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# The Comparison of some General Anesthetics Preparation in Cat Orchiectomy Based on the Onset and Duration of Anesthesia

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**Abstract**

Castration surgery (*orchiectomy*) is the most common operation veterinarians perform to control the feral cat population. This study aims to determine the potency of the most effective anesthetic from the many types of anesthetic preparations available regarding the onset and duration of anesthesia.. In this study, the comparison of the relative potency of anesthetic Ket-A-Xyl®, ketamine, ketamine-acepromazine combination, and ketamine-acepromazine-atropine combination in domestic cats (*Felis domestica*) was tested. The tested group consists of 9 cats with 3 comparison groups data from another study. The groups, namely A1 (ketamine) as control, A2 (ketamine-acepromazine), A3 (ketamine-acepromazine-atropine), and group A4 (Ket-A-Xyl®) which from this experiment. Acepromazine and atropine as premedication were administered subcutaneously, while Ket-A-Xyl® and ketamine were administered intramuscularly. All data were tested with statistical methods ANOVA and Kruskal-Wallis. The results showed that the onset of anesthesia in group A4 had a significant difference ($P<0.05$) compared to groups A1 and A3. While the duration of anesthesia, groups A2, A3, and A4 were significantly different compared to groups A1 ($P<0.05$), however, there was no significant difference between groups A2, A3, and A4. It can be concluded that the Ket-A-Xyl® preparation is the most effective anesthetic among the four test groups in terms of onset. Still, there is no significant difference in terms of duration.

**Keywords:** anesthesia, duration, feral cat, Ket-A-Xyl®, onset.

## Introduction

Anesthetics are drugs used in surgery to achieve a state of stupor, analgesia, blocking reflexes against surgical manipulation, and causing muscle relaxation (Tjay dan Rahardja, 2008). Anesthesia is an action to reduce pain with or without loss of consciousness (Sardjana dan Kusumawati, 2004). Anesthesia is usually required in surgery-related procedures because, at a particular time, it must be ensured that the animal cannot feel pain. The use of anesthetic preparations is intended to achieve a state of anesthesia, which is a generalized depressive state of various conditions in the central nervous system that is reversible in which all breathing and consciousness are eliminated, similar to a fainting state (Tjay dan Rahardja, 2015). The selection of the right anesthetic is necessary to smoothen the process of controlling the feral cat population, which will have an impact on environmental health, zoonotic management, and animal welfare.

Anesthetics are classified into two, namely local and general anesthetics. Unlike local anesthetics, general anesthetics can relieve pain throughout the body. General anesthesia can cause loss of consciousness amnesia, but is reversible or can be recovered (Whalen *et al*., 2019). General anesthetics are further classified into volatile and non-volatile groups. Volatile anesthetics or anesthetics used by inhalation are drugs that are administered as vapors through the respiratory tract. Examples include ether, N2O, halothane, isoflurane, sevoflurane, and enflurane. Non-volatile

anesthetics are anesthetic preparations that can be administered intravenously or intramuscularly to precede the induction of anesthesia. Examples include thiopental, diazepam, midazolam, ketamine, barbiturates, and propofol (Tjay dan Rahardja, 2015).

Ketamine is a drug that is often used as a general anesthetic in veterinary surgical procedures because it has the advantages of fast induction and short *recovery* (Sinner dan Graf, 2008). Generally, it takes 1 minute to have an effect on the CNS (Central Nervous System). Fast redistribution from CNS to tissues results in a short recovery phase (Rock, 2007). Ketamine is categorized as an anesthetic *dissociative*, which works by interfering with the reception of sensory input to the brain (Yew, 2015). Ketamine is an analgesic that acts powerfully on the central nervous system via sympathomimetic and parasympatholytic nerves (Pertiwi *et al*., 2004). However, the use of ketamine will increase heart rate and blood pressure, cause hypersalivation, increase respiratory secretions, and require anticholinergic drugs (Rock, 2007). The dose of ketamine injection for cats is 11-33 mg/kg of body weight, the onset occurs 10 minutes after injection, and the duration of the effect is 1 hour (Plumb, 2008).

Xylazine is an alpha-2 agonist, analgesic, and muscle-relaxant sedative drug. This drug can be used on dogs, cats, horses, and deer. Xylazine in cats can be used as a tranquilizer or muscle relaxant in surgical procedures when combined with ketamine. However, its use will cause a vomiting response in most cats. Side effects that appear can be bradycardia, hypotension, respiratory depression, and ca*rdiac arrhythmias* (Wright *et al*., 1987). The dose of xylazine injection for cats is 0.1-0.5 mg/kg B.W. with an onset of 10-15 minutes for dogs and cats via I.M. and S.C. The duration of the sedative effect ranges from 1-2 hours, depending on the dose administered (Plumb, 2008).

