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To the method of study of preparations that are often used in anesthetic practice for surgical interventions in small animals

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A review of the literature on the study of medicines that is often used in anesthetic practice for surgical interventions in small animals is made. A large arsenal of pharmacological agents and the possibility of their use in various combinations now allow the use of a variety of anesthetic methods. The choice of the method of anesthesia should correspond, above all, to the patient, as well as the nature and duration of the planned operation. As a matter of fact, an anesthetic method should be used to ensure maximum animal safety. It is known that in order to provide effective anesthesia you need: sleep, muscle relaxation (relaxation of muscles), analgesia (anesthesia). To ensure of these three requirements, a number of preparations are used: propofol, ketamine (dissociative anesthetics: zoletil-tiletamine hydrochloride, zelozepam hydrochloride), alpha-2 antagonists – xylazine (xylan, sedacil, sedazin, meditin), opioids (fentanyl, morphine, butorphanol). The characteristic of preparations propofol, ketamine, medetomidine, butorphanol is given. In view of the foregoing, we conclude that a large number of medicinal products are used in operative interventions in estheological practice. However, it is important to emphasize that only a combination of the above preparations among ourselves can provide effective anesthesia, which will increase the analgesic action, reduce the toxicity of these preparations and faster wound healing and recovery.

Key words: anesthesia, propofol, ketamine, medetomidine, butorphanol, sleep, myorelaxation, analgesia.

Introduction

Pain is a protective reaction of the organism that arose in the process of evolutionary development. Sometimes pain is the first clinical sign of a disease, or a warning of the danger that threatens the organism of animals on the environment. In this regard, the pain plays a positive role. But due to excessive intensity and duration of pain, the pain becomes a painful phenomenon. This is due to the fact that prolonged strong irritation of the peripheral receptors that perceive the pain is accompanied by an unceasing flow of pain impulses to the corresponding centers of the brain. As a result, the disorder affects their activities, which affects the work of many body systems that require medical intervention to prevent or reduce pain, especially during surgical interventions.

A large arsenal of pharmacological agents and the possibility of their use in various combinations now allow the use of a variety of anesthetic methods. However, none of them meets the requirements for ideal anesthesia (no pain, side effects, sleep, muscle relaxation, no metabolisa-

tion and cumulation, good control, ease of use, etc.). Taking account this, it is impossible to unambiguously recommend any specific method of anesthesia.

The choice of the method of anesthesia should correspond, above all, to the patient state, as well as the nature and duration of the planned operation. In fact, an anesthetic method should be used to ensure maximum animal safety during surgical intervention.

It is known that in order to provide effective anesthesia you need: sleep, muscle relaxation (relaxation of muscles), analgesia (anesthesia). To ensure these three requirements, a number of preparations are used: propofol, ketamine (dissociative anesthetics: zoletil-tiletamine hydrochloride, zelozepam hydrochloride), alpha-2 antagonists – xylalin (xylan, sedacil, sedazin, meditin), opioids (fentanyl, morphine, butorphanol) (Bley et al., 2007).

From the perspective of literature it is known that propofol is an intravenous anesthetic of short duration, which is used both for induction and for the maintenance of general anesthesia (Kirk and Bonagura, 2005). This preparation provides rapid induction in anesthesia, which,

as a rule, is not accompanied by a pronounced excitation stage. The duration of anesthesia for single infusion to relieve pain is an average of 5–10 minutes. The preparation does not possess analgesic properties, only increases the threshold of pain sensitivity. Propofol does not possess cumulative properties, therefore, the waking even after prolonged infusion of the preparation occurs very quickly. When the propofol enters the body, 98% is bound to plasma proteins. This preparation undergoes biotransformation in the liver, and the metabolites formed under these conditions are mainly secreted by the kidneys (Harkevich, 2004).

