



Practical Guidance for New Veterinarians

One of the first things we learn as veterinarians is the importance of being able to recognize *normal*. Imagine the anxiety you'd have about every single case if you had no way to compare the patient in front of you to a healthy one. *Is this heart rate too fast? Don't know! Should the mucous membranes be this color? No clue!* We'd spend our lives wondering if we should be worried about our patients.

It's rare to be taught how to recognize what's normal for **us**—and because we're human, we tend to assume whatever we're feeling must be **abnormal**. I've heard so many new graduates say things like, "I feel like I should know this already, and I'm afraid to let on that I don't." I remember feeling exactly that way on my first day of practice, when I found myself staring into a cabinet full of medications I didn't actually know how to use.

If I could go back in time and talk to that newly minted version of me, I'd tell myself that it's normal to:

- Bounce back and forth on an hourly basis between terror and wild confidence
- Feel like you're badly representing an entire generation of veterinarians when your boss says, "What are they teaching you all in school these days, anyway?"
- Wonder whether you should have taken out so many loans for something you're suddenly not sure you're cut out for (and feeling ashamed to admit it)
- Resent when clients or team members don't trust your recommendations right away and want a more experienced veterinarian to weigh in
- Be ready to care for a critical patient with multiple CRIs and 3 endocrine diseases but not be able to express impacted anal glands (shout out to Heidi, the LVT who taught me how to do that well after I graduated)

The uneasy feeling that you are basically a mixing bowl of random facts, drug names, and crippling self-doubt doesn't mean you aren't already on your way to being a great veterinarian. In fact, that's pretty much *new doctor normal*, and every doctor who's ever doctored has been there too.

Initially, you'll need to lean more heavily on colleagues who answer the phone when you need them, resources you can turn to in a hurry that help you feel confident in a treatment

plan, and the ability to gracefully leave an examination room to look something up. Above all, you'll need to remind yourself every day that if you're trying hard to do right by your patients, you're already a good doctor.

In the pages that follow, 6 members of the veterinary profession share what they would say if they had 5 minutes with a new graduate. No matter how long you've been doing this job, I'd recommend keeping their words close to your desk and your heart. If experience alone made every day easy, veterinary medicine wouldn't be the complex, rewarding, difficult, and often achingly beautiful place it is—a place you are already an essential part of creating.

One more note as you embark on this journey: I burned out hard and early in full-time primary care. I thought about leaving the field multiple times, but positive, out-of-the-box people showed me there was more here for me to do. I now work at Clinician's Brief and Plumb's, in addition to a general practice or urgent care relief shift here and there, combining my love for the veterinary community with the experience (clinical and otherwise) I've gained over the past 15 years.

I wish someone had told me at the very start that my path didn't have to look exactly like everyone else's and that the skills (leadership, communication, and candor, to name a few) I was building were at least as important as the clinical ones and fully transferable to other areas of veterinary medicine.

So, now I'm telling you. Enter practice with an open mind and learn everything you can, but don't be afraid to explore where your unique gifts and passions reside. You may accessorize with scrubs and a stethoscope, but you will be stronger if you show up dressed as yourself.



Katie Berlin, DVM
*Veterinary Director, Brand Advocacy
Clinician's Brief and Plumb's*

our authors



BARAK BENARYEH, DVM, DABVP, is the owner of Spicewood Springs Animal Hospital in Austin, Texas. Dr. Benaryeh earned his DVM from University of California, Davis. He also completed an internship in small animal medicine, surgery, and emergency at University of Pennsylvania. Dr. Benaryeh has taught practical coursework to first-year veterinary students and lectured at several conferences across the United States.



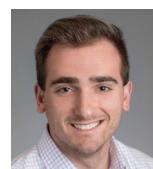
TIA GREGORIO, MBA, DBA, CVBL, CVT, is the practice manager of 2 PetMedic Urgent Care facilities in Cambridge, Massachusetts, and a tenured certified veterinary technician with a history in emergency medicine, general practice, and specialty services. Dr. Gregorio earned her BS in veterinary technology and her MBA from Mount Ida College and her DBA from Trevecca Nazarene University. Joining medicine with strategy has helped drive her passion to grow successful and empowered veterinary teams.



CARRIE JURNEY, DVM, DACVIM (Neurology), CCFP, is the president emeritus of Not One More Vet and owner of Remedy Veterinary Specialists in San Francisco, California. Dr. Journey earned her DVM from University of Georgia. She has extensive education and experience in peer interventions, including working with suicidal colleagues.



ZENITHSON NG, DVM, MS, DABVP (Canine & Feline), is a clinical associate professor of small animal primary care at University of Tennessee. Dr. Ng earned his DVM from Cornell University. He also completed an internship at the ASPCA and an American Board of Veterinary Practitioners canine and feline residency at Virginia Tech. His clinical interests include behavior, dentistry, preventive medicine, and management of chronic disease, and his research and teaching interests include the human-animal bond, diversity, equity, inclusion, and veterinary education.



JASON SZUMSKI, DVM, is a small animal veterinarian at Golf Rose Animal Hospital in Schaumburg, Illinois. Dr. Szumski earned his DVM from University of Illinois, where he was president of the Veterinary Business Management Association and class president. He has spoken at national events on the importance of understanding what newly graduated veterinarians want.



EWAN WOLFF, PhD, DVM, DACVIM (SAIM), is an internal medicine specialist at Blue-Pearl Pet Hospital in Portland, Oregon. Dr. Wolff earned their PhD in vertebrate paleontology from Montana State University and their DVM from University of Wisconsin-Madison, where they also completed a rotating internship and a partial specialty oncology clinical trials internship. Dr. Wolff started an internal medicine residency at Massey University in Palmerston North, New Zealand, and completed the residency at Purdue University. Dr. Wolff is involved in long-term medical strategy work and advocacy for gender diverse individuals in the veterinary profession as industry liaison at PrideVMC. ●



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10 Ways to Forge Your Path

Ewan Wolff, PhD, DVM, DACVIM (SAIM)

BluePearl Pet Hospital

Portland, Oregon



Being a new graduate is temporary. The first day, week, and month are over quickly—as are the first consultation, surgery, success, and complaint. There can be a lot of concern around these firsts, but they aren't nearly as important as what comes after.

Four years of veterinary school was never going to be enough to make you the perfect clinician on day one (or even year one). We all gave so much time and energy to get into the profession; the rest of the story is an investment in our own knowledge and practice.

A few things, though, will help you stay true to yourself:

- 1 Do what's meaningful to you.** No one else's expectations or good graces will motivate anyone to do this job.
- 2 You don't have to be an expert at something to be good at it.**
- 3 Let the technicians do their job.** Know what technicians can do, and learn from them. They are authorities on patient care and nursing skills.
- 4 Be an active ally for your underrepresented colleagues.** Educate yourself, listen, and have the strength to learn your own biases, and apologize and grow. Lift these colleagues up, let them lead, and help create an inclusive profession.

- 5 Give yourself grace on the hard days and cases.**
- 6 During difficult situations, take a moment to breathe and remember that conflict is not personal.** When clients or coworkers raise your blood pressure, there is often something else going on.
- 7 Remember that life outside the profession is important.** Don't steal time from yourself by failing to set boundaries.
- 8 Know your worth, and ask for it.** Ask around, make a spreadsheet, and gather the right numbers for wages, benefits, and retirement. It's okay for your heart to be in the profession and to also be paid well.
- 9 If you do everything you can to make your daily life better and you can't, reach out to colleagues, friends, family, and resources to get help.**
- 10 Nothing is as important as your patient's quality of life:** not how thoroughly you perform diagnostics, how precise your differentials list, or the client's budget. Never lose sight of healing. It's our purpose.

We're in a time of veterinary shortage. There's not enough of us, and there won't be any time soon. The postpandemic landscape is full of heightened expectations for the marvels we'll achieve with technology, but every generation faces different obstacles that are daunting at the outset. Your future depends on the path you take. ●

Performing Physical Examination

The Cornerstone of Veterinary Medicine

**Douglas Mader, DVM, MS, DABVP (Canine & Feline),
DABVP (Reptile & Amphibian), DECZM (Herpetology)**

Marathon Veterinary Hospital
Marathon, Florida



What's Inside

- Bad Medicine, Bad Business
- Important Considerations
- Prior to Examination
- Step-by-Step: Performing the Physical Examination
- Additional Considerations

For every clinical problem missed for not knowing, 10 will be missed for not looking. The physical examination (PE) is the cornerstone of diagnostic medicine—*everything* the clinician does for a patient is based on its results. If something small is missed during the PE, it can complicate later diagnostic problem solving.

Bad Medicine, Bad Business

After graduation, my first job boasted 6-minute appointments. If a patient came in for a “bad ear,” that was all I was to examine—just the ears. My boss considered it a waste of time and resources to look at the rest of the patient. In addition, he felt it was good business to churn through the appointments, 10 per hour, rather than examining the entire animal.

In actuality, it was bad medicine *not* to look at the entire animal—what if the ear problem was related to allergies, foreign bodies, or metabolic issues? From a business perspective, if a clinician is only looking at the ears, the heart murmur, dental disease, cataracts, or

other, possibly more pressing, opportunities for care (and revenue) are missed.

Important Considerations

Consistency must be a habit when it comes to PEs. By developing a consistent PE routine, the clinician is less likely to miss examining an area. The clinician should stick to a pattern when conducting the examination (ie, nose to tail, ears to feet). In cases where the client brings a pet in for a specific complaint, the clinician-client relationship may benefit from focusing on the complaint area first before proceeding with a consistent, routine PE. The client may also benefit from an explanation that the presenting complaint may have roots elsewhere, emphasizing the necessity of the PE.

A PE can take on many forms and purposes (eg, annual, presurgical, health certificate, geriatric, insurance clearance, pre- or postpurchase exam-

ination). The clinician must decide how to perform these types of examinations and what services will be included or offered with them. For instance, for an annual examination on a young dog, the author is not likely to recommend an ECG if no problems were noted on auscultation; however, for all senior wellness examinations, the ECG is mandatory. Following are the steps this author considers essential to performing a thorough PE.

Before the Examination

First, the technician should obtain temperature, pulse, and respiratory rate values. Blood pressure should be taken at the start of the examination (**Figure 1**), before the patient has a chance to become anxious and affect results. This can be done by the technician before the veterinarian arrives.

The history may be the most important part of any PE. It may be taken by the veterinary technician during check in and should include (but not be limited to): Presenting complaint; patient's age, alteration status, vaccine history, ectoparasite medications, heartworm medications, issues with prior medications, current medications, behavior issues, and health status of other household pets; and past medical history. Past medical history should be asked several times in different ways. Clients often leave things out or don't think things are important the first time around.

The technicians should then record the date of when the presenting problem began, whether the problem is progressive or stable, and anything else deemed relevant by the client.



FIGURE 1 Blood pressure measurement in a dog

“ Sticking to a consistent pattern (eg, nose to tail, ears to feet) when conducting a physical examination reduces the risk for missing an area.



Step-by-Step

Performing the Physical Examination

Step 1: Observe the Patient

Before handling the animal, evaluate its movement by watching it on the table or, if feasible, walking around the room. Vision can be evaluated by turning the room lights down or off to watch the patient navigate in dim light, whereas hearing can be evaluated by calling to the pet or making a loud noise out of its line of sight.

Author Insight

For new pets, this author scans for a microchip at the beginning of the examination.

Step 2: Examine Eyes, Ears, Nose, & Throat (Oral Cavity)

Include CRT, mucous membrane color, and dental score. Perform an otoscopic (with tympanic membranes evaluation) and ophthalmic (fundic) examination.



Continues ►

Step 3:

Conduct a Cardiopulmonary Examination

Include auscultation, heart rate, pulse quality, murmurs, heart rhythm, respiratory pattern, and adventitial sounds.



Step 4:

Palpate the Abdomen

Feel internal organs and palpate kidneys, liver, spleen, internal lymph nodes, and intestines. This can be difficult on large or obese patients. Note the patient's response to the palpation (eg, comfortable, apparent [splinting]).

Step 5:

Perform Musculoskeletal Examination

Look for gait abnormalities and deformities, palpate all joints, perform an orthopedic examination for patellar luxations or drawer signs, and feel for crepitous and joint effusions. Record a body condition score. For overweight patients, note ideal weight in their chart.



Step 6:

Palpate the Lymph Nodes

Measure and note abnormal lymph nodes. If necessary, collect samples using fine-needle aspiration.



View this article online at
brief.vet/physical-exam-steps,
or scan the QR code.



Step 7:

Check Integuments

Evaluate the hair, fur, and skin; look for ectoparasites, lesions, masses, odor, and grease. Perform skin tenting in several places to estimate hydration. Note hydration score in patient record.

Step 8:

Perform a Rectal Examination

Palpate the anal glands.

Author Insight

There is considerable debate about whether a rectal examination should be performed at every examination. The author recommends performing a rectal examination for all intact males, all males with urinary issues, older male dogs, and any patient with issues relating to defecation.

Step 9:

Perform a Basic Neurologic Examination

Include a cranial nerve evaluation and test proprioception, placing, and wheelbarrowing. For patients presenting with neurologic signs, perform a comprehensive examination.



Author Insight

Dropping a cotton ball and watching the patient follow its movement is an excellent way to evaluate vision and tracking (*Figure*).



