ANAESTHETIC MANAGEMENT OF CANINE PATIENTS WITH MITRAL VALVE REGURGITATION UNDERGOING SOFT TISSUE SURGERY

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Abstract

The purpose of this study was to establish the anaesthetic management of canine patients with mitral valve regurgitation that underwent soft tissue surgery and, also to understand the physiopathology of this cardiac disease and how anaesthesia might influence the outcome of this patients.
The study was conducted on 30 canine patients aged between 9-14 years old belonging to different breeds represented by mixed breed, Basset Hound, French Bulldog, Bichon and Pekinese.

Key words: anesthesia, geriatric dog, mitral valve disease

Mitral valve regurgitation it is represented by a degeneration of the atrioventricular valve of the left side of the heart. It is defined by regurgitant blood flow travelling from the left ventricle back into the left atrium during ventricular contraction (*Mattin et al, 2015*). Being a degenerative disease, it is more prevalent in older dogs, with studies reporting that approximately 30% of dogs over 10 years of age are affected *(Fox PR, 2012).*

Anesthetizing a patient with cardiac disease relies on the proper selection and interpretation of the tests performed during preanesthetic evaluation represented by: medical history, physical examination with special attention to cardiac auscultation followed by electrocardiography (EKG), radiography and non-invasive blood pressure measurement *(Hopkins A., 2014).*

In cardiac patients with mitral valve disease, any substance that causes a significant decrease in heart rate should be avoided, which causes an increase in regurgitation *(Fox PR, 2012).*

Opioids such as methadone and butorphanol in combination with acepromazine cause adequate sedation and analgesia. Whenever possible, induction of anesthesia should be performed under close monitoring and pre-oxygenation. In severe cases, it is recommended to use etomidate with minimal effects on the cardiovascular system *(Gaya S. et al., 2018).*

For stable patients, low doses of ketamine are a good alternative with benzodiazepines or low doses of propofol. Negative inotropic substances, such as propofol and thiopental may increase the regurgitation fraction in patients with severe pathology and should be used with caution *(Miller C., 2019).*

In order to maintain anesthesia, inhalator anesthetics can be used at the lowest possible concentrations. Another possibility would be to use total or partial intravenous anesthesia using propofol, fentanyl or ketamine at subanesthetic doses. In case of hypotension or bradycardia, the use of anticholinergics should be considered *(Robinson R., et al., 2018).*

For this purpose, the heart rate should be within the preanesthetic or slightly low values. If hypotension is not accompanied by bradycardia and does not return to normal values after the decrease in anesthetic concentration, inotropic positive substances should be used such as dobutamine *(Gaya S. et al., 2018).*

MATERIAL AND METHODS

The present study was performed on a number of 30 canine patients, aged between 9-14 years old, belonging to different breeds represented by mixed breed (5 dogs), Basset Hound (2 dogs), French Bulldog (5 dogs), Bichon (10 dogs) and Pekinese (8 dogs).

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Patients were anesthetized for various soft tissue surgical procedures represented by: mammectomy, ovariohysterectomy, orchidectomy. Physical examination, complete blood exams, Electrocardiography and radiography were also taken into consideration (Figure 1).

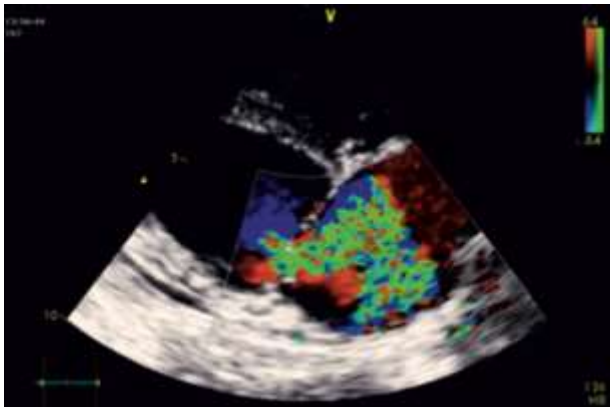

Figure 1: Colour Doppler examination in a dog with degenerative mitral valve disease - A right parasternal long axis view. The image shows the left atrium and ventricle - which are dilated

We included in the study patients who had a cardiac pathology represented by mitral valve disease in different stages of evolution and had an ASA (American Society of Anesthesiologists) score of III (Figure 2).

Figure 2: Bichon, 14 years old with mitral valve disease stage B2

Preanesthetic examination for all the patients was carried out in a quiet environment, to manipulate and stress out the patient as little as possible. In all cases, intramuscular administration of sedative substances was administered before approaching venous access in order to reduce patient stress along with preoxygenation.

Premedication was made with butorphanol 0.3 mg/kg and midazolam 0.2 mg/kg administered intramuscularly (IM). Anaesthesia was induced with Propofol (2 - 4 mg/kg IV). All patients were intubated and maintained with isoflurane. Crystalloid solutions were administered at 3-5 ml/kg/hour IV throughout anesthesia (*Costea, 2017).*

In all cases, patients were breathing spontaneous during anaesthesia which represents a low stress for the cardiovascular system compared to mechanical ventilation. (*(Gaya S. et al., 2018).*

Mechanical ventilation can lead to an increase in intrathoracic pressure followed by a compression of venous vessels and a decrease in venous return. Therefore, low pressure ventilation (approx. 12 cm H_2O) is recommended if we need to ventilate the patient.

Oxygen flow was initially delivered at 2 L/min with the vaporizer set to achieve a minimum alveolar concentration C% of 2.0% isoflurane within 10 minutes of induction (*Tudor R.G. et al., 2018*).

