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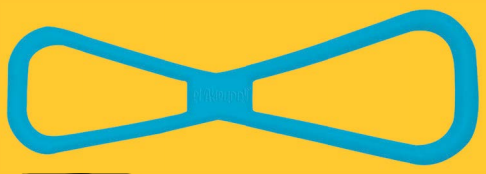

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Editor's Note

A full edition this month.

The MRI article by Dr Christelle le Roux is an excellent overview of conditions of the ear.

Warning - you will need to concentrate, so get a coffee and sit quietly to read.

Then there is that cloudy eye – is it just age? Dr Ryan has written a quick guide to assist with decision making. Our wellness articles will also resonate with many - a practical discussion from someone with on the ground experience.

At the risk of overusing the word "wellness", the rapid pace of life these days really seems to have left us more vulnerable to stress, and the fact that electronic devices make us available for work all the time puts a massive extra load on us. We cannot relax and get away from everything - it all just follows us - even if it is just one call or email a day. We need to find ways to mitigate and reduce this demand on our time and emotional energy. So switch your phones off when you can and rejuvenate with proper quiet off time.

Hope you enjoy the edition.

Liesel

vet360

VET360 aims to be a leader in the field of continuing veterinary development in Southern Africa by providing veterinary professionals from diverse disciplines with tools to help them meet the challenges of private practice. The magazine aims to make information accessible, both paper and electronic, and provide clinical, business and other veterinary information in a concise form to enable the practitioner to rapidly acquire nuggets of essential knowledge

Editor : **Liesel van der Merwe** BVSc MMedVet (Med) Small Animals
Small Animal Medicine Specialist, Department of Companion Animal Clinical Studies, University of Pretoria, South Africa

We welcome any comments, contributions, topic suggestions and letters for publication. Send them to:
The Editor, PO Box 232, GROENKLOOF, 0027
Tel: (012) 346 1590, 082 575 6479. Fax: 086 671 9907
Email: publications@vetlink.co.za

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Advertising Enquiries: AgriConnect
Ilse Liveris
Senior Commercial Consultant
072-708-4401 / ilsel@agriconnect.co.za

Illa Hugo
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082 898 3868 / sales@agriconnect.co.za

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Striving Towards Wellness: Professional Relationships

Retha Watson
(MA Industrial Psychology)

"Building strong relationships in the workplace, creates a sense of unity and shared purpose" -Unknown-

Relationships, personal or professional is the one construct which can be the point of meaning or breaking for the majority of people. As individuals we experience stressors, including relationship stressors at home which we bring to work. We also experience stressors at work, including professional relationship stressors, which we then take home with us. we do not experience the different aspects of our lives in separate boxes. Very few people are able to leave the environmental stressors where it belongs and focus on the next task completely in isolation.

In this article we will focus on professional relationships and their impact on our general well-being. Within the veterinary practice, we have regular interaction with the public, the people who are the primary caregivers of our patients; colleagues, employees and service providers. Some interactions may be intermittent and others a more regular occurrence. Some may be positive, some neutral and others emotional or stressful. A professional relationship is a more formal interaction and association between two or more people. The nature of the relationship depends on the work culture and how professional expectations are managed within that environment, for example: supportive, mentoring, service, critical or advisory. In all relationships, we also deal with various personalities and the variables of the manner in which that specific personality handles interaction, communication and conflict management. This makes navigating relationships in the workplace somewhat more complex.

Our interaction with different role-players varies according to the amount of time spent with them, the importance of the relationship and nature of the relationship.

Psychologists have identified our need to belong and be part of relationship bonds, socially as well as professionally. Positive relationships benefit us physiologically and psychologically. Oxytocin is released in our brain and is linked to trustworthiness and motivation. The brain's reward centre is activated, promoting mutual trust, respect and confidence, fostering an environment of innovation and inspiration. On the flipside in a negative relationship, the region of the brain is activated as if the person has experienced physical pain. The positive impact of balanced professional relationships is immense, according to Weziak-Białowolska, Białowolski and McNeely (2020).

Physiologically the cardiovascular, immune and neuroendocrine systems are boosted by means of a lowering in cardiovascular reactivity, stronger immune responses and improved hormonal patterns.

In the workplace there is unavoidable "forced" interaction between individuals and the fostering of positive working relationships and a supportive workplace environment results in better employee engagement, improved performance, lower staff turnover and absenteeism and less work accidents.

A few tips on how to create such an environment:

- Create an environment where colleagues can interact with each other in a social manner during work hours.
- Plan team working events, this can take the form of an informal team development session or a collective research or innovation project. Create a common objective or goal.
- Mediate conflict immediately, it does not just go away. Reduce the escalation or "simmering" of emotions as a spill-over effect into the rest of the workplace will be the result and the environment will become toxic.
- Lead by example – it is not only important that positive relationships and the space for that is created, but also to be part of that and to lead the work culture of positive social interaction.
- The positive psychology founding father Martin Seligman developed the PERMA model; five critical elements for mental wellbeing:
  - Positive emotion
  - Engagement
  - Positive relationships
  - Meaning; and
  - Accomplishment

On the other side of the coin, we have negative professional relationships. In a previous article we discussed emotion labour and how it may impact our physical and mental health. Continuously dealing with negative emotions of others and supressing it to remain professional results in the decline of our own mental and physical health.

In my years of work in suicide prevention, one of the most prevailing reasons for suicide ideation was workplace bullying. This is a phenomenon which is addressed with difficulty as the bully is usually in a position of power or there is very little evidence. More recently, I have researched the aspect of workplace abuse which has a similar prevalence to psychological domestic violence. Sometimes the one is mistaken for the other. Both phenomena prevent the victim from receiving support, both at work and at home. The victim is isolated and should receive professional psychological intervention or counselling. The resulting mental illness may cause suicide ideation and therefore intervention is very important.

Workplace Bullying

With workplace bullying the victim is isolated and in various instances ostracised by the person in the power position along with the "followers or supporters" of the bully. Regardless of what the victim produces for work objectives, it is never good enough and rarely accepted by the person in the power position. Such an employee is usually overloaded with work and important resources withheld from them to successfully complete their tasks. The victim is also under no illusion that the bully has a serious dislike for him or her for various reasons. Many times the victim is seen as a threat or outperforms the bully.

Workplace abuse

In workplace abuse the dynamics are different. The victims are usually observed by their colleagues as close to the abuser in the power position and a "favourite". The victim is also consulted and involved in various projects, meetings and objectives of the supervisor or manager. The victim has a professional relationship with the abuser, albeit dysfunctional. To the "outsiders" who envy the victim for their position, the victim is equally isolated by the rest of their peers. It is however behind closed doors and after hours that the abuse is overt. In this instance the victim is also overloaded with work on the premise that no person can do the work as well as they do. Here the victim struggles to set boundaries as their ego is soothed by the compliments and status.

The victim is called, messaged, and emailed at all hours of the night and over weekends and public holidays. Most of the communication is abusive, the victim cannot assert themselves and finds themselves in a cycle of abuse, their self-esteem at a low. The employee does not have any free time and experiences a feeling of never being allowed to relax or socialise with loved ones, when they are at home or on leave. Like domestic violence there is also a cycle in the psychological abuse. Abuse in the working environment is subtle, but the victim being so attuned to the abuser will pick up on the humiliation, sarcasm or directed jabs. The

victim will do everything in his or her power to correct the balance and may justify the behaviour of the abuser, blaming themselves for failures. Personal relationships may be sacrificed in this process.

The process of psychological workplace abuse, similar to psychological domestic violence, is depicted in Figure 1.

Figure 1: Graphic representing the phases of workplace abuse

The cycle of abuse usually starts with a neutral phase which in the beginning can be over an extended period of time. The victim is coveted and looked after, praised in front of others, the abuser is friendly towards the victim. The following phase is the building-up phase where the victim experiences the environment as "slightly off", as if they did something wrong. They become more anxious and work harder to continue the praise previously received. Work is criticised and the victim has an impending feeling of being in trouble.

The explosion phase is where the victim is overtly verbally abused and reminded of their short comings and the power of the abuser. The victim is tasked with more work and impossible targets, resulting in the victim enduring further verbal abuse.

In the remorse phase, the abuser will present the victim with gifts or spoiling at work, the abuser will be kind again and inform the victim of their value to the organisation. The remorse and neutral phase flows into each other before the cycle starts again.

Table 1: Differences in bullying and workplace psychological abuse:

Workplace Bullying	Workplace Psychological Abuse
• Victim isolated and has very little support from colleagues	• Victim observed as the right-hand person but has no support from colleagues
• Victim openly bullied	• Victim observed as celebrated but subtle abuse takes place
• No relationship between victim and bully	• Relationship is similar to Stockholm syndrome/ domestic abuse
• Results in PTSD, depression	• Results in PTSD, depression, strained home relations.
• Bullying stops when employee resigns or transfers or when bully exits organisation. Feelings of relief and optimism when bullying stops.	• Abuse will continue until abuser is exposed. • Victim will experience guilt, loss and apart from post-traumatic symptoms will enter into a grieving process.
• Silent quitting	• Victim never relaxes and continues to work harder at the cost of home life.

Our aim is to create positive relationships, an environment where each person feels safe, supported acknowledged and treated with respect. Even if we are well educated, competent, science-orientated professionals, each person does have a need to experience positive interaction and well-balanced relationships.

How do we prevent workplace abuse or bullying?

1) Develop and implement a professional relationship policy with clear boundaries on manner of address and interaction.
2) Foster an empathetic working environment where there is shared trust, camaraderie and support.
3) Align the work culture to an environment where employees and colleagues feel safe, acknowledged and valued.
4) Provide skills development training in boundary management.
5) Zero tolerance for bullying and abuse.

"If I have seen further, it is by standing on the shoulders of giants" *– Isaac Newton*

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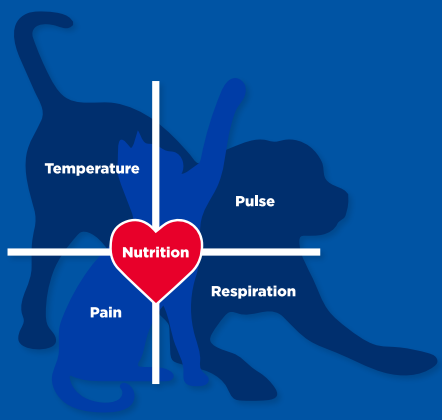


SCIENCE DID THAT.

‘Clouded by Pupil Opacities?’

Tips and Tricks on diagnosing Cataracts, and Practical Owner Advice

Dr Janine Ryan
BVSc CertVOphthal MRCVS

The general practitioner is frequently faced with assessing a ‘cloudy pupil’. An opacity within the pupil is an incidental finding or owners may present their pets as they are concerned the animal is going blind.

Being proficient and confident at evaluating the cloudy pupil will remove speculation and allow determination of prognosis. Broadly speaking, the two main differentials are cataracts and age-related nuclear sclerosis. These two conditions carry a very different prognosis. Giving owners the correct and practical advice is not only important, but also adds value to any consultation.

Below is an easy and rapid ‘on-the-spot’ assessment technique of the cloudy pupil, how to differentiate between cataracts and nuclear sclerosis, and what to tell the owners.

“I think my dog is going blind....”

The value of the ‘hands-off’ examination cannot be over emphasised. You will, within a few seconds of allowing the patient free movement in the consulting room, be able to assess its visual capability.

Visual tracking performed by dropping a cotton ball (no sound or smell and nice and bright) in front of the pet is a really easy and good tool for visual assessment before we’ve even looked at the eyes. At risk of inducing an instant ‘yawn’ response in the reader, it goes without saying that a full, well-structured ophthalmic examination should follow...

Let’s make it simple:

1. Turn the lights off - the eye consists mainly of clear media and shining a light at it in a dark room is a game changer. The most useful instrument for assessment of the anterior portion (or segment) of the eye is the otoscope head, providing both good illumination and adequate magnification.
2. Confirm if the cloudiness is in front or, behind/within the pupil. If the Cloudiness is in-front of the pupil, try your best to see if it is an opacity on the cornea or within the anterior chamber. Either way, the iris or pupil would be partially obscured. For the purpose of this article, we will focus on opacities that are behind the pupil.

“Its all in the Reflection, so take a step back...!”