Continues ►

Additional Considerations

These are the basic steps for a PE; however, depending on the type of PE and the presenting complaint, additional diagnostics may be warranted and should be recommended to the client. Additional testing options (eg, cephalic venipuncture [Figure 2], cystocentesis [Figure 3]) should be discussed with the client, even if those tests are not generally part of an annual PE. For instance, a yearly heartworm test should be recommended for patients living in heartworm endemic areas. Some tests, such as fecal examinations, CBC, urinalysis, radiography (Figure 4), and ECG may also be needed or warranted. Over testing should be avoided. For instance, a yearly FeLV test for an inside-only apartment cat is unnecessary.

Closing Thoughts

It is best to catch problems early. Although some clients may prefer to avoid a thorough PE and testing on their pet out of fear of problems being found, it is important that the veterinary team help clients understand that finding problems early helps safeguard pets and ensure they receive proper care.

Acknowledgments

The author wishes to thank Dr. Kristin Hall and Dr. Kirsten Ebb for help in preparation of this article. ●



FIGURE 3 Ultrasound-guided cystocentesis in a dog.



FIGURE 2 Cephalic venipuncture in a dog



FIGURE 4 Radiography in a dog

Set Standards & Trust Your Team

Tia Gregorio, MBA, DBA, CVBL, CVT

PetMedic Urgent Care

Cambridge, Massachusetts



Welcome to a fascinating, exhilarating, and humbling job! Entering a new career field can be exciting and overwhelming. As you embark on your new journey, remember that your voice matters. Your thoughts and ideas will shape the way you deliver robust veterinary care while advocating for growth and development.

Starting out, your focus will likely be on driving quality medicine, providing client education, and building new relationships. Although these are critical aspects of veterinary medicine, there are some other, often overlooked, areas that can help build your new career.

Help Clients Understand Costs

The last thing we want to hear is “Veterinarians only care about money.” We know this is not true, but it is our responsibility to keep the clinic functioning and provide a high standard of care. It is therefore imperative to understand the metrics that drive business, not only to benefit the clinic, but also to better explain to clients the costs associated with procedures and diagnostic tests.

Understanding and providing a high standard of client education can be beneficial long after the appointment. You can simultaneously set the standard of care for your clinic (and serve as an advocate for clinic employees, their knowledge, and the industry) *and* provide knowledge that clients can recall when considering the vital costs associated with appropriate care at future appointment (at the clinic or an emergency hospital). Clients may also be more encouraged to seek financial options, including pet insurance and possible financing offered by the clinic.

Trust the Team

An important resource in every clinic is the support team. These staff members are educated, trained, capable of helping with any task, and critical for success. Empowering team members and building relationships with them can encourage trust, strengthen communication skills and ability to work through difficult moments, and significantly increase workflow and clinic profitability. Provide staff with opportunities for growth and development. Teach them new skills, and soak up their knowledge as well.

You are the future of this incredible industry. Enjoy each defining moment, embrace the changing environment, and do not be afraid to set new standards. ●

Abdominal Palpation

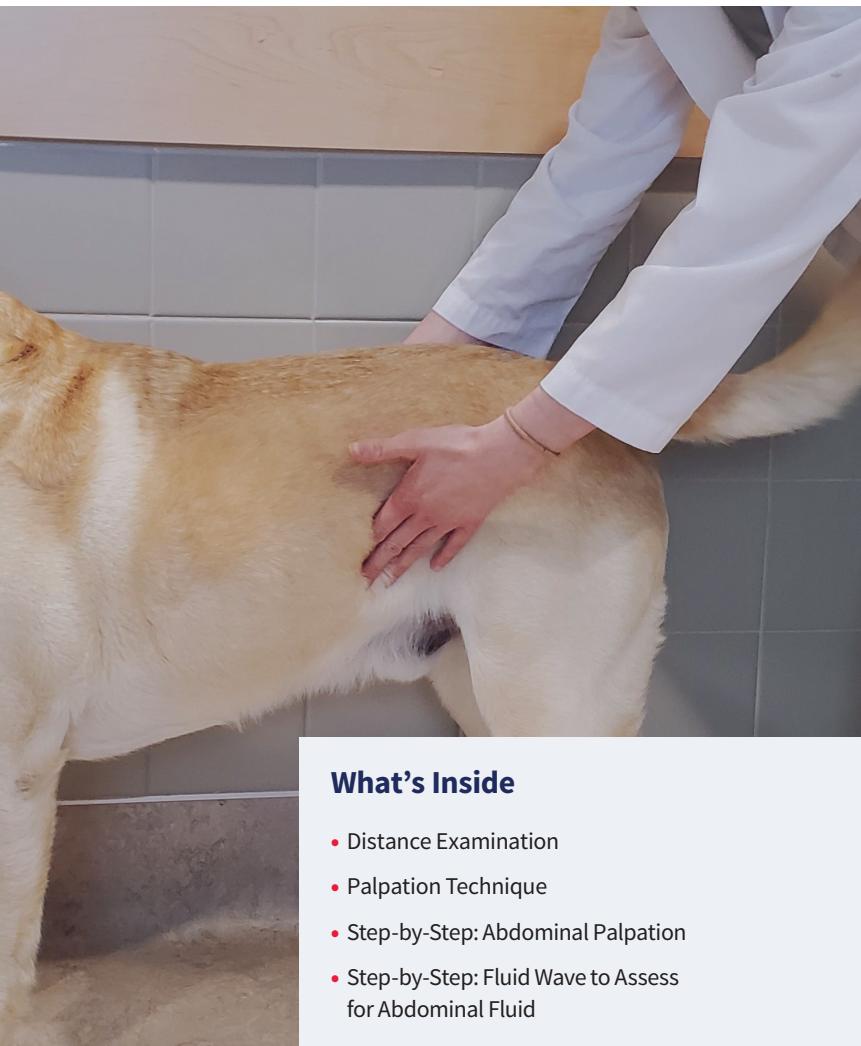
Identifying & Localizing Abdominal Pain

Alice Defarges, DVM, MSc, DACVIM

Allison Collier, DVM, DVSc

University of Guelph

Guelph, Ontario, Canada



What's Inside

- Distance Examination
- Palpation Technique
- Step-by-Step: Abdominal Palpation
- Step-by-Step: Fluid Wave to Assess for Abdominal Fluid

Abdominal palpation can help identify and localize abdominal pain during physical examination. Pathology (eg, abdominal masses, organomegaly) may be identified via palpation before development of clinical signs. Palpation should be learned through practice, ideally with a mentor, and repeated if abnormalities are missed on palpation but subsequently identified on imaging.

Distance Examination

Prior to palpation, the contour of the abdomen can be visually assessed (**Figure 1**). An abnormal contour (eg, disappearance of the flank or abdominal tuck) can indicate abdominal enlargement; differential diagnoses include obesity, pregnancy, organomegaly, and ascites.



FIGURE 1 Normal abdominal contour (**A**); abnormal abdominal contour and abdominal enlargement caused by ascites (**B**)

Assessing position and demeanor can also be beneficial. Patients with abdominal pain may be unwilling to roll onto their back, and patients with cranial abdominal pain may demonstrate *prayer position* (ie, lowered cranial half of the body and raised caudal half; **Figure 2**).

Palpation Technique

Abdominal palpation can be performed using the PALPATE (ie, position, anatomy, level, pressure, assessment, thorough systematic approach, extra-abdominal assessment) technique.¹



FIGURE 2 Prayer position, which often indicates cranial abdominal pain

Continues ►

Step-by-Step Abdominal Palpation

Step 1: Position

Provide a comfortable, safe position for the clinician and patient (ie, table for small dogs or cats, floor for large dogs) in a quiet, calm environment. If palpation is challenging (eg, patient is obese, tense, painful, or stressed), try placing the patient in lateral recumbency.

Author Insight

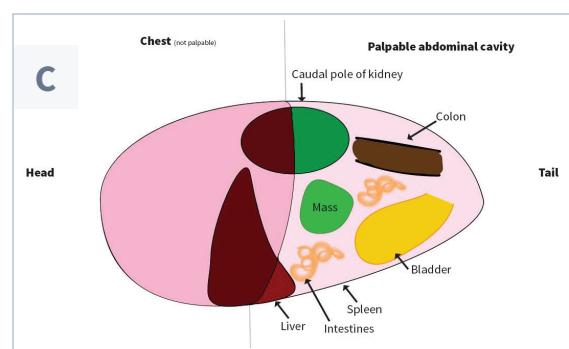
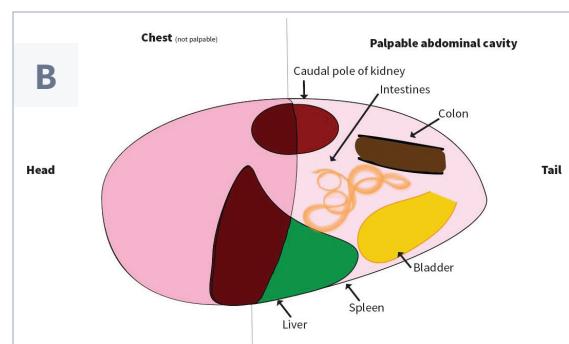
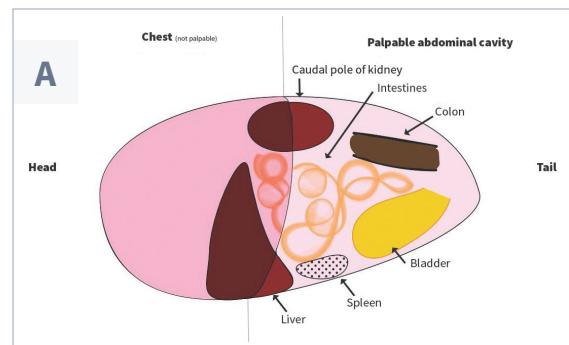
An assistant should be present to restrain the patient.

Step 2: Anatomy

Visualize the 3D orientation of abdominal organs (see *Approximate Location of Organs in the Abdominal Cavity*, next page).

Author Insight

Abdominal organ location varies among normal patients (A), patients with hepatomegaly (indicated by the liver extending beyond the costal margin; B), and patients with an abdominal mass (C). Understanding which organs are normally palpable or nonpalpable can help identify abnormalities (see *Palpable & Nonpalpable Organs on Normal Abdominal Palpation*, page 19).



Step 3:

Level

Avoid superficial palpation that only detects abdominal wall musculature and deep palpation that can cause pain.

Step 4:

Pressure

Apply gentle, progressive pressure on the abdomen. To appreciate organ shape and size in medium and large dogs, hold the abdomen between both hands (ie, 2-handed technique; **A**). For cats and small dogs, hold the abdomen between the thumb and fingers of one hand (ie, one-handed technique; **B**).^{2,3} Bring the fingers together with a light but forceful touch, and move the fingers in a dorsal to ventral direction.



Author Insight

Gentle palpation is recommended in postoperative patients and those with either suspected hemoabdomen or urethral obstruction to avoid hemorrhage from a mass or bladder rupture, respectively.

Approximate Location of Organs in the Abdominal Cavity

• Cranial abdomen	• Mid-abdomen	• Caudal abdomen
– Stomach	– Spleen	– Urinary bladder
– Liver	– Kidneys (dorsal)	– Prostate
– Spleen	– Adrenal glands (dorsal)	– Uterus
– Pancreas	– Small intestine	– Colon
		– Small intestine

Continues ►

Step 5:

Assessment

Use the fingertips to sense the size and shape of organs and detect abnormalities (eg, masses, pain, abdominal distension, organomegaly, foreign objects).

Liver

Palpate the cranial abdominal cavity beneath the costal arch; hepatomegaly is commonly indicated if margins of the liver extend beyond the rib cage.



Spleen

Palpate the mid-abdomen, usually on the left side. The tail of the spleen may be felt on the ventral abdominal floor in a normal dog in a recumbent position.

Kidneys

Palpate the dorsal abdomen.

Author Insight

Only the caudal poles of the kidneys are palpable in dogs. In some dogs, the entire right kidney is in the rib cage, and in other dogs, neither caudal pole may be palpable because of surrounding musculature and adipose tissue. Both kidneys are palpable in cats and are more mobile than in dogs, allowing assessment of shape, contour, and symmetry. Because feline kidneys can be incorrectly palpated as one large kidney, one hand should be kept still while the other hand is moved to separate the kidneys.

Intestines

Place the fingers on either side of the mid-abdomen, press the fingers toward each other, and move them in a dorsal to ventral direction; loops of intestines may be felt slipping through the fingers. Assess the intestines for thickening, masses, intussusception, and foreign objects.

Palpate the dorsal abdomen; the colon may be felt as a tubular structure if filled with feces. Fecal material is typically compressible; do not confuse fecal material with an abdominal mass.



Author Insight

Although characterization of an abdominal mass via palpation can raise suspicion for differential diagnoses, palpation is rarely diagnostic. Imaging studies are usually required to better locate and characterize a mass.

Bladder

Palpate the caudal abdomen for a fluid-filled balloon-like structure; the urinary bladder is often pear-shaped in dogs and spherical in cats. Assess size and firmness; the bladder is often firm and round in patients with [urethral obstruction](#). Palpate gently if an obstruction is suspected to avoid bladder rupture.



FIND YOUR IDEAL CLINICAL RESOURCE

To pick the right decision support tool for your practice, get to the heart of what you really need from your clinical resources.

[ASK YOURSELF 4 QUESTIONS](#) 

Step 6:

Thorough Systematic Approach

Use a consistent technique (eg, cranial to caudal, dorsal to ventral) to ensure all areas of the abdomen are evaluated and none are missed, which could result in unidentified lesions and inaccurate diagnoses.

Step 7:

Extra-Abdominal Assessment

Palpate the back for pain that may confound abdominal palpation findings. Evaluate the abdominal wall for hernias, lipomas, masses, evidence of skin disease, and evidence of dermatologic lesions (eg, petechiae and ecchymoses, both of which may be indicative of coagulopathy and warrant more gentle palpation).

