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ORIGINAL RESEARCH

Linear magnetic resonance imaging measurements of the hippocampal formation differ in young versus old dogs

A. Gardini, O. Taeymans, G. B. Cherubini, A. de Stefani, M. Targett, E. Vettorato

Introduction

The canine hippocampal formation (HF) extends caudally from the piriform lobe, and, together with its rostral extension – the fornix – forms a C-shaped structure winding around the thalamus. Reduction in the volume of the HF is considered to be an age-related physiological process, but the magnitude of this change is unclear.

Therefore, this study aimed to quantify the age-related HF atrophy using linear MRI measurements in non-brachycephalic dogs.

Approach

The clinical records of non-brachycephalic dogs that underwent brain MRI scanning at Dick White Referrals between 2007 and 2014 were retrieved and reviewed. Normal brain MRI scans of young dogs (between one and three years old) and old dogs (over 10 years old), with normal CSF analysis and no history of behavioural changes, were included in the study.

For each dog, one single transverse T2 fluid-attenuated inversion recovery image containing the right and left HF, the rostral colliculi and the mesencephalic aqueduct was selected. The height of the brain (HB) and left and right hippocampal formation height (HFH) were measured (Fig 1) by two independent observers unaware of the dogs' signalment. The mean of the right and left HFH (mHFH) and the percentage of the ratio between mHFH and HB (mHFH/HB ratio) were then calculated.

Young dogs were then divided into epileptic and non-epileptic subgroups, and the MRI images for the epileptic dogs were reviewed for signs of hippocampal sclerosis.

The data were analysed using descriptive statistics, and Bland-Altman plots were used to evaluate the intraobserver and interobserver agreement.

KEY FINDINGS

- The mean hippocampal formation height/height of the brain ratio was 15.7 per cent for old dogs and 18.3 per cent for young dogs.
- No differences in these measurements were found between epileptic and non-epileptic dogs.

Results

A total of 75 young dogs (42 epileptic and 33 non-epileptic) and 44 old dogs were included in the study. While old dogs had a statistically greater HB (P=0.024), the right and left HFH, mHFH and mHFH/HB ratio were greater (P<0.0001) in young dogs. The mHFH/HB ratio was 15.7 per cent for old dogs and 18.3 per cent for young dogs.

No differences were found when comparing measurements between epileptic and non-epileptic dogs, and no MRI images from epileptic dogs showed signs of hippocampal sclerosis.

Interpretation

This study demonstrates that linear MRI measurements of the HF could be used to assess canine age-related HF atrophy, as it is easy to perform in a clinical setting and has good intra- and interobserver agreement. Based on the findings of this study, a reduction in mHFH/HB ratio from 18.3 per cent to 15.7 per cent should be considered a normal age-related physiological change.

The HF values of epileptic and non-epileptic dogs were similar, and the epileptic dogs did not show signs of hippocampal sclerosis. These findings support the hypothesis that canine temporal lobe epilepsy is uncommon.

Significance of findings

This study introduces a simple method to measure HF in non-brachycephalic dogs and quantify its age-related atrophy. This could represent an important first step in the investigation of the HF in elderly dogs.

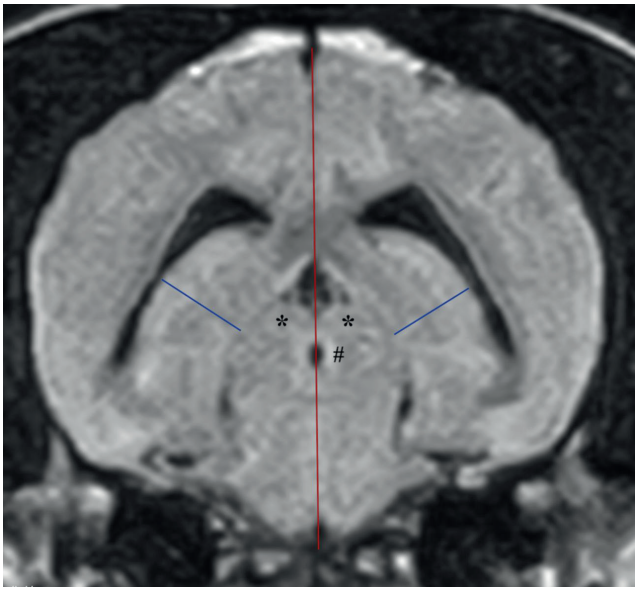

Fig 1: Transverse T2 fluid-attenuated inversion recovery MRI of the brain the level of the mesencephalon, containing both the rostral colliculi (*) and mesencephalic aqueduct (#). The height of the brain is shown by the red line, and right and left hippocampal formation heights are shown by the blue lines

A. Gardini, O. Taeymans, G. B. Cherubini, E. Vettorato, Dick White Referrals, Six Mile Bottom, UK

A. de Stefani, Department of Neurology and Neurosurgery, Royal Veterinary College, London, UK

M. Targett, Department of Neurology and Neurosurgery, University of Nottingham, Loughborough, UK

email: anna.gardini@yahoo.it

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