Comparison of the effects of morphine-lidocaine-ketamine and fentanyl-lidocaine-ketamine combinations administered as constant rate infusions on postprocedure rectal temperature in dogs

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OBJECTIVE
To compare the effects of morphine-lidocaine-ketamine (MLK) and fentanyl-lidocaine-ketamine (FLK) combinations administered as constant rate infusions (CRIs) during and after veterinary procedures on postprocedure rectal temperature in dogs.

ANIMALS
32 clinically normal client-owned dogs undergoing nonemergent procedures.

PROCEDURES
Dogs were randomly assigned to receive an MLK or FLK combination (16 dogs/group). During the procedure, each dog received 2% lidocaine hydrochloride (1 mg/kg/h; both groups), ketamine hydrochloride (0.6 mg/kg/h; both groups), and morphine (0.36 mg/kg/h; MLK group) or fentanyl (4 µg/kg/h; FLK group) via CRI for analgesia; esophageal temperature was maintained at 37° to 39°C. At extubation, each drug dose in each assigned combination was halved and administered (via CRI) for 12 additional hours for postprocedure analgesia. Rectal temperature and other data were recorded at baseline (prior to administration of premedicants), extubation (0 hours), and 0.5, 1.5, 3, 6, and 12 hours thereafter.

RESULTS
Mean postprocedure rectal temperature was significantly lower at each postextubation time point for the MLK group, compared with corresponding values for the FLK group. Compared with the baseline value, mean postprocedure rectal temperature was significantly lower at 0, 0.5, 1.5, and 3 hours for the FLK group and at all postprocedure time points for the MLK group. Hypothermia (rectal temperature < 37°C) was detected at ≥ 1 postprocedure time point more often in dogs in the MLK group (9/16) than in the FLK group (1/16).

CONCLUSIONS AND CLINICAL RELEVANCE
Dogs that received an MLK combination for analgesia during and after a veterinary procedure developed hypothermia more commonly than did dogs that received an FLK combination under similar conditions. (Am J Vet Res 2020;81:58–64)

Body temperature in dogs should be maintained within the reference range during most surgical procedures and the postoperative period to avoid the potential adverse sequelae of hypothermia, such as prolonged coagulation times and altered wound healing.1–3 Opioids act on the thermoregulation center, which is located in the hypothalamus, resulting in a shift of the thermoregulatory set point and a decrease in body temperature.4 Combinations of lidocaine hydrochloride and ketamine hydrochloride with morphine (MLK combination) or fentanyl (FLK combination) have been routinely used for analgesia during and after procedures in dogs treated at the National Chung Hsing University Veterinary Medical Teaching Hospital. In the past few years, we have observed lower postprocedure body temperatures in dogs that received the MLK combination for postprocedure analgesia than in dogs that received the FLK combination. However, to the authors’ knowledge, the effects of the FLK and MLK combinations on body temperature of dogs have not been reported. The objective of the study reported here was to compare the effects of MLK and FLK combinations administered as CRIs during and after procedures on postprocedure rectal temperature in dogs.

Materials and Methods

Animals
Owners of dogs that were scheduled to undergo nonemergent veterinary procedures were invited to
enroll their dogs in the study during preanesthetic consultations that took place from November 2015 through July 2016. Before owners were approached, exclusion criteria were used to identify dogs that were eligible for enrollment. Dogs were excluded if they had endocrine or inflammatory disease, hepatic or renal disease (because medications used in this study are metabolized by the liver and excreted by the kidneys), or neurologic disease (because intracranial pressure can increase and epileptiform activity [as noted via electroencephalography] can occur after ketamine administration). Dogs that had gastric or intestinal obstructive disease or were undergoing intraocular surgery were excluded because morphine-induced vomiting could worsen the gastrointestinal disease or increase intraocular pressure. Aggressive dogs and dogs that received NSAIDs or other analgesics before anesthesia were excluded because pain scoring of such dogs could yield unreliable results. Dogs undergoing procedures in which epidural analgesia was to be administered were excluded because of the potential for heat loss caused by redistribution of body heat from the core to the periphery. Lastly, only dogs with a body weight \( \leq 15 \text{ kg} \) and body condition score\(^a\) \( \geq 3 \) and \( \leq 7 \) (scale, 1 to 9) were included to minimize intersubject variation and the potential for dogs with low reserves of subcutaneous body fat or a high skin surface area-to-body mass ratio to develop hypothermia.\(^b\)

Owners were informed that their dogs would be randomly assigned to receive 1 of 2 drug protocols (MLK or FLK combination) for analgesia during and after the procedure and would be hospitalized for at least 12 hours following the procedure. Informed owner consent was obtained prior to the study. All procedures in this study were approved by the National Chung Hsing University Institutional Animal Care and Use Committee (protocol No. 104-086).

