Sea Turtle Analgesics Selection - NSAIDS
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Loggerhead “Coquina”
(postoperative ketorolac)
Sources of Information

- Anecdote
- Expert consultation
- Extrapolation
- Metabolic Scaling
  - $\text{SMEC} = K(W^{-0.25})$
  - $K = 10$ for reptiles
- Formularies
- Pharmacokinetic Studies
  - Gold standard
  - Pitfalls with the gold standard

Pharmacokinetic Studies in Sea Turtles

- Ceftazidime, Florfenicol
  - Stamper et al. 1999, Stamper et al. 2003, Innis et al. 2011
- Fluconazole
  - Mallo et al. 2001, Innis et al. 2011
- Itraconazole
  - Manire et al. 2001
- Praziquantel, Enrofloxacin
- Meloxicam
  - Claus et al. 2007 (Proc IAAAM), Soloperto et al. 2011 (ISTS)
- Oxytetracycline
  - Harms et al. 2004
- Ticarcillin
  - Manire et al. 2005
- Danofloxacin
  - Marin et al. 2005
- Marbofloxacin
- Clindamycin
  - Harms et al. 2011
- Tramadol
  - Norton et al. 2013 (ISTS)
Selected Studies Relevant to Sea Turtle Analgesia


COX Inhibition – NSAIDS

- Cyclooxygenase (COX) = prostaglandin-endoperoxide synthase (PTGS)
- Synthesis of prostaglandins, prostacyclin, thromboxane
- Inflammation, maintenance of gastric epithelium, kidney and platelet/thrombocyte function
- Nonsteroidal Anti-Inflammatory Drugs inhibit COX enzymes
COX Selectivity

- Mammal paradigm:
  - COX-1, constitutive, tissue maintenance
  - COX-2, inducible, inflammation

- Nonselective and Selective NSAIDS

- Potential adverse effects: GI ulceration, renal crest necrosis, liver damage, impaired hemostasis
  - Avoid concurrent use with aminoglycosides (e.g. amikacin)

- Box turtles – COX-1 induced to greater extent than COX-2 in traumatized muscle
  - Royal et al. 2012

Analgesia – NSAIDS

- Flunixin meglumine 0.1 mg/kg IM once
  - 1 mg/kg has been associated with hemorrhagic enteritis and death in green turtles; nonselective COX inhibitor, hepatic elimination

- Ketoprofen 2 mg/kg IM q 24 h up to 5 d
  - Nonselective COX inhibitor, renally excreted, slower elimination in iguanas than in dogs

- Meloxicam 0.1 - 0.2 mg/kg IM
  - Selective COX-2 inhibitor, hepatic elimination, more rapid elimination in loggerheads than in dogs (but also slow elimination in iguanas)

- Ketorolac tromethamine 0.25 mg/kg IM q 24 h up to 5 d
  - Nonselective COX inhibitor, renally excreted

- Flurbiprofen ophthalmic
  - Selective COX-2 inhibitor

Analgesia – opioid extrapolation

- Butorphanol (?) 0.4 – 2 mg/kg IM or SC
  - Failed to affect thermal withdrawal latencies in red-eared sliders at 2.8 or 28 mg/kg, and depressed ventilation for 1 – 2 hr at 28 mg/kg

- Morphine 1.5 mg/kg
  - Increased thermal withdrawal latencies in red-eared sliders by 8 hr for at least 24 hr, but depressed ventilation at least 4 hr
  - Mixed hepatic (gluronidation) and renal excretion

- Tramadol 5 – 10 mg/kg PO
  - Increased thermal withdrawal latencies with less respiratory depression than for morphine
  - “extensively metabolized by several metabolic pathways” Plumb

Local Anesthetics

- Lidocaine (1 – 2 mg/kg; < 5 mg/kg); Buprenorphine (1 mg/kg; < 2 mg/kg)
- +/- sedation with midazolam 2 – 3 mg/kg IV