After the target concentration was achieved, oxygen flow was decreased to (500+10/kg) ml/min, and isoflurane was constantly maintained at 1.5 vol. % in all cases.

Electrocardiography, heart rate, end tidal concentration ($EtCO_2$), blood haemoglobin saturation (SpO_2) and esophageal temperature were monitored. Temperature was maintained between 38ºC-38.6ºC by using a warm electrical blanket (Figure 3).

Figure 3: Monitoring during anaesthesia

At the beginning of the surgery, during skin incision if the patient responded to surgical stimulation by a rapid increase of the heart rate, mean arterial pressure or had any signs of tachypnea additional analgesic and anaesthetic drugs boluses were given: Ketamine 1 mg/kg IV.

RESULTS AND DISCUSSIONS

In our study, from the total number of 30 canine patients (Figure 4), 13 had a mitral valve disease in stage B1 (43.3%) and 17 patients had a B2 stage of mitral valve disease (56.6%) (Figure 5,6).

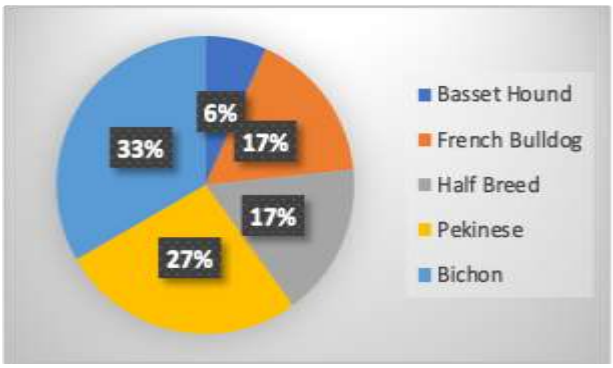

Figure 4: Patients included in the study

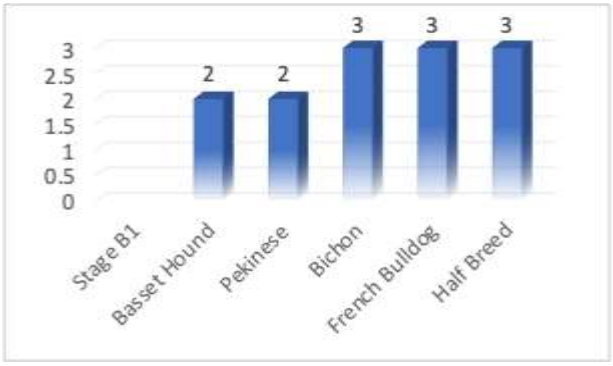

Figure 5: Patients with mitral valve disease in stage B1

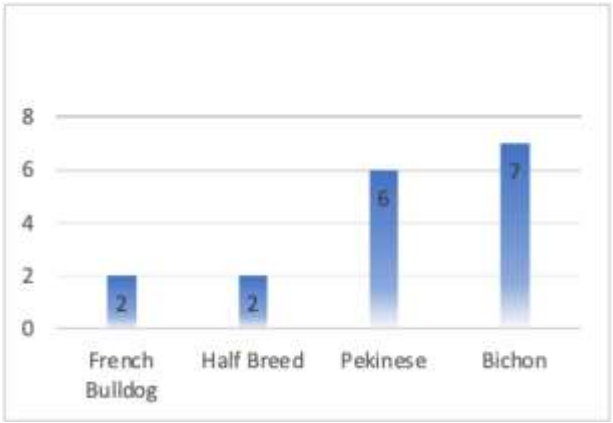

Figure 6: Patients with mitral valve disease in stage B2

Stage B1 refers to patients that have heart disease, which is characterized by a typical mitral regurgitation murmur, but they do not have an enlarged heart or clinical signs of the disease.

Stage B2 is referring to patients where evidence of cardiac enlargement is present, but we still do not have any clinical signs of the disease *(Ljungvall et al, 2014).*

In the induction phase, 5 minutes before propofol administration, all dogs were preoxygenated to reduce myocardial hypoxia and prevent apnea.

From the total of 30 patients included in the study, 2 dogs (6.7%) developed apnea in the induction phase at a propofol dose of 3 mg/kg and needed to be manually ventilated till they began to spontaneously breathe (approx. 5 minutes).

The purpose of the entire anaesthesia protocol was to maintain the cardiovascular system stable. Because of the cardiovascular depression achieved by most anaesthetic substances, changes in the cardiac function and pulse compared with an unanesthetized patient are inevitable but should be minimal as a result.

During surgery, 3 female dogs (10%) who had ovariohysterectomy required a bolus of ketamine of 1 mg/kg IV for analgesia supplement while reaching the ovary ligament due to a rapid increase in heart rate and blood pressure.

The postoperative recovery period is critical for all animals with approximately 47% of anaesthetic-related deaths occurring during this period (*Brodbelt et al, 2008*).

During recovery phase, all dogs received buprenorphine at a dose of 20 mcg/kg IV. They were closely monitored and received supplemental oxygen as well as continuously monitoring the heart rate, blood pressure and temperature (Figure 7) and recovered without any complications.

Figure 7: Oxygenation of the patient in the recovery period

CONCLUSION

Before carrying out anesthesia in a cardiac patient it is very important to diagnose the type of the condition and to start the medication in unstable cases.

The entire perianaesthetic period should be least stressful for the patient. Obtaining venous access, intubating the patient, and providing oxygen are indispensable measures for any cardiac patient to be anesthetized.

For most patients studied, premedication with an opioid and a benzodiazepine and induction of anesthesia with propofol at low doses is the right choice.

Anesthesia monitoring should include clinical monitoring, electrocardiography, blood pressure, capnography, and pulse oximetry.

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