Small Animal Pathology

for Veterinary Technicians

Amy Johnson

with website

WILEY Blackwell

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To my family and friends who put up with my absence throughout this process and support me in all my endeavors, no matter how crazy they may sound. Thank you Keith and Cooper.

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About the Companion Website

This book is accompanied by a companion website:

www.wiley.com/go/johnsonvettechpath

The website includes:

- Images from the book in PowerPoint for downloading
- Review questions and answers
- Case studies illustrating the process of handling the patient

Introduction

chapter 1

The Veterinary Technician's Role in Pathology

For a veterinary technician, there are certain tasks not allowable by law. These tasks include making a diagnosis, determining a prognosis, prescribing medication, initiating treatment, or performing surgery. Just because a technician cannot make a diagnosis does not mean he or she is not an integral part of the diagnostic team. Understanding pathology is an important part of the veterinary technician's job, meaning it cannot be overlooked.

TECH BOX 1.1: Veterinary technicians play a role as an integral part of the diagnostic team.

Why does the veterinary technician need pathology information? This question has many answers:

- The role of client education is often a task that is the job of the technician. Veterinary technicians will advise clients on the phone and in person on how to best care for their pets.
- It is important to understand disease to prevent the spread of pathogens from patient to patient. It is the role of technicians to make sure they are doing what they can to keep their patients in good health.
- As a technician, there is a need to understand how to appropriately care for the patient. This understanding of the disease process will facilitate patient care.
- An understanding of pathology will aid in protecting clients, co-workers, and the technician themselves from zoonotic diseases.
- A technician who knows the disease process is able to anticipate the veterinarian's needs, expediting patient care.

Technician Duties and Required Skills

Technician duties will include patient care, client education, laboratory diagnostics, assisting the veterinarian, and treatment. It is important to

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note that every veterinarian/clinic/hospital will have different thoughts as to what a technician's duties will be, thus making it important that the technician understands what his or her role is.

Some of the necessary skills involved in dealing with these ill patients include

- Client education and communication skills
  - The ability to speak with owners over the phone and in person.
  - The ability to speak clearly with owners during the intake process and answer questions in terms that are correct but on a level that the client will understand.
  - The ability to update clients on how their animals are doing and progressing.
  - The ability to convey information between the veterinarian and owner.
  - The ability to explain invoices/estimates to clients so there is an understanding of why the procedure and cost are necessary for the treatment of their pet.
  - The ability to discharge a patient and give owners any information needed to continue the care of their animal.
  - The ability to train owners how to medicate or perform treatments that may be necessary once the animal is home.
- Laboratory and other diagnostic skills
  - The ability to properly collect specimens including urine, feces, blood, and tissues.
  - The ability to properly submit and package samples to reference laboratories.
  - The ability to perform a complete blood count (CBC) and other basic hematological procedures.
  - The ability to run blood chemistry machines and enzyme linked immunosorbent assays (ELISA).
  - The ability to collect cytologic specimens, set up slides, and examine slides.
  - The ability to collect samples for bacterial evaluation and set up and read culture and sensitivity tests.
  - The ability to set up, perform, and develop radiographs, ensuring the safety of all persons and animals involved.
  - The ability to prepare and restrain patients for other diagnostic imaging techniques including ultrasound (US), magnetic resonance imaging (MRI), and computed tomography (CT) scans.
  - The ability to prepare the patient, set up and clean equipment, and restrain the patient for endoscopic procedures.
  - The ability to prepare the patient and equipment for other specialized diagnostic procedures.
- Treatment skills
  - The ability to place intravenous catheters (ICVs) in veins including cephalic, lateral saphenous, and jugular veins.
  - The ability to prepare fluid bags and medications.
  - The ability to calculate the patient's fluid rates.
  - The ability to administer medications through routes including injection, oral, and topical.
  - The ability to isolate infectious materials and prevent further spread of contagious diseases.
  - The ability to keep the patient comfortable and in clean quarters.
  - The ability to advocate for the patient and keep his or her best interests first and foremost.
- Other skills
  - The ability to perform dosage calculations and other important veterinary calculations.
  - The ability to induce the patient for surgery, maintain and monitor anesthesia, prepare the patient for surgery, and assist the veterinarian in surgery.
  - The ability to sterilize instruments, prepare surgical packs, and maintain sterility.
  - The ability to restrain patients for examinations and procedures, ensuring the safety of the animal and all persons involved.