**Preprocedure protocol**

At the preanesthetic consultation, dogs were determined to be healthy on the basis of results of a physical examination, CBC, and serum biochemical analysis. Food was withheld from dogs for 12 hours before the scheduled veterinary procedure, but water was available until the last 4 hours of food withholding. Dogs were randomly assigned (by lottery method) to 1 of the 2 treatment groups immediately prior to administration of premedicants.

A 20- or 22-gauge IV cannula was aseptically placed in a cephalic vein. Morphine\(^c\) (0.5 mg/kg, IM; MLK group) or fentanyl\(^d\) (5 \( \mu \text{g/kg}, \text{ IV; FLK group} \)) and midazolam maleate\(^e\) (0.2 mg/kg, IV; both groups) were administered to each dog as premedicants. Anesthesia was subsequently induced with propofol\(^f\) (3 to 5 mg/kg, IV, to effect) and maintained with isoflurane in oxygen. Drug combinations (MLK and FLK) for analgesia during and after the procedures were administered as a CRI (mixed in the same syringe) to both groups starting immediately after induction of anesthesia. Ketamine hydrochloride\(^e\) (0.6 mg/kg/h; both groups), 2% lidocaine hydrochloride\(^e\) (1 mg/kg/h; both groups), and morphine (0.36 mg/kg/h; MLK group) or fentanyl (4 \( \mu \text{g/kg/h}, \text{ FLK group} \)) were administered to each dog for analgesia during the procedure. At the time of extubation, the dose of each drug in each assigned drug combination was reduced by half and administered to each dog (via CRI) for an additional 12 hours for postprocedure analgesia.

**Procedure protocol**

During each procedure, lactated Ringer solution was administered IV, with the fluid administration rate used for each patient adjusted according to published guidelines.\(^g\) Esophageal temperature was monitored and maintained at 37° to 39°C during the procedure (until time of extubation) by use of forced-air warming devices, heating pads, warm fluid bottles, or additional blankets. Warming devices were removed once the dog’s esophageal temperature reached 37°C. Heart rate and MAP were also monitored throughout the procedure. If a dog had a heart rate and MAP \( \geq 20\% \) of baseline values (prior to administration of premedicants), it was presumed to have pain sensation and therefore rescue analgesia with fentanyl (1 \( \mu \text{g/kg}, \text{ IV} \)) was provided. The duration of anesthesia was recorded as the time from anesthetic induction to extubation. After the procedure, dogs were transferred to individual cages and kept there until discharged from the hospital. During this period, dogs were provided access to food and water after they had recovered from anesthesia.

**Data collection**

Baseline values (prior to administration of premedicants) for heart rate, respiratory rate, rectal temperature, MAP, and sedation score were recorded for each dog. Respiratory rate was measured by counting excursions of the lateral aspect of the dogs’ thorax for 15 seconds and multiplying the value by 4 (reference range, 10 to 30 breaths/min). Rectal temperature was measured by use of a clinical mercury thermometer\(^h\) (left in place for 2 minutes, with the tip reaching approx to vertebra S2; reference range. 37.8° to 39.2°C). A rectal temperature of < 37°C was considered evidence of hypothermia. Heart rate (reference range, 70 to 120 beats/min) was measured via auscultation, and MAP (reference range, 60 to 120 mm Hg) was measured by use of a high-definition oscillometric device.\(^i\) Sedation score was assigned on a 5-point scale\(^j\) as follows: 1 = agitated, 2 = normal, 3 = light sedation (sedated and sleepy, with eye contact in response to voice), 4 = moderate sedation (sedated and sleepy, with no eye contact in response to voice), and 5 = deep sedation (no response to voice or palpation).

