สมาคมสัตวแพทย์ผู้ประกอบการบำบัดโรคสัตว์แห่งประเทศไทย
โครงการ VPAT ACADEMY

VPAT ACADEMY WEBINAR

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ในคลิปบรรยายที่จัดทำขึ้นนี้ เป็นลิขสิทธิ์อย่างถูกต้อง
ของสมาคมสัตวแพทย์ผู้ประกอบการบำบัดโรคสัตว์แห่งประเทศไทย (VPAT)
ห้ามผู้ใดทำซ้ำ คัดลอก ดัดแปลง จัดเผยแพร่ จำหน่าย โดยไม่ได้รับอนุญาต"

Infectious disease

Common bacterial and protozoa diseases in dog and cat

Suchana Aruvornlop, DVM.
Ph.D. candidate, Faculty of Veterinary Science,
Mahidol University

01. Bacteria disease

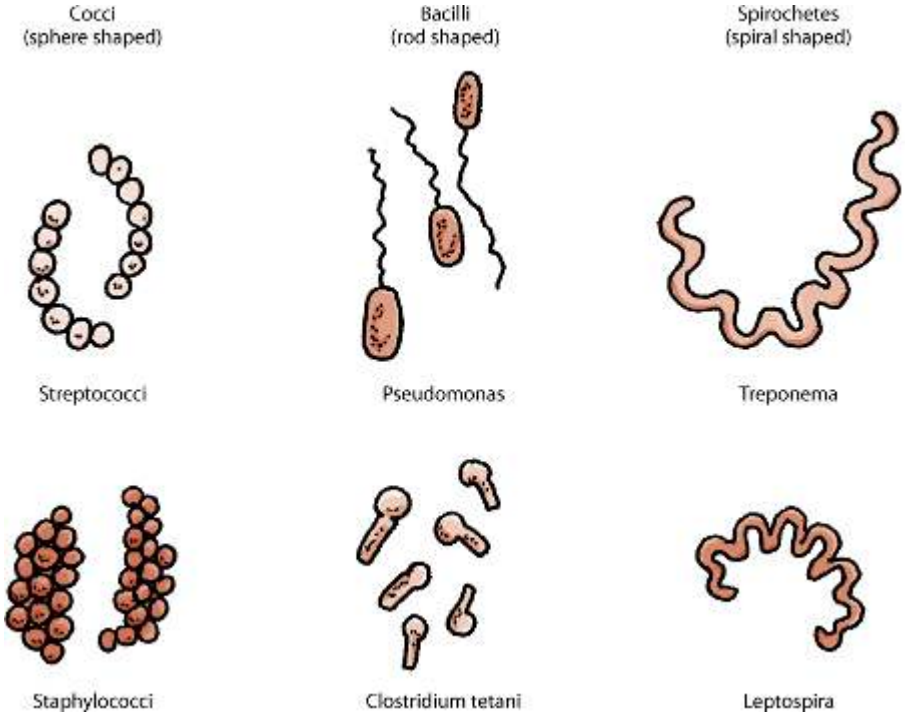
02. Protozoa disease

03. Blood parasite
(Tick-borne disease)

04. Conclusion

01

Bacterial disease

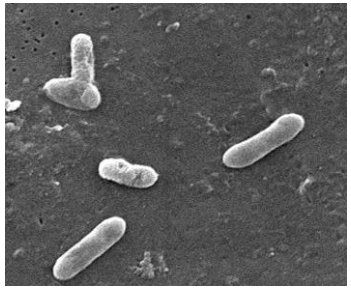


Common bacteria in dog and cat

Respiratory system	*Bordetella bronchiseptica*
	Chlamydophila felis
Gastrointestinal system	*Campylobacter jejuni*
	Clostridium perfringens, C. difficile
	Salmonella spp.
Dermatological infection	*Staphylococcus pseudointermedius*
Nervous system	*Clostridium botulism*
	Clostridium tetani
Miscellaneous	*Bartonella hensale*
	Leptospirosis

Respiratory system

Bordetellosis



(Canine and Feline Infectious Diseases, 2014)

Etiology

Bordetella bronchiseptica

a gram-negative, aerobic coccobacillus

Primary cause of respiratory disease in cat

Mode of transmission

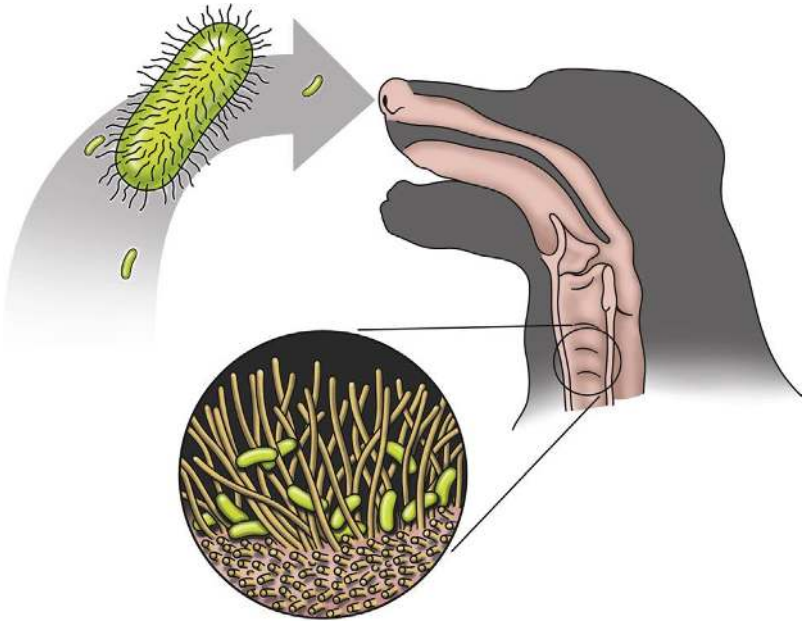
Aerosol, contact with contaminated fomites and water sources

Co-transmission from cat and dog.

zoonosis

Pathogenesis

Colonize the ciliated epithelium of respiratory tract causes ciliostasis



(Canine and Feline Infectious Diseases, 2014)

Bordetellosis

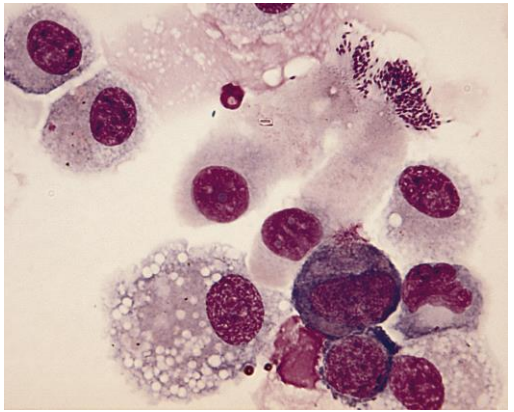
(https://profpetsit.com/is-your-dog-coughing/)

Clinical sign

Mild-severe respiratory sign e.g. kennel cough, pneumonia, dyspnea, cyanosis and death

Diagnosis

- Bacterial culture: from nasal and swabs, transtracheal and bronchoalveolar lavage
- PCR: bacterial DNA
- Serology: antibody detection



Bronchoalveolar lavage cytology of B. bronchiseptica infection dog
(Canine and Feline Infectious Diseases, 2014)

Chlamydial infection

Etiology

Chlamydophila felis

Aerobic gram-negative, rod-shaped, obligately intracellular bacteria

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Mode of transmission

Close contact to secretion of infected cats

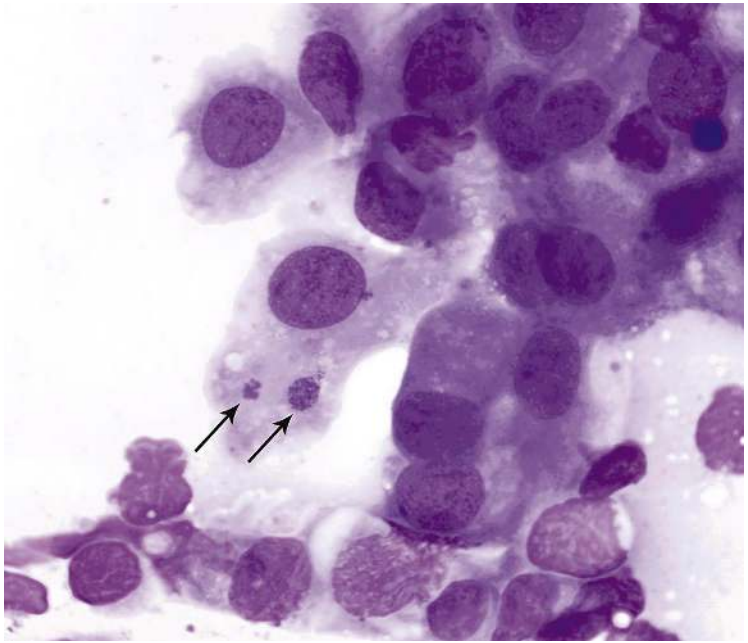
Pathogenesis

replicates in the cytoplasm of conjunctival epithelial cells especially at conjunctiva → cell lysis → spreads via the bloodstream to a variety of other tissues, (tonsil, lung, liver, spleen, gastrointestinal tract, and kidney)

Clinical sign

Upper respiratory signs, including fever, ocular discharge, keratoconjunctivitis and sneezing.

Chlamydial infection



Intracytoplasmic inclusion body

(Canine and Feline Infectious Diseases, 2014)

Diagnosis

Assay	Specimen type	Performance
Bacterial culture	Conjunctival swab	Not utilized for routine diagnostic purposes. Requires special chlamydial transport media
Cytology	Conjunctival swab	Intracytoplasmic inclusion body (insensitive method)
Serology: antibody	Serum	ELISA -<1:32 negative ->1:512 recent infection
PCR: antigen	Conjunctival swabs, scrapings, or biopsie	

Respiratory infection

Treatment

Topical treatment
Tetracycline ophthalmic ointment
Symptomatic and supportive care
Nebulization
Mucolytic drug
Fluid therapy
Oxygen supply

Antimicrobial drug

Treatment Options for Canine Infectious Respiratory Disease

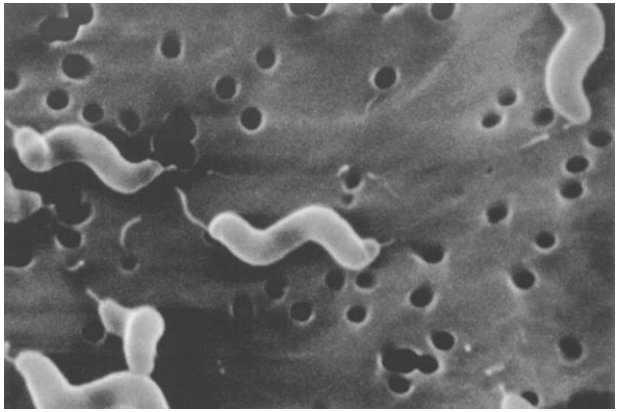
Drug[a]	Dose (mg/kg)[b]	Route	Interval (Hours)	Duration (Days)
ANTIMICROBIALS[c]				
Amoxicillin-clavulanate	12.5–25	PO	12	10–14 (minimum)
Azithromycin	5.0	PO	24	5–7
Doxycycline	2.5–5.0	PO	12	10 (minimum)
Enrofloxacin	5.0	PO	24	10
Trimethoprim-sulfonamide	15	PO	12	10–14 (minimum)
ANTITUSSIVES				
Hydrocodone	0.22	PO	8–12	prn
Butorphanol	0.55	PO, SC	8–12	prn
GLUCOCORTICOIDS				
Prednisolone	0.25–0.5	PO	12	3–5
BRONCHODILATORS				
Aminophylline	10	PO	8–12	prn
Terbutaline	2.5	PO, SC	8–12	prn

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Gastrointestinal system

Campylobacteriosis

Etiology
Campybactor jejuni
Aerobic gram-negative, gullwing – shaped rod shape,
Opportunistic bacteria

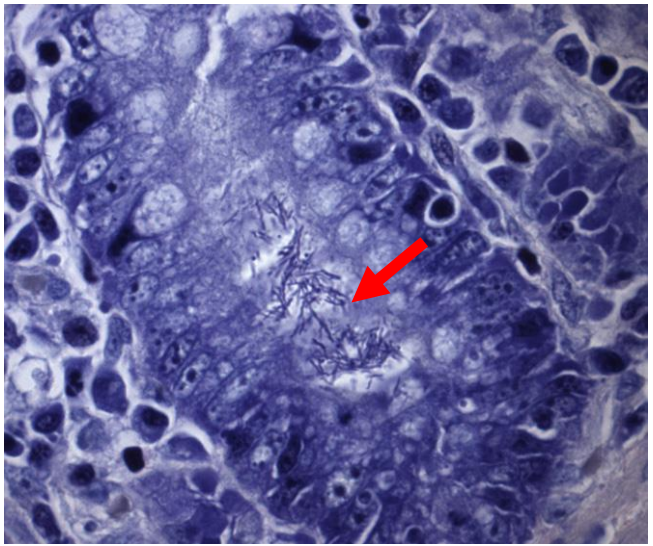


(Altekruse et al., 1999)

Mode of transmission
Fecal-oral

Pathogenesis
Normal flora imbalance or < 6 months dogs and cats' infection → Campylobacter overgrowth → colonize and invade lower intestinal tract, (jejunum, ileum, and colon) epithelial cells and produce toxin → causes cell cycle arrest and apoptosis

Campylobacteriosis



Filamentous, spiral *C. jejuni* pack the crypts and there is an associated lymphoplasmacytic enterocolitis.

