Non-invasive diagnostic biomarkers in canine gliomas and meningiomas

Universitat Autònoma de Barcelona

Faculty of Veterinary Medicine, UAB
Laura Carmona García – Final Degree Project – June 2022

Introduction

Meningiomas and glioma are the most common primary intracranial tumors in dogs. Clinical signs usually appear progressively and the most common clinical manifestation is seizures.
Currently, brain tumors in dogs are diagnosed using magnetic resonance imaging (MRI) and histological evaluation of biopsy samples.

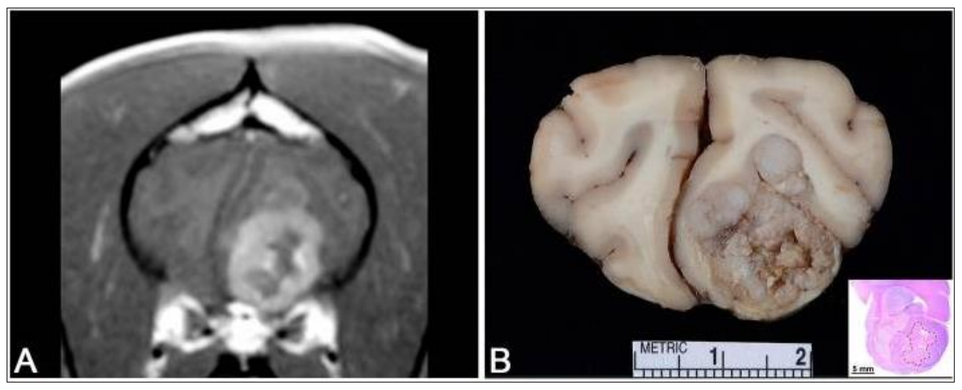


Figure 1. Canine meningioma; (A) Magnetic resonance image (B) Necropsy specimen corresponding to (A). Source: Miller et al., 2019.

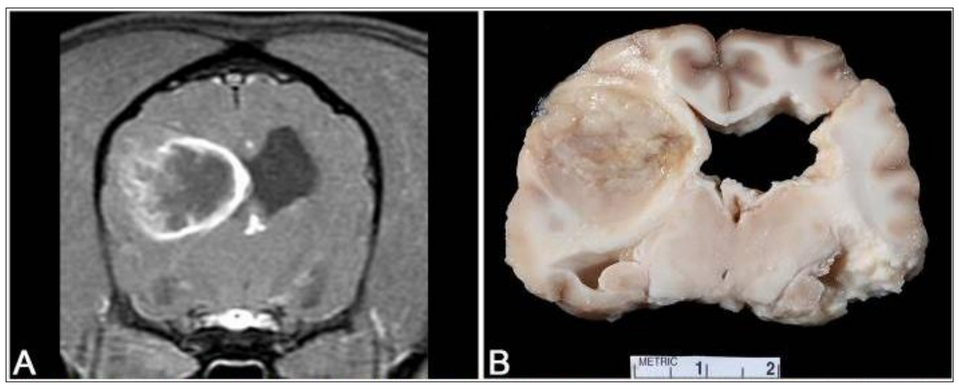


Figure 2. Canine glioma; (A) Magnetic resonance image; high-grade oligodendroglioma; (B) Necropsy specimen corresponding to (A). Source: Miller et al., 2019.

Tumor biomarkers are substances produced by tumor cells or by cells in the body in response to the presence of the tumor and whose amounts are higher than physiological values indicating the presence of the disease. The main sources of circulating biomarkers are circulating tumor cells (CTCs), cell-free fractions and circulating extracellular vesicles (EVs).

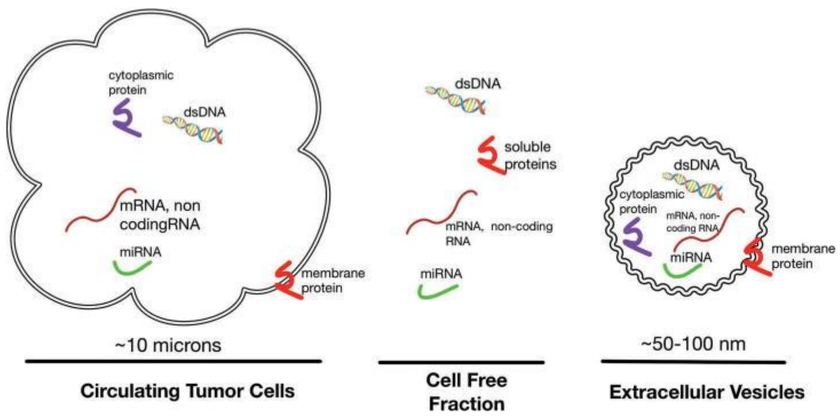


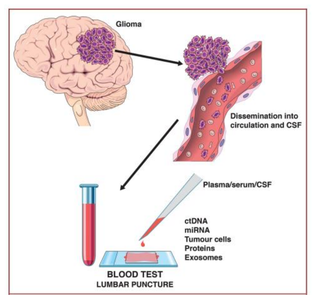
Figure 3. Examples of sources of macromolecules accessible in various liquid biopsy fractions. Source: Shankar et al., 2017.

