Original Article

TJVR 2020; 4 (2): 89-93

Turkish Journal of Veterinary Research

http://www.dergipark.gov.tr/tjvr

e-ISSN: 2602-3695

The Effect of Atropine on Post-operative Cardio-Respiratory Effect and Body Temperature in Cats That Undergoing Elective Ovariohysterectomy

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Received: 01.06.2020 Accepted: 21.10.2020

ABSTRACT

Objective: The purpose of the study reported here, to investigate the effect of atropine on cardio-respiratory parameters and body temperature in cats undergoing ovariohysterectomy with the combination of medetomidine-ketamine anesthesia.

Materials and Methods: Twenty-six adult female intact domestic cats were admitted to Ankara University Faculty of Veterinary Medicine, Department of Obstetrics and Gynecology for routine elective ovariohysterectomy. The animals were divided into two groups by the randomized grouping method before the operation. Trial animals (n=14) received atropine together with medetomidine and ketamine anesthesia. In control animals (n=12) received the same anesthesia without atropine injection. At the end of the operation, animals were moved to the critical care unit and the measurements of vital parameters were performed. Heart, respiration rates, deep rectal temperature and status of anesthesia recovery were recorded after the operation every 10 minutes for 1 hour.

Results: There was a group, time, and group x time interaction noted for heart rate. Treatment cats showed greater heart rate during measurement. The mean respiratory rate and deep rectal temperature were in reference ranges for cats and similar for both groups. In both groups significant sedation induced, however, the scores were not statistically significant among groups.

Conclusion: In conclusion, atropine is an effective drug preventing decrease of heart rate and patients have shown less undesirable side effects when it is used before the administration of medetomidine in cats that operated for ovariohysterectomy.

Keywords: *Atropine, Anesthesia, Cat, Ovariohysterectomy*

INTRODUCTION

General anesthesia a controlled drug-induced reversible intoxication of the nervous system. In this method, the patient neither perceives nor recalls noxious or painful stimuli (Hall et al., 2001). Anesthesia is a requirement for the success of surgical procedures to ensure petitive analgesia and muscle relaxation. General anesthesia is important for performing large operations in small animal applications (Haque et al., 2019).

Medetomidine, a powerful and specific α2-adrenoceptor agonist, is used worldwide as a sedative and analgesic drug for veterinary use in small animals (Cullen, 1996). Medetomidine has dose-dependent biphasic cardiovascular effects. After the administration, hypertension, and bradycardia lasting within 15 to 20 minutes. After that, sympathetic tone decreases due to vasodilation, hypotension, and bradycardia. The monitoring of vital parameters such as heart rate per minute and blood pressure should be performed. (Fossum, 2007).

Ketamine is a dissociative anesthetic that has been used in veterinary medicine for a very long time. It has cardiovascular effects similar to sympathetic nervous system stimulation with increased heart rate and blood pressure, cardiac output, and cardiac oxygen demand, especially if high doses of ketamine are used, dramatic drops in heart rate and blood pressure may occur (Fossum, 2007). The medetomidine-ketamine combination is used for anesthesia of cats that undergoing ovariohysterectomy. This method of anesthesia has some advantages such as adequate respiration, provision of analgesia, and useful for intramuscular administration (Kalchofner Guerrero *et al.,* 2014). Both medetomidine and ketamine cause bradycardia. Blood pressure should be measured before bradycardia is treated. If necessary, anticholinergic drugs can be used to treat the second phase of bradycardia when hypotension is also present. Anticholinergic drugs such as atropine and glycopyrolate are used in combination with $\alpha 2$ adrenoceptor agonists by many anesthesia practitioners based on early studies assessing only heart rate. However, the use of such combinations is controversial. Although anticholinergics have been shown to reduce heart rate, cardiac output, and decreased oxygen delivery, these drugs increase the size and duration of the hypertensive phase caused by $\alpha 2$ agonists (Fossum, 2007; Monterio *et al.,* 2009).

