A CALL FOR ADDITIONAL STUDY OF THE SAFETY OF SUBCARAPACIAL VENIPUNCTURE IN CHELONIANS

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ABSTRACT

Clinical abnormalities, including forelimb, hindlimb, or tail paresis, localized inflammation and necrosis, spinal neuroaxonal degeneration, pulmonary edema, and pulmonary fibrosis were seen in twelve chelonians, representing five species, after single or multiple venipuncture or intravenous injection of the subcarapacial sinus. While these effects could not be definitively linked to venipuncture, the temporal nature of these events suggests that subcarapacial venipuncture may result in adverse effects in some cases. Clinicians are advised to use caution in utilizing the subcarapacial venipuncture site.

Clinical Report

The anatomy and clinical utility of the subcarapacial (supravertebral) venipuncture site of chelonians was recently described. Since that time, several studies have utilized this site for blood collection or intravenous injection with no apparent adverse effects. The site has gained popularity as it is can be accessed with the head withdrawn into the shell, is located at an anatomically consistent location, and is successfully accessed by even novice reptile phlebotomists. Here we describe several observations of possible adverse effects of subcarapacial venipuncture, and propose additional studies on the safety of subcarapacial venipuncture.

Repeated blood sampling from the subcarapacial sinus has been used in two pharmacokinetic studies in red-eared sliders (Trachemys scripta elegans), one involving intracoelomic administration of metronidazole, and the other involving subcutaneous administration of voriconazole. In each study, two turtles exhibited transient to permanent paresis of the tail or hind legs. Additionally, in the voriconazole study, two turtles developed severe pulmonary edema and fibrosis. One of those turtles also had severe granulocytic inflammation and necrosis at the venipuncture site, and adjacent cavernous expansion of lymphatics and blood vessels associated with fibrinocellular thrombi. Neuroaxonal degeneration and vacuolated glial cells were noted in the white matter of the adjacent cervical spinal cord. Unfortunately the design of these studies did not allow differentiation of venipuncture effects from drug effects.
A juvenile Kemp’s ridley turtle (*Lepidochelys kempii*) was treated with a subcarapacial intravenous injection of amikacin 10 mg/kg (Amikacin, 250 mg/ml, Teva Parenteral Medicines Inc., Irvine, CA; diluted to 50 mg/ml in 0.9% sodium chloride) during medical management for *Enterococcus* sp. septicemia. The turtle was immediately affected by bilateral forelimb paresis which resolved in 24 hr. The staff of New England Aquarium have administered hundreds of intravenous amikacin injections at this dose in Kemp’s ridley turtles via the external jugular vein, with no observed adverse effects.

In three turtles (chicken turtle, *Deirochelys reticularia*; diamondback terrapin, *Malaclemys terrapin*; and *T. s. elegans*) that underwent routine or recheck examinations with venipuncture from the subcarapacial site, animals presented within one day (n=2) or within several days (n=1) with either unilateral (n=1) or bilateral forelimb paresis (n=2). In one case the animal could not retract its neck initially and also had hindlimb paresis. All animals had normal function of their limbs on initial exam, and venipuncture from the subcarapacial site was apparently uneventful. All animals regained normal use of their limbs within weeks to months. A common note regarding these animals was that they were aggressive, thus moving their heads and necks during the procedure.

In two additional cases, both involving adult red-footed tortoises (*Geochelone carbonaria*), propofol 5 mg/kg (Propofol 10 mg/ml, Hospira Inc., Lake Forest, IL) was administered via the subcarapacial site to anesthetize the animals for diagnostic procedures. The anesthetic procedures were unremarkable; however, when the animals recovered they experienced bilateral flaccid paralysis of the forelimbs. Both animals were treated with non-steroidal anti-inflammatory therapy and received physical therapy. The animals began to regain use of their limbs within 3 days of propofol administration, and were completely normal in appearance and function within 7 days. Six years later both animals remain normal. An additional five red-footed tortoises were anesthetized at the same time, using the same technique and drug dosages without any ill effect.

**Discussion and Conclusions**

While these observations are anecdotal, they collectively suggest that venipuncture of the subcarapacial sinus may result in adverse effects in some cases. The anatomic location of the subcarapacial sinus is very close to the spinal cord, and at times, attempted venipuncture of this site yields clear, colorless fluid. While it is likely that this fluid is lymph, it is also possible that it is cerebrospinal fluid. It seems possible that at least some attempts at venipuncture of the subcarapacial sinus result in penetration of the epidural or subarachnoid space, and could penetrate the spinal cord, resulting in transient or permanent neurologic dysfunction.

We advise that clinicians exercise caution in the use of subcarapacial venipuncture, possibly reserving its use for administration of life-saving intravenous medications when venipuncture of other sites has been unsuccessful. The risks associated with subcarapacial venipuncture should be discussed with clients and keepers.
Future studies should assess the effects of repeated subcarapacial venipuncture in the absence of confounding variables. Pharmacokinetic studies that utilize this venipuncture site should consider use of control animals that are treated with saline injections to separate the effects of venipuncture from the effects of the pharmaceutical. Additional imaging studies should be conducted to assess the disposition of drugs injected into the subcarapacial sinus. Finally, clinicians should continue to report adverse events associated with subcarapacial venipuncture.

LITERATURE CITED