Medical management of sea turtles

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Presented to the BCG Symposium at the Open University, Milton Keynes on 14th March 2015

Wild sea turtles are commonly presented for medical care at coastal rehabilitation centres and veterinary hospitals. This article describes the appropriate steps that should be taken into consideration to provide basic veterinary care, investigate diseases and provide successful treatments to sick and injured sea turtles. The ethics, conservation effects and costs involved in the rehabilitation of wild sea turtles should also be taken into consideration, although they will not be dealt with in this article.

Admission

When a sea turtle is found and presented for veterinary care in a critical state, it is often necessary to start the medical assessment by determining whether the animal is alive or dead. A Doppler (a tool that uses reflected sound waves to assess blood flow) can be used to detect heart beats, although presence of a heart beat in reptiles does not rule out death (Fig. 1); alternatively, ultrasonography can be used to assess heart function, particularly in critical and unresponsive animals where the Doppler may not detect mild cardiac contractions. Severely hypothermic animals may have very reduced or nearly absent heart function, but some individuals can be recovered with appropriate treatment. Presence of *rigor mortis* confirms death. An unresponsive turtle may be left for several hours at room temperature to assess either improvement or development of *rigor mortis*.

A clinical history should be collected in all cases, although on many occasions the only information available will be where and when the turtle was found. Transport to the veterinary hospital should be done with the turtle in a plastic carrier (which is easy to clean) protected with wet towels (Walsh 1999) (Fig. 2).

Fig. 1. A Doppler device is used on this juvenile loggerhead turtle (*Caretta caretta*) to assess cardiac function. The probe should be placed between the neck and the front flipper and aimed at the heart.

Fig. 2. Transportation of an adult loggerhead turtle prior to its release back into the wild. The animal is placed in a plastic container padded with wet towels. A towel is used to cover the head in order to reduce stress, but normal breathing should not be obstructed. Note the presence of a satellite tracking device attached to the carapace.

Visual and physical examination

Once a clinical history has been obtained and the patient is not in a critical condition (which would require immediate treatment), a visual and physical examination should be performed, looking for fractures, wounds, dehydration, presence of fishing lines or hooks, poor body condition, etc. To assess body condition in a sea turtle, the following structures should be examined:

- ❑ **Neck.** In a healthy sea turtle, the neck is thick and convex in shape (Fig. 3), while in an animal that has lost body condition the muscles and tendons of the neck will be evident, and concave areas will be seen where fat has been lost (Fig. 4). The occipital bony protuberance may be evident in very thin turtles (Walsh 1999).
- ❑ **Plastron.** The plastron in a healthy sea turtle is flat or slightly convex. In a malnourished animal, the plastron will be sunken adopting a concave shape (Walsh 1999) (Fig. 5). The plastron in sea turtles is not hard as in tortoises. For some species a body condition index has been developed, which includes body weight and carapacial length.

Fig. 3. A loggerhead turtle in good body condition. This was a captive animal kept in a zoological collection.

Fig. 4. A loggerhead turtle in poor body condition. Note lack of cervical fat, concave shape and evident muscles and tendons.

Fig. 5. Green turtle in poor body condition. Note depressed plastron.

Other aspects that should be taken into account on an initial examination are:

- ❑ Level of colonisation by epibionts (organisms that live on the surface of another living organism), mainly barnacles. A few epibionts growing in a sea turtle's shell is not considered abnormal (Wyneken *et al*. 2006). However, when the epibionts grow excessively or on abnormal areas (e.g. tongue, skin) it is considered that the turtle has an underlying problem (Walsh 1999; Wyneken *et al*. 2006) (Figs 6-8).
- ❑ Temperature. Body temperature of a sea turtle can be taken with a deep cloacal probe or using a laser gun to measure external temperature of the animal.

Fig. 6. Epibionts on the skin of a sea turtle are indicative of underlying disease.

Fig. 7. Abnormally high levels of epibionts (barnacles) causing damage to the scutes of the carapace of a loggerhead turtle.

