Ketamine–dexmedetomidine combined with local anesthesia, with or without different doses of atipamezole in the postoperative period, for orchiectomy in cats

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OBJECTIVE
To evaluate the anesthetic and cardiopulmonary effects of ketamine–dexmedetomidine combined with local anesthesia, associated or not in the postoperative period with different doses of atipamezole, for orchiectomy in cats.

ANIMALS
24 healthy cats.

PROCEDURES
Cats received ketamine (7 mg/kg) combined with dexmedetomidine (10 µg/kg) IM, and 1 mL of saline (group KDS_AL). 25 µg/kg (group KDA_T25), or 50 µg/kg (group KDA_T50) of atipamezole IV, postoperatively. All cats received local anesthesia (2 mg/kg of lidocaine) intratesticular and SC. Physiologic variables were recorded at baseline and at time points during anesthesia. Ketamine rescue dose (1 mg/kg) was recorded. The quality of recovery, the degree of sedation, and side effects were evaluated postoperatively.

RESULTS
2 cats received a single additional bolus of ketamine to perform local anesthesia. Heart rate was lower in KDS AL, KDA T25, and KDA T50 during anesthesia, compared with baseline. Hypertension was observed intraoperatively in all groups. The time to head up, pedal reflex regained time, time to sternal recumbency, and time to standing were shorter in KDA T25 and KDA T50 compared to KDS AL. Lower sedation scores were assigned sooner to KDA T25 and KDA T50 than KDS AL. All groups resulted in low recovery quality scores and no side effects.

CLINICAL RELEVANCE
At the doses used, ketamine–dexmedetomidine combined with local anesthesia allowed the performance of orchiectomy. Rescue dose of ketamine for performing local anesthesia may be required. This combination can result in hypertension. Both atipamezole doses shortened the anesthetic recovery, without differences among them, and side effects.

Orchiectomy in male cats is intended to improve health and reduce mortality.1 The combination of ketamine and α2-adrenergic agonists, with or without opioids can be used to castration male cats.2–4 As opioids are not always available, depending on the country,5 the administration of intratesticular and SC lidocaine prior to orchiectomy appears to be an effective option in decreasing nociceptive responses to surgery.6

The use of anesthetic protocols that optimize anesthetic recovery in cats is valuable.7 Different doses of atipamezole, a selective α2-adrenoceptor antagonist, have been used to shorten anesthetic recovery time in cats.4,8–10 Excitement, vocalizing, aversion to body touch, congestion of the conjunctiva, and rigidity of limbs have been observed after administration of atipamezole in cats.9

The aim of this study was to evaluate the anesthetic and cardiopulmonary effects of the protocol ketamine (7 mg/kg) and dexmedetomidine (10 µg/kg) IM combined with local anesthesia, and to compare the effect of 25 or 50 µg/kg of atipamezole IV on anesthetic recovery of cats undergoing orchiectomy. We hypothesized that ketamine–dexmedetomidine combined with local anesthesia would result in an adequate anesthetic plane for the performance of orchiectomy, and that the higher dose of atipamezole would be more effective in shortening the anesthetic recovery period, accompanied by more side effects.

Materials and Methods

Animals
The study protocol was approved by by Comissão de Ética no Uso de Animais da Universidade Castelo Branco (CEUA-UCB) (no. 140301/22). A total of 24 healthy (American Society of Anesthesiologists class I) male mixed-breed cats scheduled for elective orchiectomy, aged 6 months to 4 years, weighing 3.7 ± 0.6 kg (mean ± SD weight, 2.5 to 5.0 kg) were included in the study after a written consent was obtained from the owners. Cryptorchid, aggressive or obese cats were excluded.
The cats were admitted to the veterinary hospital on the morning of the surgery, with owner instructions to withhold water and food for 2 and 12 hours, respectively. The sample size was calculated by computer software (G-power 3.1.9.2; Universität Kiel). For a power of 95% at an α of 0.05 and effect size f of 0.9, 8 cats were needed per group.

**Procedures**

The animals were randomly assigned (by drawing a piece of paper from a bag containing the group names) to be administered 1 of 3 experimental treatments (8 cats in each group). Cats received ketamine (7 mg/kg; 100 mg/mL; Ketamina, 100 mg/mL; União Química, SP, Brazil) combined with dexmedetomidine (10 µg/kg; 500 µg/mL; Dexdomitor; Zoetis Inc, SP, Brazil), IM (semimembranosus muscle), and in the postoperative period 1 mL of saline (NaCl 0.9%; Eurofarma Laboratórios Ltda, SP, Brazil; group KDS$_{100}$) or atipamezole (5 mg/mL; Antisedan; Zoetis Inc), at doses of 25 µg/kg (group KDA$_{25}$) or 50 µg/kg (group KDA$_{50}$), IV, over 1 minute.