(Canine and Feline Infectious Diseases, 2014)

Clinical sign

Fever, lethargy, anorexia, large bowel diarrhea; watery to mucoid diarrhea

In humans: Guillain-Barré syndrome

Diagnosis; Feces, blood, bile, intestinal tissue

- Bacterial culture (isolation of Campylobacter does not confirm causation)
- PCR

Enteric Clostridial infection

Etiology

C. perfringens
C. difficile

Mode of transmission

Fecal-oral

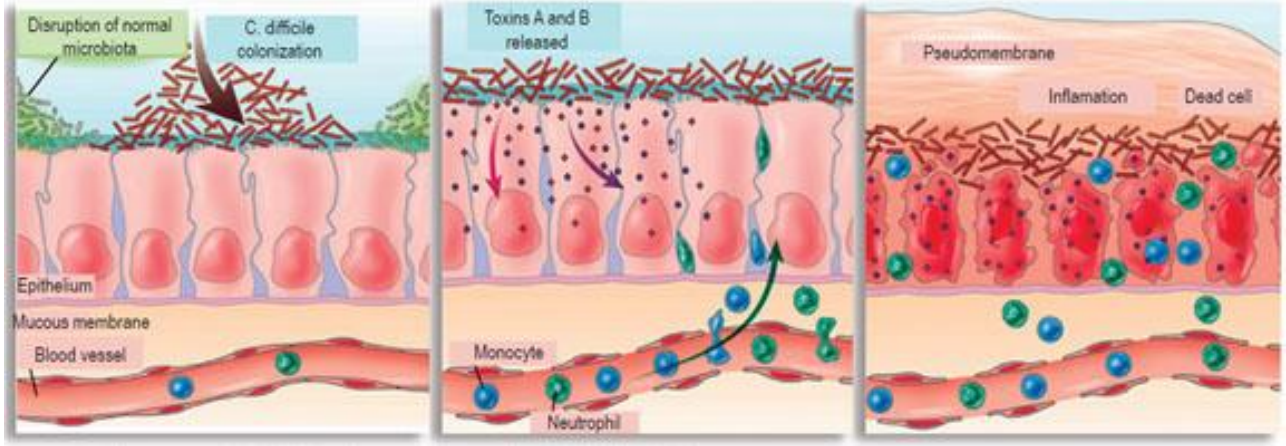
* Dogs and cats = potential source of human infection with *C. difficile*

Clinical sign

- Lethargy
- Anorexia,
- Hemorrhagic diarrhea

Pathogenesis

Decreased peristalsis/ effects of ABO drugs the resident intestinal microflora, or co-infections with other intestinal pathogens → overgrowth at large intestinal epithelium → toxin production → lyse phospholipid



(Pérez et al., 2013)

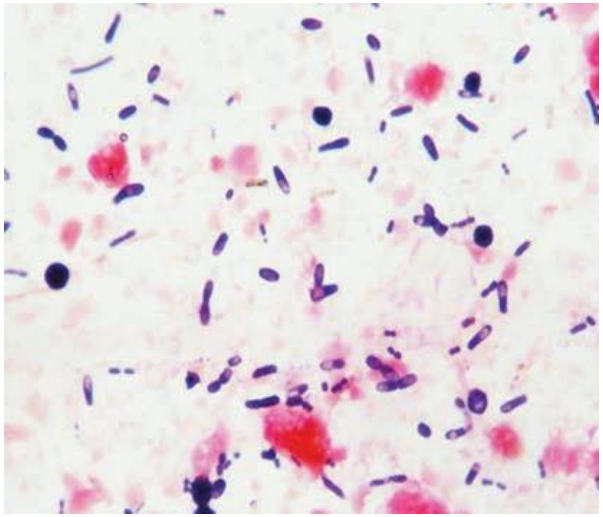
Enteric Clostridial infection

Diagnosis

Assay	Specimen	Target
Fecal smear	Feces	*Endospore*
Bacterial culture		*C. perfringens* *C. difficile*
Toxin immunoassay		C. perfringens Enterotoxin (CPE) *C. difficile:* toxin A and B
PCR		Toxin gene

Modified Wright' s stain showed endospore of *C. perfringens*

Infectious Diseases of the Dog and Cat, 4th Edition, 2012



(Canine and Feline Infectious Diseases, 2014)

Treatment

Metronidazole is a drug of choice

Salmonellosis

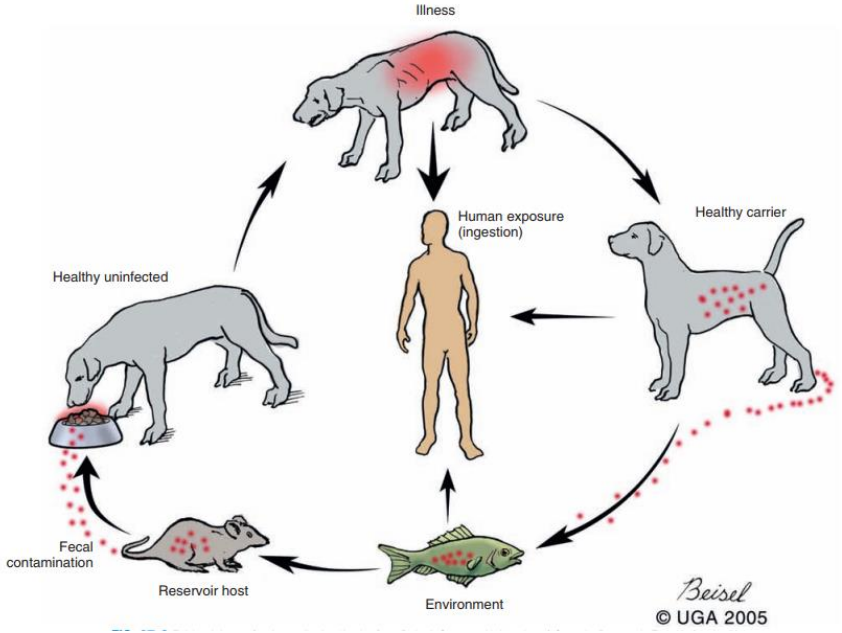
Etiology

Classification of Salmonellae		
***Salmonella* Species**	***Salmonella* Subspecies**	**Example Serotypes**
Salmonella enterica	*enterica* (I)	*Salmonella* ser. Typhimurium *S.* ser. Typhi *S.* ser. Choleraesuis
	salamae (II)	*S.* ser. Greenside
	arizonae (IIIa)	*S.* IIIa 18:z_4,z_{23}:—
	diarizonae (IIIb)	*S.* IIIb 60:k:z
	houtenae (IV)	*S.* ser. Marina
	indica (VI)	*S.* ser. Srinagar
Salmonella bongori	V	*S.* ser. Brookfield

(Canine and Feline Infectious Diseases, 2014)

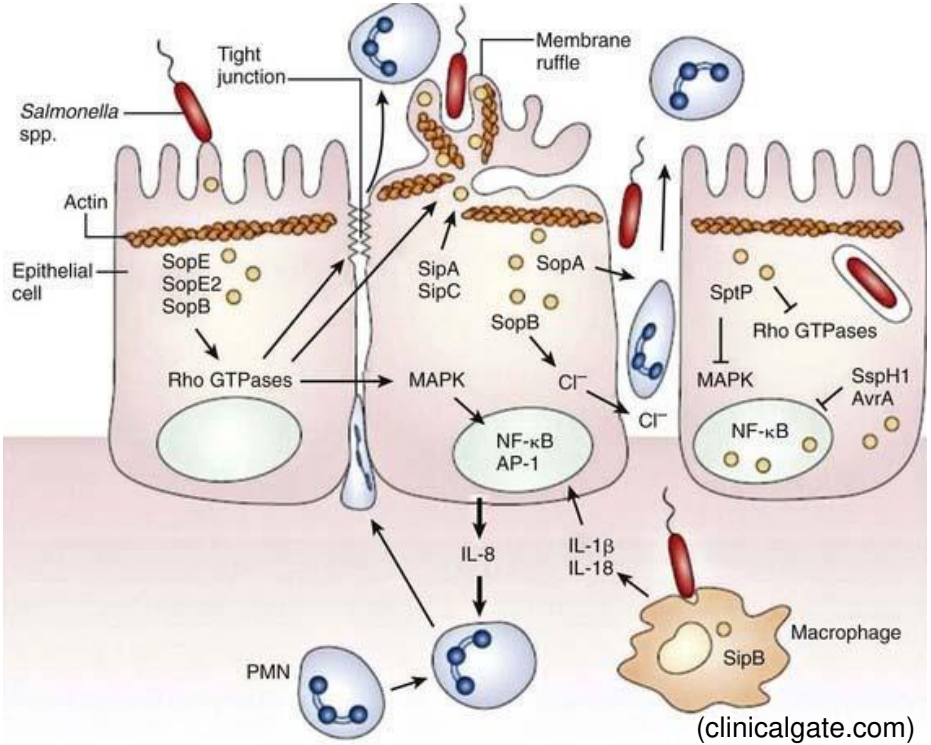
Mode of transmission

Fecal-oral

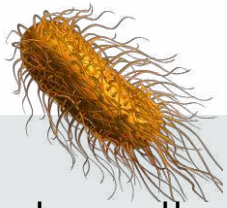


Salmonellosis

Pathogenesis



(clinicalgate.com)



Bacteria:

Ingest large amount of salmonella →colonize at tip of villi of ileum → infect epithelial cells, M cell and dendritic cell → epithelial injury and sloughing

LPS (endotoxin):

- Endotoxic shock
- Hypotension
- Activate complement and coagulation cascade

Salmonellosis

Clinical sign

- Fever
- Lethargy
- Anorexia
- Hemorrhagic diarrhea,
- Vomiting
- Less common sign
  e.g. reproductive failure, neurologic and/or respiratory signs

Diagnosis

Assay	Specimen Type	Target
Bacterial isolation	Feces, blood, synovial fluid, tissue aspirates, bronchoalveolar lavage fluid, peritoneal or pleural effusions, urine, CSF, tissues obtained at necropsy	*Salmonella* species
PCR	As for isolation	*Salmonella* DNA

(Canine and Feline Infectious Diseases, 2014)

Treatment of enteric bacteria

- Supportive treatment
- Antibody (only for animal with systemically ill e.g. severe fever, or hemorrhagic diarrhea)

