Evaluation of surgical treatment in 5 intracranial meningiomas

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Aim

The purpose of this retrospective case series is to report the results of **surgical treatment** of five dogs (n=5) with **intracranial meningiomas** according to Shores and Brisson [1].

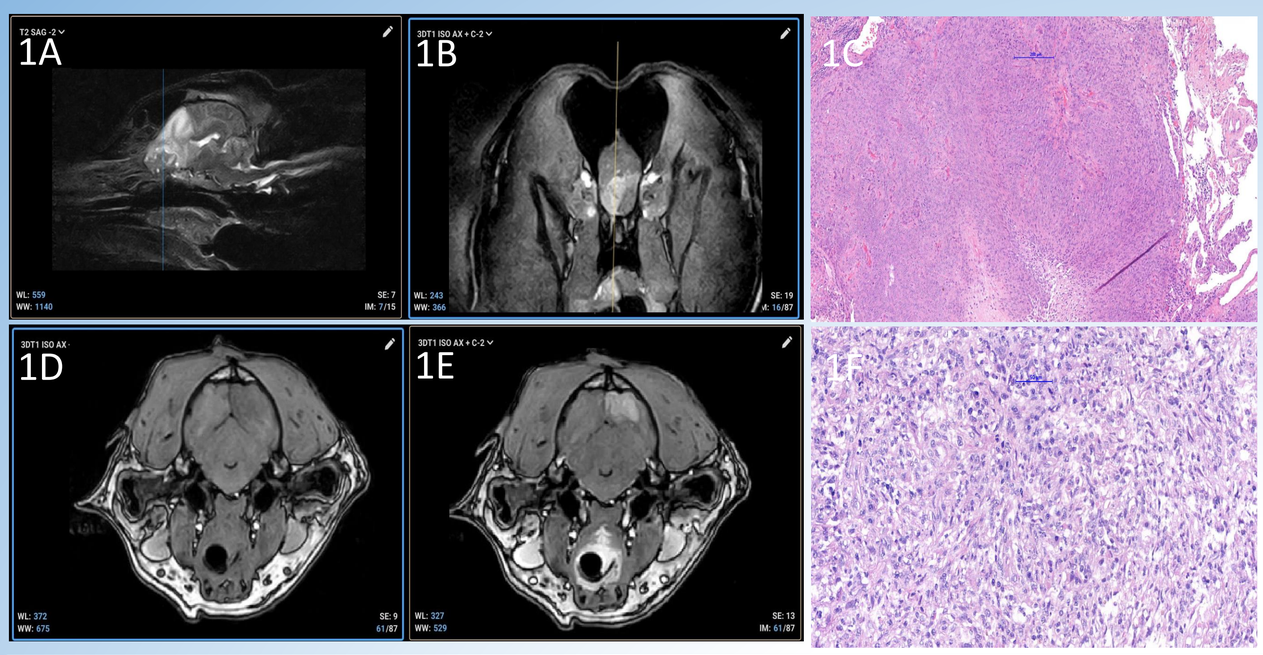


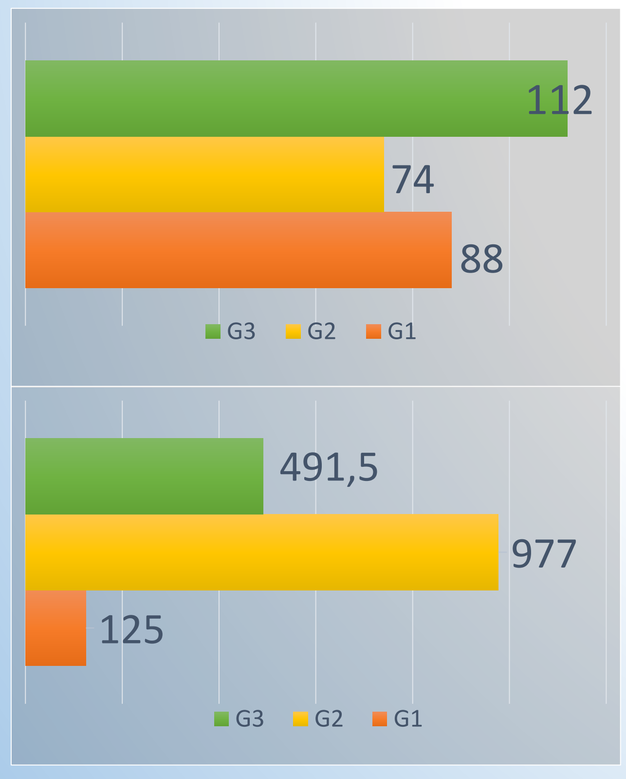
Figure 1: MRI of two dogs. (A) Space-occupying lesion apparently located extra-axially in the right olfactory lobe, oval in shape and elongated in the anteroposterior direction, measuring approximately 12 x 12 x 22 mm. (B) After administration of M.d.c, marked and homogeneous enhancement is observed, which appears to follow the olfactory meningeal profile and the falx, where signs of dural tail are observed; (C) histological examination reveals spindle-shaped and polygonal cells, arranged in bundles and solid expansions separated by a sparse matrix, sometimes with a perivascular arrangement. (D) An apparently extra-axial lesion with a roughly globular shape is located in the left occipital region. (E) After the administration of M.d.c., marked and uneven enhancement is observed, with a broad base and a dural tail. The lesion is compatible with a neoplastic form as a preliminary diagnosis. (F) Histology consisting of spindle-shaped and polygonal cells arranged in bundles and solid expansions, separated by a sparse matrix and sometimes arranged perivascularly. Immunohistochemistry was also performed on this sample, which was positive only for the vimentin marker (negative for the GFAP, E-cadherin and pan-cytokeratin markers). This histological picture is consistent with fibrous meningioma.