Each cat was acclimatized inside a cage in a small quiet room at a temperature between 23 °C to 25 °C for at least 40 minutes before anesthesia was started. Then, still in this room, the animal was weighed and baseline values of heart rate (HR; by auscultation), respiratory rate (f$_{R}$; by observation of thoracic expansion), and rectal temperature (RT; using a digital thermometer) were measured.

Subsequently, the cat received ketamine–dexmedetomidine IM (T0) performed by a veterinary anesthesiologist. The time for lateral recumbency (between T0 and adoption of the lateral recumbency), the time to loss of pedal reflex (between T0 and the loss of pedal reflex) and the occurrence of possible side effects (nausea, emesis, drooling, excitement, and hypertonia) were recorded. The loss of pedal reflex was tested by pinching a toe 1 minute after treatment administration and every 2 minutes until the animal did not respond. After adoption of lateral recumbency, a 22-gauge catheter (BD Angiocath; Becton Dickinson Indústrias Cirúrgicas Ltda, MG, Brazil) was aseptically placed in a cephalic vein, fluid therapy was started (3 mL/kg/h; lactated Ringer solution; Ringer lactato; Eurofarma Laboratórios Ltda), and hair around the surgical region was clipped.

The cat was transported to the operating room and antisepsis of the surgical site was performed. Intratesticular and SC anesthesia (2 mg/kg of lidocaine, 2%; Xylestesin 2%; Cristália Produtos Químicos e Farmacêuticos Ltda, SP, Brazil) was performed by a surgeon, administering one third of the total volume of lidocaine at each point: incision line, right testicle, and left testicle. If the animal showed reflexive movement in response to the administration of local anesthesia, it was stopped. Ketamine (1 mg/kg, IV) was administered, and after waiting 1 minute, local anesthesia was continued. Orchiectomy was started 5 minutes after local anesthesia. The total rescue dose of ketamine administered before the start of surgery was recorded.

During surgery, HR, systolic (SAP), diastolic (DAP), and mean arterial pressure (MAP; with cuff; measuring 40% to 50% of the circumference of the limb, placed above the carpus), f$_{R}$, and SpO$_{2}$ were registered using a multiparameter monitor (LifeWindow One; Digicare Biomedical Technology Inc, FL, USA) at T1, immediately before the intratesticular block; T2, after skin incision; T3, after exteriorization of the first testicle; and T4, after exteriorization of the second testicle. RT was monitored using a digital thermometer (Geratherm rapid; Geratherm Medical Latin America Ltda, SP, Brazil), at T1 and T4.

If SAP or HR increased by 20% from the values recorded at T1 or some reflexive movement was observed, surgery was stopped for 1 minute, and ketamine (1 mg/kg) was administered IV. The number of rescue doses of ketamine administered during surgery was recorded. If a cat had a consistently low SpO$_{2}$ reading of < 90% for more than a minute, oxygen rescue was implemented by means of a mask, properly fitted around the muzzle, with 3 L/min of 100% oxygen via non-rebreathing circuit. All intraoperative evaluations were performed by a single observer (VHG).

All orchiectomy procedures were performed by the same surgeon, using a standard technique.$^{11}$ The cat received meloxicam (0.2 mg/kg; Maxicam 0.2%; Ouro Fino Saúde Animal, SP, Brazil), IV at T4. The surgery time (between surgical incision and end of surgery) were recorded.

Immediately after the end of the surgery, each cat was moved to the initial acclimatization room where all postoperative evaluations were performed. In that room, 1 mL of saline (group KDS$_{100}$) or atipamezole, at doses of 25 µg/kg (group KDA$_{25}$) or 50 µg/kg (group KDA$_{50}$), were administered IV, over 1 minute, according to the assigned treatment.

