

COGNITIVE DYSFUNCTION & QoL ASSESMENT GUIDELINE FOR VETERINARY PRACTITIONERS

Background

Canine Cognitive Dysfunction (CCD) is a neurodegenerative disease in dogs that shares similarities with the early form of Alzheimer's disease in humans (2). A series of structural and molecular changes in the dog's brain are responsible for a decline in the **cognitive, social** and **emotional** functioning (3, 13, 15).

Incidence

The incidence of CCD is highest in senior dogs, i.e. from age 8 and older. It is assumed that more than 22,5% of dogs over the age of 8 suffer from CCD (1).

NOTE: CCD in dogs with idiopathic epilepsy

Research from Packer et al. (2018) indicates that dogs suffering from idiopathic epilepsy (IE) have

- A significantly increased risk of developing CCD.
- Clinical signs of CCD usually occur much earlier (between 3 and 4 years of age).
- A different clinical presentation: affected dogs mainly show deficits in the area of cognition/memory. There is no change in social interaction, for example.

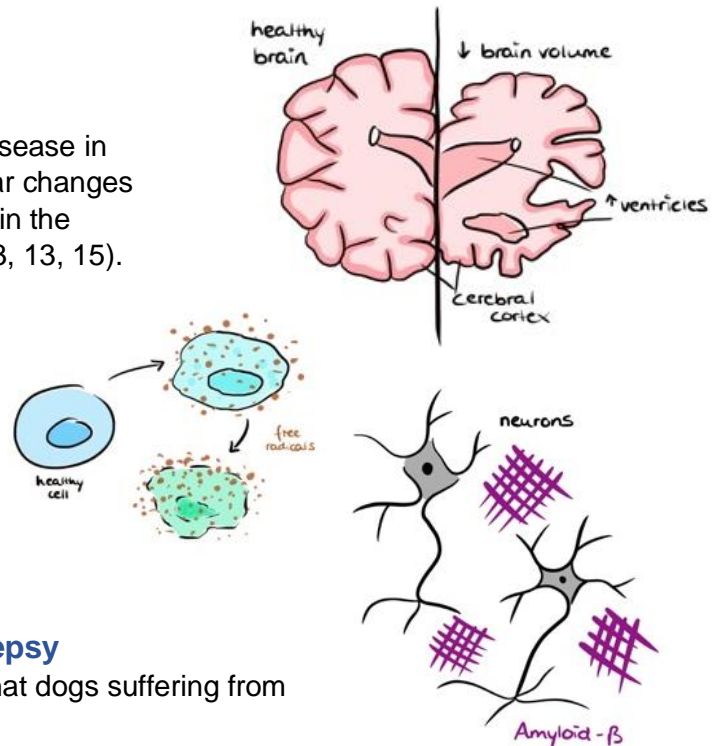
Link to EPI- CENTRUM <http://www.epicentrum.ugent.be/>

Diagnostic criteria

Clinical signs of CCD can be summarized by the acronym D.I.S.H.A.E :

Disorientation, altered **I**nteractions, changes in **S**leep-wake cycle, **H**ouse soiling, altered **A**ctivity, altered **E**motional responses).

Affected dogs usually will be presented for one or more signs of each of the categories listed below (3, 5, 10, 13-15, 18):



- **Disorientation**

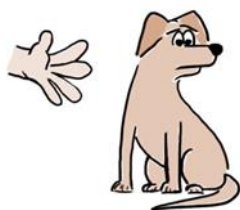
Signs of cognitive decline result in confusion and loss of orientation, e.g. standing at the wrong end of the door or getting stuck between furniture and unable to find an escape route. Signs also may include loss of day-to-day routines, such as inability to find the food bowl, or inability to recognize the route on walks. Due to the progression of the disease, signs of confusion will progress over time and negatively influence dog and owner well-being (10, 13-15).