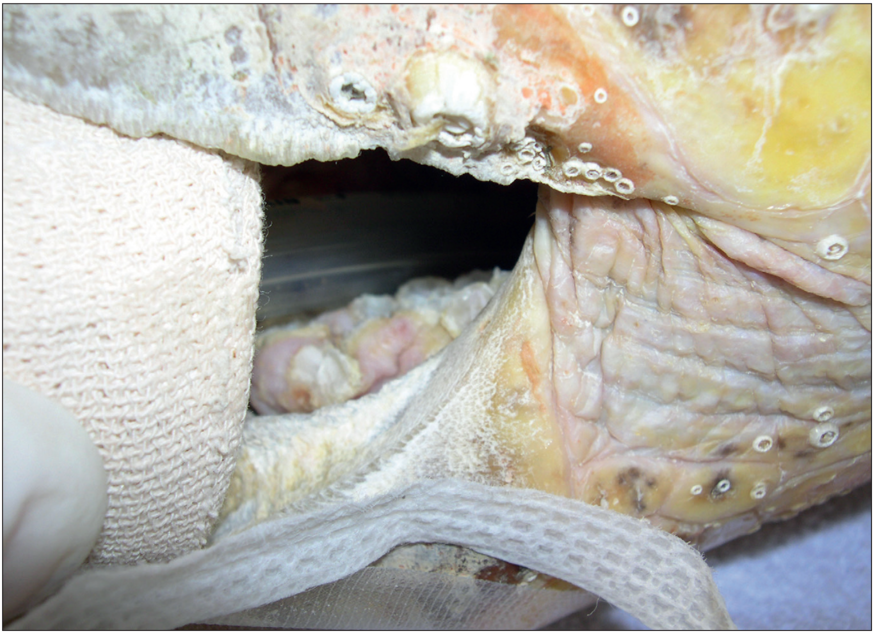

Fig. 8. Abnormally high levels of epibionts growing on the commissure of the mouth and on the tongue of a debilitated loggerhead turtle.

Initial treatment

As a general rule, the first treatment needed by a hospitalised animal is fluid therapy, as most stranded sea turtles will be dehydrated (Fig. 9). Fluids can be administered subcutaneously (Fig. 10) or by placing the turtle in fresh water (both methods are usually combined). Fresh water helps with hydration and also loosens the attachment of epibionts, making them easier to be removed after a few days. However, only turtles that are strong enough to swim and to breathe outside water should be placed in a pool (Walsh 1999). Depending on the hydration status, presence of parasites and blood electrolyte levels, the turtle should be later maintained in fresh water, low-salinity water or intermittent fresh water baths. Bathing water should be initially at 26-29°C, as this will improve immune function, but should be decreased to 22-26°C when the turtle is stable. The sea turtle will need to be adapted back into ocean water (salinity and temperature) before being released into the wild.

After a few days in fresh water, the epibiota still attached to the turtle can be removed by hand or using a screwdriver or similar device (Fig. 11). Irritation or even small wounds will be seen in the spots where epibionts were attached to the turtle (Fig. 10); treating those areas with antiseptic solutions or creams may be indicated (Fig. 12).

Fig. 9. Debilitated loggerhead turtle with excessive numbers of epibionts on head. Note sunken eyes, indicative of dehydration.

Fig. 10. Administration of subcutaneous fluids in the prefemoral area of a green turtle. Note reddish circles left after removal of barnacles, indicative of parasitic relationship between epibionts and turtles.

Fig. 11. Removal of epibionts from a green turtle using a screwdriver. The attachments of epibionts loosen after prolonged immersion in fresh water.

Fig. 12. Antiseptic cream applied on a green turtle after removal of a heavy burden of epibionts.

Fig. 13. The dorsal cervical venous sinus is the most common venipuncture site used in sea turtles.

Diagnostic tests

Diagnostic tests used in other species can be adapted to be used in sea turtles. Basic diagnostic tests commonly used when investigating an unspecific disease include radiographs, complete haematology and serum biochemistries (with a special emphasis on glucose, total protein and haematocrit value) and faecal parasitology. Anaemia and hypoglycaemia are common in sick sea turtles (Walsh 1999). Hypothermic and very critical patients will benefit from an electrolyte panel including blood gases. Most endo- and ectoparasites are not usually harmful for healthy sea turtles, but may become a problem when turtles are stressed with disease, trauma or environmental imbalances (Wyneken *et al.* 2006). Additional tests such as ultrasound, endoscopy (rigid and flexible), computed tomography (CT scan) and bacterial and fungal cultures can be used when indicated (Walsh 1999). Blood is easily obtained from the dorsal cervical venous sinus (Fig. 13), but can also be obtained from the dorsal tail vein or flipper veins. Heparin is the anticoagulant of choice for sea turtles, as EDTA can produce haemolysis of the sample.

Emergency treatment for hypothermic sea turtles

Hypothermic, extremely debilitated and sometimes unresponsive sea turtles can strand and be taken for rehabilitation. This situation is common in cases of *cold-stunning syndrome*, a condition that is typically described for Kemp's ridley turtles (*Lepidochelys kempii*) on the north-east coast of the USA (Keller *et al*. 2012); subadult animals that have migrated north fail to return to warmer waters before autumn/winter and suffer from ocean temperatures dropping below 10°C (Keller *et al*. 2012). Similar debilitating syndromes have been observed in other species and in other areas of the world, although it is still unclear if hypothermia is also the main cause for stranding in these cases (Wyneken *et al*. 2006). Affected turtles float excessively, are unable to swim and frequently strand; they present for rehabilitation hypothermic, hypoglycaemic, bradycardic, acidotic, hypoxaemic and sometimes unresponsive or even dead (Keller *et al*. 2012). Some of these animals can be recovered with the following treatment:

- ❑ Progressive increase in body temperature over a few days. Temperature should be raised 2-3°C/day until it reaches about 25°C. An abrupt increase in body temperature in a hypothermic sea turtle could exacerbate metabolic and respiratory problems.
- ❑ Assisted ventilation.
- ❑ Fluid therapy (adding calcium, dextrose and bicarbonate). Metabolic acidosis may be severe in these animals.
- ❑ Administration of atropine, doxapram and antimicrobial drugs.

