EVALUATING POSTOPERATIVE PARAMETERS IN GUINEA PIGS (*CAVIA PORCELLUS*) FOLLOWING ROUTINE ORCHIECTOMY

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Abstract

The goals of this study were to evaluate changes in gastrointestinal parameters, physiologic variables, and electronic von Frey (EVF) mechanical thresholds following routine orchiectomy to determine if these parameters can serve as appropriate, repeatable criteria to monitor postoperative changes in guinea pigs. A randomized, double-blinded study was performed with 14 intact male guinea pigs. All guinea pigs underwent routine orchiectomy and were randomly assigned to 1 of 2 postoperative treatment groups. Each guinea pig received meloxicam 0.5 mg/kg subcutaneously and buprenorphine 0.03 mg/kg subcutaneously immediately following surgery. They were then administered either: meloxicam 0.5 mg/kg subcutaneously at 24 and 48 hours postoperatively (meloxicam group) or saline subcutaneously at 24 and 48 hours postoperatively (control group). Basic physiologic parameters (heart rate, respiratory rate, rectal temperature, and body weight), urine and fecal output, food and water consumption, and EVF mechanical thresholds around incision sites were recorded for 48 hours preoperatively and postoperatively. Significant increases in heart rate and rectal temperature and significant decreases in respiratory rate, body weight, and EVF mechanical thresholds were identified postoperatively in both treatment groups. Significant decreases in consumption were noted postoperatively in both treatment groups, but no change in fecal or urine output was identified. Most of these values were easily obtained and showed significant changes from preoperative values in both study groups. Copyright 2016 Published by Elsevier Inc.

Key words: pain; analgesia; guinea pig; buprenorphine; meloxicam; orchiectomy

One of the major challenges faced throughout veterinary medicine is proper assessment and treatment of pain. Appropriate pain management is essential not only for patient welfare, but also because pain can be implicated in multiple postoperative complications, including delayed wound healing, physiologic stress, decreased appetite, gastrointestinal (GI) ileus, and weight loss.[1-4] The goal of effective analgesia is to minimize these complications, promoting smoother surgical recovery and improved animal welfare.

Analgesic therapy is limited by the reliability of the pain assessment, which remains highly subjective, especially in exotic species. Objective scales/criteria create a more accurate way to assess a patient's response to therapy as they improve individual subjective assessment variability. Pain scales and score sheets are increasingly being used to assess an animal's pain level, but they are highly

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1557-5063/16/2101-$30.00

http://dx.doi.org/10.1053/j.jepm.2016.04.009

variable amongst species and models studied. Standardized assessments such as the short-form Glasgow Composite Measure Pain Scale and the Melbourne pain scale[1,5] have been developed for repeated use in dogs and cats. These scales use basic, repeatable objective parameters and behaviors that correlate with pain in a given species under well-defined conditions. It is unknown whether the same parameters and behaviors can also be used to assess pain in guinea pigs. As a prey species, guinea pigs often hide signs of pain or distress to avoid predation,[6] and as such may show different changes in basic parameters in response to pain. There have been recent studies evaluating behavioral assessments of pain in rabbits[7] and mice,[8] but to the authors' knowledge, no studies have been published evaluating clinical pain assessment in guinea pigs.

Use of heart rate (HR), respiratory rate (RR), and body temperature (*T*) has been recommended to aid in the assessment of postoperative pain in both dogs and cats.[9]A 2007 study determined that mice lacking analgesia following laparotomy demonstrated a significant increase in HR and decreased consumptive behaviors presumed to be associated with postoperative pain.[10] The fact that these basic physiologic parameters can also be altered by the stress of handling and restraint, which can make pain assessment more challenging. However, when combined with other parameters HR, RR, and *T* can serve as valuable tools for the assessment of pain.

GI stasis is a common pain and stress response in small mammals that can cause significant morbidity and mortality if left untreated.[3] GI stasis is a major concern for guinea pigs, and an important aspect of surgical pain evaluation involves assessing GI motility in the immediate postoperative period. Consumption of hay, pellets, and vegetables as well as fecal output are practical, accessible means in which to evaluate GI motility, and are easily monitored. There are substantial reports that opioid analgesics, particularly mu opioid agonist drugs, may negatively affect GI motility in humans[11] and other mammalian species,[12] including guinea pigs.[13] Recent studies have found minimal effects on consumption and fecal output when buprenorphine was administered postoperatively to rabbits.[2,14] In Dutch belted rabbits, meloxicam 0.2 mg/kg, orally once daily for 2 days and buprenorphine 0.03 mg/kg, intramuscularly twice daily for 2 days showed similar efficacy postovariohysterectomy with only minor decreases in fecal output and food consumption that resolved without intervention.[2] However, patients who did not receive analgesia required rescue treatments because of immediate, severe GI stasis following surgery.[2] When administered as a sole analgesic, meloxicam 1 mg/kg, orally once daily for up to 29 days resulted in no adverse physiologic, consumptive, or eliminative effects in clinically healthy rabbits.[14,15,17] Similar results were found using meloxicam 1.5 mg/kg, orally for 5 days.[16]

Clinically, another manifestation of pain is hyperalgesia, or an abnormally heightened response to a painful stimulus. This is caused by central and peripheral sensitization of nociceptive pathways and inflammation at the site of tissue damage, such as at a surgical incision.[4,17] Most current comprehensive pain scales used to assess dogs and cats, as well as those being developed for mice and other rodents, include analysis of palpation response of a surgical site or painful region.[1,2,5,18] Palpation response is a direct, qualitative measure of sensitivity to a mechanical stimulus that is not normally painful, but may become so after tissue insult. Although behavioral pain scales provide a subjective way to assess for the presence of postoperative hyperalgesia, the electronic von Frey (EVF) filament has been developed as a noninvasive way of objectively quantifying clinical response to a tactile stimulus. The EVF filament supplies a mechanical stimulus with increasing pressure to provoke a threshold response (e.g., movement and vocalization) as a measure of cutaneous sensitivity, and measures the force necessary to elicit this response.[19,20] This force can be compared preoperatively and postoperatively to assess the degree of patient discomfort. This pressure threshold measurement is especially valuable when used in conjunction with other behaviors known to be associated with pain. EVF filaments have been successfully used to quantify and compare responses to mechanical skin stimuli in humans,[21] horses,[19,22] and rats[23] to determine the presence of pain surrounding surgical sites. The EVF filaments have also been used in guinea pigs to demonstrate pain related to arthritis causing compensatory weight bearing in the unaffected leg.[24] To our knowledge, EVF filaments have not been used to evaluate pain at surgical sites in the guinea pig.

The goals of this study were to evaluate changes in elimination and consumptive behaviors, physiologic variables (HR, RR, and *T*), and EVF mechanical thresholds following routine orchiectomy to determine if these parameters can serve as repeatable assessments of postoperative pain in this species. We used 2 analgesic protocols