Partial Intravenous Anesthesia and epidural block for correction of Portosystemic Shunt in canine: Case report

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ABSTRACT
The Portosystemic Shunt is a vascular alteration that causes the diversion of blood flow from the liver to the systemic circulation, preventing the hepatic filtration of substances. The treatment of this deviation is surgical, therefore, in the anesthetic procedure, it is important to choose the drugs, avoiding those that go through the liver biotransformation process. The purpose of this report is to describe the use of partial intravenous anesthesia (PIVA) and epidural block in a case of repair of Portosystemic Shunt in a canine. Yorkshire, 1 year old, not spayed, weighing 2 kg, with congenital and extra-hepatic deviation. After MPA and with the animal induced, an epidural block was performed using lidocaine without vasoconstrictor and morphine. For maintenance, PIVA was performed with continuous infusion of remifentanil and lidocaine, offering good intraoperative analgesia, associated with local anesthesia, and reducing the need for the use of inhalational agents. During surgery, the patient had hypotension as the only complication, being related to the use of drugs that potentiated hypotension, such as acepromazine and morphine, but the patient was responsive to the load test with ringer lactate associated with ephedrine, to stabilize the condition and had a fast return anesthetic without painful stimulus, demonstrating that the association of the PIVA technique and the block was effective in the analgesia of the patient in question.

Keywords: Analgesia, PIVA, Biotransformation, Liver, Infusion, Sevoflurane.

1 INTRODUCTION

Portosystemic Shunt (SPS) or Portosystemic Shunt (DPS) is an atypical connection between portal and systemic circulation. This alteration produces deviation of the blood flow of the liver in different degrees (TALARICO, 2017) and toxic substances such as ammonia and others are sent directly to the systemic circulation without passing through the liver (SANTOS *et al.*, 2014).

SPS can be acquired or congenital and anatomically can be distinguished as intrahepatic, located inside the liver, or extrahepatic, located outside the parenchyma liver (REGINATTO *et al.*, 2011).

When the Portosystemic Shunt or Portosystemic Deviation is congenital, the treatment is surgical. Ideally, the referral should be early, so veterinarians who specialize in the field should make a quick and efficient decision regarding the choice of surgery (ADIN *et al.*, 2006). As cited by Havig & Tobias (2000), there is a low mortality in dogs and cats submitted to surgical correction of SPS. However, postoperative results are variable in both species.

The veterinarian and his team have the responsibility to recognize, evaluate, prevent and treat pain, acting to, in addition to protecting their patients, meet their demands (HELLYER *et al*., 2007). The responses to visceral pain stimulus are activated in the autonomous system producing changes in heart rate and blood pressure (MEINTJES, 2012), therefore, because it is a complex surgery, it is extremely important the presence of an experienced anesthesiologist to evaluate the physiological parameters and conduct as best as possible.

In this context, it is essential to use drugs that do not present hepatotoxicity. Avoiding drugs that go through the process of liver biotransformation, being the first choice the use of inhalational anesthetics as the most recommended in these patients. Moreover, when compared to injectable anesthetics, the recovery time of patients is significantly reduced when inhalational anesthesia is used (BELLARD *et al.*, 2016).

The present report aims to describe the anesthetic management with partial intravenous anesthesia (PIVA) and epidural block in correction of Portosystemic Deviation of a one-year-old canine.

2 CASE REPORT

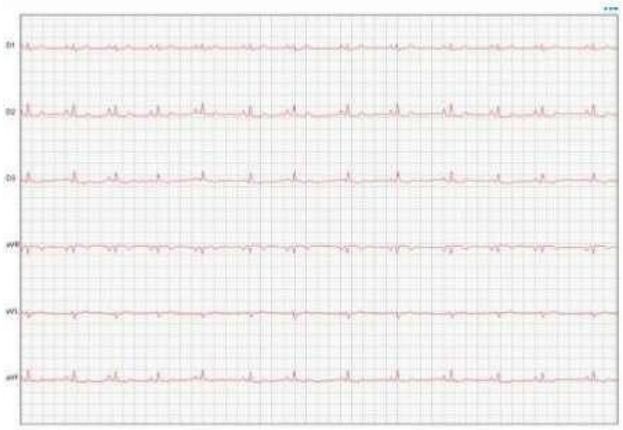
A female female Yorkshire canine was attended, 1 year old, uncastrated and weighing 2kg with a diagnosis of Portosystemic Deviation. In the consultation the animal presented sialorrhea, walking in circles and incoordination.

