Treat Large Shell Defects and Exposed Viscera: An Excellent Prognosis for Turtles

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**Introduction**
Injured turtles typically present with moderate to severely comminuted (many pieces, crushed) shell fractures requiring management of broken pieces. Injured turtles atypically present with large shell fragments missing thereby exposing the body cavity and visceral organs. Large defects accompanied by deep soft tissue trauma can be and have been mistakenly identified as cause for euthanasia. Remarkably, the prognosis is very good for this type of trauma if treated properly. Defects of the carapace (top shell) and/or bridge (side of shell) are most common. This article outlines a conservative and highly successful method for managing defects of the bridge when presented with fresh, non-infected wounds. Supportive care during the recovery period also is addressed.

**Wound Management**
Discussion of initial assessment and triage is beyond the scope of this article; however, a weak and unresponsive patient at admission requires stabilization before wound management begins. Issues such as respiratory distress, hemorrhage, and severe dehydration must be treated immediately.

**Steps in Treatment.**
- Wash hands thoroughly.
- Disinfect work area and equipment (forceps, tweezers, and scissors). Use sterile materials when possible.
- Use a white or light-colored towel to work on.
- Prepare a Povidone-iodine solution the color of weak tea using sterile isotonic fluids.
- Thoroughly examine the defect to determine the locations of all foreign material.
- Manually and carefully remove large debris (grass, twigs, bone chips) from and surrounding exposed tissue with forceps or tweezers, not fingers.
- Clean the intact shell and the margins surrounding the defect with sterile gauze moistened with the Povidone-iodine solution. Use single movements away from exposed tissue.
- Hollow-looking, dark, cavernous areas inside the body cavity require careful inspection. Use a penlight or flashlight if necessary.
- If debris is found, attempt to remove it with a sterile swab moistened with sterile isotonic fluids.
- Thoroughly and gently flush the open wound using sterile isotonic fluids.
- It is critical that the patient is positioned to allow the fluids to flow out of the body cavity to prevent debris from being flushed deeper into the turtle's body. Tilt the wound site towards the ground. Whether to tilt cranially (towards the head) or caudally (towards the rear) and to what degree depends on the wound. Remember—fluids need to flow out of the turtle and onto the towel.
- Tilt the patient briefly, approximately 15-30 seconds, then rest. Continue flushing, with rest periods, until debris is no longer visible on the towel.
- Wrap sterile gauze around the defect in a dorsal (carapace) to ventral (plastron) direction and hold in place a few minutes. This will soak up excess fluid and prepare the site for Tegaderm™ transparent dressing (3M Health Care, St. Paul, MN).
- Be careful not to touch the gauze where it will come into contact with the turtle's tissue.
- Completely cover defect with Tegaderm™ and secure with tape on the plastron and carapace.

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• The dressing may require several changes daily while there is fluid drainage.
• Flush the wound following the above protocol each time the dressing is changed.
• Following veterinary recommendation, treat the patient prophylactically with a full course of systemic antibiotics.

LONG-TERM MANAGEMENT
The first few months of rehabilitation are a challenge, as the turtle needs to be kept dry until a healthy bed of tissue seals off the body cavity and internal organs. This takes approximately six to eight weeks. Meeting the patient’s hydration and nutritional needs during this time is discussed along with husbandry recommendations.

Husbandry. The turtle’s enclosure should be set up with contamination control as the goal. Organic substrates should not be used until the open wound is healed. Dr. Stephen Barten, DVM advises in Bites from Prey (1996): “During healing, reptiles with open wounds should be kept in bare cages or in cages lined with clean newspaper, paper towels, or cloth towels. Particulate bedding material may stick to wounds and should be avoided.” A white cloth towel is the preferred bedding of this author because the quality and frequency of urinary and fecal output is easily monitored. Rubbermaid® (Newell Rubbermaid Inc., Atlanta, GA) or Sterlite® (Sterlite Corporation, Townsend, MA) containers are appropriate for housing as they are easy to clean and disinfect. Providing a place for the patient to retreat is necessary to reduce stress. This is accomplished easily by covering one end of the container with a towel or sheet. The enclosure should have a species-specific basking area and thermal gradient. If a basking area is provided before dehydration imbalances are corrected, the patient requires close monitoring. A rapid weight loss indicates dehydration, not a lack of food.