You’ve confirmed the patient has a cloudy pupil. In dogs, the two main differentials are cataracts or nuclear Sclerosis. In the cat, there is a third differential for a cloudy pupil: total retinal detachment (see post script).

3. All you need to do now is take a step back and elicit a tapetal reflection with your light source. Evaluating the tapetal reflection allows us to assess the transparency of the entire posterior segment i.e. the lens and the vitreous. By shining a light in the eye from a distance you want to find that ‘sweet spot’ where you can see a reflection. The tapetal part of the fundus has a reflective layer in it, the tapetum lucid, and this is responsible for producing the reflection.

Now.....

- Compare the colour and intensity of the reflection in both eyes - this will help you decide if there is a unilateral or bilateral condition. Different coloured fundi will also give you different coloured reflections e.g siamese cats with sub-albinotic fundi and reduced pigment in the retinal pigmentary epithelium or RPE may have a red refection. Whatever the colour of the fundus, the intensity should be similar in both eyes in a normal patient.

- Compare pupil symmetry - when we are really close to the eye with a bright light, we will induce a PLR. Assessing pupil size with the tapetal reflection from a distance is the best way to assess pupil symmetry at rest. Make sure you've taken a good step back- you can even cross the room!

and lastly.....

- Look for opacities in the visual field - just as a stop-sign will create a black silhouette in front of headlights coming towards you on the road, so would a lens opacity create a silhouette as it 'blocks' the reflection coming back at you from the tapetum.

" Congratulations - you've hit the Jackpot..."

If there is a cloudy pupil on direct examination and you have an opacity within the visual field on tapetal evaluation, it's a cataract. This opacity could be anything from a single pin-point spot within the pupil/reflection to multiple spots or streaks in a variety of shapes or total obstruction of the reflection in the case of a mature cataract.

If there is a cloudy pupil on direct examination and there is no opacity in the visual field on tapetal evaluation, in other words you see an unobstructed, clear reflection, its nuclear sclerosis. Nuclear sclerosis allows light to travel through it and therefore we can, despite a slightly hazy central lens, still see a full tapetal reflection.

"What Now Doc...?"

Nuclear sclerosis is a normal, age-related change encountered in dogs over the age of eight years and cats over the age of twelve years. The lens is like planet earth in that is has a nucleus and a cortex. As we get older and more lens fibres are laid down, the nucleus becomes hardened or sclerotic. This will give older lenses a cloudy appearance. However, all but the most advanced nuclear sclerosis, allows light to pass through it.

We are able to visualise the tapetal reflection and the animal can see out through it. It is much like putting a glass through the dishwasher too many times - its cloudy, but you can still see through it!

You can confidently tell the owner there is nothing to worry about and the pet is remains visual. If you have a patient with visual deficits and nuclear sclerosis, the deficits are NOT caused by the lens and retinal and/or senile or neurological conditions need to be considered.

Primary cataracts in dogs and cats can present at ANY life stage and can be classified accordingly - congenital, juvenile, adult onset and senile. Secondary cataract can usually be linked to a prior event or condition like trauma (penetrating or blunt eye injury), diabetes mellitus, uveitis or long standing retinal degeneration e.g. PRA amongst others. Whether primary or secondary in nature, practical advice about the road ahead for both pet and owner should be given.

"How long is a piece of string...?

Generally the advice as to when to operate is once there are visual deficits. The extent of the opacity can be monitored first at a monthly, then longer time intervals. Some cataracts remain stable to end of life and do not necessarily require intervention. Others, like rapid onset diabetic cataracts, present as 'emergency cataracts', since their rapid progression can lead to lens swelling and rupture with a profound phaco-clastic lens induced uveitis.

The latter significantly increases the risk of post-operative complications. A good candidate for cataract surgery is a patient with otherwise healthy and moist eyes which has good retinal function. Generally, patients with primary cataracts have a better prognosis for surgery than secondary cataracts, except for diabetic cataracts, which carry a good prognosis. If the pet can still show a menace response , we can be confident that the eye still has good vision. If the menace is lost due to a mature cataract, the PLR can only suggest adequate retinal function and should not be interpreted as an otherwise healthy eye. In patients with PRA (Progressive Retinal Atrophy, an inherited degenerative retinal condition) for example, PLRs and dazzle can be brisk and strong despite poor retinal function! As a general rule however, if the eyes are otherwise healthy -STTs normal and good PLR and a dazzle reflex, with or without a menace response, and the pet is an adequate anaesthetic candidate, owner options should be.

1. Referral for cataract removal by Phaco-emulsification.

Practically speaking, this option would only be available to clients who can afford the surgery. Currently the cost of bilateral cataract removal with synthetic lens implantation is around ZAR 40,000.

Post operative complications

It is important to counsel the owners that cataract surgery is not without risk, especially in the dog. Whereas the surgical procedure is almost identical to that in people, the challenge is that dogs have an exaggerated intra-ocular inflammatory response post-operatively.

This inflammation can lead to potentially blinding sequelae eg. fibrinous uveitis, intractable glaucoma and retinal detachment. The 'industry standard' for post operative complications causing blindness is approximately 12% (one in eight to nine eyes). The post-operative treatment regime is therefore quite intensive and the owner must be able and available to administer four times daily drops for at least the first month and twice daily life long.

If an owner is having doubts, there is evidence based help. Based on the DIA QoL-pet survey (assessing quality of life of diabetic pets), a follow-on survey was performed assessing owner opinion following diabetic cataract removal in their pets, and whether that lead to one or both eyes being enucleated or neither. The survey showed that owners categorically would recommend cataract removal to fellow owners. Quality of life is improved not only for their pet, but indirectly for the owner as well.

2. Benign Neglect

If cataract surgery is not an option for financial or other reasons, it is extremely important to assure the owner that benign neglect is a perfectly acceptable decision. Vision is only the 3rd most important sense in our small animal patients, following far behind smell and hearing. Blind dogs and cats can lead a perfectly normal quality of life. The owners can educate themselves on living with a blind pet.

Cataracts or bilateral Blindness IS NOT a reason for euthanasia. Pets do not attach emotion to vision. Loss of sight may be confusing to the pet initially, but, and with some patience and a period of adjustment, they will continue as thought very little has changed. Patients where surgery is not an option l as those which are poor anaesthetic candidates or poor candidates for phaco-emulsification, should always be placed on life-long topical non-steroidal anti-inflammatory eye drops. This will minimise the potentially painful consequences of lens induced uveitis long-term. It is important to monitor these eyes long term for glaucoma, a common sequel to chronic lens induced uveitis.

In Summary then, owner advice should be based around the following:

- Determine if the patient appears to be a good candidate for cataract surgery.
- Discuss costs and commitment with owners early on.
- Discuss the potentially blinding complication rate. Enucleation is the outcome in most of these cases.
- Assure owners that if they opt for benign neglect, the pets can still lead a good quality life.
- Monitor this latter group long term and intervene if pain develops.

P. S. Total retinal detatchment in the cat

There is one more fairly commonly encountered cause of a cloudy pupil that warrants mentioning, especially in the geriatric cat: total retinal detachment. The condition is usually bilateral. The most common reason for this is systemic hypertension, either primary/idiopathic or secondary. The entire neuro-sensory retina can detach and can then be seen as a 'veil', suspended or 'billowing' just behind the lens (Fig 1).

The tapetal reflection will be dull and retinal vasculature can be seen within the retina. A history of acute blindness, signalment and this peculiar ocular appearance should raise suspicion.

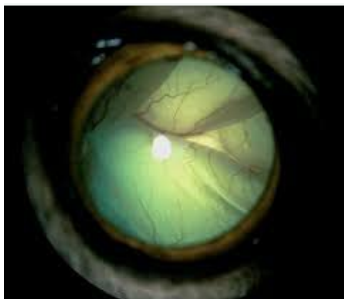
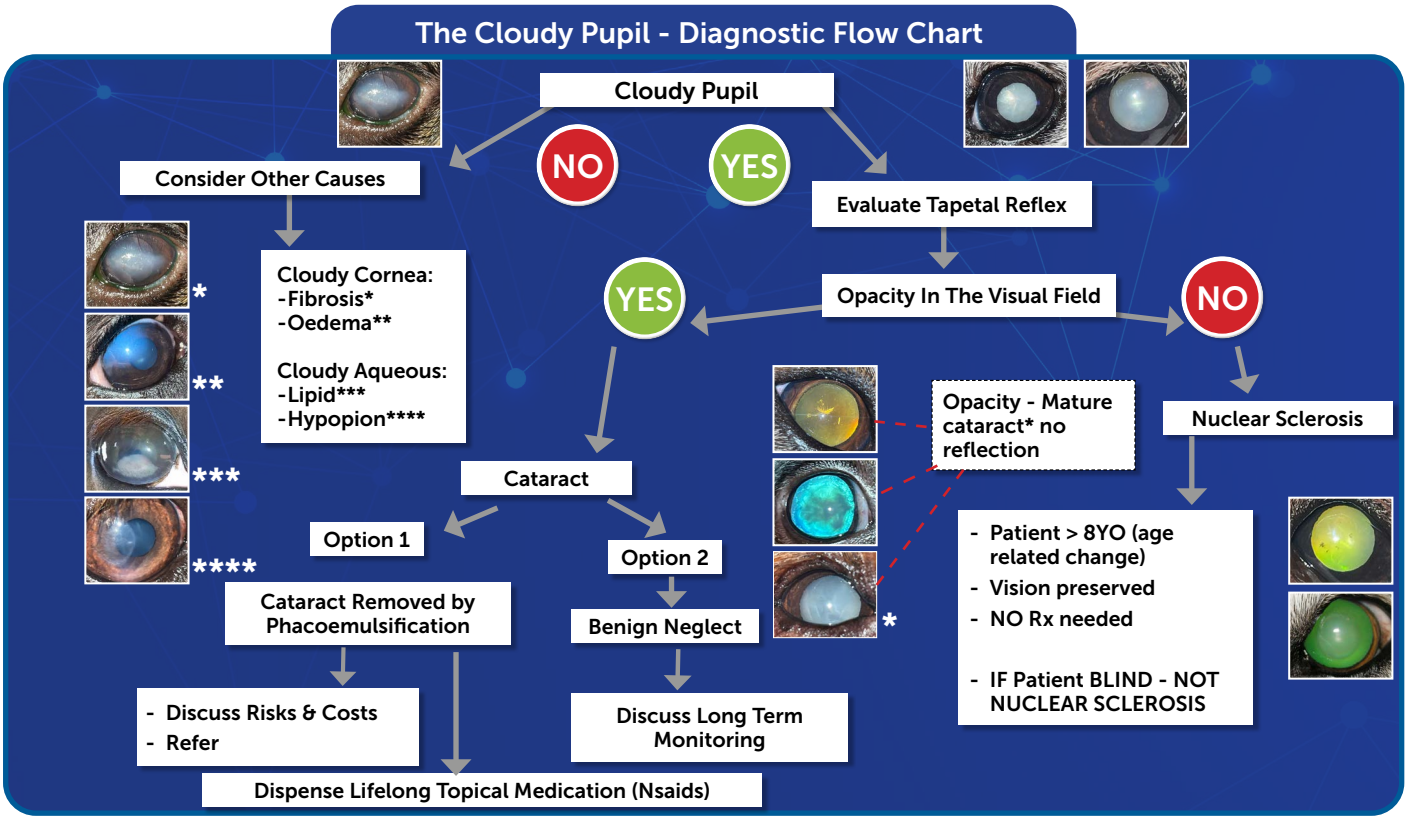


Figure 1:Total retinal detachment in a cat



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MRI of the Ears? You Heard Right!

Dr Christelle le Roux
BVSc Hons MMedVet (Diag Im) DipECVDI
Pretoria Pet MRI and Vet Imaging Specialists
www.pretoriapetmri.co.za
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Traditionally, diagnostics of the ear has been limited to a visual and otoscopic examination of the external ear with imaging of the external and middle ear being limited to radiographs (with several special projections described), ultrasound (limited utility) or contrast studies such as canalography. These methods were often not sensitive to detect subtle pathology associated with most of the ear structures and could not image the inner ear.

Computed tomography [CT] is a superior diagnostic imaging modality because, being a cross-sectional modality, it removes the anatomical superimposition associated with radiographs and is good for diagnosing otitis media and imaging of the ossicles of the middle ear and the tympanic membrane. It is especially good at separating air and bone. It however still has limitations in imaging pathology of the inner ear and the associated nerves and it also exposes the patient to radiation.

