Proteinuria in Dogs

Barry Hedgespeth, BVSc Karyn Harrell, DVM, DACVIM North Carolina State University

Following are differential diagnoses for dogs presented with proteinuria.

Prerenal

- Hemoglobinuria
- Myoglobinuria
- Light chain immunoglobulins (multiple myeloma, lymphoma)

Renal

- Functional or physiologic
 Congestive heart failure
 - Strenuous exercise
 - Fever
 - Seizure
 - Exposure to extreme temperatures
 - Glomerular
 - Infection
 - -Bacterial (eg, anaplasmosis, borreliosis, bartonellosis, brucellosis, endocarditis, pyelonephritis, pyometra, pyoderma, Rocky Mountain spotted fever, other chronic infections)
 - Protozoal (eg, babesiosis, hepatozoonosis, leishmaniasis, trypanosomiasis)
 - -Viral (eg, canine adenovirus type 1) -Parasitic (eg, dirofilariasis, schisto-
 - somiasis) -Fungal (eg, blastomycosis, coccidioidomycosis, histoplasmosis,
 - phaeohyphomycosis) • Inflammatory
 - -Chronic dermatitis

 - -Inflammatory bowel disease
 - Acute pancreatitis

- -Periodontal disease
- -Polyarthritis
- -Systemic lupus erythematosus
- -Other immune-mediated disease
- Neoplastic
- -Leukemia
- -Lymphoma
- -Mastocytosis
- -Primary erythrocytosis/ polycythemia vera
- -Systemic histiocytosis
- Congenital or familial
- Amyloidosis (eg, beagle, English foxhound, shar-pei)
- Hereditary nephritis (eg, bull terrier, cocker spaniel, Dalmatian, Samoyed)
- -Podocytopathy (soft-coated wheaten terrier)
- -Membranoproliferative glomerulonephritis (Bernese mountain dog)
- Atrophic glomerulopathy (rottweiler)
- Miscellaneous
- -Corticosteroids (endogenous/ spontaneous hyperadrenocorticism or exogenous)
- -Diabetes mellitus
- -Systemic hypertension
- –Hyperlipidemia
- Drug reactions (eg, sulfonamide [eg, sulfa-/trimethoprim] therapy, masitinib)
- -Chronic insulin infusion

- -Congenital C3 deficiency
- -Cyclic hematopoiesis (ie, gray collie syndrome)
- Tubulointerstitial
 - Chronic kidney disease (including congenital/familial conditions such as renal dysplasia and polycystic kidney disease)
 - Acute kidney injury
 Leptospirosis
 - -Toxins (eg, NSAIDs, grapes, raisins, currants, ethylene glycol, vitamin D3, aminoglycosides, amphotericin B, sulfonamide [eg, sulfa-/ trimethoprim] therapy, tyrosine kinase inhibitors [toceranib phosphate, masitinib mesylate] heavy metal ingestion [eg, lead, mercury, arsenic, thallium], insect or snake bite)
 - Fanconi syndrome
 - Interstitial nephritis

Postrenal

- Urinary
 - Bacterial cystitis
 - Urolithiasis
 - Neoplasia (eg, urothelial carcinoma)
- Extra-urinary
 - Prostatitis
- Vaginitis
- Pyometra

See page 73 for references.