Drug[a]	Species	Dose[b] (mg/kg)	Route	Interval (hours)	Duration (days)	Indicated Infections
Erythromycin	D	20	PO	12	5–21	Campylobacteriosis, nongastric helicobacteriosis
	C	10	PO	8	5	
Trimethoprim-sulfonamide	B	15–30	PO, IV	12–24	7–10	Salmonellosis, shigellosis, yersiniosis
Amoxicillin, ampicillin	B	10–20	PO, IV	8	7–10	Salmonellosis, shigellosis, CPAD
Chloramphenicol	D	25–50	PO, SC, IM	8	5–7	Salmonellosis, shigellosis, campylobacteriosis, nongastric helicobacteriosis
	C	10–25	PO	12	8	
Metronidazole	B	10–15	PO	12	5–10	Bacterial overgrowth, nongastric and gastric helicobacteriosis, CPAD,CDI
Tetracycline	B	20–25	PO	8	42	Shigellosis, yersiniosis, bacterial overgrowth
Gentamicin[c]	D	9–14	SC, IM, IV	24	5	Yersiniosis, salmonellosis, nongastric helicobacteriosis
Tylosin	B	6–16	PO	12	42	Bacterial overgrowth, CPAD
Cephalosporins (first generation)	B	20	PO	8	7	Yersiniosis
Cephalosporins (second generation)	B	22	IV	8	21	Campylobacteriosis, nongastric helicobacteriosis
Enrofloxacin[d]	D	5–10	PO, SC	24	5–7	Campylobacteriosis, salmonellosis
	C	5	PO, SC	24	5–7	

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Nervous system

Botulism

Etiology

Clostridium botulinum
gram-positive, motile, anaerobic spore-forming bacilli

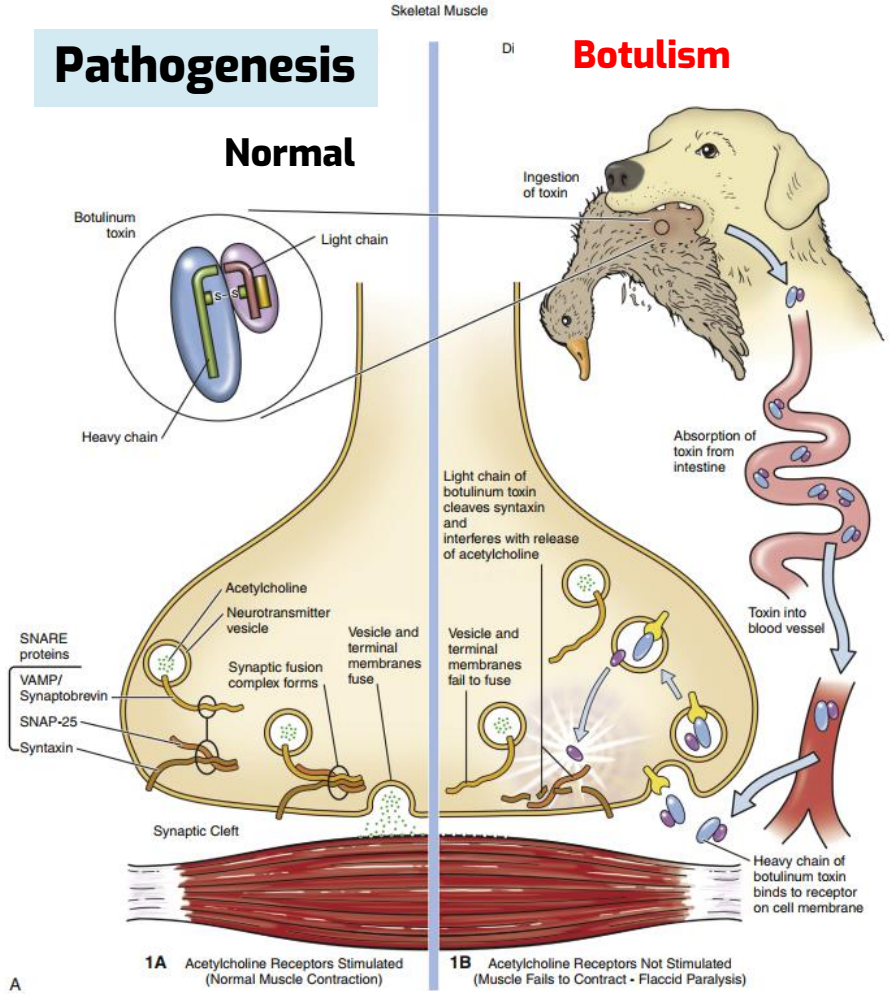
(Woudstra et al., 2016)

Mode of transmission

Ingestion of preformed toxin

Pathogenesis

Inhibit of acetylcholine release



(Canine and Feline Infectious Diseases, 2014)

Botulism

Clinical sign

Flaccid paralysis

- Decreased reflexes
- Tetraparesis
- Respiratory compromise
- Dysphonia
- Megaesophagus

Dogs with quadriplegia resulting from botulism

Normal pain perception but lack of a withdrawal reflex.

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Tetanus

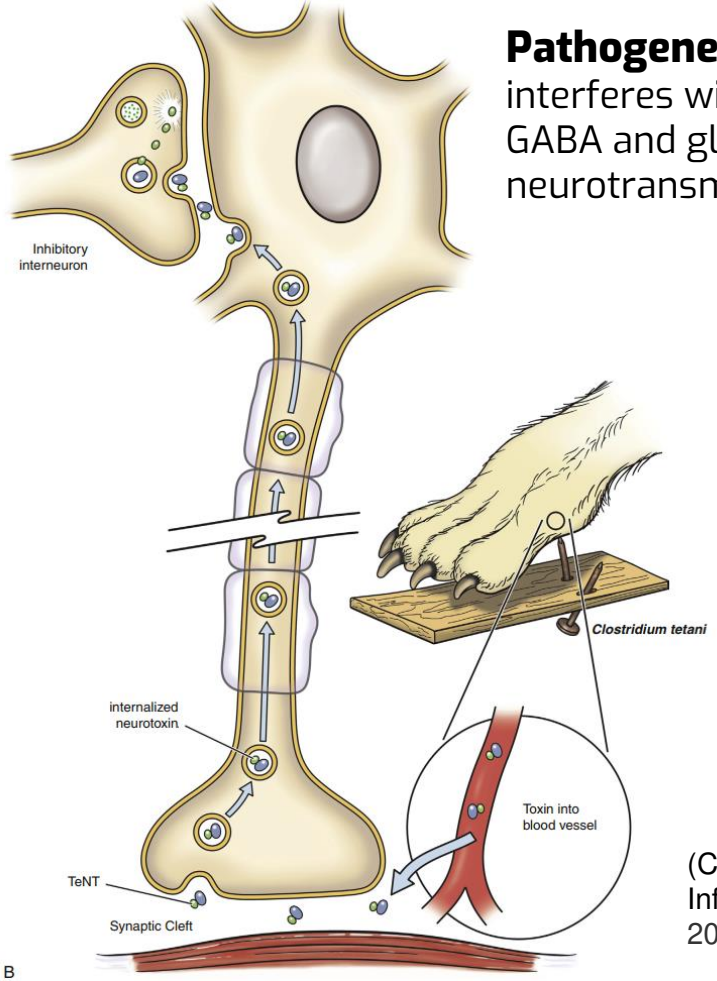
Etiology *Clostridium tetani*

Gram-positive, motile, anaerobic, spore-forming bacilli

(https://www.sciencephoto.com/media/601677/view/clostridium-tetani)

Mode of transmission
cutaneous inoculation of spores into a wound

Pathogenesis
interferes with release of GABA and glycine inhibitory neurotransmitters



(Canine and Feline Infectious Diseases, 2014)

Tetanus

Clinical sign

Spastic paralysis

- Wrinkled forehead,
- Erect ears
- Retracted lips,
- Prolapsed third eyelids,
- Generalized muscle stiffness **“sawhorse ” stance**
- Miosis

Third eyelid prolapse and contract of facial muscle

Sawhorse stance

Localized tetanus. Extension of the shoulder and elbow and partial flexion of the carpal joint is present.

(Canine and Feline Infectious Diseases, 2014)

Diagnosis

Assay	Botulism	Tetanus
Clinical sign	Flaccid paralysis	Spastic paralysis
Blood profile	- Mild to severe increases of serum creatine kinase - Mildly increased AST activity	
Electromyography (EMG)	Subnormal	-
ELISA: toxin assay	• **toxin assay**: detect toxin in feces, vomitus, intestinal content, serum, food	-
ELISA: antibody titer	detect anti– toxin antibodies from serum. (not recommend in early infection)	

Treatment

Botulism

- Supportive care
- Antibiotic: penicillin and metronidazole are drug of choice
- Antitoxin
- Caution: aspiration pneumonia, respiratory failure

Tetanus

- Supportive care
- Eliminate external stimuli
- Antibiotic
- Antitoxin

Recommended Drug Dosages for Tetanus

Drug[a]	Species	Dose[b]	Route	Interval (hours)	Duration (days)
ANTIMICROBIALS					
Penicillin G potassium[c]	B	20,000–40,000 U/kg	IV, IM	6–8	10
Penicillin G procaine	B	20,000–40,000 U/kg	IM, SC	12–24	10
Amoxicillin-clavulanate	B	12 mg/kg	PO	12	10
Metronidazole	D	10–12 mg/kg	PO, IV	8	10
	B	15 mg/kg	PO, IV	12	10
	C	10–25 mg/kg	PO	24	10
Tetracycline	B	20–22 mg/kg	PO	8	10
Clindamycin	D	11–33 mg/kg	PO	12	10
	C	11–33 mg/kg	PO	24	10
	B	10 mg/kg	IV, SC, IM	12	10
IMMUNOTHERAPEUTIC AGENTS					
Equine antitoxin[d]		100–1000 U/kg	IV, IM, SC		Once
		500-1000 U per site	Intralesional		Once
		1–10 U/kg	Intrathecal		Once
Human tetanus immune globulin	B	500-2000 U near wound if found	IM		Once
SEDATIVES AND ANALGESICS					
Acetylpromazine	B	0.01–0.07 mg/kg[e]	IV	2–6	prn
	B	0.1–0.25 mg/kg[e]	IM	4	prn
	B	1.0 mg/kg	PO	6–8	prn
Chlorpromazine	D	0.5 mg/kg	IM, SC	6–8	prn
	C	0.2–0.4 mg/kg	IM, SC	6–8	prn
Midazolam	B	0.1–0.2 mg/kg	IM, IV	2–4	prn[f]
Diazepam	D	5.0–10 mg total	IV, PO, IM	2–4	prn
	B	0.2–0.5 mg/kg	IV	4–6	prn[g]
Pentobarbital	B	3–10 mg/kg	IV, IM	2–6	prn[h]
Phenobarbital	B	1–6 mg/kg	PO, IM	6–12	prn[i]
Propofol	D	1–2 mg/kg	IV	Prn	prn[j]
Butorphanol	D	0.2–0.4 mg/kg	IV	4–6	prn
MUSCLE RELAXANTS					
Methocarbamol	B	22–44 mg/kg, up to 130 mg/kg	PO, IV	8	prn[k]
Dantrolene	D	1–5 mg/kg	PO[l]	8	prn
Magnesium	D	100 mg/kg	IV	24	prn[m]
AUTONOMIC AGENTS					
Atropine[n]	B	0.05 mg/kg	SC	Prn	prn
Glycopyrrolate[n]	B	0.005–0.01 mg/kg	SC, IV	Prn	prn
		1 mg total	PO	8	prn
Metoclopramide	B	0.28 mg/kg	PO[n]	8	prn
SUPPLEMENT					
Pyridoxine	B	100 mg total	PO	24	prn

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Bacterial dermatitis

Etiology

Staphylococcus pseudointermedius = 90%
Staphylococcus aureus
Staphylococcus epidermidis
Pseudomonas spp.
Proteus spp.
E. coli