According to some reports, it is known that cats have a significantly protracted chance to get out of anesthesia with the development of other negative factors, such as anemia, general depression, diarrhea after using of propofol for several days in a row (Morgan and Legge, 1989; Mendes and Selmi, 2003). In dogs, unlike cats, such changes are not observed and repeated use of propofol for several consecutive days is considered safe for them (Kornjushenkov and Gimel'farb, 2010).

For the first time, who conducted experiments using propofol in dogs and cats, Glen [1980], which has proved that the experimental preparation can be effectively and safely used in general anesthesia in animals of these species (Brearley et al., 1988).

The recommended preparation of propofol in a dose for anesthetic anesthesia in cats without prior premedication is 4–8 mg/kg, and after premedication from a sedative preparation the dose of propofol is reduced to 2–6 mg/kg (Pascoe et al., 2006).

Opioids and alpha-2 agonists significantly reduce the need for propofol, so after the previous injection of xylazine or medetomidine, the dose of propofol for induction anesthesia can decrease by 2–3 times (Andress et al., 1995).

In veterinary practice ketamine (kalipsovet) is also widely used, which penetrates through the hematoencephalic barrier, its action after intravenous infusion in cats and dogs occurs in 30–90 seconds. After intramuscular injection, the preparation is rapidly distributed in tissues, the maximum anesthetic effect is detected after 10–15 minutes. Ketamine causes dissociative suppression of the central nervous system, which is characterized by deep analgesia and amnesia with the preservation of eye, laryngeal, pharyngeal reflexes. In experimental animals, after pain for intravenous infusion, ketamine is rapidly redistributed and the period of half-withdrawal is about 60 minutes in dogs and 80 minutes in cats. Ketamine is subjected to biotransformation, mainly by the liver. In cats, ketamine can be excreted by the kidneys in the unchanged form. Unlike other intravenous anesthetics, ketamine stimulates the work of the heart, increases the heart rate, blood pressure and cardiac output, which is associated with increased work of the myocardium and increased use of oxygen. Sedative preparations weaken the stimulatory effect of ketamine. In some animals, with heart disease or parenteral injection of other anesthetics, ketamine can cause cardiovascular depression (Kozlovskaja et al., 1996; Alony and White, 1996; Hofmeister et al., 2009).

After the occurrence of pain in animals after the injection of the preparation, as a rule, short-term respiratory depression is observed, followed by an “apnetic” respiratory cycle, characterized by a delay in the onset followed by a short period of hyperventilation. Respiratory problems in cats and small breeds of dogs can be caused by increased salivation, which can lead to obstruction of the upper respiratory tract. After the ketamine anesthesia, there are reflexes of swallowing, sneezing, cough reflex, but “quiet” aspiration is possible as well. In addition, the experimental preparation also has an exciting action on the central nervous system, enhances cerebral blood flow and increases intracranial pressure. Ketamine also has epileptic activity, so it can not be used in animals with history of seizures.

In addition, it has the ability to increase intraocular pressure, so it is contraindicated in facial surgery. Eyeball does not move with ketamine anesthesia, which leads to a tendency to dry the cornea. After awakening of ketamine anesthesia, hyperexcitation is possible, especially in cats, under these conditions, animals become very sensitive to noise, light and various manipulations. Since ketamine has the ability to cause increased muscle tone and excitement, after awakening of an animal, it is always necessary to combine it with sedative medications. In addition, it can also be injected intraperitoneally, which is relevant to restless animals. After introducing into the preoperative period in low doses, ketamine reduces nerve stimulation, as well as the need for analgesics in the postoperative period. With constant infusion of ketamine during inhalation anesthesia, the concentration of inhaled anesthetics is significantly reduced (Saltanov, 1997; Kornjushenkov, 2009; Fayyaz et al., 2009).

