Continuing Professional Development | Business Success | Clinical Skills

vet 360

Vol 09 | Issue 01 | MARCH 2022

CPD Article
Concepts in Sterilisation

Business
Financing the Purchase of a Veterinary Practice

Opthalmology
Objects in the Anterior Chamber of the Eye

Have you heard?

There's an easier way to treat otitis externa.

Elanco

Convenience & compliance in one dose – administered by you.

Anti-bacterial (Florfenicol)

Anti-inflammatory (Mometasone furoate)

Anti-fungal (Terbinafine hydrochloride)

NEPTRA™

Neptra™ ear drops for dogs. Each 1 ml contains: Florfenicol 16,6 mg/ml, terbinafine hydrochloride 16,6 mg/ml and mometasone furoate 2,2 mg/ml. **Excipients:** Ethanol, purified water, propylene carbonate, propylene glycol, macrogol 8000. **Indications for use:** For the treatment of otitis externa in dogs associated with susceptible strains of yeast *(Malassezia pachydermatis) and bacteria (Staphylococcus pseudintermedius).* **Contraindications:** Do not use in dogs with known tympanic membrane perforation. Do not administer orally. Do not use in dogs with known or suspected hypersensitivity to florfenicol, terbinafine hydrochloride or mometasone furoate, other corticosteroids or any excipients. **Special warnings:** Read the package leaflet before use.

To be supplied only on veterinary prescription. Administration by a veterinarian surgeon or under their close supervision.

Registration Holder:
S4 Neptra™: Reg. No. 20/14.3/06 (Act 101 of 1965). Each 1 ml contains florfenicol 16,6 mg/ml, terbinafine hydrochloride 16,6 mg/ml and mometasone furoate 2,2 mg/ml.

Elanco Animal Health (Pty) Ltd. Co. Reg. No.: 2019/163893/07. N1 Business Park, Old Pretoria Road, Kosmosdal Ext 7, Gauteng, 0157. Tel: +27 12 657 6200.
Neptra™, Elanco™ and the diagonal bar logo are trademarks of Elanco™ or its affiliates. PM-ZA-20-0195

Elanco™ Helpline: 0861 777 735

Editor's Note

In this edition we have included an article from Sarah Marvel, a surgical oncologist, summarising the literature regarding the pros and cons of various types of sterilisation procedures as well as the timing of such procedures. It's an interesting read and hopefully will make us consider our patients a little more as individuals when it comes to this routine procedure. Hopefully it will become a little less routine and a little more tailored to our patients.

Dr Izak Venter has also provided an excellent summary on objects seen in the anterior chamber - there's no excuse here - we can see these with the naked eye, no fancy equipment required.

I've also found a nice article on imposter syndrome - read it and if applicable you can go on to further literature. I think it will apply to many people. We are often inclined to undervalue ourselves.

Enjoy the magazine

Liesel

vet 360

Advisory Board

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

Dr. Liesel van der Merwe BVSc MMedVet (Med) Small Animals
BVSc (Hons), MMedVet (Med)
Small Animal Internal Medicine Specialist, Small Animal Internal Medicine,
Department of Companion Animal Clinical Studies, University of Pretoria, South Africa

You have a small animal problem. We have an answer...

Vets are invited to send in questions or problems that they have regarding small animal medicine or surgery. The editor will get an expert opinion from colleagues at the Veterinary Faculty. This forum is not designed to assist with specific case management but with concepts. Please keep them short and to the point. If the question is not answered in the magazine we will try to get some advice to you personally or direct you to information sources.
We do not guarantee all questions will be answered as they will be screened.
Please send an email to the Editor at support@vetlink.co.za

We are currently distributing to SAVA members. A win-win situation for SAVA, Vetlink and the reader. Please to subscribe to ensure access to the CPD MCQ.
Subscription: www.vet360.vetlink.co.za

SAVA South African Veterinary Association Suid-Afrikaanse Veterinêre Vereniging

Index:

Vet360 is a source of current, relevant educational material for practising veterinary professionals in Southern Africa. Published Bi-monthly in hard copy and electronically on www.vet360.vetlink.co.za.

Distribution: Southern Africa, 3 500 copies.

Editor: Dr Liesel van der Merwe BVSc (Hons) MMedVet (Med) Small Animals.
Layout and design: Vetlink Publications
Publisher and Owner: Vetlink Publications
Other Publications by Vetlink: Vet360 Mobile App, Livestock Health and Production Review, Hooo-Hooo, Equine Health Update
Publisher: Madaleen Schultheiss: madaleen@vetlink.co.za

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: lieselvdmvet@gmail.com
(Dr Liesel van der Merwe)

In Memory of

Noenoe
18/02/2022

You Left Paw Prints on Our Hearts

vetlink

Financing the Purchase of a Veterinary Practice

Andrew Christie
BComm (Business Management)

In the business article in the previous issue, the variables affecting the value of a practice were explored – the performance, the financial condition, and the goodwill of the practice. It was also pointed out that the ultimate value of a practice is what a buyer is willing to pay and what a seller is willing to accept.

Traditionally the purchasing of a business is financed by the purchaser either using their own funds or obtaining a loan for the purchase amount. However, with small- to medium-sized businesses in South Africa in general, and within the veterinary profession in particular, the purchase is often financed by the seller.

1. Buyer-Financed

In an ideal world, the seller of the practice will collect their money from the buyer, put the money into a high-yield investment, and hit the beach. It very seldom works out this way for two reasons – the buyer doesn't often have access to the necessary funds and the seller may want to sell equity in the practice in portions over a period of time.

A buyer of a business in South Africa has several avenues to obtain the requisite funds; unfortunately, the buyers of a vet practice have only two - loans from a lender (normally a bank) or personal savings. And since the buyer of a practice is normally relatively young, it is unlikely that they will have amassed enough savings to buy a practice.

Borrowing the money from a bank presents several hurdles:

a. Banks want to have their loan covered by tangible (physical) assets so that if something goes wrong with the practice, they can still retrieve their loan by selling off stock and equipment etc. As discussed in the last article, vet practices have most of their value in goodwill – the reason that customers keep coming to a particular practice.
b. Practices owning the property in which they operate generally hold it separately in the seller's name which means that the main asset of the business cannot be used as security by the buyer of the business. This aspect has further-reaching effects as well – the seller may well want to retain the property and the seller must remember that the overheads listed in the income statement likely do not reflect this new and significant amount.
c. Compounding the problem is that many sellers want to extract assets from the practice – for example, cash accumulated in a bank account makes the asset value look good, but the seller will naturally feel that cash belongs to them.
d. A practice is seldom a new entity – it is often a part of the community reaching back many years. This means many things, but from a bank's perspective, it means that the fittings and equipment may have been depreciated to zero. Since much of the equipment in the practice is naturally worth much more than this, it is advisable for the buyers and sellers, to have the non-current assets re-valued. This revaluation should be conducted independently by someone who can prepare a suitable valuation report which can be submitted to the bank.

Below is a simplified example of what a buyer could be confronted with:

Agreed Selling Price of Practice:	**R3,500,000**
Net Asset Value:	**R1,000,000**
Less: Cash in Bank	**R 150,000**
	R 850,000

If the bank was to look at this, they would see that the buyer is wanting to borrow R3,5 million with security of only R850,000. As has been mentioned, the net asset value could be increased by revaluing the non-current assets such as equipment, but this amount is unlikely to add a large increase as equipment and fittings should be revalued conservatively.

And since the security is so low, it is highly unlikely that a bank will grant more than a portion of the loan.

A final point to consider is the credit profile of the buyer – a youngish vet who has been repaying a million-rand study loan, the bond on a house and the loan for a car may well have a few missed payments on their credit card, medical

aid, and cell phone. These things could damage whether, and how much, a bank would be willing to lend.

2. Seller-Financed

Seller-financed, or "owner financed" selling has been a feature of the veterinary profession for some years. In fact, it is used more broadly in South Africa than is commonly perceived – from JSE-listed retailers creating partnerships to increase market penetration to joint venture financing across most sectors of the economy. At first glance, it may seem like the answer to a prayer, enabling the buyer of a vet practice to acquire their own business, while the seller can realise a fair selling price.

However, there are weaknesses and disadvantages with the system for both parties.

a. For the Seller
   i. The seller faces a much higher risk of receiving their money – rather than receiving their money upfront, they will receive it over a period of time. Receiving the money could be affected by a drop in profitability under the management of the new owner or by adverse market conditions experienced in our volatile South African economy.
   ii. In the worst-case scenario, the buyer could simply stop paying the seller, resulting in a long legal process that can be borne far more easily by a bank than by a retired vet under a palm tree in Mauritius.
   iii. In fact, no matter how thorough the contract between buyer and seller, the actual legal processes can be difficult and expensive and the presence of pages of legal requirements tacitly hanging in the air can create a stressful atmosphere.
   iv. If the seller had received their money upfront, the capital could have been invested to render a return. This return could be direct – a vet sells their practice to retire, and the amount invested in a pension scheme; or indirect - a vet sells to "semigrate" and uses the money to finance a new practice without having to take out a loan and pay interest on it.
   v. The interest that is earned by the seller is taxable, so the seller needs to factor in that the repayment amounts will have a portion of tax to be paid.

b. For the Buyer
   i. The risk and opportunity cost for the seller means that they will probably charge a higher interest rate than a lending institution.
   ii. There is no "arms-length" in the transaction – a bank doesn't know and doesn't care how you run your practice, but the vet who sold you their practice did things a certain way for a long time, and they could theoretically enter the practice at any time and tell you how things "should be done".
   iii. See iii above.

Nevertheless, the seller financing the sale of a vet practice remains a vital component in making the purchase of a vet practice accessible to the buyer.

3. The Way Forward

In an ideal world, the buyer will have been a minority partner in the practice for many years slowly being groomed for ownership while implementing new ideas, but trends in the past decade or so have disrupted this.

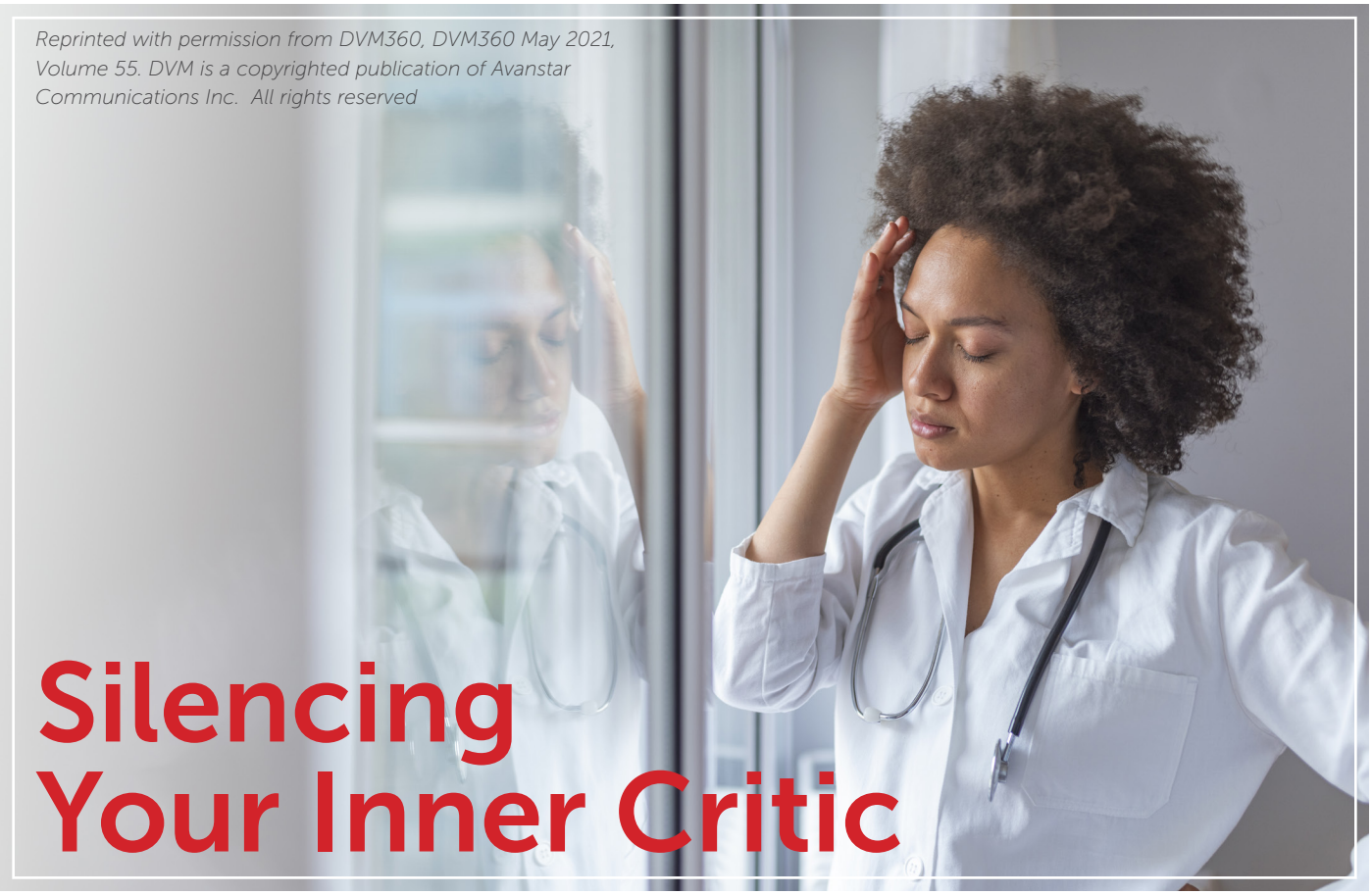
Nevertheless, an important lesson from this can be applied to the selling of a practice – rather than selling the entire practice, the seller could consider selling portions. For example, a vet could consider selling 10%, then a further 15% and then 24% in the last 3 years of their work at the practice. These reduced amounts make the equity more affordable for the buyer and gives both buyer and seller the chance to assess each other. The seller, in this example, could then retain 51% of control and profits while they settle into retirement. Of course, the remaining 51% would be sold over time. The size and number of the portions will, of naturally, be tailored to each situation and is intended to limit the risk of both the buyer and the seller.

