

## Canine Gross Pathology

Chad Frank, DVM, MS, DACVP  
 CSU Veterinary Diagnostic Laboratory  
 Office #: 970-297-5129  
 Email: [chad.frank@colostate.edu](mailto:chad.frank@colostate.edu)

#	Tissue	Morphologic diagnosis	Condition/cause	Additional information
1-2	Introduction			
3	Alimentary System			
4	Teeth	Multifocal enamel hypoplasia	In utero canine morbillivirus infection	Degeneration and necrosis of ameloblastic epithelium
5	Oral cavity	Diffuse fibrous gingival hyperplasia	Gingival hyperplasia	Familial in boxers; cyclosporine can also induce this.
6	Mandible	Malignant melanoma		Oral malignancies in dogs: melanoma > SCC > fibrosarcoma; IHC- Melan A, Tyrosinase-related proteins 1 and 2, PNL2
7	Tongue/oral cavity	Locally extensive ranula	Ranula	Stagnation of flow or obstruction of salivary gland duct by various causes
8	Tongue	Multifocal ulcerative glossitis	Condition: Uremic glossitis	
9	Esophagus	Diffuse megaesophagus	Megaesophagus	Congenital or acquired (myasthenia gravis, hypoadrenocorticism, hypothyroidism, polymyositis, lead and thallium poisoning, canine distemper)
10	Esophagus	Focal esophageal granuloma with intralesional nematode	Cause: Spirocerca lupi	Associated lesions- caudal thoracic vertebral body spondylitis and aortic aneurysm; can undergo malignant transformation
11	Esophagus	Focal esophageal granuloma with	Cause: Spirocerca lupi	

		intralesional nematode		
12	Stomach	Lamellar gastric mucosal mineralization with multifocal erosions	Condition: Uremic gastritis	
13	Abdominal cavity/stomach	Gastric dilation and volvulus with regionally extensive infarction and splenomegaly	Gastric dilation-volvulus	
14	Stomach/duodenum	Multifocal gastric or gastroduodenal ulcers with focal perforation	Perforating gastric ulceration	Predisposing causes: NSAID, mast cell tumor or mastocytosis, gastrinoma
15	Stomach	Focal gastric leiomyoma	Gastric leiomyoma	
16	Intestine	Segmental necrotizing or hemorrhagic enteritis	Canine parvovirus-2	Some cases only see "ground glass" appearance to the serosa. Thymic atrophy, Peyer's patch depletion, bone marrow hypoplasia.
17	Intestine	Lymphangectasia with multifocal serosal lipogranulomatous lymphangitis	Condition: Lymphangectasia	Yorkshire terrier and Norwegian Lundhund, but can see in any breed due to lymphatic obstruction
18	Intestine	Diffuse intestinal lipofuscinosis	Lipofuscinosis	Associated with chronic enteritis, pancreatic disease, feeding high levels of polyunsaturated fats with deficient levels of vitamin E.
19	Intestine	Locally extensive intestinal intussusception with probable segmental venous infarction	Intussusception	Can be idiopathic or associated with linear foreign body, parasitism, intestinal sx, enteritis, intramural lesions;
20	Cecum	Mild hemorrhagic typhlitis with intralesional nematodes	Trichuris vulpis	