Magnetic Resonance Imaging (MRI), like CT, also eliminates the superimposition associated with radiographs and provides excellent detail of the structures of the ears, especially of soft tissue structures that other modalities, even computed tomography, cannot adequately image. These include the the facial (CN VII) and vestibulocochlear (CN VIII) cranial nerves and the fluid filled structures such as

the endolymph and perilymph in the membranous part of the inner ear (sacculus and utriculus, the semicircular ducts and the cochlear duct). MRI also provides superior imaging of the brain and does not expose the patient to radiation.

The aim of this article is not to go into the detail of MRI interpretation, sequences or machine function but to demonstrate the beauty of MRI imaging of this complex anatomical area via several case examples, to aid the practitioner in appropriate decision making for patients suffering from diseases which might benefit from advanced MR imaging of the ear and its associated structures and to identify cases where MRI may be preferable to CT.

Magnetic Resonance Imaging:

Magnetic Resonance Imaging uses an external magnet, and radiofrequency or magnetic pulses, to obtain a signal from anatomical structures that can be detected and processed. Based on the unique hydrogen composition of soft tissues, and the ability of different tissues and fluid types to respond differently to the effects of the magnet and applied pulses, images are obtained that can give detail and different "intensities". Intensity is the brightness on a grey scale, from black through different shades of grey to white) of each tissue type.

This facilitates the identification of different tissue types e.g. pure fluid, cellular or dehydrated fluid, fat, grey and white matter of the brain, haemorrhage, mineralisation, gas or bone. Multiple different sequences are obtained which are assessed together to define tissue qualities; for example T1 and T2-weighted images, where fluid displays as black on T1 and white on T2-weighted images. It is also excellent to obtain post-contrast enhanced images to further describe tissue characteristics.

Anatomy of the ear:

The ear is divided into three parts: the external (auricle and external acoustic meatus), middle (tympanic cavity and membrane, auditory ossicles, auditory tube) and internal parts (membranous and bony labyrinth) Figures 1, 2).

External ear:

The anatomy of the external ear will not be reviewed as we are more interested in that of the more difficult parts to evaluate in the canine and feline.

Middle ear:

The tympanic cavity, consisting of a dorsal epitympanic recess and a large eggshell like ventral bulla, connects the auditory tube (formerly referred to as the Eustachian tube), to the nasopharynx, and is closed laterally to the external ear canal by the tympanic membrane at the level of the external acoustic meatus. The epitympanic recess is occupied by the stapes, the malleus and the incus at their articulation. These are the three auditory ossicles that conduct vibrations of the tympanic membrane to the perilymphatic space of the inner ear. Numerous nerves cross through the tympanic cavity. The tympanic cavity typically contains gas in the normal cat and dog.

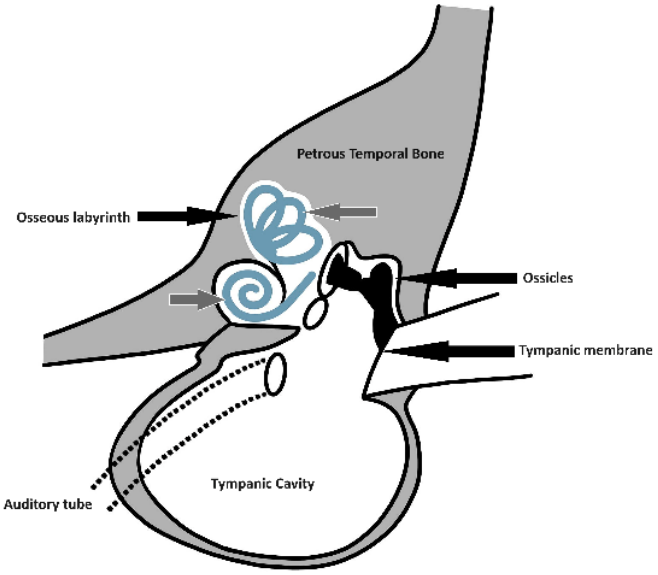

Figure 1: The basic anatomy of the middle and inner ear is depicted in this schematic drawing as it relates to relevant points in this article. The grey solid areas are of the petrous temporal bones, which houses the osseous labyrinth – these are the bony excavations, containing the membranous labyrinth [grey arrows]. In this image, the blue structures indicate specifically the semicircular ducts dorsally and the cochlear duct ventrally, housed in the semicircular canals and the cochlear canals, respectively [white areas surrounding these structures – indicated by the black arrows]. The dotted lines indicate the auditory tube draining the tympanic cavity, surrounded by the egg-shell like bulla wall. The solid black structures are the ossicles of the middle ear [malleolus, stapes and incus]. The external ear canal extends to the right of the image. Image credit A Haese.

Internal/inner ear:

The bony labyrinth of the inner ear is an excavation of the petrous temporal bone, and consists of the vestibule, the three semicircular canals, and the cochlea. These are three fluid filled compartments that are continuous with each other, each containing perilymph, which is very similar to cerebrospinal fluid. The membranous labyrinth of the inner ear consists of four fluid filled compartments, which also communicate with each other, and are housed in the osseous labyrinth described above. The compartments (sacculus and utriculus within the vestibule, the semicircular ducts within the semicircular canals, and the cochlear duct, within the bony cochlea) contain endolymph, which originates from the blood vessels and epithelium of the cochlear duct.

It is these fluids [the peri- and endolymph, in the cochlea and vestibule mainly], which MRI can so exquisitely detect in normal or abnormal cases. Both these fluids demonstrate a normal "fluid" signal on MRI, and the vestibule has a typical "duck" shape when normal, and the cochlea forms a circular shape.

Cranial nerves:

The facial and vestibulocochlear nerves enter the petrous part of the temporal bone and are enclosed in a common

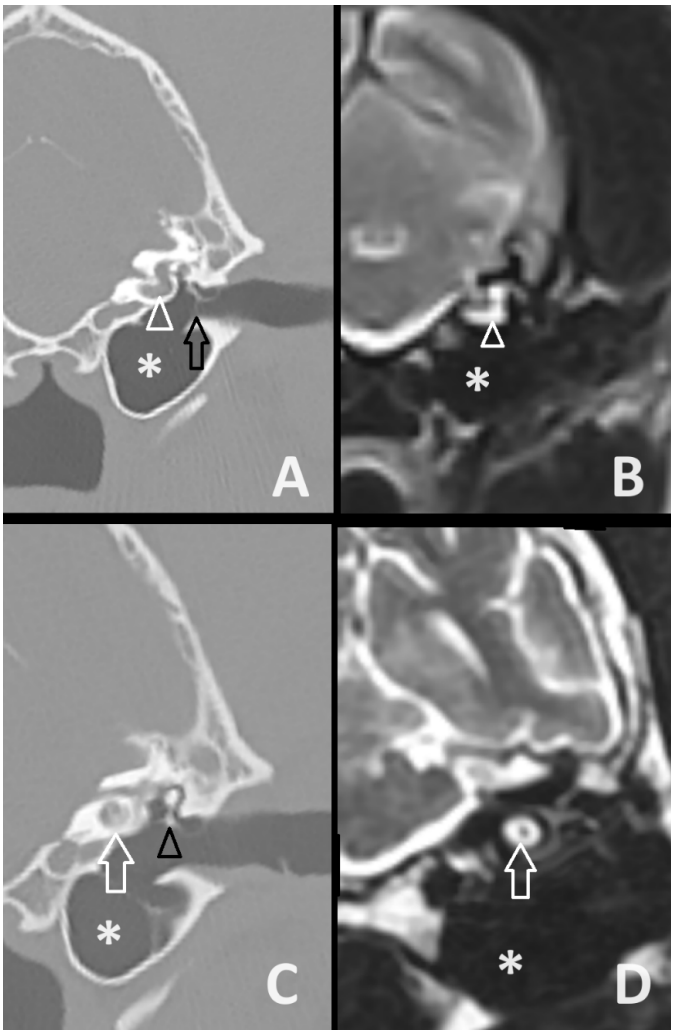

Figure 2: The top row of images are corresponding CT (A) and low field MRI (B) images of the inner ear at the level of the vestibule and base of the cochlea, which has the appearance of a duck [the vestibule is the dorsal part, and the base of the cochlea is the ventral part]. Whilst the CT is excellent at depicting the bony labyrinth, the MRI demonstrates the normal soft tissues, in this case the fluid-filled membranous labyrinth containing endolymph and perilymph (both white triangles). The black arrow indicates the tympanic membrane, which is not appreciable on the low field MRI image. The bottom row of images are corresponding CT (C) and high field MRI (D) at the level of the cochlea, which has a circular appearance (both white arrows). Again, the osseous labyrinth is better demonstrated on CT, and the membranous labyrinth on the MRI. The black triangle indicates the location of the ossicles of the inner ear (in this case, part of the malleolus). The asterisks demonstrate the gas-filled tympanic cavity on all images, of which the bony margins and gas interface is better visualized on the CT. The right of the patient is the left of the images.

dural sheath. This shared pathway extends into the proximal part of the facial nerve canal, where the nerves lie in close contact to each other. MRI can identify both these normal, whereas CT cannot.

Disease conditions of the ears and indications for MRI scanning:

The following section is a discussion on the different pathologies of the ear, with special attention to vestibular syndrome, which is a very common indication for MRI imaging of the neurocranium.

The use of MRI will be indicated for each and is also part of the included tables. It is important also to remember that there will often be a radiologist or specialist preference when considering which modality is appropriate, which can be discussed if referral for imaging is considered. There are also cases where CT and MRI may complement each other, for example to assess both bony and intracranial trauma.

1 - Otitis externa:

- MRI recommended: No.

Advanced imaging is hardly required for investigation of otitis externa, although it does a good job in demonstrating changes to the ear canals. It is more useful in chronic cases to demonstrate concurrent otitis media or interna.

2 - Otitis Media:

- MRI recommended: Variable.
- CT is usually recommended for bony/bulla assessment.

MRI can demonstrate effusion within the tympanic bulla, with contrast uptake and thickening of the bulla lining. Expansion and lysis of the bulla wall may occur with chronicity due to pressure from the contents and CT may be better suited for this assessment; although MRI can also give an idea of the composition of the bulla content (fluid, inspissated/cellular, or granulomatous/vascularized).

In some breeds, especially the Cavalier King Charles Spaniels, Cocker Spaniels and brachycephalic canines, there may be accumulation of some fluid in the bulla, unrelated to signs of ear disease. This is thought to be due to abnormal auditory tube function, possibly due to abnormal and excessive nasopharyngeal soft tissues.

3 - Vestibular Disease/Syndrome:

Vestibular disease encompasses several underlying causes and is thus not a diagnosis but refers to the constellation of typical clinical signs. It is divided into peripheral, central, and paradoxical vestibular disease.

The components making up peripheral vestibular system are in the bony and membranous labyrinths of the inner ear. Peripheral disease is identified by a head tilt and circling towards the side of the lesion, and pathological nystagmus with the fast phase away from the lesion (in a lateral direction). Postural reactions, conscious proprioception and consciousness are normal.

The components making up the central vestibular system are intracranial, and consist of vestibular nuclei in the medulla oblongata, and some projections to the cerebellar medulla and floculonodular lobe of the cerebellum. There are also projections to the spinal cord, brainstem and cerebellum.

A central location may demonstrate additional clinical findings, not present with peripheral disease, such as:

- cranial nerve deficits other than VII or VIII - deficits associated with VII or VIII alone can be seen with both peripheral and central disease, as can sympathetic dysfunction (Horner syndrome)
- any other affected nerves are typically due to brainstem involvement (cranial nerve nuclei are situated here, with possible concomitant mentation changes if the reticular activating system is affected).
- other clinical signs may include mentation changes, seizures, visual defects (cerebrothalamic pathology), intention tremors or hypermetria (cerebellar involvement) or proprioceptive deficits and paresis (lesions cortex through the thalamus and brainstem, or cerebellum, the latter without paresis)

Determining whether disease is central, or peripheral is vital clinically, and often peripheral disease does not require advanced imaging. More aggressive diagnostics such as MRI is required for central disease. However, clinical signs may not always accurately differentiate the two, and this is where imaging play a role. A study by Bongartz et al. found that the neurological examination was more efficient at identifying central lesions but less so for peripheral lesions in dogs. Thus, any patient not responding rapidly to treatment for peripheral disease, may benefit from an MRI.