While seller-finance is an option for some, or much, of the equity, I feel it is important that the buyer put up some of their own capital. This could be from savings, or from a bank loan, and demonstrates seriousness. The amount will vary from situation to situation and will depend on how much capital the buyer can access. If seller-financing has to be considered, an ideal upfront amount would be 40 – 60% of the sale price but this is unlikely to occur for the same reasons that the transaction cannot be buyer-financed in its entirety. Therefore, I recommend to my clients that they request an upfront amount that is meaningful but does not exclude buyers – between R100,000 and R1,000,000.

In Conclusion

Some important things to remember:

- *The timing of the sale of equity*
  If the sale of the equity is seller-financed, and the practice is formed as a private company, it must take place before payments begin. This is a complication added by the Companies Act which states that money generated by a company cannot be used to fund its own equity.
- *Limit the amount of time that the buyer and seller will work together*
  I find that the longest that the seller and new buyer can work together before tension becomes unbearable is two years.
- *Legal Advice*
  It goes without saying, that the contract must be prepared by a top-notch lawyer. However, the contract should be reviewed by the attorneys of both the buyer and the seller.
- *Financial Advice*
  Both the buyer and seller should have their own financial advisors have a look at the valuations and the terms of the sale agreement. Professionals such as Chartered Accountants are experts with the financial statements, but they may not necessarily be experienced with the nature of the veterinary profession as a whole.



Silencing Your Inner Critic

Rebecca A. Packer
MS, DVM, DACVIM (Neurology/Neurosurgery)

Here's everything you need to know about imposter syndrome in veterinary medicine, plus strategies to help you banish it for good.

There's no doubt that the veterinary profession has its share of mental challenges. Most of us feel the strain at least occasionally, if not regularly. There are many aspects to these challenges, but a common one is the prevalence of imposter syndrome.

During her recent Fetch talk, Colleen Best, DVM, PhD, CCFP, discussed what imposter syndrome is, its aetiology, and how to combat those feelings. If you have ever experienced imposter syndrome or felt stress associated with this profession, here's what you need to know.

A closer look at imposter syndrome

Dr. Best defined imposter syndrome, based on original research by Clance and Imes in 1978, as a feeling of phoniness, and of chance being the source of your success instead of your skills and effort. This syndrome was first described in high-achieving women. While imposter syndrome tends to occur more frequently in women and other underrepresented demographic groups. Best warned attendees that no demographic group is immune, regardless of age, sex, or race.

One of the most challenging aspects of imposter syndrome is the proficiency with which the person can negate and undermine evidence that demonstrates their capability.

How often have we downplayed our accomplishments by saying it was just chance, good timing, or due to an external force unrelated to our expertise? Dr. Best explained that this cycle, in part, drives imposter syndrome and that negative self-talk can become a self-fulfilling prophecy that undermines our work and underestimates our value. Eventually, we may disengage in our careers, avoid challenges, and limit our career growth.

Imposter syndrome tends to be transient, resulting from certain triggering events or situations. Overall, the interaction of these triggers is complex and multifactorial.

Ultimately, they all tend to potentiate us feeling as if we have failed to meet our own expectations. But where do these expectations come from?

Unreasonable expectations

Social media certainly plays a role in setting unreasonable expectations, as it only provides a glimpse (or iceberg view) of others' lives. When our lives seemingly fall short, it's easy to forget that social media neglects the unseen and more realistic, portion of the proverbial iceberg. Previous experiences, relationships, society, and our own hopes and aspirations all play a role in setting these expectations for ourselves. Facing new challenges, working with new team members, personal traits of perfectionism, and demographic influences (eg, including expectations based on your demographic) also play a role in this cycle. Once these situations or events trigger feelings of inadequacy, the cycle is hard to stop until we start to focus, or "notice" as Dr. Best refers to it, what is occurring. We may not have been aware that we had these expectations until we failed to meet them, and then we struggle to manage the effects. The result is often to perceive the unmet expectation as a personal failure.

Feelings of anger, frustration, disappointment, eroded self-trust, and further damage to your self-esteem and self-confidence can result. And the farther into this negative cycle we are, the harder it is to cope with these effects.

The body feels these stresses as a threat and initiates evolutionarily-adapted (or for this situation, maladaptive) behaviors. We become less able to balance our emotions, our ability to manage fear is diminished, and we lose critical insight. The first step to breaking this cycle, Dr. Best explains, is to acknowledge what is occurring, and then as soon as these stresses are recognised, focus on strategies to manage that maladaptive threat response.

How to stop toxic negative self-talk

Various forms of self-care, compassion, and shifting to a growth mindset will help break this imposter syndrome cycle. Among these are several "intentional breathing" techniques that can calm your body physiologically until other self-care activities can be performed. It may also help to seek honest feedback from a trusted colleague. Whereas friends or family may be innately biased, asking for honest feedback from a colleague may ultimately provide evidence of your competence to combat feelings of inadequacy.

Dr. Best emphasised that adopting a growth mindset, as opposed to a fixed mindset, is key to combating imposter syndrome. A fixed mindset is contingent on outcome, so one mistake may negate other achievements. Instead, a growth mindset is not contingent on outcomes, and one mistake is simply analysed for what it is and improved upon. Instead of feeling as if you will never be good at something, focus on the idea that everyone learns and that you can grow in areas where you feel less competent. Instead of thinking, "I'm not good at this," (fixed mindset) ask yourself, "What am I missing?" (growth mindset). It is important to remember that learning is always outside of one's comfort zone and is likely to trigger the "threat" response.

At the beginning of the learning process or when facing new challenges, Dr. Best explained, we experience unconscious incompetence. This is not a stressful phase because we are naively unaware of our lack of ability. Once we pass into the phase of conscious incompetence, where we know we are incompetent but have not yet become proficient in our learned skill, this is particularly difficult and triggers the "threat" response.

The self-perception can be, "I'm bad at this," even though it is a natural and transient part of the learning process. Eventually, we transition through that phase and become competent at the skill. Dr Best explained that whenever we sense the feeling of conscious incompetence, such as when we make mistakes (even after reaching competence), that feeling of inadequacy can trigger our threat response and imposter syndrome.

The Takehome

Although it is common to feel a sense of loneliness after making a mistake, it's important to remind yourself that everyone makes mistakes. Negative self-talk is helpful initially to point out learning opportunities or to protect us, but it's important to learn how to quiet that inner voice and focus on growth.

Recognising our thoughts and feelings of inadequacy as soon as they occur allows us to counteract these thoughts and recapture a more balanced perspective before the cycle of negativity and imposter syndrome takes hold.

Dr. Packer is an associate professor of neurology/ neurosurgery at Colorado State University College of Veterinary Medicine and Biomedical Sciences in Fort Collins, and is board certified in neurology by the American College of Veterinary Internal Medicine. She is active in clinical and didactic training of veterinary students and residents and has developed a comparative neuro-oncology research program at Colorado State University.

Reference

1. Clance PR, Imes SA. The imposter phenomenon in high achieving women: dynamics and therapeutic intervention. Psychol Psychother-T. 1978;15(3),241-247. doi:10.1037/h0086006

Abnormalities of the Anterior Chamber of the Eye

Dr Izak Venter
BVSc, MMedVet (Ophthal)
Digital Veterinary Ophthalmology Services
www.dvos.co.za
Facebook DVOS VETS

Most abnormalities affecting the anterior chamber are clearly visible – but knowing what they are is a little more complicated.

The anterior chamber is the chamber bordered by the cornea anteriorly, the iris and lens posteriorly and the drainage angle peripherally. The drainage angle is formed at the base of the iris, cornea, and the anterior extent of the ciliary body and sclera.

In a normal animal the anterior chamber is filled with aqueous humor, a transparent fluid. Aqueous humor resembles an ultra-filtrate of plasma. The chemical components of aqueous humor are proteins, immunoglobulin, enzymes, and lipids, all of which are present in much lower concentrations than in the plasma. Carbohydrates, urea and amino acids are also found in the aqueous humor. The major cations in the aqueous are sodium, potassium calcium and magnesium. The major anions in aqueous are chloride, bicarbonate, phosphate ascorbate and lactate. The ascorbate concentration in the aqueous exceeds that in plasma due to an active transport mechanism, but the reason for this is unclear.

Due to clear nature of aqueous humor most abnormalities affecting the anterior chamber are clearly visible.

1. Aqueous flare, hypopyon and fibrin clots

Aqueous flare is an optical phenomenon based on light scattering within the anterior chamber of the eye. This phenomenon occurs when an inflamed eye is viewed at right angles to a beam of light shone obliquely into the anterior chamber. In an normal eye none of the light traveling through the anterior chamber is reflected and therefore the chamber appears black. In an inflamed eye the light is reflected off floating micro-particles causing the beam of light to become visible.

Plasmoid aqueous humor is the result of alterations in the blood aqueous barrier [BAB]. Altered permeability of iris vasculature or tight junctions of the ciliary body epithelium allow bloodborne proteins to leak into the normally protein sparse aqueous humor. This condition occurs most commonly in cases of acute, severe anterior uveitis with sudden onset. If fibrinous exudation is severe, fibrin clots may form in the anterior chamber. The alterations in the blood ocular barrier may also result in white cell accumulation in the anterior chamber or hypopyon. Cellular components typically gravitate toward the ventral anterior chamber and settle in a homogeneous layer.

Hypopyon can be a result of sterile inflammation, infection, or neoplasia. Hypopyon rarely occupies more than a third of the anterior chamber and is easily missed because the ventral anterior chamber is often obscured by the third eyelid. Generally, hypopyon leaves the eye rapidly through the iridocorneal angle meshwork when treatment of the inflammatory processes is started and the blood aqueous barrier is stabilised.

The presence of aqueous flare, hypopyon and fibrin clots are characteristic for anterior uveitis.

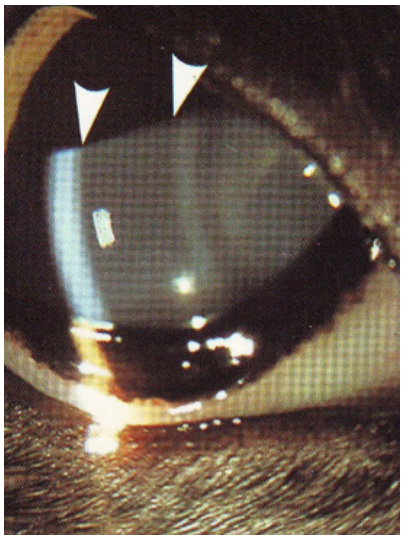


Figure 1: *Aqueous flare is visible between the two arrows. This space should appear black during examination with a slit light.*

Figure 2: *A fibrin clot in the anterior chamber of a cat with uveitis.*

2. Lipid aqueous

This is not a specific condition, but rather one of the possible clinical signs of active uveitis. As mentioned earlier, in patients with uveitis the blood aqueous barrier is abnormal resulting in aqueous flare. Lipid-laden aqueous is possible if the patient has concurrent hyperlipidaemia in which the aqueous assumes a milky-white appearance.

The hyperlipidaemia may be normal post prandially after eating a very fatty meal. True hyperlipidaemia can be either primary or secondary to other diseases. Secondary hyperlipidaemia is the most common form in dogs, and it can be a result of endocrine disorders, pancreatitis, cholestasis, protein-losing nephropathy, and obesity. Primary hyperlipidaemia is less common in the general canine population, but it can be very common within certain breeds. Hypertriglyceridemia of Miniature Schnauzers is the most common form of primary hyperlipidaemia in dogs.

Figure 4: *Typical appearance of a canine eye with lipaemic aqueous. The entire anterior chamber is filled with lipid laden aqueous, and the result is the homogenous white appearance of the entire anterior chamber.*

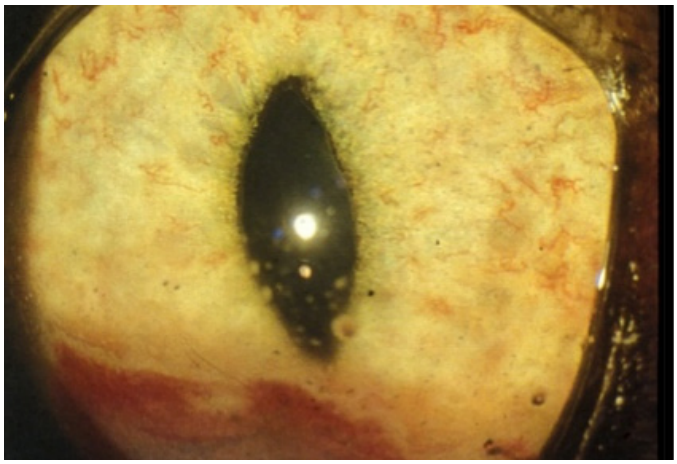


Figure 3: *The eye of a cat with uveitis. Hypopyon visible in the ventral aspect of the anterior chamber. Iris congestion is also present.*

Lipid laded aqueous can occur very acutely, and the clinical appearance is dramatic with the entire anterior chamber appearing white. It is often misdiagnosed as corneal oedema or a mature cataract in a patient with a mydriatic pupil.

Treatment is the same as the general treatment for uveitis combined with fasting for 12 hours or a low-fat diet. If the lipaemic aqueous is a recurrent event further investigation for an underlying cause resulting in recurrent lipaemia is justified.

3. Hyphaema

Hyphaema is defined as accumulated red blood cells (RBC) in the anterior chamber of the eye. Blood must be grossly visible, either on direct inspection or slit-lamp examination. It most commonly results from haemorrhage from the iris and ciliary body. The blood may also originate from the posterior uveal tract or retina; however, this is less common.

Like hypopyon the cellular components typically gravitate toward the ventral anterior chamber and settle in a homogeneous layer. If bleeding was initially extensive or is continuous, complete hyphaema with filling of the entire anterior chamber may occur. Layering in the hyphaema is an indication of rebleeding.

Causes for hyphaema include:

- Trauma - for example perforating wounds, a blunt blow to the eye region or choking a dog with a leash.
- Clotting disorders and platelet disturbances.
- Vascularised intraocular tumours.
- Systemic hypertension.
- Fragility of vessel walls, especially pre-iridal fibrovascular membranes that form in response to chronic disorders causing intraocular hypoxia for example glaucoma.
- Certain systemic disease for example Ehrlichia canis.
- Retinal dysplasia with ruptured vessels.
- Spontaneous.

Figure 4: *Severe traumatic complete hyphaema there is also severe subconjunctival hemorrhaging present.*

In most cases it is not the presence of frank blood in the anterior chamber that causes problems but the sequelae, like posterior synechiae and glaucoma, Most hyphaema cases are minor and will be absorbed over a few days.

