CE

PEER-REVIEWED

Idiosyncrasies in greyhounds that can affect their medical care

These athletes have been bred for speed and an even temper. But some irregularities in greyhounds will affect how to clinically assess and treat these dogs. Make sure you're prepared for the next greyhound that visits your practice.

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OVER THOUSANDS of years, greyhounds have been bred and selected for speed. This selective breeding may explain a number of the idiosyncrasies we see in the breed today. Retired racing greyhounds are becoming more common pets and more common patients in veterinary hospitals. It is estimated that about 18,000 greyhounds are placed into homes as pets annually. This article will familiarize practitioners with some idiosyncrasies in greyhounds that can affect their medical care.

Complete blood count idiosyncrasies

Packed cell volume

It is well-known that greyhounds have a significantly higher packed cell volume (PCV) than other breeds (*Table 1*).[1] Values are routinely above the upper reference range used by most laboratories.[1,2] PCVs as high as 65% are not uncommon and are considered normal. PCVs less than 45% likely indicate some degree of anemia in a greyhound despite the fact that the value may fall within the reference range of most laboratories.

Platelet counts

Greyhounds have lower platelet counts than other breeds (*Table 1*).[2] Reference values for greyhound platelets have been reported to be as low as 64,000/µl.[3] One complicating factor in interpreting greyhound platelet counts is ehrlichiosis, a rickettsial tick-borne disease known to cause thrombocytopenia. In my opinion, a greyhound with a platelet count of 100,000/µl or less should be tested for ehrlichiosis and other tick-borne diseases. Protatek Reference Laboratory* provides discounts on serologic tests for tick-borne diseases in retired racing greyhounds. Symptomatic treatment of thrombocytopenia that includes doxycycline and, in some cases, corticosteroids can be considered.

White blood cell counts and morphology

Greyhounds routinely have lower white blood cell counts than other breeds (*Table 1*).[1,3] Lymphocyte, neutrophil, and monocyte counts were all found to be lower in greyhounds than in nongreyhounds.[3] These findings are rarely clinically relevant and are not necessarily indicative of immunosuppressive disease or overwhelming infection.

Greyhound eosinophils have empty granules and lack the more classic orange granules, making them appear vacuolated. This finding seems to be more common in slides stained with Diff-Quik (Dade Behring) than in those stained with Giemsa and can cause the eosinophils to be misidentified as toxic neutrophils.[4]

Serum chemistry profile idiosyncrasies

Creatinine and BUN concentrations

Greyhounds have significantly higher creatinine concentrations than other

*Protatek Reference Laboratory, 574 E. Alamo St., Suite 90, Chandler, AZ 85225; (480) 545-8499.

breeds (*Table 1*).[5] These higher concentrations, primarily attributed to the breed's large muscle mass, often lead to a misdiagnosis of early renal disease. Female greyhounds have higher blood urea nitrogen (BUN) concentrations than other breeds.[1] Greyhound glomerular filtration rates are similar to those of non-greyhounds (Drost WT, Couto CG, Fischetti AJ, et al., Department of Veterinary Clinical Sciences, The Ohio State University, Columbus, Ohio: Unpublished data, 2005). In dogs, raw food diets increase BUN concentrations and, in some cases, creatinine concentrations.[6] Many active greyhound racers and some retired racers are fed a raw food diet, so their BUN and creatinine concentrations could be further elevated in the absence of renal disease.

Perform a urinalysis and measure urine specific gravity with a refractometer in any greyhound with a slightly elevated creatinine concentration. Absence of proteinuria and a urine specific gravity greater than 1.020 suggest that the creatinine concentration is likely normal for that particular patient.

Thyroid hormone concentrations

Greyhounds have lower thyroid hormone concentrations (total thyroxine [T_4] and free T_4 by equilibrium dialysis) than other breeds (*Table 1*).[7] The clinical relevance of this is controversial in veterinary medicine. Some veterinarians think that most greyhounds are hypothyroid and should be supplemented with levothyroxine, whereas others think that the lower concentrations are normal for the breed.

One greyhound adoption program suggests that greyhounds that show shyness or anxiety receive thyroid supplementation regardless of thyroid hormone concentrations.[8] I disagree with this and think greyhounds are often oversupplemented with thyroid hormone replacement medications. Greyhounds normally show many outward signs that might be confused with signs of hypothyroidism. Many greyhounds are inactive and cold-intolerant and have caudal thigh alopecia. These signs may not be a result of hypothyroidism. The thigh alopecia is referred to as *bald thighs syndrome* (*see below*) and is not consistently thyroid hormone-responsive.[9]

Hypothyroidism should only be diagnosed in a greyhound based on the results of a full thyroid profile (total T_4 concentration, free T_4 concentration by equilibrium dialysis, total triiodothyronine [T_3] and free T_3 concentrations, and a thyroid-stimulating hormone response test) and supporting clinical signs. (Total T_3 and free T_3 concentrations in greyhounds are similar to those in other breeds.) The Diagnostic Center for Population and Animal Health at Michigan State University** performs a complete thyroid panel and can provide interpretation by veterinary endocrinologists who have extensive knowledge of a greyhound's normal thyroid hormone concentrations.