Paradoxical vestibular disease occurs in a patient that presents with simultaneous postural reaction deficits that are contralateral to the direction of the head tilt, the lesion must involve the caudal cerebellar peduncle or the flocculonodular lobe of the cerebellum on the side of the body opposite that of the head tilt. It is always indicative of a central pathology; thus MRI is recommended.

I. Peripheral Vestibular Disease

- MRI recommended: Not as part of the initial patient work up, with few exceptions, and unless a poor response to treatment.

The most common causes of peripheral vestibular disease in the canine and feline are idiopathic disease and otitis media/interna.

Causes of peripheral disease are presented in Table 1 with a summary of the utility of MRI versus CT.

a. Idiopathic Vestibular disease:

- MRI recommended: No, unless poor response to treatment.

Idiopathic vestibular disease can often be negative on MRI (~45% in one study). However, facial and/or vestibulocochlear nerve enhancement after contrast administration can be demonstrated and can affected the facial nerve only, the vestibulocochlear nerve only or both nerves simultaneously, due to their common dural sheath and close proximity (Fig 3). Dogs that demonstrate contrast uptake of these nerves, are associated with a decreased likelihood of resolution of the clinical signs, for example a persistent head tilt or facial nerve dysfunction.

b. Otitis Media/Interna:

- MRI recommended: Variable and depends on preference, CT or MRI can be used to determine if surgery is indicated.

Otitis media itself will not result in clinical signs relating to the vestibular system, and vestibular signs indicate involvement of the inner ear (Fig 4, Fig 5). MRI can demonstrate contrast uptake in the membranous labyrinth, or loss of the normal signal intensity of the endo- and perilymph in this region, and possible lysis of

Table 1: Common causes of peripheral vestibular disease and the utility of MRI or CT in each

Category	Disease	MRI	CT	CT and MRI complementary
Congenital/Developmental	Congenital Vestibular Disease	X	X	N/A
Metabolic/Endocrine	Hypothyroidism	X	X	N/A
Neoplasia	Aural neoplasia, vestibular neurofibroma	**	***	N/A
Infectious/Inflammatory	Otitis media and interna Naso- or oto-pharyngeal polyps	*** **	** ***	Yes
Idiopathic	Idiopathic Vestibular Disease	***	X	N/A
Trauma	Any involvement of the inner ear	*	***	Yes
Toxic	Systemic or topical ototoxic drugs	X	X	N/A

*Key: X = Not useful, = Variable, , ** = Good, *** = Excellent, N/A = Not applicable.*

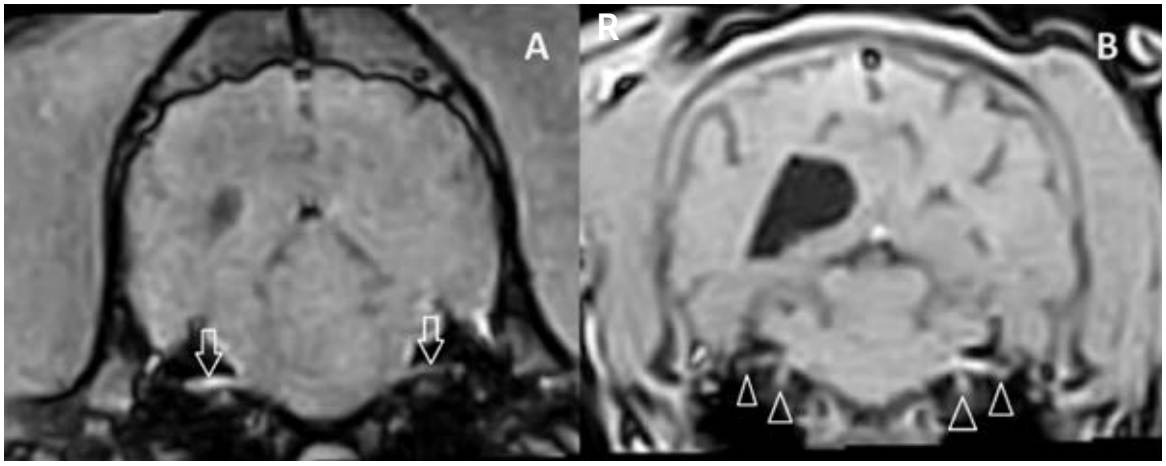

Figure 3: Transverse post-contrast SST images. The first image (A) is of a 7-year-old MN Staffordshire Bullterrier with acute onset right sided peripheral vestibular signs. The arrows indicate the facial nerves, with the right sided nerve demonstrating enlargement and enhanced contrast uptake. A diagnosis of presumed idiopathic disease was made. In (B), a 7-week-old American Bully presented for acute onset left sided peripheral disease. The triangles indicate the facial [top] and vestibulochochlear [bottom] nerves on both sides, with those on the left showing contrast uptake. A definitive diagnosis was not made. (The right of the patient is the left of the images.)

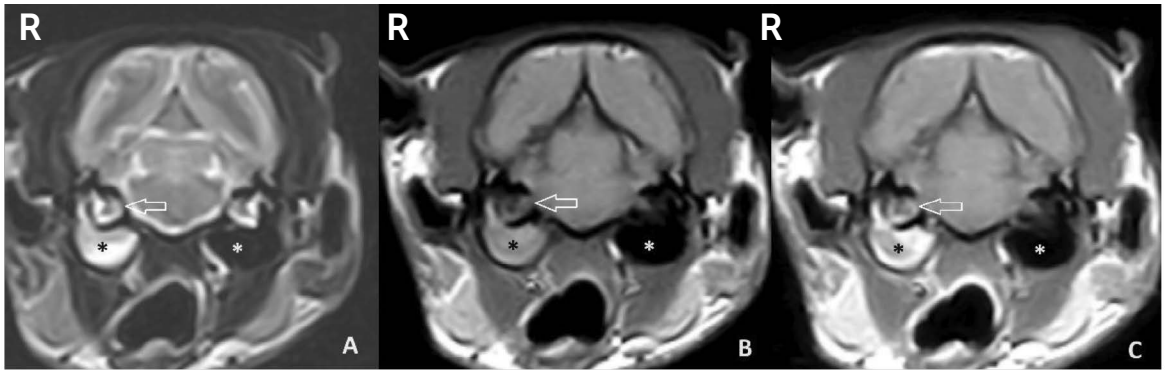

Figure 4: Transverse T2W (A), T1W pre-contrast (B) and T1W post-contrast images of a 12-year-old Burmese, with acute and progressive right sided head tilt and falling to the right side. The white arrows indicate the vestibular fluid (peri and endolymph) which is normal on the T2W images but note the contrast uptake on the last image, when compared to the pre-contrast middle image. This confirms otitis interna. The asterisk indicates the normal gas filled bulla on the left, and the content filled bulla on the right, with the last image again demonstrating a rim of contrast uptake along the bulla lining. The right of the patient is the left of the images.

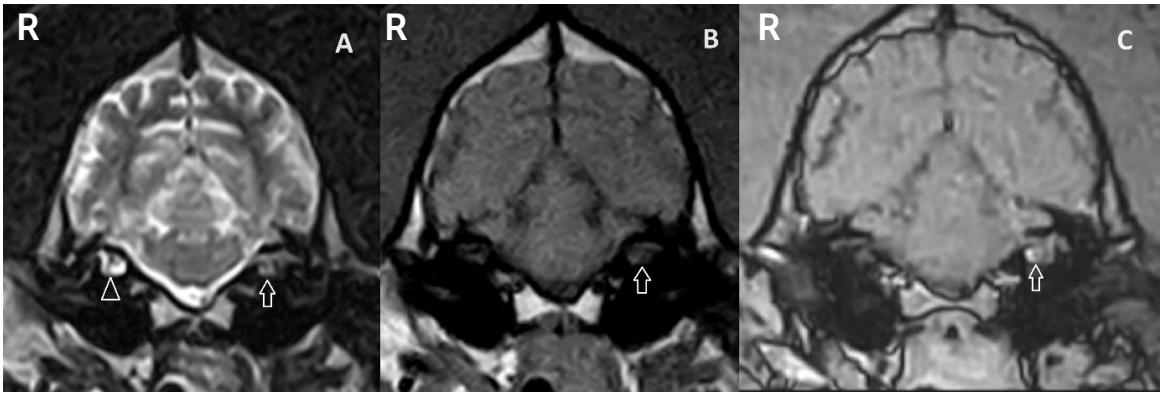

Figure 5: Transverse T2W (A), T1W pre-contrast (B) and T1W post-contrast images of a 4-year-old mixed breed with left side facial nerve paralysis and head tilt. On the first image (A) note the loss of the normal bright signal from the affected left vestibular endo/perilymph, compared to the normal right side which is bright white. The post contrast image (C) indicates contrast uptake of the ventral cochlea, best noted when compared to pre-contrast images (B). The final diagnosis was otitis interna – the patient previously had concurrent otitis media which has subsequently resolved on medical management.(The right of the patient is the left of the images.)

the osseous labyrinth and abnormal signal intensity of the petrous temporal bone.

Some breeds, without any clinical signs may have content within the bulla, as previously mentioned. Similarly, patients with trigeminal nerve dysfunction may also demonstrate fluid in the bullae, and in these cases, MRI could be useful to demonstrate trigeminal disease in the absence of otitis, as a cause for the fluid accumulation.

The mandibular branch of the trigeminal nerve innervates the tensor veli palatini muscle, which is needed to open the auditory tube, allowing drainage.

c. Endocrine/Metabolic disease:

- MRI recommended: No.

Where a patient with endocrine disease, such as hypothyroidism presents with signs of peripheral vestibular disease, it is due to myxomatous compression of the exiting cranial nerves from their skull foramina. The facial nerve is often affected concurrently.

d. Other/structural:

- MRI recommended: CT often preferable, MRI is acceptable for surgical lesion identification.

˝ *Nasopharyngeal polyps:*
Nasopharyngeal polyps are masses of granulation tissue covered by epithelium and arise from the auditory tube or middle ear but can grow into the nasopharynx. Vestibular signs may occur if there is secondary infection or inflammation of the middle or inner ear, and in some cases vestibular signs may precede the typically expected respiratory or pharyngeal signs.

˝ *Cholesteatoma (more recently reclassified as a tympanokeratoma):*
This is a nonneoplastic concretion of keratin debris, keratinizing epithelium [sebaceous material], and epidermoid cystic structure(s) that have typical CT and MRI features and is presumed to be an uncommon sequela of chronic inflammation (dogs) and can result in otitis media. Due to the cholesterol content of the mass, it typically corresponds to fat intensity on MRI sequences. It can result in significant outwards expansion of the bulla.

˝ *Aural neoplasia:*
Any type of neoplasia, such as squamous cell carcinoma, adenocarcinoma, osteosarcoma, fibrosarcoma, chondrosarcoma – can affect the peripheral vestibular system. Both CT and MRI may be useful in these cases to determine the extent of the lesion and for local invasion.

Cases where MRI is not recommended:

In congenital vestibular disease, MRI will not show any specific changes but is useful to exclude more sinister pathology and other congenital brain malformations only if there is suspicion thereof.

Toxic aetiologies, whether by topical, intravenous or inhaled routes can cause vestibular signs with a negative MRI. Several agents are implicated (antibiotics – aminoglycosides – most common, erythromycin, minocycline, topical choramphenicol, etc.), antiseptics (chlorhexidine), diuretics (furosemide), and miscellaneous other agents (salicylates, propylene glycol, cerumenolytic agents, lead, mercury, etc.)

Table 2: Common causes of central vestibular disease and the utility of MRI or CT in each (if structural changes are present).

