

RESEARCH PAPER

Retrospective study of the perioperative management and complications of ureteral obstruction in 37 cats

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Abstract

Objectives To describe perioperative management and complications, risk factors and mortality rates in cats anaesthetized for treatment of ureteral obstruction.

Study design Retrospective, clinical, cohort study.

Animals Thirty-seven client-owned cats anaesthetized for ureteral surgery.

Methods Records with sufficient data for cats treated between March 2010 and March 2013 were examined for breed, age, gender, history, concurrent diseases, pre- and post-anaesthetic biochemical and haematological parameters, American Society of Anesthesiologists classification, anaesthetic protocol, surgical technique, surgeon, perioperative complications and mortality within 48 hours after extubation. Associations between risk factors and outcome variables were evaluated using univariable analysis. Odds ratios and 95% confidence intervals were calculated for significant parameters. Sensitivity and specificity using receiving operator characteristic curve analysis were calculated for creatinine, potassium level and standard base excess (SBE) to denote survival or non-survival.

Results Preoperatively, all cats were azotaemic; mean \pm SD urea was 31.6 ± 26.9 mmol L⁻¹ and median (range) creatinine was 562 μ mol L⁻¹ (95 μ mol L⁻¹ to off scale). Thirteen cats were hyperkalaemic ($K^+ > 6.5$ mmol L⁻¹). Anaesthesia-related

complications included bradycardia ($n = 8$, 21.6%), hypotension ($n = 15$, 40.5%) and hypothermia ($n = 32$, 86.5%). Seven cats (18.9%) died postoperatively. Non-survivors were significantly ($p = 0.011$) older (9.8 ± 1.9 years) than survivors (6.4 ± 3.1 years) and had higher potassium concentrations ($p = 0.040$). Risk factors associated with mortality were ASA classes IV and V ($p = 0.022$), emergency procedures ($p = 0.045$) and bicarbonate administration ($p = 0.002$). Non-survivors had higher creatinine concentrations ($p = 0.021$) and lower SBE ($p = 0.030$).

Conclusion and clinical relevance Intraoperative anaesthetic complications were common; increased age, poor health status, preoperative bicarbonate administration, hyperkalaemia and increased creatinine were associated with increased risk for death and can be used to predict risk for complications.

Keywords Feline, general anaesthesia, hyperkalaemia, kidney injury, post-renal azotaemia.

Introduction

Ureteral obstruction is a potentially life-threatening condition in cats: depending on its severity, the reduction of glomerular filtration rate and damage of nephrons may lead to acute kidney injury or chronic renal disease. Therefore, early treatment is a key factor in decreasing potential renal parenchyma damage and the likelihood of renal failure (Berent 2011; Horowitz et al. 2013; Mestrinho et al. 2013). The prevalence of ureteral obstruction in cats

remains unknown (Adams 2013). However, there has been a significant increase in the diagnosis of upper urinary tract calculi in cats, with the most common type reported as calcium oxalate (Cannon et al. 2007).

Cats with ureteral obstruction and acute kidney injury generally present with cardiovascular collapse, acute uraemia, hypovolaemia, dehydration, electrolyte imbalances and metabolic acidosis (Kyles et al. 2005; Cobrin et al. 2013). Cats with chronic kidney disease may be anaemic as a result of gastric ulcerations or erythropoietin deficiency. Hypoalbuminaemia and systemic hypertension can also be present in cats with chronic kidney disease. Additionally, the presence of concurrent diseases, particularly hypertrophic cardiomyopathy, can potentially increase risk for mortality (Hreybe et al. 2006). There is also a potential for drug overdose as anaesthetic drugs administered may be affected by changes in ionization, pharmacokinetic profile and decreased excretion during renal disease (Valverde et al. 2002; Freitas et al. 2012). Therefore, this cohort of cats may represent particular challenges to the anaesthetist, not only with respect to the selection of sedative, analgesic and anaesthetic drugs, but also in relation to the overall management and preoperative stabilization of these patients.

The aim of this study was to describe the perioperative management, identify major anaesthetic complications and risk factors, and evaluate mortality rates in cats with ureteric obstruction undergoing surgery.

Materials and methods

The medical records of all cats diagnosed with ureteral obstruction at the Queen Mother Hospital for Animals between March 2010 and March 2013 were reviewed. Only cats which underwent surgery and for which complete clinical records were available were included in this study.

Data recorded included demographic data, concurrent diseases, reason for and distribution of obstruction, American Society of Anesthesiologists (ASA) status, the presence of preoperative anuria/oliguria, pre-anaesthetic blood gas analysis, procedure times, number and type of therapies used to treat hyperkalaemia and acidosis perioperatively, anaesthetic management, surgical technique and perioperative complications.

Pre-anaesthetic venous blood gas analyses were measured using a blood gas analyser (NOVA CCX

Blood Gas Analyzer; Nova Biomedical Corp., MA, USA). Venous blood gas analyses were repeated at 24 hours post-anaesthesia to facilitate clinical comparison after surgical decompression.

Hyperkalaemia was defined as a plasma potassium (K^+) concentration of $>6.5 \text{ mmol L}^{-1}$. For statistical analysis of perioperative treatments of hyperkalaemia, cases were grouped into cats to which fluid therapy only was administered, and cats to which fluid therapy plus adjuvant treatment (insulin with glucose or calcium gluconate) were administered. For analysis of perioperative treatments of acidaemia ($\text{pH} < 7.35$), cats were grouped according to whether they received fluid therapy only, or fluid therapy and concurrent bicarbonate administration.

American Society of Anesthesiologists classification (Saklad 1941) was assigned by the anaesthetist in charge of the case and was based on preoperative assessment including previous history, complete physical examination and pre-anaesthetic blood tests. Because of the small sample size, cats were divided by ASA status into two groups according to whether their condition was moderate (ASA classes II and III) or severe (ASA classes IV and V) for the purposes of statistical comparison. A case was defined as an emergency when pre-anaesthetic stabilization was attempted, but cardiovascular resuscitation was not possible and immediate surgery was required. This parameter included non-scheduled procedures undertaken during regular working and after-hours services.

Intraoperative complications were evaluated. Hypotension was defined as three consecutive ultrasound Doppler readings of $<60 \text{ mmHg}$ performed at 5 minute intervals; bradycardia as a heart rate (HR) of $<80 \text{ beats minute}^{-1}$ for >5 minutes and hypothermia as oesophageal temperature (T) of $<37^\circ\text{C}$ for >15 minutes during the anaesthetic period. Hypothermia was categorized as mild ($37.0\text{--}36.5^\circ\text{C}$), moderate ($36.4\text{--}34.0^\circ\text{C}$) or severe ($<33.9^\circ\text{C}$) (Redondo et al. 2012).

Postoperatively persistent hypotension was defined as non-invasive systolic blood pressure of $<60 \text{ mmHg}$ measured by Doppler ultrasound. Blood pressure monitoring after extubation varied according to the severity of hypotension in each case. Post-obstructive diuresis was measured by urinary catheterization and defined as a urine output of $>2 \text{ mL kg}^{-1} \text{ hour}^{-1}$. Postoperative potassium concentrations were monitored every 4–6 hours during the first 36 hours and were supplemented accordingly when K^+ values were $<3.5 \text{ mmol L}^{-1}$. The

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