- **Changes in social Interaction**

Changes in social interaction related to familiar humans, conspecifics or other animals, may be the ones first noted by the owners, as these signs directly affect the relationship. Signs can be seen in both dimensions, i.e., a decrease or an increase

- Signs of **decrease** in social interactions may include: e.g. distancing and withdrawal (in contrast to previous proximity and interaction), loss of play behaviour, loss of interest in social interaction that previously existed as a day-to-day routine (15, 21).



- Signs of **increase** in social interaction may include: e.g. seeking proximity with owners, following them around in a continuous way (in contrast to previous routine of resting in own basket; but also signs of panting, restlessness, pacing vocalisation as soon as owner is out of sight or out of reach (in contrast to previous relaxed behaviour when being alone) (13, 15).

- **Altered Sleep-wake rhythm**

Dogs suffering from CCD may present a reverse sleep-wake rhythm and e.g. sleep during day-time while being awake during night time (in contrast to normal sleep patterns at night in previous years).

These nightly awakenings may happen suddenly and without any apparent external trigger (e.g. no noises, no thunderstorms to explain the waking). Once awake, dogs may become restless e.g. walking around, pacing in circles or vocalising.

As dogs may be disoriented, they may get stuck between furniture in the middle of the night and whine or bark. Dogs presenting sleep disturbances will disturb owners' sleep as well and might be presented as a 'behavioural complaint' (my dog barks at night) (5, 13-15).



- **House soiling**

Loss of house training in a dog that previously was perfectly housetrained relates to the cognitive decline in dogs suffering from CCD (10, 13-15). Dogs may become unable to perform one or more steps in the process of appropriate & learned elimination: e.g.



- Awareness of urge to eliminate, but confused what to do next
- Decreased signalling towards owner about urge to eliminate
- Disoriented and confused where to go and eliminate in wrong location
- Unable to respond to owner routine of e.g. “go outside”

- **Altered Activity**

Dogs suffering from CCD may become more or less active.

- Signs of **decreased activity** include e.g. apathy, loss of interest in the environment or in social routines. Some dogs may have lost interest in toys or play (while playing previously was a favourite), some may have lost interest in walks (while previously going for a walk was their joy and pleasure) (15). Dogs may also present confusing signs: i.e. repeatedly asking to go out, but once outside behaving disorientated and confused (11).
- Signs of **increased activity** include e.g. pacing and aimless wandering. Research indicates that the more often dogs display these ‘aimless’ behaviours, the more the degree of cognitive impairment.



Dogs affected with CCD also may display repetitive behaviours i.e. related to movement (e.g. turning, circling), self-directed (i.e. licking, scratching, self-mutilation), object-directed (chewing objects, pica) (11, 15). These behaviours may repeat themselves within minutes to several hours a day and represent a major welfare issue for the affected dog (self-harm, gastro intestinal obstruction by eating objects etc.) (11).

- **Altered Emotional response**

An altered emotional response is one of the behavioural changes that has quite a strong negative impact on the dog-owner bond.

Dogs with CCD can develop fears and phobias, they can react in an exaggerated way to several (normal) stimuli and they can even become aggressive towards family members, other people or pets.



Signs of emotional disturbances may include :

- **Fears and phobic reactions towards stimuli and contexts**

while previously the dog behaved relaxed in these situations

Examples can be found in day-to-day sensory input:

- ❖ Auditory (panic when hearing the sound of the microwave),
- ❖ Vision (fearful response when watching an object),
- ❖ Odour (retreating when smelling food),
- ❖ Touch (retreating and withdrawal when touching furniture)

- **Social withdrawal or social distancing**

Aggressive reactions in contexts wherein previously the dog behaved relaxed

*Social **withdrawal** examples:*

- ❖ Auditory (**hiding** when hearing the owner coming home),
- ❖ Vision (**ducking** when watching owner getting up from chair),
- ❖ Odour (**walking away** when sniffing familiar dog / people),
- ❖ Touch (**retreating** and withdrawal when being petted)