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Staphylococcosis

Mode of transmission
Commensal of the skin and mucous membranes of dogs and cats. Infected by grooming and licking in dogs with pruritis

Pathogenesis
- Bacterial → secrete enzyme (e.g. haemolysin, protease, lipase → degradation of host tissues
- Exotoxin → tissue injury

Clinical sign
Superficial and deep pyoderma, otitis externa, urinary tract infections (UTIs), and wound and surgical site infections, bronchopneumonia, ocular infections, bacteremia, osteomyelitis, and infections of body cavities

Deep pyoderma

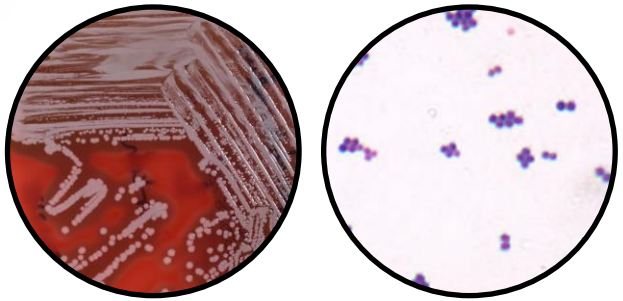
Otitis externa

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Staphylococcosis

Diagnosis

- Blood profile: neutrophilia and a left shift, toxic neutrophils, lymphopenia, and monocytosis
- Bacterial culture
- Cytology: cocci, which occur singly and in pairs or grapelike clusters
- PCR



Treatment:

Antibiotics

Topical therapy (skin)

- Benzoyl peroxide (not for cats)
- Chlorhexidine
- Sulphur
- Salicylic acid

Drug Therapy for Staphylococcal Infections in Dogs and Cats

Drug[a]	Species	Dose[b] (mg/kg)	Route	Interval (hours)	Duration (days)
Amoxicillin-clavulanate	B	12.5–25	PO	12	prn
Cephalexin or cefadroxil	D	22	PO	12	prn
Cephalexin	C	22–30	PO	12	prn
Cefadroxil	C	22	PO	24	prn
Clindamycin[c]	B	11	PO	12	14–42
Quinolones[d]	B	Varies[c]	PO	24	prn
Erythromycin	D	10–20	PO	8	prn
Chloramphenicol	D C	25–50 10–20	PO, SC, IM, IV PO, SC, IV	8 12	prn prn
Trimethoprim-sulfonamide	D	22	PO	12	prn

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)


Miscellaneous

Cat scratch disease

Etiology

Bartonella hensale

small, curved, gram-negative hemotropic α- proteobacteria

(https://cvm.ncsu.edu/bartonella-and-adolescent-schizophrenia/)

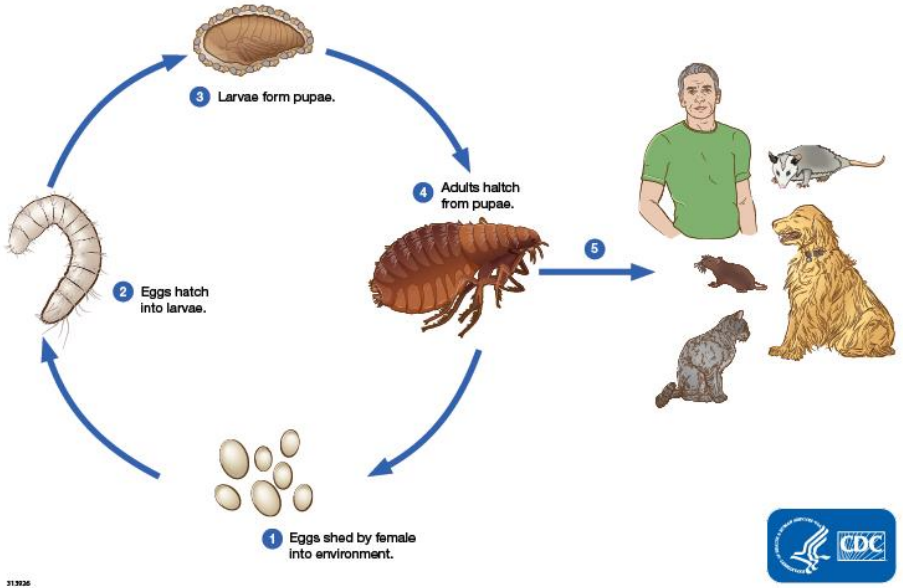
Mode of transmission

Vector = Cat flea (*Ctenocephalides felis*)

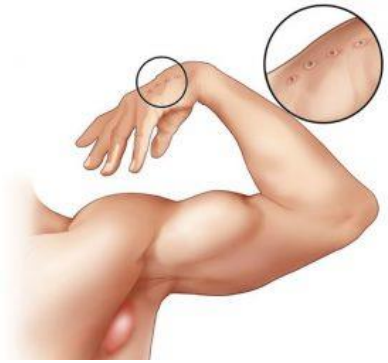
Reservoir = Domestic cats

Transmitted by cat bites, scratches, grooming, or sharing of food dishes and litter boxes

Incidental host = dog, human (Zoonosis)

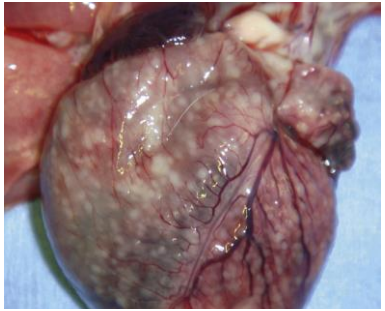


Cat scratch disease

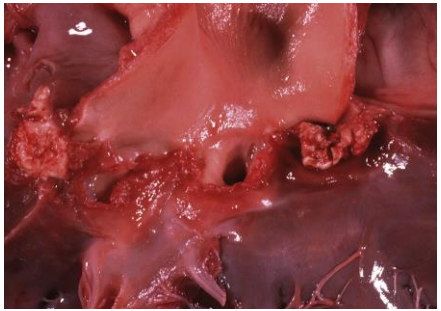


Lymphadenomegaly

Bacillary angiomatosis



Granulomatous myocarditis



endocarditis at aortic valve

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Clinical sign

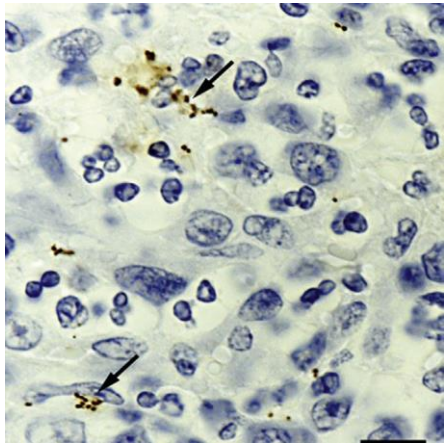
Naturally, infected cats are primarily asymptomatic

Occasionally,

- Skin papule
- Lymphadenomegaly
- Endocarditis (e.g. cardiac murmur, cough, tachypnea, lameness)
- Neurologic signs

Cat scratch disease

Diagnosis

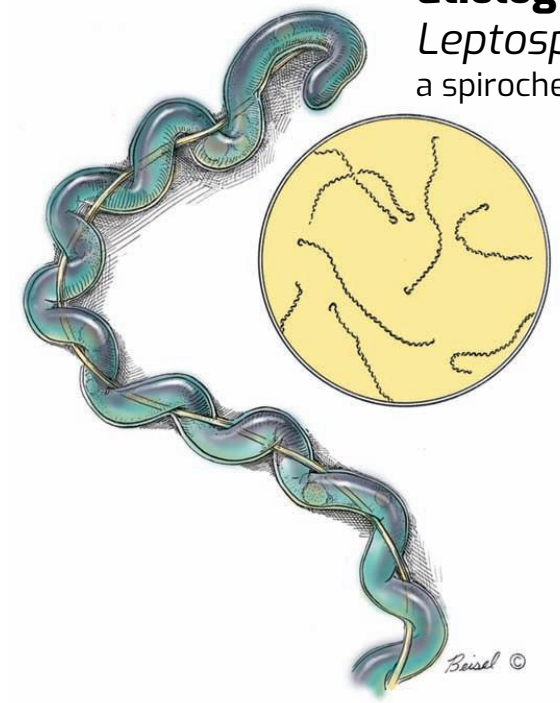


Immunohistochemistry; IHC
B. henselae–specifc
monoclonal antibody
(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Assay	Specimen Type	Target
Culture	Whole blood, tissue specimens obtained at necropsy (e.g., heart valve, myocardium) or by biopsy (e.g., liver biopsy, skin biopsy)	*Bartonella* spp.
Histopathology with organism detecting using silver stains or IHC	Tissue specimens obtained by biopsy or necropsy	*Bartonella* spp. organisms
Serology	Serum	Antibodies to *Bartonella* spp.
PCR	Whole blood, splenic or lymph node aspirates, tissue specimens obtained at necropsy or biopsy	*Bartonella* spp. DNA

Infectious Diseases of the Dog and Cat, 4th Edition, 2012

Leptospirosis



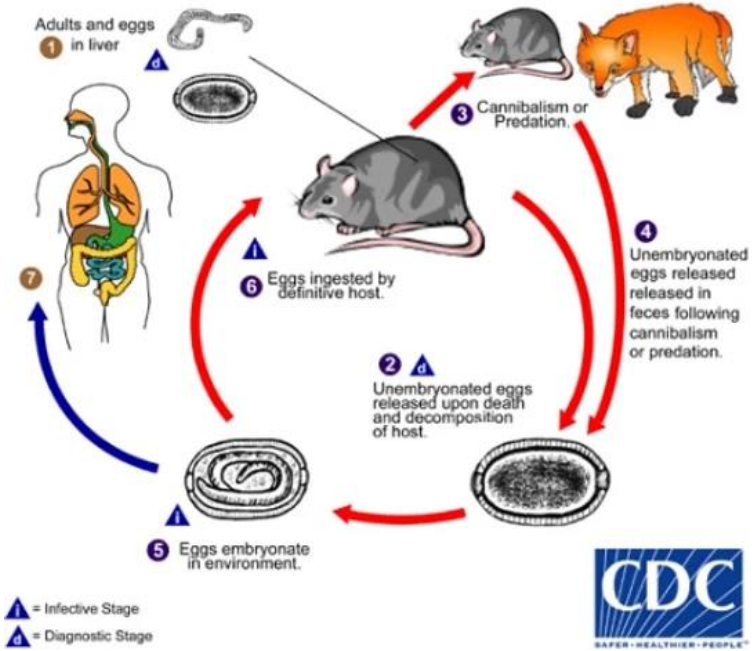
Etiology

Leptospira spp.

a spirochete, **zoonosis**

Mode of transmission

Direct contact with infected urine, soil, water, food, or other fomites contaminated with infected urine

