Antinociceptive Effects of Hydromorphone in Red-Tailed Hawks (*Buteo jamaicensis*): Preliminary Results

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INTRODUCTION

Across North America, raptors most commonly present to wildlife veterinarians due to trauma. There have been a few studies evaluating the potential analgesic effect of opioids in raptors[1-5] and a few pharmacokinetic studies of opioids in hawks. However, there has yet to be a pharmacodynamic study performed evaluating the antinociceptive effects of opioids in red-tailed hawks.

Opioids cause antinociception by reversibly binding opioid receptors in the nervous system to prevent neurotransmission. Hydromorphone is a full μ-opioid agonist commonly used in dogs and cats. The thermal model has been used in birds to evaluate opioid antinociceptive effects.

Study hypothesis: Intramuscular administration of hydromorphone would cause a significant dose-dependent increase in the thermal foot withdrawal threshold in red-tailed hawks.

MATERIALS & METHODS

Study design:

- 4-6 weeks acclimation and training period
- Randomized, blinded, cross-over design in a Latin square design
- 6 adult red-tailed hawks
- Hydromorphone at 0.3 mg/kg, 0.6 mg/kg, and saline control
- Test at 0, 0.5, 1.5, 3, and 6 hours after drug administration
- 3 testing periods, 1 week washout period between testing periods
- Statistical analysis: linear mixed modeling

Figure 1- Test box with dark sides and clear front pushed up against a wall with a camera to allow for real-time remote viewing

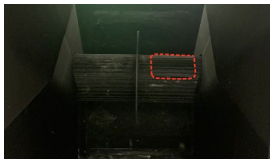


Figure 2- Inside the box is a perch divided into two sides with the right side having a thermal plate on the surface

Testing procedure:

1. Preheat plate to 40°C
2. Place bird in the box on perch
3. Turn on heating function to heat plate to 60°C at 0.3°C /sec
4. Bird lifts foot at thermal withdrawal threshold (TWT)
5. Turn off heating function which rotates right side of perch 180°
6. Review recorded video and register TWT

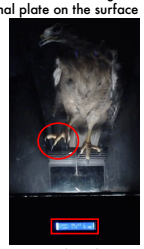
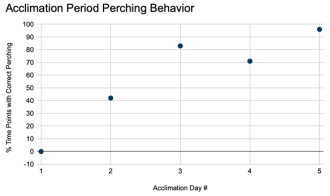


Figure 3- Bird lifting foot at TWT with temperature displayed on front of box

PRELIMINARY RESULTS

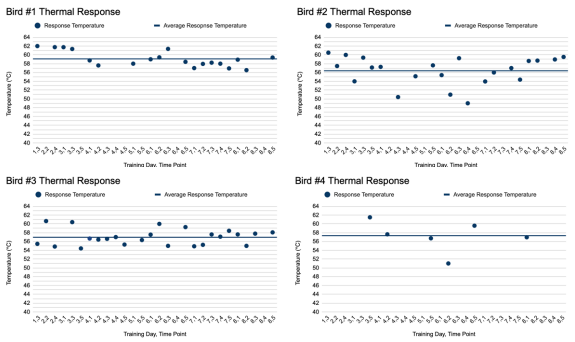
Acclimation period: placing birds in box without thermal stimulus and without drug administration to get used to the box and perch. During this period, 2 birds were removed from the study with 4 birds remaining.

Figure 4- Example of incorrect perching on left; example of correct perching on right



Training period: placing birds in box without drug administration, but with increasing the number of time points with thermal stimulus to train the birds to lift the foot when exposed to thermal stimulus

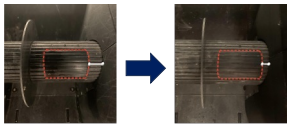
Bird	Bird #1	Bird #2	Bird #3	Bird #4
Response Rate at Start (%)	40	60	100	20
Response Rate at End (%)	60	80	80	20



DISCUSSION

The red-tailed hawks did not display consistent enough responses to the thermal stimulus at the end of the acclimation and training period to move forward with the hydromorphone trial. During the training period, issues with the testing box were identified, corrected, and implemented with the help of the Department of Biomedical Engineering. The recruitment of an additional 3-4 birds and a new acclimation and training period will be required before completing the study.

1st box adjustment: narrowed walls to encourage perching directly over thermal plate



2nd box adjustment: change drive belt material to increase right perch stability

3rd box adjustment: increased motor strength to allow for perch rotation

4th box adjustment: lengthened box to allow for tail movement

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