If the posterior segment of the eye cannot be visualised with a light source, then it is recommended to perform ocular ultrasound to image the posterior segment and retina. This can assist with a prognosis as retinal detachment with vitreal haemorrhage is frequently seen with hyphaema cases.

4. Uveal cysts

Uveal cysts are common in dogs as well as cats. The cysts can be congenital or acquired. They arise either from the posterior pigmented epithelium of the iris [posterior iris face / pupillary margin] or from the inner ciliary body epithelium [pars plicata].

When cysts occur without pre-existing eye disease, it is possible that a defect was present at birth, and the cysts were not recognised until several years of age when they become visible in the pupil. Cysts can be unilateral or bilateral; single or multiple; variably sized; and spherical, oval, or elongated. They are usually brown or black, though light brown and amelanotic cysts may occur. They are often found free-floating within the anterior chamber or attached in the posterior chamber. Cysts are thin-walled structures that makes it easy to differentiate them from solid iris melanomas by transilluminating the cysts with a bright light source. Iris cysts may collapse and is then visible as a thin layer of pigment on the ventral corneal endothelium or the anterior lens capsule.

In most cases, uveal cysts do not obstruct vision. Potential sequelae of larger cysts include vision impairment, corneal endothelial opacities, pigmentation of the anterior lens capsule, mechanical interference with iris function, and aqueous outflow obstruction with secondary glaucoma.

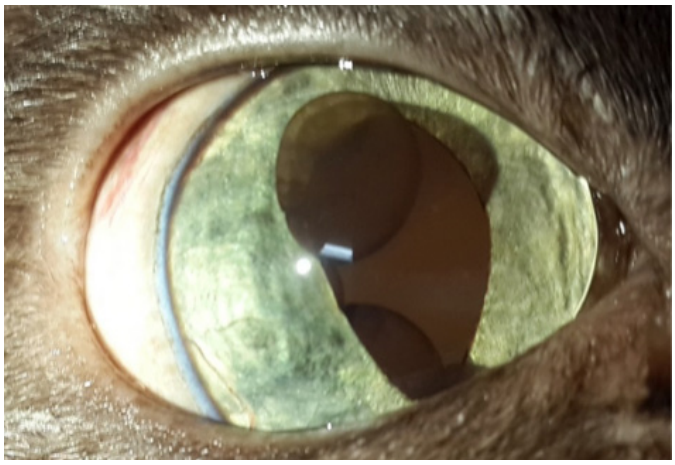


Figure 5: *Two uveal cysts one still posterior to the iris but visible in the pupil and one in the anterior chamber but still attached the pupillary margin*

Most uveal cysts do not require any treatment unless they obstruct the visual axis or lead to secondary glaucoma.

5. Intraocular neoplasia

Intraocular neoplasia may be primary or the result of metastases. Adenoma, adenocarcinoma and melanoma are the most common primary neoplasms.

Figure 6: *Intra ocular adenoma in dog clearly visible in the pupil, extending towards the iridocorneal angle. [Photo Dr Org Venter, Walmer Animal Hospital]*

Adenocarcinoma and adenoma of the ciliary epithelium usually appears as a single mass protruding from behind the iris into the pupil. The mass may be pigmented or unpigmented, depending on whether it arose from pigmented or non-pigmented ciliary epithelium. The mass may infiltrate anteriorly into the drainage angle and iris leading to secondary glaucoma.

Melanocytomas and melanomas are most common in both dogs and cats. Most uveal melanomas in dogs are

benign. In dogs enucleation of the globe is often required due to secondary glaucoma, uveitis, or hyphaema.

Intraocular melanomas in cats are more malignant than those in dogs, with higher rates of mortality and metastasis. Prognosis for survival if the eye is enucleated before the tumour has penetrated the sclera is good. Penetration may occur via ciliary arteries, veins, or nerves as well as by direct extension.

Diffuse iris melanoma is often slowly progressive, arising from pigmented areas on the anterior surface of the iris. The tumour may eventually involve the iridocorneal angle, causing secondary glaucoma. In some cases, the tumour is rapidly progressive and quick to metastasize.

In cats iris melanomas must be differentiated from benign ocular melanosis or iris nevi. The following clinical signs assists differentiating melanomas form nevi. Melanomas are raised from the iris surface, have in increased blood supply, may lead to distortion of surrounding tissues and will release pigmented cells, seen as flare.

Figure 7: *Diffuse iris melanoma in a cat extending into the iridocorneal angle.*

6. Persistent Pupillary Membranes [PPM's]

During foetal development there is a vascular network established on the anterior surface of the lens originating from the iris as mesodermal vascular arcades. These supply nutrition to the developing lens. During the 6th week of gestation in the dog, this vascular network starts too spontaneously degenerate. This process can continue into the first six weeks postnatally. Incomplete resorption of these embryological vascular arcades results in retained iris strands termed PPM's.

These can bridge from the collarette region of the iris to the iris, to the lens and to the cornea. This results in corneal [leukoma] or lens opacities [cataract] at the point of adhesion and may result in compromised vision. There is no treatment for PPM's.

Figure 8: *Eye of a cat showing iris to iris PPM's bridging the pupil*

Figure 9: *Eye of a dog showing iris to cornea PPM's leading to a corneal opacity [Leukoma]*

7. Anterior lens luxation

Anterior displacement of the lens without moving into the anterior chamber leads to the anterior displacement of the iris and a shallow anterior chamber. If the pupil dilates the lens can move into the anterior chamber, this may be partial or complete.(Fig 10) Luxation into the anterior chamber will lead to contact between the lens and endothelial cells and permanent damage to the endothelial cells. Lens luxation may be classified as primary (hereditary) or secondary.

a. Primary lens luxations
    i. Congenital.
    It is most often seen in animals with multiple ocular anomalies but can occur alone.
    ii. Hereditary.
    These animals are born with an inherent zonule weakness. Histologically these fibers have a bizarre reticulate formation. Hereditary primary

lens luxation is seen often in Terriers. Boisterous behavior may precipitate the condition. In Chinese Shar Pei's it has been found to be a simple autosomal recessive trait.

b. Secondary lens luxation
   i. Traumatic.
      Usually seen with other ocular lesions for example hyphaema and retinal detachments.
   ii. Glaucoma with buphthalmos.
      The stretching of the ocular tunics causes physical stretching of the zonules and eventually zonule rupture.
   iii. Chronic uveitis.
      The inflammation results in weakened zonules. This appears to be a rare cause of lens luxation in dogs compared to cats.
   iv. Cataracts.
      Advanced cataracts are associated with zonular degeneration. Subluxation presumably results from a reduction in overall lens size, causing zonular rupture. Anterior uveal tumours. As a tumour enlarges, it may dislocate the lens.

Anterior lens luxations are easily recognized as the lens is visible in the anterior chamber. Other clinical signs include:

   i. Pain.
      This is caused by the striking of the inner cornea by the lens.
   ii. Iridodenesis & phacodenesis.
      Abnormal vibration of the iris and lens when the patient moves its eye.
   iii. Aphacic crescent.
      This is the area in the pupil where the lens is missing. Because most lens subluxations occur in a ventral direction due to gravity, the aphakic crescent is generally present dorsally.
   iv. Increased intra ocular pressure.
      This is caused by vitreous dragged into the pupil and drainage angle. Vitreous situated in the pupil can block the pupil completely.
   v. Corneal oedema
      Occurs in the areas where the lens is in contact with the endothelial cells. Endothelial cell damage will lead to permanent corneal oedema.
   vi. Vitreous may be seen in the anterior chamber.

There are two treatment options commonly used namely the more conservative transcorneal lens reduction [TCLR] or intracapsular lens extraction.

Figure 10: *Anterior lens luxation in a dog. The lens is clearly visible in the anterior chamber and secondary corneal oedema is present in the area where lens is in contact with corneal endothelial cells*

360° Protection

AGAINST LITTER BEETLES

control ◀ balance ▶ protect

COOPERS
environmental science

www.cooperses.com +2786 030 3003 info@cooperses.co.za

REGISTRATION HOLDER: Starplex 83 CC Reg. No. 2004/015647/23 P.O. Box 14374, Bredell, 1623, SOUTH AFRICA • **EMERGENCY NUMBER:** +2782 446 8946
DISTRIBUTED BY: Coopers Environmental Science (Pty) Ltd

BASF Tenopa SC Reg. No. L8863 Act No. 36 of 1947 Active Ingredients: Alpa-Cypermethrin (Pyrethroid) 30g/lt, Flufenoxuron (Acylurea) 30g/lt
Coopers Ultrakill Wettable Powder Reg. No. L10064 Act No. 36 of 1947 Active Ingredient: Alpa-Cypermethrin (Pyrethroid) 25g/kg

IDEXX

The simplest way to get a **trusted CBC in-house**

The in-clinic ProCyte One* Haematology Analyser is packed with revolutionary technology to provide consistent reference laboratory-quality results with unprecedented simplicity and efficiency.

Accurate results
Advanced HD laser cell characterisation delivers accurate reference laboratory-quality results, which are supported with dot plots that provide a visual representation of the complete blood count (CBC).

Fast, effortless operations
Innovations, such as our SmartQC* automatic quality control and load-and-go components, simplify your workflow to deliver accurate results in under 5 minutes.

Integrated tools and expert support
Only IDEXX offers an integrated platform of advanced technology, tools and expert resources to help you interpret results and determine next steps.

Expense management made easy
Pay only for the tests you run to streamline costs.

Dimensions and weight
Width: 11.4 in (29.0 cm)
Depth: 15.3 in (38.9 cm)
Height: 14.1 in (35.8 cm)
Weight: 22 lb (10 kg)

Learn more at Idexx.co.za/procyteone

Fast, effortless operation

Deliver accurate CBC results in minutes, without the time-consuming prep and maintenance.

Plug-and-play components
Self-contained reagent packs and sheath kits make set-up (and replacement) a snap. Load and go in seconds.

Multiple tube types supported
Supports most tube types and sample sizes, including paediatric, for greater flexibility.

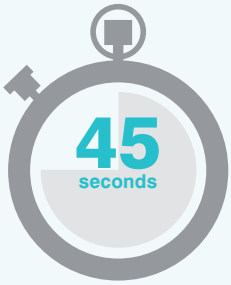
Smart camera saves time, ensures quality
The onboard camera analyses tube size and cap type to ensure proper sample draw. It also automatically scans the QR code on the packs to check the expiration date and other important information. No manual barcode scanning or interaction required.

Say hello to your new workflow

Load the sample tube

Close the door

Push the button



Sample tube available for other diagnostic tests

Results are ready

Scan the QR code to learn more

Think Before You Leap:

A New Way to Interpret Your Laboratory Results

Dr Kelly du Preez
BSc BVSc (Hons) MMedVet (Clinical Laboratory Diagnostics) Dip ECVCP
Onderstepoort Clinical Pathology Consultancy
Faculty of Veterinary Science, University of Pretoria
Tel: +27 (0) 67 766 9531
Email:kelly.dupreez@up.ac.za

Interpreting blood results is less straightforward than you imagine. Biologocal variation as well as analytical variation play a role.

Imagine you are presented one morning with a 13 year old Domestic Shorthair cat with a history of chronic kidney disease (CKD). After measuring the serum creatinine concentration on the in-clinic analyser, you obtain a result of 483 µmol/L.

Three months previously, serum was sent to a reference laboratory, where the creatinine concentration was reported as 402 µmol/L. Based on this 20% increase, you conclude that the patient's CKD has worsened from International Renal Interest Society (IRIS) stage 3 to stage 4.[1]

What is wrong with this picture? You made a clinical decision based on two incorrect assumptions.

1. Results from different analysers are not directly comparable

The first incorrect assumption is that results from different analysers are directly comparable. In many cases, this is not the case.

The result obtained when measuring the concentration or activity of a certain analyte (also known as a measurand) such as creatinine, will differ depending on the analyser used.

In some cases, these differences are so marked that results cannot be compared, even when analysing the same sample.

Figure 1: *Using a dartboard analogy to demonstrate the difference between accuracy and precision.*

What causes this difference in results?

A variety of factors can affect the end result that an analyser reports.

- The use of different test methodology, reagents, and/or technologies are a significant cause of differences in results, especially when the analysers were not built by the same manufacturer. For example, the creatinine concentration measured by an in-clinic analyser that uses dry slide technology will not be the same as the concentration measured by a wet-chemistry analyser used at a reference laboratory. This is most clearly reflected in the different reference intervals that are reported and used to interpret the result from each analyser.

- Another cause for dissimilar results is the differing levels of measurement accuracy and precision inherent to each analyser. Accuracy is the closeness of the result measured by an analyser to the sample's true result, whereas precision is the closeness of results from repeated measurements of the same sample by the same analyser.[2]

This concept is best illustrated by using a dart board (Figure 1). If the bullseye is the true/actual concentration or activity of a measurand, then accurate results will be those closest to the bullseye. However, in order for the results to be precise, they need to be close to one another.

The degree of inaccuracy (or bias) and imprecision (or coefficient of variation/CV) may differ between analysers. Together, the bias and CV of a method contribute to the total analytical variation (or total observed error) with which a sample is measured.[3] In other words, the reported result will not necessarily be the true concentration or activity of a measurand but should be within a certain range around the true result. This range is determined by the size of total error by which the analyser operates.

When analysers are not maintained as per manufacturer instructions, when the person analysing the sample does not have proper training, or when the analyser is housed in less than optimal conditions, the results obtained from that machine are more likely to be inaccurate and/or imprecise.

We can assess an analyser's bias, CV and total error by measuring quality control materials.[3] These are usually available from the manufacturer or supplier of the analyser. If the bias and CV are outside the range of the expected analytical variation or error for that method, then steps need to be taken to improve the analyser's performance. For more information regarding quality control, a number of excellent sources for general practitioners are available.[3-6]

Analyser quality control is vital for accurate test results. This process cannot be downplayed.

How should I be comparing follow up results?

When serial measurements are required for monitoring a patient, it is best to run the sample on the same analyser each time. In this way, additional analytical variation is not introduced when assessing for trends. In this scenario, the serum creatinine concentration should be requested at the same reference laboratory that was used three months previously. Also, it is important to ensure that the analyser used is properly maintained and housed, that its performance is routinely assessed and that the person analysing the sample has received training, especially when using an in-clinic analyser.[3]

2. Biological variation will affect a result

The second incorrect assumption is that any increase or decrease in a result is clinically significant. In addition to analytical variation, biological variation will also affect a given result.

