

# Normal Pituitary Gland and Pituitary Macroadenoma Size Variations of Brachy-, Meso-, and Dolichocephalic Dogs

Hannah Pham, Michael S. Kent DVM, Kelsey Brust DVM

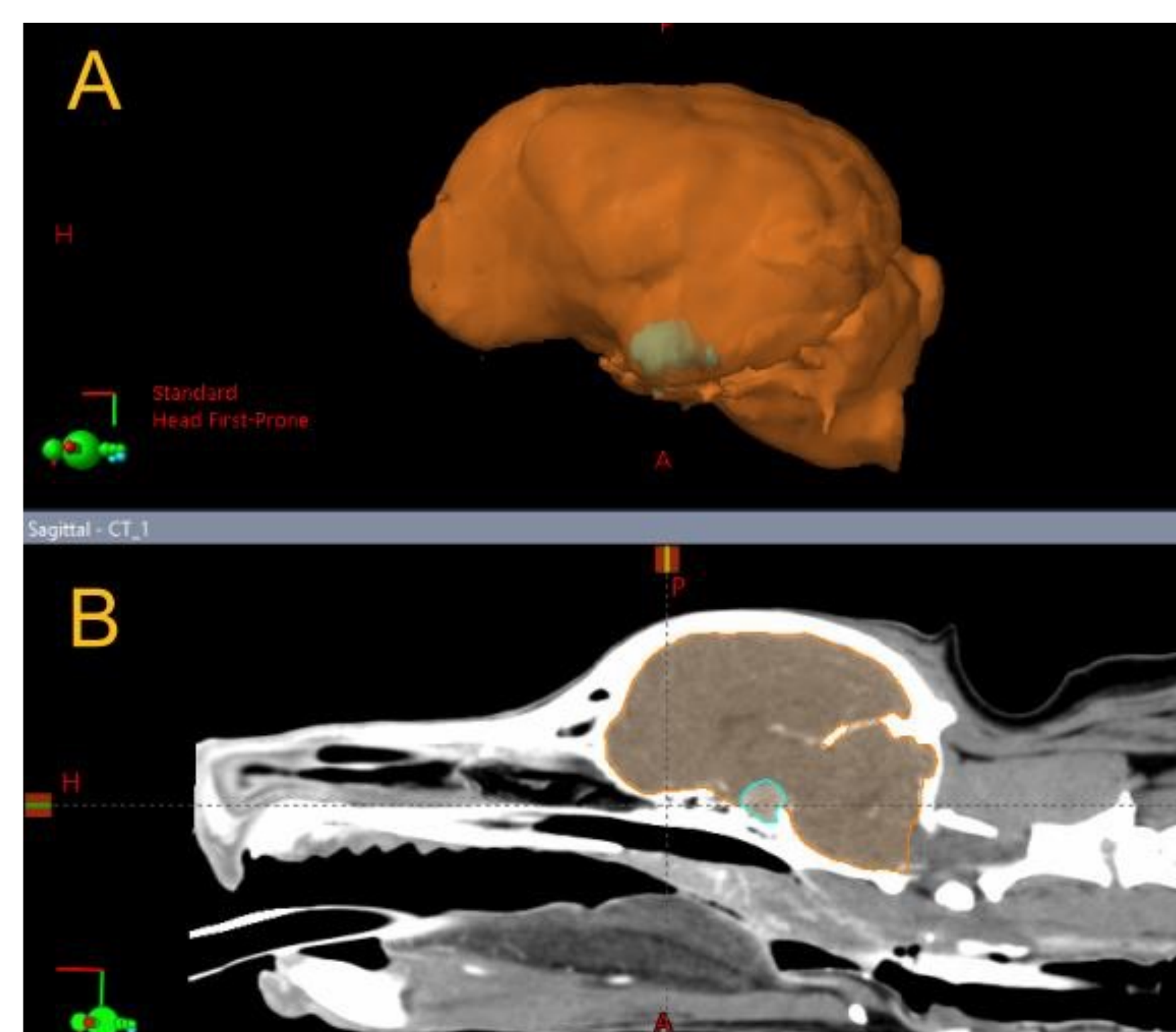
Department of Surgical and Radiological Sciences, UC Davis School of Veterinary Medicine

## Background

- A standard definition of a **canine pituitary macrotumor** based on imaging characteristics has not been established.
- The definition used in human medicine of a pituitary mass > 1 cm in diameter has been previously adopted for canine patients.<sup>1</sup>
  - This definition fails to account for the variability in size and skull conformation of dogs.
- Another definition uses the ratio between pituitary height and brain area to account for differences in body weight.<sup>2</sup>
  - This method is not always robust due to a lack of correlation between body weight and normal pituitary size.<sup>3</sup>

## Hypothesis & Aims

- Hypothesis:** Canine pituitary macroadenomas are smaller than the human definition. The size of normal canine pituitary glands and pituitary macroadenomas vary by skull conformations.
- Aim 1:** Determine the variations in the size of normal pituitary glands between dogs of different skull morphologies: brachy-, meso-, and dolichocephalic.
  - Aim 2:** Compare the relationship between brain volume and pituitary macroadenoma size across different skull morphologies.