Postprocedure values for heart rate, respiratory rate, MAP, rectal temperature, room temperature, and

and sedation and pain scores were recorded for each dog at the time of extubation (0 hours) and 0.5, 1.5, 3, 6, and 12 hours thereafter. Pain scores were assigned by use of the short-form Glasgow Composite Measure Pain Scale, with higher scores indicating more severe pain (range, 0 to 24 for the full scale [score ≥ 6 indicates pain] or 0 to 20 with part B of the scale omitted [score ≥ 5 indicates pain]). All data were collected and recorded by the same person (CWC).

Statistical analysis

Normality of continuous data was assessed with the Shapiro-Wilk test. Normally distributed variables (ie, body weight, age, heart rate, rectal temperature, MAP, and room temperature) were compared between the MLK and FLK groups by use of the 2-sample t test. Within the MLK and FLK groups, differences between baseline values and values recorded at subsequent time points were compared by use of the paired t test.

Nonnormally distributed (ie, respiratory rate, duration of anesthesia, and fentanyl dose administered for rescue analgesia during procedure) and ordinal (ie, body condition score and pain and sedation scores) variables were compared between groups by use of the Wilcoxon rank sum test. Within-group comparisons were performed with the Wilcoxon signed rank test. Sex distribution was compared between groups with the Fisher exact or χ² test.

Data were reported as median (range) or mean ± SD (or both). All analyses were performed with statistical software. Values of P < 0.05 were considered significant.

Results

Animals

Owners of 32 dogs were invited to enroll their dogs in the study, all of which were enrolled (16 in the FLK group and 16 in the MLK group). There were 19 females (14 sexually intact and 5 spayed) and 13 males (11 sexually intact and 2 neutered), with a median age of 8.5 years (range, 10 months to 14.0 years). Mean ± SD body weight of the included dogs was 7.2 ± 3.7 kg. Although 8 dogs received dopamine during the procedure because of hypotension, none of the dogs required postprocedure vasopressor administration. All dogs had an unremarkable recovery from anesthesia and completed the study treatments and data collection period.

Group comparisons

Age, body weight, body condition score, sex distribution, fentanyl dose administered for rescue analgesia during the procedure, and duration of anesthesia did not differ significantly between the FLK and MLK groups (Table 1). Dogs in the FLK group underwent intraperitoneal procedures (ovariohysterectomy and cystotomy, bilateral mastectomy, or electromagnetic wound treatment [n = 3]; cystotomy [2]; and ovariohysterectomy [2]) or extraperitoneal procedures (orthopedic surgery [3]; electromagnetic treatment of soft tissue masses [3]; castration and removal or electromagnetic treatment of soft tissue masses [2]; and unilateral mastectomy [1]). Similarly, dogs in the MLK group underwent intraperitoneal procedures (ovariohysterectomy [n = 4], ovariohysterectomy and...
Table 2—Values for physiologic variables, room temperature, and pain and sedation scores measured at baseline (prior to administration of premedicants), extubation (0 hours), and 0.5, 1.5, 3, 6, and 12 hours thereafter for the dogs in Table 1.