Premedication must be given because it can reduce anxiety and provide sedatives or hypnotics, reduce salivary secretion, and reduce pain (Baradero *et al*., 2005). Atropine is a drug that can be used as an anesthetic premedication to reduce the effects of bradycardia, salivary secretions, and respiratory tract secretions. Onset occurs 3-4 minutes after IV administration. The drug is well distributed throughout the body and can penetrate into the CNS. Acepromazine can also be used as a premedication. At low doses, it will cause a calming effect, while at higher doses, it will cause a sedative effect. The time required to take effect is approximately 30 minutes after I.M. injection (Maddison *et al*, 2008). Drugs from these two groups are expected to facilitate the injection of ketamine (Sardjana dan Kusumawati, 2004).

Using appropriate anesthetic drugs can reduce the increase in the cat population in the environment with minimum side effects. Currently, the increase in the cat population per year can reach 18 times. Hence, controlling it is a notable priority (Rahmiati *et al*., 2020). A controlled cat population will improve their welfare and reduce the potential for the spread of zoonotic diseases. The use of the most effective anesthetic drugs must be selected to minimize the impact of tissue trauma, the potential for overdose, and the efficiency of anesthetic working time. This study aims to identify a combination of anesthetic drugs better as a dissociative anesthetic through the speed of onset, duration of anesthesia, and the potential for tissue trauma inflicted on local cats during castration. The results of this study are expected to assist in the selection of the right anesthetic drug for use in the castration procedure, safe for the environment and useful in inhibiting the spread of zoonotic diseases.

## Materials and Methods

The variables in this research consisted of 3 (three) kinds namely, the independent variable in this study was the dose of acepromazine (Castran® 100 ml, Interchemie, Holland) 0.2 mg/kg B.W. (S.C.), atropine (V-Tropin® 0.3%, AgroVet, Peru) 0.02 mg/kg B.W. (S.C.), ketamine (Ketamine III® 10 ml, Dechra Veterinary Products, USA) 20 mg/kg B.W. (I.M.). These three groups were used as comparison references (Apritya dan Ardiani, 2015) and Ket-A-Xyl® (Ket-A-Xyl® 20 ml, AgroVet, Peru) 0.1 mg/kg B.W. (I.M.). The dependent variables are the onset of anesthesia (calculated from the injection until the cat loses consciousness) and the duration of anesthesia (calculated from the drug starting to work, namely from the time the cat was unconscious after the injection until it woke up), while the control

variables in this study are male domestic cats one or more years old, and weighs between 2-4 kg.

This study used nine male cats that come from shelters, and their use in this study has been in agreement with the owners of the shelters. These cats were given Ket-A-Xyl® at a dose of 0.1 mg/kg B.W. given by intramuscular injection. Before anesthesia for surgery, the cats were fasted for 12 hours to avoid the gag reflex caused by the use of anesthetic drugs. After the drug was injected, a digital timer measured the time of onset and duration. Onset is noted after the drug is injected until signs of loss of consciousness appear, namely loss of reflexes in the extremities and pedals. Duration is the length of time from loss of consciousness until consciousness begins to appear, namely the appearance of pupillary reflexes and recovery of limb reflexes. As comparison data, from Apritya and Ardani (2015) will be used. The results of this research data will be presented as mean ± standard deviation in descriptive form and analyzed by ANOVA and Kruskal-Wallis statistics followed by Bonferroni and Mann-Whitney Post Hoc tests using IBM SPSS Statistics 25 software.

## Results and Discussion

The result ( Table 1) showed that the onset of anesthetic drugs in the first treatment (A1) using ketamine as a single drug was an average of 7.37 minutes (Apritya dan Ardiani, 2015). Based on the results of statistical analysis using ANOVA and Post Hoc test using Bonferroni, it was found that group A1 was significantly different ($P<0.05$) compared to other groups. The onset of ketamine when injected intramuscularly in cats is 1-5 minutes with a peak effect at 6-8 minutes post-injection. Other literature explains that the peak effect is 10 minutes post-injection (Plumb, 2008; Sardjana dan Kusumawati, 2004). Premedication has several purposes, one of which is to facilitate the conduction of anesthesia so that the use of ketamine as a sole anesthetic drug will take longer to onset (Dobson, 1994).

From the Figure 1, it can be seen that group A1, using ketamine as a general anesthetic without premedication, had a fast duration of anesthesia. Based on the results of statistical analysis using Kruskal-Wallis and Post Hoc test using Mann-Whitney, it was found that A1 was significantly different ($P<0.05$) compared to other groups. This is evidenced by the shorter duration, with an average time of 24.76 minutes.

Ketamine, as a general anesthetic without premedication, has a short duration (Apritya dan Ardiani, 2015). The duration of anesthesia possessed by ketamine is indeed used for short-

Table 1. Data on onset and duration in groups A1, A2, A3, and A4

| | A1 | A2 | A3 | A4 |
|---|---|---|---|---|
| Onset (minute) | 7.37 ± 1.57* | 4.79 ± 0.92* | 5.51± 1.93* | 3.49 ± 0.7 |
| Duration (minute) | 24.76 ± 9.23* | 64.3 ± 20,19* | 64.41 ± 34.96* | 75.56 ± 21.62 |

*Data from the study of Apritya and Ardani (2015)