- The ability to lift patients on to exam tables, into and out of cages, and help patients ambulate if they are unable to.
- The ability to perform euthanasia or aid in the process.
- The ability to maintain patient records and hospital logs.
- The ability to log and track controlled substances.
- The ability to triage patients and deal with multiple animals.

There are other additional skills and duties that will be discussed with specific pathologies and highlighted by "Technician Duty" boxes.

Diagnosis

The word "diagnosis" literally means "a state of complete knowledge" and is used to label the condition the patient is suffering from. Types of diagnosis include

- A presumptive diagnosis is the identification of the likely cause of disease.
- A definitive diagnosis is the identification of the definite cause of disease; this type of diagnosis involves diagnostic testing.
- A differential diagnosis is a list of possible diseases the patient could have. Testing will aid in ruling diseases out and narrowing the list.

What is involved in a diagnosis and what is the technician's role? Not many patients will present with signs so distinct that the veterinarian knows immediately what disease they have. Achieving a diagnosis takes work and there is a process involved. First a history will need to be taken and a physical examination performed. A problems list will be generated that will allow the veterinarian to form a differential diagnosis. Performing diagnostic testing or imaging will allow for conditions to be crossed off that list. Technicians play a crucial role in this process, and it does not stop there. Once the veterinarian initiates treatment, the technician will provide that treatment. Client communication is necessary throughout the animal's hospitalization, and more client education will be necessary upon the patient's release. What this means is the veterinary technician is a critical part of the whole process.

Immunity

Immunity is the ability of the body to fight off disease and can be categorized in several different ways.

Non-specific immunity/resistance is general protection that does not initiate a response against a specific pathogen. The first line of defense is provided by mucous membranes and skin providing a physical barrier. Innate immunity, including inflammation, fever, antimicrobial proteins, and phagocytes, is the body's second line of defense. Specific immunity/resistance is the body's third line of defense, giving the body the ability to target and destroy specific antigens. Specific immunity involves lymphocytes that produce antibodies and memory cells.

Active immunity is formed when the body is allowed to form its own antibodies against a pathogen. Examples of active immunity include antibodies formed when the body is exposed to a disease or a vaccine. Passive immunity is produced when the body receives preformed antibodies, such as in the instance of colostrum or plasma.

Cellular immunity (cell-mediated immunity) is immunity involving the activation of T cell lymphocytes. These T cells have different functions:

- Cytotoxic T cells have the ability to attach to the antigen and attack it.
- Helper T cells enhance the activities of other immune responses.
- Supressor T cells aid in control of the immune response.
- Memory T cells create a memory of the antigen for a quicker response with the second exposure.

Humoral immunity involves production of antibodies from B cell lymphocytes. B cells transform into plasma cells creating antibodies, which work by neutralizing the pathogen, preventing cell attachment, immobilizing bacteria, and enhancing phagocytosis. Antibodies formed are for specific antigens and initiate memory B cells that create a quicker response in future exposures.

Factors Involved in Infectious Disease

How can two animals come in contact with a disease in their environment and only one of them get sick? The answer involves factors or variables involved with each patient and circumstance. First are host factors, dealing with the patients themselves. Age, nutritional status, health status, medications, immunization status, and stress will all play a role in how well a patient's immune system will protect it. Next are environmental factors, which involve temperature, humidity, and sanitation. Lastly, agent factors involve the micro-organism. Virulence, mode of transmission, and the amount of exposure needed aid in determining how a patient's immune system will react to each pathogen.

