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Clinical evaluation of oral administration of ketamine with acepromazine or midazolam in cats: a preliminary study

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Abstract

There are a variety of methods to induce anesthesia in animals. Oral anesthetic drugs are suitable for short-term restraint in most healthy animals. The aim of the present study was a comparative evaluation of the effects of anesthetic drugs ketamine, ketamine with acepromazine or midazolam as oral on vital signs, anesthesia duration, and neural reflexes in the cat. This study was performed on fifteen clinically healthy adult cats that were categorized into three equal groups A (alone ketamine), B (ketamine with acepromazine), and C (ketamine with midazolam). In group A; ketamine was administrated with a dosage 80 mg/kg oral once. In group B; first acepromazine was given 0.15 mg/kg and after thirty-minute, ketamine was eaten to cats. Group C was similar to group B; with the difference that midazolam was administrated 0.3 mg/kg instead of acepromazine. Group B had the lowest fluctuations in heart rate and group C was better for the influence on temperature and respiratory. There were no significant variations for neural reflexes; however, there was a significant difference for anesthesia duration between groups B (37.2 minutes), and C (37.4) with group A (26). Induction of anesthesia was better in groups B (14.6±1.4 minutes), and C (15.6±1.14) compared with group A (20±2.34). The time of first voluntary movement was recorded in minutes of 38.2±2.38, 43±2.43, and 44.8±3.27 for groups A, B, and C respectively. The oral administration of ketamine with midazolam or acepromazine is a better method than alone ketamine for induction of anesthesia in cats, because of the longer anesthesia duration and fewer muscle tremors.

Keywords: Acepromazine, Cat, Ketamine, Midazolam, Oral administration

Introduction

There are a variety of methods to induce anesthesia in animals. The use of different combinations of anesthesia and premedication drugs is different in various species, breeds, and even animal gender, therefore, a wide field has been provided for research (Freitas et al, 2012). In general, the anesthetic or chemical restraint techniques rely on local, injectable, or inhalation anesthesia. Sedative combinations are suitable for short-term restraint or minimally invasive procedures such as radiography, suture removal, otoscopic examination, and physical examination in an intractable animal. Advantage is that these components are reversible, allowing a rapid return to pre-anesthetic function. Anesthetic drugs induce rapid and predictable short-term loss of consciousness. The duration of action is generally less than 15 min following a single dose of drugs. At present, some

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anesthetic drugs are administered orally in a wide range of animal species, including dogs, cats, and several species of wildlife (Wetzel & Ramsay, 1998). Considering that general anesthesia is not without side effects and may alter the hemostasis of the body, it is important to know the function of important organs, including the cardiovascular and respiratory systems (Freitas et al, 2012).

Oral anesthetic drugs are suitable for short-term restraint in most healthy animals (Grimm et al, 2015). Ketamine is a dissociative anesthetic drug commonly used in veterinary medicine, mainly for induction and maintenance of anesthesia, also for pain management in the peri- and postoperative period. It is the drug of choice for members of the cat family (such as lion and tiger). High levels of ketamine can increase anesthesia duration up to six hours or more. This drug increases the heart rate, with the effect on sympathetic activity. Benefits of ketamine are included the rapid onset of action, maintenance of laryngeal reflex, and stimulation of the heart (Pascoe et al, 2007). One of its disadvantages is that its IM injection is painful, causes weakens of the respiratory tract, and increases muscle tone. Ketamine should not be used in animals with seizures. The dosage of drug is between 11-33 mg/kg depending on the degree of restraint or surgical interference (Freitas et al, 2012).