The degree of sedation was assessed using a previously published$^{12}$ non-validated sedation score in response to tactile and auditory stimulation (the assessor called the cat by name, stroked its back, and encouraged it to walk): 0, no sedation, normal movement; 1, mild ataxia, able to stand; 2, severe ataxia, sternal recumbency; 3, lateral recumbency, strong reaction to stimulation; 4, lateral recumbency, slight reaction to stimulation; 5, lateral recumbency, no response to stimulation. Quality of recovery was assessed using a previously published$^{12}$ non-validated numerical rating scale based on a comfort (0 to 2), coordination (0 to 3), vocalization (0 to 2), movement (0 to 3), scratching and grooming (0 to 1). The total scores ranged from 0 to 14, where 0 represented a smooth recovery and 14 a very excited and uncoordinated recovery. Sedation score and quality of recovery were recorded at 3, 5, 10, 30, 60, and 120 minutes after postoperative administration of saline or atipamezole.

The time to head up (moment the cat spontaneously elevated its head), pedal reflex re-gained (by pinching a toe after 5 minutes of administration of saline or atipamezole, and every 15 minutes until the animal respond), time to sternal recumbency and time to standing were recorded from the administration of saline or atipamezole. The occurrence of side effects in the postoperative period was recorded. The animal was evaluated for 120 minutes. All postoperative evaluations were performed by a single researcher (VCP) who was blinded to the group assigned.

**Statistical analysis**

Statistical analysis was performed using SigmaPlot, version 11.0 (Systat Software Inc). The Shapiro-Wilk test was used to assess normal distribution of the variables. Body weight, time to lateral recumbency, time to loss of pedal reflex, surgery time, time to head up, pedal reflex regained, time to sternal recumbency and time to standing were compared by one-way ANOVA to identify differences among groups.
Differences in HR, SAP, DAP, MAP, \( f_R \), \( \text{SpO}_2 \), and RT among groups were analyzed by one-way ANOVA. Bonferroni correction for multiple paired comparisons was performed when an overall treatment effect was detected. The Kruskal-Wallis test followed by the Dunnett test were used to detect differences between the baseline values with the values recorded at each subsequent time point.

Differences among groups in sedation and quality of recovery scores at the same time point were analyzed using the Kruskal-Wallis test followed by the Dunn test for multiple comparisons. For all analyses, values of \( P < .05 \) were considered significant.

**Results**

**Preoperative and intraoperative variables**

All animals that were enrolled completed the study. All cats in the study were mixed breeds.

There were no significant differences among the groups for body weight (\( P = .092 \)), time to lateral recumbency (\( P = .684 \)), time to loss of pedal reflex (\( P = .739 \)) and surgery time (\( P = .311 \); Table 1). Emesis and nausea were recorded in 1 cat in KDA\(_{25}\) and in 1 cat in KDA\(_{50}\).

Reflexive movement in response to the administration of local anesthesia was observed in 1 cat in KDA\(_{25}\) and 1 cat in KDA\(_{50}\). These 2 cats received a single additional bolus of ketamine (1 mg/kg) to perform local anesthesia. No cat required bolus of ketamine during surgery.

Compared with baseline, HR was significantly decreased in KDS\(_{AL}\), KDA\(_{25}\), and KDA\(_{50}\) at T1 to T4 (\( P < .05 \); Table 2). Compared with T1, DAP was significantly decreased in KDS\(_{AL}\) at T2 to T4 (\( P = .011 \), \( P = .006 \), respectively; Table 2) and in KDA\(_{25}\) at T2 and T4 (\( P = .04 \) and \( P = .01 \), respectively; Table 2).

Table 1—Mean ± SD for body weight, time to lateral recumbency, time to loss of pedal reflex, and surgery time in cats (n = 8 in each group) undergoing orchiectomy following injection of 7 mg/kg of ketamine combined with 10 µg/kg of dexmedetomidine, IM, and postoperative 1 mL of saline, 25 µg/kg of atipamezole, or 50 µg/kg of atipamezole, IV, each including local lidocaine infiltration.