Ultrasound examination showed a liver with decreased volume, regular contours, normoechogenic parenchyma, homogeneous, hepatic veins and portals not very evident, portal vein with a diameter of 0.26 cm in the portal hilum, presenting hepatopetal flow with a velocity of 9.19 cm/s (normal: 10 – 25 cm/s). AO: 0.46 cm; VDC: 0.52 cm; PV: 0.26 cm. VP/AP: 0.60. Value indicating the possibility of presence of extrahepatic deviation. In addition, dilated and tortuous vessel, coming from the portal vein, with craniodorsal path, towards the diaphragm, between the abdominal aorta artery and caudal vena cava, an image compatible with porto-azygos deviation, measuring approximately 0.45 cm in diameter in the region near the portal vein, 0.34 cm in most of the path and 0.51 cm in the diaphragmatic region.

In the blood count the parameters were within the normal range for the species, however in the biochemicals albumin, creatinine and urea were below the reference values and the (alamine

aminotransferase) ALT above the reference values. The coagulation times, protombin time (PT) and activated partial thromboplastin time (APPT) within the reference values. C-reactive protein CRP above the reference values. The preoperative electrocardiogram (figure 1) showed physiological sinus arrhythmia with a mean heart rate (HR) of 158 beats per minute (bpm).

Figure 1 – Pre-surgical Yorkshire electrocardiogram, 1 year, which underwent SPS correction under PIVA anesthesia and epidural block



3D computed ultrasonography was performed to confirm the diagnosis of Portosystemic Shunt. Regarding the pre-surgical-anesthetic exams, the patient was submitted to food fasting of 8 hours and water fasting of 4 hours aiming at the surgical-anesthetic procedure. In the pre-anesthetic evaluation, the patient presented alert behavior, with HR of 100 bpm, respiratory rate (RR) 10 movements per minute (rpm), and systolic blood pressure (SBP) 100mmHg, synchronous and strong pulse, normostained mucous membranes (NC), normohydrate (NH), capillary filling time (CPT) less than two seconds, rectal temperature (RT) 38.2 and glycemia 65mg/dL. According to the American Society of Anesthesiologists (ASA), the animal was classified as ASA III.

In MPA, the association of acepromazine (0.02mg/kg) and methadone (0.2mg/kg), both MI, was used, and after about 15 minutes trichotomy and venoclysis were performed. Pre-oxygenation was performed via mask for five minutes, followed by anesthetic induction consisting of the administration of propofol (slow *bolus* 4mg/kg, IV). Continuously, the animal was intubated with endotracheal probe number 3.0 and coupled to the anesthetic circuit without double reinhalation T of Baraka on spontaneous ventilation.

Anesthetic maintenance was performed with PIVA, using sevoflurane in a calibrated vaporizer, associated with continuous infusion of remifentanil (1mcg/kg/h) and lidocaine (2mg/kg/h). In addition, he received intraoperative fluid therapy with lactated Ringer's solution (RL) at the rate of 2ml/kg/h. Cephalothin was administered as a prophylactic antibiotic (20mg/kg) IV. Anesthetic monitoring was constant and performed with the aid of Doppler to measure noninvasive blood pressure, multiparametric monitor to visualize temperature, electrocardiogram, pulse oximeter

and capnograph, in addition to the constant verification of ocular reflexes and rotation of the eyeball, suggested by Guedel's plans. The patient presented a moment of hypotension in the intraoperative period, where a load test of 10ml/kg/h was used for 20 minutes and ephedrine 0.1mg/kg, IV.

Prior to the beginning of the surgical procedure, antisepsis and epidural block located between the seventh lumbar vertebra (L7) and the first sacral vertebra (S1) were performed, which was accessed with a Tuohy needle confirming the location by the pending drop test or by the loss of resistance to air application. Subsequently, morphine (0.1mg/kg) and lidocaine without vasoconstriction (3mg/kg) were administered.

The surgical procedure lasted a total of 180 minutes (3 hours) and anesthesia lasted 190 minutes (3 hours and 10 minutes). At the end of the procedure, the patient presented parameters of SBP 120mmHg, HR 100bpm, RR 20mpm, RT: 35.1 and glycemia 75mg/dL. Therefore, she presented hypothermia, even though she had been previously heated with a thermal mattress. Was used hot water bags to warm the patient and after 15 minutes was extubated. In the immediate post-anesthetic period, he received dexamethasone (0.25mg/kg), dipyrone (25mg/kg), maropitant (1mg/kg), ondansetron (0.5mg/kg) and metoclopramide (0.3mg/kg), all IV.

