

Treating “External Gas Bubble Disease” in Seahorses

“Gas Bubble Disease” is a term that refers to three symptoms of disease found in seahorses kept in captivity. It has been reported in both home and public aquaria. It is usually a chronic problem and is often fatal if left untreated.

The three common forms of Gas Bubble Disease are:

External (subcutaneous emphysema) - clear gas bubbles form under the skin.

Internal (where the abdomen appears bloated and the seahorse floats upward when not hitched. If the animal is not floating, it is not internal gas bubble disease: negative buoyancy may be caused by weight gain resulting from edema, or if no other symptoms are evident, abdominal bloating in a female may simply mean the animal is gravid),

Pouch bloat (pouch emphysema) - trapped gas in the pouch causes buoyancy problems in male seahorses.

With External Gas Bubble Disease, gas emboli are most commonly formed on the tail, but can appear anywhere on the seahorse’s body. They may be large defined bubbles or a mass of smaller bubbles. In advanced cases, the trapped gas can cause buoyancy, and this can prevent the seahorse from hunting and feeding. It should be treated as soon as possible to prevent permanent damage.

Gas emboli are clear/translucent – care should be taken to differentiate between larger emboli and the white/grey opaque granulomas that can be caused by bacterial diseases such as *Mycobacterium marinum* (“fish tuberculosis”), which may appear similar.

This is a fairly typical presentation of the symptoms of External Gas Bubble Disease:



Cause:

The etiology of the “Gas Bubble Diseases” is unknown at present. Hypotheses are varied and include metabolic or respiratory acidosis. “Gas Bubble Disease” in other fish is usually caused by supersaturation of nitrogen, carbon dioxide or more rarely very high levels of oxygen – seahorses are also susceptible to this, and it will produce similar symptoms to “External Gas Bubble Disease”. However, seahorse “Gas Bubble Diseases” can readily occur without gas supersaturation present and should be treated as a separate conditions.

Treatment:

Traditionally, advice was given to “lance” the bubbles with a sterilized needle. This is usually unnecessary, and has lead to secondary opportunistic infections with *Vibrio* sp. We strongly recommend **not** lancing as the secondary infection is often more deadly than the External Gas Bubble Disease itself.

Acetazolamide (trade name “*Diamox*”) is the current drug of choice: it is usually very successful in treating the symptoms of external gas bubble disease. Diamox is a carbonic anhydrase inhibitor used to treat glaucoma and altitude sickness in humans. It is a non-bacteriostatic sulfonamide and has been used successfully in conjunction with antibiotics, where cases of external gas bubble disease and bacterial infection occur simultaneously. It is administered as a bath treatment over 3-5 days.

- 1) Prepare a hospital tank for the seahorse with a capacity of 10 US gallons. The new water used should be properly mixed, aged & aerated, and carefully pH/temperature/salinity matched to the seahorse’s tank so as not to shock the animal.
- 2) Provide a hitching post and plastic plants for the seahorse to hitch and hide, a heater to maintain the species’ required temperature, provide a couple of airlines to create water movement and aeration. A cycled filter can be utilised, as Diamox is not toxic to nitrogen fixing bacteria. However, carbon and anything that can remove the medication from the water (skimmers, UV etc) should be removed. If a cycled filter is not available, test the water at intervals for ammonia – even at the lowest detectable levels, ammonia is toxic and immunosuppressive. Lighting is not necessary: in humans Diamox can cause photosensitivity so low levels of ambient light only are recommended.
- 3) Using the tablet form of acetazolamide (250mg of Diamox) crush the required amount to a fine powder and mix in with some seawater. There will be a slight residue that will not dissolve. Add the solution to your hospital tank, discarding the residue. This is the dosage required:

Dwarf species (up to 8 cm)	-	¼ x 250mg tablet per 10 gallons
Small species (up to 12 cm)	-	½ x 250mg tablet per 10 gallons
Medium to large species (over 20 cm)	-	1 x 250mg tablet per 10 gallons
- 4) Move your seahorse to the hospital tank and leave in the Diamox solution for 24 hours. This is day one of the treatment plan.
- 5) After 24 hours has elapsed, you need to perform a 100% water change on the hospital tank. You can do this by moving the sick seahorse to a holding container, discarding the water from the hospital tank and adding in the fresh temperature/salinity/pH matched seawater. Prepare the dose of Diamox and add it to the water. Place the seahorse back into the hospital tank. This is day two of the treatment plan. This process is repeated for up to a total of five days of diamox treatment.