<table>
<thead>
<tr>
<th>Variable, by group</th>
<th>Baseline</th>
<th>0 hours</th>
<th>0.5 hours</th>
<th>1.5 hours</th>
<th>3 hours</th>
<th>6 hours</th>
<th>12 hours</th>
</tr>
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<tbody>
<tr>
<td>Recal temperature (°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MLK</td>
<td>39.0 (37.6–39.8)</td>
<td>37.8 (36.2–38.9)</td>
<td>37.4 (36.3–38.8)</td>
<td>37.5 (36.2–38.4)</td>
<td>37.5 (36.0–39.2)</td>
<td>37.3 (36.2–38.6)</td>
<td>37.3 (35.9–39.5)</td>
</tr>
<tr>
<td>FLK</td>
<td>38.7 (38.3–39.6)</td>
<td>37.7 (36.9–39.3)</td>
<td>37.9 (36.8–38.8)</td>
<td>38.1 (37.0–39.0)</td>
<td>38.3 (37.2–39.5)</td>
<td>38.5 (37.6–39.0)</td>
<td>38.8 (37.7–39.7)</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td></td>
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<td></td>
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<tr>
<td>MLK</td>
<td>113 ± 20</td>
<td>110 ± 24</td>
<td>97 ± 26</td>
<td>87 ± 20</td>
<td>81 ± 16</td>
<td>83 ± 18</td>
<td>77 ± 14</td>
</tr>
<tr>
<td>FLK</td>
<td>114 ± 20</td>
<td>135 ± 31*</td>
<td>122 ± 25</td>
<td>118 ± 34</td>
<td>118 ± 32</td>
<td>112 ± 37</td>
<td>113 ± 32</td>
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<td>MAP (mm Hg)</td>
<td></td>
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<td></td>
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<tr>
<td>MLK</td>
<td>93 ± 11</td>
<td>106 ± 17</td>
<td>99 ± 16</td>
<td>97 ± 15</td>
<td>103 ± 14</td>
<td>100 ± 18</td>
<td>104 ± 19</td>
</tr>
<tr>
<td>FLK</td>
<td>103 ± 9</td>
<td>107 ± 7</td>
<td>106 ± 20</td>
<td>109 ± 23</td>
<td>101 ± 20</td>
<td>107 ± 16</td>
<td>106 ± 19</td>
</tr>
<tr>
<td>Respiratory rate (breaths/min)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>FLK</td>
<td>42 (16–240)</td>
<td>30 (16–220)</td>
<td>44 (16–240)</td>
<td>42 (12–200)</td>
<td>34 (12–220)</td>
<td>34 (16–276)</td>
<td>34 (20–204)</td>
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<tr>
<td>Pain score‡</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MLK</td>
<td>3.0 (1–5)</td>
<td>2.5 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
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<td>2.0 (2–5)</td>
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<td>Sedation score§</td>
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<tr>
<td>MLK</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
<td>3.0 (1–5)</td>
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<tr>
<td>FLK</td>
<td>3.0 (1–5)</td>
<td>2.5 (1–5)</td>
<td>2.0 (1–5)</td>
<td>2.0 (1–5)</td>
<td>2.0 (1–5)</td>
<td>2.0 (1–5)</td>
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<tr>
<td>Room temperature (°C)</td>
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</tr>
<tr>
<td>MLK</td>
<td>25.3 ± 1.6</td>
<td>25.3 ± 1.3</td>
<td>25.0 ± 1.2</td>
<td>25.1 ± 1.1</td>
<td>25.0 ± 1.2</td>
<td>25.0 ± 1.5</td>
<td>25.1 ± 1.4</td>
</tr>
<tr>
<td>FLK</td>
<td>25.3 ± 1.6</td>
<td>25.3 ± 1.5</td>
<td>25.4 ± 1.5</td>
<td>25.3 ± 1.4</td>
<td>25.2 ± 1.4</td>
<td>25.1 ± 1.4</td>
<td>25.1 ± 1.4</td>
</tr>
</tbody>
</table>

Rectal temperature, although normally distributed, is reported as median (range) to supplement the data (mean and SE) shown in Figure 1.

‡Value differs significantly (P < 0.05) from that at baseline. §Value differs significantly (P < 0.05) between groups at the indicated time point.

bilateral mastectomy or electromagnetic treatment of a soft tissue mass [2], cystotomy [2], and laparotomy [1]) or extraperitoneal procedures (orthopedic surgery [4], castration and removal of a soft tissue mass [1], removal of a soft tissue mass alone [1], and electromagnetic treatment of a soft tissue mass [1]). The number of dogs that underwent intraperitoneal (vs extraperitoneal) procedures was similar between the FLK and MLK groups. All 16 dogs in the FLK group and 12 of 16 dogs in the MLK group required rescue analgesia during the procedure.

No dog in either group required postprocedure rescue analgesia. Mean postprocedure rectal temperature at each time point (0.5, 1.5, 3, 6, and 12 hours) after extubation was significantly lower for the MLK group, compared with corresponding values for the FLK group (Table 2). Compared with baseline values, mean rectal temperature was significantly (P < 0.05 for all comparisons) lower at the time of extubation (0 hours) and at 0.5, 1.5, and 3 hours after extubation for the FLK group and at each postprocedure time point for the MLK group (Figure 1). Individual postprocedure rectal temperature values were > 39.2°C (the upper reference limit) in 13 instances (9 in the FLK group and 4 in the MLK group) and < 37°C (the cutoff used to indicate hypothermia) in 28 instances (1 in the FLK group and 27 in the MLK group). Evidence of hypothermia was detected at ≥ 1 postprocedure time point for 1 of 16 dogs in the FLK group and 9 of 16 dogs in the MLK group. Mean room temperature did not differ significantly between the MLK and FLK groups at any time point.

