ABSTRACT
Three series of trials involving 10 domestic short-haired cats were carried out to determine the influence of dosage of contrast media or type of chemical restraint on feline excretory urography. The 1st series (group A) involved 5 cats sedated with 2.0 mg/kg intramuscular (i.m) injection of 2 % xylazine and receiving 800 mg/kg of 76 % meglumine diatrizoate (urografin). The 2nd series (group B) involved another 5 cats sedated with 2.0 mg/kg (i.m) injection of 2 % xylazine and receiving 1200 mg/kg of 76 % urografin. The 3rd series (group C) involved the repeat urography of the group B cats but sedated with 15 mg/kg (i.m) injection of 5 % ketamine hydrochloride. Ventrodorsal radiographs were obtained immediately, 5, 15 and 40 minutes after the injection of 76 % urografin. Scores were assigned to nephrographic opacification as described in the literature. The heart rates, respiratory rates and rectal temperatures of the cats were also determined before sedation, after sedation, immediately after the injection of 76 % urografin and at 15-minute intervals over a period of 60 minutes. In this study, there were significant differences (P < 0.05) in the nephrographic opacification scores between the group A and group B cats at times 0 and 40 minutes post-administration of urografin. Group A cats had good initial nephrographic opacification which faded later while the nephrographic opacification of group B cats progressively increased. Similarly, nephrographic opacification was significantly (P < 0.05) higher in the xylazine-sedated cats (groups A and B) than the ketamine-sedated cats (group C). However, there were no significant differences (P > 0.05) in heart rates, respiratory rates and rectal temperatures between the 3 groups of cats. It was therefore concluded that increasing the dosage of urografin above 800 mg/kg in cats does not provide additional beneficial effects on the nephrograms produced. Xylazine sedation was observed to produce better nephrographic opacification, however, with delayed nephrographic fading compared to ketamine sedation.

Key words: cat, chemical restraint, dosage, excretory urography, ketamine, urografin, xylazine.


INTRODUCTION
Excretory urography is defined as sequential radiographic imaging that includes the opacification of the kidneys, renal pelves and ureters following the administration of iodinated contrast medium

These rates have been shown to depend on factors altering the amount of contrast agent in the glomerular filtrate and those modifying its concentration as it passes through the renal tubule. Although there are circumstances in which the use of central nervous system depressant drugs is contraindicated, most radiological examinations in cats are best performed under some form of chemical restraint, in order to make the uncooperative cat calm, as well as to reduce the risk of personnel irradiation. The ideal agent should produce a dose-dependent central nervous depression without adversely affecting the patient or the result of the radiographic examination.

Xylazine, an α2-adrenergic agonist and ketamine are commonly used chemical restraints for radiographic purposes in cats. Xylazine has been reported to delay nephrographic fading in dogs. However, the effect of xylazine on the relative rates of nephrographic opacification and fading is not well known in cats.

In our previous study of the excretory urography of xylazine-sedated dogs, we suggested that increasing the dosage of contrast agent administered might improve the nephrogram of animals with prior sedation. The aim of this study therefore was to determine the influence of dosage of contrast media and type of chemical restraint on the rates of nephrographic opacification and fading in cats.

MATERIALS AND METHODS
All procedures were approved by the Animal Care Committees of the Faculty of Veterinary Medicine, University of Ibadan.

Ten adult domestic short-haired cats comprising 8 non-lactating non-pregnant queens and 2 intact toms cats with a mean body weight of 2.2 ± 0.35 kg were used. They were sourced from a local market and housed inside battery cages for the duration of the experiment. Prior to the study, all the cats were considered to be in good general health and with no renal abnormality based on the findings by complete physical examination, urinalysis and serum creatinine analysis.

Three series of trials were carried out. The 1st series (group A) involved the excretory urography of 5 cats sedated with 2 % xylazine (Chanazine®, Chanelle, Liverpool, UK) at 2 mg/kg and receiving 800 mg/kg of 76 % urografin. The 2nd series (group B) involved the excretory urography of another 5 cats sedated with 2 % xylazine at 2 mg/kg and receiving 1200 mg/kg urografin. The 3rd series (group C) involved the repeat excretory urography of group B cats but sedated with 5 % ketamine hydrochloride (Ketalem®, Hanslecemlocke, Hamburg, Germany) at 15 mg/kg. An interval of 1 week was allowed between each series and cats were assigned randomly to groups A and B. Cats were starved overnight but had free access to water until the commencement of the experiment. Effective sedation was taken as the cat’s assumption of lateral recumbency. Following lateral recumbency, 76 % urografin (Schering Pharmaceuticals, Berlin, Germany) was rapidly administered through the cephalic vein using a 23-gauge needle connected to a 5 ml
syringe. Urografin was then administered at the dose rate of 800 mg/kg (group A) or 1200 mg/kg (groups B and C). With the cat quickly having been positioned in dorsal recumbency, ventrodorsal radiographs were obtained at 5–15 seconds (i.e. immediately), and 5, 15 and 40 minutes post-injection of the contrast agent using a Phillip Practex 20 mA portable unit.