21	Intestine	Segmental intestinal lymphoma	Intestinal lymphoma	T-cell>>B-cell for intestinal lymphoma; can be nodular or diffuse; look for lymph node or hepatic mets
22	Respiratory System			
23	Nasal cavity	Nasal adenocarcinoma	Ddx- granulomatous rhinitis, other neoplasia	Most common primary nasal tumor of dogs
24	Larynx	Unilateral dorsal cricoarytenoideus atrophy	Condition: Laryngeal paralysis	Injury to recurrent laryngeal nerve; more commonly bilateral; major complication is aspiration pneumonia
25	Trachea/larynx	Diffuse tracheal hypoplasia and everted laryngeal sacculles	Condition: Brachycephalic syndrome	Additional features of the syndrome: elongated soft palate and stenotic nares
26	Trachea	Diffuse tracheal collapse	Condition: Tracheal collapse	
27	Trachea/bronchi	Multifocal tracheal/bronchial eosinophilic granulomas	Cause: Oslerus osleri	
28	Lungs	Necrohemorrhagic bronchointerstitial pneumonia	Cause: Canine morbillivirus	Ddx- canine influenza virus, adenovirus-2, herpesvirus
29	Lungs	Multifocal to coalescing granulomatous pneumonia	Cause: Blastomyces dermatitidis	Ddx- coccidioides immitus, Histoplasma capsulatum, Cryptococcus spp., metastatic neoplasia
30	Lungs	Diffuse pulmonary interstitial metastatic mineralization	Condition: Uremic pneumonitis	Rule out vitamin D toxicity or other causes of hypercalcemia
31	Thorax	Pyothorax with sulfur granules and regionally extensive pulmonary atelectasis	Pyothorax	Ddx: Actinomyces, Nocardia, or Bacteroides; look for migrating grass awns, bite or other penetrating wounds
32	Thorax	Disseminated thoracic Mesothelioma	Mesothelioma	IHC: Dual expression of cytokeratin and vimentin (ovarian, prostatic, and renal

				cell carcinomas can also express both markers)
33	Lungs	Pulmonary adenocarcinoma	Pulmonary adenocarcinoma	
34	Lungs	Metastatic thyroid carcinoma		
35	Cardiovascular System			
36	Heart	Subvalvular left ventricular endomyocardial fibrosis with left ventricular concentric hypertrophy and post-stenotic aortic dilation	Condition: Subaortic stenosis	Breeds: German Shepherds, German shorthaired pointer, Weimaraner, Golden retriever, Saint Bernard, Newfoundland, and English bulldogs
37	Heart	High (subaortic) ventricular septal defect	Condition: ventricular septal defect	
38	Heart	Biventricular dilation	Condition: Dilated cardiomyopathy	Breeds: Doberman Pinschers, Cocker Spaniels, Boxers, Great Danes, Irish Wolfhounds and Newfoundlands
39	Heart	Coronary atherosclerosis	Condition; Atherosclerosis	Associated with hypothyroidism, diabetes mellitus and idiopathic hyperlipoproteinemia (miniature schnauzers)
40	Heart	Pulmonary artery villous and eosinophilic endarteritis with intravascular nematodes	Etiologic diagnosis: Verminous endarteritis Cause: Dirofilaria immitis	Sequella: Right-sided heart failure secondary to pulmonary hypertension, anemia, membranoproliferative glomerulonephritis, pulmonary thromboembolism
41	Heart	Villous pulmonary endarteritis	Cause: Dirofilaria immitis	
42	Heart	Mitral vegetative valvular endocarditis	Condition: Valvular endocarditis	Streptococcus, Staphylococcus, E. coli, Pasteruella multocida, Bartonella vinsonii
43	Heart	Mitral valvular myxomatous	Mitral valvular endocardiosis	Left AV>>Right AV

		degeneration with left atrial dilation and focal endocardial fibrosis (jet lesion)		
44	Heart	Locally extensive left atrial ulcerative endocarditis with mineralization	Condition: Uremic ulcerative endocarditis	Sequella: Left atrial thrombus
45	Heart	Multifocal myocardial degeneration and necrosis	Etiologic dx: Neurogenic cardiomyopathy Condition: Brain-heart syndrome	
46	Heart	Chemodectoma	Chemodectoma	Ddx: Hemangiosarcoma, ectopic thyroid or parathyroid carcinoma, and lymphoma
47	Heart	Right atrial hemangiosarcoma	Hemangiosarcoma	Sequella- cardiac tamponade secondary to hemopericardium
48	Heart/lungs	Hemopericardium with multifocal pulmonary metastatic hemangiosarcoma	Hemangiosarcoma	
49	Pulmonary artery	Focally extensive pulmonary artery thrombus	Pulmonary artery thrombosis	Predisposing conditions: hyperadrenocorticism, iatrogenic Cushings, pancreatitis, IMHA, septic embolism
50	Urinary System			
51	Kidney	Bilateral renal dysplasia	Renal dysplasia	Histologic criteria- undifferentiated mesenchyme, groups of immature glomeruli, persistent metanephric ducts, tubules lined by atypical epithelial cells, and cartilaginous or osseous metaplasia
52	Kidney	Multifocal renal cysts with fibrosis and hydronephrosis	Condition-polycystic kidney disease	Autosomal dominant in Bull Terriers- mutation in PKD1; autosomal recessive = West highland white and cairn Terriers