Atropine is an anticholinergic medication often added to premedication. Atropine reduces salivation and increases heart rate by acting in parasympathetic cholinergic areas. Useful to intravenous administration for the treatment of bradycardia in an anesthetized patient. The administration of low doses results in a paradoxical decrease in heart rate in consequence of the presynaptic cholinergic receptors inhibition (Stoelting *et al.,* 2006; Fossum, 2007).

The purpose of the study reported here, to investigate the effect of atropine on cardio-respiratory parameters and body temperature in cats undergoing ovariohysterectomy with the combination of medetomidine-ketamine anesthesia.

MATERIALS and METHODS

Twenty-six female intact domestic cats among the different breeds (mix breed, Angora cat, British Shorthair, Siamese) were admitted to Ankara University Faculty of Veterinary Medicine, Department of Obstetrics and Gynecology for routine elective ovariohysterectomy. The animals weighing were between 2.5-4.5 kg and the ages were between 7 months to 12 months. The animals were considered healthy based on normal physiological examination. The cats were vaccinated routinely and free of intestinal parasites.

Study design

The animals were divided into two groups by the randomized grouping method before the operation. Trial animals (n=14) received atropine together with medetomidine and ketamine anesthesia. In control animals (n=12) received the same anesthesia without atropine injection. Measurement of vital parameters was performed and recorded after operation for 60 minutes.

Anesthesia Protocol and operation

At least 12 hours before the operation food and water access were ceased. The cats were placed in unheated cages at least 30 min before the operation. Premedication was performed with subcutaneous atropine (50 µg/kg; Atropin, Vetas, Turkey) and intramuscularly (i.m.) medetomidine (80 µg/kg medetomidine; Domitor, Zoetis, Finland) in trial group and alone medetomidine (i.m.) in control group. Ten minutes after premedication, ketamine (5 mg/kg ketamine; Alfamine, Ege Vet, Turkey) was injected intramuscularly. After then, cats were moved stainless steel preoperative preparation table. An intravenous catheter was replaced to the cephalic vein and Ringer’s lactate solution was administered at the beginning of the operation (10ml/kg/h). The left flank was clipped, cleaned and disinfected in cats for cleaning at the preparation of the operation area. A left flank blunt incision was performed and both ovaries and uterine horns and corpus uteri were removed. Absorbable suture material (Polyglycolic acid, Katsan, Turkey) was used for closing the abdomen wall and skin. Injectable amoxicillin-clavulanic acid (25 mg/kg; Synulox, Zoetis®, Finland) was administered subcutaneously at the end of the operation. Atipamezole (200 µg/kg; Antisedan, Zoetis, Finland) was injected intramuscularly 45 minutes after the ketamine injection. The cats were discharged from the clinic on the day of operation and animals were presented to the clinic 3 days after the operation. Then the owners continued the treatment with antibiotics for 7 days. The abdominal skin sutures were removed on the 7th day after the operation.

Measurements of vital parameters

At the end of operation animals were moved to the critical care unit and the measurements of vital parameters were performed. Heart rate was measured and recorded after the operation. The measurement was performed by auscultation with a stethoscope. Respiration rates were determined by following the intercostal muscle movement. Deep rectal temperature was measured by a rectal thermometer. The heart rate, respiration rate, and deep rectal temperature were measured every 10 minutes for 1 hour.

Anesthesia recovery

Assessment of recovering from anesthesia were adapted from Ko et al., (2001) and started just after operation and lasted 1 hour later. For assessing the following measures were used, motor activity, respiration, circulation, level of consciousness, the coloration of the mucosa. Grades from 1 to 4 were assigned to the degree of functional recovery. The fourth degree was deep anesthesia and the first degree was recovered anesthesia. In the first degree, cats successfully attempt to walk unassisted.