Acepromazine is a phenothiazine tranquilizer that blocks dopamine receptors in the CNS and depresses the reticular-activating system, resulting in sedation. This drug causes sedation without significant respiratory depression. Acepromazine has antiemetic, antihistaminic, antisympathetic, antiarrhythmic, and antishock properties. Caution should be used when administering acepromazine to animals that are predisposed to seizures. It is administered with dosage 0.03-0.15 mg/kg in combination with ketamine in cats (Grimm et al, 2015). Midazolam is a water-soluble benzodiazepine drug that metabolized in the liver. It is used both as a premedication and for induced anesthesia. Midazolam is used in a wide range of mammals including dogs and cats (Faghihi & Gandomi Sani, 2013). One of the most important uses of midazolam is the control of seizure in cats with a dosage of 0.07-3 mg/kg. It has the least side effects on the cardiovascular system (Ebner et al, 2007).

In some cases, such as replacement of bandage, burns, or washing wounds, the owners are anxious and worried about injection of drugs and ask the veterinarian to anesthetize their animals orally. As a result, the animal does not require injection. The investigations on oral ketamine administration are limited in cats. In a study, intranasal administration of ketamine with midazolam avoided the pain of injection in cats (Marjani et al, 2015). In another survey, after injection of midazolam with ketamine; there were fewer complications than ketamine alone (Ilkiw et al, 1996). The present study aimed to evaluate the effects of oral administration of ketamine alone, ketamine with acepromazine, and ketamine with midazolam on the induction of anesthesia and their influences on vital signs in cats. The clinical aspects and the duration of anesthesia and the response to neural reflexes were also evaluated. These results can be applicable for feline.

Materials and Methods

The present study was accomplished from May to August 2017 (four months), in the Veterinary Hospital of Shahid Chamran University of Ahvaz. The studied cats were fifteen clinically healthy adult animal, male, DSH (domestic short hair) breed, 1 to 1.5 years-old, and with mean body weight 3.45 kg (SD±0.37). The cats were kept in separate cages for three weeks to reduce stress and their aggressive behavior. Triple vaccines PCH (Biocan, Bioveta, Czech Republic) and Rabies (Rabisin, Merial, France) were injected with SC. Antiparasite drugs of praziquantel (Damloran Razak,

Borujerd, Iran) and mebendazole (Mehr Darou, Tehran, Iran) were administered with dosage 5 and 22 mg/kg respectively. Finally, the studied cats were categorized into three equal groups: A (control: alone ketamine), B (ketamine with acepromazine), and C (ketamine with midazolam). Food was withheld from the cats for 12 hours before each trial but with free access to water. This survey was approved by the Animal Care and Research Committee of Shahid Chamran University of Ahvaz. It was conducted based on the Guidelines for Animal Care and Use (Ethical code: 66280: 27/8/94).

In group A, First normal saline was given to them to normalize the volume of the drug, and after 30 minutes, ketamine (Alfasan, The Netherlands) was eaten to cats with a dosage of 40 mg/kg once by a syringe attached to a catheter. Cats were manually restrained while drugs squirted into the oral cavity. The anesthesia duration was short; so the dosage was gradually increased to achieve the ideal dose of 80 mg/kg (Grimm et al, 2015). Vital signs the (measurement of heart rate, respiration rate, and body temperature), and neurological reflexes (pedal reflex in forelimbs and hind limbs, eyelid reflex, cornea, anus, local sedation in the face, pupil condition, tears, and saliva) were recorded also. The reflexes were evaluated as scoring based on predetermined forms. Furthermore, sternal or lateral recumbency, getting up time and the first voluntary movement was examined in all cats. Cats were monitored by a single observer for degree of sedation at 5-minute intervals for at least 60 minutes after treatment. The time interval between the measurement of vital signs and reflexes was every 5 minutes and followed until 60 minutes. In group B, first acepromazine (Alfasan, The Netherlands) was administered orally with a dosage of 0.15 mg/kg, and after 30 minutes, ketamine was given similar to the dosage of group A. In group C, midazolam (Chemi Darou, Tehran, Iran) was initially administered orally with a dosage of 0.3 mg/kg, and after 30 minutes, ketamine was eaten similar to previous groups. In the case of acepromazine and midazolam drugs, after the calculation of dosage per kg, the volume was increased to a constant amount of 1 ml using distilled water and then administered orally; however in relation to ketamine, since the concentration of drug was 10%, the volume of the obtained drug was suitable for oral administration (0.8 ml/kg body weight). All drugs were administered through a catheter attached to the syringe and the restraint methods were applied for all cats. In this study, all cats were kept until seven days after returning from anesthesia to ensure health.