				(mutation unknown); also see hepatic biliary cysts
53	Kidney	Multifocal cystic glomeruli with fibrosis and mild hydronephrosis	Glomerulocystic kidney disease	Uncommon form of polycystic kidney disease
54	Kidney and liver	Multifocal renal cortical hemorrhage and necrosis; multifocal necrotizing hepatitis	Cause: Canine herpesvirus-1	Young animals (<2 weeks of age)
55	Kidney	Acute suppurative and hemorrhagic pyelonephritis	Pyelonephritis	Common organisms include E. coli, Staph aureus, Steptococcus spp., Proteus and Pseudomonas
56	Kidney	Suppurative and hemorrhagic pyelonephritis with regionally extensive renal papillary necrosis		
57	Kidney	Renal amyloidosis	Renal amyloidosis	
58	Kidney	Locally extensive acute hemorrhagic renal infarction	Renal infarction	
59	Kidney	Multifocal acute glomerulonephritis	Condition: Acute glomerulonephritis	Often immune- mediated; many potential causes including infectious, neoplastic, autoimmune, or hereditary
60	Kidney	Multifocal acute glomerulonephritis	Condition: Acute glomerulonephritis	
61	Kidney	Renal cell carcinoma		IHC: Uromodulin, PAX8, Napsin A, and Neprilysin confirm renal origin; some have dual expression of vimentin and cytokeratin

62	Urinary bladder	Diffuse emphysematous cystitis	Condition: Emphysematous cystitis	Predisposing cause: Diabetes mellitus (fermentation of sugar by glucose-fermenting bacteria)
63	Urinary bladder	Multifocal follicular cystitis	Condition: Follicular cystitis	
64	Urinary bladder	Transitional cell carcinoma with severe hydronephrosis, renal atrophy, and interstitial fibrosis	Transitional cell carcinoma	
65	Urinary bladder	Urethral transitional cell carcinoma with extensive necrosis and intralesional stent	Transitional cell carcinoma	
66	Urinary bladder	Embryonal rhabdomyosarcoma		Young dogs (~1-2 yrs)
67	Reproductive System			
68	Uterus	Suppurative endometritis	Condition: Pyometra	Usually associated with endometrial hyperplasia; E. coli is the most common isolate
69	Uterus	Multifocal cystic endometrial hyperplasia	Condition: Cystic endometrial hyperplasia	Associated with prolonged progesterone stimulation of an estrogen primed uterus.
70	Prostate	Diffuse prostatic hyperplasia	Benign prostatic hyperplasia	Symmetrically enlarged prostate gland; testosterone dependent
71	Prostate	Prostatic carcinoma	Prostatic carcinoma	Ddx: Transitional cell carcinoma; IHC for Uroplakin III to differentiate (labels TCC, but not prostatic)
72	Penis	Multifocal transmissible venereal tumor	Transmissible venereal tumor	Neoplastic cells have 58 or 59 chromosomes vs normal 78
73	Testis	Diffuse necrotizing epididymitis with sperm granulomas	Cause: Brucella canis	Ddx: ascending E. coli or other gram negative bacteria