Category	Disease	MRI	CT	CT and MRI complementary
Congenital/Developmental	Supracollicular fluid accumulations, caudal occipital malformation syndrome, hydrocephalus	***	*	N/A
Metabolic/Endocrine	Hypothyroidism	***	X	N/A
Neoplasia	Primary or metastatic intracranial neoplasia	***	*/X	N/A
Nutritional	Thiamine deficiency	***	X	N/A
Infectious/Inflammatory	Viral - Canine distemper virus, feline infectious peritonitis Bacterial - Abscess, ehrlichiosis, bartonellosis Protozoal—Toxoplasmosis, neosporosis Fungal —Cryptococcosis, blastomycosis, many others Non-infectious meningoencephalitides (meningoencephalitis of unknown origin/MUO) – such as granulomatous meningoencephalitis, necrotizing meningoencephalitides	***	*/X	N/A
Trauma	Any involvement of the inner ear	**	***	Yes
Toxic	Systemic or topical ototoxic drugs	X	X	N/A
Vascular	Cerebrovascular disease i.e. ischaemic infarction	***	*/X	N/A

*Key: X - Not useful, * = Variable, ** = Good, *** = Excellent, N/A = Not applicable.*

Traumatic causes for vestibular disease may better be assessed with CT, or a combination of CT and MRI as these may be complementary to assess bony and neurological structures.

Ii - Central Vestibular Disease:

- MRI recommended: Yes.

The most common causes of central vestibular disease in the feline are inflammatory or infectious conditions, including intracranial spread from otogenic disease, neoplasia, and vascular disease. The canine patient follows a similar order, but with meningoencephalitis of unknown origin (MUO) being a common inflammatory disease in this species, followed by neoplasia and infarcts.

MRI is the ideal modality to assess the myriad of causes of central vestibular disease, such as intracranial neoplasia, ischaemic events, nutritional deficiencies, infections or non-infectious inflammatory diseases/ meningoencephalitis of unknown origin (MUO). Please see Table 2 for a summary.

Intracranial malformation such as arachnoid diverticula or Chiari-like malformation, can be detected with MRI. Non-neoplastic causes such as epidermoid cysts, dermoid cysts, and teratomas are also amenable to MRI. Otogenic spread of otitis (Figure 6) though the internal acoustic meatus, into the cranium is also best detected with MRI, and can result in intra-cranial abscesses of localized meningoencephalitis.

Primary infectious or non-infectious meningoencephalitis (Figure 7) can involve the central vestibular system and may result in vestibular signs as the predominant clinical signs, versus multifocal intracranial signs.

Neoplastic disease affecting the central vestibular system depends on the location of the mass and include those commonly found at the cerebellar pontine angle, such as malignant peripheral nerve sheath tumours of the trigeminal nerve, meningiomas, choroid plexus tumours, or ependymomas(Figure 8).

Meningiomas, gliomas, round cell tumours, and metastatic disease involving the cerebellum (flocculonodular lobe), or brainstem vestibular nuclei can also result in vestibular signs. Any mass resulting in secondary compression of components of the vestibular system can result in clinical signs. MRI is the gold standard imaging modality for detection of intracranial neoplasia.

CT poses difficulties in imaging the region of the temporal bones and associated brain parenchyma, due to artefacts ["beam hardening"] which is common for this region.

Endocrine causes, such as hypothyroidism, may not show primary changes in the vestibular tracts intracranially, but potentially secondary concurrent changes. Hypothyroidism can result in the formation of atherosclerosis, leading to vascular thrombosis which may well be detected on MRI, as well as CNS demyelination. These are not specific findings and diagnosis will still depend on demonstration of abnormal thyroid testing.

Ischaemic infarction (Figure 9) of the medullary components of the central vestibular system and the vestibulocerebllum, unrelated to hypothyroidism, can result in acute-onset, focal, nonprogressive central and paradoxical vestibular signs and there are several MRI sequences [e.g. diffusion weighting] that can be utilized that are sensitive to detect early signs of this.

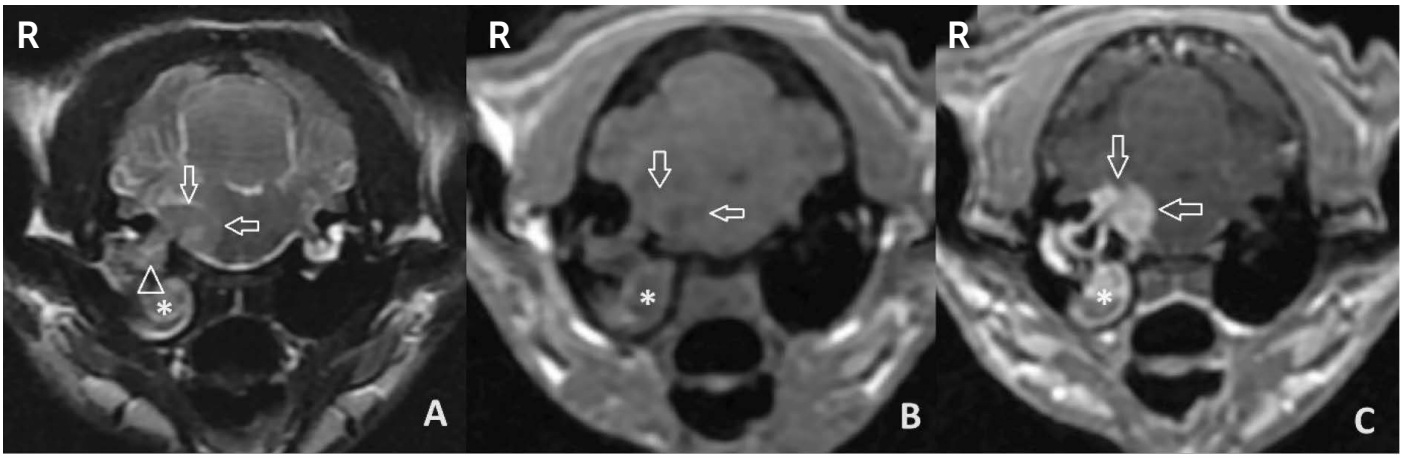

Figure 6: Transverse T2W (A), T1W pre-contrast (B) and T1W post-contrast images of a 2-year-old Russian Blue presenting with otitis and a head tilt to the right. The triangle indicates the complete loss of the normal bright signal from the abnormal right vestibule if the inner ear, and the white arrows indicate a contrast enhancing mass within the cranium, consistent with otogenic spread from otitis media/interna – the asterisk indicates the abnormal bulla content with contrast uptake on the last image. The right of the patient is the left of the images.

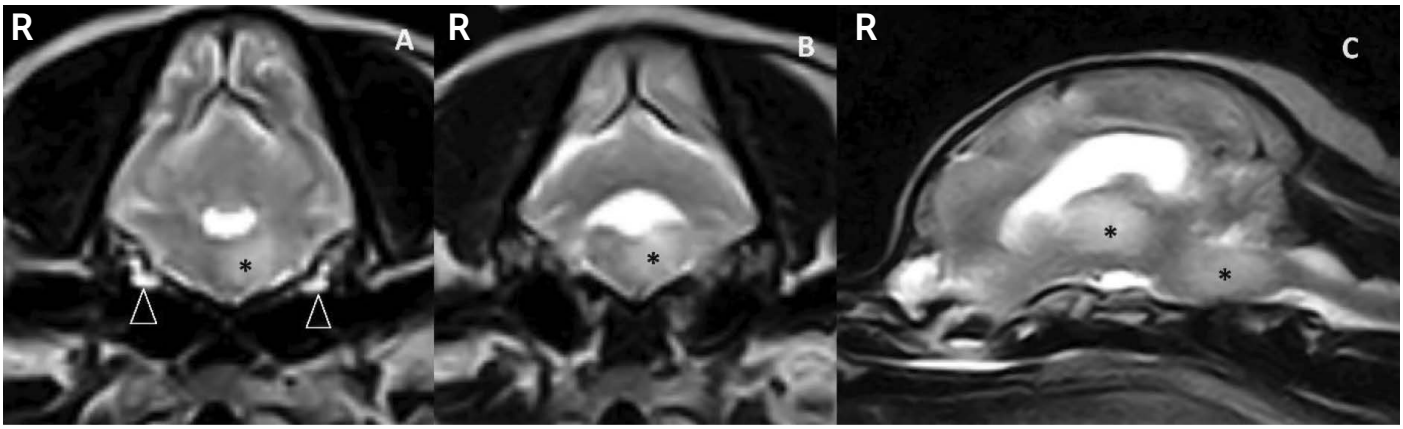

Figure 7: Transverse (A, B) and sagittal (C) images of a 10-year-old Shi Tzu, with signs of hyporexia and reluctance to walk, progressed to an inability to stand or walk, with severe left sided head-tilt. The triangles indicate the normal "bright" vestibule, and the asterisk indicates multifocal regions of increased signal (bright lesions) mainly affecting the left brainstem (transverse images) as well as the thalamus (sagittal image). The main differential was meningitis of unknown origin/MUO. The right of the patient is the left of the images.

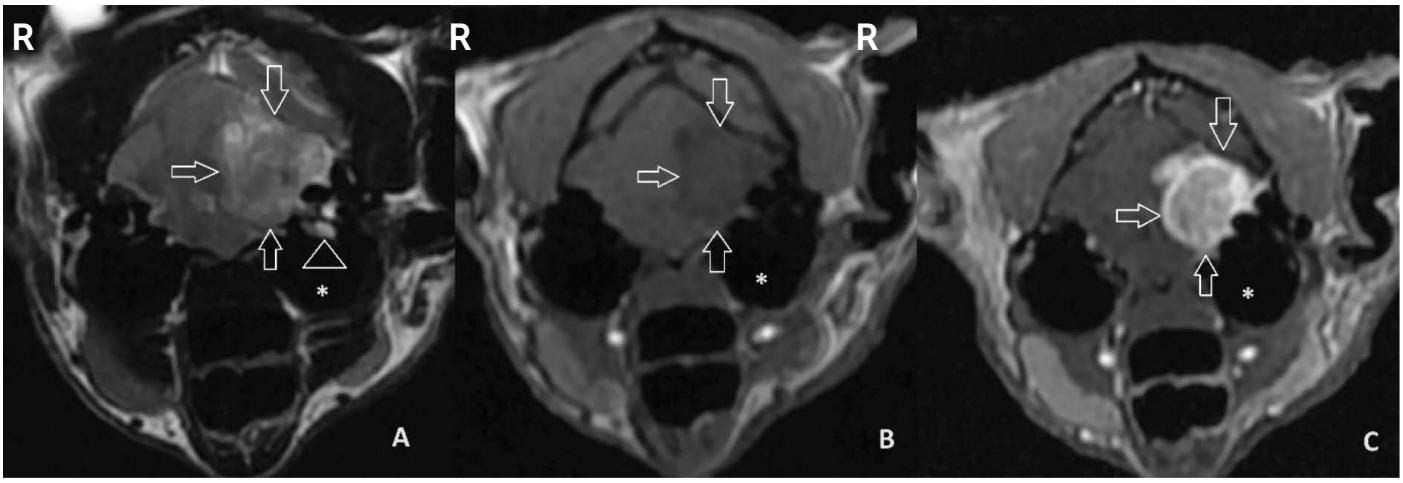

Figure 8: Transverse T2W (A), T1W pre-contrast (B) and T1W post-contrast images of a 6-year-old Maine Coon with acute-onset progressive left-sided head tilt and central vestibular signs. The triangle indicates the vestibule of the inner ear, and the white arrows indicate a heterogenous mass, which on the last image indicates significant contrast uptake. The findings were consistent with a meningioma. The right of the patient is the left of the images.

Nutritional disease such as thiamine deficiency (vitamin B1) present with well described MRI lesions in canines and felines, with very specific brain regions typically affected and showing bilateral symmetrical changes.

Signs include that of central vestibular disease in addition to cerebrothalamic signs (mental dullness, seizures) and postural changes, cervical ventroflexion (in cats in particular), and paraparesis in dogs.

Cats are more commonly affected than dogs and signs can progress rapidly.

Metronidazole and ronidazole toxicity demonstrate well described MRI features in man, but limited cases in companion animals – in these cases, history will guide the practitioner and MRI is not likely to be needed.

Summary - If considering advanced imaging, when should I choose MRI over CT?

If you are concerned about primarily osseous disease [such as neoplasia, especially bony or of the ear canal], chronic otitis externa and media with osseous bulla remodeling, or the integrity of the tympanic membrane, then CT is typically the preferred modality.

Any bony or soft tissue malformations may also benefit from CT, as determining the origin of the malformation might be easier with this modality.