Statistical analysis

Vital signs and the anesthesia proceeding were reviewed and compared together using statistical analysis of ANOVA One way; in the following for differentiation between times from repeated measure ANOVA test and evaluation of neural reflexes from Wilcoxon signed Ranks test using software SPSS version 20. The values of $P< 0.05$ were statistically significant.

Results

Administration of oral ketamine (group A) caused take a longer time for the animal to become unconscious and it took less time to recover from anesthesia than two other groups (B and C). After the administration of the drugs, the cats were favorably placed on their sides and established good sedation; nevertheless, this induction of anesthesia was better in groups B (14.6±1.14 minutes), and C (15.6±1.14) than group A (20±2.34). Muscle tremors were more observed in group A (three cases) than groups B and C. The time of the first voluntary movement was recorded in groups A, B, and C in minutes of 38.2±2.38, 43±2.54, and 44.8±3.27, respectively (Table 4). A significant difference was observed between group A (26 minutes) with groups B (37.2) and C (37.8) for the anesthesia duration ($P<0.05$). The

mean±SD of anesthesia proceeding is shown in Table 4.

Effect of ketamine on heart rate, respiratory rate, and temperature

The mean heart rate increased to 5 minutes and then decreased up to 60 minutes, but ultimately increased more than zero time. The heart rate was significantly higher in 5 minutes than all times (P<0.05). The mean respiratory rate decreased gradually until 6 minutes, and finally decreased than the time of zero. The decrease in respiratory rate had a significant difference in 35 minutes than zero time (P<0.05). The mean body temperature decreased gradually and then increased slightly in 20 minutes, but eventually decreased than zero time. A decrease in temperature was significant in 25 minutes than 5 minutes also (P< 0.05). The mean±SD of ketamine effects on vital signs is shown in Table 1.

Effects of ketamine with acepromazine on heart rate, respiratory rate, and temperature

The mean heart rate increased to 5 minutes and then decreased to 60 minutes, nevertheless was higher than zero time. The number of heart rate was significantly higher in 25 minutes than zero time (P<0.05). The mean of number breaths decreased to 30 minutes and then increased, finally was lower than zero time. The proceeding of respiration decreasing showed a significant difference in 5 and 10 minutes than zero time (P<0.05). The mean of body temperature increased until 20 minutes, and then decreased, but eventually was lower than zero time. The mean temperature was significantly higher in zero time than 15, 25, 30, 40, 55, and 60 minutes (P<0.05). None of the cats showed signs of tremor. The mean±SD of the effects of acepromazine with ketamine on vital signs is shown in Table 2.

Effects of ketamine with midazolam on heart rate, respiratory rate, and temperature

The mean heart rate increased to 5 minutes and then decreased in 60 minutes, but eventually was higher than zero time. The heart rate was significantly higher at 15 minutes than 45 minutes (P<0.05). The respiratory rate fluctuated at different times and eventually was lower in 60 minutes than zero time. The mean temperature began to drop; eventually decreased more than zero time. None of the cats showed signs of tremor. The mean±SD of the effects of midazolam with ketamine on vital signs is shown in Table 3.