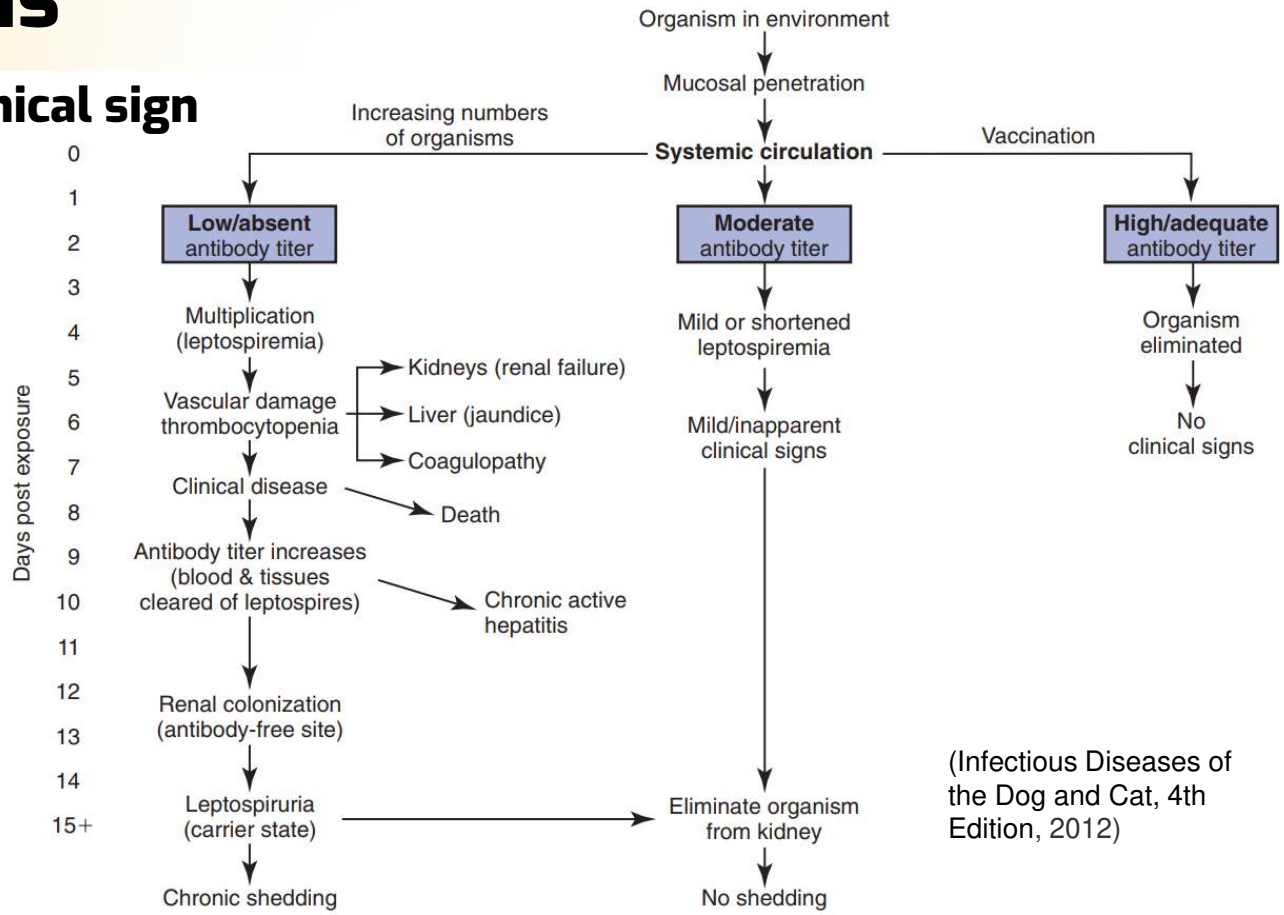


Leptospirosis

Pathogenesis and clinical sign

Icterus of mucous membranes

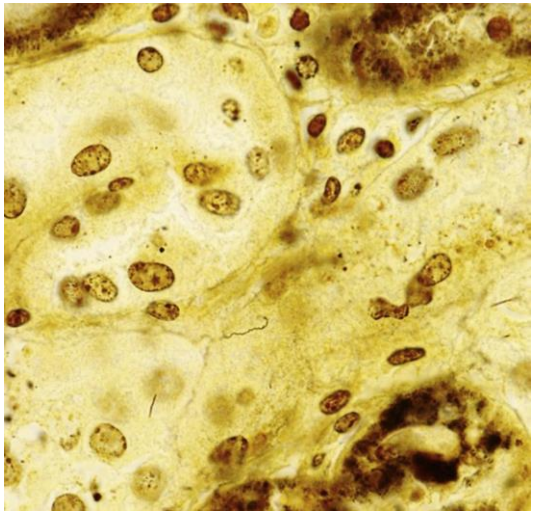
kidney with a band of medullary Hyperechogenicity corresponds to renal edema, necrosis, and hemorrhage



(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Leptospirosis

Diagnosis



Warthin-Starry stain,
Histopathology of kidney of a dog infected with leptospirosis

Assay	Specimen Type	Target
Darkfield microscopy	Urine	*Leptospira* organisms
Culture	Whole blood, urine	Leptospires
Serology (MAT)	Serum	Antibodies against various leptospiral serovars
Histopathology	Kidney tissue collected via biopsy or necropsy	Leptospires
PCR	Blood, urine, tissue specimens	*Leptospira* DNA

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Leptospirosis

Treatment

Antimicrobial drug

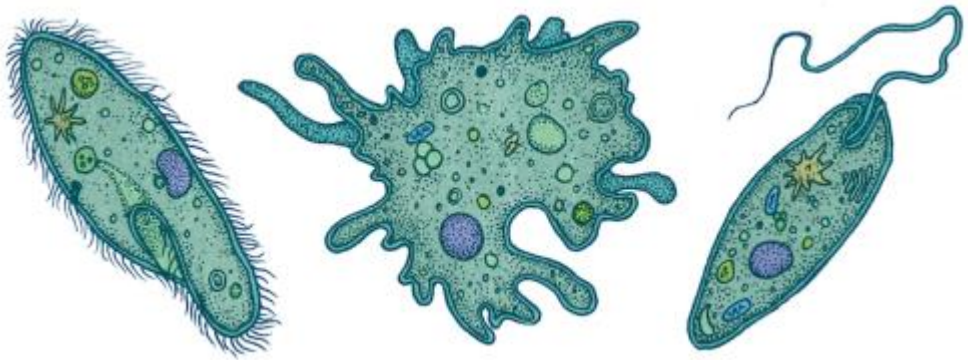
Drug	Dose	Route	Interval (hours)	Duration (days)
Doxycycline	5 mg/kg	PO, IV	12	14
Ampicillin	20 mg/kg*	IV	6	Variable
Penicillin	25,000-40,000 U/kg	IV	12	Variable

*Reduce dose in renal failure.

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

02

Protozoa



Giardiasis

Etiology

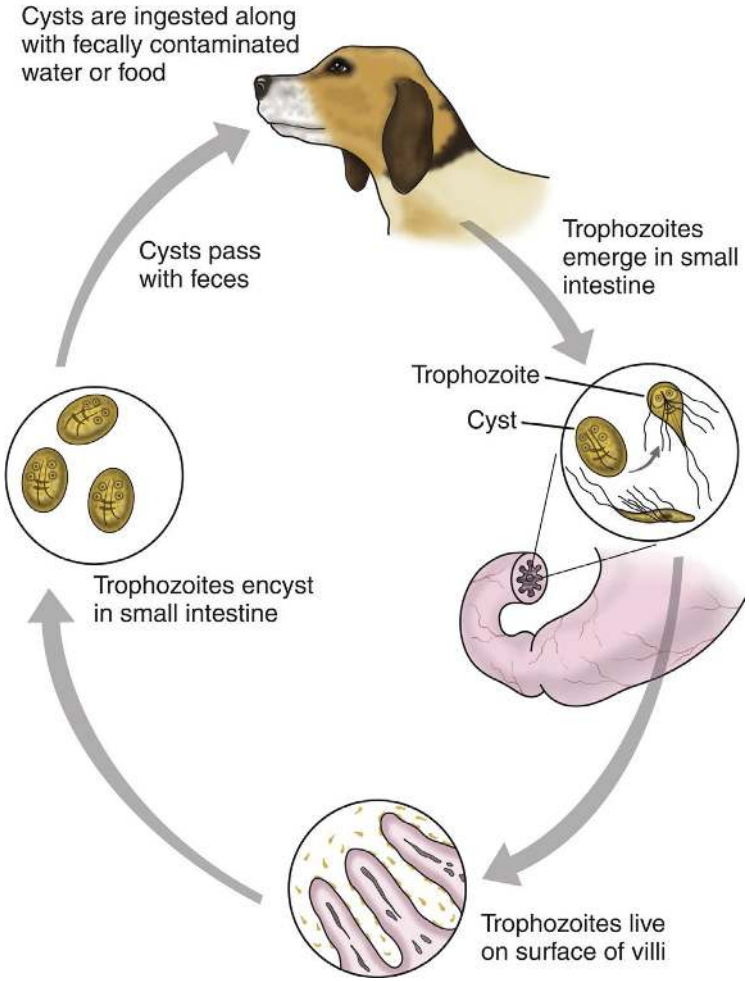
Giardia duodenalis

- Cyst form
  - Contain 2 trophozoite
  - Resistant in environment
- Trophozoite form
  - Active motile form ‘falling leave’
  - Tear-drop shape ‘smiling-face’

Mode of transmission

Fecal-oral (cyst ingestion)

Host can shed for months



(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

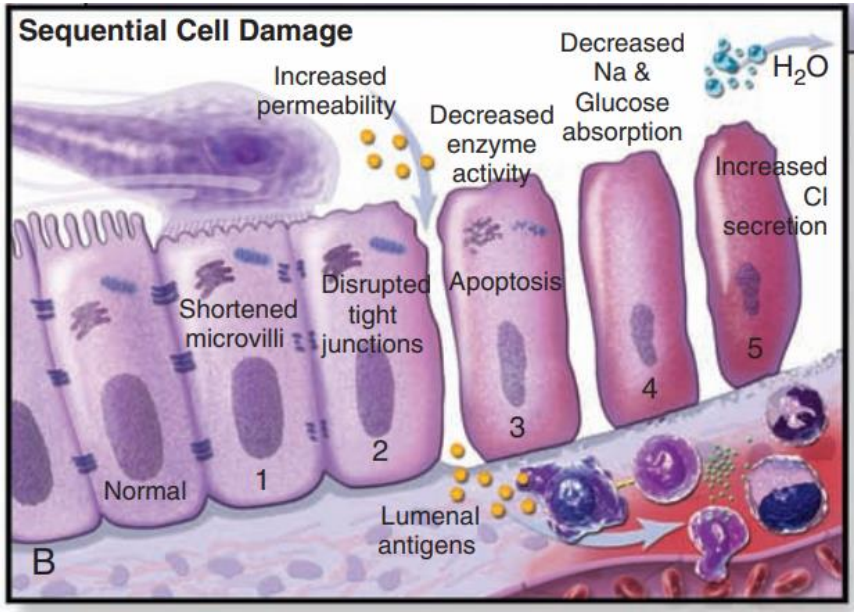
Giardiasis

Pathogenesis

- Damage to microvilli on epithelium of small intestine → malabsorption, hypersecretion of electrolyte (Cl^-)
- Inhibition of some digestive enzymes
- Host elicits inflammatory response

Clinical sign

Usually asymptomatic in dogs and cats
Young and immunosuppressive animal: chronic watery diarrhea, weight loss, steatorrhea (severe case)



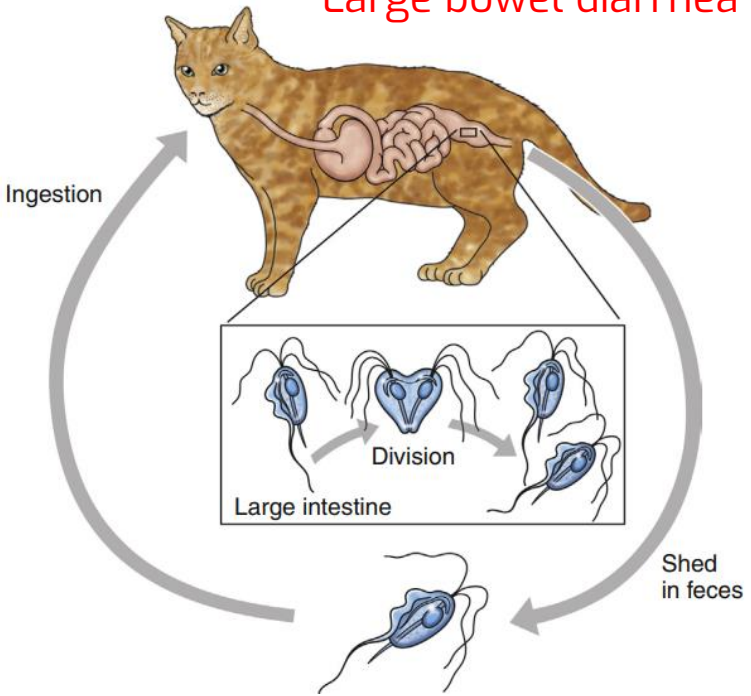
(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Tritrichomonas