References

- Brodbelt DC, Pfeiffer DU, Young LE, Wood JLN. Risk factors for anaestheticrelated death in cats: results from the confidential enquiry into peri-operative small animal fatalities (CEPSAF). Br J Anaesth. 2007;99(5):617-623.
- Brodbelt DC, Pfeiffer DU, Young LE, Wood JLN. Results of the confidential enquiry into perioperative small animal fatalities regarding risk factors for anesthetic-related death in dogs. J Am Vet Med Assoc. 2008;233(7):1096-1104.
- Matthews NS, Mohn TJ, Yang M, et al. Factors associated with anestheticrelated death in dogs and cats in primary care veterinary hospitals. J Am Vet Med Assoc. 2017;250(6):655-665.
- Hofmeister EH, Herrington JL, Mazzaferro EM. Opioid dysphoria in three dogs. J Vet Emerg Crit Care. 2006;16(1):44-49.
- 5. Bednarski R, Grimm K, Harvey R, et al. AAHA anesthesia guidelines for dogs and cats. J Am Anim Hosp Assoc. 2011;47(6):377-385.
- Kropf J, Hughes JL. Effect of midazolam on the quality and duration of anaesthetic recovery in healthy dogs undergoing elective ovariohysterectomy or castration. *Vet Anaesth Analg.* 2019;46(5):587-596.
- 7. Grubb T, Sager J, Gaynor J, et al. 2020 AAHA anesthesia and monitoring guidelines for dogs and cats. *J Am Anim Hosp Assoc*. 2020;56(2):59-82.
- Becker WM, Mama KR, Rao S, Palmer RH, Egger EL. Prevalence of dysphoria after fentanyl in dogs undergoing stifle surgery. Vet Surg. 2013;42(3):302-307.
- Mathews K, Kronen PW, Lascelles D, et al. Guidelines for recognition, assessment and treatment of pain: WSAVA Global Pain Council members and co-authors of this document. J Small Anim Pract. 2014;55(6):E10-E68.
- 10. Moore AD, Anghelescu DL. Emergence delirium in pediatric anesthesia. *Paediatr Drugs*. 2017;19(1):11-20.
- Kanaya A, Kuratani N, Satoh D, Kurosawa S. Lower incidence of emergence agitation in children after propofol anesthesia compared with sevoflurane: a meta-analysis of randomized controlled trials. J Anesth. 2014;28(1):4-11.
- Reid J, Nolan AM, Hughes JML, Lascelles D, Pawsom P, Scott EM. Development of the short-form Glasgow Composite Measure Pain Scale (CMPS-SF) and derivation of an analgesic intervention score. *Anim Welfare*. 2007;16(S):97-104.
- Calvo G, Holden E, Reid J, et al. Development of a behaviour-based measurement tool with defined intervention level for assessing acute pain in cats. J Small Anim Pract. 2014;55(12):622-629.
- 14. Hernandez-Avalos I, Mota-Rojas D, Mora-Medina P, et al. Review of different methods used for clinical recognition and assessment of pain in dogs and cats. *Int J Vet Sci Med.* 2019;7(1):43-54.

DIFFERENTIAL DIAGNOSIS

CONTINUED FROM PAGE 31

- Lloyd JKF. Minimising stress for patients in the veterinary hospital: why it is important and what can be done about it. Vet Sci. 2017;4(2);22.
- Gruen ME, Sherman BL. Use of trazodone as an adjunctive agent in the treatment of canine anxiety disorders: 56 cases (1995-2007). J Am Vet Med Assoc. 2008;233(12):1902-1907.
- Gruen ME, Roe SC, Griffith E, Hamilton A, Sherman BL. Use of trazodone to facilitate postsurgical confinement in dogs. J Am Vet Med Assoc. 2014; 245(3): 296-301.
- King C, Buffington L, Smith TJ, Grandin T. The effect of a pressure wrap (ThunderShirt) on heart rate and behavior in canines diagnosed with anxiety disorder. J Vet Behav. 2014;9(5):215-221
- Cottam N, Dodman NH, Ha JC. The effectiveness of the anxiety wrap in the treatment of canine thunderstorm phobia: an open-label trial. J Vet Behav. 2013;8(3):154-161.
- Ness TJ, Richter HE, Varner RE, Fillingim RB. A psychophysical study of discomfort produced by repeated filling of the urinary bladder. *Pain*. 1998;76(1-2):61-69.
- Dyson DH, Doherty T, Anderson GI, McDonell WN. Reversal of oxymorphone sedation by naloxone, nalmefene, and butorphanol. *Vet Surg.* 1990;19(5): 398-403.
- Court MH, Greenblatt DJ. Pharmacokinetics and preliminary observations of behavioral changes following administration of midazolam to dogs. J Vet Pharmacol Ther. 1992;15(4):343-350.
- Stegmann GF, Bester L. Some clinical effects of midazolam premedication in propofol-induced and isoflurane-maintained anaesthesia in dogs during ovariohysterectomy. J S Afr Vet Assoc. 2001;72(4):214-216.
- 24. Gardos G. Disinhibition of behavior by antianxiety drugs. *Psychosomatics*. 1980;21(12):1025-1026
- Posner LP, Burns P. Sedative agents: tranquilizers, alpha-2 agonists, and related agents. In: Riviere JE, Papich MG, eds. *Veterinary Pharmacology & Therapeutics*. 9th ed. Wiley-Blackwell; 2009:356-365.
- Mathus-Vliegen EMH, de Jong L, Kos-Foekema HA. Significant and safe shortening of the recovery time after flumazenil-reversed midazolam sedation. *Dig Dis Sci.* 2014;59(8):1717-1725.
- 27. Costa RS, Karas AZ, Borns-Weil S. Chill protocol to manage aggressive & fearful dogs. *Clinician's Brief*. 2019;17(5):63-65.