After the procedure, she remained hospitalized for two days receiving ondansetron (0.5mg/kg) IV, TID, metoclopramide (0.3mg/kg) IV, TID, benzoylmetronidazole (10mg/kg) IV, TID, maropitant (1mg/kg) IV, SID, dipyrone 25mg/kg IV, TID, methadone the day after the procedure (0.15mg/kg) SC, TID, dexamethasone (0.25mg/kg) IV, SID, domperidone (0.1mg/kg) VO, BID, lactulose syrup (0.5ml/kg) VO, IDB.

At hospital discharge, she was referred with benzoylmetronidazole (10mg/kg) VO, TID, for 7 days. Tramadol hydrochloride (4mg/kg) VO, QID, for 5 days. Dipyrone (25mg/kg) TID, for 2 days. Lactulose syrup (0.5ml/kg) BID, VO, continuous use. Continued use of feeding with hepatic ration, Elizabethan collar or use of surgical clothing until removal of the stitches, cleaning of the stitches with saline solution once a day until removal of the stitches, removal of the stitches in 15 days. After 15 days, the animal was stable, with no changes related to pain and discomfort.

3 DISCUSSION

The Portosystemic Shunt in the canine species is usually diagnosed in small dogs (TOBIAS, 2003) and is considered surgical, so it is important to determine the preoperative procedures. It can be extrahepatic or intrahepatic, congenital or acquired based on anamnesis, clinical signs, physical examination and complementary tests. The canine in the present report had a great similarity with that described in the literature, mainly because it is a Yorkshire (MEHL *et al.*, 2005).

In the patient in the present report, the deviation was congenital and extrahepatic (azygos), since liver function was impaired due to abnormal blood flow. In addition, the absorption, metabolism and exclusion rate of undesirable substances were also reduced (FUTEMA, 2010).

There are several parameters that should be evaluated, together, with the surgeon and anesthesiologist for the correction of SPS. The approach used in the preoperative evaluation is of great relevance for the identification of anesthetic risks and visualization of patient management characteristics (BRODBELT; FLAHERTY; PETTIFER, 2017)

Patients with DPS have laboratory test results, such as complete blood count and biochemical profile not specific for the disease (RULAND *et al.*, 2007). Meanwhile in the case described, the blood count was within the normal range for the species, but regarding the biochemicals, hypoalbuminemia, creatinine and urea were below the reference values and the ALT above the reference values. Patients with Portosystemic Shunt may present with changes in coagulation time and altered response to substances metabolized and excreted by the liver (KUMMELING *et al.*, 2006) but in the patient the coagulation times TP and TPPA were within the reference values. C-reactive protein was above the reference values, with what (GOW *et al.*, 2012) reports on the elevation of protein C in patients with SPS.

The patient was submitted to electrocardiogram to evaluate arrhythmias, enlargement of cardiac cavity, coronary pathologies and anesthetic risk, the referred presented physiological respiratory sinus arrhythmia, being considered a normal rhythm. The exam showed QRS complexes of low amplitude negative T wave, asymmetric and less than 25% of the R wave may be associated with increased parasympathetic activity in the sinoatrial node, however, it is an indicator of reduced sympathetic tone (NOGUEIRA et al., 2010). Liver disease commonly has cardiovascular disease. It is related to hyperdynamic disease, with cardiac index twice normal and low peripheral vascular resistance (WIKLUND, 2004).

This patient was classified as ASA III, was taken into account physical status, age and because it is a liver disease, that is, a systemic disease. Patients classified as ASA III are generally more likely to have lower blood pressure under anesthesia than those with less severe diseases because it is a systemic disease (REDONDO et al., 2007).

One of the drugs used in MPA was acepromazine IM, an agent of the phenothiazine class, at a dose of 0.02mg/kg, as cited by Saponaro *et al.* (2013), sedation scores in dogs receiving this dose of intravenous acepromazine are elevated up to 80 min compared to baseline values. The drugs of this class produce effect through antagonism of dopaminergic receptors, that is, depression of the central nervous system (BALDESSARINI &TARAZI, 2001).

Methadone, a potent opioid (dose 0.02mg/kg) was associated with acepromazine in order to produce neuroleptanalgesia. In addition, its action acts as an antagonist of NMDA-type receptors, being useful in cases of hyperalgesia and tolerance to opioids (WAGNER, 2009).

Before induction, the patient was pre-oxygenated for five minutes. Induction was with slow *bolus* of propofol (4mg/kg), IV. This drug exerts activity on GABA receptors and the synergistic effects observed may result in significant depression of the nervous system central (WIEDERSTEIN; AUER; MOENS, 2006). The main adverse effect of this general anesthetic is respiratory depression and apnea if administered quickly, however these clinical signs were not observed in the patient (WHITTEM et al., 2015). For this reason, she was immediately intubated for administration of the anesthetic.