74	Testis	Interstitial cell tumor		
75	Testis	Sertoli cell tumor		Some develop hyperestrogenism-squamous metaplasia of prostate, bone marrow suppression, symmetrical alopecia, gynecomastia
76	Mammary glands	Diffuse mammary hyperplasia	Gynecomastia	33% of sertoli cell tumors result in gynecomastia; excess estrogen or inhibin secretion by sertoli cells
77	Testis	Multifocal Seminomas		Disproportionally seen in cryptochid testis
78	Scrotum/testis	Scrotal mesothelioma with testicular atrophy		Derived from mesothelial lining of vaginal tunics
79	Musculoskeletal System			
80	Femur	Diffuse metaphyseal sclerosis	Ddx: Canine distemper virus or lead toxicity	Persistence of mineralized cartilage trabeculae in primary spongiosa due to impaired osteoclastic resorption
81	Rib	Suppurative and hemorrhagic osteitis with regionally extensive infraction	Condition: Metaphyseal osteopathy (previously hypertrophic osteodystrophy)	Histo: persistence of cartilage lattice in primary spongiosa, suppurative inflammation, necrosis/loss of osteoblasts
82	Several bones	Multifocal to coalescing periosteal hyperostosis	Condition: Hypertrophic osteopathy	Associated with chronic inflammatory or neoplastic lesions in the thorax or less commonly the abdomen
83	Mandible/maxilla	Mandibular and maxillary hyperostosis	Condition: Craniomandibular osteopathy	Cause unknown; Autosomal recessive in West Highland white Terrier and Scottish Terriers
84	Femur	Chronic osteoarthritis with eburnation of subchondral bone,	Chronic hip dysplasia	

		osteophytes, and proliferative synovitis		
85	Humerus	Articular cartilage degeneration and necrosis with flap formation	Condition: Osteochondrosis dissecans	
86	Vertebrae	Suppurative discospondylitis with disk herniation and regionally extensive osteosclerosis	Discospondylitis	Usually secondary to bacteremia; Staphylococcus pseudointermedius most common isolate
87	Maxilla	Chronic osteopenia with replacement fibrosis	Condition: Fibrous osteodystrophy	Ddx- primary or secondary hyperparathyroidism
88	Thoracic body wall	Multifocal intercostal subpleural mineralization	Uremia	
89	Rib	Osteochondroma	Osteochondroma	Young dogs during active bone growth; histo- Cartilage cap overlying cancellous bone that is continuous with the marrow space of parent bone
90	Long bone	Osteosarcoma	Osteosarcoma	Appendicular skeleton 3-4 x more common than axial skeleton; common locations include distal radius, proximal humerus, distal tibia, and distal femur
91	Humerus	Osteosarcoma with pathologic fracture	Osteosarcoma	
92	Skull	Multilobular osteochondrosarcoma (multilobular tumor of bone) with cerebral compression	Multilobular osteochondrosarcoma	Usually flat bone of the skull (dorsal more common)
93	Nervous System			
94	Brain	Lissencephaly	Lissencephaly	Arrested migration of neuroblasts to cortical lamina; likely hereditary in Lhasa Apso dogs

95	Meatball		Strychnine	Mechanisms of toxicity: Competitively inhibits the inhibitory neurotransmitter glycine at postsynaptic membranes.
96	Brain	Bilateral internal hydrocephalus with cerebrocortical atrophy	Hydrocephalus	Congenital- stenosis of mesocephalic aqueduct Acquired- obstruction by either inflammatory lesions or neoplasia
97	Spine	Intervertebral disk degeneration and herniation with segmental acute extradural hemorrhage and myelomalacia	IVDD	
98	Brain	Focal cerebral hemorrhagic infarct	Hemorrhagic infarct	Focal lesions- tumor emboli, thromboemboli (valvular disease), atherosclerosis, arteriosclerosis, trauma; multifocal- hypertension and vasculitis
99	Brain	Focally extensive hemorrhagic infarction	Hemorrhagic infarct	
100	Brain	Cerebellar herniation		
101	Brain	Multifocal necrotizing meningoencephalitis	Condition: Necrotizing meningoencephalitis	Usually small breed dogs
102	Brain	Granulomatous optic neuritis/encephalitis	Condition: Granulomatous meningoencephalitis	
103	Brain	Bilaterally symmetrical malacia and cavitation of caudal colliculi	Cause: Thiamine deficiency	Periventricular gray matter most susceptible, especially caudal colliculi
104	Brain	Diffuse cerebrocortical congestion	Cause: Babesia canis	
105	Brain	Meningioma with cerebrocortical		Frontal lobe and olfactory bulbs most common sites