Palpable & Nonpalpable Organs on Normal Abdominal Palpation

- Palpable
 - Intestines, colon
 - Bladder (if full)
 - Both kidneys (cats); ± caudal pole of left kidney (dogs)
 - Tail of spleen
- Nonpalpable
 - Liver
 - Pancreas
 - Stomach
 - Adrenal glands
 - Uterus (except with pregnancy or pyometra)
 - Ovaries
 - Lymph nodes

“ In some dogs, the entire right kidney is in the rib cage, and in other dogs, neither caudal pole may be palpable because of surrounding musculature and adipose tissue.

Continues ►

Step-by-Step

Fluid Wave to Assess for Abdominal Fluid

Step 1:

Place one hand on either side of the abdomen.

Step 2:

Perform gentle ballottement of the abdomen with one hand, keeping the other hand in a fixed position on the opposite side of the abdomen for at least 3 to 5 seconds to allow the impulse to be transmitted through the abdominal fluid (if a fluid wave is present) and perceived (ie, tap; [Video](#)).

Author Insight

A minimum of 30 to 40 mL/kg of peritoneal fluid is necessary for detection of a fluid wave.⁴ Lack of a fluid wave thus does not rule out ascites, and presence of a fluid wave does not indicate the cause of ascites. ●

References

1. Aubin A, Gagnon K, Morin C. The seven-step palpation method: a proposal to improve palpation skills. *Int J Osteopath Med.* 2014;17(1):66-72. doi:10.1016/j.ijosm.2013.02.001
2. Ettinger SJ, Feldman EC, Côté E. The physical examination. In: Ettinger SJ, Feldman EC, Côté E. *Textbook of Veterinary Internal Medicine: Diseases of the Dog and Cat*. 8th ed. Saunders Elsevier; 2017:4-24.
3. Barrett KA. Abdominal distension. In: Côté E, ed. *Clinical Veterinary Advisor: Dogs and Cats*. 2nd ed. Elsevier Mosby; 2011:2.e3-4.
4. Dünser MW, Petros S, Grander W, Öfner-Velano D, Mer M. The liver. In: Dünser MW, Dankl D, Petros S, Mer M, eds. *Clinical Examination Skills in the Adult Critically Ill Patient*. Springer; 2018:129-136.

Suggested Reading

Englar RE. *Performing the Small Animal Physical Examination*. Wiley Blackwell; 2017.

Taylor SM. *Small Animal Clinical Techniques*. 2nd ed. Elsevier; 2016.

Fluid Wave Technique

Assessing for abdominal fluid during abdominal palpation is important, as a fluid wave can suggest ascites.

Video

A [video](#) showing the proper technique for fluid wave is available.

View this article online at [brief.vet/abdominal-palpation](#), or scan the QR code.



Essential Lessons in Life & Medicine

Barak Benaryeh, DVM, DABVP
Spicewood Springs Animal Hospital
Austin, Texas



While attending a recent veterinary conference, I posed the question to seasoned veterinarians: What would you tell a young version of yourself that is just starting out?

Here are their responses:

Hone your people skills.

Your job is to practice medicine at the level your **client** would like, not what *you* would like. The better you are able to communicate effectively and draw out what the client is looking for, the easier your job will be. Try to *read* the people you encounter in everyday life. You don't need to read their minds, but you should be able to read their mood. Understanding facial expressions, body language, and nonverbal cues is important for success. Being able to read and understand those around you may be the single most effective talent you can develop.

Don't take things personally.

Not all clients will listen to you. Early in your career, you may feel like you're not getting the respect you deserve from clients, but this isn't about you, it's about them. Try not to take interactions personally. Focus on helping the patient when a conversation with a client is not going the way you would like.

Remember that the sum total of your life is more than just your job.

Don't judge your clients.

Tell yourself that no matter what this person chooses,

you're okay with it. It is your job to give appropriate information and make recommendations, but it is ultimately the client's choice (within reason) whether to take that advice.

This is a long road.

A person who has never made a mistake has never made anything. You will definitely make mistakes, but take each error as a lesson that will make you a better veterinarian. Mistakes slow you down; don't let them stop you.

Medicine does not stand still, and neither should you.

Some of the happiest people are those who dedicate their life to self-improvement. Never stop learning new things. This is an ever-changing field; if you don't change with it, your medical practices will grow outdated.

You can't fix everything, and you can't fix it all in one visit.

Rome wasn't built in a day, nor will the complicated Cushing's patient be fully treated in one examination. Some cases take more time, and there is nothing wrong with arranging to follow up on less urgent issues on another day. Sometimes your job is helping the person in front of you to understand that, but first you need to understand it yourself.

You don't need to know everything, and it's okay for clients to know you are fallible.

You will need to ask for help from others with a different knowledge base or experience, and you may have to research a case. Help the client trust you by letting them know you are seeking the best understanding for their pet. Be the person who is most willing and able to help. ●

Treatment Approaches for Canine Aural Hematoma

Don't Play It By Ear: Double Check Your Technique

Robert J. Hardie, DVM, DACVS, DECVS

Alex M. Aubrecht, DVM

University of Wisconsin–Madison



What's Inside

- Incidence & Etiology
- Anatomy of the Canine Ear
- Treatment
- Potential Complications
- Step-by-Step: Surgical Treatment

Incidence & Etiology

Aural hematomas are common in dogs, can occur unilaterally (typical) or bilaterally (rare), and are most often caused by trauma (ie, excessive scratching or head shaking) to the pinna that leads to fracture of the auricular cartilage and subsequent hematoma formation between the skin and cartilage of the pinna (**Figure 1**).¹

Underlying causes for excessive head shaking or scratching include [otitis externa or media](#) caused by bacteria, yeast, or parasites (eg, mites, fleas); underlying disease processes (eg, atopy, endocrine disease, neoplasia); and hypersensitivity reactions.²⁻⁴ An immunologic event that results in degeneration of auricular cartilage is also a possible cause⁴; however, multiple factors may be present, and the exact pathophysiology has yet to be determined.

Untreated aural hematomas can lead to fibrotic changes that cause thickening and irregular appearance of the pinna (ie, *cauliflower ear* in humans).

Anatomy of the Canine Ear

The pinna is composed of a thin layer of auricular cartilage covered by hairless skin on the concave side and haired skin on the convex side. Blood supply to the skin and cartilage arises from the auricular arteries and veins that run longitudinally on the

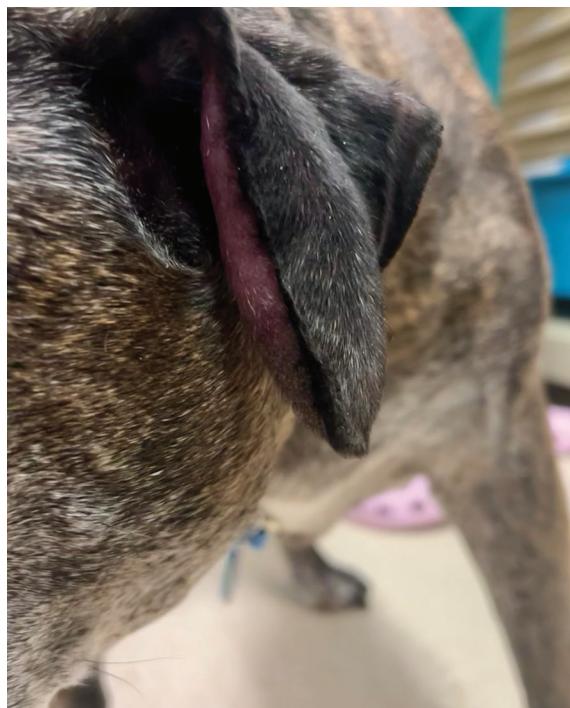


FIGURE 1 Aural hematoma involving the left pinna of a dog

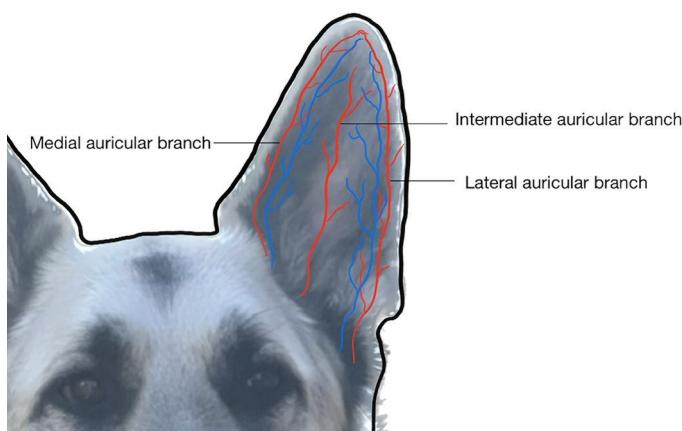


FIGURE 2 Illustration of the vascular supply to the pinna of a dog. Vessels run predominantly on the medial (cranial or rostral) and lateral (caudal) margins of the pinna.

medial (cranial or rostral) and lateral (caudal) margins of the pinna (**Figure 2**).

Treatment of Aural Hematoma in Dogs

Accurately diagnosing and treating the underlying cause of excessive head shaking or scratching is a core component of overall management.

Treatment approaches include surgical management, less-invasive management with active or passive drainage, and conservative management (ie, aspiration and local corticosteroid injection, oral corticosteroid therapy alone). With the exception of oral corticosteroid therapy alone, treatment goals should be to remove hematoma contents, provide continuous or intermittent drainage, and allow for reapposition of the layers of the pinna to reduce the risk for recurrence. Treatment should be based on the patient's comorbidities or risks associated with general anesthesia, cost, patient and pet owner compliance, and clinician preference and experience.

Surgical Management

Surgical management typically results in a positive outcome and minimal recurrence.⁵ Surgery involves incising the skin over the hematoma to allow drainage and flushing, then directly reapposing the pinna layers with sutures.

Less-Invasive Management

Passive and active drains are less-invasive options for managing aural hematomas and typically do not require general anesthesia⁶⁻⁸; however, risk for reaccumulation of fluid after drain removal and delayed healing may be increased because the pinna layers are not directly apposed.

Passive Drains

Passive drains (eg, teat cannulas) should be placed into the hematoma on either the concave or convex side of the distal aspect of the pinna (**Figure 3**, next page). The drain should be placed via a small stab incision and secured to the skin with a purse-string

or other type of securing suture. After the hematoma is drained, the pinna should be bandaged over the head to provide compression and promote adhesion of the skin and cartilage. Disadvantages of passive drains include more frequent bandage changes depending on the volume of fluid produced and risk for ascending infection via the drain site. Similar to other wound drains, the drain should be removed once fluid production has decreased and reaccumulation is less likely (\approx 7-10 days).

Active Drains

Active or closed-suction drains use negative pressure from a collection chamber to maintain continuous drainage, collapsing the dead space created by the hematoma and bringing the pinna layers together to promote adhesion and healing. Advantages of active drainage include the ability to quantify fluid production and potential reduced risk for ascending infection due to the closed nature of the system; however, maintaining placement of the tubing and suction unit can be difficult, and occlusion of the drain tubing can lead to loss of suction.

Conservative Management

Conservative management involves aspiration of the hematoma followed by local injection of corticosteroids (eg, triamcinolone, dexamethasone) into the existing dead space. Alternatively, administration of oral corticosteroids (eg, prednisolone) alone (without aspiration or other drainage) has been described as a conservative option.⁹⁻¹¹ Corticosteroids reduce inflammation within the pinna, thus decreasing fluid production responsible for separating the skin from the cartilage.

Repeated aspiration is typically required because of ongoing fluid production; however, one study reported clinical improvement (ie, subjective

improvement in pinna status) in 87.5% of dogs treated with oral prednisolone alone.¹¹

The primary disadvantage of a less-invasive or conservative approach is lack of direct apposition of the pinna layers, which may increase the risk for reaccumulation of fluid and delayed healing.

Potential Complications

Potential complications of treatment include recurrence, infection, cellulitis, and thickening or scarring of the pinna; however, these can be avoided or reduced with early management, careful tissue handling, and bandaging of the ear to provide gentle compression and prevent shaking and trauma to the pinna.



FIGURE 3 Teat cannula placed at the tip of the pinna for continuous hematoma drainage



Step-by-Step Surgical Treatment for Canine Aural Hematoma

What You Will Need

- Cotton ball or gauze
- Electric clippers
- Surgical scrub (eg, chlorhexidine scrub)
- Sterile surgical drapes
- Sterile gloves
- #15 scalpel blade
- Scalpel blade handle
- Sterile saline flush and device for flushing (eg, syringe, catheter, needle)
- Needle drivers
- Absorbable or nonabsorbable suture material
- Mayo scissors
- Bandage material (eg, cast padding, absorbent stretch conforming gauze, self-adherent bandages)
 - Alternatives: elastic stockinette, custom-sized head wrap
- Elizabethan collar

Step 1: Prepare the Patient

Anesthetize and place the patient in lateral recumbency with the affected ear exposed. Insert a cotton ball or gauze into the ear canal to help prevent surgical scrub, flush, and hematoma contents from entering the canal. Clip hair from both sides of the affected pinna, scrub the area with surgical scrub, and drape the site using sterile surgical drapes. If indicated, collect a sample of fluid via fine-needle aspiration for cytologic examination.



Continues ►

Step 2:

Make an Incision

Using a #15 scalpel blade, make a longitudinal or S-shaped incision over the hematoma on the concave aspect of the pinna. Only extend the incision through the skin to allow draining and flushing. Do not extend the incision through the auricular cartilage.