Hydration. Rehydration and maintaining a positive hydration balance can be accomplished by several methods. Warmed, subcutaneous, isotonic fluids may be slowly delivered into a fold or loose skin of the hind limbs and should not exceed one to three percent of the total body weight. Depending on the turtle’s state of dehydration and rate of absorption, fluids can be administered several times a day if necessary. Always give the patient the opportunity to drink voluntarily. Cupping a hand under a steady stream of water while holding the patient in the other hand encourages most turtles to emerge from their shell and drink copiously. This method should be offered several times a day. Furnishing the enclosure with a small water dish is also an option; however, precautions must be taken. Do not supply a dish that the turtle can crawl into or one so deep that the patient could fall into head-first and drown. The height of the dish and the depth of the water should allow the turtle to immerse only their head into the water. The dish is placed in a corner, opposite the basking area, and taped to the enclosure on two sides so it cannot be dumped. Ramps are provided with rolled or folded up cloth towels.

Nutrition. Wound healing consumes energy and adequate nutrition is essential to promote the healing process. Chelonians (turtles) recovering from major trauma should not go for weeks without food. Species that must be in water to eat or exhibit prolonged inappetence may require supportive tube feedings. Getting past a turtle’s behavioral and structural defenses in order to gain access to the mouth is extremely difficult and different species require different techniques. For rehabilitators who cannot provide this therapy, enlisting the help of a skilled turtle veterinarian, rehabilitator, or care expert is necessary. Choosing dietary items that facilitate wound healing should be considered. The role of protein in the wound healing process is well known. “For patients suffering severe trauma, infection or burns, there is usually an increase in metabolic rate (termed hypermetabolism) and a shift towards relatively more utilization of fat and protein” (Donoghue and Langenberg 1996). Whole fish, cooked chicken, thawed, skinned fuzzy (developmental stage following pinky stage) or adult mice, and ReptoMin® (Tetra, Blacksburg, VA) are appropriate protein items for carnivorous/omnivorous species. Whole-bodied animals “provide essential amino acids and high-quality protein from muscle and organs, lipids from adipose, vitamins and trace minerals from liver, macrominerals from bone, iodine from thyroid, and vitamins K and B12 from ingesta” (Donoghue and Langenberg 1996). ReptoMin®, which is manufactured as a well-balanced diet for aquatic turtles, is recommended by Andy Highfield of the TortoiseTrust (Highfield 2002) and Dr. Frederic Frye (Frye 1991). Drs. McArthur and Barrows state the following: “Of the pelleted or flaked turtle diets available, ReptoMin® (Tetra) sticks are recommended” (McArthur and Barrows 2004). Over-reliance on invertebrates is discouraged by this author. Most insects are calcium-deficient and a chitinous (horny polysaccharide) exoskeleton is difficult to digest. Pinky mice are not recommended if adult or fuzzy mice are
available. Pinkies do not yet have a well-developed skeletal system and the bones contain more cartilage and less calcium than older mice. Injured animals have additional nutritional requirements, and a thorough knowledge of dietary needs and the composition of foods offered will enhance the recovery process.

**CONCLUSION**

The treatment protocol described in this paper has proven successful for eight out of eight turtles over the past seven years. The following figures track the healing process of an adult, female painted turtle (*Chrysemys picta*) hit by a car (Figures 1 through 7).

**Figure 1.** Four days after admission.

**Figure 4.** Twenty-one days after admission. Note the loose, dead tissue at the cranial end of the wound was removed easily.

**Figure 2.** Twelve days after admission.

**Figure 5.** The wound appears to be completely sealed although loose, dead tissue at the cranial end was removed again. The healthy bed of tissue is fragile and susceptible to damage. The turtle can be put in water for one hour twice a day.

**Figure 3.** Seventeen days after admission.

**Figure 6.** The wound is completely sealed and full-time access to a water dish for soaking, drinking, and eating may be provided.
Figure 7. After five to seven months the wound is heavily mineralized (hardened) and the turtle is fully in an aquatic environment. It was released the following spring after 354 days of rehabilitation.

**Literature Cited**


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