Statistical Analyses

Before performing the statistical analysis, data were examined with the Shapiro-Wilk test for normality and Levene test for homogeneity of variances as parametric test assumptions. Descriptive statistics for each variable were calculated and presented as "Mean ± Standard Error of Mean". The student t-test was used to evaluate the differences between groups for the duration of the operation and weight of cats. The effect of group, time of measurement, and their interaction on hearth rate, respiration, body temperature, and the score of sedation was analyzed linear mixed models by using the following model with repeated measures:

Yijk= + Gi+ Tj+(G T)ij+ eijk

Where, Yijk, dependent variable; , overall mean; Gi, the effect of the group (i = Control and Trial groups); Dj, effect of time of measurement (j = 1,2,3,4,5,6 measurement points); (G D) ij, the interaction between group i and time of measurement j; and eijk, residual error. Animals within the group were assessed as a random effect, while group, period, or day of sampling, and their interaction were assessed as a fixed effect. When a significant difference was revealed, any significant terms were compared by Simple effect analysis with Bonferroni adjustment. P<0,05 was considered as significant in all analyses.

RESULTS

Cats among the different breeds (mix breed, Angora cat, British Shorthair, Siamese) were allocated to the present study. The mean age was similar among groups. The mean time of operations was similar. Also, the mean body weights were not statistically different among groups (Table 1).

Table 1. Mean operation time and body weight in trial and control cats.

Parameters	Groups	Mean	Standard Error	*P*
Time of Operation	Trial	25.15	2.01	0.878
	Control	24.73	1.81	
Weight	Trial	3.00	0.13	0.579
	Control	2.89	0.15	

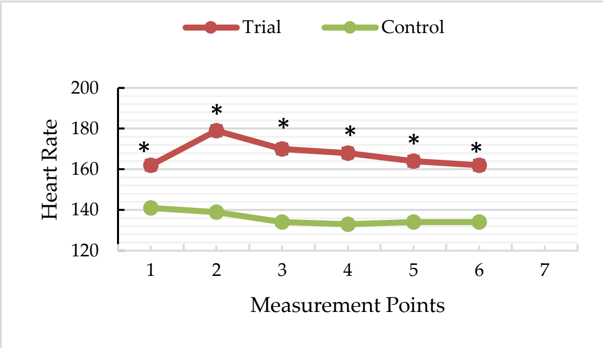

Figure 1. Heart rate (bpm) after the operative approach in Atropine treated and control cats.

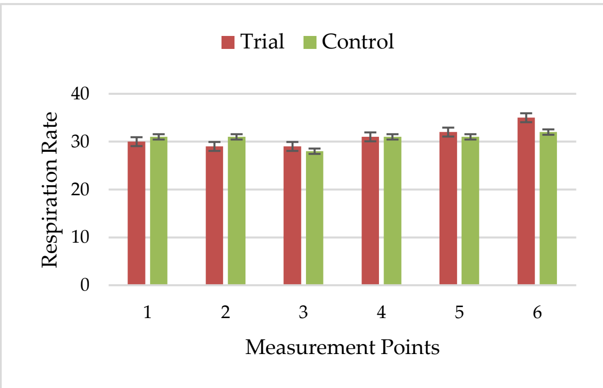

Figure 2. Respiratory rate per minuteafter the operative approach in Atropine treated and control cats.

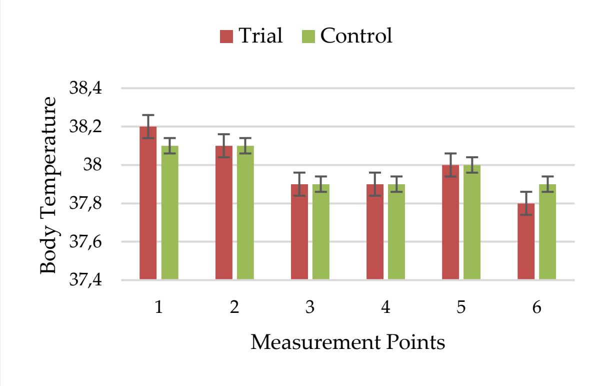

Figure 3. Body temperature changes after the operative approach in Atropine treated and control cats.