Author Insight

An S-shaped incision may reduce the likelihood of cosmetic deformities caused by longitudinal contracture of the incision. Alternatively, a dermal punch or carbon dioxide laser can be used to create defects in the skin on the concave side of the pinna for hematoma drainage.¹² Use of a carbon dioxide laser may create adhesions between the skin and underlying cartilage acting as an alternative to suture placement; however, suturing the S-shaped incision is often preferred, as this provides a direct and more secure apposition of the skin to the auricular cartilage. The number of sutures should be based on clinician preference and provide adequate reduction of dead space.



Step 3:

Flush with Sterile Saline

Once the hematoma has been drained, flush any remaining fluid or clots using sterile saline.

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brief.vet/treating-aural-hematomas,
or scan the QR code.



Step 4:

Place Sutures

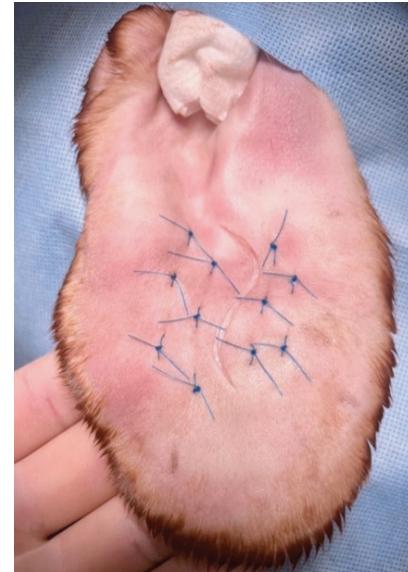
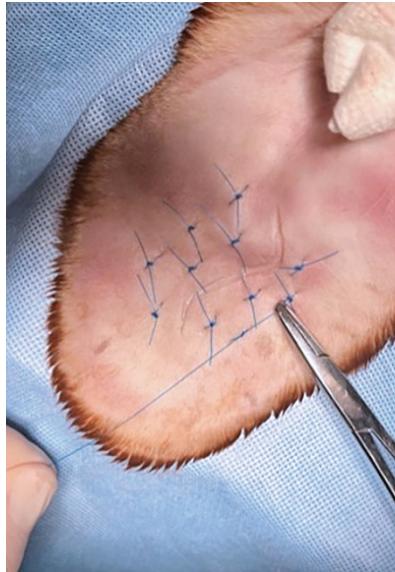
Using nonabsorbable, monofilament suture material (eg, 3-0 or 4-0 nylon), place sutures \approx 8 to 10 mm apart using either a partial- or full-thickness mattress pattern. Keep the skin incision slightly open for continued drainage and healing by second intention.

Author Insight

Mattress sutures should be placed parallel to the long axis of the pinna to minimize incorporation of the auricular vasculature, as this could result in avascular necrosis of the pinna. Any suture pattern can cause avascular necrosis if accidental ligation of the auricular vasculature occurs.

In patients with an excessively swollen pinna or anticipated progressive swelling, stenting the mattress sutures may minimize the risk for sutures becoming embedded in the skin and causing additional irritation. Stents can be fashioned from latex tubing or other soft material (A). Despite the use of stents, some scarring on the concave aspect of the pinna may occur (B).

As an alternative to full-thickness sutures, intradermal sutures may be used to minimize the reaction to external sutures and eliminate the need for suture removal.¹³ Using a simple continuous pattern, a row of sutures (ie, 4-0 synthetic absorbable material) can be placed through the dermis on the underside of the skin and the superficial surface of the cartilage on each side of the incision to provide apposition of the tissue layers.



Continues ►

Step 5:

Bandage the Pinna

Bandage the pinna and head, and fit an Elizabethan collar prior to recovery from anesthesia.

Author Insight

Bandaging the pinna for 1 to 2 weeks after drainage can minimize further trauma from continued head shaking and reduce the risk for incision or suture infection during healing.

Maintaining bandage position and preventing slippage can be difficult in some dogs. Traditional bandaging techniques use cast padding, absorbent stretch conforming gauze, and self-adherent bandage materials to encompass both the head and affected pinna. Alternatively, an elastic stockinette or custom-sized head wrap can be used, as these are generally easier to replace and allow convenient evaluation of the sutures or drain. Modifications may allow the unaffected pinna to exit freely from the stockinette or bandaging, reducing the occurrence of bandage slippage.



Monitoring bandages for excessive tightness or slippage is critical because of increased risk for compression of the airway and asphyxiation.

An Elizabethan collar should be used whether or not a bandage is present to prevent self-trauma of the pinna and to protect the incision or drain.

Step 6:

Remove the Sutures

Remove the sutures after 2 to 3 weeks if the incision has healed and the layers of the pinna are well apposed. Allow any remaining gaps in the incision to heal by second intention, noting the risk for recurrence if the layers are not well apposed and fluid reaccumulates in the pinna.

Author Insight

Continued monitoring for recurrence and incisional healing is recommended. ●

References

1. Dubielzig RR, Wilson JW, Seireg AA. Pathogenesis of canine aural hematomas. *J Am Vet Med Assoc.* 1984;185(8):873-875.
2. Bajwa J. Canine otitis externa - treatment and complications. *Can Vet J.* 2019;60(1):97-99.
3. Kuwahara J. Canine and feline aural hematoma: clinical, experimental, and clinicopathologic observations. *Am J Vet Res.* 1986;47(10):2300-2308.
4. Joyce JA, Day MJ. Immunopathogenesis of canine aural haematoma. *J Small Anim Pract.* 1997;38(4):152-158. doi:10.1111/j.1748-5827.1997.tb03453.x
5. Hall J, Weir S, Ladlow J. Treatment of canine aural haematoma by UK veterinarians. *J Small Anim Pract.* 2016;57(7):360-364. doi:10.1111/jsap.12524
6. Dye TL, Teague HD, Ostwald DA Jr, Ferreira SD. Evaluation of a technique using the carbon dioxide laser for the treatment of aural hematomas. *J Am Anim Hosp Assoc.* 2002;38(4):385-390. doi:10.5326/0380385
7. Győrffy A, Szijártó A. A new operative technique for aural haematoma in dogs: a retrospective clinical study. *Acta Vet Hung.* 2014;62(3):340-347. doi:10.1556/AVet.2014.016
8. Pavletic MM. Use of laterally placed vacuum drains for management of aural hematomas in five dogs. *J Am Vet Med Assoc.* 2015;246(1):112-117. doi:10.2460/javma.246.1.112
9. Lahiani J, Niebauer GW. On the nature of canine aural haematoma and its treatment with continuous vacuum drainage. *J Small Anim Pract.* 2020;61(3):195-201. doi:10.1111/jsap.13107
10. Seibert R, Tobias KM. Surgical treatment for aural hematoma. *Clinician's Brief.* 2013;11(3):29-32.
11. Itoh T, Kojimoto A, Kojima K, Mikawa K, Shii H. Surgical creation of multiple drainage holes versus local injection of corticosteroids for treatment of aural hematomas in dogs: 51 dogs with 71 aural hematomas (2000-2017). *J Am Vet Med Assoc.* 2021;260(S1):S15-S23. doi:10.2460/javma.20.12.0672
12. Kuwahara J. Canine and feline aural haematomas: results of treatment with corticosteroids. *J Am Anim Hosp Assoc.* 1986;22:641-647.
13. Rüfenacht S, Schellenberg S, Borio S, Summerfield A, Ricklin ME. Non-blinded treatment of aural hematoma with oral prednisolone as a monotherapy in privately-owned dogs. *Schweiz Arch Tierheilkd.* 2022;164(6):447-455. doi:10.17236/sat00358

Suggested Reading

Fossum TW, Duprey LP. *Small Animal Surgery.* Elsevier; 2019.
Slatter D. *Textbook of Small Animal Surgery.* Vol II. 2nd ed. W.B. Saunders; 1993.



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It's Okay Not to Know Everything

Carrie Jurney, DVM, DACVIM (Neurology), CCFP

Remedy Veterinary Specialists

San Francisco, California



I was a different person when I graduated from veterinary school, and I wish someone had told me some things (like, “It’s okay to ask for help”).

At the time, I wanted to present an external image of having everything under control, when nothing could be further from the truth. On the inside, I was an anxious mess, questioning my every decision, but I wouldn’t ask for help because I was too scared to look like I didn’t know what I was doing. I was grasping for control by leaning into my perfectionist tendencies, but that was only making things worse.

As a new graduate faced with your first day of being called **doctor**, you may feel like you have to fake it until you make it. That may be true to some extent, but you are likely holding yourself to standards that no one else is. **Your team knows you are learning and going to make mistakes, and they want you to ask for help when you need it.**

I have trained dozens of interns and specialists, and, more often than not, I see anxiety and perfectionism make an already difficult task even harder. I remember all too well

what that feels like. During my first year of residency, I attended a neurology conference with my mentor. I was more than a little overwhelmed, but I was trying to present a cool, confident image. A lecture was starting, and I didn’t even understand the words in the title. It sent me into a spiral of self-doubt: *If I was too stupid to even comprehend the title of the lecture, how could I possibly make it as a neurologist?* The lecture concluded, and I was about ready to quit my residency when my mentor raised their hand and asked a question, “You used a word in your title I do not know. Will you please define that term?” Relief washed over me, and I realized if my mentor, who had been a neurologist longer than I had been alive, had that question, the only stupid thing I had done was beat myself up. That experience helped me learn that asking for help is a sign of confidence. It shows you are comfortable enough to admit you don’t know everything.

I have since realigned my goals toward progress, not perfection. We all need help. As a boarded specialist with 15 years of experience, I ask my colleagues for their opinions daily, and I am a better colleague and clinician for it.

Be humble, ask for help, and be willing to grow and change, and I promise you will have a better path toward a fruitful career. ●



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Fundic Examination

Guide for Performing a Fundic Examination

Brett D. Story, DVM

Caryn Plummer, DVM, DACVO

University of Florida



What's Inside

- Indirect Ophthalmoscopy
- Direct Ophthalmoscopy
- Step-by-Step: Fundic Examination: Indirect Ophthalmoscopy
- Step-by-Step: Fundic Examination: Direct Ophthalmoscopy

A fundic examination is an important component of a thorough ophthalmologic examination and a complete physical examination. Fundoscopy may seem warranted only when a patient is presented with vision loss; however, the results of a fundic examination can be helpful when determining differential diagnoses and prognosticating. For example, patients presented for potential infectious, immune-mediated, vascular, neoplastic, nutritional, or metabolic disease may exhibit ocular manifestations of systemic disease. Proper examination of the fundus is not an inherently easy skill but, once mastered with practice and patience, is an invaluable tool.

The examination should be performed in a dimly lit, quiet room with an assistant stabilizing the patient's head near the eye level of the examiner.^{1,2} The patient should be in a seated position with minimal restraint. To achieve full

view of the fundus, pharmacologic dilation of the pupil is necessary; otherwise, visualization of the peripheral fundus is impossible and lesions may be overlooked. The short-acting anticholinergic tropicamide (1%) is the preferred mydriatic agent for diagnostic purposes. One application typically results in mydriasis within 15 to 20 minutes that lasts 3 to 8 hours, depending on the degree of iris pigmentation.³ Examination of the anterior segment should precede administration of mydriatic drugs, which can confound the results of other diagnostic tests or exacerbate lens luxation and intraocular pressure elevation.⁴⁻⁶

Two main techniques are used to evaluate the fundus: indirect and direct ophthalmoscopy. The most thorough examination is achieved via a survey view of the fundus with indirect ophthalmoscopy followed by examination of an identified lesion with the higher magnification used in direct ophthalmoscopy.

Indirect Ophthalmoscopy

Indirect ophthalmoscopy can be performed via monocular or binocular examination, the latter of which requires a head-mounted light source and permits a greater degree of stereopsis (ie, depth perception). Both methods require a handheld condensing lens to form a magnified image of the patient's eye. The following discussion describes use of monocular indirect ophthalmoscopy using a Finoff transilluminator as a bright light source. This method provides a more thorough examination of the fundus as compared with direct techniques and is more readily available than binocular examination. When performing indirect ophthalmoscopy, the examiner's head, the light source, and the condensing lens should act as a unit, pivoting together on an axis (**Figures 1 and 2**, next page); alignment is of utmost importance. Indirect ophthalmoscopy produces a reversed and inverted (ie, upside down and backward) image and allows a larger, panoramic field of view as compared with direct techniques (**Figure 3**, next page).² Magnification is inversely proportional



FIGURE 1 Correct (A) and incorrect (B, C) techniques for monocular indirect ophthalmoscopy. The examiner's hand should be stabilized on the patient and the lens held 2 to 4 cm away from and perpendicular to the axis of the pupil. In the images demonstrating incorrect technique, the axis of the lens is not perpendicular in alignment to the patient's eye and is less than 2 cm in distance (B), and the examiner's hand is floating and distanced from the patient's eye (C).

to the diopter strength (ie, focal length) of the convex lens used. A lower diopter strength results in greater magnification with a smaller field of view, whereas a higher diopter strength results in lower magnification but a larger field of view.² Lenses between 20 diopter (D) and 30D are most commonly used for examining dogs and cats, although lenses can have a wider range (up to 40D). Additional advantages of indirect ophthalmoscopy include a safer working distance from the patient and increased ability to view the fundus through opacities in ocular media.

Most dogs and cats have a tapetum lucidum, the brightly colored reflective structure located in the choroid that gives the fundus its “eyeshine.”