Etiology
Tritrichomonas foetus
Cat > dog
Mode of transmission
Fecal-oral (cyst ingestion)

Pathogenesis
Adherence to host epithelium, and elaboration of cytotoxins and enzymes chronic colonization of the terminal ileum, cecum, and colon

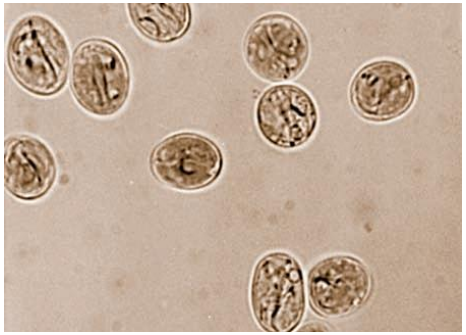
Clinical sign
Large bowel diarrhea



(Canine and feline infectious diseases, 2014)

Enteric protozoa

Diagnosis



Cyst form of Giardia by zinc-sulfate centrifugation technique (ZSCT) (Canine and feline infectious diseases, 2014)

Organism	Assay	Specimen type	Performance
Giardia and *Tritrichomonas foetus*	Fecal smear: trophozoite	feces	False negative: intermittent cyst shedding, fecal floatation solution destroy the cyst False positive: pseudoparasite, yeast
Giardia	Zinc-sulfate centrifugation technique (ZSCT): cyst	feces	Take at least 3 samples in a week False positives: cysts are confused with yeasts.
	Immunochemical detection: cyst	Feces	Gold standard More sensitivity and specificity than ZSCT
	ELISA: antigen detection	Feces	False positive when clinical sign resolved
Giardia and Tritrichomonas foetus	PCR: antigen	Feces	False positive: not specific primer, PCR inhibitors

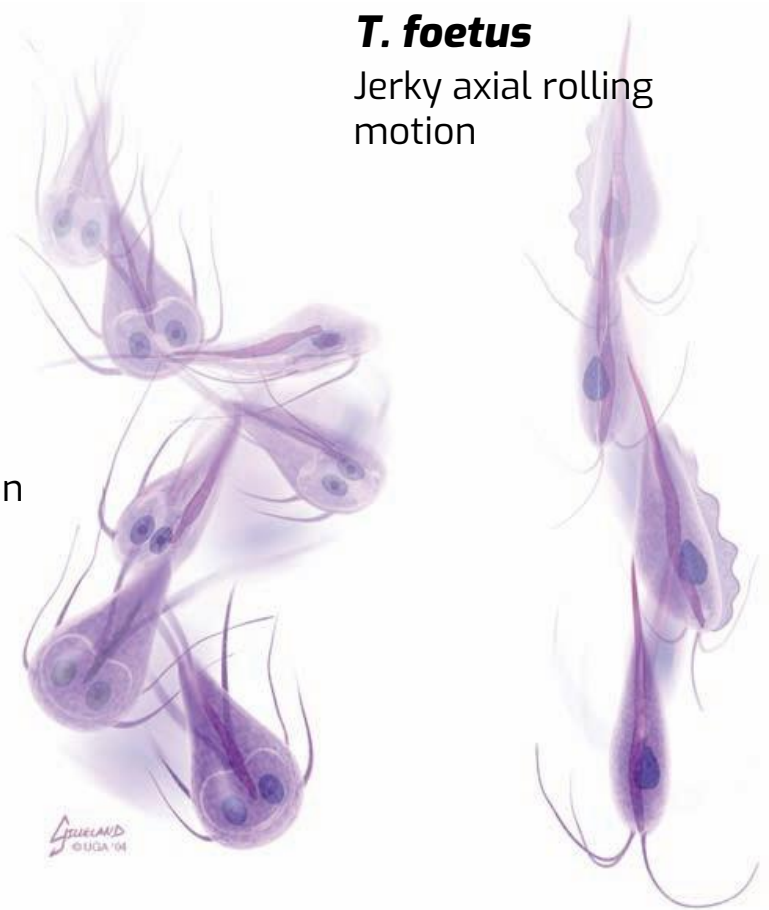
Enteric protozoa

Diagnosis

Fecal smear:
Trophozoite detection

Giardia spp.
Falling leaf motion

T. foetus
Jerky axial rolling motion



(Canine and feline infectious diseases, 2014)

Giardiasis and Tritrichomonas

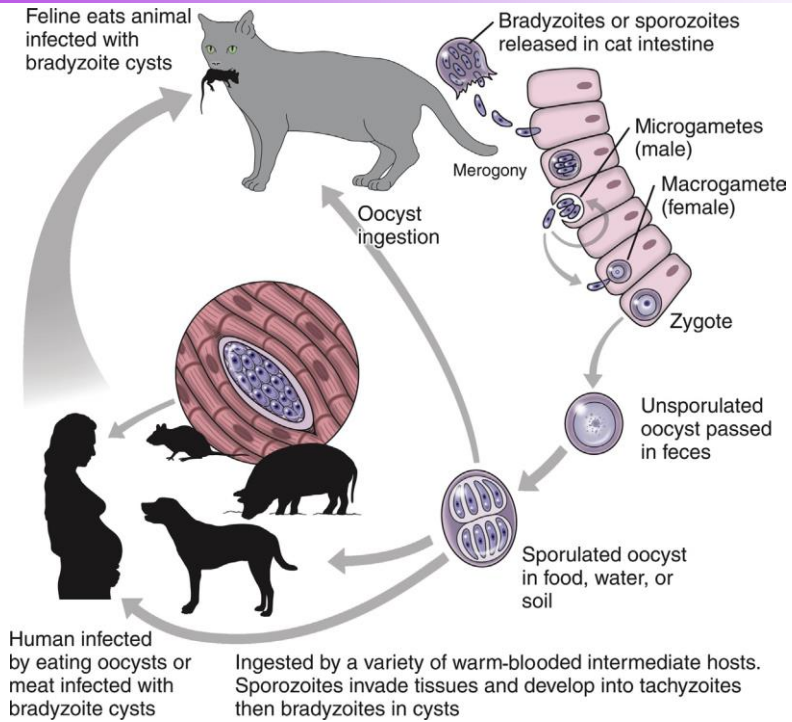
Treatment

Drug Therapy for Giardiasis, Amoebiasis, Balantidiasis, Blastocystosis, and Trichomoniasis

Drug[a]	Species	Dose[b]	Route	Interval (hours)	Duration (days)
Drontal Plus[c] tablets	D	25 mg/kg feb 5 mg/kg praz 5 mg/kg pyr base	PO	24	3
	C	56.5 mg/kg feb 11.3 mg/kg praz 11.3 mg/kg pyr	PO	24	5
Drontal Plus Flavour[d]	D	15 mg/kg feb 5 mg/kg praz 5 mg/kg pyr base	PO	24	3
Fenbendazole	B	50 mg/kg	PO	24	5
Metronidazole[e]	B	25 mg/kg	PO	12	5–7
Ipronidazole	D	126 mg/L[f]	PO	Ad libitum	7
Tinidazole	D	44 mg/kg	PO	24	6
	C	30 mg/kg	PO	24	7–10
Nitazoxanide	B	100 mg/animal	PO	12	3–4
Quinacrine	D	9 mg/kg	PO	24	6
	D	6.6 mg/kg	PO	12	5
Furazolidone[g]	C	4 mg/kg	PO	12	7–10

(Canine and feline infectious diseases, 2014)

Toxoplamosis



(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Etiology

Toxoplasma gondii

Coccidial protozoan parasite

Mode of transmission

Eat infected animal

Cats are the definitive host

Clinical sign

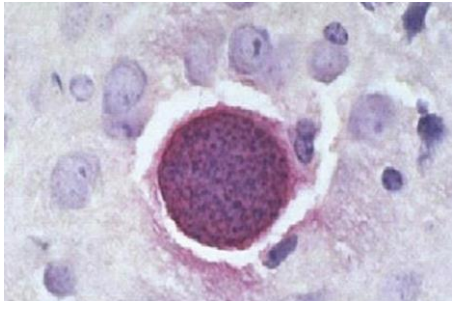
Dogs and cats: fever, ocular inflammation, ataxia, seizures, muscle pain, and respiratory distress

Humans: significant risk to the fetus after transplacental infection and to any immunocompromised person

Toxoplamosis

Diagnosis ;

Sporulated oocysts of *T. gondii*.



bradyzoites in the brain tissues

Assay	Specimen Type	Assay Target	Comments
Fecal flotation	Feces	*T. gondii* oocysts	The negative predictive value of this assay is poor for clinical toxoplasmosis, since most cats cease shedding by the time illness occurs.
Fecal PCR assay	Feces	*T. gondii* DNA	As for fecal flotation.
Cytologic examination	Effusions, skin lesions, tissue aspirates	*T. gondii* tachyzoites and occasionally bradyzoites	Confirms current infection and is generally associated with disease. Organisms cannot be readily distinguished from *Neospora caninum*.
Histopathology	Multiple tissues	*T. gondii* tachyzoites and bradyzoites	If the organisms are detected in the presence of inflammation and necrosis, clinical toxoplasmosis is likely. Can be difficult to differentiate *T. gondii* from tissue protozoans such as *N. caninum* in dogs. Immunohistochemistry can be used to differentiate the two species.
PCR assay	Effusions, blood, multiple tissues	*T. gondii* DNA	*T. gondii* DNA can be amplified from the blood of normal dogs and cats and so PCR on blood has a low positive predictive value. Amplification of specific DNA confirms infection, and if appropriate clinical signs and inflammation are present, positive results document clinical toxoplasmosis.
Serology for *T. gondii* IgM	Serum	*T. gondii* IgM antibodies	Most consistent with recent infection but can be induced during reinfection and by other immune drugs such as glucocorticoids. Positive results do not correlate with active disease.*
T. gondii IgG	Serum	*T. gondii* IgG antibodies	Most consistent with infection of > 10 days duration. Positive results do not correlate with active disease.*
Agglutination assays	Serum	*T. gondii* antibodies	Hypothetically detects all antibody classes but can be falsely negative in animals that only possess anti-*Toxoplasma* IgM antibody. Positive results do not correlate with active disease.*

*Results of serum antibody assays are combined with clinical findings to aid in making a diagnosis of clinical toxoplasmosis.

(Canine and feline infectious diseases, 2014)

Toxoplamosis

Treatment ;

Antimicrobial Drugs That May Be Used to Treat Clinical Toxoplasmosis in Dogs and Cats				
Drug	**Dose**	**Route**	**Interval**	**Duration**
Azithromycin	10 mg/kg	PO	q24h	4 weeks
Clindamycin	10-12 mg/kg	PO	q12h	4 weeks
Ponazuril	20 mg/kg	PO	q24h	4 weeks
Trimethoprim-sulfa	15 mg/kg	PO	q12h	4 weeks

If a positive response to treatment is achieved by week 4 but the animal is still improving slowly, continue treatment for 1 week past clinical resolution or when maximal response is recognized.

