MELOXICAM AND REPTILES – A PRACTICAL APPROACH TO ANALGESIA

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INTRODUCTION

Reptiles remain popular zoo exhibits and companion animals, and their numbers in captivity and presented for veterinary treatment continue to increase. Similar growth and development has occurred within the field of herpetological medicine and surgery with the publication of a number of detailed texts. Reptile anesthesia, particularly involving the green iguana (Iguana iguana), has been the subject of detailed study. However, despite this interest there is a noticeable lack of published information on pain and its alleviation in reptiles. Analgesics, including opiates and non-steroidal anti-inflammatory drugs (NSAID) are commonly recommended despite a lack of pharmacokinetic and pharmacodynamic data to support their use. There is certainly evidence to confirm the anatomic, physiologic and biochemical components of nociception, at least in crocodiles, and despite poor clinical definition and quantification, there is little doubt that members of the Reptilia can perceive pain.1-4

A recent survey of members of the Association of Reptilian and Amphibian Veterinarians indicated that 98.4% of questioned veterinarians believed that reptiles do perceive pain, and yet < 40 % of respondents used analgesics in the majority of their patients.5 Inadequate knowledge of analgesia in reptiles was cited as a probable cause for the lack of analgesic use, signaling an urgent need for further research into this field. Basic research into the pharmacokinetics of different analgesic agents in different reptile species to determine appropriate doses, dosing intervals, and safety was the most common request for further research into reptile pain management.5 A recent review of the peer-reviewed literature by this author failed to reveal ANY previous pharmacokinetic or toxicity studies of ANY class of analgesic agent (opiate or NSAID) in ANY species of reptile.

NSAIDs

NSAIDs play a pivotal role in producing a balanced analgesic protocol. The combination of different classes of analgesics have been shown to have a far greater analgesic effect than using a single drug class. There are a variety of NSAIDs that are often described according to their relative inhibition of cyclo-oxygenase enzymes (COX-1 and COX-2). Most modern NSAIDs are more selective COX-2 inhibitors because of the reduced gastro-intestinal side-effects associated with minimal COX-1 inhibition. However, tolerability for renal, liver and cardiothrombotic events appear similar for both COX-2 selective and mixed COX-1 and COX-2 drugs. Meloxicam has been shown to have more selective COX-2 activity and have excellent anti-inflammatory potency in the rat model. In other species meloxicam has been shown to have equal or better anti-inflammatory properties to ketoprofen and banamine (flunixin) while maintaining a higher therapeutic (safety)

Figure 1. (A) Following coeliotomy this bearded dragon was unwilling to rest its ventrum on the floor of the enclosure, presumably due to abdominal discomfort associated with surgery. Less than 1 hr after administering analgesics the lizard was able to adopt a normal resting posture, presumably due to the reduction in discomfort. (B) While it is difficult to evaluate pain in non-vocal, stoic reptiles, it is prudent to consider pre-emptive analgesia prior to surgeries that would be considered to be painful for mammals. For example, in this case a transplastron coeliotomy in a box turtle requires incision through bone and muscle which mandates the use of balanced, pre-emptive analgesia.
Meloxicam has also been found to be safe and effective when given pre-operatively to both dogs and cats.

**REPTILES & MELOXICAM**

Based on the paucity of pharmacokinetic data, a study was recently concluded at the University of Georgia which evaluated the single-dose IV and PO pharmacokinetics of meloxicam in green iguanas (*Iguana iguana*).

**Figure 2.** Drug profile in a green iguana following the single intravenous injection of 0.2 mg/kg meloxicam.

At the time of writing, a single intravenous injection of 0.2 mg/kg meloxicam maintained blood levels consistent with analgesic effects in mammals for up to 48 hours (unpublished data). Intramuscular dosing would be expected to produce similar effects of comparable duration. Oral bioavailability was good and a single dose of 0.2 mg/kg appeared to produce adequate plasma levels for 48 hours (unpublished data). Oral overdoses of 10-50 times the recommended dose for 2 weeks produced very high terminal plasma levels, and yet no evidence of toxicity according to hematology, biochemistry and histology of stomach, liver and kidneys (unpublished data). In the absence of pharmacodynamic studies to demonstrate the analgesic and anti-inflammatory properties of NSAIDs in reptiles, it is important to appreciate the current assumption that both reptiles and mammals benefit from similar analgesic effects at similar dose rates. Clinical experience with meloxicam in numerous reptile cases, including preoperative administration, have been both rewarding and without apparent side-effects (personal observations).

Preliminary data, at least in the iguana, indicates that meloxicam is a valuable NSAID because; a) it achieves blood levels in iguanas following a single injection that would be consistent with analgesia and anti-inflammatory effects in mammals, b) is well tolerated and has a high therapeutic index, and c) is available as both an injectable and oral suspension making in-hospital and home dosing relatively simple.

It would be a mistake for practitioners to abuse this safety margin by careless and frequent administration.

In addition, dramatic and unexpected differences in pharmacokinetics may exist between different orders and species of reptiles, and therefore caution is still advised. The author currently uses meloxicam at a dose of 0.2 mg/kg SC, IM or IV (including pre-operatively), and this dose can be repeated at 48 hr intervals as necessary. Single oral doses are unlikely to be effective, and several doses are probably required to reach therapeutic levels. However, until multi-dose trials have been completed prolonged oral meloxicam use should be approached with caution, and the author currently recommends 0.1-0.2 mg/kg PO every 48-72 hrs with close monitoring. In the few cases where chronic NSAID therapy have been required, titrating to the minimally effective dose is preferable, along with regular evaluation for gastro-intestinal, liver and renal disturbances. Further studies are planned to elucidate meloxicam pharmacokinetics in other reptile species, specifically sea turtles and red-eared sliders.

**References**