Conclusions and future

- Currently we do not have sufficiently sensitive and specific circulating biomarkers for clinical application in the diagnosis of canine intracranial tumors.
- Plasma free amino acid profiles (PFAA) and circulating vascular endothelial growth factor (VEGF) expression have not shown significant results.
- The future of circulating biomarkers as a non-invasive diagnostic method in canine gliomas and meningiomas seems to lie in **microRNAs**.
- **Further research is needed** to validate and implement these biomarkers as a routine diagnostic method in veterinary clinics and hospitals.

Objectives

The objective of this study was:
- To identify circulating biomarkers useful for the diagnosis of gliomas and meningiomas in dogs and/or to evaluate those with better future prospects.



Results

1. Study of the expression of microRNAs in plasma and plasma-derived extracellular vesicles in dogs with glioma.

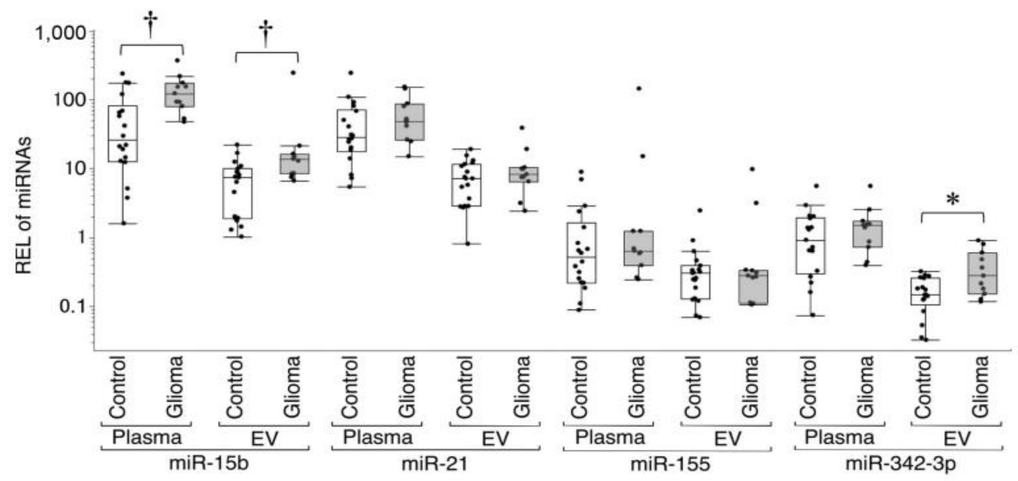
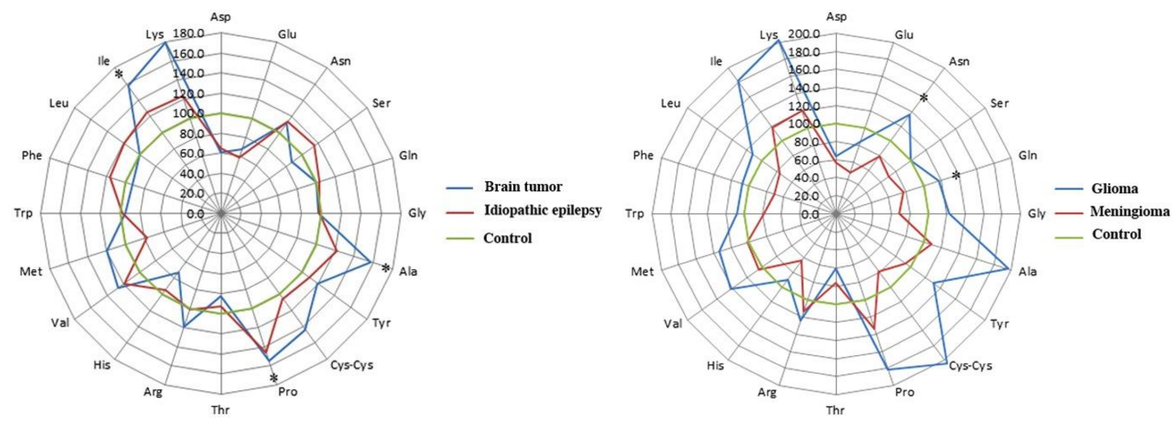


Figure 4. Box plot of the relative expression (REL) of 4 miRNAs in plasma and plasma-derived EVs for glioma and control dogs. Source: Narita et al., 2020.

2. Study on the analysis of plasma free amino acid profiles in canine brain tumors.



Figures 5 and 6. Alterations in PFAA levels in dogs with brain tumours (glioma and meningioma) and epilepsy. Source: Utsugi et al., 2017.

3. Study on the expression of vascular endothelial growth factor (VEGF) in tumor tissue and plasma of dogs with primary intracranial tumors.

Tumor type comparison	Rate (proportion of dogs) of detectable plasma VEGF concentration	Odds ratio (95% CI)	*P* value†
Astrocytoma vs meningioma	77% (7/9) vs 9% (1/11)	35 (2.63 to 465.4)	0.007
Oligodendroglioma vs meningioma	14% (1/7) vs 9% (1/11)	1.67 (0.09 to 31.87)	0.73
Astrocytoma vs oligodendroglioma	77% (7/9) vs 14% (1/7)	0.05 (0.003 to 0.665)	0.027

Figure 7. Associations between detectable plasma VEGF concentration and tumor type in dogs with meningiomas, oligodendrogliomas or astrocytomas. Source: Rossmeisl et al. 2007.

References

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