What is biological variation?

Throughout the day, measurands within the blood (e.g. blood cells, proteins, enzymes, electrolytes) will randomly fluctuate[7] and each measurand will fluctuate to a different degree. For example, sodium, potassium and calcium are essential for many basic processes throughout the body and are tightly controlled to maintain homeostasis. In contrast, the concentration or activity of other

measurands, such as cortisol and creatinine, fluctuate widely in response a variety of factors such as time of day, hydration status, feeding and bodily requirements.

These daily variations are known as biological variation and, in health, these variations will occur around a particular normal value or "homeostatic set point" for that specific individual.[7] Thus, when a result is increased or decreased, especially in those measurands which are known to fluctuate widely, it is important to determine if the change is in fact clinically significant.

3. How do I know if a change in a result is clinically significant?

Using biological variation data gathered from healthy dogs, we know the percentage of change that is needed before an increase or decrease in a measurand should be regarded as significant.

This required percentage of change is known the "reference change value (RCV)" of a measurand. For example, the RCV of serum creatinine for cats is reportedly 24.7 – 28.9%.[8,9]

Using the scenario of the cat with CKD, the follow up creatinine concentration should be 501 – 518 µmol/L in order to be clinically significant. In this case, the change from 402 to 483 µmol/L may be due to analytical variation or biological variation and not necessarily worsening renal function.

One caveat when using RCVs is this: if the concentration or activity of a measurand is *steadily trending up or down over a number of results* and you are certain the analyser you are using is reliable, then the changes are also considered clinically significant.

4. Where do I find reference changes values?

Biological variation data for a variety of species including dogs, cats, horses and cattle is available on at VetBiologicalVariation.org (http://vetbiologicalvariation.org).

This website contains up to date biological variation data, including RCVs, for a variety of clinical chemistry, haematology and endocrine measurands. This website will soon be launching a RCV calculator page for quick interpretation.

Table 1 . A few important measurands and their reported RCVs (at a 95% probability) from VetBiologcalVariation.org have been included in the table below:

Measurand (sample)	Dog	Cat
Albumin (serum)	13.2 – 20.3%	11%
ALT (serum)	56.4 – 82.8%	26.5%
ALP (serum)	42.7 – 120%	23.6%
Creatinine (serum)	27.7 – 32.2%	24.7 – 28.9%
Glucose (serum)	21.5 – 31.5%	22.9%
Potassium (serum)	13.2%	15.3%
Total protein (serum)	4.9 – 18.4%	11.9%
Urea (serum)	39.7 – 165.4%	19.5%
Haematocrit (EDTA blood)	18%	15.4%
Platelets (EDTA blood)	39.4%	42.1%
Total leukocytes (EDTA blood)	35 – 54.6%	53.3%
Total T4 (serum)	47.6%	33.3 – 34.1%

Note: Ranges for RCVs are reported where more than one biological variation study was conducted.

5. What is the take home message?

Laboratory results are affected by two main sources of variation – analytical and biological. Interpreting results without taking these two sources of variation into consideration may lead to erroneous clinical and treatment decisions.

To avoid making this error ask yourself two questions:

1) Am I comparing the two results from the same analyser and is this analyser reliable in terms of its performance? If yes, then follow-up results and serial measurements are directly comparable.
2) Is this increase or decrease in value clinically significant based on RCV or trends?

In short, think before you leap!

References

1. International Renal Interest Society. 2019. Staging of CKD. Accessed at: http://www.iris-kidney.com/pdf/IRIS_Staging_of_CKD_modified_2019.pdf..
2. Flatland B, Freeman KP, Friedrichs KR, et al. ASVCP quality assurance guidelines: control of general analytical factors in veterinary laboratories. Vet Clin Pathol 2010;39:264-277.
3. Arnold JE, Camus MS, Freeman KP, et al. ASVCP Guidelines: Principles of Quality Assurance and Standards for Veterinary Clinical Pathology (version 3.0): Developed by the American Society for Veterinary Clinical Pathology's (ASVCP) Quality Assurance and Laboratory Standards (QALS) Committee. Vet Clin Pathol 2019;48:542-618.
4. Hooijberg EH, Cook JR, Freeman KP. Equipment maintenance and instrument performance. Journal of the American Veterinary Medical Association 2021;258:725-731.
5. Freeman KP, Cook JR, Hooijberg EH. Introduction to statistical quality control. Journal of the American Veterinary Medical Association 2021;258:733-739.
6. Flatland B, Freeman KP, Vap LM, et al. ASVCP guidelines: quality assurance for point-of-care testing in veterinary medicine. Vet Clin Pathol 2013;42:405-423.
7. Campora C, Freeman KP, Baral R. Clinical application of biological variation data to facilitate interpretation of canine and feline laboratory results. J Small Anim Pract 2018;59:3-9.
8. Prieto JM, Carney PC, Miller ML, et al. Biologic variation of symmetric dimethylarginine and creatinine in clinically healthy cats. Vet Clin Pathol 2020.
9. Falkeno U, Hillstrom A, von Bromssen C, et al. Biological variation of 20 analytes measured in serum from clinically healthy domestic cats. J Vet Diagn Invest 2016;28:699-704.

your pet's first choice
Omega

YOUR CLIENTS HANG ON TO YOUR EVERY WORD.

RECOMMEND NOTHING LESS THAN A **PREMIUM PET FOOD.**

- Rich in **ostrich** (min. 15%)
- High in **EPA & DHA** (min. 3 000 mg/kg)
- **Joint-supporting nutraceuticals** (fish oil, chondroitin and glucosamine)
- **Prebiotics** (dried beet pulp and inulin)
- **L-Carnitine** to promote fat metabolism
- Meticiously prepared in a **FSSC 22 000 certified** facility

PROUD MEMBER OF THE
PET FOOD INDUSTRY
ASSOCIATION OF SOUTHERN AFRICA

Available at the following veterinary wholesalers: Lakato, Midlands, VetServ and MCP

www.omegapetfoods.com

Reg No (Act 36/1947): V21407 (South Africa) and NFF2326 (Namibia)

Concepts in Sterilisation

From: Vet Clin North Am Small Anim Pract. 2022 Mar;52(2):419-436. doi: 10.1016/j.cvsm.2021.11.003. Epub 2022 Jan 24. PMID: 35082093 (https://pubmed.ncbi.nlm.nih.gov/35082093/)

Sarah Marvel, DVM, DACVS-SA
ACVS Fellow, Surgical Oncology, ACVS Fellow, Minimally Invasive Surgery (Small Animal Soft Tissue)

Introduction

There are many controversies surrounding surgical sterilisation in small animals, including the type of procedure that is performed and the timing of that procedure. To prevent overpopulation, early spay and neuter has been advocated in cats and dogs, particularly in the United States where approximately 86% of owned dogs are spayed or neutered.[1]

Traditional sterilisation techniques involve the removal of gonads, which in turn eliminates sex hormones. In the United States, sterilisation of female companion animals was routinely performed by ovariohysterectomy (OHE) through an open mini-laparotomy.

Recommendations on the timing of OHE in female dogs from nonshelter/rescue settings were historically based on a study by Schneider and colleagues. This study found that OHE before the first oestrus cycle yielded a relative risk of 0.5% for developing mammary tumours, whereas those dogs undergoing OHE after their first heat cycle had a relative risk of 8% for developing mammary tumours and those with OHE after their second heat cycle had a relative risk of 26% of developing mammary tumours.[2] There was no protective effect of OHE for developing mammary tumours after the second heat cycle. Therefore, many dogs had an OHE before their first heat cycle to minimise the risk of mammary tumours. In male dogs, castration or orchidectomy has been the traditional method of sterilisation, and timing was often based on achieving avoidance of unwanted behaviours linked to breeding, urination, and aggression.

Over time, two major developments occurred, which have altered recommendations on the procedure type and timing of sterilisation, particularly in female dogs. The first was the increasing popularity of minimally invasive surgery. As laparoscopic sterilisation became increasingly popular, so did a shift toward ovariectomy (OVE) as this is considered less technically challenging than a laparoscopic OHE.[3] Ovariectomy has been the preferred procedure for sterilisation in many European countries for decades.[4]

The second major development that occurred was additional research on the effects of timing of gonadectomy in relation to various orthopaedic, oncologic, and other miscellaneous conditions. These studies have generated discussion regarding our historical recommendations on both timing and technique of sterilisation.[4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32] In addition to delaying neutering in the nonshelter population, sterilisation techniques that spare the gonads have recently been reported, including vasectomy and hysterectomy. Limited information is available on the long-term consequences of these procedures.

OVE versus OHE

Both OVE and OHE are considered acceptable methods of sterilisation in female cats and dogs. Although the American Veterinary Medical Association and the American College

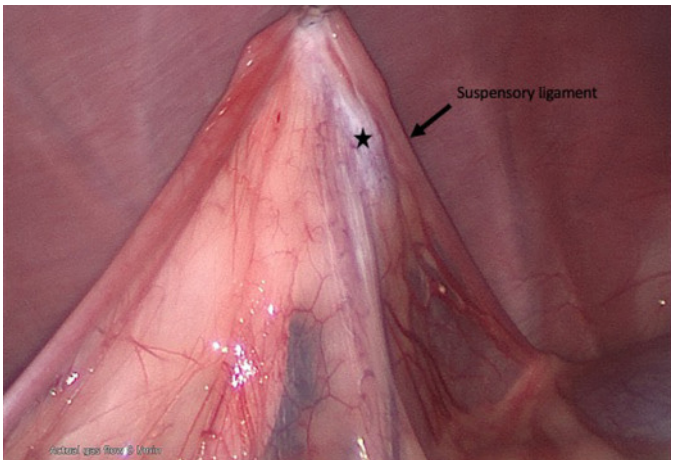


Figure 1: *A laparoscopic approach for an ovariectomy. The proper ligament has been grasped with 5-mm Babcock forceps to expose the ovary and ovarian pedicle. The black star denotes the ovary.*

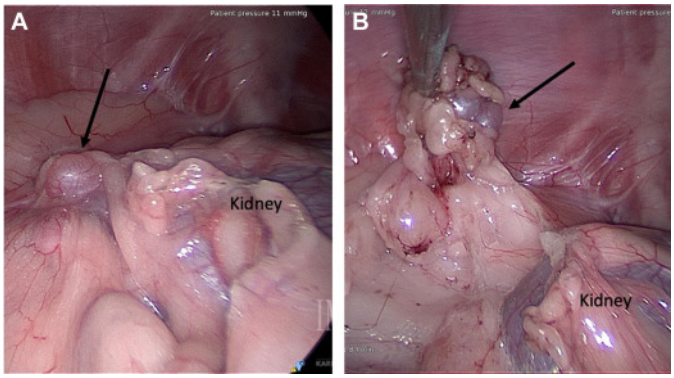


Figure 2: *A laparoscopic approach for ovarian remnant removal located caudal to the right kidney. The black arrow points to the ovarian remnant before (A) and during dissection (B). A 5-mm grasping forcep is used to elevate the remnant ventrally (B).*

of Theriogenologists promote elective neuter for animals that are not intended for breeding, neither association recommends a specific procedure.[33,34]

Recent literature review studies suggest OVE (Fig. 1) may be superior[4,35]; however, direct comparison of these two techniques has not yielded a significant benefit of one technique over another.[36] Proposed benefits of OVE include shorter surgical times; less potential for haemorrhage, urinary complications, and ovarian remnants; smaller incisions and therefore possibly reduced postoperative pain.[4,35] Many of these proposed benefits result from a more cranial abdominal incision centered over the ovaries rather than equidistant between the ovaries and the uterine body as is the case for OVH. This theoretically allows for improved visualisation of the ovaries and surrounding anatomy.

Improved visualisation may decrease the risk of ovarian remnant syndrome (Fig. 2). With OVE, there are fewer structures encountered that can lead to potential hemorrhage (ovarian vasculature vs ovarian vasculature, broad ligament, and uterine vasculature). OVE also theoretically decreases the risk of urinary complications as inadvertent ureteral ligation should only occur near the kidney. Without removal of the uterus, caudal ureteral ligation should not occur.

Another theoretic benefit is reduced pain, as fewer parts of the reproductive tract are manipulated and dissected with an OVE. During OHE, significant traction is applied to the ovaries and uterus to mobilise them toward the incision. During OVE, it is not necessary to tear or ligate the broad ligament. Not only is this a potential reduced source of haemorrhage, but also a potential reduced source of pain.

One of the main arguments for removal of the uterus is to avoid long-term complications from uterine disease. However, dogs that undergo OVE are not at an increased risk of cystic endometrial hyperplasia or pyometra as long as the hormone source has been removed and there is no exposure to exogenous hormones. In addition, the incidence of uterine neoplasia is low 0.03% and many of these tumours are benign leading to a 0.003% chance of developing a malignant uterine tumour.[37] When considering uterine pathology, it is important to take into consideration that in most cases of OVH, the entire uterus is not removed and endometrial tissue is often left behind unless the entire cervix is removed.[28]

Controversies surrounding timing of gonadectomy

In recent years, timing of sterilisation has become a topic of discussion. This controversy stems from recent studies evaluating the risk of certain disease processes in relation to hormone status and timing of gonadectomy. Interpretation of this data is difficult as many of these studies are breed or species-specific, making it challenging to extrapolate across small animal companion medicine where significant diversity exists between breeds and species. Another potential source of bias is the study population. Although some studies include large numbers in the study population, they often use the Veterinary Medical Database (VMDB) and surveys from breed clubs.

Studies using the VMDB reflect only those patients at referral hospitals and those from breed clubs represent a different population than those of typical pet owners. Another potential source of bias is the disproportionate number of animals that are spayed and neutered in the United States. As a result, there are often fewer intact animals represented in studies, which has the potential to result in an overinterpretation of neutered animals being higher risk for certain conditions.

There are 3 main categories of disease processes that have been looked at in relation to the timing of gonadectomy. These include the risk of neoplasia, orthopaedic disease, and miscellaneous conditions such as inflammation/infection,

urinary incontinence, obesity, and so forth. When considering the timing of gonadectomy, the risk of these conditions must be balanced along with the effects of gonadectomy on population management and lifespan in companion animals.

