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THE REQUIREMENT OF PROPOFOL SUPPLIMENTATION DURING MAINTENANCE OF ANESTHESIA FOR DOGS UNDERGOING MAGNETIC RESONANCE IMAGING

NECESARUL SUPLIMENTĂRII PROPOFOLULUI ÎN MENȚINEREA ANESTEZIEI CÂINILOR SUPUȘI IMAGISTICII PRIN REZONAȚĂ MAGNETICĂ

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ABSTRACT

This study evaluated the need of various additional doses of propofol during maintenance of anaesthesia of dogs subjected to magnetic resonance imagistic diagnosis (MRI). Our study was conducted at the Faculty of Veterinary Medicine in Bucharest throughout 2018, on a number of 60 dogs. Animals were divided in three different groups. Patients from group B (n=20) were premedicated with 0.2 mg/kg butorphanol intramuscularly (IM), group BK (n=20) received 0.2 mg/kg butorphanol and 2.5 mg/kg ketamine IM while dogs in group BD were given 0.2 mg/kg butorphanol and 0.2 mg/kg diazepam IM. All patients were induced with propofol intravenously (IV) at a dose of 2-4 mg/kg, intubated and maintained with 1.5 % Isoflurane and oxygen. We considered necessary the administration of an additional dose of propofol when the anaesthetic plan was superficial or when respiratory movements became a problem for the MRI scan. The mean additional dose of propofol for group BD was 2.3 mg/kg and 2 mg/kg for group BK respectively, while patients premedicated with butorphanol required a higher mean additional dose of propofol of 3.2 mg/kg. The incidence of dogs from group B requiring at least one additional dose was 100%, compared with 70% for the BD group and 65% for the BK group.

Keywords: anaesthesia, dose, premedication, propofol, magnetic resonance

REZUMAT

Acest studiu a evaluat necesarul diferitelor doze suplimentare de propofol din timpul menținerii anesteziei câinilor supuși diagnosticului imagistic prin rezonanță magnetică (IRM). Studiul s-a realizat la Facultatea de Medicină Veterinară din București pe parcursul anului 2018, pe un număr de 60 de câini. Animalele au fost împărțite în trei grupuri diferite. Pacienții din grupul B (n=20) au fost premedicați cu 0,2mg/kg de butorfanol, intramuscular (IM), grupul BK (n=20) au primit 0,2 mg/kg de butorfanol și 2,5 mg/kg de ketamina IM, în timp ce câinilor din grupul BD le-au fost administrate 0,2 mg/kg de butorfanol și 0,2 mg/kg de diazepam IM. Toți pacienții au fost induși cu propofol intravenos (IV) la o doză de 2-4 mg/kg, intubați endotraheal și menținuți în anestezie cu Isofluran 1,5% și oxigen. Am considerat necesară administrarea unei doze suplimentare de propofol atunci când planul anestezic a fost superficial sau pacienții prezentau mișcări respiratorii care au devenit o problemă pentru scanarea RM. Doza medie de propofol administrată grupului BD a fost de 2,3 mg/kg, respectiv 2 mg/kg pentru grupul BK, în timp ce pacienții premedicați cu butorfanol au necesitat o doză medie mai mare de propofol și anume 3,2 mg/kg. Incidența câinilor din grupul B care au necesitat cel puțin o doză suplimentară a fost de 100%, comparativ cu 70% pentru grupul BD și 65% pentru grupul BK.

Cuvinte cheie: anestezie, doză, premedicație, propofol, rezonanță magnetică

Anaesthesia for veterinary imaging plays an important role in diagnosing of patients with different pathologies, especially neurologic ones. Compared with other diagnosis imaging methods, magnetic resonance requires in all cases the use of general anaesthesia. The purpose of anaesthesia is to obtain the patients immobilization in order to achieve high quality images with a minimum motion, to reduce stress and ensure a correct interpretation (10).

The risk associated with any general anaesthesia must be reduced and the side effects incurring as a result of anaesthetic drugs use should not put the animal`s life in danger.

The study of different anaesthetic protocols contributes to a better approach and understanding of the effects of different substances, thus considerably reducing the variant of a negative prognosis.

Anaesthetic substances are most often used in combinations, which allows a reduction in individual doses, reducing unwanted side effects, while ensuring

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good sedation and analgesia (5).