Common Terminology Necessary for Understanding Pathology

- *Bacterial translocation*: The movement of bacteria or bacterial products across the intestinal lining to either the lymphatics or peripheral blood circulation.
- *Bacterin*: An immunization against a bacterial agent.
- *Biological vector*: An organism in whose body a micro-organism develops or multiplies prior to entering the definitive host.
- *Carrier*: A living organism that serves as host to an infection yet shows no clinical signs of the disease.
- *Clinical sign*: Objective changes an observer can see or measure in a patient.
- *Contagious infectious disease*: An infectious disease that can be passed from one animal to another.
- *Disease*: Any changes from the state of health disrupting homeostasis.
- *Endemic*: A disease that is present in the community at all times.
- *Fomite*: An inanimate object that transmits a contagious infectious disease.
- *Homeostasis*: The ability of an organism to maintain its internal environment within certain constant ranges.
- *Horizontal disease transmission*: Transmission of disease among unrelated animals; can occur through direct contact or vectors. Horizontal disease transmission occurs when an animal comes in contact with a disease in his or her environment.
- *Incubation period*: The period of time from when a pathogen enters the body until signs of disease occur.
- *Infection*: Invasion and multiplication of a micro-organism in body tissues.
- *Infectious disease*: A disease caused by a micro-organism.
- *Latent infection*: An infection where the individual does not show signs of disease, unless under stressful conditions.
- *Local disease*: A disease that affects a small area or part of the body.
- *Mechanical vector*: An organism that transmits a micro-organism by moving it from one location to another.
- *Morbidity*: A ratio of sick to well in a population; refers to how contagious a disease is.
- *Mortality*: The number of deaths among exposed or infected individuals.
- *Palliative*: Relieving clinical signs/symptoms without curing disease.
- *Pathogen*: An infectious agent or micro-organism.
- *Pathognomonic sign*: A hallmark sign or one that is unique to a particular disease.
- *Pathology*: The study of disease.

- *Prognosis*: The estimate of the likely outcome of disease.
- *Reservoir*: A carrier or alternative host that maintains an organism in the environment.
- *Resistance*: The ability to ward off disease (immune).
- *Subclinical or unapparent infection*: An infection where clinical signs cannot be observed.
- *Susceptibility*: The lack of immunity or vulnerability to disease.
- *Symptom*: Subjective changes not obvious to the observer, requiring the patient to report them.
- *Systemic disease*: A disease that affects a number of organs/tissues or body systems.
- *Vaccine*: An immunization against a viral agent.
- *Vector*: Anything that transmits a contagious infectious disease.
- *Vertical disease transmission*: Transmission of disease from parent to offspring in the period prior to birth or immediately after birth. Examples of vertical disease transmission include transplacental transmission of disease or transmission through colostrum or lactation.
- *Zoonotic disease*: An infectious disease that can be passed from animal to man.

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Canine Infectious Disease

chapter 2

There are numerous infectious agents ubiquitous in the environment with which dogs come into contact. Most of these agents can be fought off by the immune system, but multiple variables will allow that protection to fail (discussed in chapter 1). Vaccines will protect many dogs, and yet patients will still present to veterinary clinics with these infections.

Canine Distemper Virus (CDV) or Hard Pad Disease

Description

Distemper virus is a highly contagious systemic infection caused by an enveloped ribonucleic acid (RNA) virus from the family Paramyxoviridae. As a member of the *Morbillivirus* genus, it is very closely related to human measles virus. Distemper is seen in domestic dogs and ferrets but transmission can be linked to wildlife such as skunks, minks, raccoons, coyotes, wolves, and foxes. It is a fairly labile in the environment, being easily killed by common disinfection methods. Incubation for distemper virus is approximately 2 weeks.

Transmission

- The main transmission route for distemper is through aerosolization. Respiratory secretions contain virus, although all other secretions should be considered contagious. Distemper can be passed from mother to fetus across the placenta.

Clinical Signs

- Highest rate of infection is among young unvaccinated puppies.
- Dogs with distemper may have a fever accompanying the disease.
- Respiratory signs include severe ocular and nasal discharge and pneumonia (Figure 2.1).
- Integumentary signs include pustules on the abdomen and hyperkeratosis of the pads and nose. These tissues produce excess keratin,

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Figure 2.1 Nasal discharge from a dog with distemper virus. (Image courtesy Michael Curran)

causing a waxy hard surface commonly called "hard pad."

- Vomiting and diarrhea are clinical signs associated with the gastrointestinal (GI) tract.
- Dental disorders arise from enamel hypoplasia, as the enamel does not properly form on developing teeth in puppies with the infection (Figure 2.2).
- Seizures are common with distemper. If the dog is exposed to distemper after birth, the seizures may develop during the course of the disease or be delayed 1–3 weeks after recovery from the other clinical signs. These seizures will range from mild to severe. "Chewing gum" seizures and focal seizures in the facial muscles are common.

