Top 5 Genetic Diseases of Cats

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Most feline patients are random-bred domestic cats; random breeding propagates and disperses evolutionarily ancient disease-liability genes, which causes the random development of clinical genetic disease. Pedigreed breeds may have varied incidence of disease, depending on the frequencies of liability genes in their gene pools. Insurance claims and centralized hospital databases monitor the most frequent disease presentations, which helps veterinarians understand the most frequent genetic diseases.[1-3] The most frequent conditions are complexly inherited and involve combinations of multiple genes and environmental factors. Genetic diseases should be recognized in practice because they must be treated as chronic illnesses—not episodic diseases.

1 Feline Lower Urinary Tract Disease (FLUTD)

Sterile FLUTD, including both *feline idiopathic cystitis* and *feline urologic syndrome*, is the most frequent feline hereditary predisposition observed in practice, affecting 1% to 2% of domestic cats.[4-6] No infectious causes for FLUTD have been identified,[7] and it can occur in individual cats in multicat households.[8] Persian cats may be at increased risk, and Siamese cats may be at decreased risk for developing FLUTD.[8] In an experimental model, when exposed to stressors, only cats predisposed to FLUTD developed clinical signs and showed mRNA responses for biomarkers vs controls.[6] Similar gene-expression profiles are found in interstitial cystitis or bladder pain syndrome in humans,[9,10] and a hereditary component has been documented.[11,12] There is no

TOP 5 GENETIC DISEASES OF CATS

1. Feline Lower Urinary Tract Disease
2. Diabetes Mellitus
3. Lymphocytic or Plasmacytic Inflammatory Disease
4. Polycystic Kidney Disease
5. Hypertrophic Cardiomyopathy

established mode of inheritance, and no predisposing genes have been identified in cats.

Most practitioners recognize that once diagnosed and controlled, signs associated with FLUTD can recur if owners are not diligent about controlling predisposing factors. Such measures can include minimizing environmental stress, maintaining anti-inflammatory or behavior-modifying drugs that decrease likelihood for bladder inflammation, and maintaining dietary control for cats predisposed to crystalluria.

2 Diabetes Mellitus

Diabetes mellitus is a common diagnosis in cats controlled via insulin regulation and diet.[13] It is primarily seen in random-bred cats, although an increased incidence is seen in Burmese[14] and possibly Siamese, Norwegian forest, Russian blue, and Abyssinian cats.[15,16] Obesity is a predisposing factor.[17] One study found a mutation in the melanocortin 4 receptor gene to be significantly associated with diabetes in obese domestic shorthair cats.[17] This is similar to findings associated with human type 2 diabetes.[17]

3 Lymphocytic or Plasmacytic Inflammatory Disease

Predisposition toward lymphocytic or plasmacytic inflammation represents a complex immunologic response involving innate, humoral, and cell-mediated immunity. In cats, lymphocytic or plasmacytic inflammatory disease most frequently manifests as gingivostomatitis[18] or inflammatory bowel disease (IBD).[19] Although the histopathologic descriptions of these 2 entities are similar, they rarely occur in the same patient.

Breed predisposition to IBD has been found in Siamese and other Asian breeds, but causal genetic mutations have not been found.[19] Liability genes for IBD have been identified in German shepherd dogs[20] and humans.[21] Liability genes have been identified for recurrent aphthous stomatitis in humans, the corollary to feline lymphoplasmacytic gingivostomatitis.[22]

Genetic diseases should be recognized in practice because they must be treated as chronic illnesses—not episodic diseases.

Many possible environmental variables exist, including diet (and possibly dietary reactivity), reactivity to the local microbiome, and behavioral stress.[6,19] Affected cats show a lifelong propensity to inflammatory cell infiltration that does not occur in other cats in the same household. Control of both conditions can include dietary changes, anti-inflammatory or immunoregulatory drugs, minimization of environmental stress, and dental extraction in cats with severe gingivostomatitis.