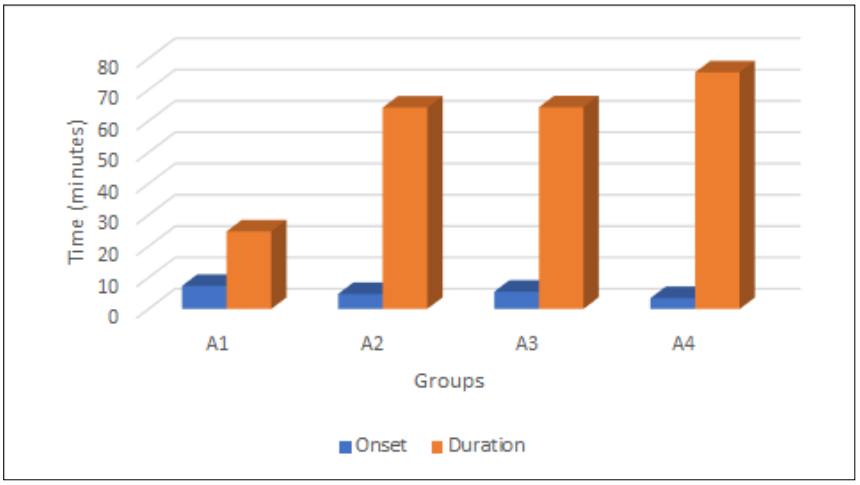


Figure 1. Graph of time of onset and duration of treatment groups (A1, A2, A3 from study of Apritya and Ardani (2015)

term anesthesia. This is because ketamine has a small molecular weight so that it quickly crosses the blood-brain barrier and has an onset of 1-5 minutes intramuscularly.

In contrast to group A1, group A2, using a combination of ketamine-acepromazine preparations had a shorter onset of action than group A1 using ketamine alone. This result was confirmed by the Bonferroni Post Hoc test, which was significantly different compared to group A1 but not significant when compared to other groups. The onset value for group A2 using ketamine as a general anesthetic and acepromazine as a premedication was 4.79 minutes. This can be affected by giving acepromazine 10 minutes before ketamine injection. At the same time, the duration of anesthesia in A2 combined with acepromazine was longer than A1, with an average of 64.30 minutes. Acepromazine is a tranquilizer that has a sedative effect but does not cause *drowsiness* and, at high doses, does not cause hypnosis or general anesthetics. Its use mostly does not have an analgesic effect, so it is used to facilitate the injection of ketamine (Apritya dan Ardiani, 2015).

The A3 treatment group that combined acepromazine with atropine had an onset time of 5.51 minutes, so there was no significant difference when compared to the A2 group. The properties of atropine that can reduce the vagal effect can prevent bradycardia and excessive salivary secretion and reduce gastrointestinal motility (Sardjana dan Kusumawati, 2004). This is evidenced by the time after 10 minutes, the cat was injected with the acepromazine-atropine combination. The cat was calm and did not secrete excessive saliva (Apritya dan Ardiani, 2015).

The duration of anesthesia for A3 using an acepromazine-atropine combination as a premedication was 64.41 minutes, certainly similar to the A2 group. Atropine serves to reduce the potential for muscle spasm, gastrointestinal motility and secretion, salivation, and respiratory secretions of animals and reduce tear production during anesthesia, especially when using anesthetic preparations that cause salivary gland hypersalivation such as ketamine (Nesgash *et al*., 2016). Therefore, the combined use of atropine and acepromazine in group A3 was not significant in terms of the duration of anesthesia.

Group A4, using Ket-A-Xyl® (ketamine-atropine-xylazine), had a significantly different onset value compared to group A3, but not significantly different from group A2. This was confirmed by the Bonferroni Post Hoc test with an average value of onset of group A4, which was 3.49 minutes. An ideal anesthetic is one that has a rapid onset and long duration (Aprilianti *et al*., 2020), then The Ket-A-Xyl® preparation is better in terms of onset, but the duration of anesthesia is not significantly different compared to groups A2 and A3.

Ideally, the administration of anesthetics should consider the side effects first so that it can be determined what premedication is suitable to reduce the effects of general anesthetics, including ketamine (Apritya dan Ardiani, 2015). The use of Ket-A-Xyl® as a general anesthetic, which is a combination of ketamine-atropine-xylazine preparations, can be used as a reference for practicing veterinarians as an effective and practical anesthetic preparation in terms of its onset.

## Conclusion

It can be concluded that Group A1 (ketamine) has a slower onset value because it is used as a single drug and without combination with premedication drugs. While the A2 (ketamine-acepromazine), A3 (ketamine-acepromazine-atropine), and A4 (Ket-A-Xyl®) groups had a short anesthetic onset value with no significant difference.

The duration of anesthesia in group A1 (ketamine) was faster than the other three treatment groups. Group A2 (ketamine-acepromazine) had a long duration of anesthesia, as did group A3 (ketamine-acepromazine-atropine) and group A4 (Ket-A-Xyl The anesthetic preparation Ket-A-Xyl® has the potential to induce anesthesia in domestic cats because it has a shorter onset and medium duration and is more efficient than other anesthetic combinations. The selection of the right anesthetic drug can control the increase in the cat population through castration with minimum side effects so that their welfare will increase and minimize the spread of zoonotic diseases.

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