TECH BOX 2.1: Distemper is one of the most common causes of seizures in puppies less than 6 months old.

- Puppies exposed to distemper prior to birth will develop seizures within the first few weeks of life, while other clinical signs are absent.

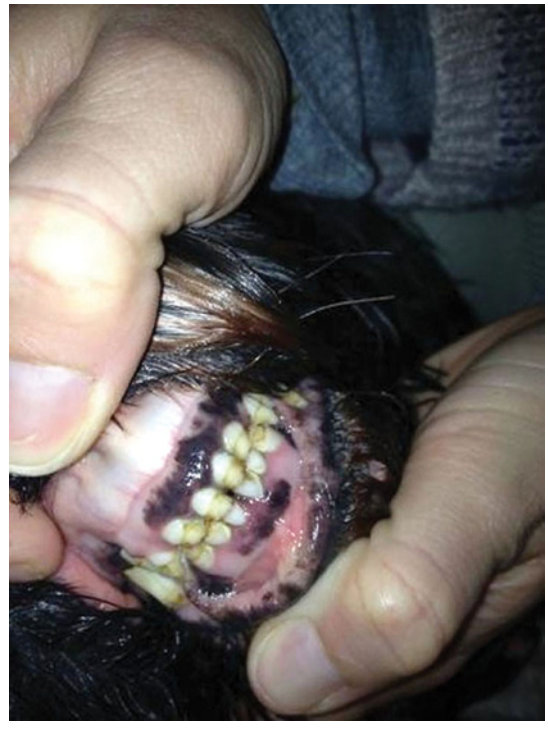

Figure 2.2 Enamel hypoplasia seen as a result of distemper virus. (Image courtesy Shawn Douglass)

Diagnosis

- Distemper is most commonly diagnosed based upon presenting clinical signs, physical exam, and history.
- Radiographs can be used to diagnose pneumonia (Figure 2.3).
- Reference lab testing includes polymerase chain reaction (PCR), antibody titers, and immunofluorescent antibody assay (IFA).
- In-house testing includes distemper antigen test kits and routine laboratory work (Table 2.1), although the lab values are not definitive. Distemper inclusions can be found in the red blood cells (RBCs) and white blood cells (WBCs) of infected patients (Figure 2.4) on a routine blood film.

Treatment

- Treatment is supportive care targeted at the patient's clinical signs.
- Treatment includes intravenous (IV) fluids, correction of electrolyte imbalances, antibiotic drug therapy to prevent secondary bacterial infections, anticonvulsants, and oxygen therapy.
- Even with treatment, the disease will most often be fatal.

Table 2.1 Distemper laboratory work

Morphology changes on blood film	Inclusions found in RBC and WBC: Dark purple Round to oval Inconsistent size
Blood cell count changes	Leukopenia first 3–6 days of infection
PCV/TP	Increase due to hemoconcentration
Blood chemistry	Hypoglycemia due to anorexia and vomiting
Electrolytes	Imbalances due to dehydration and anorexia
Urine changes	Increase in USG due to dehydration

