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PERIANESTHETIC MANAGEMENT OF DOGS WITH INTRACRANIAL PATHOLOGY UNDERGOING MAGNETIC RESONANCE IMAGING

Aisha HAMEED[1], Alexandru Gabriel NEAGU[1], Ruxandra PAVEL[1], Ruxandra COSTEA[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Mărăști Blvd, District 1, Bucharest, Romania

Corresponding author email: aisha.hameed@fmvb.usamv.ro

Abstract

Magnetic resonance imaging (MRI) is an essential diagnostic modality in veterinary neurology and requires close collaboration among neurologists, anesthesiologists, and radiologists. This study aimed to evaluate the perianesthetic management of 20 dogs with intracranial disorders undergoing MRI, with particular emphasis on protocols and the incidence of anesthesia-related complications. The dogs were assigned to three age-based groups. All patients were referred for MRI following a specialized neurological examination and underwent a comprehensive preanesthetic assessment. After premedication, anesthesia was induced and maintained for 25-38 minutes. The recorded complications included hypothermia (n = 5), delayed recovery (n = 3), hypotension (n = 2), and hypertension (n = 2). These findings highlight that a tailored anesthetic approach, guided by thorough preanesthetic evaluation and proactive management, is essential for optimizing patient safety and clinical outcomes in dogs with neurological disorders.

Key words*: anesthesia, MRI, dogs, neurolog*

INTRODUCTION

Perianesthetic management of patients with intracranial pathology undergoing MRI is of critical importance. In contrast to human medicine, where anesthesiology support may not be routinely required, veterinary MRI examinations necessitate complete patient immobilization to achieve optimal image resolution and diagnostic accuracy. This requirement is reliably fulfilled through the administration of general anesthesia (Pavel et al., 2024).

MRI has significantly contributed to the evolution of veterinary medical research through its application in the study of central nervous system (CNS) and spinal cord disorders (Labruyère & Schwarz, 2013).

This paper aims to demonstrate the importance of tailored anesthetic protocols for patients with intracranial disorders, with particular attention to optimizing welfare and ensuring safety throughout anesthesia.

MATERIALS AND METHODS

This prospective clinical observational study was performed between November 2024 and April 2025 at the Faculty of Veterinary Medicine in Bucharest. Informed consent for inclusion in the study was obtained from all owners of the patients involved. This study included 20 dogs, aged between 3 and 14 years old, both males and females, of the following breeds: French Bulldog (n = 5), mixed breeds (n = 5), Maltese dog (n = 3), Beagle (n = 2), Chihuahua (n = 2), Cane Corso (n = 1), Amstaff (n = 1) and Labrador Retriever (n = 1).

Dogs meeting the following inclusion criteria were enrolled in the study: requirement for a head magnetic resonance imaging (MRI) examination along with a complete preanesthetic evaluation consisting of a neurological assessment, completion of a cardiological examination, biochemical and hematological analyses. Following the preanesthetic examination, all patients were classified according to the American Society of Anesthesiologists (ASA) into ASA II and ASA III status to assess anesthetic-related risks. Before premedication, patients were stratified into three age groups. The classification was performed in order to evaluate age-related differences in anesthetic approach and perioperative management. The anesthetic protocol was adapted according to patient age,

physiological characteristics, and underlying intracranial pathology. Standard monitoring was applied in all cases, and anesthetic techniques were selected based on current clinical practice and individual patient needs. The three groups are:

- Group 1 (G1)- between 3 and 5 years, ASA II status
- Group 2 (G2)- between 6 and 9 years, ASA II & III status
- Group 3 (G3)- between 11 and 14 years, ASA II & III status.

All dogs assigned to this study received intramuscular (IM) premedication. This choice of IM premedication reduced stress and calmed the patients, which is crucial in neurological patients (Costea, 2016). The anesthetic agents selected for this stage were dexmedetomidine (Dexdomitor®, 0.5 mg/mL), butorphanol (Butomidor®, 10 mg/mL) and midazolam (Midazolam®, 5 mg/mL) at the doses presented in Table 1.

Table 1. Premedication protocols and dosages

	G1	G2	G3
Dexmedetomidine	2 µg/kg	-	-
Butorphanol	0.3 mg/kg	0.3 mg/kg	0.2 mg/kg
Midazolam	-	-	0.2 mg/kg

After a 10-minute waiting period, an intravenous (IV) catheter was inserted to facilitate the administration of anesthetic agents as well as fluid therapy. Before induction, all patients were preoxygenated for 2-3 minutes and after that, induction was performed intravenously with 2-3 mg/kg of propofol (Propomitor®, 1%) (IV), followed by endotracheal intubation. Anesthesia was maintained with 2-4% Isoflurane (Isothesia®, 1000 mg/g) and 100% oxygen with a total flow of (500 mL/min + 10 mL/kg/min), through an anesthesia machine (AEON 7200A) with the use of a rebreathing system.

End-tidal carbon dioxide ($EtCO_2$) was continuously monitored using a side stream capnograph. To maintain $EtCO_2$ values within the target range of 35-45 mmHg, patients were managed either with spontaneous ventilation or intermittent positive pressure ventilation (IPPV) at a respiratory rate of 12-15 breaths per minute. Blood pressure was monitored non-invasively using the oscillometric method systematically at baseline, at 2-minute intervals through anesthesia, and upon emergence. The threshold for hypotension was a Mean Arterial Pressure (MAP) of 60 mmHg and for hypertension a Systolic Arterial Pressure (SAP) of 182 mmHg. Corneal protection during the MRI examination was ensured by the application of an ocular lubricant in all patients. All dogs received intravenous fluid therapy with Ringer's solution at a rate of 3 mL/kg/h. Intrarectal temperature was measured at two time points: before the induction of anesthesia and during the recovery phase with a hypothermia threshold set at 37°C. A silicone hot water bottle was placed beneath the abdomen of each patient to prevent hypothermia, as the ambient temperature in the MRI suite was maintained at approximately 20°C and scan durations ranged from 25 to 38 minutes. According to the MRI protocol that included image acquisition both before and after contrast agent administration, all patients in this study received gadolinium-based contrast medium (Clariscan®, *acidum gadotericum* 0.5 mmol/mL) at a dose of 0.2 mL/kg, approximately 15-20 minutes after the induction of anesthesia.

