
This retrospective study found medetomidine, ketamine, and sevoflurane to be safe and effective for controlled anesthesia in injured loggerheads. All turtles presented with a variety of skull, shell, or soft tissue injuries necessitating surgical intervention. Most (n = 12) were juveniles weighing 17 – 49 kg. The remaining animal was an adult weighing 120 kg. Several animals had blood work parameters consistent with poor nutrition.

Anesthesia was induced with medetomidine (0.05 mg/kg) and ketamine (5 mg/kg) administered IV over 15 sec into the dorsal cervical sinus, or medetomidine was given IM 20 min prior to ketamine IV. Anesthesia was supplemented with sevoflurane via endotracheal tube, initially at 3 – 7% and decreasing to 0.5 – 2.5%, utilizing pressure-limited intermittent-flow ventilation. Intubation was achieved by placing a PVC T-piece between the relaxed jaws, opening the glottis with hemostats, and placing a cuffed endotracheal tube (6 – 10 mm internal diameter). A ventilator was used initially at 4 – 8 breaths/mm, decreasing to 1 – 2 breaths/mm once a surgical plane of anesthesia was reached. Inspiratory flow was 10 – 20 L/min, while peak inspiratory pressure was 10 – 15 cm H2O. Sevoflurane administration was discontinued 30 – 60 min prior to the end of the procedure. Atipamezole (0.25 mg/kg) was administered IV at the end of the procedure.

Median time to intubation was 11 min, and median time to extubation after atipamezole was 14 min. Several 1 – 2 min periods of strong, coordinated flipper and head movements generally occurred, followed by return to profound sedation; extubation was not done until the animal demonstrated a sustained period of recovery (usually after the third excitement period). In five of seven animals extubation was achieved within 30 min after atipamezole administration. Of the two exceptions, one animal had been maintained on higher concentrations of sevoflurane and the other was given atipamezole IM instead of IV. Once the dose was repeated IV, the animal was extubated within five minutes.

Monitoring included heart rate and rhythm, end-tidal partial pressure of CO2, cloacal temperature, and intermittent venous blood gas analysis. The ECG readings were obtained by placing adhesive pads directly on the carapace over the area of the right and left shoulders and left femur. Median values for all physiologic parameters were reported for each hour of anesthesia. Heart rates began to decline immediately after induction in all turtles and then stabilized after 15 – 20 min. Median pH and P,O2 values increased after induction of anesthesia, while median P,C02 and HCO3 values decreased. P,C02 did not appear to vary with P,O2.

This anesthetic combination caused rapid induction and recovery, and allowed long procedure times. The doses of medetomidine and ketamine used in this study were much lower than those previously reported for either drug used alone in reptiles.

Reviewed by Leigh Ann Clayton, DVM


Superficial and systemic mycotic infections are common among clinically ill sea turtles, however, safe and effective dosage regimens for antifungal agents in sea turtles have yet to be determined. In this study, the pharmacokinetics of a single-dose of fluconazole were compared after single IV and SC injections in six juvenile (two to four year old, 0.48 – 12.2 kg body weight) loggerhead sea turtles. A crossover design was used, with a two-week washout period between administration routes. Blood collection alternated between the right and left dorsal cervical sinuses at 0, 0.5, 1.5, 3, 6, 12, 24, 48, 72, and 120 hr after injection for both routes. Fluconazole administration produced nearly identical plasma concentration profiles by both IV and SC administration; there were no statistically significant differences between routes of administration.

Four two-year old juvenile loggerhead sea turtles were used in the multiple dose phase, in which a regimen was derived from pharmacokinetic estimates from the single-dose study. The regimen was calculated to provide an initial SC loading dose (21 mg/kg) followed by a maintenance SC dose (0.0 mg/kg) that would maintain the fluconazole plasma concentration above a target level during the dosing interval. The regimen was optimized to allow for a long dosing interval of five days. The maintenance dose was administered on days five and 10 of the experiment. Blood was collected before the loading dose and before each maintenance dose to assess trough concentrations. Additional samples were collected 4 hr after injection on days 0 and 10 to assess peak concentrations, and on days 12 and 15 to measure the terminal elimination of fluconazole after the administration of the last dose.

The results of this study suggest that fluconazole can be effectively administered by SC injection to sea turtles at a dosage of 10 mg/kg body weight every five days after a single loading dose of 21 mg/kg. Throughout the multiple-dose regimen, fluconazole concentrations in the plasma ranged from approximately 8 to 19 μg/ml (the target concentration was 8.0 μg/ml). This study also indicates that fluconazole has a prolonged half-life in sea turtles (143 hr) as compared with the half-lives in cats, dogs, and humans (12 – 25, 15, and ~30 hr, respectively). This can probably be attributed to differences in the clearance of fluconazole, most likely due to differences in glomerular filtration rate.

Reviewed by Cindy DiGesualdo, DVM

Juvenile loggerhead sea turtles with central nervous system signs attributed to neurosurgical spororchiid trematode infections have been reported in southern Florida. Praziquantel is the drug of choice when treating humans with schistosomiasis, a similar disease. The purpose of this study was to determine the pharmacokinetics of praziquantel after oral administration of single and multiple doses in loggerhead sea turtles and to propose dosing recommendations for treatment of sea turtles infected with spororchiids. Oral dosing was selected to avoid large volumes of injected drug.