Table 1: The mean±SD of ketamine effects on vital signs (per minute) in the studied cats

Time	Heart rate	Respiratory rate	Temperature body (C)
Thirty minute before administration	132.4 ± 24.22^{A}	22.8 ± 4.14^{A}	38.74 ± 0.43^{A}
zero	134.4 ± 22.28^{A}	22.8 ± 4.14^{AC}	38.74 ± 0.43^{A}
5	164.8 ± 20.22^{B}	21.2 ± 3.63^{A}	38.68 ± 0.42^{AC}
10	162.8 ± 18.08^{AC}	20.8 ± 2.28^{A}	38.58 ± 0.42^{A}
15	155.2 ± 19.16^{AC}	19.2 ± 3.63^{A}	38.5 ± 0.4^{A}
20	148 ± 19.49^{A}	18 ± 2.82^{A}	38.52 ± 0.42^{A}
25	143.6 ± 19.3^{A}	18.4 ± 2.6^{A}	38.46 ± 0.46^{BD}
30	139.6 ± 23.21^{A}	18 ± 3.16^{A}	38.38 ± 0.43^{B}
35	136.8 ± 22.65^{A}	18.8 ± 3.34^{B}	38.42 ± 0.44^{A}
40	139.2 ± 19.87^{A}	19.6 ± 1.67^{A}	38.42 ± 0.39^{A}
45	139.2 ± 22.56^{A}	20.4 ± 2.6^{A}	38.4 ± 0.37^{A}
50	139.2 ± 22.82^{A}	21.2 ± 2.28^{A}	38.44 ± 0.32^{A}
55	137.6 ± 19.04^{A}	21.6 ± 3.28^{A}	38.5 ± 0.35^{A}
60	137.2 ± 19.21^{A}	22.4 ± 3.57^{A}	38.44 ± 0.32^{A}

The different letters in each column indicate a significant difference (P<0.05).

Table 2: The mean±SD of acepromazine with ketamine effects on vital signs (per minute) in the studied cats

Time	Heart rate	Respiratory rate	Temperature body (C)
Thirty minute before administration	126.4±21.46^{A}	21.28±4.6^{ACD}	38.62±0.43^{AC}
zero	124.4±21.46^{AC}	21.2±4.6^{ABCD}	38.62±0.43^{AC}
5	139.2±23.09^{a}	19.6±4.09^{bc}	38.52±0.44^{ac}
10	138.4±23.16^{A}	18.8±3.34^{BDE}	38.5±0.41^{AC}
15	136.8±23.22^{A}	18.8±3.89^{A}	38.4±0.41^{BD}
20	133.2±22.11^{A}	17.2±3.63 ^{ABD}	38.34±0.49^{BD}
25	130.8±23.98^{B}	17.2±3.63 ^{ABD}	38.36±0.46^{BD}
30	129.2±22.91^{A}	17±2.82 ^{ABD}	38.26±0.47^{B}
35	136.8±22.65^{A}	18.8±3.34^{B}	38.32±0.43^{AC}
40	128.8±21.42^{A}	19.2±3.63^{A}	38.34±0.45^{BDE}
45	130.4±20.89^{A}	18.4±4.33^{A}	38.34±0.46^{AC}
50	129.6±21.97^{A}	19.6±4.98^{A}	38.34±0.46^{AC}
55	130.4±23.08^{A}	19.4±4.44^{ABD}	38.36±0.47 ^{BDE}
60	129.6±22.19^{A}	19.2±5.4 ^{ADB}	38.36±0.47 ^{BDE}

The different letters in each column indicate a significant difference (P<0.05).

Table 3: The mean±SD of midazolam with ketamine effects on vital signs (per minute) in the studied cats