There was a group, time, and group x time interaction noted for heart rate. The mean heart rate was greater in trial group for all measurement points (Figure 1). However, none of the cats experienced bradycardia or tachycardia during the study period. There was no interaction noted between group x time for respiration rate. The mean respiratory rates were presented in Figure 2. There was no group, time, or group x time interaction recorded for deep rectal temperatures. The body temperatures were in normal ranges for all measurement points (Figure 3). In both trial and control groups, all cats assigned a sedation score of 0 at baseline. In both groups significant sedation induced, however, the scores were not statistically significant among groups.

DISCUSSION

In the present study we evaluated the post-operative role of atropine on selected vital parameters in cats that had elective ovariohysterectomy. α-2 adrenergic receptor agonist administrations resulted in cardiovascular changes. Especially heart rate parameter decreases under the baseline value (Lamont *et al.*, 2001; Graholm *et al.*, 2006). Under the influence of medetomidine and ketamine anesthesia central venous pressure and systemic vascular resistance increases although, cardiac index decreases (Lamont *et al.*, 2001). Interestingly, the increased dose of medetomidine did not affect the severity of the decrease of heart rate in dogs (Monteiro *et al.*, 2008). However, the dose depended heart rate evaluation was not measured in the present study (Ko *et al.*, 2001). The present study showed that the use of medetomidine alone resulted in decreased heart rate during the measurement period. The role of anticholinergics in combination with α-2 adrenoreceptor agonists is not exactly known the data about combine used has inconsistent results in dogs (Sinclair *et al.*, 2003). Especially combination using α-2 adrenoreceptor agonists and anticholinergics prevented reduction in heart rate in dogs. Also, Monteiro *et al.*, (2009) showed that atropine prevented medetomidine caused bradycardia in cats. However, in that study, the authors evaluated the role of different doses of medetomidine. Different than that, in the present study we have used the same doses per kg for all animals and evaluated the role of atropine directly. Similar to both previous studies (Selmi *et al.*, 2002; Monterio *et al.*, 2009) we have encountered decreased heart rate post-operative measurement points in control cats. And atropine prevented heart rate to decrease. Unlike the other studies, we have just evaluated the post-operative period until anesthesia recovery for 1 hour. Monterio *et al.*, (2009) reported that atropine has a shorter duration of effect than medetomidine. Our study has no information because we have determined the post-operative 1 hour to evaluate the early effect of drug administration, but Monterio *et al.*, (2009) evaluated animals for 3 hours. Short (1991), reported that atropine administration increases the risk of cardiac dysrhythmia which associated with increased heart rate and not affected respiratory function. Possibly, the way of administration is a factor. Intravenously injected atropine and cardiac arrhythmias such as multiple premature ventricular contractions observed (Short, 1991; Lamont *et al.*, 2001). On the other hand, Ko *et al.*, (2001) atropine administered only intramuscularly in combination with medetomidine and reported only a few dogs had premature contractions. Different than others, we have administered atropine subcutaneously maybe that is a factor we did not record any cardiac arrhythmias.

In dogs and cats α-2 adrenoreceptor agonists decrease the body temperature. This process-related due to decreased heat production, muscle relaxation, and the influence of the drug in the thermoregulatory system. There is another mechanism that affects body temperature loss (Granholm *et al.*, 2006). The duration and area of operation might be effective in body temperature. In the present study, we have used an automated critical care unit to keep animals in a normal temperature environment and oxygenated. Heat loss can be originated from surgical sites well especially major body cavities such as the abdominal cavity and thorax are exposed. The style of operation maybe has a role in heat loss (Kelly *et al.*, 2012). In the present study, after the operation deep rectal temperatures were similar and not decreased under the reference value. We have operated cats from the left flank. This small invasive operation technique might decrease heat loss.

CONCLUSION

In conclusion, atropine is an effective drug preventing decrease of heart rate and patients have shown less undesirable side effects when it is used before the administration of medetomidine in cats that operated for ovariohysterectomy.

ACKNOWLEDGMENTS

Conflict of Interests: The authors declared that there is no conflict of interests.

Financial Disclosure: The authors declared that this study has received no financial support.

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