Neoplasia

There are many factors that contribute to the development of neoplasia, including genetics, age, environment, body condition, and sex hormone status. Although early gonadectomy supports minimising the risk of reproductive tumours in females, it may potentially increase the risk of other cancers in certain breeds (Table 1). The degree of malignancy and incidence of the tumour type must be taken into consideration when making decisions about the timing of gonadectomy for the prevention of certain tumours. Historic studies have shown that gonadectomy before the first heat essentially eliminates the risk of mammary neoplasia (0.05%).[2]

Gonadectomy also eliminates the risk of ovarian cancer and cysts in females and decreases the risk of uterine, vaginal, and vulvar tumours.[38,39] In male dogs, testicular tumours account for 16% to 27% of tumours in sexually intact male dogs; however, castration eliminates this risk.[40] Conversely, castration appears to increase the risk for prostatic carcinoma, but this tumour is rare (0.29%-0.6%) and the risk seems to vary among breeds.[40]

Cancer Type	Breed	Effect of Neutering on Risk in Females	Effect of Neutering on Risk in Males	Timing of Neuter Evaluated[a]	Effect of Timing of Neuter
Mammary	Many	Decreased	N/A	Yes	Before first heat results in the greatest benefit
	Golden Retriever	None	N/A	Yes	Not significant
	German Shepherd	None	N/A	Yes	Not significant
	Labrador Retriever	None	N/A	Yes	Not significant
Ovarian, Uterine, and Vaginal	Many	Decreased	N/A	No	Not assessed
Testicular	Many	N/A	Decreased	No	Not assessed
Prostatic	Many	N/A	Increased	No	Not assessed
Lymphoma	Golden Retriever	Increased	Increased	Yes	Females and males neutered 6–11 mo
	German Shepherd	None	None	Yes	Not significant
	Labrador Retriever	None	None	Yes	Not significant
	Vizsla	Increased	Increased	Yes	Increased risk when neutered at all time frames
Mast Cell Tumours	Golden Retriever	Increased	None	Yes	Females neutered <6 mo, 1 y, 2–8 y
	German Shepherd	None	None	Yes	Not significant
	Labrador Retriever	None	None	Yes	Not significant
	Vizsla	Increased	Increased	Yes	Increased risk when neutered at all time frames
Haemangiosarcoma	Golden Retriever	None	None	Yes	Not significant
	German Shepherd	None	None	Yes	Not significant
	Labrador Retriever	None	None	Yes	Not significant
	Vizsla	Increased	Increased	Yes	Females neutered ≤12 mo and >12 mo; males neutered >12 mo
Splenic Haemangiosarcoma	Many b	Increased	Increased	No	Not assessed
Cardiac Haemangiosarcoma	Many c	None	None	No	Not assessed
Osteosarcoma	Many	Increased	Increased	No	Not assessed
	German Shepherd	None	None	Yes	Not significant
	Rottweiler	Increased	Increased	Yes d	Females and males neutered <1 y

a Timing of neuter evaluated for Golden Retrievers, Labrador Retrievers, and German Shepherds: less than 6 months, 6 to 11 months, 1 year, and 2 to 8 years. Timing of neuter evaluated for Vizslas: ≤12 months, greater than 12 months.
b Overrepresented breeds: German Shepherd, Golden Retriever, American Cocker Spaniel, and Miniature Poodle.
c Overrepresented breeds: Golden Retriever.
d Timing of neuter evaluated: less than 1 year, ≥1 year.

Multiple studies have evaluated gonadectomy status and/or the timing of gonadectomy on the risk of nonreproductive tumours in dogs, including lymphoma, mast cell tumours, Haemangiosarcoma (HSA), and osteosarcoma (OSA).[6, 7, 8, 9,11, 12, 13,29,41,42] A large study using the VMDB found that intact male dogs and neutered male and female dogs were twice as likely to develop lymphoma than intact females.[29] Timing of neuter was not evaluated in this study. However, when looking specifically at Vizslas, neutered males and females were 4.3 times as likely to have lymphoma compared with intact Vizslas.[11] Conversely, gonadectomy performed at any time did not affect the risk of lymphoma in either sex in Labrador Retrievers or German Shepherds.[8,9] Male Golden Retrievers neutered before a year of age were three times more likely to develop lymphoma than those that were intact.[12] Both male and female Golden Retrievers neutered between six and 11 months were found to be at increased risk of lymphoma.[9]

Mast cell tumours (MCTs) are more common in gonadectomised female dogs compared with intact female dogs; however, many studies do not take into account the timing of spay and neuter.[41,43] When looking at breed-specific studies, there is a trend toward female gonadectomised dogs having an increased risk of MCT. Gonadectomised Vizslas were 3.5 times more likely to develop an MCT than those that were sexually intact.[11] Timing of neuter in both males and females was evaluated and neutering of both sexes and any time frame appeared to increase the risk of mast cell tumours in Vizslas. Gonad status and timing of gonadectomy did not appear to affect the risk of MCT in either sex for German Shepherds and Labrador Retrievers or male Golden Retrievers.[8,9,12] Female Golden Retrievers were more likely to develop MCT when they were spayed less than six months, at one year, or between two and eight years.[9]

HSA is a highly malignant tumour associated with a poor prognosis. A large VMDB study looked at 5736 dogs diagnosed with HSA found that spayed females had an odds ratio (OR) of 1.72 for HSA and castrated males had an OR of 1.14 compared with their intact counterparts. All cases were matched to control for age and the period since the study period spanned almost 40 years.[10] When cardiac HSA was separated from splenic HSA cases, the risk of cardiac HSA did not appear to be associated with gonadectomy status.

Several breed-specific studies have evaluated gonadectomy status as a risk factor for HSA. When looking at the overall gonadectomy status for male Vizslas, there did not appear to be a risk for the development of HSA.[11] However, when the timing of gonadectomy was considered, male and female Vizslas neutered after 12 months of age were more likely to develop HSA (OR, 5.3 and 11.5, respectively) and female Vizslas neutered before 12 months of age were also more likely to develop HSA (OR 6.0) compared with intact dogs.[11] An increased risk for HSA in female dogs neutered after a year of age was also seen in Golden Retrievers in one study,[12] but a follow-up study did not find an increased risk in neutered dogs of either sex for HSA in Golden Retrievers or Labrador Retrievers.[9] Similarly, neutered male and female German Shepherds were not found to have an increased risk for HSA.[8]

Gonadectomy status has also been evaluated as a risk factor for OSA. In an older case-controlled retrospective study using the VMDB, gonadectomised dogs were 2 times more likely compared with intact dogs to develop OSA.[42] Timing of gonadectomy was not considered in this study. In a breed-specific study on Rottweilers, male and female dogs neutered before one year of age were at increased risk of developing OSA.[13] Conversely, gonadectomy status did not appear to be a risk factor for OSA in German Shepherds.[8]

Age is likely a major confounding factor in many of these studies. When looking specifically at Golden Retrievers, which have a high incidence of cancer-related mortality, age appeared to be the most important variable associated with cancer-related death.[44] Kent and colleagues evaluated 655 Golden Retrievers that underwent a necropsy examination and found that 65% of dogs died of cancer; however, reproductive status had no effect on the risk of death from neoplasia, and increasing age was an independent risk factor for cancer-related death.[44]

Orthopaedic Disease

It is well documented that sex hormones play an important role in musculoskeletal development. Gonadectomising dogs before skeletal maturity delays physeal closure, leading to increased long bone growth, which may predispose some dogs to future joint disease.[6, 7, 8, 9,12,14, 15, 16, 17, 18, 19] Although many of these studies contain confounding factors that are difficult to tease out, including genetics, breed predispositions, body weight, body condition, lifestyle, and so forth, multiple studies have shown a link between gonadectomy and orthopaedic disease. The most common diseases noted are hip dysplasia, elbow dysplasia, and cranial cruciate ligament rupture. Gonadectomised dogs have been shown to have an increased risk of cranial cruciate ligament injury.[14, 15, 16, 17,19] Although some studies show a higher risk in spayed female dogs,[14,17] others have shown both neutered males and females have a higher risk of cranial cruciate ligament rupture.[15]

Breed-specific studies in Boxers, German Shepherds, Golden and Labrador Retrievers found an increased incidence of orthopaedic disease in gonadectomised dogs; however, the risk differs substantially between breeds (Table 2).[8,9,12,18,19] The incidence of one or more joint disorders (hip dysplasia, elbow dysplasia, cranial cruciate ligament rupture) in Labrador Retrievers doubled in both males and females when they were neutered before 6 months of age.[9] When Golden Retrievers were neutered before six months of age, the incidence of a joint disease was four to five times higher compared with intact dogs.[9] A study looking at German Shepherds found that the incidence of joint disease (mostly cranial cruciate ligament rupture) was higher in both males and females neutered before a year of age.[8]

Table 2: *Risk of orthopedic disease in relation to timing of neuter in male and female dogs*[8,9,18]

Orthopedic Condition	Breed	Effect of Neutering on Risk in Females	Effect of Neutering on Risk in Males	Timing of Neuter evaluated	Effect of Timing of Neuter
Hip Dysplasia	Boxer	Increased	Increased	Yes	Males and females neutered 6 mo before diagnosis
	German Shepherd	None	None	Yes	Not significant
	Golden Retriever	None	Increased	Yes	Males neutered <6 mo, 6–11 mo, 2–8 y
	Labrador Retriever	Increased	None	Yes	Females neutered <6 mo, 6–11 mo, 1 y
Elbow Dysplasia	German Shepherd	None	None	Yes	Not significant
	Golden Retriever	None	None	Yes	Not significant
	Labrador Retriever	None	Increased	Yes	Males neutered <6 mo and 2–8 y
Cranial Cruciate Ligament Rupture	German Shepherd	Increased	Increased	Yes	Females and males neutered <12 mo
	Golden Retriever	Increased	Increased	Yes	Females and males neutered <6 mo, 6–11 mo, 2–8 y
	Labrador Retriever	None	Increased	Yes	Males neutered <6 mo

a Timing of neuter evaluated for Golden Retrievers, Labrador Retrievers, and German Shepherds: less than 6 months, 6 to 11 months, 1 year, and 2 to 8 years.

The risk of hip dysplasia was evaluated in Boxers and it was found that those neutered at least six months before the diagnosis of hip dysplasia were 1.5 times more likely to develop hip dysplasia (median age at gonadectomy was three years) compared with those that were intact.[18] In other studies, there was no association between timing of gonadectomy and hip or elbow dysplasia in German Shepherds,8 but both male and female Golden Retrievers neutered before one year of age were at higher risk of hip dysplasia,[9] and only female Labrador Retrievers neutered before a year of age had a higher incidence of hip dysplasia.[9]

Miscellaneous Conditions

i. Urinary incontinence

Another factor to consider regarding timing and technique of sterilisation in female dogs is urinary incontinence. Urinary incontinence following spay appears to be at highest risk in larger breed dogs gonadectomised before three months of age.[20] Studies looking at the risk of incontinence when spayed between four and six months versus waiting until after the first heat cycle did not reveal an increased risk of incontinence.[20,21]

A more recent study suggests that heavier dogs have a higher risk of urethral sphincter mechanism incompetence following neuter and recommend delaying neuter to closer to a year of age in dogs whose adult weight is anticipated to be >25 kg.[22] A breed-specific study looking at German Shepherds found that urinary incontinence was much less likely to occur in intact females versus females spayed between six and 11 months.[8]

ii. Vulvar conformation

Vulvar conformation may also be affected by the timing of spay. Although there are no data that the author is aware of regarding the timing of spay and its effect on vulvar conformation, there is anecdotal evidence to suggest that prepubertal spay may contribute to a recessed vulvar conformation, which could contribute to perivulvar dermatitis. As a result of this, some recommend delaying gonadectomy in female dogs until after their first heat cycle. The risks of mammary neoplasia should be discussed with owners considering this delay.

iii - Prostatic and perineal disease

In male dogs, sterilisation impacts the occurrence of prostatic disease, perineal hernias, and perianal tumours. Castration eliminates the occurrence of benign prostatic hyperplasia and reduces the risk of prostatic abscessation/prostatitis, and prostatic cysts.[45,46] Other sex-hormone-driven conditions like perineal hernia and perianal adenomas are much less likely to occur in castrated dogs. Conversely, prostatic neoplasia is more common in castrated male dogs, but this tumour is rare (0.29%-0.6%)[40] and may have less of an impact on decision making for timing of neuter in male dogs than other more prevalent conditions.

iv. Obesity

Obesity is common in companion animals and is estimated to affect 24% to 30% of the pet population in the United States.[47] Although it is unclear if age at the time of sterilisation contributes to obesity, studies consistently document obesity in neutered animals versus those that are sexually intact.[23,24,25] Obesity is confounded by environmental factors

and other medical problems; therefore, a recommendation on timing of sterilisation based solely on this condition is difficult to make.

v. Behavioural changes

Studies document that removal of sex hormones with gonadectomy leads to decreased roaming, hormonal aggression, and urine marking.[25,48,49] Other behaviours including noise phobias, fear, and anxiety have been evaluated, but the effects of early gonadectomy on these behaviours appear to be inconsistent across studies.[11,20] Spain and colleagues[20] found that dogs neutered before 5.5 months were more likely to have noise phobias and to display sexual behaviors and less likely to have separation anxiety and inappropriate urination due to fear. Meanwhile, a breed-specific study in Vizslas found that those neutered before six months of age appeared more fearful and more anxious.[11]

vi. Longevity

Despite numerous recent studies documenting associations between gonadectomy and timing of gonadectomy in relation to the development of cancer,[6, 7, 8, 9, 10, 11, 12, 13,29,42] studies also show that gonadectomised animals live longer.[25, 26, 27] A study using the VMDB found that spayed females live 26.3% longer and castrated males live 13.8% longer than their intact counterparts.[26] Sterilised animals also had different causes of death than intact animals. Those that were intact were more likely to die from infectious disease and trauma compared with those that were neutered were more likely to die from cancer and immune-mediated disease.[26] A retrospective study of 927 military working dogs found that castrated males lived longer than intact males and spayed females (intact females were not evaluated). The leading cause of death was due to degenerative joint disease, neoplasia, and spinal cord disease.[27]

Gonad sparing sterilisation

Given the recent body of literature suggesting possible connections to certain disease processes and timing of gonadectomy, there has been interest in sterilisation procedures that spare the gonads and therefore maintains the sex hormone source. In males, vasectomy, which prevents sperm from reaching the semen and therefore rendering them infertile, has gained popularity. In female dogs, hysterectomy and salpingectomy are options for ovarian sparing sterilisation. Hysterectomy requires the complete removal of the uterus and endometrium, whereas salpingectomy involves surgical removal of the fallopian tubes and has been described in the veterinary literature.[50] Hysterectomy is more widespread and therefore will be discussed here. Both hysterectomy and vasectomy can be performed through an open or laparoscopic approach.[30,31,41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55]

Hysterectomy

Limited information is available on hysterectomy in dogs.[28,30,51] Criticism of this procedure surrounds the fact that the entire endometrial lining must be removed to prevent a stump pyometra from occurring given that dogs still maintain their hormone source (Figs. 3 and 4). A cadaveric study evaluated the feasibility of this procedure in dogs and found that ligation and transection of the uterus caudal to the cervix allowed for complete removal of glandular tissue from the caudal aspect of the uterus; however, half of the uterine horns, which were transected at the proper ligament had glandular tissue noted at the cut margin, which could be a risk for pyometra in the future.[28] As the risk of pyometra increases with age, many of the younger dogs undergoing hysterectomy may not develop clinical signs associated with this potential risk until later in life.