Time	Heart rate	Respiratory rate	Temperature body (C)
Thirty minute before administration	117.6±18.78^{A}	20.4±3.28^{A}	38.6±0.47^{BC}
zero	116.8±18.3^{A}	20±3.16^{A}	38.6±0.47^{BC}
5	139.6±17.57^{B}	19.4±4.44^{A}	38.6±0.47^{BC}
10	138.8±16.82^{BC}	18.4±3.84^{A}	38.5±0.47^{AC}
15	136±16.06 ^{BCD}	17.6±2.96^{A}	38.5±0.47^{AC}
20	136±16.06^{A}	16.8±3.63^{A}	38.42±0.44^{AC}
25	127.2±17^{A}	18.2±3.03 ^{A}	38.42±0.44^{AC}
30	126±16.85^{A}	16.4±2.96^{A}	38.34±0.47^{AC}
35	122.8±16.28^{A}	16.6±3.71^{A}	38.34±0.47^{AC}
40	124±17.94 ^{A}	16.8±3.34 ^{A}	38.38±0.45 ^{AC}
45	123.6±16.21^{A}	18±3.16^{A}	38.36±0.49^{AC}
50	124.4±18.56^{A}	18.4±3.57^{A}	38.42±0.44^{AC}
55	123.2±17.97^{A}	19.4±4.44 ^{A}	38.4±0.45 ^{AC}
60	124.4±16.93^{A}	18.8±4.14 ^{A}	38.38±0.45 ^{AC}

The different letters in each column indicate a significant difference (P<0.05).

Table 4: The mean±SD of anesthesia proceeding (per minute) in the studied cats

Neural reflexes	Ketamine	Acepromazine with ketamine	Midazolam with ketamine
Sleeping time on the chest	16±1. 41^{B}	11±1.0^{A}	11.6±1.14^{A}
Sleeping time to the side	20±2.34^{B}	14.6±1.14^{A}	15.6±1.14^{A}
Sleeping time on the chest after returning of anesthesia	42±3.31^{B}	48.2±2.77^{A}	49±4.3^{A}
Getting up time after returning of anesthesia	47.4±2.88^{B}	54.2±3.56^{A}	55.4±6.02^{A}
The first time of voluntary move	38.2±2.38^{B}	43±2.54^{A}	44.8±3.27^{A}

The different letters in each column indicate a significant difference (P<0.05).

Neural reflexes

Ketamine

Pedal Reflex of the forelimbs and hindlimbs: This reflex decreased from 15 minutes and continued to decrease until 40 minutes. At times between 25 and 30 minutes, this reflex was negative. Eyelid and corneal reflex: This reflex started to decrease from 15 minutes, but it never became negative, and started to increase

again in 45-40 minutes. Anal reflex: This reflex began to decrease after 15 minutes, but was never negative, and increased again from 35 to 40 minutes. Sedation of the face: This reflex was started in 15 minutes, then increased, and in following decreased in 25-35 minutes. Pupil reflex: It was normal during the test. Tear reflex: A small amount of tear was observed in 10-15 minutes. Salivary gland reflex: Saliva began from 5 minutes severely, and eventually became negative from 20 minutes next.

Ketamine with Acepromazine

Pedal Reflex of the forelimbs and hindlimbs: This reflex began to decrease from 15 minutes and became negative in 25 minutes. It was reactivated in 30 minutes and then started to increase. Eyelid and corneal reflex: It was started to decrease from 15 minutes, but it never became negative and increased again from 45 minutes. Anal reflex: It was started to decrease from 15 minutes, and then increased from 45 minutes. Sedation of the face: It was started in 15 minutes and in following it decreased in 40 minutes. Pupil reflex: It was normal during the test. Tear reflex: A small amount of tear was observed in 15 minutes. Salivary gland reflex: There was a moderate amount in 5-15 minutes and then it became negative.

Ketamine with Midazolam

Pedal Reflex of the forelimbs and hindlimbs: It was started to decrease from 15 minutes and became negative in 30 minute; in following it increased from 35 minutes. Eyelid and corneal reflex: This reflex decreased from 15 minutes, and then increased from 45 minutes. Anal reflex: It decreased from 15 minutes, but it never became negative, and began to increase from 45-40 minutes. Sedation of the face: It was started in 15 minutes, and then it decreased in 45 minutes. Pupil reflex: It was normal during the test. Tear reflex: A small amount of tear was observed in 10-15 minutes. Salivary gland reflex: A moderate salivation was observed in 5-15 minutes. There were no significant variations for neural reflexes ($P<0.05$).