(Canine and Feline Infectious Diseases, 2014)

03

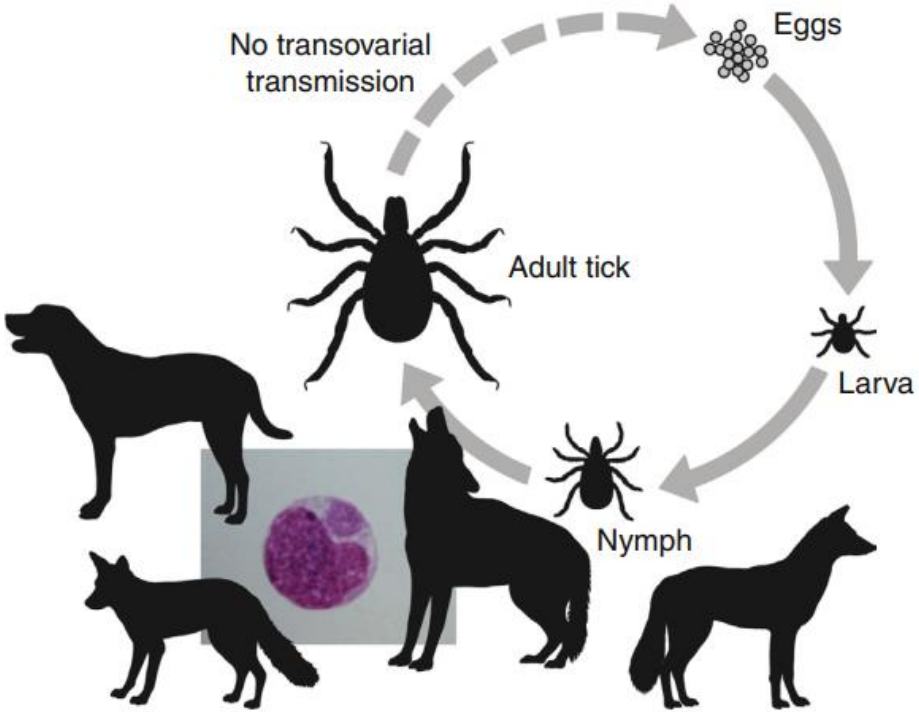
Blood parasite (Tick-borne disease)

Ehrlichiosis

Etiology
Ehrlichia canis
intracellular bacteria
caused canine monocytic ehrlichiosis

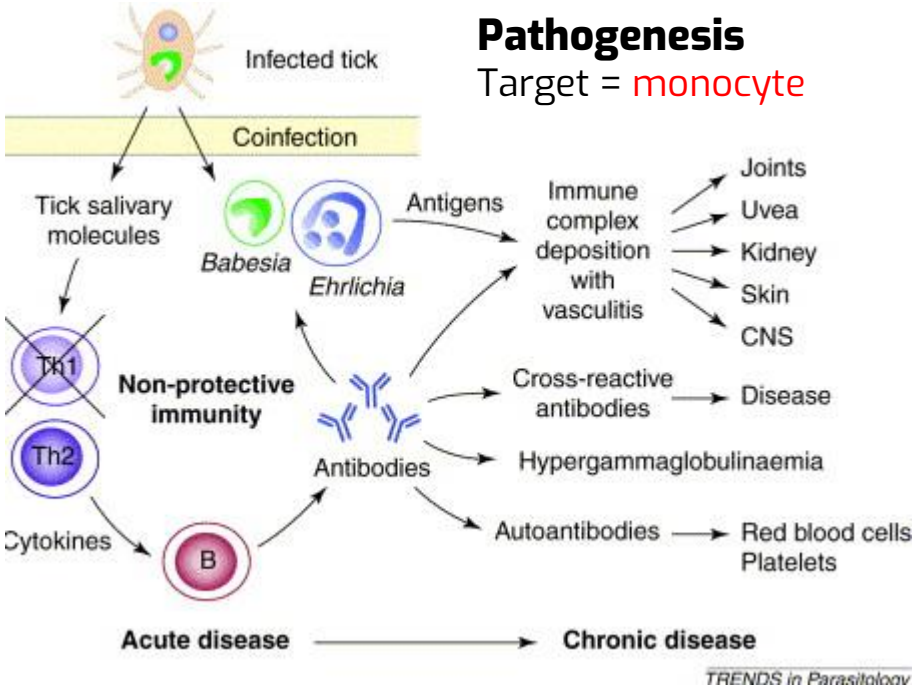
Mode of transmission
Vector: brown dog tick
(*R. sanguineus*)

Life cycle



(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Ehrlichiosis

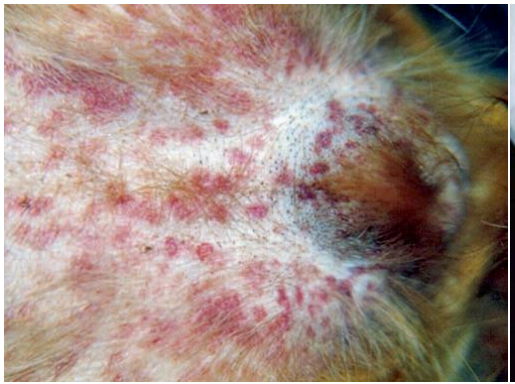


Pathogenesis

Target = monocyte

Clinical sign

fever, lethargy, inappetence, weight loss, mucosal hemorrhages, uveitis, pallor, edema, and sometimes neurologic signs.



Petechial hemorrhage

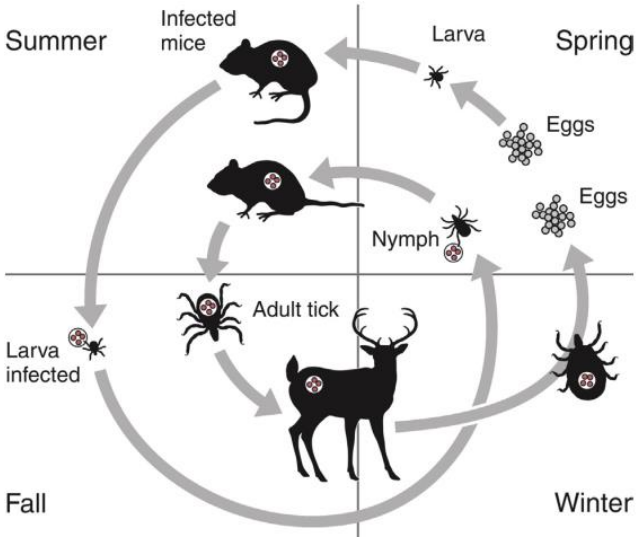
Epistaxis

(Canine and feline infectious diseases, 2014)

Anaplasmosis

Etiology

Anaplasma platys



(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Mode of transmission

Vector: tick (Rhipicephalus sanguineus, Dermacentor auratus)

Pathogenesis

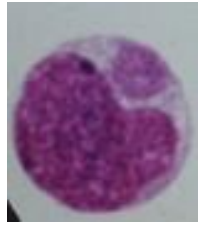
Target = platelets

Infect in platelet caused direct injury to by replicating organisms or immune-mediated mechanisms of platelet removal

Clinical sign

Mild fever, uveitis, petechiae and ecchymoses, often asymptomatic

Ehrlichiosis and Anaplasmosis
Diagnosis



(Dyachenko, 2012)

Assay	Specimen type	Performance
Blood profile (complete blood count; cbc)	Whole blood	A. platys = thrombocytopenia E. canis = pancytopenia (leukopenia, nonregenerative anemia, Mild thrombocytopenia
Inclusion body detection	Whole blood. Buffy coat smear, body fluid	A. platys = inclusion body in platelet E. canis = morula in mononuclear phagocyte Low sensitivity Required experience technician
Serology: antibody (ELISA, IFA)	Serum	Rapid, inexpensive false negative in acute disease (<2 weeks infection), and false positive in previous exposure.
PCR: antigen	Whole blood. Buffy coat smear, tissue	Confirm active infection

Ehrlichiosis and Anaplasmosis

Treatment

Antimicrobial Therapy for Canine Monocytotropic Ehrlichiosis

Drug[a]	Dose[b] (mg/kg)	Route Preferred (Alternative)	Interval (hours)	Duration (days)
Doxycycline	10 5	PO (IV) PO, IV	24 12	21–28[c] 21–28
Minocycline	10	PO	12	21–28
Tetracycline	22	PO	8	21–28
Oxytetracycline	7.5–10	IV	8	21–28
Chloramphenicol	25–50	PO (IV, SC)	8	21–28

Antimicrobial Therapy for Feline Monocytotropic Ehrlichiosis and Granulocytotropic Anaplasmosis

Drug[a]	Dose[b] (mg/kg)	Route Preferred (Alternative)	Interval[c] (hours)	Duration (days)
Tetracycline	22	PO	8	21
Doxycycline	10	PO[d]	24	28
Doxycycline	5	PO (IV)[d]	12	21–28
Chloramphenicol	25–50	PO (IV, SC)	8	≤14[e]
Imidocarb dipropionate[f]	5	IM	Once	Repeat day 14

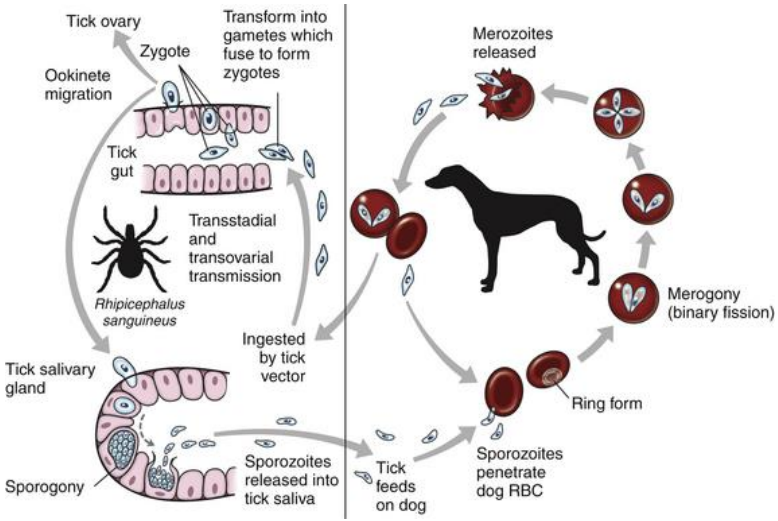
(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Babesiosis

Etiology

Babesia canis

Babesia gibsoni



(https://veteriankey.com/babesiosis/)

Mode of transmission

Vector: tick (R. sanguineus, D. reticulatus)

Transmitted by

- Fighting or biting interactions
- Blood transfusion

Pathogenesis

Target = RBCs surface → induce host-opsonizing antibodies →removal of infected RBCs by the mononuclear phagocytic system

Clinical sign

Anorexia, Lethargy, Weakness, Pyrexia, Weight loss, Hemolytic anemia, Icterus

Splenomegaly, Lymphadenopathy

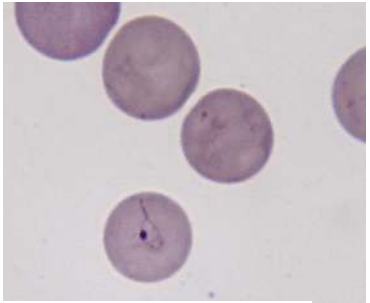
Vomiting

(Canine and feline infectious diseases, 2014)

Babesiosis

Blood profile: anemia and thrombocytopenia

Diagnosis



Babesia gibsoni

Babesia canis

Diagnostic Assays Available for Babesiosis in Dogs and Cats

Assay	Specimen Type	Target	Performance
Cell culture	Whole blood	*Babesia* spp.	Not widely offered or utilized for routine diagnostic purposes. Requires several weeks' incubation.
Cytology	Whole blood, buffy-coat smears (the area just below the buffy coat), tissue aspirates	*Babesia* spp.	Rapid and specific (i.e., when merozoites are identified by experienced cytologists, the sample is likely to be infected with *Babesia* spp.; however, *Babesia* spp. cannot be accurately differentiated based on morphology alone). Less sensitive than PCR.
Immunofluorescent antibody serology	Serum	Antibodies to *Babesia* spp.	Acute and convalescent serology may be required for diagnosis of acute infection, because initial results may be negative in dogs with acute disease and positive results may reflect previous exposure rather than active infection. Cross-reactivity can occur between *Babesia* spp. Some dogs do not develop detectable antibody titers despite chronic infection.
PCR	Whole blood, splenic aspirates	*Babesia spp.* DNA	Confirms active infection. Sensitivity and specificity varies depending on assay design and specimen type. Both false-positive and false-negative results are possible; PCR results must be interpreted in light of the clinical signs. Serial sampling (i.e., two or more tests on specimens obtained 2-4 weeks apart) will increase sensitivity, especially in chronically infected animals.