Propofol is the induction substance commonly used in general inhalation anaesthesia of a large number of animal species. Depending on the dose, route of administration and substances chosen for the patient's premedication, the required dose of propofol may differ. Propofol is a phenol solubilized in glycerol in the form of an emulsion with egg phosphatides, with a pH of 7. The effect is installed quickly and the action time is short, having a fast metabolism. The administration is done strictly intravenously, and in addition to the hypnotic effects, it is also known as an anticonvulsant. Slow administration is recommended to reduce the risk of apnoea. It has a negative inotropic effect on the cardiovascular system (1).

The purpose of this study is to determine the doses of propofol administered in addition to maintaining anaesthesia, depending on the premedication received.

MATERIALS AND METHODS

The study was conducted during 2018 at the clinic of the Faculty of Veterinary Medicine in Bucharest. A total of 60 dogs of different breeds and ages were subjected to general anaesthesia for magnetic resonance diagnosis. There were no major or significant differences between the body mass of the patients in the three groups (Table 1).

Table 1

Mean body weight (kg)

Group	Mean body weight (kg)
B	13.6 kg
BD	14.4 kg
BK	14.2 kg
Mean bogy weight for each group of patients. It can be seen that there are no significant differences between the values	

Following the pre-anaesthetic examination, patients were included in risk categories ASA 2-3.

The 60 patients were divided into 3 different groups (n=20), depending on the substances administered in premedication. Animals in group B were premedicated with 0.2 mg / kg of butorphanol, intramuscularly (IM). Patients in the BK group received 0.2 mg /kg of butorphanol and 2.5 mg / kg of IM ketamine, while animals in the BD group received 0.2 mg / kg of butorphanol and 0.2 mg /kg of diazepam IM. All patients received fluid therapy with Ringer Lactate throughout the anaesthesia and until complete awakening, at a maintenance rate of 5 ml / kg / hour.

Once the premedication substances effects were installed, at an interval of 10-15 minutes, all patients were given propofol at a dose of 2-4 mg / kg IV (Fig.1), in order to induce anaesthesia. Endotracheal intubation was followed by maintaining anaesthesia with Isofluran at 1.5% and oxygen. During the scan, some patients required additional doses of propofol to keep them in a still position in order to obtain qualitative images. We considered it necessary to administer an additional dose of propofol when we were dealing with a superficial anaesthesia or when the movements given by the respiratory act became a problem for the quality of the sequences. Patients becoming apnoeic were mechanically ventilated with an intermittent positive pressure in order to maintain an EtCO2 value between 35-40 mmHg.

Fig. 1. IV Propofol administration using a three-way stopcock

RESULTS AND DISCUSSIONS

Studies recommend the use of combinations of substances that have a different mechanism of action, affecting different receptors, due to increasing their effects and at the same time reducing doses (8,11).

The substances used in the premedication of our patients belong to 3 different groups of substances. Butorphanol is a mixed synthetic opioid, agonist on kappa receptors and antagonist on μ receptors. Its action lasts about an hour. It has a moderate analgesic effect and a sedative effect, thus being a good candidate for the anaesthesia of patients undergoing MRI. At clinical doses, the effects on the respiratory and cardiovascular systems are minimal. However, respiratory depression can occur during anaesthesia, when butorphanol is combined with other substances (7).

Diazepam is a benzodiazepine used for its sedative, anxiolytic and muscle relaxation effects. It is also used as an anticonvulsant in patients with seizures, being a good choice in the protocol of neurological patients encountered mainly for MRI scanning. It is successfully used in the anaesthetic protocols of patients belonging to ASA 3-5 risk groups (4). However, a third of our patients underwent its administration, even though they were not part of a higher risk group. It has been shown that in patients belonging to a group with a lower anaesthetic risk ASA 1-2, it can cause paro-

xysmal reactions. However, this type of reaction was not found in our patients. Its combination in premedication with other anaesthetic substances, such as opioids or α2-adrenergic receptor agonists, ensures sufficient sedation for the period before the induction of anaesthesia. The use of diazepam together with propofol reduced the dose of propofol as well as the hemodynamic changes associated with propofol administration (9).

Ketamine is a dissociative agent that affects the NMDA receptors, having hypnotic, analgesic and sedative effects. Compared to the other two substances used in our protocols, ketamine, has a positive inotropic effect on the cardiovascular system, increasing the heart rate and blood pressure. At the same time, both ketamine and propofol are substances known to cause respiratory depression, which explains the increased incidence of apnoea in patients pre-medicated with ketamine compared to those in other groups (BD, B).

The patients who proved to have the most superficial anaesthesia were those premedicated with butorphanol. The incidence of group B dogs that required at least one additional dose of propofol was 100% compared to patients in group BD with an incidence of 70% and 65%, respectively, for group BK animals (Table 2, Fig.2).