Discussion

The present study showed that the combination of ketamine with acepromazine or midazolam was useful to induce anesthesia in cats orally. Its reason was the longer duration of anesthesia (37.4 and 37.2 minutes, for groups B and C, respectively) than group A (26 minutes) and fewer side effects. Following the administration of the drugs, the cats were placed on the sides and created appropriate sedation, although this induction of anesthesia was better in groups B (14.6±1.14), and C (15.6±1.14) than group A (20±2.34). In fact, less time was needed for the animals to be placed on their sides. Group B had the lowest fluctuations in heart rate and group C was better for the influence on temperature and respiratory. The importance of this research is that the owners can give the drugs to their pet, in special circumstances such as changing of bandage in burns and other cases that require sedation. Injectable ketamine as IM has a bioavailability of 93% in cats, but in the case of oral administration, bioavailability is reduced to 16%; as a result, at least 5 times the muscular dosage should be given orally to achieve the bioavailability of IM injection (Pulley et al, 2004). In the present study, ketamine was administered with a dosage of 80 mg/kg. Drug toxicity may occur following the use of high dosage especially in cats with hepatic failure; so, it is better to use a lower dose of anesthetic drugs early to prevent possible intoxication, and then to use injectable drugs to induce anesthesia after observing ataxia and ensuring of the drug effectiveness (O'Brien & Coate, 2010). In the present study, all cats were kept until seven days after returning from anesthesia to ensure health. No major side effects were observed in them.

A survey was done on cats that they were received dexmedetomidine IM. The results showed similar sedative effects compared with dexmedetomidine orally (Porters et al, 2015). In another study, no significant bradycardia was observed in four cats that were received ketamine and detomidine orally. Dose-dependent bradycardia had been reported on cats in which the drugs were injected for a long time intravenously (Sinclair, 2003). Other studies have suggested that ketamine and xylazine or medetomidine have a lower effect than ketamine with detomidine, because of the less solubility in fat. Xylazine has less lipophilic properties, so they are less likely to cross the blood-brain barrier (Ebner et al, 2007). In the present study, the mean heart rate increased than zero time in cats of group A. The mean respiration rate gradually decreased until the time of 60 minutes. The mean temperature decreased than the zero time also.

Ketamine may increase body temperature due to the enhancement of muscle activity. In some cases, ketamine depresses the temperature control center in the hypothalamus, resulting in a decrease in temperature (Tranquilli et al, 2007). In a study, the combination of xylazine with ketamine reduced temperature during anesthesia. It has been reported that the cause of the decrease in temperature is due to the reducing effects of these drugs on the temperature regulation center (Kul et al, 2000). In another survey, it was found that ketamine reduced the respiratory rate in cats through the central nervous system weakening (Nascimento Jdos et al, 2007). As the results of the above investigations show, in most cases, following the administration of anesthetic drugs caused a decrease in body temperature, heart rate, and respiration. The results of the present study confirmed the above findings also. In another survey, a comparison between four oral anesthesia protocols showed that a combination of detomidine and ketamine was a suitable method for the induction of anesthesia. In their study, the cats were evaluated at 3-minute intervals for 60 minutes (Wetzel & Ramsay, 1998). It was shown that co-administration of diazepam with ketamine greatly increased the effects of ketamine on the CNS in cats. Also, the depth and duration of CNS attenuation, the duration of anesthesia, and the time peak of drug action were increased compared with ketamine (Kaffashi Elahi et al, 2012). Furthermore, a combination of ketamine and midazolam produces less muscle relaxation than ketamine-propofol, or thiopental. In used dosages, ketamine-midazolam is also associated with increased salivation and dysphoria upon recovery (Grimm et al, 2015). In the present study, the evaluation was continued in intervals of 5 minute for 60 minute and the effectiveness of anesthesia protocols was better in groups B, and C than group A.