FIGURE 2 Correct (**A**) and incorrect (**B**) techniques for monocular indirect ophthalmoscopy. The light source should be held against the dominant eye and the examiner's elbow should be straight, permitting distance for a panoramic view of the fundus. In the image demonstrating incorrect technique, the examiner's elbow is bent and the examiner is too close to the patient to permit an image that takes up the entirety of the indirect lens.

Patients that do not possess a tapetum—usually those with lightly colored or blue eyes—have a red fundic reflection that originates from illumination of the choroidal vasculature. This should not be confused with posterior segment hemorrhage.

Direct Ophthalmoscopy

Direct ophthalmoscopy provides a direct, upright image of the patient's fundus. The image seen by the examiner is noninverted and magnified 15 to 17 times.¹ However, the field of view is much more restricted as compared with indirect techniques due to the higher magnification. Direct ophthalmoscopy enables description and characterization of focal fundic lesions and close examination of the optic disc.

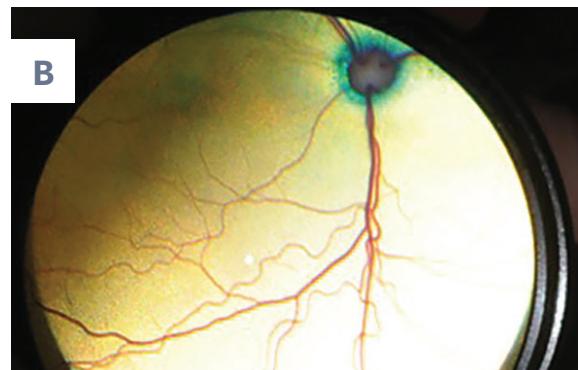
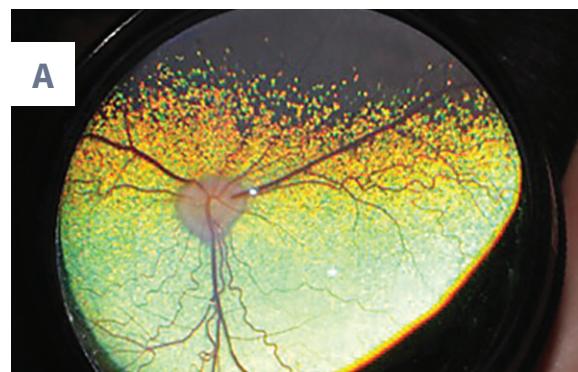


FIGURE 3 Normal canine (**A**) and feline (**B**) fundus viewed with indirect ophthalmoscopy. With indirect ophthalmoscopy, the image formed is upside down and backward.

Patience is required to complete a thorough examination because a much larger series of vignettes must be acquired to piece together the entire fundus. In addition, visualization of peripheral fundic lesions with direct ophthalmoscopy is practically impossible, particularly if the eyes are not dilated.

A direct ophthalmoscope has many adjustable settings. The rheostat allows the light intensity to be controlled and should be kept low to ensure patient comfort and an accurate view for the examiner. If the pupil cannot be dilated, the patient should be examined in a darkened room and the rheostat adjusted to minimize pupillary constriction. An aperture dial and filter switch on the patient side of the ophthalmoscope allow adjustment of the size, shape, and color of the light beam. The smaller apertures should be used for nondilated eyes and the larger apertures for dilated eyes. The specific filters and apertures vary by instrument, but most include a slit beam for evaluating fundic elevations and depressions, graticule grid for size estimation, cobalt blue light for corneal fluorescein dye excitation, and red-free light for differentiation of hemorrhage (appears black) and pigment (appears brown). A series of concave and convex lenses located on the rotating diopter dial allow both depth adjustment and focus to bring structures at different levels into view (**Figure 4**). A direct ophthalmoscope may also be used to evaluate the anterior segment of the eye with magnification. The dial must be changed to the positive diopter settings to view the anterior segments (**Figure 5**). If the examiner's vision is not emmetropic (ie, ideal vision without focusing deviations or visual defects), the initial dial setting at which the normal fundus is in focus will not be 0. Each subsequent setting must be interpreted in the light of the initial setting.

Advantages of direct ophthalmoscopy include close evaluation of fundic lesions, accessory features, and lower equipment cost as compared with indirect ophthalmoscopy. Disadvantages include the lack of

stereopsis, small field of view, proximity of the examiner's face to the patient, limited evaluation of the peripheral fundus, and impaired visualization of the fundus through opaque anterior ocular structures (eg, corneal edema, nuclear sclerosis).



FIGURE 4 A direct ophthalmoscope (patient side). Rotating focusing lenses (A), red-free filter (B), large circle aperture (C), light aperture size (D), and slit aperture

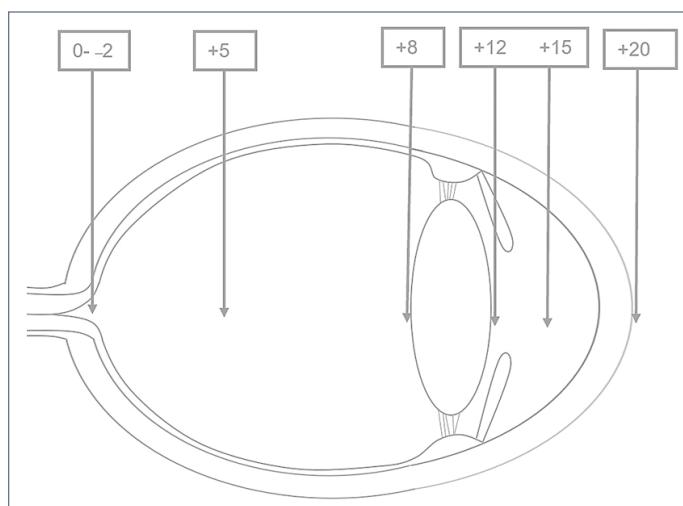


FIGURE 5 Cross-section of the eye. A direct ophthalmoscope can be used to view the structures of the anterior segment with magnification. To bring the anterior segment into focus, the lens wheel should be rotated through the positive (green or black) diopters. With the direct ophthalmoscope placed 2 cm from the cornea, the following structures are usually in focus at the corresponding diopters: cornea +15 to +20; anterior chamber +12 to +20; iris and pupil +12; lens +8 to +12; and vitreous 0 to +10.

Continues ►

Step-by-Step Fundic Examination: Indirect Ophthalmoscopy

What You Will Need

- Dilating agent (eg, 1% tropicamide ophthalmic solution)
- Focal light source (eg, Finoff transilluminator, high-quality pen light)
- Indirect condensing lens (between +40D and +20D)
- Direct ophthalmoscope



Step 1

While sitting or standing an arm's length away from the patient and holding the light source next to the dominant eye so that the examiner's head and light source move as a single unit, use the opposite hand to hold and position the lens. Hold the lens between the forefinger and thumb with the flatter surface toward the patient and more convex surface toward the examiner. Position the light beam—keeping light intensity low to avoid obscuring details or disturbing the patient—until a bright reflection from the patient's fundus is observed.



Author Insight

Lenses may have one etched silver rim indicating the side to be directed toward the patient.

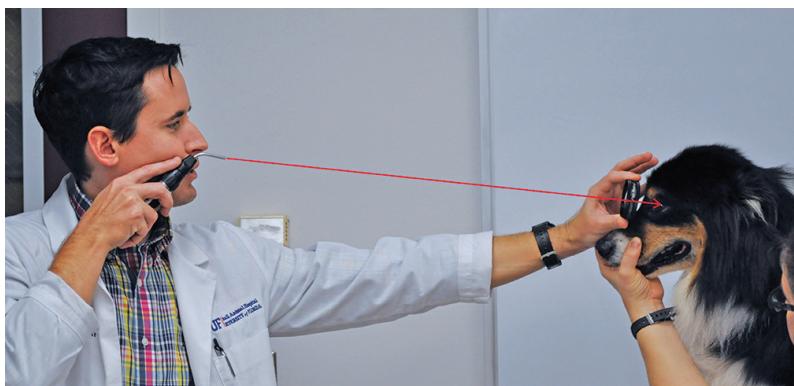
To facilitate examination, the examiner may rest the little finger on the patient's forehead with the condensing lens held above, ready to drop into place once the reflection has been identified.

Movement of the patient's eye will frequently result in loss of the fundic image. The quickest way to regain alignment is to step back, find the tapetal reflection, and move close.



Step 2

Locate the tapetal reflection, then place the lens 2 to 4 cm from the corneal surface and perpendicular to (ie, in the path of) the light beam while keeping the remaining fingers in contact with the patient's head.



Step 3

Hold the condensing lens parallel to the iris with the lens axis in alignment with the pupil axis to maintain a stable fundic image. Ensure the examiner's head, light source, and condensing lens act as a unit, pivoting together on an axis. If the view of the fundus is lost, remove the indirect lens, re-establish visualization of the tapetal reflection, and replace the lens in front of the eye.



Step 4

Move around, being sure to maintain a constant tapetal reflection, to observe the entire fundus, especially the periphery, and to follow the patient's eye.

Continues ►



Step-by-Step

Fundic Examination: Direct Ophthalmoscopy

Step 1

Turn on the ophthalmoscope and set the light to the correct aperture based on whether the eyes are dilated. Rest the brow on the brow rest.



Step 2

While holding the ophthalmoscope in the dominant hand and using the opposite hand to stabilize the patient's head and keep the eyelids open (**A**), use the right eye to look through the instrument and examine the patient's right eye (**B**). Repeat using the left eye to examine the patient's left eye.



Step 3

Locate the patient's fundic/tapetal reflection from approximately an arm's length distance (**A**), then move 2 to 4 cm from the patient's eye to widen the field of view (**B**). Adjust the lens settings so the fundus is in focus.

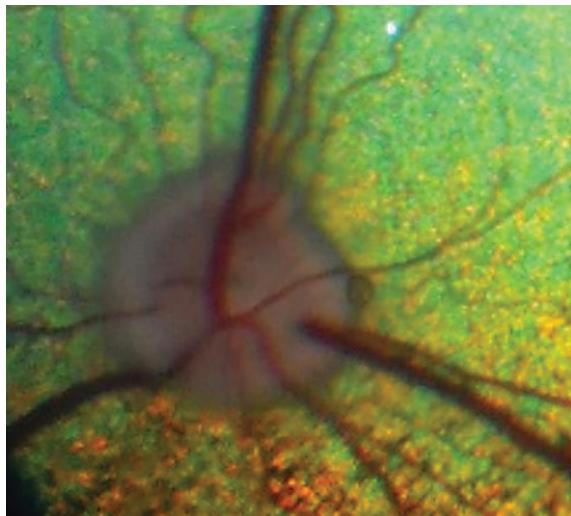
Author Insight

If the examiner has \approx 20/20 corrected vision, the fundus of most dogs and cats will be in focus at the 0D setting. Deviations may indicate pathology; recessed lesions will be in focus at negative diopter settings, whereas forwardly displaced structures will be in focus at positive diopter settings.



Step 4

Identify the optic nerve, then thoroughly examine the remainder of the fundus in quadrants. ●



References

1. Maggs DJ. The ophthalmic examination and diagnostic testing. In: Maggs DJ, Miller PE, Ofri R, eds. *Slatter's Fundamentals of Veterinary Ophthalmology*. 6th ed. St. Louis, MO: Elsevier; 2018:18-50.
2. Featherstone HJ, Heinrich CL. The eye examination and diagnostic procedures. In: Gelatt KN, Gilger BC, Kern TJ, eds. *Veterinary Ophthalmology*. 5th ed. Hoboken, NJ: Wiley-Blackwell; 2013:533-602.
3. Klauss G, Constantinescu GM. Nonhypotensive autonomic agents in veterinary ophthalmology. *Vet Clin North Am Small Anim Pract*. 2004;34(3):777-800.
4. Kovalcuka L, Ilgazs A, Bandere D, Williams DL. Changes in intraocular pressure and horizontal pupil diameter during use of topical mydriatics in the canine eye. *Open Vet J*. 2017;7(1):16-22.
5. Margadant DL, Kirkby K, Andrew SE, Gelatt KN. Effect of topical tropicamide on tear production as measured by Schirmer's tear test in normal dogs and cats. *Vet Ophthalmol*. 2003;6(4):315-320.
6. Stadtbaumer K, Frommlet F, Nell B. Effects of mydriatics on intraocular pressure and pupil size in the normal feline eye. *Vet Ophthalmol*. 2006;9(4):233-237.

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Choosing the Correct Fluid Type & Calculating Fluid Rates

The ABC's of Fluid Therapy: More Than Just LRS & NaCl

Ronald Goncalves, DVM, MS, PhD, DACVECC

Adesola Odunayo, DVM, MS, DACVECC

University of Florida



Fluid therapy is essential for common conditions (eg, dehydration, hypovolemia, electrolyte abnormalities, acid–base disturbance) in cats and dogs and can be the cornerstone of therapeutic management in critically ill patients.^{1,2} Formulation of a fluid therapy plan requires knowledge of fluid types, specific fluid compositions, therapeutic recommendations, and possible iatrogenic adverse effects.³ This article discusses how to choose the most appropriate fluid type and calculate fluid rates in dogs and cats. Additional information (eg, fluid therapy for anesthesia, electrolyte supplementation, acid–base disorders, [outpatient fluid therapy](#)) is available elsewhere in the literature.²⁻¹¹



What's Inside

- Crystalloids & Colloids
- Choosing, Writing, and Implementing the Fluid Prescription Plan
- Diuresis
- Monitoring Fluid Therapy
- Case Example

It is estimated that ≈60% of a cat's or dog's body weight is comprised of water (total body water). Total body water is distributed in the intracellular, interstitial, and intravascular (plasma) spaces. Fluid losses from these spaces occur due to various clinical diseases, and fluid therapy aims to restore fluid balance (**Figure**).