*Social **distancing** examples:*

- ❖ Auditory (**barking**, growling when hearing owner's footsteps),
- ❖ Vision (**snapping** when watching owner getting up from chair),
- ❖ Odour (**growling** when sniffing familiar dog / people),
- ❖ Touch (snapping, **biting** when being petted)

Practical approach

STEP 1 - ANAMNESIS

What

- Thorough medical history
- Dog characteristics
- Physical Health: check different organ systems (D.A.M.N.I.T.)
- Behavioural health: check previous behavioural complaints
- Drugs: is the dog treated with any medication at the time
- Explore CONTEXT(s) wherein dog displays abnormal behaviour
 - environment: home / outside home / owners present/absent
 - resource related (food – toys – resting places)
 - interaction-related: type of interaction/human, conspecific

How

O.E.Q (Open Ended Questions) .
these are questions that cannot be answered with “yes” or “no”.
They usually start with “what”, “how”, “when”, “with whom” (e.g. “what happened, with whom did the problem occur, how did you respond?”) They also can start with: “please describe what you observed, how exactly did your dog respond?”

Open-ended-questions allow clients to tell their story and to describe their animal’s behavior. They allow the clinician to explore a case history more profoundly, to receive unbiased client answers and to build a positive client-vet relationship.

TIMELINE!

When senior dogs are presented in veterinary practice with multiple behavioural signs, it will be VERY useful to draw a timeline, indicating for **each of the “abnormal” behaviours**, when exactly the problem first occurred (puppy – adult – senior) and how it evolved over time (weeks – months – years) until recently.

Some example questions:

- **When** exactly did you notice the dog’s abnormal behaviour at first? (month – year)?
- What was the **context** wherein it happened at first (social – objects- noise)?
- How did the behaviour **evolve** over time (got better – remained the same – got worse) ?

This procedure will enable the veterinary practitioner to establish a differential diagnosis between long existing complaints that actually got worse over time, versus normal behavior(s) that changed at a certain moment in time (senior).

STEP 2 - CLINICAL EXAMINATION

OBSERVATION

What General appearance of the dog
Level of alertness, consciousness

How Observe the animal in your consultation room: exploration and locomotor behavior, attention and response to social and non-social stimuli
CAVE: a veterinary clinic may be perceived as stressful for the animal, and may influence his way of behaving (decreased or increase).
In case of doubt: request videos of the dog's behavior in a familiar environment.

PHYSICAL EXAMINATION

What Examine different organ systems (respiratory, digestive, urinary, cardiovascular, skin, musculoskeletal, endocrine, lymphatic, nervous, reproductive system)

How Examine the dog from head to tail (use a consistent method)

- Check the teeth, ears, eyes, nose → sensory decline?
- Capillary refill time
- Body conformation, symmetry, masses?
- Body Condition Score
- Muscular atrophy? Uni-/bilateral
- Palpate the lymph nodes (normal/enlarged)
- Palpation of the joints
- Does the dog show signs of pain during palpation?
- Abdominal palpation
- Lameness examination (orthopedic)
- Temperature
- Heart rate
- Respiratory rate
- Cardiac auscultation

STEP 3 - DIFFERENTIAL DIAGNOSIS

What In case history and clinical examination reveal insufficient data, continue diagnostic approach: Blood examination (hematology, biochemistry), Urine analysis (8).

How Further examination: GI, endocrine, urogenital, orthopedic, neurological screening (D.A.M.N.I.T.), use of medical imaging: RX, ultrasound (8).
IMPORTANT: In case all of the above is non-conclusive: communicate with owners → discuss medical imaging (Brain CT-SCAN or MRI)

*** Note** Clinical signs for CDS are **NOT** pathognomonic (8, 14, 17).
Signs may overlap with chronic pain or other diseases (see table below).