Nutrition

Recent captives and debilitated turtles may need supplemental feeding until they are able to eat by themselves (Wyneken *et al.* 2006). Sea turtles regurgitate/vomit easily and they are fed initially with small volumes of diluted electrolyte solutions (no more than 1 ml/kg for an adult turtle, with no other food being offered during the first day). Volume and frequency of feedings can be increased as the condition of the turtle improves (Walsh 1999), and consistency of food can also be increased from liquid to a gruel diet (Wyneken *et al.* 2006). Supplements such as calcium, iron and vitamins should be added depending on the turtle's condition. A piece of lubricated hosepipe or an equine gastric tube can be used for force-feeding and is introduced down to the stomach or distal oesophagus (Fig. 14). Due to the anatomical characteristics of the oesophagus of sea turtles, the gastric tube does not usually advance easily (Fig. 15). The turtle should be fed in a vertical position, and weak animals should be maintained in that position for a few minutes after force-feeding in order to decrease the chance of regurgitation (Walsh 1999). An oesophagostomy tube can also be placed, using the same technique as in other chelonians. Defecation should be monitored daily as dehydrated and weak sea turtles may develop constipation (Walsh 1999).

Once the turtle has survived the initial critical period, it should be fed with pieces of fish, squid, prawn, octopus, etc., using long tongs to place the food in front of their mouth (Fig. 16). As in any other animal species, if frozen fish is used as a food resource, the diet should be supplemented with thiamine (vitamin B1; 25 mg/kg of fish) and vitamin E (100 iu/kg of fish). Green turtles (*Chelonia mydas*, a vegetarian species) can be fed with pieces of lettuce (or other vegetables) on a floating platform (Fig. 17). The amount of food to be fed depends on the age of the turtle:

- ❑ Hatchlings: 5% of their body weight (BW).
- ❑ Up to 1 year of age: 1.5-3% BW.
- ❑ Two years of age: 1.5% BW.
- ❑ Older than 2 years of age: 0.8% BW. All these values should be incremented in sick or debilitated animals.

Fig. 14. Force-feeding adult sea turtles may be a laborious task involving several people in order to restrain the animal, open its mouth and pass the tube into the stomach or distal oesophagus.

Fig. 15. This picture shows the proper way to open the mouth of a loggerhead turtle, preventing the turtle from biting the operator. Note the anatomy of the oesophagus, showing sharp and keratinised oesophageal papillae.

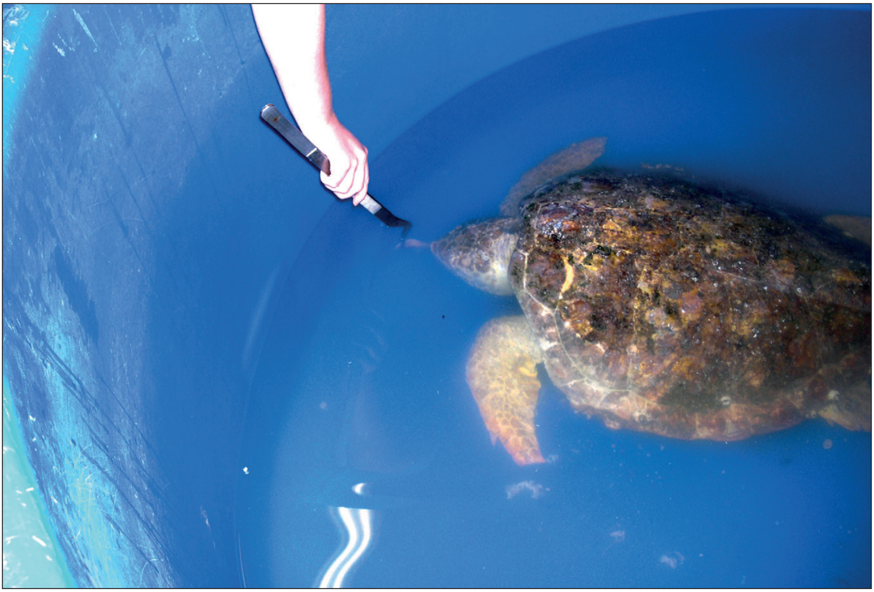

Fig. 16. Having survived the initial critical period, sea turtles should be fed with pieces of fish or seafood placed in front of their mouths with tongs.

Fig. 17. Vegetarian species, such as this green turtle, can be fed using a floating platform or pipe to attach green leaves.

Acknowledgements

The author would like to thank the staff of the Georgia Sea Turtle Center (Georgia, USA), where most pictures illustrating this article have been taken.

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