Crystalloids & Colloids

Fluids are divided into crystalloids and colloids. Crystalloids are solutions that contain electrolytes and other small, water-soluble molecules and/or dextrose. Crystalloids may also contain buffers (eg, lactate, gluconate, acetate) typically converted to bicarbonate or

a bicarbonate precursor to maintain the body's acid–base status and are generally categorized as isotonic (**Table 1**), hypotonic (**Table 2**, next page), or hypertonic based on tonicity relative to plasma. Moreover, crystalloids vary in their concentration of electrolytes.¹² Colloids are fluid types that contain macromolecules suspended in a crystalloid solution and are used to support intravascular volume or raise plasma oncotic pressure. Colloids are not discussed in detail in this article, but additional information is available.^{12,13}

Choosing the Right Fluid Therapy Plan

It is important to first identify whether the fluid deficit is in the interstitial or intravascular space.

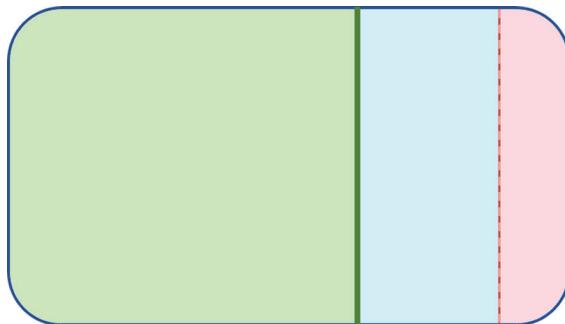


FIGURE Volume of water in each body compartment, considering a patient with a total body water of 1,000 mL (values are approximate). Not represented is a small amount of fluid in the transcellular space (eg, cerebrospinal fluid, joints).

Significant fluid deficit in the intracellular space (manifesting as [hypernatremia](#)) occurs less commonly than in the extracellular space and is not discussed in this article.

Dehydration

Fluid deficit in the interstitial space is dehydration and manifests as dry mucous membranes, skin tenting, sunken eyes, doughy abdomen, and dry corneas. Dehydration may also be characterized by elevated hematocrit, total protein/solids, BUN, serum creatinine, and/or urine specific gravity. Most clinical patients with dehydration are usually 5% to 8% dehydrated; more profound dehydration can occur but is uncommon. Vomiting and diarrhea are the most common causes of fluid loss, inducing dehydration.

Hypovolemia

Fluid deficit in the intravascular space is hypovolemia, caused either by severe isotonic fluid loss or hemorrhage, and manifests as tachycardia, weak peripheral pulses, pale mucous membranes, altered mentation, prolonged capillary refill time, and cold extremities. Hyperlactatemia (lactate, ≥ 22.5 mg/dL [2.5 mmol/L]) and hypotension may also be identified. Cats with hypovolemia have a classic triad of hypotension, bradycardia, and hypothermia.

Table 1: Isotonic Crystalloids

Fluid Type	pH	Osmolarity (mOsm/L) ^b	Sodium (mEq/L)	Chloride (mEq/L)	Potassium (mEq/L)	Calcium, Ionized (mEq/L)	Magnesium (mEq/L)	Lactate (mEq/L)	Acetate (mEq/L)	Glutamate (mEq/L)
0.9% sodium chloride	5	308	154	154	0	0	0	0	0	0
Lactated Ringer's solution ^a	6.5	273	130	109	4	3	0	28	0	0
Plasma-Lyte 148 ^a	5.5	294	140	98	5	0	1.5-3	0	27	23
Normosol-R ^a	6.4	294	140	98	5	0	1.5-3	0	27	23

^aBalanced solutions (ie, bicarbonate is produced as final product of lactate, acetate, and/or glutamate metabolism)

^bNormal blood osmolality: dogs, 290 to 310 mOsm/L; cats, 311 to 322 mOsm/L

Continues ►

IV Fluid Options

Isotonic crystalloids are the fluid type of choice for treating dehydration. When multiple isotonic fluid options are available, an isotonic crystalloid fluid type that aligns most closely with the patient's sodium concentration may be selected.

In humans, high-chloride fluids (eg, 0.9% sodium chloride) may be associated with increased risk for acute kidney injury (AKI) and mortality.^{14,15} In dogs, the relationship between fluid-induced hyperchlremia and development of AKI is not yet determined. A recent study demonstrated significant hyperchlremia in dogs with hospital-acquired AKI.¹⁶ The most unbalanced isotonic crystalloid is 0.9% sodium chloride because of its high chloride concentration. Plasma-Lyte 148, lactated Ringer's solution, and Normosol-R have chloride concentrations closer to normal patient plasma concentrations and contain buffers.¹²

Isotonic crystalloids, hypertonic crystalloids, and/or colloids can be used to treat hypovolemia. In patients

with normal vascular permeability, after 30 minutes of IV isotonic crystalloid administration, ≈25% of the fluid remains in the intravascular space, and ≈75% has moved to the interstitial space.

Hypertonic crystalloids (eg, 3%, 7.2%-7.5%, 23.4% hypertonic saline) draw fluid from the interstitial and intracellular spaces, expand the intravascular space because of their high effective osmolality (≤8× higher than blood), and may therefore exacerbate dehydration even while restoring intravascular volume. The primary indications for use of hypertonic saline include life-threatening hypovolemia, severe hyponatremia, and suspected intracranial hypertension due to traumatic brain injury.

Hypotonic crystalloids have a low sodium concentration and thus a higher concentration of free water and are preferable for use as maintenance fluids to replace ongoing sensible (eg, urine, feces, sweat) and insensible (eg, unmeasurable loss from the respiratory tract, GI tract) losses.¹² Also due to their low sodium concentration, hypotonic fluids

Table 2: Hypotonic Crystalloids

Fluid Type	pH	Osmolarity (mOsm/L) ^c	Sodium (mEq/L) ^d	Chloride (mEq/L)	Potassium (mEq/L)	Calcium, Ionized (mEq/L)	Magnesium (mEq/L)	Lactate (mEq/L)	Acetate (mEq/L)	Dextrose (g/L)
0.45% sodium chloride	5.6	154	77	77	0	0	0	0	0	0
0.45% sodium chloride with 2.5% dextrose	4.5	280	77	77	0	0	0	0	0	25
Plasma-Lyte 56 ^a	5	110	40	40	13	0	3	0	16	0
Normosol-M with 5% dextrose ^a	5.5	363	40	40	13	0	3	0	16	50
5% dextrose in water ^b	4	252	0	0	0	0	0	0	0	50

^aBalanced solutions (ie, bicarbonate is produced as final product of acetate metabolism)

^bMay be classified as an isotonic or hypotonic solution; initially isotonic, but becomes hypotonic when dextrose is metabolized

^cNormal blood osmolality: dogs, 290 to 310 mOsm/L; cats, 311 to 322 mOsm/L

^dThese solutions have lower sodium concentration compared with normal serum sodium concentration (140-155 mEq/L) in dogs and cats.

are used to treat hypernatremia and may be preferred in patients with fluid intolerance (eg, from heart or kidney disease) because fluid redistributes more to the intracellular space and less to the intravascular space, decreasing the risk for an increase in hydrostatic pressure.¹² Although isotonic crystalloids may be preferred to treat dehydration and/or hypovolemia and hypotonic crystalloids preferred to meet daily maintenance requirements, most patients are managed with isotonic crystalloids alone.¹²

Hypotonic fluids are not effective as replacement fluids to restore intravascular or interstitial deficits and should not be used to treat dehydration or hypovolemia.¹⁷ Infusion of large amounts of hypotonic fluids may cause rapid shifts in sodium concentrations and result in life-threatening cerebral edema.

Writing the Fluid Prescription

The fluid prescription plan is dynamic. The veterinary team (including the clinician, veterinary technicians, and veterinary assistants) should [monitor the patient](#) to ensure response to therapy and identify complications. Alterations to the fluid plan are common and should be made based on patient response.

Implementing the Fluid Prescription Plan

Treatment for Hypovolemia

Untreated hypovolemia is life-threatening and may lead to rapid deterioration and death. Hypovolemia may be present with or without dehydration and should be identified based on physical examination findings. Hypovolemic patients should be resuscitated with IV fluids. If hypovolemia is present (with or without dehydration), a large bore peripheral catheter should be placed when possible. If peripheral access cannot be obtained, a central vein (eg, jugular vein) or the intraosseous route can be used.¹⁷ Oral, subcutaneous, and intraperitoneal routes should not be used, as these routes rely on

perfusion and absorption, which occur too slowly to be effective for treatment of hypovolemia.¹⁸

Isotonic crystalloids should be administered at a fraction of the shock dose of fluids, with the shock dose representing the total blood volume (dogs, 80-90 mL/kg; cats, 50-60 mL/kg).¹⁷ Clinical signs of hypovolemia occur when 20% to 25% of blood volume is lost. Reasonable resuscitation is \approx 20% to 25% of the total blood volume (dogs, \approx 20-25 mL/kg over 15-20 minutes; cats, \approx 10-15 mL/kg over 15-20 minutes).¹⁷ Fluids should be administered rapidly via high-pressure infusion bags, fluid infusion pumps, syringe pumps, syringes, or manual squeezing of the fluid bag (based on total volume administered and available resources). Concurrent heat support should be provided to hypothermic cats, as cats are most often hypothermic when in shock, and blood vessels may not constrict appropriately when cold. Although this is not a classic finding for dogs in shock, heat support should also be provided to hypothermic dogs. A fluid bolus should not be administered if there is no clinical evidence of shock.

Continues ►

Diuresis

Fluids may be administered in multiples of maintenance (eg, any rate $>$ 45-60 mL/kg every 24 hours [eg, 120 mL/kg or 180 mL/kg every 24 hours]) to provide diuresis, which is only effective for toxins (eg, bromides, amphetamines, phenobarbital) that can be forcibly excreted through the kidneys.²⁶

Forced diuresis is no longer recommended for treatment of azotemia, as these patients should be resuscitated (if required) and rehydrated (often required). Fluids should be provided at maintenance rates until renal or clinical recovery occurs in order to prevent fluid intolerance (ie, fluid overload; diminished capacity to accept additional IV fluids without adverse reaction), which is common in azotemic patients treated with diuresis and may worsen organ function.¹¹

The patient should be re-evaluated after the fluid bolus is administered. If there is a positive response (eg, normotension, lower heart rate, lower lactate, improved mucous membrane color and capillary refill time), the patient should be closely monitored, as an intervention plan may be needed.¹⁹ If there is a partial or absent response, the fluid bolus may be repeated up to 3 or 4 times. Diagnostic testing (eg, packed cell volume, total solids, glucose, lactate, point-of-care ultrasound) can be repeated as necessary in patients unresponsive to fluid therapy. Vasoressor therapy can be performed if indicated.²⁰

Hypertonic crystalloids may also be considered in patients with hypovolemia. Hypertonic saline (dogs, 4-6 mL/kg over 10-15 minutes; cats, 1-4 mL/kg over 10-15 minutes) can be administered, ideally in nondehydrated patients with normal sodium concentrations.¹⁷ Hypertonic crystalloids can also be used in hypovolemic patients that are also dehydrated, but isotonic crystalloids should be provided concurrently to replace fluid moved from the interstitial

space by the hypertonic crystalloid. In addition, hypertonic saline can improve cardiac contractility and rheology and is the fluid of choice for resuscitating patients with suspected cerebral edema. Use of natural and/or synthetic colloids to treat hypovolemia is not described in this article.^{21,22}

Bleeding patients with signs of hypovolemia may require resuscitation with blood products.¹⁷ Hypovolemic patients unresponsive to fluid therapy may require inotropes or vasopressors (eg, dobutamine, norepinephrine, vasopressin).¹⁸

Many clinically ill patients that require fluid therapy are not hypovolemic and do not require treatment for hypovolemia.

Treatment for Dehydration

If the patient is dehydrated, an intentional rehydration plan can be initiated and the fluid therapy plan calculated based on the estimated amount of fluid lost (ie, fluid deficit): patient's fluid deficit (L) = body weight (kg) × estimated dehydration % (**Table 3**).

Table 3: Estimating Dehydration Percentage

Dehydration Percentage	Physical Examination Findings
<5%	Dehydration not clinically detectable, but patient has history of fluid loss
5%-7%	Dry mucous membranes; skin tenting
7%-9%	Dry mucous membranes; skin tenting; sunken eyes; doughy abdomen
9%-12%	Dry mucous membranes; skin tenting; sunken eyes; doughy abdomen; possible evidence of hypovolemia
12%-15% ^a	Dry mucous membranes; skin tenting; sunken eyes; doughy abdomen; evidence of hypovolemia

^aDeath is imminent.

The fluid deficit should be replaced over 4 to 24 hours (average, 12 hours), depending on the individualized patient plan. Longer rehydration times are needed in patients with cardiovascular compromise and/or increased risk for fluid overload. The authors prefer to rehydrate cats over 12 to 24 hours because cats have a higher incidence of occult heart disease.²³

Patients should be re-evaluated every 4 hours (or more often if specific concerns exist) and at the end of the rehydration period for resolution of dehydration. Weight gain should be equivalent to the fluid deficit (1 mL = 1 g) but does not always occur if ongoing losses are present.²⁴

Patients with no evidence of hypovolemia or dehydration (eg, obtunded dog [ie, unable to eat or drink] with multiple seizures) may require hospitalization.