STEP 4 - DIAGNOSIS

Cardiovascular	unlikely – likely – most likely
Respiratory	unlikely – likely – most likely
Endocrine system	unlikely – likely – most likely
Gastro- intestinal	unlikely – likely – most likely
Urogenital	unlikely – likely – most likely
Neurological (other than CCD)	unlikely – likely – most likely
Orthopedic	unlikely – likely – most likely

INVESTIGATE / REFER TO SPECIALIST

Chronic pain unlikely – likely – **most likely**

INVESTIGATE CAUSE!!

Evolution emotional disorder over time unlikely – likely – **most likely**

BEHAVIOURAL EXAM / REFER TO SPECIALIST

Canine dementia unlikely – likely – **most likely**

SCREENING QUESTIONNAIRE CCD

STEP 5 – MEDICAL AND NUTRITIONAL TREATMENT OF CCD

DRUGS

SELEGILINE



Selegiline hydrochloride (Selgian®) is a selective irreversible inhibitor of monoamine oxidase B (MAOB) that is approved for the treatment of CCD. The drug is thought to have neuroprotective effects on dopaminergic, noradrenergic and cholinergic neurons and it possibly decreases the production of free radicals in the brain. Furthermore, scavenging enzymes such as superoxide dismutase and catalase, which help reducing free radicals, are increased (7).

Dose: 0,5-1 mg/kg

Improvement: some dogs show improvement of clinical signs within two weeks, others within two months (7).

CAVE: do not use Selegiline together with other MAO inhibitors such as **amitraz** and drugs that might **increase serotonin transmission** (SSRIs, tricyclic antidepressants, tramadol, buspirone and most narcotics). A withdrawal time of at least two weeks is suggested before starting a therapy with one of these drugs (7).

PROPENTOFYLLINE

Propentofylline (Karsivan Vet®) is a xanthine derivative that might increase brain oxygenation by improving microcirculation and inhibiting platelet aggregation as well as thrombus formation (7).

Dose: 5 mg/kg twice a day

CAVE: Avoid, if possible, the use of anticholinergic drugs in dogs with CCD (7).



NATURAL SUPPLEMENTS

SENILIFE®

Senilife® contains phosphatidylserine to facilitate neuronal transduction and enhance cholinergic transmission and Ginkgo biloba, Vitamin E, resveratrol for their antioxidant effects. It also contains Vitamin B6 which might have neuroprotective effects (7).

AKTIVAIT®

Aktivait® contains phosphatidylserine, omega-3 fatty acids, vitamins E and C, L-carnitine, alpha-lipoic acid, coenzyme Q and selenium. It has demonstrated to improve clinical signs regarding social interaction, disorientation and house soiling (7).

THERAPEUTIC DIETS

Hill's Pet Nutrition (Prescription Diet b/d Canine)
Purina Pro Plan Bright Mind
Royal Canin Canine Mature Consult

STEP 6 – QoL ASSESSMENTS IN DOGS WITH CCD

QoL CHALLENGES: IMPAIRED COGNITION LEADS TO INCREASED STRESS

- **What is cognition?**

Cognition is a specific task of the brain that helps interpretation, assimilation and memory of stimuli encountered in everyday life.

Cognitive functioning examples:

- provides **meaning** to sensory input = visual, auditory, odour and tactile
- helps the individual **rate** the information in terms of importance
- **links** the new information to already known experience
- helps the individual to **recognize** information and respond appropriately
- provides links of new information with **memory**
- helps the dog to use **stored** information within memory

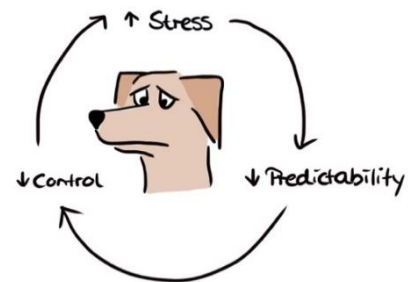
- **Importance of healthy cognition**

Thus, healthy cognitive functioning ensures that daily routines and social interactions become predictable, and that animals perceive a sense of controllability about the environment. From research, it is known that the more an environment is perceived as predictable and controllable, the more relaxed an individual can function.