Table 2—Mean ± SD of physiologic variables recorded before (baseline; awake values) and during anesthesia for orchectomy in cats administered 7 mg/kg of ketamine combined with 10 µg/kg of dexmedetomidine, and postoperative 1 mL of saline, 25 µg/kg of atipamezole, or 50 µg/kg of atipamezole, IV, each including local lidocaine infiltration (8 cats in each group). Time points were T1, immediately before lidocaine injection; T2, after skin incision; T3, after exteriorization of first testicle; and T4, after exteriorization of second testicle.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment</th>
<th>Baseline</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (beats/min(^{-1}))</td>
<td>KDS(_{AL})</td>
<td>206 ± 28</td>
<td>130 ± 21*</td>
<td>129 ± 21</td>
<td>135 ± 14*</td>
<td>134 ± 18*</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>184 ± 54</td>
<td>123 ± 20*</td>
<td>135 ± 18*</td>
<td>128 ± 18*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KDA(_{50})</td>
<td>184 ± 40</td>
<td>127 ± 15*</td>
<td>132 ± 19*</td>
<td>129 ± 19*</td>
<td></td>
</tr>
<tr>
<td>Systolic arterial pressure (mm Hg)</td>
<td>KDS(_{AL})</td>
<td>NA</td>
<td>184 ± 9</td>
<td>174 ± 11</td>
<td>176 ± 13</td>
<td>166 ± 10</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>NA</td>
<td>176 ± 36</td>
<td>172 ± 17</td>
<td>168 ± 12</td>
<td>165 ± 20</td>
</tr>
<tr>
<td></td>
<td>KDA(_{50})</td>
<td>NA</td>
<td>180 ± 16</td>
<td>169 ± 18</td>
<td>169 ± 18</td>
<td>165 ± 15</td>
</tr>
<tr>
<td>Diastolic arterial pressure (mm Hg)</td>
<td>KDS(_{AL})</td>
<td>NA</td>
<td>148 ± 5</td>
<td>132 ± 8*</td>
<td>133 ± 8*</td>
<td>130 ± 9*</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>NA</td>
<td>140 ± 27</td>
<td>132 ± 10*</td>
<td>132 ± 11</td>
<td>128 ± 9*</td>
</tr>
<tr>
<td></td>
<td>KDA(_{50})</td>
<td>NA</td>
<td>138 ± 16</td>
<td>129 ± 13</td>
<td>126 ± 17</td>
<td>123 ± 17</td>
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<td>Mean arterial pressure (mm Hg)</td>
<td>KDS(_{AL})</td>
<td>NA</td>
<td>158 ± 12</td>
<td>147 ± 10</td>
<td>149 ± 10</td>
<td>142 ± 9</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>NA</td>
<td>152 ± 30</td>
<td>146 ± 13</td>
<td>144 ± 11</td>
<td>141 ± 13</td>
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<tr>
<td></td>
<td>KDA(_{50})</td>
<td>NA</td>
<td>153 ± 16</td>
<td>144 ± 15</td>
<td>142 ± 15</td>
<td>140 ± 16</td>
</tr>
<tr>
<td>( f_R ) (breaths/min(^{-1}))</td>
<td>KDS(_{AL})</td>
<td>36 ± 19</td>
<td>22 ± 12</td>
<td>23 ± 8</td>
<td>18 ± 5</td>
<td>22 ± 5</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>40 ± 9</td>
<td>30 ± 13</td>
<td>30 ± 9</td>
<td>29 ± 11</td>
<td>30 ± 10</td>
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<td>KDA(_{50})</td>
<td>51 ± 9</td>
<td>40 ± 17</td>
<td>37 ± 15</td>
<td>36 ± 14</td>
<td>35 ± 14</td>
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<tr>
<td>( \text{SpO}_2 ) (%)</td>
<td>KDS(_{AL})</td>
<td>NA</td>
<td>95 ± 1</td>
<td>95 ± 1</td>
<td>95 ± 1</td>
<td>95 ± 1</td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
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<td>95 ± 5</td>
<td>96 ± 2</td>
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<td>96 ± 2</td>
</tr>
<tr>
<td></td>
<td>KDA(_{50})</td>
<td>NA</td>
<td>96 ± 3</td>
<td>97 ± 2</td>
<td>97 ± 2</td>
<td>97 ± 2</td>
</tr>
<tr>
<td>Rectal temperature (°C)</td>
<td>KDS(_{AL})</td>
<td>38.7 ± 0.8</td>
<td>38.6 ± 0.9</td>
<td>NA</td>
<td>38.3 ± 1.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KDA(_{25})</td>
<td>38.5 ± 0.7</td>
<td>38.6 ± 0.9</td>
<td>NA</td>
<td>37.8 ± 0.8</td>
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<tr>
<td></td>
<td>KDA(_{50})</td>
<td>38.2 ± 0.9</td>
<td>38.2 ± 1.0</td>
<td>NA</td>
<td>37.9 ± 0.8</td>
<td></td>
</tr>
</tbody>
</table>

\( \text{AL} = \text{Saline}. \)
Postoperative monitoring

The time to head up ($P = .001$), pedal reflex regained time ($P = .002$), time to sternal recumbency ($P = .002$), and time to standing ($P = .006$) were shorter in KDA$_{25}$ and KDA$_{50}$ compared to KDS$_{AL}$ (Table 3).

