

Prevalence, Diagnosis and Treatment of Canine Cognitive Dysfunction

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Introduction

With developments in veterinary medicine, domestic dogs are progressively living longer. As a result, neurodegenerative disorders, such as canine cognitive dysfunction (CCD), are of growing concern. CCD is a gradual decline in cognitive function that remains under-diagnosed (Landsberg & Araujo, 2005; Salvin *et al.*, 2010). Typically, CCD results in disorientation, house soiling and changes in activity, social interactions and sleep/wake cycles (Landsberg & Araujo, 2005). CCD compromises the welfare of geriatric dogs because many owners perceive the clinical signs as the adverse effects of normal ageing and consequently treatments are not initiated (Osella *et al.*, 2007; Landsberg & Araujo, 2005). This essay explores improvements in understanding the prevalence, diagnosis and treatment of CCD to improve the wellbeing of senior dogs.

Discussion

Understanding the prevalence and level of under-diagnosis of CCD would stimulate interest in this disease. Owners are unaware that CCD behavioural changes are neural disturbances (Osella *et al.*, 2007). Additionally, only 12% of owners who notice changes report them to their veterinarian (Landsberg & Araujo, 2005). This results in lack of treatment, a poor prognosis and is an obstacle for epidemiological research (Landsberg & Araujo, 2005).

Salvin *et al.* (2010) determined the occurrence and rate of diagnosis of CCD using an 84-item questionnaire. This study utilised behavioural information collected from owners of 957 senior dogs; within this group were 18 dogs diagnosed with CCD. This allowed Salvin *et al.* (2010) to delineate specific behaviours associated with CCD from normal ageing. Researchers allocated a score from 1 (least) to 5 (most) to the frequency of behaviours affected by CCD and the perceived level of change in that behaviour over the previous 6 months. This allowed a quantitative separation of the dogs into three categories: diagnosed with CCD, undiagnosed suspected CCD, or no cognitive impairment. Using these data the prevalence and diagnosis rates of CCD were analysed.

The analysis by Salvin *et al.* (2010) determined the prevalence of CCD at 14.2% in the senior-dog population. The prevalence also increased with age and thus highlights the need for early diagnosis in order to conserve remaining cognitive function (Salvin *et al.*, 2010). This is of critical concern as the official rate of diagnosis of CCD was determined to be 1.9%, leaving 85% of dogs with affected cognitive function undiagnosed (Salvin *et al.*, 2010). The significant under-diagnosis of this common disease reiterates the need for more awareness of CCD.

Exacerbating the difficulties in identifying cognitive impairment is the absence of diagnostic guidelines for veterinarians (Salvin *et al.*, 2011, in press). Veterinarians are almost completely reliant on owner-reported history (Landsberg & Araujo, 2005). Diagnosis of CCD requires elimination of alternative pathologies that may have led to behaviour changes (Landsberg & Araujo, 2005). However, it is common for older dogs to have multiple medical problems and these could mask the clinical signs associated with concurrent CCD (Landsberg & Araujo, 2005; Azkona *et al.*, 2009). This could be a hindrance to developing diagnostic tools to assess cognitive function in geriatric dogs.

Using the information obtained in the previous epidemiological survey, the researchers developed the canine cognitive dysfunction rating scale (CCDR) to assist in accurate diagnosis of CCD (Salvin *et al.*, 2011, in press). Salvin *et al.* (2010) delineated 27 behaviours associated with CCD from symptoms of normal ageing. Of these, abnormal orientation, interests, memory, olfaction and mobility are most indicative of CCD and were therefore used

to generate the CCDR (Salvin *et al.*, 2011, in press). The CCDR allocates a score calculated on the frequency and level of change in the aforementioned behaviours. Scores of greater than 50 are indicative of CCD in senior dogs 99.3% of the time (Salvin *et al.*, 2011, in press).

After assessment to rule out behavioural changes associated with organ system failure, the CCDR allows veterinarians to determine the level of cognitive decline and initiate appropriate treatment (Salvin *et al.*, 2011, in press). The exceptional psychometric properties, reliability and accuracy of the CCDR demonstrates its potential as a diagnostic tool in a clinical context (Salvin *et al.*, 2011, in press). Regular use of the CCDR by veterinarians would generate more awareness of CCD and reduce its under-diagnosis (Salvin *et al.*, 2011, in press).

Early diagnosis of CCD enhances the effects of treatment and reduces the cost (Salvin *et al.*, 2011, in press; Azkona *et al.*, 2009). Treatment of CCD cannot resolve cognitive impairment, but drug therapy, nutritional supplements and behavioural enrichment can successfully delay neural degeneration (Landsberg & Araujo, 2005). Research by Pan *et al.* (2010) augments the nutritional therapies available to address CCD. Age-related cognitive decline is associated with a decrease in available glucose for normal brain function (Pan *et al.*, 2010). Pan *et al.* (2010) proposed the use of medium chain triacylglycerols (MCT) to provide ketone bodies as an alternative energy source for neuronal function.

Pan *et al.* (2010) demonstrated improvements in the learning ability, visuospatial function and attention of healthy senior dogs after eight months on a diet supplemented with 5.5% MCT. MCT significantly increased blood ketone body concentrations without starvation or toxic effects on the dogs (Pan *et al.*, 2010). As the research used healthy dogs, the results may be extrapolated only to predict a delay in cognitive decline in CCD-affected dogs (Pan *et al.* 2010). This study adds to the observed synergistic benefits of multi-domain therapies to treat CCD (Pop *et al.*, 2010).

Conclusion

There is limited awareness of CCD within the community and in veterinary practice (Azkona *et al.*, 2009). The resultant under-diagnosis of this common disease presents a welfare issue for geriatric dogs (Salvin *et al.*, 2010). To address this situation, the CCDR is a valuable screening tool for veterinarians to assist in the diagnosis of CCD (Salvin *et al.*, 2011, in press). In addition, continual improvements in the treatment of CCD, such as dietary addition of MCT, improves patient prognosis (Pan *et al.*, 2010). These recent developments have enhanced animal welfare of geriatric dogs by conserving cognitive function and the human–animal bond (Salvin *et al.*, 2011, in press).

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