		atrophy		
106	Brain	Oligodendroglioma	Oligodendroglioma	Grossly well-demarcated and gelatinous; brachycephalic breeds predisposed; common sites include olfactory bulbs, frontal, temporal, and piriform lobes
107	Brain	Astrocytoma (low grade)	Astrocytoma	Low grade tumors usually indistinct unilateral swelling; brachycephalic breeds predisposed; temporal and piriform lobes common sites
108	Brain	High grade glioma		
109	Brain	Choroid plexus papilloma	Choroid plexus papilloma	Commonly cause obstructive hydrocephalus
110	Brain	Multifocal metastatic hemangiosarcoma	Metastatic hemangiosarcoma	
111	Brain	Regionally extensive meningeal lymphoma	Lymphoma	
112	Brachial plexus	Peripheral nerve sheath tumor		Brachial plexus>>lumbosacral plexus; Trigeminal-most common cranial nerve
113	Endocrine System			
114	Brain/pituitary gland	Pituitary cyst (Rathke's pouch cyst)	Condition: Juvenile panhypopituitarism (pituitary dwarfism)	
115	Whole body	Pituitary dwarfism	Pituitary dwarfism	German Shepherd dogs (also other breeds) defect in the LHX3 gene; retention of puppy coat, symmetrical alopecia, delayed permanent dentation, delayed closure of epiphyses, and infantile genitalia due to absence of pars distalis

116	Pituitary gland/adrenal gland	Pituitary macroadenoma with multifocal adrenocortical hyperplasia	Pituitary macroadenoma	Approximately 80% of spontaneous canine hyperadrenocorticism cases are pituitary dependent
117	Adrenal gland/vena cava	Pheochromocytoma with vena caval invasion	Pheochromocytoma	
118	Adrenal gland	Adrenal cortical adenoma	Adrenal cortical adenoma	
119	Adrenal gland	Diffuse adrenocortical atrophy	Condition: Hypoadrenocorticism	Normal cortex:medulla ratio is 2:1; usually see lymphoplasmacytic adrenalitis
120	Thyroid gland	Diffuse atrophic lymphocytic thyroiditis	Condition: Lymphocytic thyroiditis (hypothyroidism)	Associated lesions: Bilateral symmetrical alopecia, myxedema, atherosclerosis, corneal lipidosis
121	Thyroid gland	Unilateral thyroid carcinoma with contralateral thyroid atrophy	Thyroid carcinoma	Approximately 90% are malignant; unilateral involvement twice as common as bilateral
122	Parathyroid gland	Unilateral parathyroid adenoma with contralateral atrophy	Condition: Primary hyperparathyroidism	Sequella: Multiple bone fractures, fibrous osteodystrophy, metastatic mineralization of various tissues
123	Parathyroid glands	Diffuse parathyroid hyperplasia	Condition: Renal or nutritional secondary hyperparathyroidism	
124	Pancreas	Diffuse pancreatic atrophy	Canine Juvenile pancreatic atrophy	Familial predisposition in German Shepherds, Chows, English Setters, and Rough-coated Collies
125	Pancreas	Necrohemorrhagic pancreatitis with peripancreatic fat necrosis	Condition: Acute pancreatic necrosis	
126	Pancreas	Pancreatitis with peripancreatic fat necrosis and saponification		
127	Hematopoietic System			