When there is no evidence of hypovolemia or dehydration, identifying the fluid location and administering isotonic crystalloids can be skipped, and a maintenance fluid plan should be calculated to provide ongoing maintenance fluid needs.

Maintenance Requirements

Dogs and cats have an ongoing fluid requirement for daily cellular and tissue maintenance that should be provided to patients unable or unwilling to eat and drink normally. Although a range of formulas are available to calculate maintenance fluid needs,²⁵ clinicians should use a formula with which they have a high level of comfort to ensure consistency. Based on results of a survey, the most common veterinary maintenance IV fluid rate is 60 mL/kg every 24 hours in cats and dogs²⁵; however, calculations using body surface area may also be used:

$$(30 \times \text{body weight in kg}) + 70 \text{ (for patients 2-50 kg)}$$
$$70 \times (\text{body weight in kg})^{0.75}$$

Isotonic or hypotonic crystalloids can provide maintenance fluid needs in dogs and cats.

Replacing Ongoing Sensible Losses

Ongoing fluid losses should be replaced when significant losses (eg, irritable vomiting or diarrhea, polyuria, fluid losses from surgical drains or wounds) occur. Ongoing losses may be objectively measured (eg, urine measured via indwelling urinary catheter) or estimated (eg, for diarrhea). The ongoing loss volume is typically replaced using isotonic crystalloids over 2 to 8 hours, depending on the volume of fluid lost and patient tolerance of fluid replacement.

Monitoring Fluid Therapy

As with all drugs, the fluid therapy plan should be intentional and patients monitored for adverse effects. Common adverse effects include fluid intolerance (especially in patients with underlying heart disease or poor kidney function; see **Clinical Signs**

That May Indicate Fluid Intolerance), interstitial edema (patients with hypoalbuminemia treated exclusively with large volumes of crystalloids), dilution coagulopathy (from excessive administration of crystalloids), or electrolyte and acid-base imbalances. ●

Case Example

Gracie, a 3-year-old 40-lb (18-kg) spayed Australian shepherd, was presented for anorexia, vomiting, and diarrhea of \approx 72-hours' duration.

On physical examination, mucous membranes were dry, and there was slight skin tenting. Gracie was estimated to be 5% dehydrated. There was no evidence of hypovolemia. Based on physical examination results and initial diagnostic testing, she was hospitalized for supportive care.

An isotonic crystalloid was selected for treatment. The fluid deficit was calculated as: fluid deficit (L) = 18 kg \times 5% (0.05) = 0.9 L or 900 mL. In the absence of underlying heart disease or concern for volume overload, the fluid deficit was replaced over 12 hours (75 mL/hour).

The maintenance rate was calculated as: 60 mL/kg \times 18 kg = 1,080 mL every 24 hours (45 mL/hour). The final fluid rate was thus: 75 mL/hour + 45 mL/hour = 120 mL/hour for the first 12 hours.

Gracie was evaluated after 12 hours and determined to be well hydrated. The fluid plan was continued at the maintenance rate of 45 mL/hour until she started to show interest in eating and drinking.

Clinical Signs That May Indicate Fluid Intolerance

- Increased respiratory rate and effort
- New cavitary effusion and/or peripheral edema
- Excessive weight gain
- Hypertension
- Chemosis

References

1. Mazzaferro E, Powell LL. Fluid therapy for the emergent small animal patient: crystalloids, colloids, and albumin products. *Vet Clin North Am Small Anim Pract.* 2013;43(4):721-734. doi:10.1016/j.cvsm.2013.03.003
2. Chow RS. Terms, definitions, nomenclature, and routes of fluid administration. *Front Vet Sci.* 2021;7:591218. doi:10.3389/fvets.2020.591218
3. Goggs R, Humm K, Hughes D. Fluid therapy in small animals: 1. Principles and patient assessment. In: *Pract.* 2008;30(1):16-19. doi:10.1136/inpract.30.1.16
4. Boag A, Hughes D. Fluid therapy. In: King LG, Boag A, eds. *BSAVA Manual of Canine and Feline Emergency and Critical Care.* 3rd ed. British Small Animal Veterinary Association; 2018:29-43.
5. Davis H, Jensen T, Johnson A, et al. AAHA/AAFP fluid therapy guidelines for dogs and cats. *J Am Anim Hosp Assoc.* 2013;49(3):149-159. doi:10.5326/JAAHA-MS-5868
6. Montealegre F, Lyons BM. Fluid therapy in dogs and cats with sepsis. *Front Vet Sci.* 2021;8:622127. doi:10.3389/fvets.2021.622127
7. Pigott A, Rudloff E. Traumatic brain injury—a review of intravenous fluid therapy. *Front Vet Sci.* 2021;8:643800. doi:10.3389/fvets.2021.643800
8. Muir WW, Ueyama Y, Noel-Morgan J, Kilborne A, Page J. A systematic review of the quality of IV fluid therapy in veterinary medicine. *Front Vet Sci.* 2017;4:127. doi:10.3389/fvets.2017.00127
9. Yozova ID, Howard J, Sigrist NE, Adamik KN. Current trends in volume replacement therapy and the use of synthetic colloids in small animals—an internet-based survey (2016). *Front Vet Sci.* 2017;4:140. doi:10.3389/fvets.2017.00140
10. Muir WW, Hughes D, Silverstein DC. Editorial: fluid therapy in animals: physiologic principles and contemporary fluid resuscitation considerations. *Front Vet Sci.* 2021;8:744080. doi:10.3389/fvets.2021.744080
11. Langston C, Gordon D. Effects of IV fluids in dogs and cats with kidney failure. *Front Vet Sci.* 2021;8:659960. doi:10.3389/fvets.2021.659960
12. Rudloff E, Hopper K. Crystalloid and colloid compositions and their impact. *Front Vet Sci.* 2021;8:639848. doi:10.3389/fvets.2021.639848
13. Adamik KN, Yozova ID. Colloids yes or no? - a "Gretchen question" answered. *Front Vet Sci.* 2021;8:624049. doi:10.3389/fvets.2021.624049
14. Jaynes MP, Murphy CV, Ali N, Krautwater A, Lehman A, Doeppker BA. Association between chloride content of intravenous fluids and acute kidney injury in critically ill medical patients with sepsis. *J Crit Care.* 2018;44:363-367. doi:10.1016/j.jcrc.2017.12.014
15. Ostermann M, Randolph AG. Resuscitation fluid composition and acute kidney injury in critical illness. *N Engl J Med.* 2022;386(9):888-889. doi:10.1056/NEJMMe2200294
16. Libin MB, Weltman JG, Prittie J. A preliminary investigation into the association of chloride concentration on morbidity and mortality in hospitalized canine patients. *Vet Med (Auckl).* 2020;11:57-69. doi:10.2147/VMRR.S253759
17. Pachtinger GE, Drobatz K. Assessment and treatment of hypovolemic states. *Vet Clin North Am Small Anim Pract.* 2008;38(3):629-643, xii. doi:10.1016/j.cvsm.2008.01.009
18. Valverde A. Fluid resuscitation for refractory hypotension. *Front Vet Sci.* 2021;8:621696. doi:10.3389/fvets.2021.621696
19. Silverstein DC, Kleiner J, Drobatz KJ. Effectiveness of intravenous fluid resuscitation in the emergency room for treatment of hypotension in dogs: 35 cases (2000-2010). *J Vet Emerg Crit Care (San Antonio).* 2012;22(6):666-673. doi:10.1111/j.1476-4431.2012.00822.x
20. Murphy KM, Rishniw M, Silverstein DC. Use of vasopressors for treatment of vasodilatory hypotension in dogs and cats by Diplomates of the American College of Veterinary Emergency and Critical Care. *J Vet Emerg Crit Care (San Antonio).* 2022;32(6):714-722. doi:10.1111/vec.13230
21. Cazzolli D, Prittie J. The crystalloid-colloid debate: consequences of resuscitation fluid selection in veterinary critical care. *J Vet Emerg Crit Care (San Antonio).* 2015;25(1):6-19. doi:10.1111/vec.12281
22. Brooks A, Thomovsky E, Johnson P. Natural and synthetic colloids in veterinary medicine. *Top Companion Anim Med.* 2016;31(2):54-60. doi:10.1053/j.tcam.2016.08.003
23. Loughran KA, Rush JE, Rozanski EA, Oyama MA, Larouche-Lebel É, Kraus MS. The use of focused cardiac ultrasound to screen for occult heart disease in asymptomatic cats. *J Vet Intern Med.* 2019;33(5):1892-1901. doi:10.1111/jvim.15549
24. Hansen B, DeFrancesco T. Relationship between hydration estimate and body weight change after fluid therapy in critically ill dogs and cats. *J Vet Emerg Crit Care (San Antonio).* 2002;12(4):235-243. doi:10.1046/j.1435-6935.2002.t01-1-00050.x
25. Hopper K, Garcia Rojas A, Barter L. An online survey of small animal veterinarians regarding current fluid therapy practices in dogs and cats. *J Am Vet Med Assoc.* 2018;252(5):553-559. doi:10.2460/javma.252.5.553
26. Peterson ME. Toxicologic decontamination. In: Peterson ME, Talcott PA, eds. *Small Animal Toxicology.* Elsevier Saunders; 2013:73-83.

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Embracing Mentorship & Overcoming Imposter Syndrome

Jason Szumski, DVM
Golf Rose Animal Hospital
Schaumburg, Illinois



Entering the veterinary profession as a recent graduate is both thrilling and daunting, and the first 3 months can be extremely difficult. Despite holding leadership roles and graduating near the top of my class, I still had to overcome the significant hurdle of imposter syndrome. I hope that sharing my experience will inspire you to navigate challenges with determination and resilience.

The first case I saw was supposed to be simple: a dog urinating more than usual. I put the ultrasound probe on the dog to get a cystocentesis and look at the urinalysis. I fanned cranially and saw what I thought was a second bladder—and just like that—the imposter syndrome kicked in. *What do I do here? What is this second bladder? Did I learn anything in vet school?* Luckily, the clinic had excellent mentorship. My mentor saw my confusion and said, “Hey, that’s what I’m here for. I’m suspicious it’s a stump pyometra.” In veterinary school, mentorship had

been very important to my growth, but I didn’t realize how pivotal it was to my transitional growth and confidence. All it takes is one case without support to set us back.

Transparency and open communication in the workplace are pivotal, as well as building relationships that encourage psychological safety. We need to eliminate the *it was bad for me, so it should be bad for you* mindset. It is important to have structured mentorship and understanding that the first few months will be difficult, but you will be rewarded with confidence and competence.

Reflecting on the start of my career, as well as the stories of fellow new graduates, the transition from veterinary school to professional practice was filled with excitement, challenges, and growth opportunities. Embracing initial difficulties (eg, imposter syndrome) and seeking mentorship and support are vital in overcoming obstacles and thriving in this dynamic field. By fostering a culture of transparency, open communication, and structured mentorship, veterinary clinics can empower recent graduates to navigate the new grad experience with confidence, resilience, and a passion for lifelong learning and growth. ●

Neurologic Examination

Step-by-Step Guide to Perform Neurologic Examination

Cheryl L. Chrisman, DVM, MS, EdS, DACVIM (Neurology)



What's Inside

- Step-by-Step: How to Perform a Neurologic Examination
- Initial Observations & Cranial Nerves
- Gait Evaluation & Postural Reactions
- Spinal Reflexes
- Thoracic Limb Reflexes
- Pelvic Limb Reflexes
- Other Examinations

Neurologic examination is a series of observations and tests performed to answer the following questions:

- Is a lesion present in the nervous system?
- Where is the lesion located (focal or multifocal)?
- How severe is the lesion?
- Is the disease worsening, improving, or staying the same? (serial neurologic examinations)



Step-by-Step

How to Perform a Neurologic Examination

What You Will Need

- Penlight
- Percussion hammer
- Pair of hemostatic forceps
- [Neurologic examination form](#)



Initial Observations & Cranial Nerves

Step 1:

Initial Observations

Mentation, head posture, and coordination and function of some cranial nerves can be directly observed. The patient will sniff and eat if the olfactory nerves (CN1) are functional and will avoid objects in a strange environment if the optic nerves (CN2), optic tracts, and occipital cortex are intact. By observing reactions to sounds while the patient is sleeping, hearing (the cochlear nerves [CN8]) can be evaluated.



Step 2:

Menace Response

To evaluate the menace response, advance the hand toward the eye. A blink should be observed, indicating that CN2, the facial nerves (CN7), and their connections in the brain and brainstem are functional.



Continues ►

Step 3:

Pupillary Light Reflex

Shining a light into one pupil causes constriction of the pupil tested (direct pupillary light reflex) as well as the opposite pupil (indirect pupillary light reflex). This test evaluates CN2, the oculomotor nerves (CN3), and their brainstem connections.



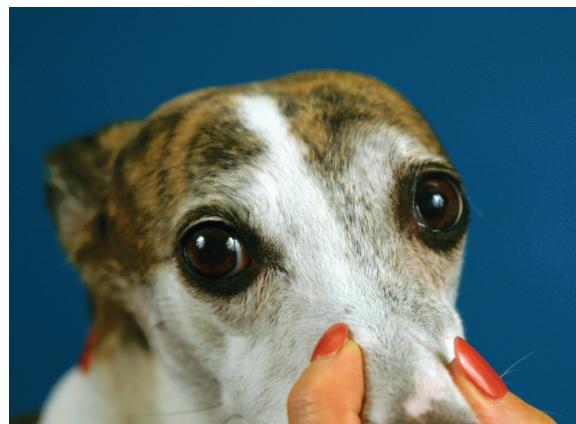
Step 4:

Examination of the Pupils, Eyelids, & Eyeball Position

Observe the position and movement of the eyeballs to evaluate the function of the innervation to the extraocular muscles (oculomotor [CN3], trochlear [CN4], and abducens [CN6] nerves) and associated brainstem structures.