Materials and Methods

Diagnosis was made by magnetic resonance imaging (MRI) (***Figure 1***) and confirmed, after surgery, by histopathology.
Cases were subdivided according to **surgical approach** into *transfrontal* (n=1; **G1**), *parieto-occipital* (n=2; **G2**) and *rostrum-tentorial* (n=2; **G3**).
Neurological status was assessed immediately after surgery (**T0**), at 8 days (**T8**), and at 30 days (**T30**).
Neurological status was re-evaluated thereafter only if **neurological signs** occurred.
In all subjects, the **outer cortex** was removed with a **high-speed spherical burr** (5 mm) until the **inner cortex** was exposed. Once the thinnest point of the internal cortex was identified, the remaining plate of bone was removed using a **Kerrison rongeur**, taking care not to perforate the underlying **dura mater**.
The portion of the **dura mater** above the neoplasm was then removed with a **bipolar electrocauteriser** for neurosurgery.
An operating **microscope** was used to distinguish the neoplastic tissue from the healthy brain parenchyma and to identify the cleavage plane of the **meningioma**.
Intracranial surgery **tampons** (Saugermed, Medikokim, Istanbul, Turkey) were inserted into the cleavage plane to allow retraction of the cerebral tissue from the **neoplastic tissue**.
Tumour resection was performed centrifugally or centripetally, depending on the case, using **arthroscopic forceps** or **bipolar electrocautery**. Excision of the neoplasm was performed using arthroscopic forceps and a **neurosurgical aspirator** calibrated to -0.40 bar.
In the subject who underwent transfrontal craniotomy (**G1**), the bone flap was fixed with **polydioxanone** (**PDO**) sutures.

Results

The duration of surgery (time from first incision to skin suture) was **88 minutes** in G1, an average of **74 minutes** in G2 and **112 minutes** in G3 (***Graph 1***).
No dog showed neurological changes at T8 and T30.
No dog showed MRI changes at T30.
Two subjects had **convulsive crises 4** (G1) and **2** (G3) months after surgery requiring follow-up MRI. One of these (G3) showed signs of **tumour recurrence** and died 14 days later.
Survival times were **125 days** for G1, an average of **977 days** for G2 and **491.5 days** for G3 (***Graph 2***).
The use of surgical **swabs** allowed for retraction of brain tissue and optimal delineation of the tumour cleavage plane. In addition, the swabs provided effective **haemostasis**, thus reducing the operative time.
Handling meningiomas is complex due to their structure and the fragile consistency of the neoplastic tissue. The safe performance of traction manoeuvres is essential to prevent **iatrogenic dissemination** of neoplastic cells, but it prolongs operative time.
The use of a low-pressure **aspirator** and **bipolar electrocautery** allowed a firmer yet delicate grip of the meningioma, reducing iatrogenic dissemination of neoplastic cells.
Finally, the use of **PDO** sutures instead of cerclage sutures avoided metallic artefacts in the control MRIs of the patient treated with the transfrontal approach (G1).



Graph 1. Duration of the surgery.
Graph 2. Survival times.