All animals showed a sedation score of 5 (lateral recumbency and no response to stimulation) and no response to noxious stimulation before administration of saline or atipamezole. Lower sedation scores were assigned to KDA$_{25}$ and KDA$_{50}$ compared with KDS$_{AL}$ at T3 to T60 ($P < .001$; Table 4).

KDS$_{AL}$, KDA$_{25}$, and KDA$_{50}$ resulted in acceptably low recovery scores. Comfort, coordination, vocalization, movement during sternal recumbency and scratching and grooming were not significantly different among groups ($P > .05$). Higher locomotor activity scores were assigned to KDA$_{25}$ at T3 ($P = .009$) and to KDA$_{50}$ at T3 to T5 ($P = .009$ and $P = .002$, respectively) compared with KDS$_{AL}$. Compared with KDS$_{AL}$, total recovery scores were higher in KDA$_{25}$ at T3 ($P = .01$), and in KDA$_{50}$ at T3 to T5 ($P = .02$ and $P = .006$, respectively). No side effect was observed postoperatively in group KDS$_{AL}$, KDA$_{25}$, and KDA$_{50}$.

## Discussion

The combination of ketamine (7 mg/kg) and dexmedetomidine (10 µg/kg) combined with local anesthesia allowed the performance of orchietomy. Rescue dose of ketamine for performing local anesthesia may be necessary. At these doses, ketamine–dexmedetomidine resulted in apparent hypertension. Both atipamezole doses (25 and 50 µg/kg) shortened the anesthetic recovery period, without differences among them. All groups showed good recovery quality scores, and no side effects were observed.

In the present study, the combination of ketamine–dexmedetomidine was administered IM because this route is commonly used in cats undergoing orchietomy.$^{2-4}$ The doses of the drugs were chosen based on previous studies: ketamine, 7.0 mg/kg$^{14}$; dexmedetomidine, 10 µg/kg$^{15}$; and atipamezole, 50 µg/kg$^{8}$. Based on the authors’ experiences, considering the cost and the possibility of reducing side effects, we chose to evaluate a lower dose of 25 µg/kg of atipamezole.

The results of the present study recommend the use of the protocol 7 mg/kg of ketamine and 10 µg/kg of dexmedetomidine combined local anesthesia for orchietomy in cats. Although some cats (2 out of 24) required additional doses of ketamine for local anesthesia injection, rescue may be necessary.

Opioids form the basis of a balanced analgesic protocol; however, as these drugs are not always available,$^5$ the use of other analgesic techniques, such as the use of local anesthetics, should be encouraged. Similar to previous studies,$^4,6$ in this study intratesticular and SC administration of lido-
caine (2 mg/kg) was adequate for orchietomy in cats, since there was no reflexive movement or significant increases in HR and arterial blood pressure during surgical manipulation.

Administration of ketamine increases heart rate by increasing the sympathetic nervous system outflow and the concentration of plasma catecholamines.14 Dexmedetomidine can induce bradycardia in cats, mediated by increased vagal tone in response to peripheral α2-receptor stimulation.16,17 It is known that the administration of ketamine prevents the decrease in HR induced by α2-adrenergic agonists18 and may partially counteract the bradycardia and hypotension induced for these drugs.19 In the current study, although the administration of ketamine (7 mg/kg) and dexmedetomidine (10 µg/kg) resulted in a decrease in HR, the values were within the normal for anesthetized cats (100 to 180 beats per minute).18 Previous studies revealed that heart rate decreased significantly in cats that received ketamine (5 mg/kg) and dexmedetomidine (10 µg/kg), IM also without bradycardia.4,15

Ketamine promotes increased blood pressure by the same mechanisms that result in increased heart rate.14 In cats, doses of 15 and 30 µg/kg of dexmedetomidine slightly lower SAP, with no initial hypertensive phase.17 The combination of ketamine (5 mg/kg) and with dexmedetomidine (10 µg/kg) do not result in hypertension (SAP > 160 to 180 mm Hg).4,15 Although probable and plausible, it cannot be said that the hypertension observed in the present study was due to the administration of the anesthetic protocol, since baseline blood pressure was not measured. However, it is recommended that the anesthetic combination used in this study not be administered to hypertensive patients.