The cats’ heart rates (HR), respiratory rates (RR) and rectal temperatures (RT) were determined before sedation, after sedation, immediately after contrast medium injection and thereafter at 15-minute intervals over a period of 60 minutes. Heart rates were counted in beats/min with the aid of a precordial stethoscope. Respiratory rates were counted in breaths/min by visual observation of chest excursion, while the rectal temperature was measured in centigrade using a clinical thermometer.

Nephrographic opacity was evaluated by assigning scores ranging from 4 (excellent opacification) to 0 (poor opacification) (Table 1). Scoring of nephrographic density was done by a veterinary surgeon that had no previous knowledge of the sedation or contrast given.

Data are presented as mean ± SEM. Nephrographic opacity scores were compared using Student’s paired t-tests. Physiological variables were compared using analysis of variance (ANOVA) for repeated measures. A P value <0.05 was accepted as significant in all cases.

RESULTS

The HR, RR and RT of the 3 groups of cats are shown in Fig. 1. Although, there was no significant difference (P > 0.05) in the HR, the ketamine-sedated cats (group C) tended to have a higher HR than the xylazine-sedated cats (groups A and B) following the administration of 76% urografin. Similarly, the ketamine-sedated cats showed an increasing RR (Fig. 1) following the administration of 76% urografin, while the xylazine-sedated cats showed a decreasing RR. The dosage of urografin administered did not affect the HR and RR significantly in the xylazine-sedated cats compared to the ketamine-sedated cats. It may be that there is an antagonistic effect between xylazine and the contrast agent. Xylazine causes cardiovascular depression resulting in bradycardia17, while organic contrast mediums produces a compensatory increase in heart rates due to decreased systemic blood pressure5.

It is of interest to note that the administration of 76% urografin did not alter the HR and RR significantly in the xylazine-sedated cats compared to the ketamine-sedated cats. Both chemical restraints and urographic contrast agents have been reported to affect the heart rate (HR) and respiratory rate (RR) of cats8,9.

DISCUSSION AND CONCLUSION

Both chemical restraints and urographic contrast agents have been reported to affect the heart rate (HR) and respiratory rate (RR) of cats8,9. In this study, administration of 76% urografin did not alter the HR and RR significantly in the xylazine-sedated cats compared to the ketamine-sedated cats. It may be that there is an antagonistic effect between xylazine and the contrast agent. Xylazine causes cardiovascular depression resulting in bradycardia17, while organic contrast mediums produces a compensatory increase in heart rates due to decreased systemic blood pressure5.

Table 1: Scoring of nephrographic opacification.

<table>
<thead>
<tr>
<th>Score</th>
<th>Remark</th>
<th>Signs</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>Excellent</td>
<td>Renal pelves and calyces distinctly visible</td>
</tr>
<tr>
<td>3</td>
<td>Very good</td>
<td>Renal pelves and calyces faintly visible</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>Renal pelves and calyces not visible but kidney outline distinctly visible.</td>
</tr>
<tr>
<td>1</td>
<td>Fair</td>
<td>Kidney outline not distinctly visible.</td>
</tr>
<tr>
<td>0</td>
<td>Poor</td>
<td>Kidney outline not visible.</td>
</tr>
</tbody>
</table>

Fig. 1: Mean heart rate (a), respiratory rate (b), and rectal temperatures (c) of cats sedated with either 2% xylazine and receiving 800 mg/kg urografin (group A), 2% xylazine and receiving 1200 mg/kg urografin (group B) or 5% ketamine and receiving 1200 mg/kg urografin (group C). Values were obtained before sedation (1), after sedation (2) and at times 0 (3), 15 (4), 30 (5), 45 (6) and 60 (7) minutes after the injection of urografin.
traction of 76 % urografin resulted in a progressive decrease in rectal temperature in all groups of cats. This drop in temperature may also contribute to the hypotensive action of the contrast medium. It has been reported that organic contrast media stimulate the hypothalamus, causing cardiovascular and respiratory collapse.

Prior treatment of cats with either xylazine or ketamine significantly affected the rate of nephrographic opacification and fading following administration of 76 % urografin. The optimal dosage is 800 mg/kg as a higher dosage does not produce any additional beneficial effect on the quality of the nephrogram produced in premedicated cats. This is in contrast to what has been reported in dogs.

Nephrographic opacification was significantly higher in the xylazine-sedated cats than in the ketamine-sedated cats. Also, opacification tended to persist longer in the xylazine-sedated cats. Xylazine has been shown to cause initial hypertension and individual dog variation. American Journal of Veterinary Research 40: 1595–1604.