Predictability and control reduce the perception of stress (12).

- **What happens in CCD?**

As dogs with CCD have a decline in cognitive functioning, they will have increasing problems to recognize and memorise their environment. Dogs with CCD gradually will perceive the environment as unpredictable and uncontrollable. In this way, CCD affected dogs will find themselves trapped in a circle of **increasing STRESS**.



STEP 7 – ENSURING QoL IN DOGS AFFECTED WITH CCD

Veterinary practices have a key role in transferring information about the impact of CCD on the dog's brain. Vets and Vet nurses can help create **owner awareness** about what happens in CCD affected dogs. In addition, vets may take the opportunity to explain that patients may develop a number of problem behaviours that negatively influence the dog's but also the family's QoL.

KEY POINTS:

Dogs with CCD may forget about day-to-day items (food, toys, resting places, doorways)

Dogs with CCD may forget routines and be confused: how to get there

Dogs with CCD need support in terms of **consistency** (no changes of routines), **repetition** and **encouragement** on how to do them, so that CCD patients experience stress reduction.

Below, some examples representing welfare and QoL challenges for dogs with CCD are mentioned, as well as tips and tricks on how the dogs' QoL can be managed and improved by the **OWNER'S intervention**:

EATING BEHAVIOUR

- QoL challenges**
- Increased food intake (polyphagia)
may lead to obesity, gastric dilatation/ volvulus
 - Decreased food intake (confusion, unable finding food bowl)
May lead to weight loss, weakness, illness
 - Pica/ ingestion of uneatable objects → vomiting, GI problems, GI obstruction
- Owner education:**
- Check if dog is able to find feeding bowl
 - Check if dog is able to ingest food easily/ regulate amounts
 - Install and repeat feeding routines on a daily base
 - Regular vet visit: Check dog's BCS on a regular base
 - If Pica: create dog-safe environment

FLUID INTAKE

- QoL challenges**
- Increased drinking (Polydipsia, stress-related) may lead to polyuria and house soiling. Drinking large amounts of fluid at once also may lead to gastric overload / torsion
 - Decreased drinking (confused, cannot find the water bowl, stares at water bowl without drinking) may lead to weakness, dehydration, compromising renal function
- Owner education**
- Polydipsia: regulate amounts – medical re-check DD pu/pd!
 - Adipsia: Check if dog is able find his water bowl (routines)
 - Medical check (Blood/ urine – systemic disease)
 - Educate owner to check hydration status of dog (skin elasticity)
 - Communicate with owner about option of iv fluids

ACTIVITY / MOBILITY

- QoL challenges**
- Increased activity (e.g. circling behaviour, constantly walking around, aimless pacing, repetitive behaviour), may lead to self-harm, getting stuck between furniture, but also may lead to inappropriate owner intervention (wanting to stop behaviour, getting angry, punishment)
 - Decreased activity (e.g. apathy, loss of interest in going out for a walk, reduced consciousness, unable to getting up, getting up but standing there confused, ...)

Owner education Increased activity: provide CCD-dog-safe environment, make sure the dog is able to move around safely.
Decreased activity: plan short activities outside, encourage dog to get up and move, reward every activity. Try to repeat daily routines, so that animal feels more secure (e.g. time of the day, route, activity)
Increased / decreased activity combined with lack of recovery = **alarm bell** ! Owner should contact vet clinic, medical update, re-check neurological state, re-check mental health (look for signs of anxiety).

RESTING PLACES

QoL challenges Unable to recognise/ orient towards resting place, wandering around without finding (confusion).
Finding resting place, but unable to relax (increased activity, increased perception of stress, evolution towards anxiety).

Owner education Make sure that the dog's resting place is easy to reach, no obstacles in the way (e.g. avoid that dog can get stuck behind furniture or objects). Educate owner to support and encourage their dog in orienting towards the resting place, and supporting the dog in resting (e.g. owner stays in proximity, owner repeats routine of resting place, owner rewards the dog for every effort).