Author Insight

Pupil size and symmetry, eyelid aperture, and the position of the third eyelid are affected by CN2, CN3, and sympathetic innervation to the eyes.



Step 5:

Positional Strabismus

When the nose is elevated, the position of the eyeballs should be level if CN3, CN4, CN6, the vestibular nerve (CN8), and their brainstem connections are normal. Positional strabismus (usually manifested as a ventral deviation of the eyeball on one side) is an abnormal finding.



Step 6:

Temporal/Masseter Muscles

Palpate these muscles for atrophy. Muscle atrophy indicates a lesion of the motor portion of the trigeminal nerves (CN5), the associated brainstem region, and the muscles themselves.



Step 7:

Jaw Tone & Range of Motion

Open the jaw to evaluate muscle tone and range of motion. Reduced muscle tone indicates a lesion of the motor portion of CN5 and the associated brainstem region.

Author Insight

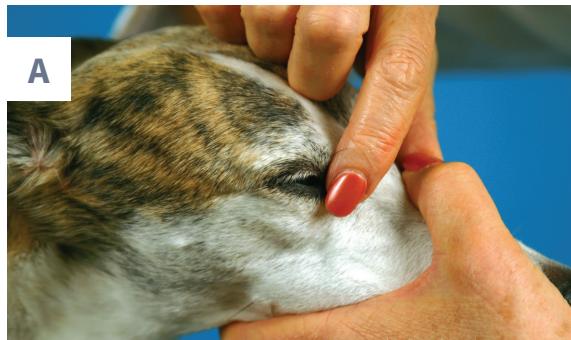
Reduced range of motion usually indicates muscle disease.



Step 8:

Palpebral, Aural, & Buccal Reflex

Touch the palpebrae (**A**), tickle the ears (**B**), and pinch the lips (**C**) to elicit movement of these structures to evaluate the three branches of the sensory portion of CN5, the motor portion of CN7, and their caudal brainstem connections.



Continues ►

Step 9:

Physiologic Nystagmus

Move the head to the left, right, up, and down. Two to three rhythmical beats of the eyeballs should be observed with a fast phase in the direction of the movement (normal physiologic nystagmus). This tests the function of CN8 and associated structures in the caudal brainstem and cerebellum.



Step 10:

Swallowing

Induce swallowing by external or internal palpation of the pharynx to evaluate the glossopharyngeal nerves (CN9) and vagus nerves (CN10).



Step 11:

Trapezius Muscle

Palpate the trapezius muscle for atrophy. If atrophy is present, the patient may have a lesion of the accessory nerve (CN11) or caudal brainstem.



Step 12:

Tongue

Observe the tongue for appropriate movement and strength, and palpate it for atrophy or hypertrophy (muscle disease) to evaluate the hypoglossal nerve (CN12) and caudal brainstem.



Gait Evaluation & Postural Reactions

Step 13:

Hemistand & Hemiwalk

Evaluate the gait during walking, trotting, and galloping and while turning the patient to the left and right. Pushing down on the shoulders and hips and observing the resistance to this pressure can also evaluate strength.

Author Insight

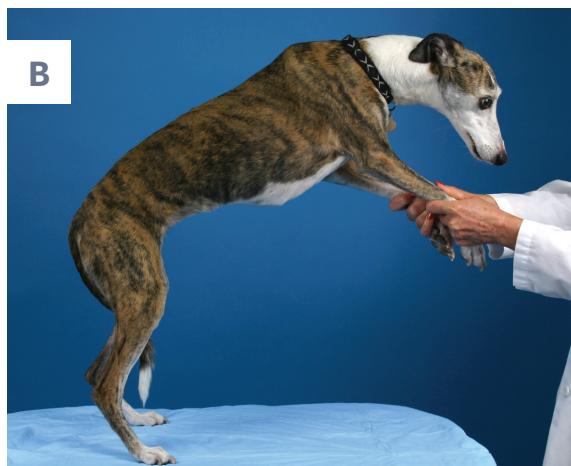
Hemistanding and hemiwalking (standing and walking on one side) isolates the left and right sides to determine if one side is less coordinated or weaker than the other.



Step 14:

Wheelbarrow Thoracic Limbs

Support the patient while making it stand and walk, first on the thoracic limbs (**A**) and then on the pelvic limbs (**B**). The wheelbarrow test can detect subtle deficits in coordination, strength in the thoracic and pelvic limbs, and whether one side is less coordinated or weaker than the other.



Continues ►

Step 15:

Hopping

With support, have the patient stand and hop (hopping test) on each limb individually to detect subtle deficits in limb coordination, strength, and whether one limb is more uncoordinated or weaker than the others.



Step 16:

Conscious Proprioception

Individually knuckle the paw of each limb onto its dorsum. It should immediately return to the correct position if conscious proprioception is normal.



Spinal Reflexes

The anatomical components of each spinal reflex are specific peripheral sensory nerves, spinal cord segments, motor peripheral nerves, and muscles (indicated in parentheses in the following sections). All components must be functional for the spinal reflex to be present. A depressed or absent spinal reflex indicates a lesion in the specific region of the spinal reflex tested. An exaggerated spinal reflex often means a lesion is present somewhere between the brain and the spinal reflex tested.

Thoracic Limb Reflexes

Step 17:

Biceps Reflex

Place a finger on the biceps tendon and percuss the finger. A brief elbow flexion indicates a normal biceps reflex (C6–C8). The response can be subtle in healthy dogs and cats.



Step 18: Triceps Reflex

Place a finger on the triceps tendon and percuss the finger. A brief elbow extension indicates a normal triceps reflex (C7-T2). The response can be subtle in healthy dogs and cats.



Step 19: Extensor Carpi Radialis Muscle Reflex

Directly percuss the muscle. A brief extension of the carpus indicates a normal extensor carpi radialis muscle reflex (C7-T2).



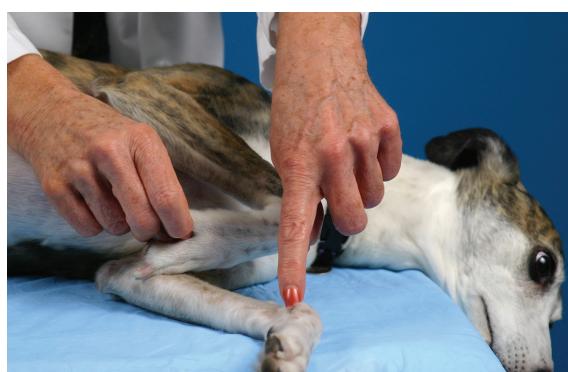
Step 20: Withdrawal Reflex

Pinch the toe with fingers or forceps. Flexion of all thoracic limb joints indicates a normal withdrawal reflex (C7-T2). Pain is present if the patient turns to look, cries, or growls.



Step 21: Crossed Extensor Reflex

When the withdrawal reflex is elicited, there should be no obvious extension of the opposite limb; such extension is a crossed extensor reflex, indicating a lesion between the brain and C5.



Continues ►

Pelvic Limb Reflexes

Step 22:

Patellar Reflex

Percussing the patellar tendon and observing a brief extension of the stifle joint indicates a normal patellar reflex (L4–L5).



Step 23:

Gastrocnemius Muscle Reflex

Grasp the gastrocnemius muscle between the thumb and forefinger and percuss the thumb. A brief hock extension indicates a normal gastrocnemius muscle reflex (L6–S2).



Step 24:

Cranial Tibial Muscle Reflex

Percussing the cranial tibial muscle directly and observing a brief flexion of the hock indicates a normal cranial tibial muscle reflex (L6–S2).



Step 25:

Sciatic Nerve Reflex

Place a finger over the sciatic nerve in the sciatic notch and percuss the finger. Brief extension of the hip, stifle joint, and hock indicates a normal sciatic nerve reflex (L6–S2).



Step 26: Withdrawal Reflex

Pinching the toe with fingers or forceps and observing flexion of the joints of the pelvic limb indicates a normal withdrawal reflex (L7–S2). Pain is present if the patient turns to look, cries, or growls.



Step 27: Crossed Extensor Reflex

Extension of the opposite limb when the withdrawal reflex is elicited is a crossed extensor reflex, which is seen with a lesion between the brain and L5.



Video

A [video series](#) on how to perform a neurologic examination, including tips, is also available.

View this article online at
brief.vet/neuro-exam,
or scan the QR code.



Step 28: Anal Reflex

Pinching the perineal area with a finger or forceps and observing contraction of the anal sphincter indicates that the anal reflex (S1–3) is present. If the tail simultaneously pulls down, this indicates the anal/caudal reflex (S1–Cd5) is present. The anal reflex can also be elicited by rectal palpation.



Continues ►

Other Examinations

Step 29:

Babinski's Sign

Scraping the tip of the percussion hammer proximally on the metacarpal and metatarsal bones elicits slight flexion of the digits.

Author Insight

Extension of the digits is a positive Babinski's sign and indicates a lesion somewhere between the brain and C5 (thoracic limb) or the brain and L5 (pelvic limb).



Step 30:

Limb Muscle Atrophy

Atrophy of the limb muscles is detected by palpation and observation. Muscle atrophy often indicates a lesion of the specific nerves to that muscle.



Step 31:

Cervical Muscle Palpation

Deeply palpate cervical muscles to detect evidence of neck pain (will induce muscle spasms, crying, or growling).



Step 32:

Neck Range of Motion

A limited range of motion could indicate that the neck is painful and may induce muscle spasms, crying, or growling.



Step 33:

Back Pain

Back pain may be elicited by palpating the paravertebral muscles; pain may result in muscle spasms, crying, or growling.



Step 34:

Cutaneous Trunci Muscle Response (Panniculus)

Pinching the skin with hemostatic forceps and observing contraction of the cutaneous trunci muscles indicates a normal cutaneous trunci muscle response (T2-L5). Superficial sensation is observed if the patient turns to look, cries, or growls. ●



Acknowledgments

In memory of the author's beloved whippet, "Solo" Windsome's A Simple Twist of Fate, 1993-2005, the model in the photographs. *Images courtesy of Mark Hoffenberg.*

Suggested Reading

Aiell SE, May A. The neurologic evaluation. Aiell SE, May A. *The Merck Veterinary Manual*. 8th ed. Merck; 2003:889-894.

Braund KG. Neurological examination. In: Braund KG. *Clinical Syndromes in Veterinary Neurology*. 2nd ed. Mosby; 1994:1-36.

Chrisman CL, Mariani CL, Platt SR, Clemons RM. Introduction. In: Chrisman CL, Mariani CL, Platt SR, Clemons RM. *Neurology for the Small Patient Practitioner*. Teton NewMedia; 2003:14-37.

deLahunta A. Neurologic examination. In: Braund KG, ed. *Clinical Neurology in Small Patients*. International Veterinary Information Service; 2001.

deLahunta A. Small patient neurologic examination and index of diseases of the nervous system. In: deLahunta A. *Veterinary Neuroanatomy and Clinical Neurology*. 2nd ed. WB Saunders; 1983:365-374.

Dewey C. Performing the neurologic examination. In: Dewey C. *A Practical Guide to Canine and Feline Neurology*. Blackwell Publishing; 2003:31-55.

Lorenz M, Kornegay J. Neurologic history and examination. In: Lorenz M, Kornegay J. *Handbook of Veterinary Neurology*. 4th ed. WB Saunders; 2004:3-44.

Daily Gratitude Builds Resilience

Zenithson Ng, DVM, MS, DABVP (Canine & Feline)

University of Tennessee



The veterinary profession is not for the faint of heart, but it is for those who are filled with heart (and gratitude). The road ahead may not always be smooth; however, **cultivating gratitude can be a powerful tool in navigating even the darkest of times.** Practicing daily gratitude can foster resilience and help you gain perspective.

Before work, try to cultivate gratitude and excitement for the job. On those challenging mornings when the urge to stay in bed is strong, reflect on the passion that led you to this profession. There was likely a point when there was nothing you wanted more than to be accepted into veterinary school. Recall the pivotal moment when you received the acceptance letter—a dream realized, a milestone achieved. Embrace the pride of completing a rigorous education and the privilege of finally having your dream job.

During work, practice gratitude for the opportunity to assist people and animals, as well as the support of colleagues. When faced with a challenging situation (eg, a

patient not getting better, a frustrating client, being pulled in too many directions), grant yourself permission to step back and recharge. Amidst setbacks and exhaustion, acknowledge at least one positive aspect of your day. Whether it's simply making yourself a cup of coffee, addressing a client's question, or engaging in a constructive interaction with a team member, celebrate these small victories. Embracing even small accomplishments can help you navigate difficulties and savor triumphs.

After work, be grateful for being anything other than a veterinarian. Be a parent, be a partner, be a sibling, be a friend, be an athlete, be an artist, be a chef, or be lazy if that makes you happy. On the days that work seems to consume you, establish boundaries by allocating dedicated time to vent to a trusted colleague, friend, mentor, or mental health professional. It is crucial to both voice frustrations and safeguard your well-being by ensuring work does not overshadow other aspects of your life. Creating space to nurture your identity outside of veterinary medicine can help you honor your true self, enabling you to approach each workday with renewed vigor and gratitude.

So, take every moment you can to express gratitude for the abundance in your life, and thank you for being you. ●

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