Some studies have been suggested that acepromazine may reduce heart rate. The reason for the decrease is related to the increased activity of the vagus nerve and the direct depression of the heart muscle. In some cases, acepromazine has been increased heart rate as compensatory due to low blood pressure, adrenergic block, and dilation of superficial arteries. It was stated that acepromazine overcomes sympathetic activity and decreases the activity of the vagus nerve caused by ketamine, leading to a decrease in heart rate (Heidari et al, 2017). Furthermore; acepromazine reduces the amount of catecholamine in the hypothalamus, dilates blood vessels, and reduces skeletal muscle activity, so temperature decreases under the environment effects (O'Brien & Coate, 2010). In another study on cats, the combination of ketamine with acepromazine increased heart rate significantly (Tranquilli et al, 2007). In hypovolemic cats with bleeding, a combination of ketamine with acepromazine reduced heart rate significantly (Pascoe et al, 2007), which is inconsistent with the present survey. It was

shown that the combination of ketamine with acepromazine reduced heart rate until 10 minutes after anesthesia in cats (Colby & Sanford, 1981). They reported that this drug combination reduced the number of breaths in cats, while another study in red wolves found a combination of ketamine with medetomidine and acepromazine increased respiratory rate due to the stimulating effects of medetomidine on the respiratory center (Sladky et al, 2000). Confirming the present study, it was reported that the administration of ketamine with acepromazine reduced respiration rate in cats (Colby & Sanford, 1981). It was announced that the combination of the above drugs resulted in a significant reduction in the respiratory rate in cats. Various studies confirm the results of the present study; however, in our study, the oral forms of anesthesia drugs were examined on cats. It is emphasized that the dose maximum of oral ketamine is 80 mg/kg, and a high dosage is not recommended. Another point is that this volume of drug is calculated in healthy cats and it should be used with extreme caution in sick animals.

In group B, the most important changes were between zeros and 25 minutes for heart rate, in times of 5, 10, and 20 minutes for respiratory rate, and most minutes for body temperature. A decrease in temperature is reported following the administration of ketamine with acepromazine in the monkey (Lopez et al, 2002). In another study on dogs, acepromazine reduced the temperature (O'Brien & Coate, 2010). As a result, precaution should be accomplished during anesthesia in cats with the cardiovascular disease when using a combination of ketamine and acepromazine. In cats of group C, the mean heart rate increased than the zero time. In confirmation of the results of the present study, it was found that more muscle tremors were observed in the group of ketamine alone in cats; however, the combination of ketamine and midazolam had good sedative effects (Troyer et al, 2005). In another study, ketamine with midazolam was used to induce anesthesia in cats with cardiomyopathy. It was observed the effects of adequate sedation, decrease of heart rate, and reduction of arterial pressure (Akkerdaas et al, 2001). According to the results of the present study, the mean respiratory rate fluctuated in different minutes, and there was no significant difference. In another survey, similar to our study, midazolam reduced respiratory distress. The effects of debilitating of midazolam and ketamine can reduce the number of breaths significantly. Possible causes are included decreased CNS activity due to a decrease of benzodiazepines and consequent reduction of muscle activity (O'Brien & Coate, 2010).

In another study on twelve cats announced that intranasal administration of ketamine (14 mg/kg) with midazolam (0.5 mg/kg) was atraumatic, and its use avoided the pain of injection of ketamine combinations when this drug was used to induce sedation in cats (Marjani et al, 2015). In the further survey, after injection of midazolam with ketamine; there were fewer complications than ketamine alone in cats (Ilkiw et al, 1996). According to the present study, ketamine alone took a longer time that cats to become conscious, and coming back of anesthesia in a shorter time, so the combination of drugs is more effective than single-use. Regarding the time of sleeping on the chest, getting up after returning to anesthesia, and the first voluntary movement, there was a significant difference between group A with groups B, and C. The findings of other researchers showed the cats that were received meloxicam orally or subcutaneously had less pain than the group in which buprenorphine was injected or given orally (Gassel et al, 2005). In the present study, evaluation of the pedal reflex of the forelimbs and hindlimbs showed similar relatively results in all groups. In the case of the eyelid, corneal, pupil, and anal