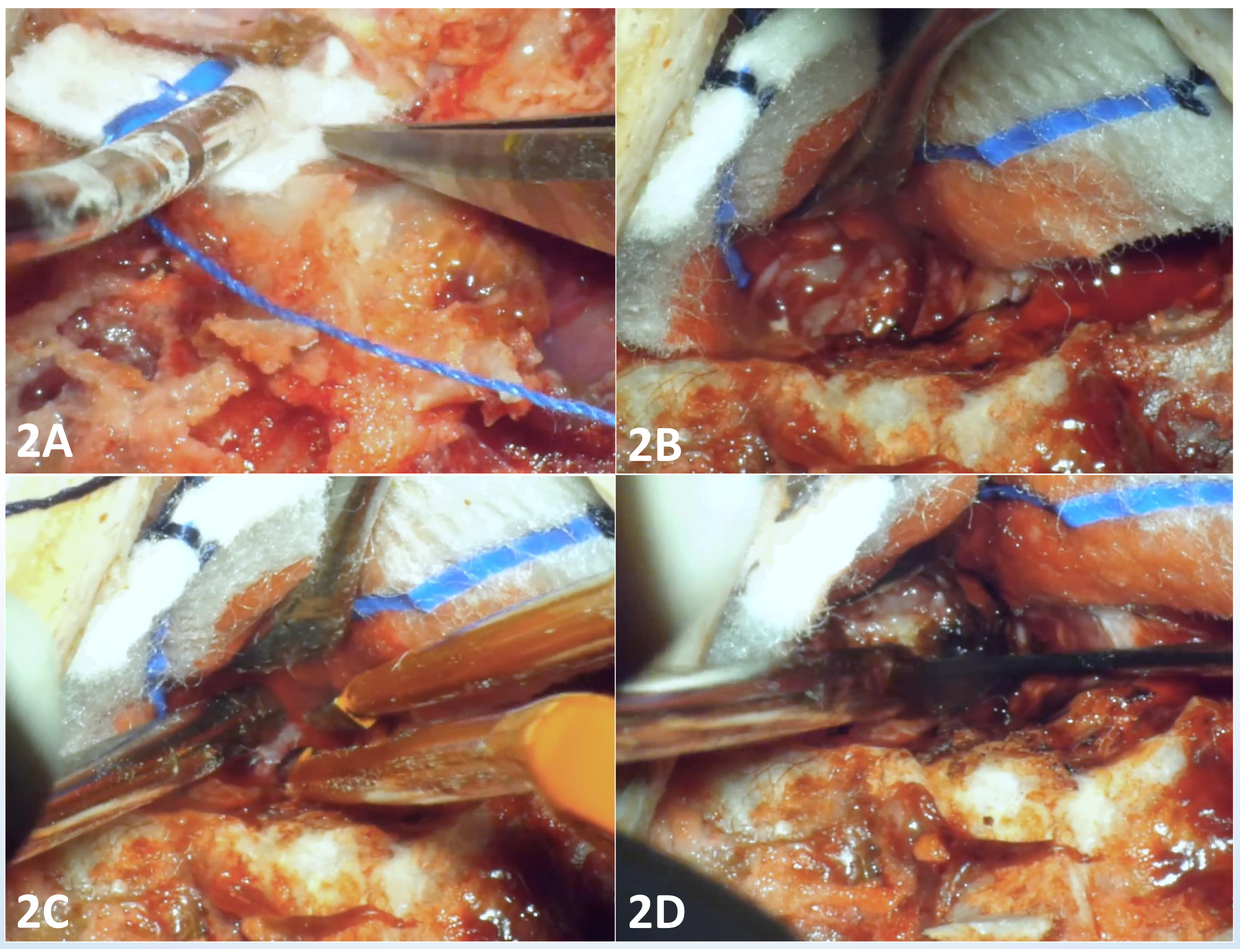


Figure 2: (A) After the dura mater was removed, neurosurgical sponges were placed in the cleavage plane.
(B) The dorsal portion of the tumour was isolated using neurosurgical sponges.
(C) The neoplasm was electrocauterised using bipolar neurosurgical forceps to facilitate its removal.
(D) The surgeon used an aspirator and a palpator to remove small portions of neoplastic tissue.

Discussions

In veterinary medicine, the surgical treatment of **intracranial meningiomas** is often considered **curative**, with a median survival time (MST) of approximately **37 months** in cats. In dogs, the higher incidence of **atypical meningiomas** makes the medium- and long-term prognosis **less favourable**, probably due to their frequent uneven structure compared to brain tissue, which prevents proper cleavage and consequently complete **excision**. Complications of intracranial surgery are divided into **neurological** (early postoperative neurological deterioration, oedema, etc.) and **non-neurological** (ab ingestis pneumonia). In our study, none of the patients experienced **complications** in the immediate postoperative period. The median survival time (MST) was **higher** in G2 than in G3. The G1 patient is still **alive** and in good condition. The current classification of meningiomas categorises them into three groups: **benign** (Grade I), **atypical** (Grade II) and **malignant** (Grade III). As the grade increases, more aggressive behaviour and a **higher recurrence rate** are observed, resulting in a reduction in **survival time**. Our results, which concern grade II cases, provide significant data on the association between **meningioma subtype** and **survival time**. Finally, another interesting finding, although not the main focus of our investigation, is the simplification of **post-operative management** for owners. We believe this aspect is particularly relevant: given the **complexity** of intracranial surgery, relatively easy home management can effectively encourage the choice of **surgery**.

Conclusions

In conclusion, the treatments described seem to be valid, based on patients' positive neurological outcomes on discharge.Further research into the surgical management of intracranial meningiomas is needed to reduce recurrence rates and complications. This should involve comparing different treatment methods in order to determine the most effective therapeutic strategy.

Reference

[1] Shores A. In Current Techniques in Canine and Feline Neurosurgery. I ed. Wiley & Sons, 2017.