4 Polycystic Kidney Disease[23]

Polycystic kidney disease (PKD) is the most common single-gene feline disorder seen in practice. It is caused by an autosomal dominant gene for which a commercial genetic test exists (UC-Davis VGL). This defective gene is present in 38% of Persian cats (6% of cats worldwide), as well as in high frequencies in Himalayan and other Persian-derived breeds. PKD is also seen in random-bred longhair cats with presumed Persian ancestry. All affected cats are heterozygous for the defective gene, as homozygosity is prenatally lethal.

Most affected cats develop kidney failure at an average age of 7 years (range, 4-10 years).[24]

FLUTD = feline lower urinary tract disease

IBD = inflammatory bowel disease

PKD = polycystic kidney disease

Variable expression of this gene can be noted in cats that develop a few cysts but maintain normal renal function. There is no specific treatment aside from support for chronic kidney disease and failure.

Prospective pet owners interested in kittens of susceptible breeds should ask for the PKD DNA test results on both parents and/or the kittens. Breeders who offer a breeding stock that is "PKD clear" on ultrasonography are using an outdated and unreliable diagnostic standard.[25] If valid PKD DNA test results are not available from the breeding stock, potential pet owners can collect a cheek swab from kittens for testing.

5 Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy (HCM) occurs as a breed-related disease in several breeds as well as in random-bred cats.[26] A mutation in the myosin-binding protein C gene occurs in 33% of Maine coon cats and causes highly penetrant, autosomal-dominant HCM.[26] Affected cats can experience heart failure or sudden death at 6 months to 7 years of age. Cats homozygous for the mutation have a more severe and earlier-age onset than do heterozygotes.[26] The disease shows incomplete penetrance, and some heterozygous cats can remain clinically normal.[27]

Twenty percent of ragdoll cats carry a different mutation in the same gene that causes HCM.[28] A genetic test is available for breed-specific mutations in the ragdoll and Maine coon breeds.[26] Prospective breeding cats should be tested, or kittens should be tested before placement.

HCM = hypertrophic cardiomyopathy

PKD = polycystic kidney disease

HCM also occurs in individual Maine coon and ragdoll cats not carrying the breed-specific mutations, as well as in random-bred cats and individual cats of other breeds.[29] These findings support both within-breed and between-breed genetic heterogeneity for the disease. Clinical treatment for HCM involves controlling heart failure.

Cats of the sphynx breed may develop an earlier-age (average, 2 years) onset HCM.[30,31] In Norwegian forest cats, cardiomyopathy with signs of both hypertrophic and restrictive disease has been documented.[32] HCM has also been reported in Persian, Chartreux, Bengal, and Birman cats.[29] Causative genes have not been identified in these breeds, but pedigree studies suggest dominant inheritance with incomplete penetrance.[29]

Conclusion

Other common feline diseases with hereditary components include calcium oxalate bladder stones,[33] allergic skin disease with or without eosinophilic granuloma complex,[34] mammary tumors,[35] and lymphoma.[36] Hyperthyroidism is frequently seen in practice, but the cause is thought to be related to environmental goitrogens and not heredity.[37] There is also no published evidence for heritability of chronic kidney disease seen in older cats.

Many breed-specific genetic diseases are seen at a lower frequency in clinical practice. The WSAVA Canine and Feline Hereditary Disease (DNA) Testing website (research.vet.upenn.edu/WSAVA-LabSearch) is an excellent source of information on DNA tests, susceptible breeds, and testing laboratories.[38]

Cats affected with genetic disorders should not be used for breeding. For complexly inherited genetic disorders, risk for carrying disease-liability genes should be based on knowledge of clinical disease or normalcy in first-degree relatives of prospective breeding cats. Carriers of testable recessive disease-liability genes can be bred with normal-testing mates and replaced for breeding with normal-testing offspring. Cats with testable dominant disease-liability genes should be replaced for breeding with normal-testing relatives.

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