Canine cognitive dysfunction – recognition and treatment

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ABSTRACT: Canine cognitive dysfunction (CCD) is a condition seen in aged dogs. The causes, signs and development of the disease must be well understood for correct diagnosis and treatment to be considered. The disease can impact greatly on the dog's quality of life and the owner–animal relationship as loss of learned behaviours and reduced social interaction can be frustrating, especially if the cause is unknown. Drug therapy and dietary modification have been proven to be successful in slowing the progression of the disease and improving brain function when used alongside behavioural modification.

Introduction

The pathology of CCD incorporates a number of factors which can cause a decrease in cognitive function. This includes an increased level of brain tissue damage by the release of free radicals alongside a decrease in antioxidant levels (Vetsci 2011). CCD has been compared to human Alzheimer's, in terms of both its 'pathophysiology and symptomology' (Heath 2002*a*).

Some degree of impairment, mild or more severe, is seen in 27.5 per cent of 11–12-year-old dogs and 67 per cent of 15–16-year-old dogs (Bowen 2013). Given this level of occurrence, it is likely that all practitioners will, at some point, be presented with a dog showing signs of CCD (**Figure 1**).

Diagnosis and detection of CCD

It is thought that CCD is under-diagnosed due to a combination of owners not reporting behavioural changes and accepting them as normal in older animals, and inaccurate/insubstantial history being taken by the practitioner resulting in a failure to diagnose the condition. A CCD rating scale, an online tool designed to assess dogs for symptoms of CCD, has been designed by Salvin *et al.* (2011) to aid in the successful diagnosis of the condition.

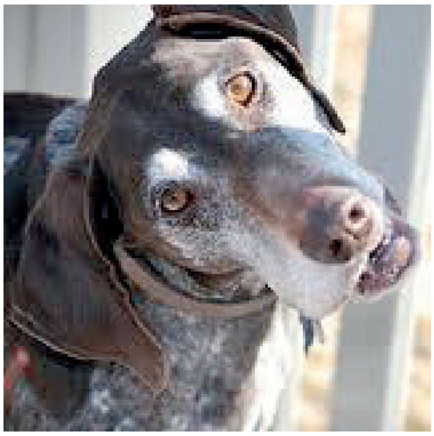

Figure 1. Many aged dogs may present with signs of CCD (Source: https://www.petfinder.com/blog/2011/03/pet_dementia_cognitive_dysfunc/)

Behavioural changes are frequently observed. Landsberg, Hunthausen & Ackerman (2003) discuss the recognised use of the acronym DISHA (disorientation, interaction changes, sleep/wake disturbances, house soiling and activity changes) which can be used when assessing dogs suspected of CCD.

Inappropriate elimination within the home is common and may be due to the dog no longer displaying a signal that it wishes to go outside or displaying the signal in the wrong context, for example standing at internal doors. Dogs may fail to maintain correct associations with suitable locations or substrates for elimination and begin to toilet in other areas such as carpets or patios (Heath 2002*a*).

Changes in the dog's sleep pattern may also be noticed. This may become apparent immediately if owners sleep in the same room as the dog but it can be overlooked for a period of time if the owner is not woken or disturbed.

Dogs with CCD are often unable to recognise familiar faces and this can cause upset to owners used to being greeted on their arrival home or potential conflict should the dog not recognise the owner. A study by Azkona *et al*. (2009) looked at behavioural issues associated with CCD and concluded that impaired social interaction, impaired learning and house soiling were the most common signs reported by owners (**Figure 2**).

Treatment aims

Treatments available for dogs with CCD include dietary management, behavioural modification, prescription medication and nutraceuticals. Owners must be made aware that there is no cure for the condition and treatment is aimed at delaying the progress of the damage, reducing emotional problems, improving cognition and retraining learned behaviours (Heath 2002*b*).

Diet

Dietary changes, if required, should be introduced immediately to slow the progression of cognitive decline.

The brain requires large volumes of energy for sustenance due to the high proportion of fat within it. A good energy source is required to fuel and repair the brain and a diet rich in antioxidants is essential to these dogs (Cotman *et al*. 2002). Antioxidants bind to and neutralise free radicals produced from lipids within the brain which result in neuronal dysfunction and cognitive decline. L-carnitine is an essential ingredient in these diets; it reduces the production of harmful free radicals and increases the efficiency of the mitochondria. It also increases muscular development, which is beneficial in older animals where muscle mass has depleted. The inclusion of medium-chain fatty acids is required for the repair of damaged brain cells (Bowen 2013).

Dogs fed on high-quality veterinary-approved diets may already be benefitting from this research and a change to a specific prescription diet may therefore not be of great importance. However, dogs fed on lower-quality diets will certainly benefit from dietary change and this may prove valuable in reducing the progression of cognitive decline.