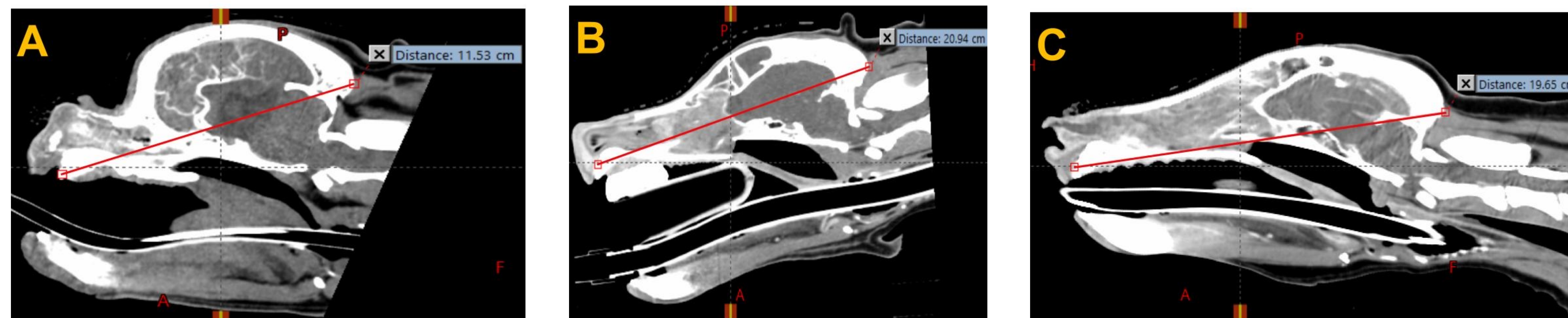


**Figure 1:** The brain (orange) and pituitary macrotumor (cyan) of a mesocephalic dog depicted on (A) volume rendering and (B) sagittal contrast CT.

## Methods

Contrast CT scans of 89 dogs with presumed pituitary macroadenomas and 89 skull matched dogs with normal pituitary glands were selected from the UC Davis Veterinary Medical Teaching Hospital from 2010 to 2023.