**Diagnostic Center for Population and Animal Health, P.O. Box 30076, Lansing, MI 48909-7576; (517) 353-0621.

TABLE 1 Laboratory Values in Greyhounds and Other Dog Breeds*

Laboratory Test	Greyhound Values	Canine Reference Range
PCV (%)	41.4–64.2	37–55
Platelets ($\times 10^3$/µl)	64–292	160–416
WBC (/µl)	1,800–14,600	6,000–17,000
Seg (/µl)	3,690–7,298	3,000–11,400
Lymph (/µl)	246–3,198	1,000–4,000
Mono (/µl)	0–820	150–1,350
Creatinine (mg/dl)	0.8–1.6	0–1
Total T_4 (nmol/L)**	2.1–37	10–45.5
Free T_4 by dialysis (pmol/L)**	1.3–32.2	3.9–39.9
Globulin (g/dl)	1.4–4.2	3.8–5
Sodium (mmol/L)	149–157	142–150
Chloride (mmol/L)	110–122	110–121
Total bilirubin (mg/dl)	0–0.7	0.1–0.3

*Source: References 3, 6, and Drost WT, Couto CG, Fischetti AJ, et al., Department of Veterinary Clinical Sciences, The Ohio State University, Columbus, Ohio: Unpublished data, 2005.

**Total and free T_4 reference values for greyhounds are at the lower sensitivity of the assay, which may make diagnosing hypothyroidism based solely on these hormones impossible. A diagnosis of hypothyroidism should only be made in a greyhound with supporting laboratory test findings (elevated thyroid-stimulating hormone response test result, decreased total and free T_4 concentrations) and appropriate clinical signs.

Other idiosyncrasies

Greyhounds have lower globulin concentrations and higher sodium, chloride, and bilirubin concentrations than other breeds (*Table 1*), although these findings are rarely misinterpreted or clinically relevant.[3]

Cardiologic idiosyncrasies

Greyhounds may have mildly enlarged hearts and mild heart murmurs that can occasionally be considered normal. The murmur is known as a *physiologic flow murmur* and is considered idiopathic but most likely relates to turbulent blood flow associated with a high stroke volume.[10,11] The physiologic flow murmur can be characterized as systolic (not holosystolic), loudest over the left base, and low intensity (grade III or less)[10,11] and must be distinguished from murmurs due to cardiac diseases. Mild generalized heart enlargement is also a common finding in many normal greyhounds, even many years after retirement.

Echocardiographic idiosyncrasies

FIGURE 1

1. Numerous comedones and papules on the sternal area of a greyhound with ventral comedo syndrome. (Reprinted from Burkett G. Skin diseases in greyhounds. *Vet Med* 2000;95: 115-124.)

FIGURE 2

2. This 6-year-old neutered male ex-racing greyhound shows the alopecia characteristic of bald thighs syndrome. (Reprinted from Burkett G. Skin diseases in greyhounds. *Vet Med* 2000;95: 115-124.)

noted in greyhounds include enlarged left ventricular cavity dimensions, increased left ventricular and septal wall thickness, and increased systolic time intervals when compared with nongreyhounds. These differences were significant despite corrections for body surface area and body weight.[12] Greyhounds are also known to have significantly higher mean arterial pressures than nongreyhounds (118 mm Hg vs. 98 mm Hg).[13]

Dermatologic idiosyncrasies

Alabama rot

Idiopathic cutaneous and renal glomerular disease, also known as *Alabama rot*, is a rare disease seen more frequently in greyhounds than in other breeds.[14-16] It is thought to be caused by *Escherichia coli* 0157:H7 toxin.[14] The first clinical signs noted are inflamed and painful cutaneous swellings that may crust and progress to slow healing ulcers ranging from a few millimeters to several centimeters in length. The most commonly affected sites include the hocks, stifles, or medial thighs. In rare cases lesions may be noted on the forelimbs, thorax, or ventral abdomen. General malaise and inappetence is often associated with this period. Renal disease occurs in 25% of cases and may occur up to 10 days after the onset of signs.

Alabama rot is diagnosed by histologic examination with supporting complete blood count, serum chemistry, and urinalysis results and clinical signs. The most consistent laboratory abnormalities include mild anemia, thrombocytopenia, hypoalbuminemia, elevated alanine transaminase activity, and proteinuria.[17] Treatment is supportive and includes appropriate topical and systemic antibiotics selected based on culture and sensitivity results (note that *Staphylococcus* species are often cultured but are thought to be a secondary pathogen).[18] Those greyhounds with azotemia should undergo intravenous fluid therapy and symptomatic treatment.