It was considered superficial anaesthesia when a significant and often sudden increase in respiratory rate and blood pressure was encountered. Moreover, all these patients had a palpebral reflex. Other vital parameters, such as heart rate or body temperature, could not be recorded during anaesthesia due to lack of equipment dedicated to MRI.

The data suggested that patients in all three groups needed additional doses of propofol during anaesthesia. The use of propofol as a CRI has not been considered in this study due to the fact that the use of an infusion pump or infusion syringe is more difficult because of a large space between where any device can be safely placed and the patient. In addition, the difference between other studies (2), in which only propofol in CRI or only isoflurane is used to maintain anaesthesia, and our case, is that the patients were maintained with isoflurane and a bolus of propofol was administered only in the case of superficial anaesthesia. In a study on dogs, Njoku N.U. (2015) showed that the use of repeated boluses of propofol (2 mg / kg) to maintain anaesthesia was correlated with respiratory depression, when compared to patients maintained with a CRI of propofol. A study of women undergoing gynaecological interventions (6) shows that the total maintenance dose of propofol is lower in bolus use compared to the dose for CRI.

There is a correlation between the incidence of patients who required at least one dose of propofol and the amount of an additional dose of propofol given.

Therefore, for group B an average dose of propofol of 3.2 mg / kg was recorded while for group BD an average dose of 2.3 mg / kg. The lowest doses were given to patients in the BK group, namely 2 mg /kg. Additional doses of propofol were administered slowly to avoid the onset of respiratory depression (Table 2).

Table 2

The incidence and mean additional dose of propofol

Group	Incidence	Mean additional dose of propofol (mg/kg)
B	100%	3.2
BD	70%	2.3
BK	65%	2
The incidence shows us that all patients (100%) in group B required at least one additional dose of propofol compared with patients in group BK (65%) and BD (75%)		

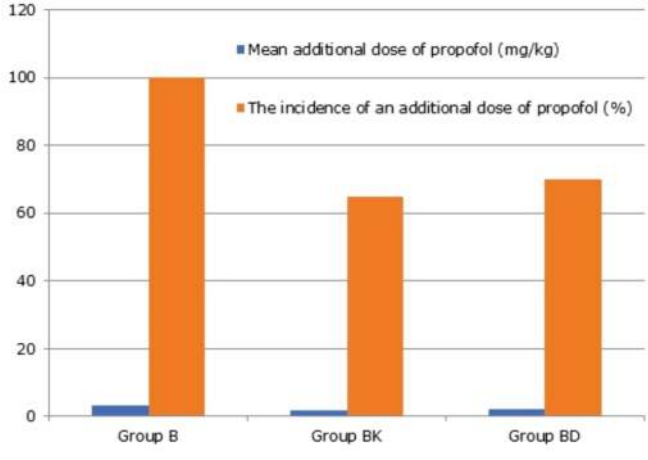

Fig. 2. Mean values for additional doses of propofol and the incidence of propofol administration for each group

The onset of apnoea following the administration of propofol has been seen mainly in patients premedicated with butorphanol and ketamine. 12 of the 20 (60%) patients in the BK group had transient apnoea. In the other two groups, the number of patients who required mechanical ventilation was lower, namely 6 out of 20 patients in group BD (30%) and 4 out of 20 (20%) in group B.

No other complications were encountered during the entire duration of the anaesthesia. No other problems were reported during recovery phase, all patients having been infused and monitored until full waking, to reduce the risks associated with this stage.

CONCLUSIONS

It has been shown that the choice of an anaesthetic protocol composed of several substances, determines a deeper anaesthesia. However, deeper anaes-

thesia, as found in patients in the BK and BD groups, was not correlated with the occurrence of complications or side effects.

Dogs in group B showed superficial anaesthesia, characterized by the presence of palpebral reflex, increased respiratory rate and blood pressure, which is why the additional doses of propofol were higher (3.2mg /kg), with an incidence of patients who needed an additional dose of 100% propofol.

Following this study, it was proven that all three chosen protocols are suitable for patients undergoing magnetic resonance imaging.

The use of ketamine in combination with butorphanol and propofol has produced respiratory depression compared to the use of butorphanol alone or in combination with diazepam, which is why extra caution is recommended when using this protocol.

Further studies are needed to better assess all vital functions, given the effects of anaesthesia on the whole body. The advantage of magnetic resonance imaging anaesthesia is that in certain situations patients are not subjected to the painful act, so the doses of analgesics and especially opioids can be reduced or even excluded from the anaesthetic protocol.

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