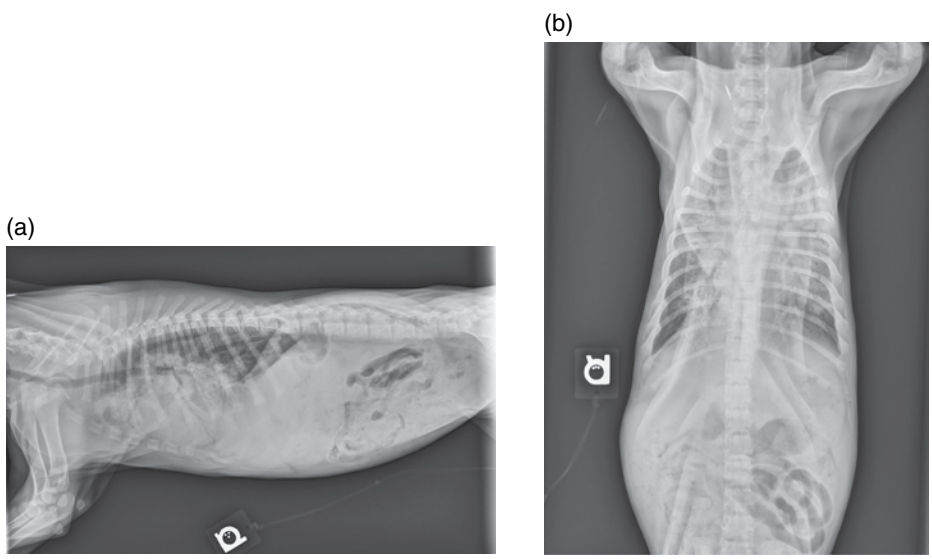

Figure 2.3 Radiograph of a puppy with pneumonia: (a) lateral, (b) ventral/dorsal. (Image courtesy Brandy Sprunger)

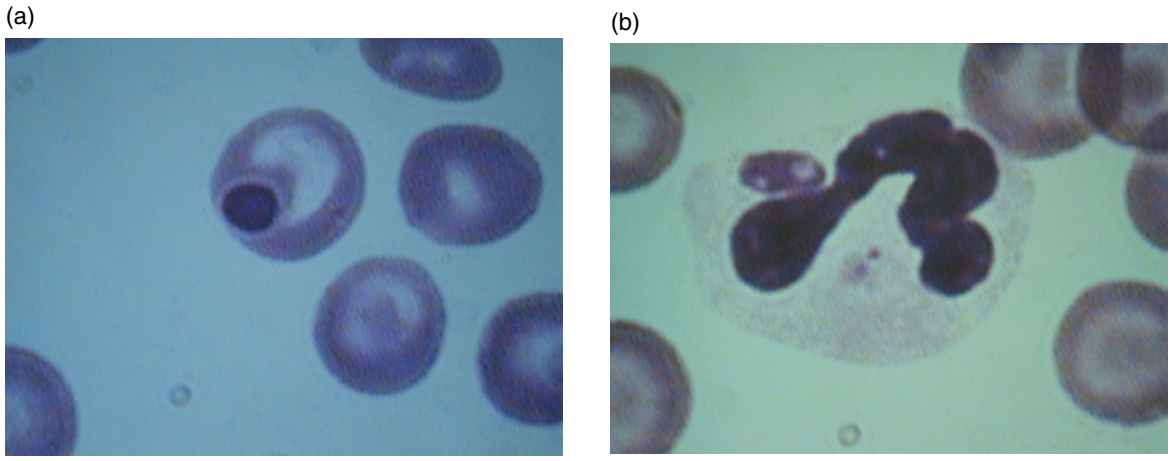

Figure 2.4 Blood film with distemper inclusions in (a) RBC, (b) WBC. Stained in routine hematology stain (Diff Quik). (Image courtesy Tammy Schneider)

Client Education and Technician Tips

- Distemper is one of the leading causes of death in unvaccinated dogs.
- Vaccination, isolation, and sanitation are key in preventing the spread.
- High-risk young puppies can be given human measles vaccine. This offers cross-protection as the antibodies formed will recognize distemper virus but will not interfere with maternal distemper antibodies.
- If a dog survives distemper, he or she may have lifelong problems, including dental and central nervous system (CNS) problems (seizures).

TECH BOX 2.2: With distemper, the long-term prognosis is questionable. Patients may not recover from neurological clinical signs.

- "Old dog encephalopathy" (ODE) is a condition seen in surviving dogs as they age. The virus remains long term in their brain tissue and can cause encephalitis. It is important to note that these dogs are not contagious and will not develop any other signs of distemper. Dogs with ODE will exhibit CNS signs such as seizures, ataxia, and head pressing.

Canine Parvovirus Type 2 (CPV-2)

Description

Canine parvovirus type 2, a highly contagious virus, will cause an acute severe gastroenteritis in dogs. CPV-2 is seen in wild canids as well as domestic dogs. This non-enveloped deoxyribonucleic acid (DNA) virus is from the Parvoviridae family, and although there are many species that are affected by viruses in this family, CPV-2 will not cross species lines. Dogs with parvovirus start to exhibit clinical signs within 4–9 days after exposure. Viruses in the Parvoviridae family are some of the most resistant viruses known. CPV-2 will live in the environment for approximately a year, possibly longer. The virus is resistant to some disinfectants, extreme temperatures, and changes in pH; however, dilute bleach will kill the virus on hard surfaces.