reflexes, similar results were observed in all groups, as well as, the examination of the sedation reflex in the face showed that it was negative for a few minutes in group B, as a result, it is better to combine ketamine with acepromazine for better checking of this reflex. In the case of salivation reflex, it was observed more in group A; therefore, the combination of drugs is more appropriate than only ketamine. In the present study, no significant changes were observed between groups of B and C in association with their effects on neural reflexes. It can be concluded that ketamine should be used in combination with other drugs to induce better anesthesia and reduce the side effects. In comparison between the three groups, the combination of ketamine with other drugs (groups B and C), were more appropriate because of the less negative effects on vital signs, longer anesthesia duration, and fewer muscle tremors. It is emphasized that the use of any anesthetic drugs should be accomplished only in special circumstances and with the advice of a veterinarian.

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Conflict of Interests

The authors declare that they have no conflict of interest.

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ارزیابی بالینی تجویز خوراکی کتامین همراه با آسپرومازین یا میدازولام در گربه‌ها: یک مطالعه مقدماتی

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چکیده

روش‌های متعددی جهت القاء بیهوشی در حیوانات وجود دارد. داروهای بیهوشی خوراکی، جهت مقید کردن کوتاه مدت، در اغلب حیوانات سالم مناسب هستند. هدف از انجام مطالعه‌ی حاضر، ارزیابی مقایسه‌ای اثرات داروهای بیهوشی کتامین تنها، کتامین همراه با آسپرومازین و کتامین با میدازولام به صورت خوراکی، بر علائم حیاتی بدن، طول دوره‌ی بیهوشی و رفلکس‌های عصبی در گربه بود. این تحقیق روی ۱۵ قلاده گربه بالغ سالم از نظر بالینی انجام شد که به ۳ گروه مساوی A (کتامین تنها)، B (کتامین با آسپرومازین) و C (کتامین با میدازولام) تقسیم‌بندی شدند. در گروه A، کتامین تنها با دوز ۸۰ میلی‌گرم/کیلوگرم، یک‌بار خورانده شد. در گروه B، ابتدا آسپرومازین با دوز ۰/۱۵ میلی‌گرم/کیلوگرم و پس از ۳۰ دقیقه، کتامین به گربه‌ها خورانده شد. گروه C، مشابه گروه B بود، با این تفاوت که به جای آسپرومازین، میدازولام با دوز ۰/۳ میلی‌گرم/کیلوگرم تجویز گردید. گروه B، کم‌ترین تغییرات را بر ضربان قلب داشت و از لحاظ تأثیر بر درجه حرارت بدن و تنفس، گروه C بهتر بود. در مورد رفلکس‌های عصبی، تفاوت معنی‌داری مشاهده نگردید؛ اما از نظر طول دوره بیهوشی، تغییرات معنی‌داری بین گروه‌های B (۳۷/۲ دقیقه) و C (۳۷/۴) با گروه A (۲۶) مشاهده گردید. القاء بیهوشی در گروه‌های B (۱۴/۶±۱/۴ دقیقه) و C (۱۵/۶±۱/۱۴) نسبت به گروه A (۲۰±۲/۳۴) بهتر بود. زمان اولین حرکت ارادی در گروه‌های A، B و C به ترتیب در دقایق ۳۸/۲±۲/۳۸، ۴۳±۲/۵۴ و ۴۴/۸±۳/۲۷ ثبت گردید. تجویز خوراکی میدازولام یا آسپرومازین همراه با کتامین، به دلیل طول دوره‌ی بیهوشی طولانی‌تر و لرزش‌های ماهیچه‌ای کم‌تر، نسبت به کتامین تنها، روش مناسب‌تری برای ایجاد بیهوشی در گربه‌ها است.

کلمات کلیدی: آسپرومازین، گربه، کتامین، میدازولام، تجویز خوراکی

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