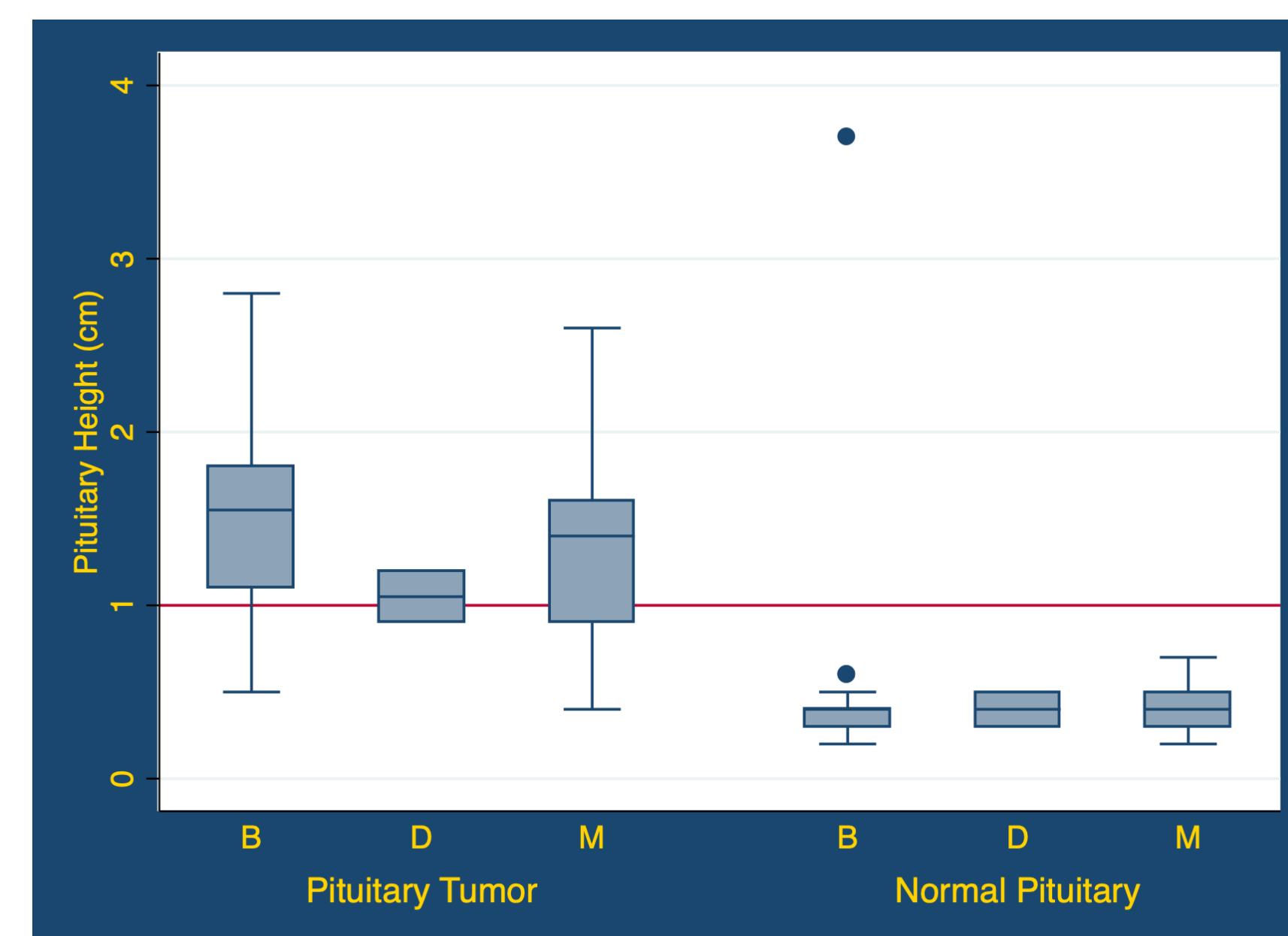
- Eclipse Treatment Planning Software System was used to measure the dimensions and volumes of 3 structures: the pituitary gland, sella turcica, and brain.
- To classify skull morphology, skull index (SI) was calculated where  $SI = \frac{\text{skull width (cm)}}{\text{skull length (cm)}} \times 100$



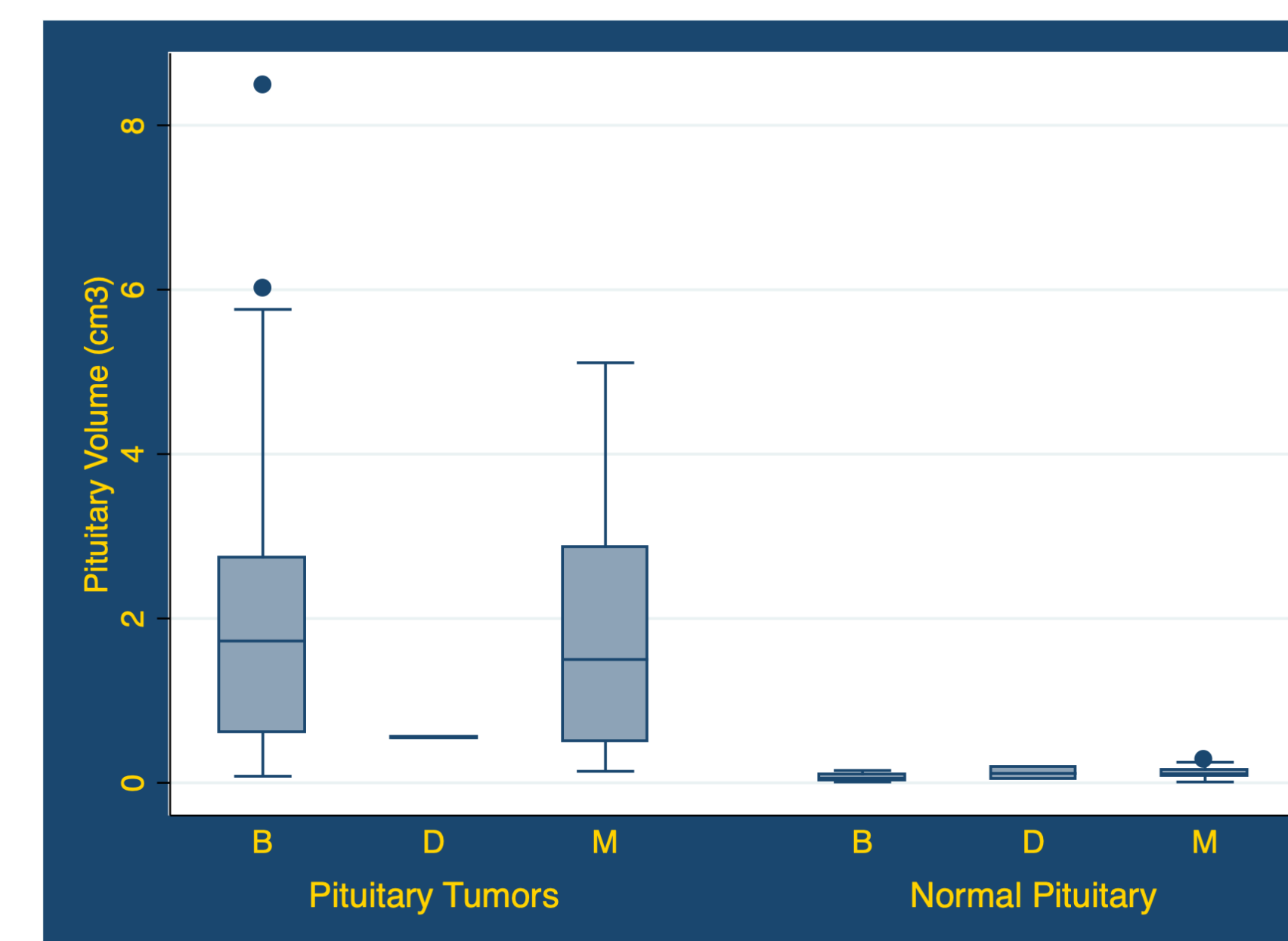
**Figure 2:** Sagittal contrast CT scans of (A) brachycephalic (B) mesocephalic and (C) dolichocephalic dogs. Skull length measurements are represented by red lines.