SLEEP

QoL challenges Reverse of sleep/wake cycle: CCD affected dogs may sleep all day long, wake up at night, vocalise and wander around, thereby disturbing the owners' sleep pattern.

Owner education Increase comfort (e.g. sleeping place in proximity of owner). Establish a fixed bedtime routine: increase predictability. Use ADAPTIL® to help the dog feeling comfortable.

In case night-waking / vocalising continues = alarm bell!

Owner should contact the vet, medical update, re-check neurological state, re-check mental health (look for signs of anxiety) support of medication to improve sleep/wake cycle will be needed.

HYGIENE

QoL challenges Increased hygiene behaviour (excessive licking on body parts/objects). This may result in self-harm or in licking/ chewing fabric.
Decreased hygiene (lack of self-hygiene, dogs may smell urine/faeces).

Owner education Increased / decreased: DD painful process.
Alarm bell! owner should contact vet clinic, medical update, re-check neurological state, re-check mental health (look for signs of anxiety) , support of medication may be needed.

ELIMINATION

QoL challenges Unable to recognising/ orienting towards elimination spot, wandering around without finding place of elimination, eliminating everywhere by chance (confusion).

Owner education Make sure that the dog's elimination spot is easy to reach, no obstacles in the way (e.g. avoid that dog can get stuck behind furniture or objects).
Educate owner to support and encourage their dog in orienting towards elimination spot, and supporting dog elimination process (e.g. owner stays in proximity, owner repeats routine of elimination place, owner rewards dog for every effort).

RELATIONSHIP WITH HUMANS / CONSPECIFICS

QoL challenges Dog is responding fearful during day-to-day routines in the home (e.g. sounds, Tv, car, vacuum cleaner) or outside (cars, bikes, people, ...) jeopardising function as a family pet.
Dog withdraws or engages with conflict signalling (possibly aggression) in day-to-day routines with familiar people or pets.

Owner Education Cognitive decline will lead to loss of memory and may impair the dogs' behavioural responses to sounds, routines and social encounters.
Benign actions or sounds (e.g. closing a door, moving a chair or greeting a conspecific) may be perceived as scary by a dog with CCD.

Educate owners in providing a safer environment for their dog: teach awareness of dogs' stress signalling (meaning), avoid conflict and stressful situations, encourage to protect their dog from threatening situations, support owners to provide safety places where dog can relax, encourage owners to become observers: how did it work?

STEP 8 – QoL FOLLOW-UP

CCD is a progressive degenerative disease, so it is important to screen senior dogs at least several times a year.

For some dogs, it may be needed to present them once a month to the veterinarian, while for others three times a year may be enough. It all depends on the stage of cognitive impairment and the effect on the dog's QoL.

How to screen the evolution of CCD and how to screen QoL in dogs affected dogs?

QoL assessment and follow-up cannot be measured in exact data. Measuring QoL means balancing the observations of **good days** vs **bad days**.

The table below is a compilation of QoL scales by several authors (16, 22) and hopefully will help you educating owners.

Important: Explain to owners what they should look for!

e.g.

How does acute / chronic pain look? What can be observed?

What is normal eating behaviour? What should they look for?

What is balanced drinking? What should they look for?



MORE GOOD THAN BAD DAYS?

Draw a circle around the number that fits best: 0 = never, 10 = always

Is your dog pain-free?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Is your dog eating well?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Is your dog drinking well?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Is your dog active in a normal way?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Can your dog get up easily?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Does your dog easily find his resting place?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Does your dog sleep well at night?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Does your dog groom himself normally?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Does your dog eliminate at the appropriate places / times	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10
Is your dog's behaviour with familiar people / dogs normal?	0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

How is my dog's score today/ this week / this month for each of the QoL items ?

At the end of the week/month the good days need to outweigh the bad ones

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