Another consequence of complete removal of the uterus and cervix while maintaining sex hormones is that female dogs continue to cycle, attract males, and are at risk of being mated. There are anecdotal reports of these dogs having weakened and altered vaginal vaults leading to perforation of the remaining vagina resulting in life-threatening injury.[51]

A small case series evaluated laparoscopic sterilisation techniques in dogs including 17 dogs that underwent hysterectomy. They found that 24% of dogs continued to have mild nonhemorrhagic vaginal discharge during their heat cycles and 29% of dogs had behaviors changes during heat. Although one dog went on to get ovariectomised,

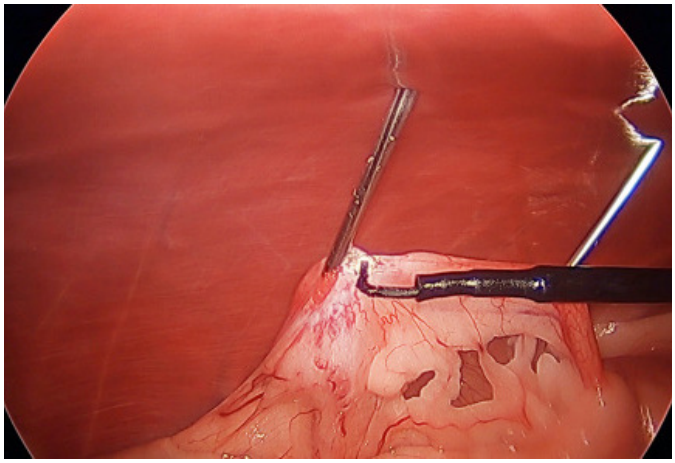


Figure 3: *Laparoscopic-assisted ovarian sparing hysterectomy performed in a dog. The ovary (left) and the uterine horn (right) have been suspended to allow for dissection at the proper ligament with the J-hook electrocautery. Separation of the uterine horn is performed as close as possible to the ovary.*

none of the dogs developed medical conditions related to maintaining their gonads 34 months (±13) after hysterectomy.[30]

Vasectomy

Vasectomy can be performed through an inguinal approach[51,52] (Fig. 5) or a laparoscopic approach[30, 31, 32, 53](Fig. 6).During vasectomy, the blood supply to the testicles can be preserved,[30,53] which allows for sterilisation while maintaining sex hormones or the blood supply to the testicles can be ligated removing the hormone source.[31,32] Recently, laparoscopic vasectomy was performed on eight dogs. Sixty-three percent of those dogs went on to have a castration performed due to behavioural challenges associated with their intact status.[30]

Although very few dogs were reported in this abstract, results suggest that counseling owners on the behavioural implications of gonad sparing sterilisation surgery in male dogs is important. Other important considerations are the long-term disease implications of sex hormones in male dogs discussed previously.

Libermann and colleagues recently described laparoscopic castration in 17 dogs where in addition to sealing and transecting the vas deferens (as is performed during vasectomy), the blood supply to the testicles was also sealed and transected. Testosterone levels were measured up to 12 months postoperatively and were not significantly different from those dogs that had traditional orchidectomy, showing that laparoscopic castration without removal of the testicles achieves testosterone suppression in addition to sterilisation.[31] This technique deserves further investigation, but it is important to note that it would not be considered a hormone sparing procedure because testosterone levels were similar to those dogs with traditional orchidectomy.

Summary

Recommendations on Timing and Sterilisation Technique in Dogs

Given that there are numerous factors that affect decision making for timing of sterilisation, including whether the animal is going to be bred, population control, behavioural concerns, lifespan, breed, size, risk for orthopedic disease, risk for development of malignant cancers, urinary incontinence, and so forth, many organisations are reluctant to make recommendations for timing of sterilisation in dogs. The American Veterinary Medical Association does not take a stance on when to perform surgical sterilisation in dogs or which procedure to perform. Instead, it provides veterinarians with resources to determine which procedure (OVE, OHE, hysterectomy, orchidectomy, vasectomy) is appropriate for the patient/client.[33] This is similar to the American College of Theriogenologists and the Society for Theriogenology, which states that the method and age of sterilisation should be made on a case-by-case basis.[34]

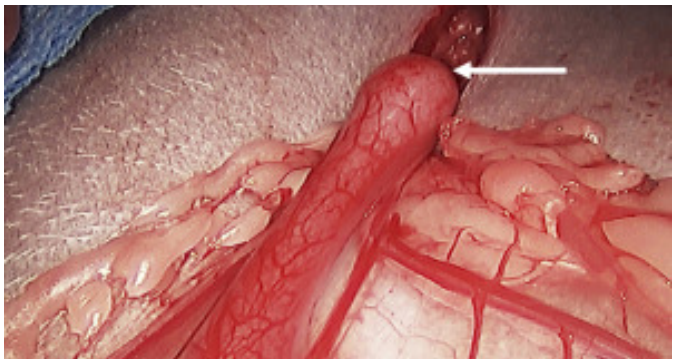


Figure 4: *Laparoscopic-assisted ovarian sparing hysterectomy performed in a dog. The ovaries have been spared and the uterus has been dissected and exteriorized out through the body wall incision. The white arrow denotes the cervix. Ligation is performed on the vaginal side of the cervix to ensure all endometrium has been removed. (Image courtesy of Dr Boel Fransson.)*

Figure 5: *An inguinal approach for vasectomy in a male dog. The vas deferens has been double ligated before removing a small segment between the 2 sutures. (Image courtesy of Dr Dan Smeak.)*

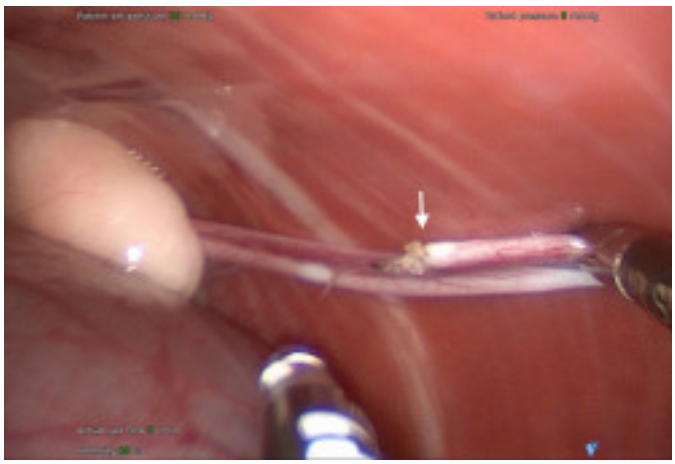


Figure 6: *A laparoscopic approach for vasectomy in a male dog. The vas deferens has been sealed and transected with a 5-mm vessel sealant device. The white arrow points to the sealed end of the vas deferens. (Image courtesy of Dr Eric Monnet.)*

Recently, two studies were published regarding recommendations on timing of gonadectomy in relation to risk factors for particular breeds and mixed-breeds.[6,7] The first study evaluated pure-breed dogs and their risk for joint disorders (hip and elbow dysplasia, and cranial cruciate ligament rupture), neoplasia (lymphoma, mast cell tumour, HSA, and OSA), and urinary incontinence. Most breeds evaluated did not have an increased risk of joint disorders or cancers in relation to timing of neutering. However, this is not true for all breeds.[6] They also found that in some breeds, the risk of joint disorders and cancers was different between for males and females. These results emphasise the difficulty with applying data from breed-specific studies across all breeds or making blanket recommendations for timing of gonadectomy for all breeds and sexes. Instead, veterinarians can reference this information when they are helping clients decide on timing of gonadectomy for the specific breeds and disease processes evaluated in that study. The second study evaluated the timing of gonadectomy on similar joint and neoplastic disease processes in a population of mixed-breed dogs divided into five weight categories. Interestingly, there was no significant risk of occurrence of cancer in mixed breed neutered dogs in any weight category compared with intact dogs. However, they found that dogs that weighed ≥20 kg and were neutered before a year of age were at higher risk for one or more joint diseases.[7]

Suggested guidelines from this study for age of neutering mixed-breed dogs based on body weight are recommended in Table 3.[7] These recommendations for mixed-breed dogs only take into consideration certain cancers and joint disease and do not consider behavior, longevity, obesity, environmental factors, and the risk of accidental breeding/pregnancy. The studies from Hart and colleagues can aid in decision making[6,7]; however, when breed-specific data are not available, the author uses Table 4 as a guideline to aid in decision making on timing of gonadectomy.

Table 3: *Suggested guidelines considering joint disease and cancers for age of neutering 5 mixed-breed groups of dogs* adapted from Hart *et al*.[7]

	Males				Females			
	Leave Intact	Choice	Beyond 11 mo	Beyond 23 mo	Leave Intact	Choice	Beyond 11 mo	Beyond 23 mo
<10 kg		✔				✔		
10–19 kg		✔				✔		
20–29 kg			✔				✔	
30–39 kg			✔				✔	
>40 kg				✔			✔ [a]	

a Consider neutering beyond 11 months due to weight "Choice" means there was no increased risk for any age of neutering.

Table 4: *Authors' suggested timing of sterilisation based on adult weight*

Adult Weight (kg)	Suggested Timing of Sterilisation (mo)
<10	6
10–20	6–8
21–30	9–12
31–40	10–14
>40	12–24

Given the lack of information supporting the need to remove the uterus, the author prefers OVE (laparoscopic or open) for sterilisation of females, but also supports OHE (laparoscopic or open) as an acceptable means of sterilisation. There is a lack of large prospective data on hysterectomy in dogs for both short-term and long-term complications; therefore, the author does not recommend hysterectomy in dogs at this time. Vasectomy is a routine surgical procedure, which allows for sterilisation while maintaining sex hormones and appears to be an acceptable method of sterilisation in male dogs. In some pure-breed dogs with increased risk of malignant cancers or joint disease with gonadectomy, vasectomy may be an appropriate option for certain clients and their dogs.

Pet owners should be counselled that vasectomy will not alleviate sex-hormone-related behaviors and can leave dogs predisposed to BPH, prostatic cysts and abscesses as well as perineal hernias and perianal gland and testicular tumours.

Recommendations on Timing and Sterilisation Technique in Cats

Cats are induced ovulators and therefore very efficient breeders. In an effort to reduce overpopulation and unwanted litters the Veterinary Task Force on Feline Sterilisation Recommendations for Age of Spay and Neuter Surgery recommend sterilisation of cats by five months of age if they are not intended for breeding.[56] This recommendation is endorsed by the American Veterinary Medical Association and stems from both behavioral and medical issues. Unintended pregnancies can occur in cats as early as four months of age. Gonadectomising cats before their first oestrus cycle decreases their risk of mammary carcinoma,[57] eliminates the risk of pyometra and dystocia, and has the potential to decrease behavioural problems which have been linked to relinquishment in cats.[58] Many of the controversies (oncologic and orthopaedic) surrounding timing of gonadectomy in dogs have not been studied in cats. A retrospective study in 26 cats found that overweight male neutered cats appeared to be at higher risk of capital femoral physeal fractures.[59] Twenty-five of the cats were neutered males, but timing of neuter was only known in 16 of the cats. Fourteen cats were neutered before six months of age. Bodyweight may be a confounding factor in this study and additional prospective research is needed in cats to determine if similar links to orthopaedic and neoplastic conditions are affected by timing of gonadectomy. Both OVE and OHE are considered acceptable methods of sterilisation in females. There are currently no data regarding gonad sparing surgeries in male or female cats.

Clinics care points

- Timing of gonadectomy in mixed-breed dogs may increase the risk of joint-related conditions in dogs greater than 20 kg.
- Timing of gonadectomy in certain pure-breed dogs may increase the risk of certain neoplastic and joint conditions, but there are significant differences among breeds and sexes.
- When performing hysterectomy alone it is essential that all the glandular epithelium is removed.
- There are no long-term studies determining the consequences of hysterectomy alone in the dog and further research is needed to determine the risk of pyometra and vaginal rupture as a result of accidental breeding.

Disclosure: The author has nothing to disclose.

References: Due to lack of space references published online - www.vet360.vetlink.co.za - Vol 1 Issue 9 March22

CPD Questions

CPD Questions and AC number available
https://bit.ly/CPDvet360

Go to www.vet360.vetlink.co.za or download the new Vet360 App to answer the questions
CPD reserved for Vet360 subscribers (R360 per annum) Call 012 346 1590 or visit www.vet360.vetink.co.za to sign up

1. **Which one of the following statements regarding canine sterilisation is true?**
a. Sterilisation before the first oestrus cycle yields a risk of only 0.5% for developing mammary tumours
b. Sterilisation after the first oestrus cycle yields a risk of only 0.5% for developing mammary tumours
c. Sterilisation before the second oestrus cycle yields a risk of 26% for developing mammary tumours
d. The age of sterilisation does not affect the risk of developing mammary tumours
e. There was still a protective effect of sterilisation on development of mammary after the third cycle.