Heart rate during the procedures ranged from 60 to 220 beats/min for the MLK group and from 60 to 160 beats/min for the FLK group. Compared with baseline values, mean heart rate was significantly lower at the time of extubation for the FLK group and at Figure 1—Mean rectal temperature prior to administration of premedicants (baseline), at extubation (0 hours), and 0.5, 1.5, 3, 6, and 12 hours thereafter for client-owned dogs undergoing nonemergent veterinary procedures that received an MLK (squares) or FLK (triangles) combination (16 dogs/group) for analgesia during and after the procedure. Morphine (0.5 mg/kg, IM; MLK group) or fentanyl (5 µg/kg, IV; FLK group) and midazolam maleate (0.2 mg/kg, IV; both groups) were administered to each dog as premedicants. Immediately after anesthetic induction with propofol, the assigned drug combination (mixed in the same syringe) was administered as a CRI for analgesia during the procedure (2% lidocaine hydrochloride [1 mg/kg/h; both groups], ketamine hydrochloride [0.6 mg/kg/h; both groups], and morphine [0.36 mg/kg/h; MLK group] or fentanyl [4 µg/kg/h; FLK group]). At extubation, the dose of each drug in each drug combination was reduced by half and administered to each dog (via CRI) for an additional 12 hours for postprocedure analgesia. Error bars represent SE. **Rectal temperature differs significantly (P < 0.05) from that at baseline. †Rectal temperature differs significantly (P < 0.05) between groups at the indicated time point. to 160 beats/min for the FLK group. Compared with baseline values, mean heart rate was significantly lower at the time of extubation for the FLK group and at
0.5, 1.5, 3, 6, and 12 hours after extubation for the MLK group (Table 2). Mean values for MAP and respiratory rate did not differ significantly between the MLK and FLK groups at any time point. Compared with baseline values, mean respiratory rate was significantly lower at 3 and 12 hours after extubation for the MLK group and did not differ at any time point for the FLK group. Panting was observed after extubation for 7 of 16 dogs in the MLK group and 9 of 16 dogs in the FLK group.

None of the dogs had a pain score > 5 at any of the postprocedure time points (Table 2). As a result, no dogs received fentanyl for postprocedure rescue analgesia. Pain scores did not differ significantly between the MLK and FLK groups at any of the postprocedure time points.

Compared with baseline values, sedation scores were significantly lower at 0, 0.5, and 1.5 hours after extubation for the MLK group and at 0, 0.5, and 12 hours after extubation for the FLK group (Table 2). Sedation scores did not differ significantly between the MLK and FLK groups at any time point.

Discussion

Lidocaine and ketamine are commonly used in combination with opioids (eg, morphine) for multimodal analgesia in dogs. The results of the present study indicated that dogs receiving an MLK combination as a CRI during and after a procedure had lower rectal temperatures than did dogs receiving a similarly administered FLK combination. Indeed, 27 of the 96 (28%) postprocedure rectal temperature measurements (6 measurements/dog X 16 dogs) obtained for dogs in the MLK group were < 37°C (vs 1/96 [1%] for dogs in the FLK group). Similar findings have been observed in other studies, in which morphine alone was noted as causing a thermoregulatory effect in various species, including dogs.

No difference in mean rectal temperature at the time of extubation was identified between the MLK and FLK groups in the present study; however, significant differences were observed between the 2 groups at each subsequent time point (0.5 to 12 hours after extubation). There are several possible explanations for why the effect of the MLK combination on rectal temperature was greater than that of the FLK combination. For instance, the administered doses of fentanyl and morphine may not have been equally effective. However, the sedation and pain scores did not differ between the MLK and FLK groups at any of the postprocedure time points, indicating that the doses were clinically equivalent. In addition, morphine has no accumulation effect at the infusion rate that was used in the present study. Lastly, the fentanyl dose administered for rescue analgesia during the procedure did not differ significantly between the MLK and FLK groups, making it unlikely that postprocedure rectal temperature was differentially affected by a difference in dose effectiveness.