The combinations of ketamine and α2-adrenergic agonist, with or without opioids, may result in desaturation of SpO2 (< 90%).4,14,20 In the present study, although the number of animals that presented SpO2 < 90% was low (2 out of 24 cats), we suggest that, when using this anesthetic protocol, oxygen supplementation equipment should be available. The ketamine–dexmedetomidine combination used in the present study promoted minimal changes in fr and RT, proving to be safe in relation to these variables.

Delayed recovery is a common complication in the postoperative period, and when residual drug effects are suspected to be contributing to delayed recovery, consideration should be given to administering specific reversal agents.18 The results of the present study confirm the effectiveness of atipamezole to shorten the anesthetic recovery of cats anesthetized with the ketamine–dexmedetomidine combination, already observed in previous studies.4

Although atipamezole is only approved for IM use in dogs in the US, making this an extralabel usage in cats in some countries, some studies have already investigated the action of this drug in this species. Doses of 50 µg/kg, SC4 and IV,4,8 75 µg/kg, IM,15 and 200 µg/kg, IV10 of atipamezole have already been used postoperatively to shorten recovery in cats anesthetized with different combinations of ketamine, α2-adrenergic agonists, benzodiazepines, and opioids.

Although IM administration of atipamezole is effective, there is a possibility that some animals may experience prolonged sedation or incomplete reversal.14 and therefore we chose to administer atipamezole IV in this study. IV administration of atipamezole can result in rapid vasodilation and consequent hypotension,14,21 and although these effects are transient, some patients may not tolerate them.14 In the present study, the movement and difficulty of physically restraining the animals soon after the administration of atipamezole prevented the physiologic variables from being recorded. It is not possible to say, but we believe that the use of healthy cats and the administration of the antagonist over 1 minute and diluted in this study made the animals tolerate IV administration.

To date, no studies have compared the effectiveness of different doses of atipamezole to shorten the anesthetic recovery of cats. The authors expected that higher doses of atipamezole (50 µg/kg) would be more effective in shortening the anesthetic recovery period, however, this did not happen. Both doses showed similar time to head up, pedal reflex regained, time to sternal recumbency, and time to standing, and after 30 minutes of administration of the antagonist, no cat had sedation. Thus, for this ketamine–dexmedetomidine combination, atipamezole (25 µg/kg) is sufficient to shorten anesthetic recovery and higher doses offer no advantage.

The α2-adrenergic receptors are primarily responsible for the sedative effect promoted by α2-adrenergic agonists.14 It is likely that the excitatory effects promoted by the use of atipamezole are mediated by the antagonistic action on α2a receptors. To date, no studies have been found that assess the occurrence of side effects (nausea, emesis, drooling, excitement and hypertension) when comparing different doses of atipamezole; the occurrence of cardiovascular effects has already been investigated.21 In the present study, no adverse effects were observed with the use of 25 or 50 µg/kg of atipamezole, but further studies should be performed to confirm whether the dose of atipamezole used is related to the intensity of adverse effects. The investigation of only 2 doses of atipamezole is the main limitation of the present study.

In the present study, all groups had good recovery quality scores. Recoveries in cats in groups KDA25 and KDA50 were accompanied by mild agitation and ataxia, increased locomotor activity and occasional position changes at 3 and 10 minutes after atipamezole. For a smooth recovery, the administration of atipamezole should occur 45 minutes after the administration of the anesthetic combination,22 which justifies our results, since in this study atipamezole was administered approximately 19 minutes after ketamine–dexmedetomidine. The recovery of cats that did not receive atipamezole in the postoperative period was longer, but smoother and accompanied by coordinated movements.

Emesis and nausea observed in some cats after administration of ketamine–dexmedetomidine in the
current study were mediated by dexmedetomidine and had already been observed in a previous study.

On the basis of our results, we concluded that ketamine (7 mg/kg) and dexmedetomidine (10 µg/kg) combined with local anesthesia allowed the performance of orchietomy. Rescue dose of ketamine for intratesticular and SC anesthesia may be necessary. At these doses, ketamine–dexmedetomidine results in apparent hypertension. The 50 µg/kg dose of atipamezole was not more effective in shortening recovery from anesthesia than the 25 µg/kg of atipamezole. All cats showed good quality anesthetic recovery, free of side effects.

Acknowledgments

The authors declare that there were no conflicts of interest.

References