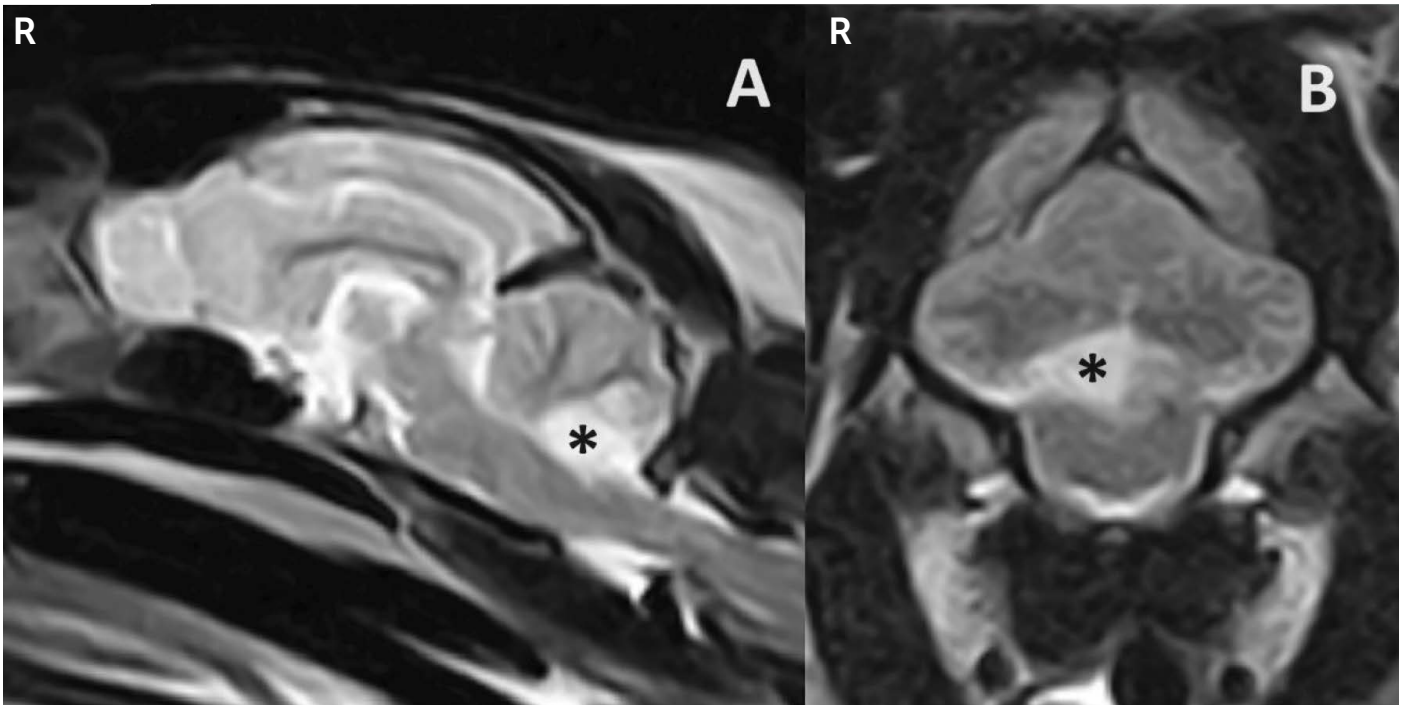

Figure 9: Sagittal (A) and transverse (B) T2W images of an 11-year-old Main Coon found collapsed with absent conscious proprioception in all 4 limbs, unable to stand and rolling. The asterisk indices a region of hyperintensity (bright signs) on the images affecting the caudal and ventral right cerebellum, most consistent with an ischaemic infarct. The right of the patient is the left of the images.

CT may also be more beneficial in trauma cases, although MRI is complementary depending on intracranial involvement suspected.

Any suspicion of brain or cranial nerve involvement, for example, intracranial/otogenic spread from otitis, or central vestibular disease, is better demonstrated with MRI than CT []. Any patient presenting with progressive clinical signs, or signs that do not respond as expected to supportive and symptomatic treatment, may benefit from MRI.

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1 Which ONE of the following statements regarding the use of MRI versus CT is TRUE:
a. MRI is the best modality to assess the osseous labyrinth.
b. MRI can demonstrate the cranial nerves.
c. MRI exposes the patient to radiation.
d. MRI is the better modality needed to investigate the tympanic membrane.
e. MRI is just as good at demonstrating brain lesions as CT is.

2 Which ONE of the following structures of the vestibular system is typically better assessed with CT?
a. The ossicles of the inner ear
b. The vestibular nucleus
c. The flocculonodular lobe
d. The perilymph
e. The epithelial lining of the tympanic bulla.

3 With regards to contents or fluids within the tympanic cavity/bullae, which ONE of the following statements is true:
a. It is always associated with vestibular dysfunction.
b. It can occur in certain breeds due to abnormal auditory tube function and found incidentally on MRI.
c. CT can assist in diagnosing concurrent otitis interna because it can assess the soft tissues in the inner ear.
d. Abnormal contents always result in expansion and lysis of the bulla walls.
e. MRI is better than CT to assess the osseous bulla wall.

4 Which ONE of the following statements used to complete the following sentence is false – "MRI is usually not needed as part of the initial workup for peripheral vestibular disease because: ..."
a. Clinical signs often respond rapidly to symptomatic and supportive treatment.
b. Abnormalities may not always be present on MRI.
c. Radiographs can adequately assess all affected structures.
d. MRI is an expensive modality with long imaging times.
e. CT is the better imaging modality in these cases.

5 In MRI scans in cases of idiopathic peripheral vestibular disease, which ONE finding do we NOT expect to see?
a. Contrast uptake of the vestibulocochlear nerve.
b. Contrast uptake of the facial nerve.
c. A normal MRI study.
d. Contrast uptake of both the facial and vestibulocochlear nerves.
e. Contrast uptake of the vestibular nucleus.

6 Which ONE of the following causes of central vestibular disease in dogs and cats cannot reliably be seen on MRI?
a. Thiamine deficiency
b. Meningioma
c. Intracranial abscess
d. A traumatic fracture of the petrous temporal bone
e. Metronidazole toxicity

7 In cases of hypothyroidism associated vestibular disease which ONE of the following statements is CORRECT?
a. You will always see contrast enhancing compressed nerves on MRI in cases of peripheral vestibular signs.
b. You always need to perform MRI as part of the workup for vestibular signs.
c. MRI may demonstrate secondary changes such as ischaemic infarction in cases with central vestibular signs.
d. It is the second most common cause of canine peripheral vestibular disease.
e. MRI shows typically bilaterally symmetrical lesions in very specific parts of the brain.

8 Which ONE of the clinical signs below , when associated with vestibular disease and, would you consider referring for an MRI as part of the immediate initial work up?
a. Conscious proprioception deficits of the thoracic limbs
b. Facial nerve dysfunction
c. Horizontal nystagmus
d. Vomiting
e. Head tilt

9 Why do cases of paradoxical vestibular syndrome require an MRI? Choose ONE of the options below.
a. The lesion is in the cerebellum.
b. The lesion affects the facial nerve because it shares a common dural sheath with the vestibulocochlear nerve.
c. It indicates that the otitis media lesion is opposite to the side of the head tilt.
d. Cases only require MRI if not rapidly responding to symptomatic treatment.
e. CT is the preferred modality in these cases.

10 There are conditions or clinical signs of vestibular disease for which MRI is useful in the work-up, and some of these are listed below. Which ONE of the following is TRUE ?
a. Otitis externa resulting in ear scratching
b. Aminoglycoside toxicity resulting in vestibular signs
c. Congenital vestibular disease resulting in vestibular signs
d. Mental dullness and vestibular signs
e. Endocrine disease

What's New in Mitral Valve Disease

Myxomatous mitral valve disease (MMVD; also known as endocardiosis and degenerative or chronic valvular heart disease) is the most common cardiac condition in dogs, with a higher incidence in male, small breeds and older dogs.

According to the 2019 American College of Veterinary Internal Medicine (ACVIM) consensus guidelines for the diagnosis and treatment of myxomatous mitral valve disease in dogs, 10% of dogs present to primary care veterinary hospitals with heart disease and of those, approximately 75% (more than 4.5 million dogs) have MMVD.

Progression of the disease is typically slow but certain breeds are predisposed to rapid progression and a poorer prognosis.

Besides a thorough physical examination, radiographs should be the first diagnostic step in suspected MMVD cases. As these dogs often have concurrent tracheobronchial disease, baseline radiographs are ideal to differentiate future cardiac from non-cardiac aetiologies of coughing.

Additionally, pulmonary oedema associated with congestive heart failure (CHF) is a radiographic diagnosis.

Parameters to evaluate :

- Vertebral heart score (VHS) and/or vertebral left atrial size (VLAS)
- Baseline and serial blood pressure
- Echocardiography
  - LA: Ao
  - LVIDDn
- Baseline laboratory tests, at least PCV, TP, creatinine, BUN, electrolytes, urine specific gravity
- Resting respiratory rate

One consequence of MMVD is activation of the renin-angiotensin-aldosterone system (RAAS). The RAAS is a mechanism to detect and adjust for changes in body homeostasis.

In situations where blood loss or dehydration occurs, the kidneys detect decreased perfusion and release renin, thus beginning the cascade that causes vasoconstriction and retention of sodium and water.

These systems expand blood volume and maintain organ perfusion. When the hypovolemia is controlled, the cascade is deactivated.

- Short-term, the RAAS activation is advantageous.
- Long-term, chronic, unchecked activation of the RAAS occurs with MMVD due to decreased cardiac output. Effects of chronic activation of the RAAS system are vasoconstriction and volume expansion. These negative effects include chronic vasoconstriction which leads to raised arterial pressures, increased afterload which further compromises systolic function, and limits perfusion of smaller arterioles. Sodium and water retention as well as cardiac remodeling are also associated with chronic RAAS activation (Fig 1).

Due to decreased cardiac output, renin is released from the kidneys. Renin cleaves a piece off angiotensinogen to create angiotensin I. Angiotensin converting enzyme (ACE) converts angiotensin I to angiotensin II. Angiotensin II causes the adrenal glands to release aldosterone, norepinephrine, and epinephrine. Angiotensin II bind with the AT1 and AT2 receptors in the vessel walls and, along with norepinephrine and epinephrine, cause vasoconstriction. Aldosterone causes retention of sodium and water at the nephron to expand blood volume.

While this can be lifesaving in cases of acute blood loss, it contributes to pulmonary congestion in the MMVD patient. Aldosterone and angiotensin II excess contribute to cardiac muscle remodeling or fibrosis. This fibrosis

causes stiffening and dysfunction of the cardiac muscle which further contributes to decreased cardiac output and arrhythmias in the MMVD patient. For these reasons, suppression of RAAS is a key strategy in the management of canine cardiovascular disease. Angiotensin converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), and mineralocorticoid receptor antagonists (MRAs) are all used to suppress the effects of RAAS.

Andrea C. Lantis et al (2011) has shown that, because furosemide, both when administered alone and in combination with pimobendan, has been shown to activate the RAAS, its use as a sole agent or with pimobendan alone is not appropriate. When loop diuretics are used for CHF treatment, mitigation of the RAAS cascade with ACEIs, ARBs, and MRAs is necessary.

Now well accepted as a human and canine phenomenon, the concept of aldosterone breakthrough (ABT) was first described by Bertram Pitt in 1995. ABT is the condition in which ACEIs and/or ARBs fail to fully suppress the activity of the RAAS. In one study, MK Ames et al (2017), ABT occurred in approximately 30% of dogs (32% which were in CHF and 30% not in CHF) despite ACEI administration. This phenomenon is the reason spironolactone, a mineralocorticoid receptor antagonist (MRA), is recommended to augment the traditional triple-therapy approach to CHF management in dogs. Published in 2019, the revised ACVIM consensus guidelines (Fig 2) for the diagnosis and treatment of MMVD in dogs contains updates to the diagnostic, medical, surgical, and dietary treatment recommendations which were last published in 2009. The significant recommendation updates include the use of a positive inotrope in stage B2 and the addition of spironolactone to CHF management in stages C and D. Rather than the traditional use of triple-therapy (furosemide, ACEI, pimobendan) for the CHF patient, a quad-therapy approach (furosemide, ACEI, pimobendan, spironolactone) is now recommended. It is important to check renal function to avoid compromise due to volume depletion.