NOTE: No side effects or problems have been reported to date from performing 50% daily water changes instead of 100%. 100% changes are recommended because it is currently uncertain how quickly the drug is inactivated by salt water. This is the safest method, avoiding any potential cumulative dosage. However, 100% water changes are more stressful on the animal, especially if improperly pH/SG/temperature matched, and may not be necessary.

- 6) If the symptoms abate by day three, treatment can be stopped. However, it is fairly common for the treatment to take longer to have any noticeable effect. Remain patient, do not rush to lance the bubbles. At the end of the treatment, the seahorse may be returned to the main tank. It is currently believed that environmental factors such as poor gas exchange may be a trigger for the disease and it is recommended that this is addressed before returning the animal, or the symptoms may reoccur.

Notes:

- In humans, loss of appetite sometimes occurs as a side effect of Diamox treatment.
- This method of treating Gas Bubble Disease has been proven very effective in a series of tests run with sick seahorses under the control of the emergency team from the website www.seahorse.org.
- The repeated doses of Diamox are required, as the medication appears to lose its effectiveness over 24 hours.
- Toxicity has not been determined, although tests have been run with 500mg Diamox in 30 litres seawater changed daily over a 4 day test period with no apparent ill effects on 2 *Hippocampus reidi* (medium seahorses)
- The long-term effects of acetazolamide on other inhabitants of the marine aquarium are unknown, so the use of a hospital tank is considered mandatory. Additionally, as the condition may have an environmental trigger, removing the animal to an isolation tank is a sensible precaution. In some cases, simply doing this alone can cure the condition without medication.
- Do not mix medications without seeking advice. Do not combine this treatment advice with any other.
- Alternatives to Diamox include decompression treatment of Gas Bubble Diseases.

Quote: Dr. Martin Greenwell, D.V.M., the Aquatic Vet at the Shedd Aquarium (*Seahorse Husbandry guide, 2002* – Project Seahorse, Shedd et al)

"...My working hypothesis on this one is that the vascular bed that supports the physiologically dynamic brood pouch of male seahorses is probably predisposed to gas embolization. Like the pseudobranch found in many teleosts, this vascular bed is rich in carbonic anhydrase and by inhibiting this enzyme with acetazolamide, we manage to stop the gas bubble accumulation. It was actually a veterinary student preceptor at NAIB who stumbled on to the connection between the pseudobranch, carbonic anhydrase, and the accumulation of gas bubbles that is so common in Holocentridae. Dr. Whitaker of NAIB then started treating these cases with acetazolamide and/or surgical removal of the pseudobranch and found that they reoccurred at a much lower frequency. Dr. Andy Stamper (Living Seas/Epcott) then adapted the idea to the subcutaneous emphysema phenomenon in seahorses which both NAIB and Shedd have repeatedly confirmed with resolution of cases that prior to acetazolamide Tx almost always reoccurred."

Instructions:

Pouch Flush

In cases of recurring pouch emphysema, Diamox can be administered as a solution injected into the pouch via an narrow gauge irrigating cannula or narrow gauge IV catheter sleeve attached to a 0.5 or 1ml syringe (larger syringes should not be used).

Using a blender, mix 1/4 of a 250mg tablet with a cup of seawater at the same SG as the tank. Fill the syringe with about 0.5ml of this solution after it has settled, avoiding the residue at the bottom of the cup. The seahorse should be held as per the procedure for pouch evacuations.

Insert the catheter sleeve slowly and gently a small way into the pouch opening and inject this solution SLOWLY into the seahorse's pouch, leaving the solution in the pouch. Make sure you are familiar with the location of the pouch opening.

Never use a metal needle for this procedure.

The procedure may have to be repeated twice (once every 24 hours) to be effective. In stubborn cases, it is recommended to concurrently administer water borne broad spectrum antibiotics in a hospital tank. Diamox and antibiotics have been used simultaneously and successfully without apparent side effects.

If you are using a larger catheter, you can do a pouch evacuation first, before the flush

You need an IV catheter sleeve (anything from a 26 to 18 gauge will do the job). You don't use the needle.

NOTE: Since this paper was posted in Jan 2006, most now use 1 full 250mg tablet per 10 gallons regardless the size of the seahorse. This seems to work the best!