2. **Which one of the items listed below is NOT one of the proposed advantages of performing an ovariectomy instead of an ovariohysterectomy?**
a. Less potential haemorrhage
b. Shorter surgical times
c. Decreased cost
d. More cranial abdominal incision allowing for improved visualisation
e. Decreased urinary complications

3. **Which one of the following questions regarding the uterus is INCORRECT?**
a. Removal of the uterus will decrease the risk of long-term complications of uterine disease.
b. There is no risk of cystic endometrial neoplasia if the ovary has been removed and there is no exogenous hormone.
c. The incidence of uterine neoplasia is very low (0.03%)
d. Many of the uterine neoplasia are benign
e. The cervix is not considered as part of uterine tissue

4. **Which one of the factors listed below, which contribute to the development of neoplasia in dogs, is INCORRECT?**
a. Genetics
b. Environment
c. Exercise level
d. Neuter status
e. Age

5. **Which one of the conditions listed below, relating to the castration of male dogs, is INCORRECT?**
a. Castration slightly increases the risk of prostatic carcinoma
b. Testicular tumours account for up to 27% of tumours in intact male dogs.
c. Castration decreases the risk of perineal herniation.
d. The incidence of benign prostatic hyperplasia is reduced with castration.
e. Castration will increase the risk of bladder sphincter mechanism incontinence

6. **Which one of the following non-reproductive tumours which may be affected by sterilisation status listed below is INCORRECT?**
a. Lymphoma
b. Mast cell tumours
c. Osteosarcoma
d. Fibrosarcoma
e. Haemangiosarcoma

7. **Which one of the factors listed below is NOT a confounding factor in evaluating the correlation between sterilisation and the development of neoplasia in dogs?**
a. Inconsistent timing of sterilisation
b. Breed of dog
c. Vaccination history
d. Origin of database skewing results
e. Age of patient when neoplasia develops

8. **Which one of the following statements regarding orthopaedic disease in dogs is INCORRECT?**
a. Sterilized dogs have a decreased incidence of CCLR.
b. Incidence of joint disorders doubled in Labrador retrievers neutered before six months of age.
c. The risk of joint disorders varied significantly between breeds.
d. Timing of sterilisation did not affect hip or elbow dysplasia in German Shepherd dogs.
e. Sterilisation before maturity delays physeal closure.

CPD continues on page 35

Imaging of Nasal Disease

Dr Nicolette Hayward BVM&S DVR DipECVDI MRCVS

Introduction

Nasal disease and paranasal sinus disease are relatively common conditions in cats and dogs, and definitive diagnosis of the causative pathology can be challenging. Rhinoscopy, nasal flushes, biopsies, and serology are all valuable diagnostic tools. However, a multi-modality approach may be required where results are inconclusive. The primary aims of imaging nasal and sinus disease are to determine the extent of pathology, create an ordered differential list, and to aid planning for further investigations or therapy.

Historically, radiography has been the standard imaging technique for the diagnosis of nasal disease and remains the principal first imaging resource used in general practice. Radiographic examination provides a non-invasive, and frequently effective method of diagnosing nasal pathology (e.g., >80% of nasal tumours) at relatively low cost. However, radiographic findings may prove vague or non-specific, as well as offering only two-dimensional information.

In recent years, three-dimensional imaging modalities have become more widespread in veterinary practice and may provide valuable information where radiography has proven inconclusive. Furthermore, the multi-planar approach that CT and MRI offer enable full characterisation of pathology to be established for surgical planning, radiotherapy, and prognostic purposes. The choice of which advanced imaging modality is used frequently depends upon its availability, as well as cost issues.

Table 1: Comparison of imaging modalities

	Advantages	Disadvantages
Radiography	• Cheap	• May be inconclusive
	• Available	• No differentiation soft tissue and fluid
	• Frequently diagnostic	
CT	• Multi-planar	• Expensive
	• Good bone detail	• Limited availability
	• Some fluid soft tissue differentiation (<MRI)	• Expertise required
	• Fast	
MRI	• Multi-planar	• Expensive
	• Good soft tissue contrast	• Limited availability
	• Excellent soft tissue and fluid differentiation	• Expertise required
	• Valuable where brain or orbit involved	• Time consuming

Indications

- Nasal discharge
- Epistaxis
- Sneezing
- Head trauma
- Swelling
- Pain
- Proptosis
- Epiphora

Radiography

To obtain accurate patient positioning, general anaesthesia is usually required, unless the patient is very depressed. At least four projections are recommended for a complete study.

Projections

- *Lateral*
  - Overview of nasal chambers, frontal sinuses, skull, and pharynx
  - Superimposition of bilateral structures
- *Dorso-ventral or ventro-dorsal*
  - Superimposition of mandible over nasal chambers
  - Remove ET tube for evaluation of midline structures
- *Dorso-ventral intra-oral*
  - Good for nasal chambers
  - No superimposition of mandibles
  - Enables evaluation of symmetry
  - **Most informative projection**
- *Lesion-oriented oblique*
  - May be useful where standard orthogonal views are inconclusive
- *Rostro-caudal skyline*
  - Highlights frontal sinuses and cranium (Fig. 1)
  - Patient in dorsal recumbency with hard palate vertical
- *Caudo-rostral horizontal beam*
  - Highlights frontal sinuses
  - Care with radiation safety
- *Ventral 20° rostral - dorso-caudal oblique*
  - Useful where intra-oral views fail to reach the caudal extent of nasal cavity e.g., where a thin film carrier is not available
  - The patient is placed in dorsal recumbency with the maxilla parallel to cassette and, with the mouth held open with ties, the tube head is tilted towards the mid nasal cavity

Computed Tomography

CT offers exquisite bony detail and has been shown to be more accurate and sensitive than radiography for the investigation of nasal disease in many studies (>90% sensitivity). In some cases, CT is also more accurate than biopsy or rhinoscopy in reaching a diagnosis. Where symptoms such as neurological signs, exophthlamos and nasopharyngeal pathology suggest that the cranium and nasal chambers have been breached, CT or MRI are indicated.

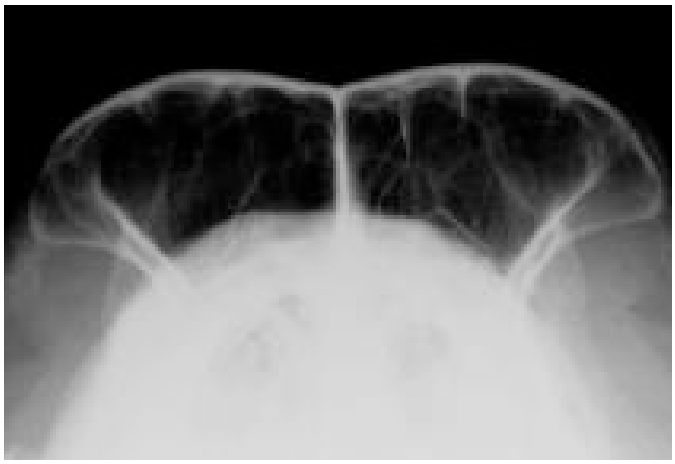


Figure 1: *Radiographic rostro-caudal skyline projection for frontal sinuses*

Magnetic Resonance Imaging

MRI offers the most information for nasal and sinus disease due to its good soft tissue contrast, which enables the differentiation of fluid from soft tissues, unlike radiography. As such, radiography tends to over-estimate tumour size. An MRI study should include sequences in all three planes and a postcontrast study to evaluate potential intracranial extension of pathology. MRI is particularly useful for differentiating tissue and fluid within the frontal sinuses and tympanic bullae.

Normal Anatomy

Skull shape and size varies widely with breed types, but can largely be categorised as follows:

- Dolichocephalic (long nosed)
- Mesaticephalic (equal cranium and nose length)
- Brachycephalic (short nosed)

Turbinate detail, as seen in Figure. 2, should be clearly delineated and generally symmetrical, although may be less so in brachycephalic dogs and cats.

- The **rostral third** of the nasal chamber contains a fine linear distribution of turbinates.
- The **middle third** has a more honeycomb appearance.
- The **caudal third** of the nasal chamber has a larger linear pattern.

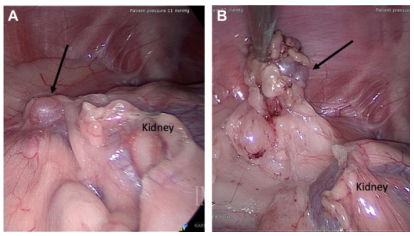


Figure. 2: *Dorso-ventral intra-oral projection of the canine maxilla*

Approach

Acute onset nasal signs are often unrewarding to image unless traumatic, but radiography provides a high diagnostic yield where chronic disease is present.

Accurate positioning to minimise rotation is vital to assess symmetry.

Evaluation of the nasal chambers requires assessment of the:

- Symmetry and integrity of turbinates and nasal meati (intra-oral views)
- Alterations in radiographic opacity
  - Mass effect
    - Soft tissue
    - Bone
  - Increased lucency indicative of turbinate destruction
  - Loss of integrity of cortical bone
  - Trapped fluid in nasal chambers or sinuses
- Assessment of the nasal septum / vomer bone
  - Integrity
  - Deviation
- Presence of pathology unilaterally or bilaterally
- Extent of pathology including involvement of sinuses and orbits
- Patency of nasopharynx
- Dental changes

Table 2: Summary of radiographic findings with chronic nasal disease in dogs

Lesion	Nasal tumour	Destructive rhinitis	Non-destructive disease
Turbinate destruction	Common	Common	Mild / none
Opacity	Increased	Variable / patchy	Normal / mild
Deviation of/ changes of integrity to the Vomer / Septum	Common	Rare	None
Distribution	Unilateral or bilateral	Commonly bilateral	Commonly bilateral unless foreign body
Skull involvement	Common	Pinpoint lucencies	None

Pathology

Where chronic nasal disease is present in dogs, radiographic changes can usually be categorised into non-destructive/non-neoplastic disease, destructive/non-neoplastic disease, or neoplastic disease. The severity of changes generally reflects the severity and chronicity of signs, but normal nasal radiographs do not rule out nasal disease.

1. Acute Rhinitis

In the acute stages, there may be only minor mucosal swelling and discharge, and radiographically the nasal chambers commonly appear normal. A subtle 'unsharpness' of turbinate detail may be identified in some cases.

2. Chronic Rhinitis

As the condition progresses, chronic rhinitis typically presents with a diffuse or patchy increase in soft tissue opacity over one or, more commonly, both nasal chambers (Fig. 3). Whilst turbinate detail may be reduced in clarity, it remains largely intact. MRI may show mucosal thickening and a variable accumulation of fluid in the meati and sinuses.

3. Destructive Rhinitis

Destructive rhinitis is most associated with fungal infection in the dog, and radiographically presents as variably sized lucencies within one or both nasal chambers (Fig. 4). Deviation of the nasal septum / vomer is rare compared to neoplasia.

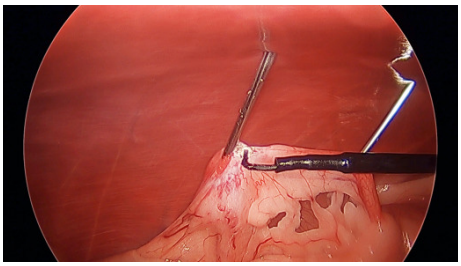


Figure. 3: *Dorso-ventral intra-oral radiograph showing subtle increase in soft tissue opacity in both nasal chambers but no turbinate or bony destruction.*

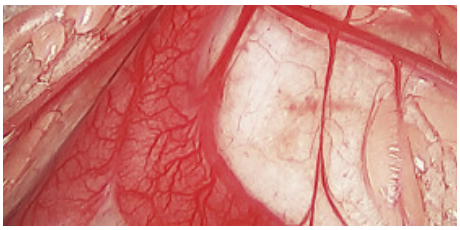


Figure. 4: *Radiographic dorso-ventral intra-oral projection of a dog with destructive rhinitis. There is loss of turbinate detail in right caudal nasal chambers (arrowed).*

There may be localised areas of soft tissue opacity, corresponding to accumulation of secretions and/or fungal plaques, which may also extend into the frontal sinuses. In severe cases, there may be punctate lucencies within the cortical bone of the maxillae and frontal bones. Both MRI and CT demonstrate the severity and extent of turbinate loss and are particularly useful where early disease is present. (Fig. 5.)

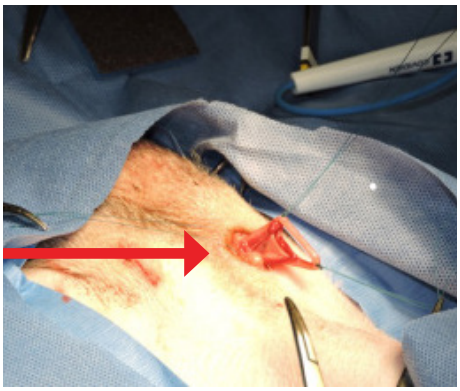


Figure. 5: *CT dorsal plane reconstruction showing destructive rhinitis in a dog with a large defect in turbinate detail (arrowed).*

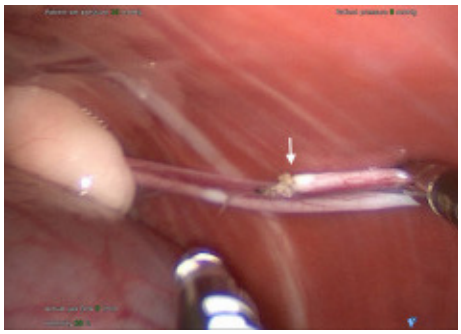


Figure 6: *MRI dorsal plane T1W image of a cat with chronic rhinitis. There is bilateral thickening of the nasal mucosa and reduced air lucencies within the nasal turbinates bilaterally. The nasal septum deviation is likely to represent normal anatomical variation*

4. Rhinitis in Cats

There is often a natural asymmetry between the nasal chambers of the cat, also with deviation of the nasal septum, and this anatomical variation should be considered when interpreting radiographs of the feline nose. Infections such as Calicivirus, Herpes virus, Bordetella, Chlamydia and Cryptococcus, and FIV may produce chronic inflammatory and potentially structural changes in the nasal mucosa, which are shown best by MRI (Fig. 6).

Radiographically, these changes would typically appear as for chronic rhinitis in the dog, although occasionally may demonstrate more lytic changes. Fluid accumulation is not uncommon in the frontal sinuses.

5. Foreign Body Rhinitis

Commonly caused by grass seeds and other plant fragments, these objects are not seen radiographically per se. However, when chronic, the local inflammation they induce may be seen as a local thickening of soft tissue and loss of turbinate definition, normally in one nasal chamber. Radiopaque foreign bodies such as needles or gunshot are readily identified and localised on orthogonal radiographic projections. MRI and CT are valuable for assessing the three-dimensional effect of foreign material within the nose (Fig. 7). MRI may indirectly highlight this material by demonstrating local inflammatory changes and fluid accumulation, even where visualisation of the foreign body itself is not possible.