Treatment Criteria and thresholds (Figs 1 - 3):

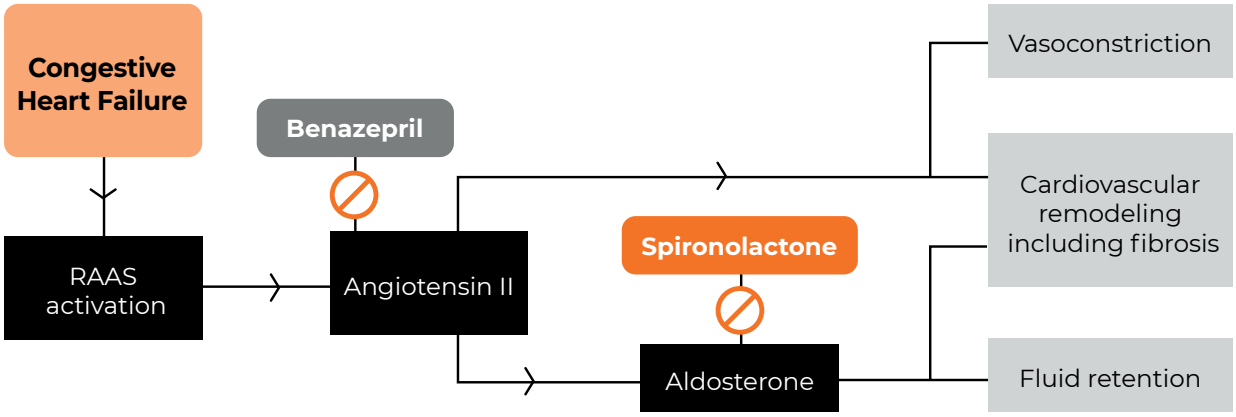


Figure 1: Schematic representation of the activation and consequences of the RAAS system and areas where medical intervention can be of benefit

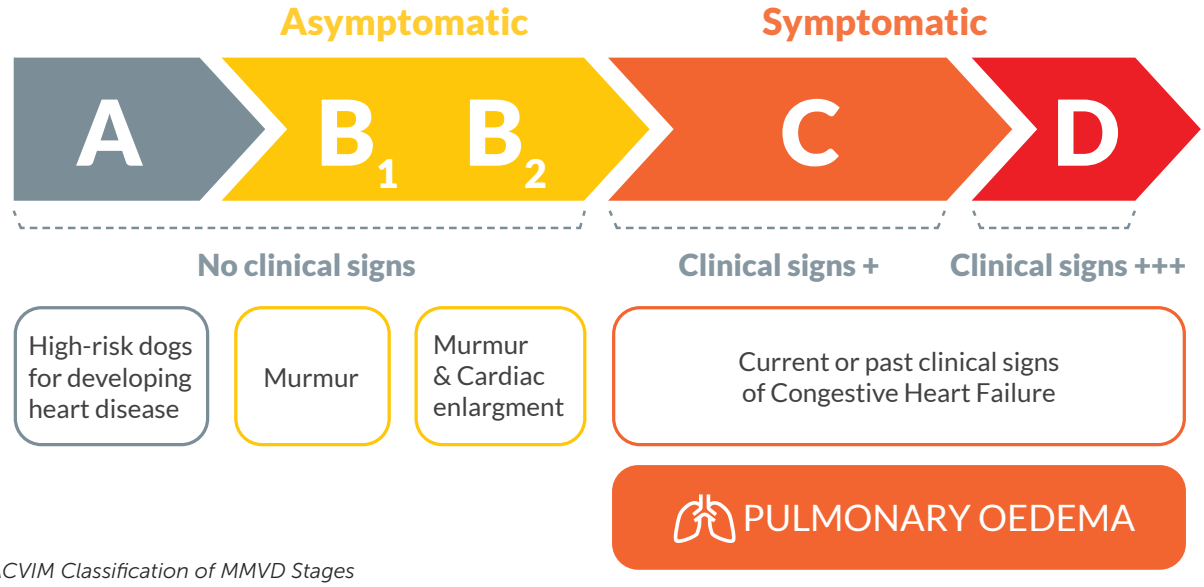
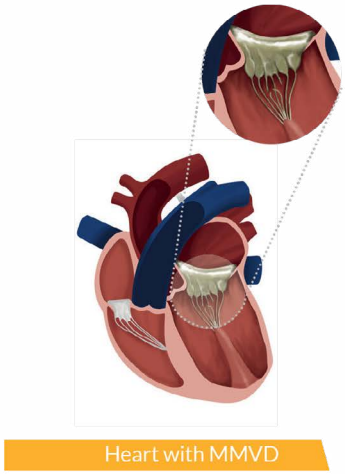


Figure 2: ACVIM Classification of MMVD Stages



Heart with MMVD

Compensated phase

› No clinical signs
› Cardioremodeling incl. enlargement detected by radiograph or echocardiography

Examinations

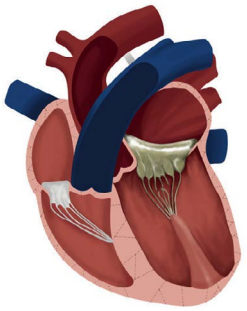
Criteria to be met before treatment initiation:

› Auscultation: Murmur ≥ 3/6
› Echocardiography:
- LA/Ao ≥ 1.6
- LVIDDn ≥ 1.7

› Thoracic radiograph
- VHS > 10.5
- If no echo available: VHS ≥ 11.5

› Blood pressure measurement

Figure 3 (a): Compensated MMVD and deciding on when and how to treat MMVD.



Decompensated phase

› Current or past clinical signs of left-sided Congestive Heart Failure:
- *Tachypnea*
- *Activity intolerance*
- *Respiratory distress*
- *Cough*

Examinations

› Auscultation
› Thoracic radiograph
› Echocardiography
› Blood testing *incl. Serum total protein, Creatinine, BUN & electrolytes concentrations*
› Serum NT-proBNP
› Blood pressure measurement

Figure 3 (b): Stage C en Stage D

Stage B2

- **Pimobendan**

Stage C

- **Furosemide up to 8mg/kg/day**
- **ACEi**
- **Spironolactone**
- **Pimobendan**

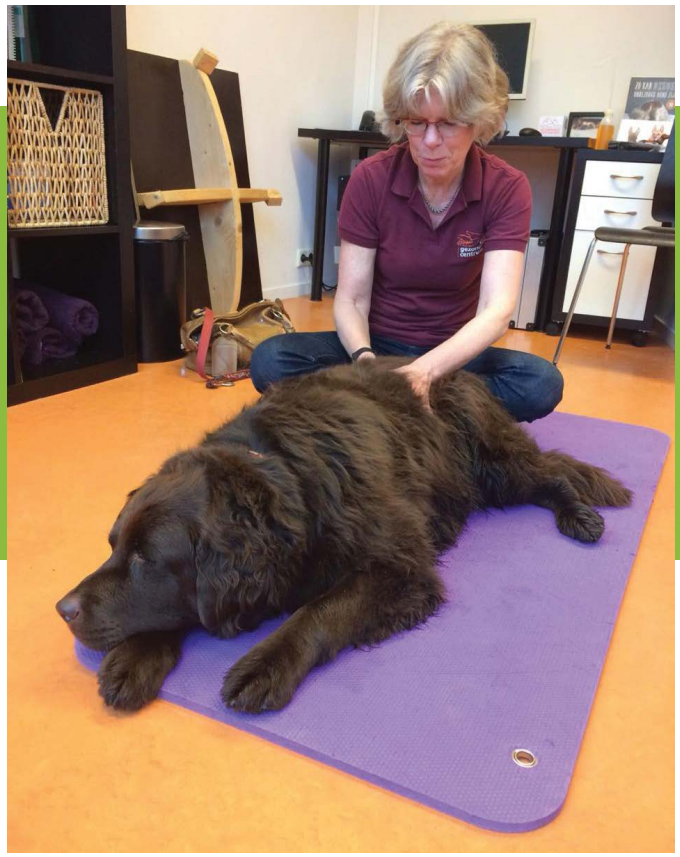
Stage D

- **Furosemide >8mg / kg/day or torsemide >0.4mg/kg/day**
- **ACEi**
- **Spironolactone**
- **Pimobendan**

Figure 4: Treatment Recommendations for MMVD stages

References available on request

Physiotherapy for Back Issues



May Römer-Bartels
Animal physiotherapist

Introduction

According to data from CBS (Statistics Netherlands) in March 2013, between 2008 and 2011, 8.7% of the Dutch population reported having a chronic back condition. Additionally, research indicates that the back of a quadruped can be a valuable model for studying the human spine. Thus, comparing the incidence of back problems in people and dogs is quite relevant. However, in first-line veterinary practice, the back-assesment of dogs is often not thoroughly examined. Just like in people, back pain in dogs is not always visible. It is worthwhile to add a simple back test to the standard physical examination, especially if there is any degree of lameness.

Another reason to focus more on the back is prevention. When a dog is diagnosed with a back condition, everything possible is done to address it. However, once the acute phase is over, care for the dog and its back often diminishes. The same is true for dogs in risk groups; relatively little attention is given to prevention there as well. In (animal) physiotherapy, prevention is a key component and involves more than just advice. Dog owners could benefit from movement advice and home exercises to prevent (recurrence of) back issues in their dogs.

The purpose of this piece is to highlight back conditions that may present less dramatically than a herniated disc with neurological deficits but still affect a dog's quality of life.

The Conditions

The most commonly diagnosed back conditions in dogs are herniated discs in various degrees, spondylosis, and lumbosacral instability. These conditions are frequently discussed at veterinary conferences. However, the role of animal physiotherapy is often under emphasised. Although physiotherapy cannot cure these conditions, it can certainly provide support.

Less frequently diagnosed but still common are vertebral subluxations of the vertebrae. The muscles most affected by vertebral subluxations are the multifidus muscles, which are key segmental stabilizers of the spine. Changes in the alignment or mobility of two vertebrae can cause over-stimulation of the multifidus muscles and the facet joint capsule, which the dog experiences as back pain.

When the dog moves, the alignment of the vertebrae will also be affected by the muscles attached to these vertebrae that control the flexion and extension of the shoulder and hip joints. This additional stimulation can lead to pain-avoidant behavior, causing the dog to walk with a limp.

Such lameness can be continuous or intermittent, sometimes alternating between left and right. Examination of the peripheral joints usually yields no or insufficient findings, and X-rays may show no or minimal abnormalities. Rest helps only temporarily, and painkillers are insufficient as the cause of the lameness—the subluxation—remains. Over time, the body may adapt to the altered alignment, and the lameness will only occur with increased load, but back pain may persist to some degree. Secondary issues may also arise as the dog adjusts its gait to walk as pain-free as possible.

The Examination

Detecting a suspected subluxation is relatively easy to learn. Manual examination, possibly combined with X-ray diagnostics to rule out contraindications, can ensure effective referral. Examining the back can be done in a few seconds. First, the flat hand is used to check if the back yields to light pressure. The dog's age and breed are considered when assessing the quality of the findings. Then, with light pressure applied to each vertebra, mobility in the dorsoventral direction is checked. Signs of pain, such as skin pulling or flinching away from pressure, combined with a stiff feeling at the specific level, should raise alarm. Additional X-ray examination can reveal anatomical changes in the back. If no such changes are found, a vertebral subluxation is likely, especially if there is a trauma in the history. This trauma doesn't always need to be recent; it can also be from a slightly rough play, an unexpected collision with another dog, or a poorly aimed jump. Often, such trauma is a common household issue. Despite puppies being quite elastic, such trauma can occur even in their early months if the back is not protected by an efficient muscle corset.

The Treatment

Strictly speaking, "treatment" does not exist as a one-size-fits-all solution. Each case is unique. As mentioned earlier, many conditions cannot be cured by physiotherapy, but pain can be alleviated. Physiotherapy focuses on treatable aspects identified during the assesment, such as pain, altered muscle tone, loss of strength, or mobility restrictions. Goals are set for each case and addressed in sequence. Treatment may include massage, exercise therapy, hydrotherapy, or electrophysical modalities,, often in combination. This is complemented by advice for daily activities and usually involves home exercises for the owner. The home environment is also reviewed to eliminate factors that could increase the load on the back. For example, if a dog has to jump in and out of the car every day, using a ramp or step might be advised. Once a treatment plan is established and treatments have begun, noticeable progress should be evident within 3 or 4 sessions. If not, the treatment plan will be revised if possible, or treatment will be discontinued.