The ambient temperature of the surgical suite and preoperative body temperature are important predictors of postanesthetic body temperature. In the present study, room temperature during the postprocedure period did not differ between the MLK and FLK groups, and esophageal temperature of dogs was maintained at 37° to 39°C during the procedure (until the time of extubation) by use of patient warming devices. Dogs with a higher body weight or body condition score may be less likely to develop hypothermia than dogs with a lower body weight or body condition score. In addition, factors such as American Society of Anesthesiologists physical status classification, duration of anesthesia, interval between administration of premedicants and induction of anesthesia, and type of surgical procedure can influence postanesthetic body temperature in dogs. However, for the dogs of the present study, room temperature, sex distribution, body weight, body condition score, age, and duration of anesthesia did not differ significantly between the MLK and FLK groups. In addition, we excluded aggressive dogs and dogs with endocrine diseases from our study so that these factors would not influence rectal temperature measurements.

Fentanyl and morphine act on opioid receptors in the cerebellum, such as κ and δ opioid receptors. The binding affinity of these drugs for κ receptors on human embryonic kidney cells is similar, although the half maximal effective concentration of fentanyl at κ receptors is approximately 8 times that of morphine. Accordingly, in the present study, the lower rectal temperature in the MLK group than in the FLK group may have resulted from differences in the effects of morphine and fentanyl on κ opioid receptors. In fact, morphine stimulates both μ and κ opioid receptors in dogs. A previous study of mice showed that central (vs peripheral) opioid receptors are the predominant site of action of morphine-induced hypothermia, which suggests that the hypothermia in the MLK group of the present study was centrally mediated. Further investigation of the thermoregulatory effect of κ opioid receptors is warranted.

A previous study in humans showed that lidocaine has no thermoregulatory effect. Ketamine administration is associated with maintenance or an increase in body temperature, and the drug acts by altering or maintaining vasomotor tone and decreasing redistribution of body heat from the core to the periphery. In the present study, the administered doses of lidocaine and ketamine were the same for the MLK and FLK groups, suggesting that the observed difference in rectal temperature between the 2 groups was associated with the use of morphine or fentanyl rather than with the use of lidocaine or ketamine.

Postprocedure heart rates were lower for dogs in the MLK group, and decreased to a greater extent with respect to baseline value, compared with values for dogs in the FLK group. However, postprocedure heart rates remained within reference range for both groups for the most part. Mean arterial blood pressure did not differ between the groups. Because no
Administration of an MLK combination could possibly result in deeper sedation and a lower heart rate than results from administration of an FLK combination. However, in our clinical experience, dogs that receive an FLK combination during the procedure recover faster than do dogs that receive an MLK combination. Hence, the stimulus of extubation and the agitation after recovery from anesthesia may act to increase the heart rate to a greater extent in dogs that receive an FLK combination. Although median sedation scores for dogs in the MLK group were slightly higher at the time of extubation and at 0.5 hours and 1.5 hours after extubation than were scores at the corresponding time points for dogs in the FLK group, no significant differences were detected in sedation scores between the 2 groups at any of the postprocedure time points. None of the dogs of the present study required administration of fentanyl for rescue analgesia during the postprocedure period, suggesting that the MLK and FLK combinations were effective for control of postprocedure pain.

The results of the present study indicated that postprocedure rectal temperature was affected by administration of MLK or FLK combinations during and after the procedure. According to our findings, mean rectal temperature for dogs that received the MLK combination was below the lower reference limit (37.8°C) at all postextubation time points. Conversely, mean rectal temperature for dogs that received the FLK combination, although lower than at baseline for 3 hours after extubation, remained at ≥ 37.9°C for all postextubation time points. Information regarding the observed effects of the MLK combination on postprocedure rectal temperatures of dogs of the present study might be helpful in a clinical setting for reducing the risk of postprocedure hypothermia in other dogs.

Acknowledgments

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Footnotes

a. Morphine, Taiwan Food and Drug Administration, New Taipei, Taiwan.
b. Fentanyl, Taiwan Food and Drug Administration, New Taipei, Taiwan.
c. Dormicum, Roche Inc, Basel, Switzerland.
d. Propofol-Lipuro 1%, B. Braun Melsungen AG, Melsungen, Germany.
e. Ketamine hydrochloride Imalgene 1000, Merial, Lyon, France.
f. Xylocaine 2%, Cenexi, Fontenay-sous-Bois, France.
g. Flyhorse clinical mercury thermometer, Shanghai Hua Chen Medical Instruments Co Ltd, Shanghai, China.
h. VET-HDO monitor, S + B medVET GmbH, Babenhausen, Germany.
i. Wisewind thermostat, Wisewind Enterprise Co Ltd, Taipei, Taiwan.
j. SPSS Statistics, version 20.0, IBM Corp, Armonk, NY.

References