Eleven healthy juvenile (7.3-81 kg) loggerhead sea turtles were divided into two groups. Praziquantel tablets were administered orally in squid as a single dose (25 or 50 mg/kg) to both groups. Blood samples were collected from all turtles at 0, 0.5, 1, 3, 6, 12, 24, 48, and 72 hr after drug administration for assessment of plasma praziquantel concentrations. A multiple-dose study was then performed in which six turtles received three doses of praziquantel (25 mg/kg) at three hour intervals; blood was collected for sampling at 0, 1.5, 3, 6, 18, and 42 hr after drug administration.

Results showed large interanimal variability in plasma praziquantel concentrations for both dosages in both the single- and multiple-dose phases. After administration of 25 or 50 mg/kg of praziquantel, mean plasma concentrations were below the assay’s limit of quantification (LOQ) after 24 hr. In the multiple-dose group of turtles, mean plasma concentration was 50 ng/ml at last sampling time-point (48 hr after the first of three doses), greater than the LOQ. After administration of multiple doses of praziquantel, only MRTs was significantly increased, compared with values after administration of a single 25 mg dose. One turtle that received a single dose of 50 mg/kg of praziquantel developed necrotizing skin lesions within 48 hr that healed within 11 d. As a result, the lower dose was chosen for the multiple dose study; no animals in the latter phase developed skin lesions.

Although efficacy against spororchiids was not examined, oral administration of praziquantel at 25 mg/kg three times at three hour intervals succeeded at producing persistent therapeutic plasma concentrations. This regimen may be appropriate for treatment of loggerhead sea turtles with spororchiidiasis. The 25 mg/kg dosage is greater than a previously recommended dosage for sea turtles.

Reviewed by Sue Horton, DVM


Green turtle fibropapillomatosis has been estimated to affect greater than 50% of the world’s green sea turtle population. The disease can be severely debilitating for affected turtles and the etiology remains unconfirmed, though many possibilities exist. The lesions may be secondary to a compromised immune system. This study further characterized the green sea turtle immune system and its relationship to fibropapillomatosis, using blood collected from a control group of 16 turtles and 22 diseased animals, each group from a different population. Lymphocytes were cultured and stimulated with mitogens (agents inducing mitosis). Proliferation of lymphocytes in response to both B- and T-cell mitogens was significantly greater (P < 0.05) in healthy than in diseased turtles. There was no statistical difference in total WBC counts between groups, but diseased turtles had a lower proportion of lymphocytes, a greater relative abundance of heterophils, depressed albumin levels, and elevated gamma globulins levels (P < 0.05). These findings suggest a relationship between altered immune function and fibropapillomatosis, and provide further evidence that green turtles have both cellular and humoral immune system responses.

Reviewed by Eric Klaphake, DVM


The pharmacokinetic properties of oral itraconazole were studied using two groups of juvenile Kemp’s ridley sea turtles that were being rehabilitated after cold stunning (extended hypothermia) while stranded. Stranded turtles that are hypothermic for long periods of time have compromised immune systems; prophylactic antymycotic agents are commonly administered, but there is no published data on which to base itraconazole dosage.

Turtles under rehabilitation received varying dosages of itraconazole (5 - 25 mg/kg PO q 24 - 72 hr) for at least 30 days and serial jugular venous blood samples were collected at irregular intervals after drug administration to measure plasma concentrations of itraconazole and its major metabolite hydroxylaconazole (OH-ITRA).

Administration of itraconazole orally in dosages of evaluated produced plasma concentrations equivalent to trough levels necessary in humans to effectively prevent fungal infections. However, plasma OH-ITRA concentrations in the turtles were about 6% of plasma itraconazole concentrations. This contrasts with humans, where OH-ITRA is found at twice the concentration of itraconazole in a steady-state condition. The authors suggest that the low metabolic rate of sea turtles and possibly metabolism of the drug by different pathways may result in an increased itraconazole to OH-ITRA ratio as well as a longer half-life. Dosages of 5 mg/kg SID and 15 mg/kg q 72 hr produced consistent therapeutic concentrations; 5 mg/kg q 24 hr produced the highest plasma concentrations in the turtles in this study.

Reviewed by Greg Levens, DVM


Floresfenicol absorption from IM injection sites is slow in cattle. Prolonged elimination of this drug in reptiles might allow infrequent dosing. To determine a dosage regimen for loggerhead sea turtles, eight juvenile turtles were given a single injection of floresfenicol at 30 mg/kg, either IV (cervical sinus, n = 4) or IM (deltoid muscle, n = 4). Blood samples were collected from the cervical sinus (alternating sides) at 0,
0.5, 1.5, 3, 6, 12, 24, and 48 hr after drug injection, and were analyzed for plasma florfenicol concentrations using high performance liquid chromatography. To characterize the early disposition of florfenicol, two additional animals were given florfenicol IV, and plasma concentrations were determined at 0, 3, 5, 10, 20, 30, and 60 min.

Following the IV dose, there was a biphasic decline in florfenicol concentration with a slow phase of elimination having a half-life that ranged from 2 - 7.8 hr. Following the IM dose there was rapid absorption, with the greatest concentration occurring at the first sampling time of 30 min, and the half-life ranged from 3.2 - 4.3 hr. There were no measurable florfenicol concentrations in any animal after 12 hr. Three individuals (one IV and two IM) had no detectable florfenicol in any of the samples.

Florfenicol plasma concentrations were below the minimum inhibitory concentrations for susceptible bacteria within one hr for both routes of administration. In sea turtles, florfenicol dosed at 30 mg/kg will not be effective against most bacteria. There was no absorption-limited decrease in plasma concentrations after IM injection, as seen in cattle. The authors stress that this study's conclusions should be regarded cautiously, because the IV study was performed as two experiments and a small number of animals were evaluated, with only two turtles sampled earlier than 30 min post-injection.

Reviewed by Cynthia Stadler, DVM