Manipulations are needed to treat minimal vertebral subluxations. These can be performed by animal physiotherapists or veterinarians with additional training as chiropractors or osteopaths. The animal physiotherapist may first address hypertonia in the surrounding muscles and later provide exercises to strengthen the muscle corset and movement advice to prevent recurrence. The physiotherapist will also check for any adverse changes in the movement pattern and address them if present. As the condition persists, its impact on the body becomes greater, and more treatable aspects emerge.

Prevention

Prevention involves not only developing a strong muscle corset but also training balance and coordination. Exercises that strengthen the core muscles improve spinal stability, but these muscles are only effective if coordination is good. Balancing and coordination exercises take time and discipline to become effective.. Varied exercises with different surfaces and support levels are playful and easy to integrate into daily routines, increasing adherence to therapy. This is crucial as daily practice is necessary to achieve the desired outcome. The muscle corset is exercised by inducing trunk movements, with gravity often providing sufficient resistance.

Sporting dogs and dogs from risk breeds benefit from a targeted exercise program. A well-designed preventive exercise program can prevent much suffering and allows owners to take responsibility. Increased insight into the dog's movement pattern can help detect minor deviations early. This gives the veterinarian the chance to identify (back) conditions at an early stage and take immediate measures to prevent worsening, such as adjustments to the living environment.

Conclusion

Although the back plays a crucial role in the gait pattern, basic examination of the back receives little attention in first-line companion animal practice. Vague lameness and lameness without a clear cause in the extremities may arise from spinal dysfunction. Including a few simple tests for back mobility and pain in the standard physical examination can benefit both the dog and the veterinarian. Increased focus on the back and better collaboration between veterinarians and supplementary disciplines, such as animal physiotherapists or veterinarian/chiropractors, can significantly improve the quality of life and mobility of many dogs. Further research on back issues in dogs, similar to studies done on horses, is desirable if not necessary.

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May began her career in veterinary physiotherapy in 1984, and was a key figure in establishing the Dutch Professional Veterinary Physiotherapy Association (NVFD) and the International Association for Veterinary Rehabilitation and Physical Therapy (IAVRPT). May helped develop educational programs that enabled physiotherapists to gain the credentials needed to practice veterinary physiotherapy legally. She also taught small animal physiotherapy for many years. After years of working alongside veterinarians, May and her husband, a veterinarian, established their own practice, which included behavioral therapy and a grooming salon.

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Is This Structure in the Mouth Normal?

Dr Roxanne Emslie
BSc, BVSc, MSc, Dipl. EVDC
European Recognised Veterinary Specialist - Dentistry and Maxillofacial Surgery

To serve our patients and clients well, we must know which lumps and bumps in the mouth are normal and which are cause for concern.

The old adage of knowing what is normal in order to recognise what is abnormal still rings true today. The study of orofacial anatomy is, however, frequently brushed aside, perhaps because it appears complicated and overwhelming, or perhaps the separation of human medicine and dentistry subconsciously leads us to believe that oral anatomy is less worthy of our attention than other body systems.

And so, it is often only studied if there is time to cram it in after memorising every bony tuberosity and muscle origin and insertion. Consequently, when a case demands the inclusion of a thorough oral examination as part of our clinical examination, we may suddenly notice a structure for the first time and think to ourselves, "Eek, what the heck is that?!" while trying to appear confident in front

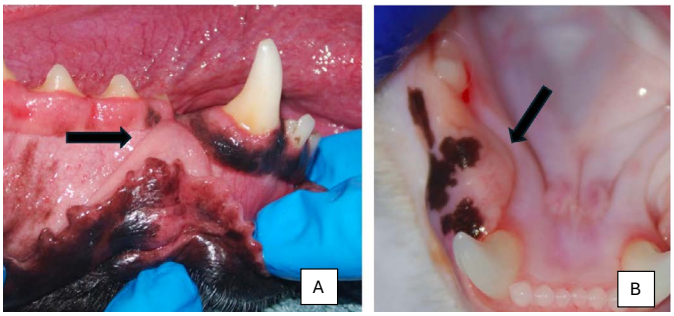

Figure 1: The normal appearance of the right mandibular labial frenulum of a dog (A) and a cat (B) . One should not mistake this thickened area of mucosa for pathology.

of the client. Therefore, to serve our patients and clients well, we must know which lumps and bumps in the mouth are normal and which are cause for concern.

Labial frenulum

Every now and then, I receive a photo from a colleague or friend, asking whether the tissue on the side of the mouth near the canine is swollen or not. Inevitably, the structure in question is the mandibular labial frenulum (Fig 1).

This frenulum forms the rostral extent of the mandibular vestibule, which plays a role in creating a 'gutter' to help contain saliva to the oral cavity. When on the hunt for oral pathology, a normal labial frenulum may appear oedematous. Therefore, to avoid over or under diagnosing pathology in this area, we need to become acquainted with its normal appearance.

Salivary glands, puncta and caruncles

Dogs and cats have four paired major salivary glands, the parotid, mandibular, sublingual and zygomatic salivary glands. Salivary ducts convey saliva from the major salivary glands to the oral cavity and open at salivary puncta or caruncles in the oral mucosa.

The parotid and zygomatic salivary puncta are situated in the alveolar mucosa dorsal to the maxillary fourth premolar and first molar (Fig 2). The parotid salivary punctum is the more rostrodorsal and the zygomatic salivary punctum is the more caudoventral of the two puncta.

The ducts conveying saliva produced by the mandibular and sublingual salivary glands open sublingually at the salivary caruncles (Fig 3). There are also numerous minor salivary glands that open directly to the labial, lingual and palatal mucosa. A line of discrete puncta can sometimes be visualised in the alveolar mucosa, particularly along the mandible.

This is normal in all dogs and cats but is more noticeable in large-breed dogs. In cats, a fleshy fold of mucosa located directly lingual to the mandibular molar, contains the lingual molar salivary gland (Fig 4). Especially in cases

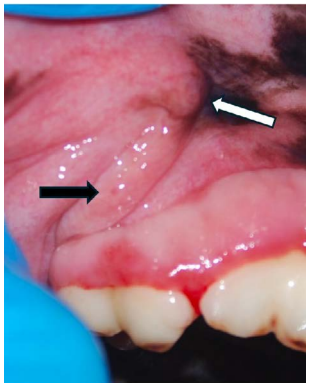

Figure 2: The mucosa of the caudal maxilla. The white arrow indicates the parotid salivary punctum and the black arrow indicates the zygomatic salivary punctum.

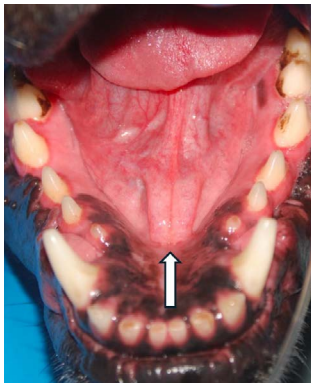

Figure 3: The sublingual salivary caruncles

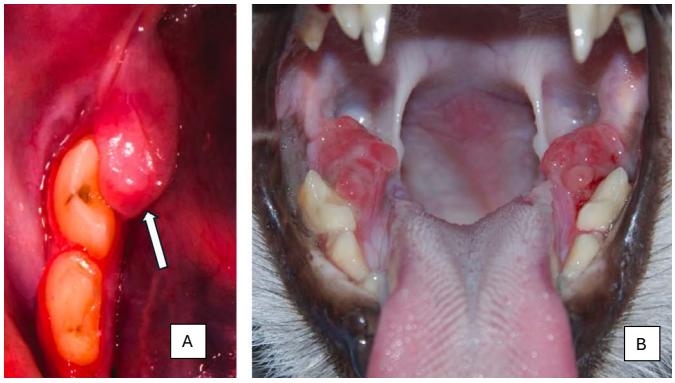

Figure 4: A normal lingual molar salivary gland in a cat (A). This fleshy fold of mucosa containing the salivary gland may be quite large, particularly in cases of feline gingivitis and feline chronic gingivostomatitis (B).

of feline gingivitis or chronic gingivostomatitis, it can be alarmingly enlarged and many a clinician has biopsied this tissue having mistaken it for a neoplastic mass.

Incisive papilla

Hiding away caudal to the maxillary incisors, a small, round to triangular mound of soft tissue often goes unnoticed, until one day when we examine the oral cavity from ventrally and it suddenly jumps out at us. The incisive papilla is an eminence of soft tissue between two fissures (Fig 5). These fissures are the openings of the incisive ducts that lead to the paired vomeronasal organs.

Palatal rugae

In dogs and cats, the palatal mucosa is thrown into a series of 6 -10 ridges and troughs. These mucosal ridges are called the palatal rugae. The challenge comes in when the same number of palatal rugae are forced to fit into a brachycephalic muzzle.

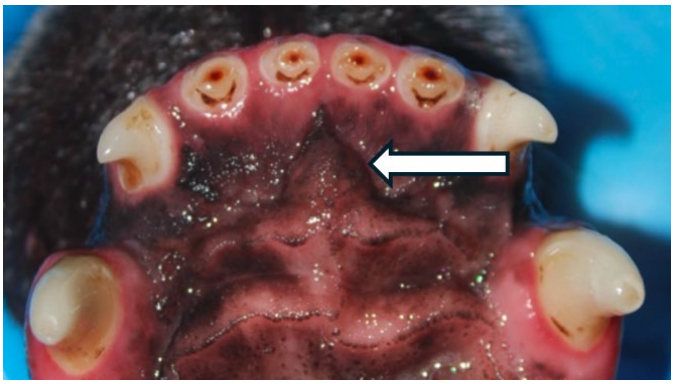

Figure 5: The incisive papilla bordered on either side by the openings of the incisive ducts which lead to the vomeronasal organ. Also note the normal conformation and variable pigmentation of the palatal rugae.

Figure 6: A case of epitheliotropic lymphoma. Note the area of depigmentation and effacement of the palatal rugae warranting biopsy.

Consequently, the rugae are squashed together, resulting in entrapment of hair and other debris. This can result in inflammation of the palatal mucosa and enlargement of the rugae.

Normal palatal mucosa may also display various levels of pigmentation, which should always be carefully examined (Fig 5). Our eyes have been better trained to detect areas of hyperpigmentation, for example in cases of malignant melanoma.

However, areas of depigmentation should not be overlooked and should always be biopsied, particularly if there is effacement of the rugae (Fig 6).

Pharyngeal anatomy

The caudal extent of the oral cavity proper is demarcated by the bilateral pillars of soft tissue coursing between the soft palate and the root of the tongue, called the palatoglossal folds (Fig 7). Caudal to the palatoglossal folds is the oropharynx.

The lateral walls of the oropharynx are called the fauces. This term is often incorrectly used to describe the caudal oral mucosa that is inflamed in cases of feline chronic gingivostomatitis.

The tonsils, housed in the tonsillar crypts, are located bilaterally in the fauces. The pharynx ends caudally at the epiglottis, which guards the entrance to the larynx.

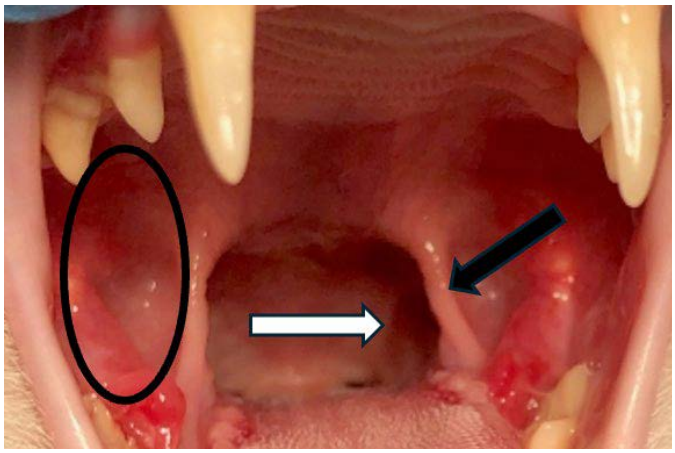

Figure 7: The palatoglossal fold of a cat indicated by the black arrow. The black oval demarcates the caudal oral mucosa which can be severely inflamed in cases of feline chronic gingivostomatitis. The white arrow points to one of the lateral walls of the oropharynx known as the fauces.

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