(Canine and feline infectious diseases, 2014)

Babesiosis

Treatment

Selected Antibabesial Compounds Used in the Treatment of Dogs and Cats

Generic (Brand)[a]	Dose (mg/kg)[b]	Route	Interval (hours)	Duration (days)	Organism		
					Babesia canis	*Babesia gibsoni*	*Babesia felis*
Imidocarb dipropionate[c] (Imizol)	5–6.6 7.5	IM IM	Once Once	Repeat in 14 NA	+++	+	—
Diminazene aceturate (Berenil, Ganaseg)[c]	3.5–5	IM	Once[d]	NA	+++	++	+
Phenamidine isethionate (Lomadine, Phenamidine)[e]	15–20	SC	24	2	+++	++	—
Pentamidine isethionate (Pentam, Pentacarinat)	16.5	IM	24	2	++	++	?
Azithromycin (Zithromax)[f]	10	PO	24	10	+++	+++	?
and							
Atovaquone (Mepron)[f]	13.3	PO	8	10	+++	+++	?
Clindamycin (Antirobe)[g]	25	PO	12	90	?	+	?
and							
Doxycycline (Vibramycin)[h]	5	PO	12	90	+	?	?
and							
Metronidazole (Flagyl)	15	PO	12	90	?	?	?
Quinuronium sulfate (Acaprin)	0.25	SC	48	2	++	?	?
Trypan blue	10	IV	Once	NA	++	—	—
Primaquine phosphate (Primaquine)	0.5 1 mg/cat	PO IM	24 36	1–3 [i]	? —	— —	+++ +++

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)

Hepatozoonosis

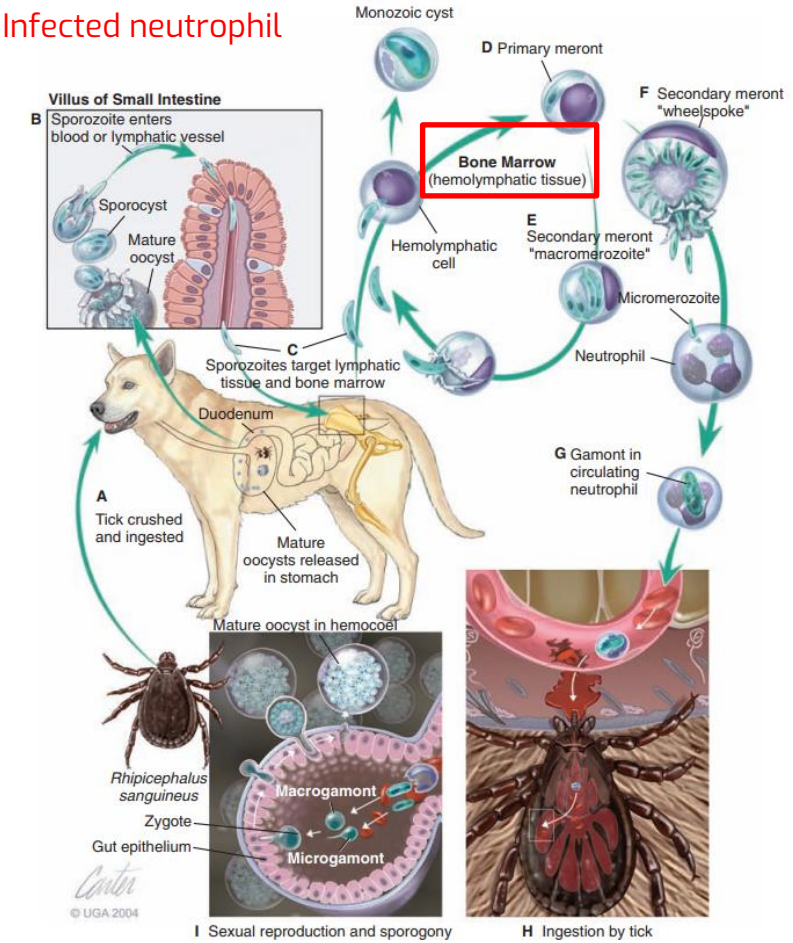
Etiology
Hepatozoon canis
Hepatozoon americanum

Mode of transmission
Tick ingestion through grooming
(R. sanguineus; A. maculatum)

Clinical sign
H. canis: mild to severe;
fever, lethargy, weight loss, hepatitis, splenitis, nephritis, and pneumonia
H. Americanum: severe;
gait abnormalities, fever, muscle hyperesthesia

Life cycle and pathogenesis

Infected neutrophil



Hepatozoonosis

Diagnosis

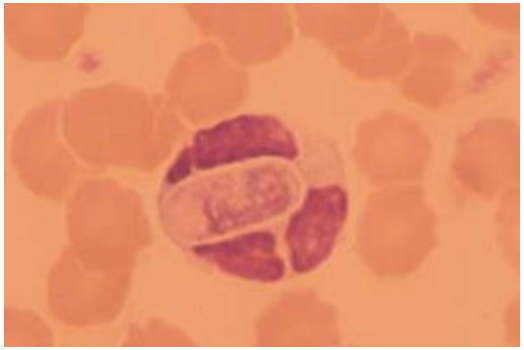
- Blood profile: anemia, neutrophilia
- Blood smear: gamont locate in cytoplasm of a neutrophil
- ELISA (gamont antigen)
- PCR

Treatment

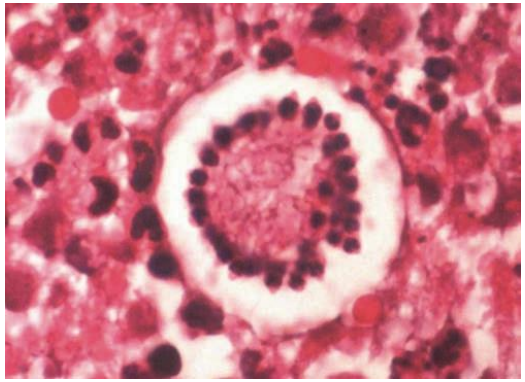
Therapy for *Hepatozoon canis* Infection in Dogs

Drug[a]	Dose[b] (mg/kg)	Route	Interval (frequency)	Duration (days)
Imidocarb dipropionate	5–6	SC or IM	14 days	prn[c]

(Infectious Diseases of the Dog and Cat, 4th Edition, 2012)



Blood smear
H. canis gamont locate in cytoplasm of a neutrophil compressing the lobulated nucleus to the margins of the cell



Histopathology
micromerozoites forming a “ wheel-spoke ” shape in splenic tissue

Conclusion

Bacteria

Disease	Etiology	Transmission	Clinical sign	Diagnosis	Drug of choice
Respiratory system					
Bordetellosis	*Bordettella bronchiceptica*	Aerosol or close contact with infected secretion *(zoonosis)*	Kennel cough, pneumonia, dyspnea, cyanosis and death	• Bacterial culture • PCR: antigen • Serology: antibody	• Antibiotic: doxycycline
Chalmydial infection	*Chlamydophila felis (intracellular bacteria)*	Close contact with infected secretion	Upper respiratory signs (keratoconjunctivitis, sneezing)	• Bacterial culture • Cytology: intracellular bacteria • PCR • Serology: antibody detection	

Bacteria

Disease	Etiology	Transmission	Clinical sign	Diagnosis	Drug of choice
Gastrointestinal system					
Campylobacteri-osis	*Campylobacter jejuni*	Fecal-oral	• Watery to mucoid diarrhea • Guillain-Barré syndrome (human)	• Bacterial culture • PCR	• Macrolide • Fluoroquinolone
Enteric Clostridial infection	Clostridium perfringens, C. difficile	Fecal-oral	Hemorrhagic diarrhea	• Fecal smear: endospore • Bacterial culture • Toxin assay • PCR	• Metronidazole
Salmonellosis	Salmonella spp.	Fecal-oral	Hemorrhagic diarrhea	• Bacterial culture • PCR	• Fluoroquinolone, • Chloramphenicol, • Trimethoprim-sulfonamide • Amoxicillin

Bacteria

Disease	Etiology	Transmission	Clinical sign	Diagnosis	Drug of choice
Nervous system					

Botulism	*Clostridium botulism*	Ingestion of toxin	Flaccid paralysis (Decreased reflexes, tetraparesis, megaesophagus)	• Clinical sign
				• EMG: subnormal
				• ELISA
				  • Toxin assay
				  • Anitibody titer
					• Antibiotic: penicillin and metronidazole
					• Antitoxin
					• Supportive care

Tetanus	*Clostridium tetani*	Cutaneous inoculation of spores	Spastic paralysis (e.g. sawhorse, stance, miosis)	• Clinical sign
				• ELISA
				  • Toxin assay
				  • Antibody titer	

Bacteria

Disease	Etiology	Transmission	Clinical sign	Diagnosis	Drug of choice
Dermatological system					
Staphylococcosis	*Staphylococcus pseudointermedius*	Invade mucosal through grooming and licking	Superficial and deep pyoderma, otitis externa	Blood profile: neutrophilia with left shift, toxic neutrophils, lymphopenia, and monocytosis Bacterial culture Cytology: cocci, grapelike clusters PCR: antigen	• Amoxicilin-clavulonic acid • Cephalexin • Fluoroquinolones

Bacteria

Disease	Etiology	Transmission	Clinical sign	Diagnosis	Drug of choice
Miscellaneous					
Cat scratch disease	*Bartonella hensale (zoonosis)*	Vector: cat flea (Ctenocephalides felis)	asymptomatic In cat, Occasionally, skin papule, enlarge lymph node Endocarditis and Neurologic signs	• Bacterial culture • Immunohisto-chemistry • Serology • PCR	-
Leptospirosis	*Leptospira spp.*	Direct contact with infected specimen or contaminated fomite of infected urine	Jaundice, coagulopathy, hepatitis	• Dark field microscopy • Bacterial culture • Serology: MAT • PCR	• Penicillin • Doxycycline

Protozoa

Disease	Etiology	Transmission	Diagnosis	Drug of choice
Giardiasis	*Giardia duodenalis*	Fecal-oral (ingest cyst or trophozoite)	• Fecal smear: trophozoite, smiling face, falling-leaf motion • ZnSO4 concentration technique • ELISA • PCR	• Metronidazole • Fenbendazole
Trichomoniasis	*Tritrichomonas foetus*	Fecal-oral (ingest cyst or trophozoite)	• Fecal smear: Jerky axial rolling motion • PCR	• Metronidazole • Ronidazole
Toxoplasmosis	*Toxoplasma gondii* (zoonosis)	Eat infected animal	• Fecal flotation • Cytology • Serology: IgM, IgG • PCR	• Azithromycin • Clindamycin • Ponazuril • Sulfa-trimethoprim

Blood parasite

Disease	Etiology	Transmission	Target cell	Diagnosis	Drug of choice
Canine monocytic Ehrlichiosis (CME)	*E. canis*	Tick bite (R. sanguineus)	Monocyte	• Pancytopenia • Blood smear: morula • Serology (ELISA, IFA) • PCR	Doxycycline
Anaplasmosis	*A. platys*	Tick bite (R. sanguineus)	Platelet	• Thrombocytopenia • Blood smear: inclusion body in platelet • Serology (ELISA, IFA) • PCR	
Babesiosis	*B. canis*, *B. gibsoni*	Tick bite (R. Sanguineus, D. reticulatus)	RBCs	• Anemia, Thrombocytopenia • Blood smear: • Serology (ELISA, IFA) • PCR	Imidocarb dipropionate
Hepatozoonosis	*H. canis* *H. americanum*	Tick infestation (R. sanguineus, A. maculatum)	Neutrophil	• Anemia, Thrombocytopenia • Blood smear: • Serology (ELISA, IFA) • PCR	

References

- Infectious Diseases of the Dog and Cat, 4th Edition, 2012
- Canine and Feline Infectious Diseases, 2014
- Dyachenko, V., Pantchev, N., Balzer, HJ. *et al.* First case of *Anaplasma platys* infection in a dog from Croatia. *Parasites Vectors* **5,** 49 (2012). https://doi.org/10.1186/1756-3305-5-49