6. Neoplasia

Primary nasal neoplasia in the dog and cat is rare, but frequently malignant, and the commonest cause of chronic nasal discharge in dogs. Differential diagnoses include adenocarcinoma, squamous cell carcinoma, chondrosarcoma, osteosarcoma, and lymphoma.

Figure 7: *Dorsal plane T1W MRI image of a dog, right is to the left of the image. There is a foreign body (stick) in the right nasal chamber (arrowed).*

Figure 8: *Dorso-ventral intra-oral radiograph of a dog, right is to the left of the image. There is a right sided nasal neoplasm, associated with opacification of the right nasal chambers, with loss of turbinate detail and thinning of the vomer bone.*

Radiographically, neoplasia is typically identified as a soft tissue mass lesion, obliterating local turbinate detail unilaterally or bilaterally (Fig. 8). As the mass grows, it may obstruct drainage of secretions, resulting in accumulation of fluid caudal to the mass, for example in the frontal sinuses. Amorphous mineralisation is occasionally seen within nasal tumours.

Advanced tumours may cause thinning, deviation or destruction of the vomer bone and overlying incisor, nasal or maxillary bones. A mass may also cause destruction of the hard palate, seen as an area of lysis, which may be confused with destructive rhinitis, despite the primary radiographic sign of a solid increase in opacity within the nasal chamber.

In patients where differentiation between rhinitis and nasal neoplasia remains unclear, CT and MRI offer three-dimensional evaluation of the pathological features and extent of the disease. Hence, local invasion into the contralateral nasal chamber, maxillary and frontal bones and sinuses, hard palate, orbits and even the cribriform plate may be assessed. Whilst CT offers exquisite bony detail, the soft tissue/fluid contrast that MRI provides is equally advantageous, and thus choice of advanced imaging used may be based on availability of either modality to the practice. (Fig. 9)

Figure 9: *Transverse CT image, right is to the left of the image. There is a soft tissue mass replacing the turbinates within the left nasal chamber, with lysis of the overlying maxilla (arrowed).*

Trauma

Fractures of the nasal and maxillary bones frequently involve multiple fragments, as well as soft tissue swelling. Standard orthogonal radiographic projections may be supplemented by skyline and lesion-oriented oblique views (Fig. 10) to characterise the pathology. CT is particularly useful for establishing the three-dimensional effect of any bony displacement for surgical planning.

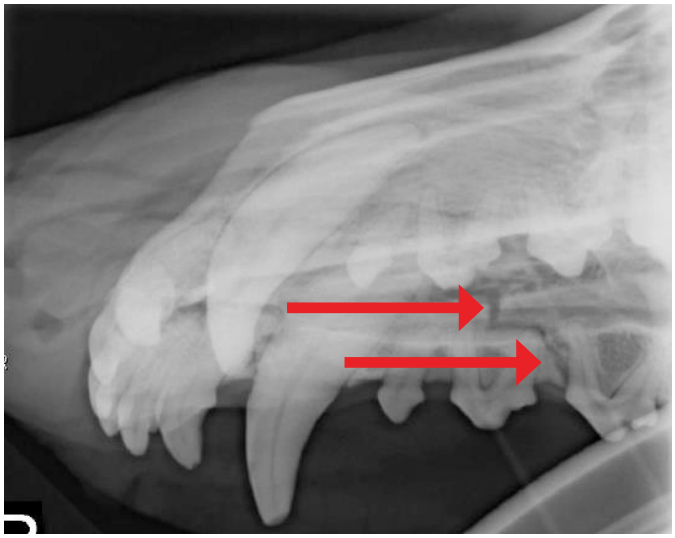


Figure 10: *Lesion orientated oblique radiograph (sagittal oblique view) highlighting an irregular radiolucent line consistent with maxillary fracture caudal to UPM3, arrowed.*

CPD Questions

9. Which one of the following statements regarding gonad sparing sterilisation in dogs is INCORRECT?

a. With a hysterectomy the entire endometrium must be removed to avoid stump pyometra as the ovaries are retained.
b. Transection of the uterus caudal to the cervix allows for complete removal of all glandular tissue.
c. Resection of uterine horns at the proper ligament showed histopathological evidence of residual glandular tissue on the cut margin in 50% of cases.
d. There are anecdotal reports of weakening of tissue of vaginal vault.
e. Only 10% of dogs will persist in having mild haemorrhagic discharge during their oestrus cycle.

10. Which one of the guidelines listed below is NOT one recommended by the author.

a. Suggested age of castration of small breed dogs at greater than 6 months of age.
b. Suggested age of castration of large breed male dogs (20 – 40kg) at greater than 11 months of age.
c. Suggested age of castration of giant breed dogs greater than 23 months of age.
d. Suggested age of sterilisation of large breed female dogs (20 – 40kg) at greater than 11 months of age.
e. Suggested age of sterilisation of giant breed female dogs at greater than 11 months of age.

KYRON LABS

KYRON PROBIOTICS

& THE TREATMENT OF DIARRHOEA

PROTEXIN

Multi-strain Probiotic

Backed by over 20 years expertise & research

60g | 250g | 1kg

PRO-KOLIN+

Restores gut microflora

Dual source pre-biotic

Optimised levels of medicinal Koalin clay

Protects irritated intestinal walls

15ml | 30ml

PRO-LYTE

Replaces lost electrolytes

Minimises villous atrophy

Replenishes & restores beneficial gut microflora

Restores energy levels

10 x 80g sachet bucket

10 x 20g sachet box

Health and beauty for all animals®

www.kyronlabs.co.za

Kyron Laboratories (Pty) Ltd. Co. Reg. No. 1990/004442/07
29 Barney Road, Benrose 2094 South Africa Tel. +27 11 618 1544 info@kyronlaboratories.com

Canine Gallbladder Mucocele

In healthy dogs the gallbladder plays a vital role in the digestion process as well as the absorption of many vital nutrients through the fortification and storage of bile. Hepatocytes within the liver continuously secrete bile, which primarily consists of water, bile acids and pigments, cholesterol and salts. The bile eventually makes its way into the gallbladder for storage and modification. After meals, bile is pumped through the common bile and cystic ducts into the duodenum. In between meals, most bile will be pumped back into the gallbladder, where it is stored, concentrated and acidified.

Pathophysiology:

Gallbladder mucocoele (GBM) occurs when the dog's gallbladder becomes filled with an excessive amount of mucin rich bile, forming a solid or semisolid mass. The formation of these solid masses can obstruct bile flow to and from the gallbladder, causing opportunistic bacterial infections, stretching of the gall bladder wall (resulting in ischaemia and pressure necrosis) and even rupturing of the gall bladder, leading to septic peritonitis and septic shock.

GBM mostly occurs in small to medium-sized older dogs (ages 3 to 17 years), with no apparent gender predilection. The disease has so far been identified in many breeds but is more prevalent in Cocker Spaniels, Miniature Schnauzers, Scottish Terriers and Shetland Sheepdogs. The over secretion of mucus and alteration in components is likely multifactorial and can be linked to certain factors such as inflammatory bowel disease, endocrine diseases such as Cushing's disease, diabetes mellitus or hypothyroidism, high cholesterol, high fat diets, pancreatitis and gallbladder stones. Unconjugated bile acids, which are increased in dogs with a mucocoeles, lead to damage to the epithelium of the gall bladder. Mucin secretion will increase due to the injury and ultimately result in mucinous hyperplasia of the gall bladder epithelium.

A recently discovered, dominantly inherited with incomplete penetrance, genetic mutation has also been linked in the development of GBM. An insertion mutation in exon 12 of the ABCB4 gene introduces 4 premature stop codons, halting the production of the ABCB4 protein. As the ABCB4 proteins play a vital role in hepatocyte phosphatidylcholine transport, the bile itself will contain less phosphatidylcholine, ultimately subjecting the biliary epithelial cells to higher levels of bile salts and damaging them in the process.

Clinical:

The development of a GBM is a prolonged insidious process and as many as 25% of dogs with a GBM will not present with any clinical signs. If the dog does present with clinical signs, they are mostly non-specific and can include the following:

- Vomiting and/or diarrhoea
- Abdominal distention
- Fever
- Lack of appetite
- Abdominal pain
- Lethargy
- Tachypnoea and tachycardia
- Icterus
- Polyuria and polydipsia
- Septic shock, collapse

Typical clinicopathologic indicators include high liver enzyme activities (ALP, GGT, ALT and AST) and leukocytosis with a mature neutrophilia and monocytosis.

Diagnosis:

GBM is most commonly diagnosed on abdominal ultrasound - often as an incidental finding. It is not advised to perform a guided cholecystocentesis in cases with a mucocoele, as this could lead to haemorrhage or bile leakage. As almost half the dogs brought in for clinical signs have already experienced gallbladder rupture early diagnostic intervention may be of great value in predisposed breeds.

Treatment:

The severity of GBM should be evaluated in the individual before deciding on the best course of action. Medical management can be considered in cases where serious complications such as gallbladder rupturing has not yet occurred. Choleretic drugs, such as ursodiol, can be administered to stimulate the volume of secretion of bile from the liver. This may also cause rupture of a very fragile gall bladder and is not advised in cases with a very clear large mass. Antibiotics, selected for efficacy against gram –ve bacteria, can also be prescribed for 6 – 8 weeks to prevent opportunistic infections from occurring. Hepatoprotectants, such as the anti-oxidant S-adenosylmethionine (SAMe) can be administered to protect the liver. Dogs should be monitored every 4 – 6 weeks to evaluate the effectiveness of treatment. Should the dog not improve with medical management or in the event that the dog starts to show clinical symptoms/ worsening of symptoms, surgical intervention should be considered. Should the dog present with septic peritonitis or bile leakage, emergency surgery will be necessary. Gallbladder rupture should be suspected in dogs showing signs of sepsis, if the wall of the gallbladder is discontinuous, if a hypoechoic fluid ring is present around the gallbladder or if pericholecystic fat is hyperechoic.

Surgical intervention will entail removing the gallbladder (also known as a cholecystectomy). Many surgeons recommend removing the gallbladder upon first diagnosis of GBM, before symptoms worsen or the gallbladder ruptures. In clinically unaffected or stable dogs, removal of the gallbladder has an excellent prognosis. Patients should be stabilised with antibiotics, antiemetics, fluids and pain medications before anaesthesia is administered.

The median survival time post-surgery is 1802 days and 1340 of medical treatment. The surgery has inherent risks, with 22 – 40% of patients dying within 14 days of surgery. Survival rate is excellent after the 14 day post-surgery mark. Early surgical intervention may significantly reduce these mortality rates as the gall bladder wall would be healthier.

Source Material

Literature consulted in the writing of this article:

- Canine Gallbladder mucocele. Cornejo & Webster 2005. VetFolio Journal, 27(12): 912-930.
- Gallbladder mucocele. American college of veterinary surgeons website.
- Canine Gallbladder mucocele. Center 2015. MSD Veterinary Manual.
- An insertion mutation in ABCB4 is associated with gallbladder mucocele formation in dogs. Mealey, Minch, White, Snekvik & Mattoon 2010. Comparative Hepatology, 9(6): 1-7.

REVIVE

Reg. No. V32688 Act 36 of 1947

Energy and stress tonic for optimal nutrition and performance.
A concentrated liquid containing Vitamins, Trace Elements, Essential Fatty Acids, Essential Amino Acids, Prebiotics, Nucleotides and Energy from Specialised Fatty Acids.

- Bio-available, **balanced,** water-soluble liquid for optimal health
- Can be used as a **nutritional-and-energy boost** for dogs, cats and other small animals
- Aids in **recovery** after stressful events
- Helps regain **strength** and **replenish** energy
- Contains Nucleotides which aid **gut health** and boost **immunity**
- Aids where **Vitamin deficiency** is detected

Ideal for use:

- after **deworming**
- after **antibiotic** use
- after **vaccination**
- during **disease** challenges
- after exercise
- for **weak/sick and/or newly born animals** as a booster

Available sizes:
50ml, 130ml, 1ℓ

(011) 614 8915
info@medpet.co.za
www.medpet.co.za
Medpet
@medpetsa

MEDPET (PTY) LTD
THE SCIENTIFIC ALTERNATIVE

FOR VETERINARY USE ONLY

Vetcam 2%

Meloxicam 20 mg/mℓ

S3 Reg. No. 13/3.1.2/09

INJECTABLE SOLUTION

For intravenous or subcutaneous use only

- Long half-life.[1,2]
- Highly plasma bound.[2]
- Preferential COX-2 selective anti-inflammatory drug.[2,3]
- Targeted action – concentrates in inflamed tissue.[4]
- Highly effective with long-term benefits as an adjunctive treatment for bovine respiratory disease.[3,5]

For full prescribing information refer to approved package insert.

Anti-inflammatory • Analgesic • Antipyretic • Anti-endotoxic

Registraton Holder: Ascendis Animal Health (Pty) Ltd
Marketed and Distributed by: Ascendis Animal Health (Pty) Ltd Reg. No. 2001/017471/07
Tel: 012 661 4076 Address: Unit 45A, 45 Parkview Street, Highway Business Park, Rooihuiskraal, Centurion, South Africa, 0157 Email: vet-info@ascendis-health.com VET.22.02/1

Ascendis ANIMAL HEALTH

References:
1. Stock, M.L. & Coetzee, J.F., 2015. Clinical pharmacology of analgesic drugs in cattle. *Veterinary Clinics of North America: Food Animal Practice*, 31:113-138. 2. Papich, M.G., 2016. Meloxicam. Saunders Handbook of Veterinary Drugs (4th edition). *Elsevier Health Sciences*. 488-491. 3. Bednarek, D., Zdzisińska, B., Kondracki, M., Kandefer-Szerszen, M., 2003. Effect of steroidal and non-steroidal anti-inflammatory drugs in combination with long-acting oxytetracycline on non-specific immunity of calves suffering from enzootic bronchopneumonia. *Veterinary Microbiology*, (96):53-67. 4. Brune, K. & Furst, D.E., 2007. Combining enzyme specificity and tissue selectivity of cyclooxygenase inhibitors: towards better tolerability? *Rheumatology*, 46(6):911–919. 5. Friton, G.M., Cajal, C. & Ramirez-Romereo, R., 2005. Long-term effects of meloxicam in the treatment of respiratory disease in fattening cattle. *The Veterinary Record*, 156(25):809-811.