128	Thymus	Diffuse thymic hemorrhage	Thymic hemorrhage	Seen in young dogs; can be idiopathic, but need to rule out anticoagulants
129	Spleen	Multifocal to coalescing siderotic plaques		
130	Spleen	Multifocal splenic infarcts	Splenic infarcts	
131	Spleen	Diffuse splenic lymphoma	Splenic lymphoma	
132	Spleen	Diffuse granulomatous splenitis	Cause: Mycobacterial infection secondary to immunosuppression	
133	Spleen	Focal splenic hematoma	Splenic hematoma	Ddx- hemangiosarcoma, hemangioma, nodular follicular hyperplasia
134	Tonsils	Bilateral tonsillar lymphoma		Bilateral enlargement of the tonsils consider lymphoma or reactive hyperplasia
135	Whole body	Icterus and diffuse splenomegaly	Condition: Immune-mediated hemolytic anemia	
136	Integument System			
137	Face	Periocular and perioral leukotrichia	Condition: Vitiligo	Caused by immune-mediated destruction of melanocytes
138	Face	Nasal, periocular, and perioral histiocytic lichenoid interface dermatitis with depigmentation	Condition: Uveodermatologic syndrome; Vogt-Koyanagi-Harada syndrome	Associated lesion: Granulomatous endophthalmitis with pigment dispersal; Akita, Siberian Husky, Samoyed, and Malamute
139	Face	Nasal planum, perioral and periocular interface dermatitis with depigmentation	Condition: Discoid lupus erythematosus or systemic lupus erythematosus	Collies, Shetland sheepdogs, German Shepherds, and Siberian huskies have breed predilections
140	Skin	Bilaterally symmetric regionally extensive epidermal hyperplasia and hyperpigmentation	Condition: Acanthosis nigricans	Primary form occurs predominantly in dachshunds (similar changes can be secondary to any

				chronic pruritic dermatitis)
141	Skin	Regionally extensive alopecia and hyperpigmentation	Condition: Hyperglucocorticoidism	
142	Skin	Regionally extensive dermal dystrophic mineralization and granulomatous dermatitis	Condition: Calcinosis cutis Cause: Hyperglucocorticoidism	
143	Skin	Multifocal to coalescing dermal mineralization with granulomatous dermatitis	Condition: Calcinosis circumscripta	
144	Skin	Bilaterally symmetric perineal alopecia with vulvar enlargement	Condition: Hyperestrogenism	Condition seen in intact females with polycystic ovaries or functional neoplasms, following estrogen supplementation, or in male dogs with functional testicular neoplasms
145	Skin	Diffuse cutaneous collagen dysplasia with hyperelastosis	Condition: Ehlers-Danlos syndrome; dermatosparaxis	
146	Skin	Proliferative and hyperkeratotic dermatitis with alopecia	Condition: Sarcoptic mange Cause: Sarcoptes scabiei var canis	
147	Tail	Regionally extensive tail tip necrosis		Ddx: frostbite, trauma, vasculitis
148	Paws	Severe proliferative and necrotizing pododermatitis with hyperkeratosis	Superficial necrolytic dermatitis; hepatocutaneous syndrome	Usually associated with severe vacuolar hepatopathy
149	Lips and oral cavity	Multifocal mucocutaneous papillomas	Cause: Canine papillomavirus-1 and 13	
150	Hepatobiliary System			
151	Liver	Liver lobe torsion with venous infarction	Liver lobe torsion	Left lateral lobe predisposed
152	Liver	Chronic passive hepatic congestion	Chronic passive hepatic congestion	

		with fibrinous capsulitis		
153	Liver	Diffuse hepatic fibrosis, chronic loss (necrosis), and macronodular regeneration	Condition: Hepatic cirrhosis	Causes: Chronic-active hepatitis, Chronic biliary obstruction, CAV-1, anticonvulsants, aflatoxin, copper storage disease
154	Liver	Multifocal hepatic nodular hyperplasia	Nodular hyperplasia	
155	Liver	Focally extensive hepatocellular adenoma or carcinoma		
156	Liver	Multifocal cholangiocellular carcinoma	Cholangiocellular carcinoma	
157	Liver	Multifocal hepatic hemangiosarcoma	Hepatic hemangiosarcoma	
158	Liver/gall bladder and intestine	Transmural gall bladder edema; multifocal to coalescing serosal hemorrhage	Cause: Canine adenovirus 1 Condition: Infectious canine hepatitis	Associated lesions: Corneal edema (“blue eye”) and necrotizing hepatitis
159	Gall bladder	Diffuse cholecystic mucinous hyperplasia	Cystic mucinous hyperplasia	
160	Liver/gall bladder	Diffuse hepatic fibrosis, hepatocyte loss, and macronodular regeneration with gall bladder mucocele	Hepatic cirrhosis and mucocele	Mucocele can be associated with decreased motility, bile stasis or bile composition