References

- Biller B, Berg J, Gerrett L, et al. 2016 AAHA oncology guidelines for dogs and cats. J Am Anim Hosp Assoc. 2016;52(6);181-204. doi:10.5326/JAAHA-MS-6570.
- Clinkenbeard KD, Cowell RL, Tyler RD. Disseminated histoplasmosis in dogs: 12 cases (1981-1986). J Am Vet Med Assoc. 1988;193(11):1443-1447.
- Cork LC, Morris JM, Olson JL, Krakowka S, Swift AJ, Winkelstein JA. Membranoproliferative glomerulonephritis in dogs with a genetically determined deficiency of the third component of complement. *Clin Immunol Immunopathol*. 1991;60(3):455-470.
- DiBartola SP, Tarr MJ, Webb DM, Giger U. Familial renal amyloidosis in Chinese Shar-Pei dogs. JAm Vet Med Assoc. 1990;197(4):483-487.
- Harley L, Langston C. Proteinuria in dogs and cats. Can Vet J. 2012;53(6):631-638.
- Hood JC, Huxtable C, Naito I, Smith C, Sinclair R, Savige J. A novel model of autosomal dominant Alport syndrome in Dalmatian dogs. *Nephrol Dial Transplant*. 2002;17(12):2094-2098.
- Hood JC, Savige J, Hendtlass A, Kleppel MM, Huxtable CR, Robinson WF. Bull terrier hereditary nephritis: a model for autosomal dominant Alport syndrome. *Kidney Int*. 1995;47(3):758-765.
- IRIS Canine GN Study Group Diagnosis Subgroup, Littman MP, Daminet S, Grauer GF, Lees GE, van Dongen AM. Consensus recommendations for the diagnostic investigation of dogs with suspected glomerular disease. J Vet Intern Med. 2013;27(Suppl 1):S19-S26.

- Lees GE, Helman RG, Kashtan CE, et al. A model of autosomal recessive Alport syndrome in English cocker spaniel dogs. *Kidney Int*. 1998;54(3):706-719.
- Lees GE, Helman RG, Kashtan CE, et al. New form of X-linked dominant hereditary nephritis in dogs. *Am J Vet Res.* 1999;60(3):373-383.
- Lees GE, Jensen WA, Simpson DF, et al. Persistent albuminuria precedes onset of overt proteinuria in male dogs with X-linked hereditary nephropathy. J Vet Intern Med. 2002;16(3):353.
- Littman MP. Protein-losing nephropathy in small animals. Vet Clin North Am Small Anim Pract. 2011;41(1):31-62.
- Mason NJ, Day MJ Renal amyloidosis in related English foxhounds. J Small Anim Pract. 1996;37(6):255-260.
- Spano M, Zuliani D, Peano A, Bertazzolo W. Cladosporium cladosporioides-complex infection in a mixed-breed dog. *Vet Clin Pathol.* 2018;47(1):150-153.
- Vaden SL, Elliot J. Management of proteinuria in dogs and cats with chronic kidney disease. Vet Clin North Am Small Anim Pract. 2016;46(6):1115-1130.
- Vaden SL. Glomerular diseases. In: Ettinger SJ, Feldman EC, Côté E, eds. Textbook of Veterinary Internal Medicine. 8th ed. Elsevier; 2017:1959-1972.
- Wright NG, Nash AS, Thompson, H, Fisher EW. Membranous nephropathy in the cat and dog: a renal biopsy and follow-up study of sixteen cases. *Lab Invest.* 1981;45(3):269-277.