A good muscle relaxant is medetomidine (meditin, medison), which refers to stimulators of alpha 2 adrenergic receptors, whose mechanism of action is to suppress the transmission of nerve impulses. It causes depression of the central nervous system and increases the threshold of pain. The action of the medetomidine depends on the dose: small doses cause an average sedative action without analgesia, and large doses cause a significant sedation effect with analgesia. After intramuscular injection, the maximum concentration of medetomidine in the blood is reached after 15–30 minutes, and binding with serum protein is 85–90%. Medetomidine is oxidized in the liver, and most metabolites are excreted with the urine. The period of half-withdraw reaches 1–2 hours. This preparation is well tolerated in animals at recommended doses, does not possess embryotoxic, teratogenic and hepatotoxic properties. Medinets are injected to dogs and cats for sedation and analgesia in surgical operations and various clinical searches. It is recommended to use this preparation before injecting or inhalation anesthesia. It can be injected intravenously, intrapulmonally and subcutaneously, for the need to re-injection the preparation in 10–15 minutes after the first injection (Andreeva and Nechaev, 2001).

Meditine is injected to dogs of 0.1% solution in a dose of 0.1–0.8 ml per 10 kilograms of body weight, cat 0.01–0.15 ml/kg of body weight. After overdose with the prep-

aration, there is apnea, bradycardia, a decrease in blood pressure. Under the condition of overdose or in the case when the action of the introduced medicine poses a threat to the life of the animal the preparation of atimedin is used. If you need to remove bradycardia, preserving the sedative effect, it is advisable to use atropine sulfate. After injection of the preparation to cats in most cases there is vomiting, and in dogs is only in about 10%. In some animals, bradycardia is observed, the number of cardiac contractions is reduced by 50%, and body temperature is also reduced. In rare cases, bradycardia with anthriventricular blockade, extrasystole, coronospasm, and a decrease in cardiac output is possible. Medicine can be injected in combination with ketamine or butorphanol (Richard Adams, 2001; Betshart-Vol'fensberger et al., 2010).

Butorphanol tartate belongs to the pharmacological group of opioid analgesics, a derivative of phenanthrene. In addition to the central analgesic action has still sedative, also reduces the excitability of the cough center, inhibits the vomiting reflex, causes narrowing of the eye apple, increases arterial pressure, pressure in the pulmonary artery, secretory and motor activity of the digestive canal, bladder tonus. Butorphanol is rapidly absorbed after intramuscular injection, maximum concentrations in the blood are reached in 20–40 minutes. The experimental preparation undergoes metabolism in the liver and is excreted in the form of oxidative and bound metabolites in the urine in the unchanged state (less than 5% of the intravenous injection) and feces. In small animals, butorphanol is often used as one of the means for complex premedication before anesthesia. It is injected in a dose of 0.1–0.4 mg/kg subcutaneously, intramuscularly, intravenously. This preparation is well used in cats, because it does not cause a phase of excitation. Intravenous infusion of butorphanol in high doses of 0.1–0.2 mg/kg per minute is accompanied by cardiovascular depression in dogs. It is also part of the preparation butemidor, which is a highly effective and good anesthetic for both cats and dogs. Recommended doses of 1% solution of butemidor for dogs i/v, i/m, s/c in 0,3 ml/10 kg of body weight of the animal, for cats i/v – 0,01 ml/kg, s/c – 0,04 ml/kg of body weight of the animal. The analgesic action comes in a few minutes after the intravenous infusion, in 10–15 minutes after the intramuscular injection. The maximum action is set to 30–60 minutes, with dogs and cats lasting about six hours.

Butorphanol can also be injected orally to small animals at a dose of 0.5 to 1.0 mg/kg 2–3 times a day (Richard Adams, 2001).

Conclusion

So, summing up the review of preparation used in anesthetic practice after surgery, we can say that only a combination of the above-described preparations can provide a full and effective anesthetic. These combinations are given in Table 1.

Table 1

A combination of anesthetic preparation used in short surgical operations

Preparations	Doses mg/kg	Indication
Medetomidine	0,02	Short surgical operations
Butorphanol	0,1	
Ketamine	5	
Xylazine	1	
Ketamine	5–10	
Medetomidine	0,04	
Ketamine	5–7	
Propofol	4–8	
Ketamine	10–20	

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