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Effect of Research Manipulations on Behavioral Indices in Captive and Free-Ranging Wildlife (3-Dec-2002)

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Many field and laboratory studies use various forms of manipulation (e.g. capture, handling, blood sampling, radio transmitter attachment) to gain more insight into animal ecology and behaviour with little attention to the ethical and conservation implications of such wildlife manipulations. Radio transmitters are used to provide valuable information on reproduction, movement patterns, habitat use, and survival in a variety of wildlife species. In many mammalian and non-mammalian species these transmitters are attached with the use of subcutaneous anchors or are implanted subcutaneously or intra-abdominally. However, the impacts of these procedures are seldom addressed and overt signs of pain are seldom recognized. Wildlife species do not display overt pain-associated behaviour because they may attract attention of predators and be preyed upon. As pain can be produced by any procedure or injury that causes tissue damage it is reasonable to assume that wildlife species likely experience pain during these procedures. Sublethal effects may interfere with normal behaviour and effect results obtained with the use of radio transmitters.

My research is directed at the effects of radio transmitter packages on captive and free-ranging wildlife, primarily using waterfowl as a model because waterfowl are commonly fitted with radio transmitters. I am attempting to gain insight into the mechanisms of pain coping mechanisms and sublethal effects of pain by evaluating several physiological, behavioural and reproductive indices of fitness. My research focuses on nonsteroidal anti-inflammatory drugs and local anesthetics because they tend not to have residual effects such as sedation, which is important in facilitating rapid release of wildlife species.

Very little information is available on the pharmacology of NSAIDs and local anesthetics in non-domestic species. An investigation of the pharmacological action of flunixin and ketoprofen measured by thromboxane B2 in mallard ducks revealed that these NSAIDs may exert pharmacological effects for at least 12 hours. However, the role of stress may play a role in plasma thromboxane levels. An investigation measuring plasma levels of bupivacaine indicated that it may be shorter acting in ducks than in mammals. Sequestration and redistribution of bupivacaine may result in a delayed toxicity in birds but mechanisms are unknown. A shorter absorption time compared to elimination time may, in part, explain avian sensitivity to local anesthetics, however, more information on drug distribution is required to draw concrete conclusions. Pharmacokinetics may contribute to the sensitivity of avian species to local anesthetics but other possible mechanisms could be involved and more studies are necessary to elucidate the mechanism of local anesthetic toxicity in avian species.

Isoflurane anesthetized mallard ducks demonstrate response to painful stimuli with an increase in heart and respiratory rates. Ketoprofen produces significant analgesic effects that reduce increases in heart and respiratory rates compared to saline controls. However, administration of ketoprofen, earlier than 30 minutes prior to surgery, may be necessary to ensure that ketoprofen's analgesic effects are present in 100 % of the animals.

In an examination of the effects of analgesia on reproductive fitness of free-ranging mallards comparing females that received ketoprofen prior to surgery with those that did not (saline controls). A significant surgeon effect was detected, in that, longer surgeries were correlated with increased time to first nesting attempt. Females that received ketoprofen took 3.5 days less to first nest attempt than did females that received saline, indicating that analgesia was beneficial, and there was no evidence to suggest that ketoprofen was harmful. However, ketoprofen may have more benefit if administered well in advance of surgery, to allow time for the drug to exert its analgesic effects.

In a study examining the post-operative behaviour of male and female ruddy ducks determined that bupivacaine does not appear to achieve long-term analgesia or prevention of post-operative pain-related behaviours. However, it does not preclude the possibility that there was some short-term or pre-emptive benefit. Increasing bupivacaine dose to attain longer lasting pain relief would not be beneficial as birds may be more sensitive to the toxic effects of local anesthetics compared to mammals.

In studies of duckling survival and mortality, the female is often radio-marked in late incubation. Thus a comparison of ketoprofen and bupivacaine analgesia was undertaken in mallard ducks implanted with radio transmitters at 18 days of incubation to examine the effects of surgery and type of analgesic on incubation rhythms. Surgery altered incubation patterns in the 24 h period following surgery, regardless of analgesic. Length of the incubation period was extended in bupivacaine-treated females compared to ketoprofen-treated females, indicating that analgesia may interfere with brood patch sensation. However, ketoprofen and bupivacaine likely provided analgesia but the parameters monitored were not the best indicators of post-operative analgesia. Increases in corticosterone and progesterone were detected following surgery which may indicate stress and/or pain during this time.

The benefits of administering analgesia cannot be overlooked in minimizing effects of placement of radio transmitters on free-ranging wildlife. Research clearly demonstrates that there are benefits to administration of analgesia but also that more research is necessary to determine the impacts of intervention in field experiments.