too small.
 - Tank valve has to be open.

Hypercapnia

- o Without a scrubber monitor, difficult to assess the CO₂ level in the loop.
- o A diluent flush helps & could help in case of partial loop flood.
- o To efficiently flush the loop on most of the units, you have to open the OPV first.
- Monitor displays & pressure gauges
 - o Keep informed of victim's breathing gas and rig status.
- Water in mask?
 - o If so pinch nose during ascent to stop inspired water.
- Make controlled ascent to 1st decompression stop
 - o Maintain slight pressure on diver's chest to assist exhalation.
- If victim regains control = continue with appropriate decompression.
- If victim remains incapacitated =
 - i. Surface at moderate rate.
 - ii. Establish airway
 - iii. Treat for symptomatic omitted decompression
- Additional buoyancy = victim's BC, drysuit, CLs, etc.

C. Establishing Positive Buoyancy at the Surface

- At surface, inflate victim's BC, Drysuit, CLs.
- If still negative:
 - Release weight or accessories (canister light, sling tank, etc).
- On CC, remove mouthpiece and switch to SURFACE
 - Prevent rig flooding and weighing down victim.
- Signal for emergency pickup, if any.
- Ensure victim is breathing.
- If not, mouth-to-mouth may be initiated if no help is in sight & if seas permit.
 - Move into doe-se-doe position & provide 2 breaths.
 - Remove mask and reg so you can do the emergency breaths.
 - Count 4 seconds (1-1000, 2-1000, 3-1000, 4-1000) and provide 2 breaths, repeat.
 - With no cardiovascular stimulation, this action may not be helpful.

REMEMBER:

- **An unconscious diver needs to be removed from water as soon as possible.**
- **This goal should take precedence over all other considerations in the vast majority of circumstances.**
- **There may be situations when you can not save your Buddy.**
 - **You have time now to start planning to minimize those situations.**