Nutraceuticals

Nutraceuticals (Aktivait®, VetPlus Ltd) are available for the treatment of CCD and presented as capsules containing antioxidants, free radical scavengers and essential fatty acids such as phosphatidylserine (Vetplus 2014). They offer the ability to dose the dog orally rather than making changes to their daily diet.

Figure 2. Impaired social interaction is commonly associated with CCD (Source: https://www.petfinder.com/dogs/dog-health/cognitive-dysfunction-syndrome-pets-what-is-it/)

A trial by Heath, Barabas & Craze (2007) showed the use of Aktivait® to be beneficial to dogs showing signs of CCD and indicated that nutritional supplementation was beneficial in relation to some aspects of behaviour associated with CCD. A study conducted by Osella *et al.* (2008) also looked at the use of the fatty acid phosphatidylserine (PS) in the management of brain neurodegenerative processes in senior dogs. From this they concluded that: 'The PS nutraceutical approach to brain aging may offer a new tool in the management of the related signs and symptoms.'

Drug therapy

Prescription drugs are available to physicians to treat CCD but their success is variable. Drug therapy alone is not a cure for the problem and must only be considered alongside behavioural therapy, nutraceuticals and/or dietary modification.

The use of propentofylline (Vivitonin®, Intervet) and nicergoline (Fitergol®, Merial) is recognised in older pets and works by 'producing vasodilation, improving cardiac output, increasing cerebral blood flow and consequently improving brain oxygen supply' (Heath 2002*a*). This can help reduce confusion and make the dog more aware of their surroundings, which can also help to reduce inappropriate elimination and sleep disturbances. Propentofylline has been considered for use prior to general anaesthesia in senior dogs to reduce the incidence of prolonged episodes of hypoxia that may be linked to the onset of signs of CCD post anaesthesia. Selegiline hydrochloride is indicated in the treatment of CCD and is a selective and irreversible inhibitor of monoamine oxidase B (Milgram *et al.* 2002). According to Knoll (cited in Landsberg 2005, p. 474), the exact way in which selegiline works in cases of CCD is not fully understood but is thought to be related to the 'enhancement of dopamine and other catecholamines in the cortex and hippocampus'. Selegiline can enhance cognition as it offers increased reward perception and allows for new learning to take place. It should be used with caution and is contraindicated for use alongside many other preparations. The animal's general health and organ function must be checked prior to administering treatment and monitored during treatment with selegiline.

The use of selective serotonin reuptake inhibitors (SSRIs) has been discussed but they are not licensed for the specific treatment of CCD. They may, however, be beneficial in treating secondary issues such as anxiety, increased phobia and panic attacks (Overall 2002).

Pheromones

Dog appeasing pheromone (DAP) has been discussed by Bowen (2013) as a potential complementary therapy in cases of CCD. DAP contains anti-anxiety properties to calm the dog, and it may be considered after an improvement in brain function following the use of other therapies discussed previously.

Sedatives

Since behavioural modification takes time and the effects of drugs and diets also take 6–8 weeks, short-term relief from sleep deprivation and night wandering may be sought in the form of sedation. In these cases, the practitioner and owner are advised to consider the use of antihistamines as these drugs offer sedation without delayed drowsiness that could impair learning the following day. Sedative drugs that impair cognition, such as acepromazine and diazepam, are best avoided (Bowen 2013).

Behavioural modification

Behavioural modification is essential and the most important element in the treatment plan. Increasing physical and mental activity helps to increase blood flow and oxygenation to the central nervous system and stimulates new cell growth in the hippocampus. Combining dietary changes or drug therapy with behavioural modification may offer the best improvement overall, and evidence of this appears in a study by Milgram (cited in Landsberg 2005, p. 475).

It is important to consider the dog's environment and ensure that they can cope without unnecessary distress. Increasing the cues within the environment can assist in this and may be tactile, such as rugs on the floor indicating when the animal approaches the walls of the room, or olfactory where the use of scented candles can be used to aid the animal's recognition of one area of the house (Bowen 2013). The animal's environment should be improved by ensuring that obstacles do not prevent free movement and that resources are easily accessible.

Figure 3. Food-finding games can help stimulate the brain (Source: http://www.whole-dog-journal.com/issues/11_12/features/Caring-For-An-Older-Dog_16086-1.html)

Food-finding games actively engage most dogs and activity feeders are a good source of entertainment and stimulation while memory tasks encourage use of the brain and promote cognitive improvement (**Figure 3**).

Conclusion

Opportunities to explore surrounding areas are essential and, for old animals, short manageable walks can enable this. Behaviours can be slowly retrained with the aid of positive reinforcement (Bowen 2013). Negative punishment should be avoided because this can prove damaging to the owner–animal relationship that the owner is trying to re-establish. Retraining appropriate elimination and response to commands may be undertaken initially as these allow for mutually beneficial outcomes. It is important to stress to owners that improvement is unlikely if behavioural modification is not undertaken and continued. This may be implemented alongside drug therapy and dietary changes, but it is a vital and essential aspect of treatment. vnj

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