## Results

- 21.3% (19/89) of pituitary macroadenomas were smaller than the human definition.
- The median pituitary macroadenoma volume to brain volume ratios were 0.021 in brachycephalic, 0.017 in mesocephalic, and 0.008 in dolichocephalic dogs. These were not significantly different ( $p = 0.39$ ).



**Figure 3:** Heights of pituitary tumors and normal pituitary glands grouped by skull morphology



**Figure 4:** Volumes of pituitary tumors and normal pituitary glands grouped by skull morphology

**Table 1:** Comparison of normal pituitary gland sizes across skull morphologies

	Brachycephalic	Mesocephalic	Dolichocephalic	p-value
<b>PG Volume (cm<sup>3</sup>)</b>	0.06	0.11	0.12	0.0001
<b>PG Height (cm)</b>	0.40	0.40	0.40	0.2836
<b>PG Width (cm)</b>	0.50	0.70	0.70	0.0055
<b>PG Length (cm)</b>	0.60	0.80	0.65	0.0023
<b>P:B Ratio</b>	0.0007	0.0012	0.0008	0.0004

Data are presented as median. Abbreviations: PG is pituitary gland; P:B Ratio is the pituitary gland volume to brain volume ratio.

## Conclusions

- The human pituitary macrotumor definition may not be a reliable guideline for dogs** because some canine pituitary macrotumors are smaller than 1 cm in diameter.
- Variations in normal pituitary gland size across skull morphologies are shown in **Table 1**.
  - The brachycephalic group had the smallest normal pituitary gland volumes, widths, and lengths.**
  - There was no significant difference in normal pituitary gland height.
- The relationship between brain volume and normal pituitary gland volume significantly varied by skull morphology.**
  - The pituitary volume to brain volume ratio was smallest in brachycephalics and largest in mesocephalics.
- A pituitary gland height > **0.60 cm** or a pituitary volume > **0.17 cm<sup>3</sup>** should be considered a macrotumor in **brachycephalic** dogs.
- A pituitary gland height > **0.65 cm** or a pituitary volume > **0.31 cm<sup>3</sup>** should be considered a macrotumor in mesocephalic dogs.

## Acknowledgements

Financial support was provided by the UC Davis School of Veterinary Medicine Students Training in Advanced Research (STAR) Program and NIH Training Grant T35-OD010956-25.

## References

- Molitch ME, Russell EJ. The pituitary "incidentaloma". *Ann Intern Med.* 1990; 112(12):925-931. doi:10.7326/0003-4819-112-12-925
- Kooistra HS, Voorhout G, Mol JA, Rijnberk A. 1997. Correlation between the impairment of glucocorticoid feedback and the size of the pituitary gland in dogs with pituitary-dependent hyperadrenocorticism. *J Endocrinology.* 152(3):387-394. doi:10.1677/joe.0.1520387
- Kippenes H, Gavin PR, Kraft SL, Sande RD, Tucker RL. Mensuration of the normal pituitary gland from magnetic resonance images in 96 dogs. *Vet Radiol Ultrasound.* 2001;42(2):130-133. doi:10.1111/j.1740-8261.2001.tb00915.x