RESULTS AND DISCUSSIONS

The 20 cases included in the study were diagnosed with a range of cerebral pathologies following MRI examination. In G1, MRI diagnoses included: encephalitis (n = 1), ventriculomegaly (n = 1), meningioma (n = 1) and frontal lobe glioma (n = 1). In this group delayed recovery was observed beyond 15 minutes (n = 2) and hypothermia (n = 1).

For G2 the MRI diagnosis included: intraventricular mass (n = 2), hydrocephalus with secondary cerebellar herniation (n = 2), intracranial mass in the left cerebral hemisphere (n = 2), encephalitis (n = 1), thalamic glioma (n = 1), frontal lobe glioma (n = 1) and thalamic cystic lesion (n = 1). In this group we identified hypotension after contrast administration (n = 2), hypothermia (n = 1), delayed recovery beyond 15 minutes (n = 1), and hypertension during recovery (n = 1).

For G3 the MRI diagnoses included: subarachnoid diverticulum (n = 2), temporal lobe glioma (n = 2), encephalitis (n = 1) and

left tympanic bulla mass (n = 1). In this group we identified hypothermia (n = 3) and hypertension (n = 1). All cases of delayed recovery (n = 3), were considered likely to be associated with the underlying cerebral pathology.

The study population consisted primarily of dogs classified as ASA II and ASA III, reflecting the increased anesthetic risk associated with intracranial neurological disorders. Magnetic resonance imaging revealed a wide spectrum of neurological conditions, including inflammatory diseases, congenital abnormalities, and intracranial neoplasms with various anatomical localizations. Hypothermia was the most frequently observed peri-anesthetic complication (n = 5). All cases of hypothermia were associated with prolonged MRI scan durations exceeding 32-38 minutes, regardless of ASA classification. Delayed anesthetic recovery, defined as recovery exceeding 15 minutes, was recorded in three cases. In all cases, delayed recovery was considered likely to be related to the underlying cerebral pathology, suggesting an influence of central nervous system disease on anesthetic drug metabolism and recovery dynamics. Hypotension (n = 2) occurred following intravenous administration of the gadolinium-based contrast agent, with recorded mean arterial blood pressure values ranging between 58 and 60 mm Hg, but cannot be totally related to its administration, since it can also be considered a general anesthesia complication and it was not accompanied by other specific side effects.

Hypertension was an infrequent finding, observed in two cases, occurring either during the recovery phase or intra-procedurally. These events were transient and did not require interruption of the MRI examination.

A higher incidence of hemodynamic disturbances was observed in dogs classified as ASA III compared to ASA II patients, indicating reduced physiological reserve in animals with more severe systemic compromise.

The findings of this study indicate that general anesthesia in dogs with intracranial neurological disorders is associated with an increased risk of peri- and post-anesthetic complications, even in patients classified as ASA II.

Hypothermia and delayed recovery were the most commonly encountered adverse events, possibly influenced by prolonged procedure duration and the presence of underlying cerebral disease. Additionally, intravenous contrast administration represents a period during which the patient must be closely monitored, as it was associated with transient hypotensive episodes in a subset of patients in this study. Correlation of the present study's results with those reported in the literature shows that no severe reactions have been reported after administration, such as changes in pulse or respiratory rate (Pavel et al., 2018). Anaphylactic or anaphylactoid reactions following IV gadolinium injections may include vomiting, facial, periorbital and sublingual oedema, soft feces but also severe cardiovascular and respiratory dysfunctions (Girard & Leece, 2010).

Based on the findings reported in this study, the results suggest that perioperative management is particularly important in patients with cerebral disorders, as the risks are higher both during anesthesia and in the post-anesthetic period. According to previous studies, anesthetic complications for neurological patients occur more frequently in dogs with intracranial lesions than in those without. Through detailed assessment of perioperative risk factors and the procedures performed, outcomes in these patients can be improved (Hicks et al., 2013).

Assessing perianesthetic risk in veterinary patients with suspected intracranial lesions undergoing diagnostic procedures is of critical importance, as it enables both clinicians and owners to make well-informed anesthetic decisions. Identifying patient-specific risk factors allows for the consideration and application of targeted protocols or therapeutic interventions before or during anesthesia, intending to improve anesthetic recovery (Jiménez et al., 2012).

CONCLUSIONS

Although this research was limited by the small number of cases, we can state that a personalized anesthetic approach, guided by comprehensive preanesthetic evaluation and

proactive management, is essential for optimizing patient safety and outcomes in this high-risk population. The careful selection of a premedication protocol for patients with cerebral disorders is crucial, employing agents with minimal impact on key physiological functions, including the nervous, cardiovascular, and respiratory systems. Collaboration between the anesthesiologist and the neurologist is vital in the management of patients with cerebral pathologies, as it can enhance patient safety and minimize perioperative risks. This study emphasizes the importance of individualized perioperative anesthetic management in dogs with neurological pathology, with particular attention to thermoregulation, hemodynamic stability, and close monitoring during both anesthesia and recovery.

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