For anesthetic maintenance, sevoflurane was used in a calibrated vaporizer associated with continuous infusion of remifentanil and lidocaine, being classified as a PIVA. Partial intravenous anesthesia has as its main advantage over inhalation alone, the decrease in the need for inhalational agents (ILKIW & PASCOE, 2003). In what Patel & Goa (1996) says, the use of Sevoflurane was described, which has some characteristics of pharmacokinetics, such as the speed of uptake by the blood from the lungs, distribution by the body and final elimination by the lungs, distributing by the body and final elimination by the lungs and other pathways therefore, allows rapid and precise adjustment to the desired effects and rapid recovery of physiological parameters, as observed in the patient.

The remifentanil used in continuous infusion at a dose of 1mcg/kg/h is a synthetic opioid, has high analgesic potency, with ultra-short action and duration and, therefore, should be administered in continuous infusion in the intraoperative period to promote good analgesia (SOUZA *et al.*, 2018), as observed in the present report.

Lidocaine was associated with remifentanil by continuous infusion and according to Robertson *et al.* (2005), the administration of lidocaine intravenously *(bolus* of 2 mg/kg, followed by 0.05 mg/kg/min) is intended to perform antinociception. The mechanism by which systemic administration of lidocaine produces analgesia is uncertain, but is believed to include an action on the Na+, Ca2+, and K+ channels and the NMDA receptor.

Regarding the epidural block, it was performed with the association of lidocaine (3mg/kg) and morphine (0.1mg/kg) in order to potentiate analgesia on pain physiology. The use of opioid analgesic agents serves as an important alternative in the control of nociception in animals and, mainly, by the epidural route, for the control of postoperative pain (POPILSKIS *et al.*, 2000). Morphine administered by this route stands out for its long-lasting systemic analgesic action and minimal side effects (PASCOE & DYSON, 1993). Lidocaine is the most versatile local anesthetic used in Veterinary Medicine, due to the short latency, moderate duration of effect and safe toxic

dose in dogs (DUKE *et al., 1994), it has analgesic and antihyperalgesic properties (SHAH et al., 2018).*

During the procedure, the referred patient presented hypotension, which may have been caused by the use of acepromazine, sevoflurane, propofol and even PIVA. PAS is responsible by tissue perfusion, with evidence for cerebral and coronary perfusion, and is calculated by the product between peripheral vascular resistance and cardiac output (HUBBELL & BEDNARSKI; MUIR, 1989).

A load test was performed in order to stabilize the patient's BP, which consists of increasing the intravenous fluids provided in a short period of time. Rabelo & Arnold (2007) cite that aggressive administration is necessary to obtain an adequate increase in volume to reestablish tissue perfusion and, consequently, increase blood pressure and stabilize tissue perfusion.

Hoffman + Lefkowitz (1996) determine the use of ephedrine as an agent of agonist actions directly and indirectly on alpha and beta receptors: the release of presynaptic noradrenaline from peripheral nerve endings to extracellular fluid increases cardiac output and blood pressure, but with variable effects on systemic vascular resistance.

The recovery of the canine was quiet and without serious intercurrences, only hypothermia, which is something expected in anesthesia, as well as indicated was controlled with the use of thermal mat and hot water bags after the procedure (GORCZAK *et al.*, 2021). And evidencing what was found by Duval *et al.* (2018), who state that the patient's recovery with the use of PIVA can be smoother. It should be noted that inhalational anesthetics are almost totally excreted immutably by the lung, with negligible accumulation in the body, allowing to complement anesthesia with other drugs that promote a quality analgesia, more complete and safer, in terms of metabolism (DORSCH & DORSCH, 2008).

The rate of postoperative intercurrence is commonly caused by hypoglycemia, while surgical mortality is low in most cases of extrahepatic deviations. The clinical improvement, in general, occurs on the first postoperative day (TOBIAS, 2007). In what Neto (2013) cites, from two to four months after surgery, the animal's liver regenerates, and may have a significant increase.

4 CONCLUSION

It is understood that anesthetic care in patients with SPS is related to preoperative management, monitoring care and the pharmacological protocol, i.e., MPA, induction and maintenance. The anesthetic procedure was effective, with an alteration occurring with the use of medications that potentiated hypotension, but having been responsive to the maneuvers performed to reestablish the hypotension. The patient had a return fast and without painful stimulus, having

been effective the epidural block associated with the PIVA technique to control pain in the animal, therefore the success of the procedure.

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