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RESEARCH PAPER

Postanesthetic hyperthermia in cats: a retrospective comparison between hydromorphone and buprenorphine

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Abstract

Objective To determine the prevalence of postanesthetic hyperthermia [rectal temperature >40 °C (104 °F)] in a clinical population of cats.

Study design Retrospective study.

Animal population One hundred and twenty-five cats with an age range of 2 months to 16.1 years, and weighing 3.9 ± 1.5 kg.

Materials and methods Data were obtained from the medical records of 125 cats that underwent general anesthesia. Information on perioperative rectal temperatures, breed, sex, weight, surgical procedure, anesthetic time, surgery time, anesthetic and analgesic drugs were retrieved.

Statistical analyses Five groups of cats were compared; group 1 ($n = 15$) received acepromazine and no opioids; group 2 ($n = 17$) received acepromazine and buprenorphine; group 3 ($n = 19$) received acepromazine, buprenorphine and ketoprofen; group 4 ($n = 45$) received acepromazine and hydromorphone and group 5 ($n = 29$) received acepromazine, hydromorphone and ketoprofen. Data conformed to a split-plot repeated measures analysis of variance and was analyzed using SAS PROC MIXED. *Post hoc tests* were by means of Bonferroni *t*-test; ≤ 0.05 was considered significant.

Results Rectal temperature was significantly decreased in all groups at the end of anesthesia. Rectal temperature was significantly elevated at 1, 1.5, 2, 3, 4 and 5 hours after the end of anesthesia in group 4, and at 2, 3 and 4 hours in group 5. Sixty-four percent of cats in group 4 and 69% in group 5 had rectal temperatures >40 °C (104 °F) at one or more times in the postanesthetic period. The highest temperature recorded was 42.5 °C (108.5 °F) in one cat in group 4. Mean rectal temperature did not exceed the preoperative temperature at any time during the postanesthetic period in group 1, 2 and 3 animals.

Conclusions This study indicates an association between hyperthermia and perioperative administration of hydromorphone in cats.

Clinical relevance When hydromorphone is used in cats their body temperature should be closely monitored.

Keywords analgesia, buprenorphine, cats, hydromorphone, hyperthermia, opioids.

Introduction

Data from surveys conducted between 1996 and 2001 indicate that cats are under treated for surgical and traumatic pain (Dohoo & Dohoo 1996; Watson et al. 1996; Lascelles et al. 1999; Joubert 2001) when compared with dogs they are less likely to receive an analgesic. For example only 56% of cats received an analgesic for an exploratory laparotomy compared with 71% of dogs despite the fact that veterinarians thought that the pain associated with this procedure was the same in both species (Lascelles et al. 1999). Reasons for the lack of pain

management in the cat stems from the difficulties in assessing pain, a lack of knowledge regarding the use of, and side effects of many analgesics (Lascelles & Waterman 1997; Lamont 2002). Opioids, in particular, have historically been avoided in cats because of a fear of the production of excitement (Joel & Arndts 1925; Watts et al. 1973; Fertziger et al. 1974). There is an increasing awareness of the need to treat cats in pain and with more recent studies showing that at appropriate doses opioids can have beneficial analgesic effects without undesirable side effects (Dixon et al. 2002; Robertson et al. 2003a,b; Lascelles & Robertson 2004 a,b; Robertson et al. 2005), this group of drugs is being more widely used. Morphine, oxymorphone, hydromorphone, buprenorphine and fentanyl are now commonly used in cats alone or in conjunction with acepromazine, benzodiazepines or alpha$_2$-agonists in clinical practice (Lamont 2002).

Opioid analgesic use in cats has increased over the past 4 years at the University of Florida Veterinary Medical Teaching Hospital (UF VMTH). Concomitant with this, an increase in the number of cats with elevated postoperative rectal temperatures has been noted (SA Robertson, unpublished observations). In addition, other veterinarians have voiced concern over hyperthermia in cats receiving opioid analgesics (Veterinary Information Network website: http://www.vin.com/). Rectal temperatures in healthy cats range from 37.8–39.5 °C (100–103.1 °F) (Plumb 2002). Because of their high body surface area to weight ratio, cats lose body heat during anesthesia and low body temperatures have been the most frequent thermoregulatory event (Waterman 1975). Hyperthermia is defined as an elevation of body temperature above the normal range and in cats a temperature above 39.3 °C (103 °F) is considered abnormal (Tilley & Smith 2004). Hyperthermia following anesthesia may be missed because temperature monitoring often ends once a patient reaches normothermia, and only in the most severe cases will cats show overt physical symptoms of hyperthermia such as open-mouth panting. Elevation in body temperatures following a medical or surgical procedure may be caused by infection, administration of certain drugs or overzealous warming and the cause must be identified so that appropriate treatment can be initiated.

Much of the available data relating to changes in body temperature in response to opioid administration in cats involve doses in excess of those required for clinical analgesia. Cats experience hyperthermia in a dose-dependent fashion at doses of intravenous (IV) morphine sulfate >1 mg kg^{-1} (Clark & Cumby 1978). High doses (30 mg kg^{-1}) of meperidine (pethidine) were associated with rectal temperatures >41.7 °C (107 °F) (Booth & Rankin 1954). In cats that underwent onychectomy, the use of transdermal fentanyl patches was associated with higher rectal temperatures compared with cats that received butorphanol (Gellasch et al. 2002). Newer and more potent opioids including alfentanil produced elevated rectal temperatures in isoflurane anesthetized cats (Ilkiw et al. 1997).

The current trend towards increased provision of analgesia for feline patients undoubtedly has numerous benefits, but these must be weighed against any adverse effects including hyperthermia. The aim of this retrospective study was to determine the incidence of postanesthetic hyperthermia in a clinical setting where opioids are commonly used, and to identify a causative factor or factors.

Materials and methods

Data from 472 medical records of cats that underwent general anesthesia at the University of Florida VMTH between August 1992 and April 2003 were examined. Of the 472 records examined, 125 were selected for the study based on number of data points for rectal temperature, drug used for premedication, opioid and nonsteroidal anti-inflammatory administration. These cats were admitted to the UF VMTH between May 2001 and April 2003. The remaining records were excluded because of small numbers administered a specific opioid, incomplete information, insufficient data, or an infectious disease which was associated with an elevated body temperature.

Data extracted included breed, age, sex, weight, reason for anesthesia, duration of anesthesia, duration of surgery, antibiotic administration, premedication, anesthetic and analgesic drugs, pre- and postoperative rectal temperatures and postanesthetic behavior. Rectal temperature readings were recorded in all cats preoperatively and at the end of anesthesia. Temperatures were also recorded 0.5, 1, 1.5, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18 and 20 hours postoperatively in some, but not all cats.

Statistical analysis

One hundred and twenty-five cats, nested in five groups were identified for further analysis. The groups were; (1) acepromazine and no opioid (n =