Ventral comedo syndrome

Ventral comedo syndrome affects many greyhounds. Comedones occur most commonly along the ventral thorax and may be secondary to pressure-point contact of a greyhound's deep chest with the ground.[18] This contact allows for the implantation of the hair shaft within the hair follicle that acts as a foreign body, which results in inflammation and causes obstruction and comedo formation (*Figure 1*). This condition is rarely clinically relevant and is only a cosmetic problem. It can be treated with benzoyl peroxide- or keratolytic-containing shampoos or gels.[18] Antibiotics are not indicated unless a secondary pyoderma is present.

Bald thighs syndrome

Bald thighs syndrome is a nonpruritic and noninflammatory alopecia affecting the caudal aspect of the pelvic limbs (*Figure 2*). The lesions can be progressive and can involve the abdomen. Primary differential diagnoses for the syndrome include demodicosis, dermatophytosis, hypothyroidism, hyperadrenocorticism, and sex hormone imbalances.[18] There is no specific treatment for this condition, which has no known cause. Thyroid supplementation will stimulate hair growth in euthyroid dogs, so be cautious if using levothyroxine to treat this condition.[19] The syndrome will resolve in many greyhounds a few months after retirement.[18]

Corns

Greyhounds seem to be susceptible to corns.[20] Corns are keratotic growths most commonly found on the footpads that can result in marked pain and lameness. The primary differential diagnoses are plantar and palmar warts. The true cause of corns is unknown, but corn formation may be due to the absence of a thick fatty layer in the greyhound footpad that absorbs shock and protects the skin and footpad.[20] The absence of this fatty layer results in a concussive force between the phalanx and footpad that may cause corns to form.[20,21] Another theory is that corns result from trauma to the footpad, which heals and becomes fibrous and scarred.[20,21]

Treatment of corns has included administering topical products containing salicylic acid (KeraSolv Gel—DVM Pharmaceuticals), surgically removing the corn (about 50% of corns will recur within one month to one year after surgery), and amputating the digit. Digit amputation can present complications because corns can occur in the remaining digits.[21] If a corn is excised, perform a histologic examination of the lesion to confirm the diagnosis.

Symmetrical lupoid onychodystrophy

Symmetrical lupoid onychodystrophy is the most common cause of multiple toenail loss (onychomadesis, onychogryphosis, onychoschizia) on multiple paws in greyhounds. This condition, also known as *pemphigus*, does not seem to affect the footpads or other areas as it does in other breeds. Definitive diagnosis requires amputation and histologic examination (sample sent to a dermatohistopathologist) of the third phalanx, but definitive diagnosis is rarely necessary since most dogs respond to treatment without a definitive diagnosis. Ideally, all secondary infections should be resolved before biopsy. Differential diagnoses include bacterial infection, fungal infection, neoplasia, and autoimmune disease.

Treatment consists of high doses of essential fatty acids, immunosuppressive medications, and systemic and topical antibiotics as indicated.[22] Some dermatologists have found that the combination of tetracycline, niacinamide, and high doses of essential fatty acids (180 mg eicosapentaenoic acid/10 lb) effectively controls this disease without concurrent corticosteroid administration. Long-term medication may be necessary to control the condition.[22]

Orthopedic idiosyncrasy

Central tarsal bone fractures are one of the most common career-ending orthopedic injuries of active racing greyhounds.[23] These injuries can often be surgically repaired, although many trainers and rescue groups lack the financial resources to treat surgically. Extended rest (six to 12 months) and casting are another treatment option often used. Although swelling and arthritis will develop in the affected tarsus if surgery is not performed, most greyhounds will still maintain a high quality of life.

Reproductive idiosyncrasies

Clitoral hypertrophy occurs in many recently retired female greyhounds. Female greyhounds are routinely given testosterone injections at the racetrack to prevent estrous cycles. One of the long-term sequelae of these injections can be clitoral hypertrophy.[24] In some cases this condition has been confused with hermaphroditism. If a greyhound is asymptomatic, the condition does not require treatment.[24] Abnormalities in the internal reproductive organs would potentially be of concern and could be addressed at the time of neutering.

Anesthetic idiosyncrasies

Greyhounds have a reputation among veterinarians and owners as having many anesthetic idiosyncrasies. The nervous

demeanor of some greyhounds and the stress of a hospital setting can lead to potential gastrointestinal upset, hyperthermia, and unreliable response to anesthetic premedications. A greyhound's body conformation can also predispose it to hypothermia during anesthesia. Greyhounds have a relatively high body surface-to-volume ratio and a low average body fat (17% average body fat for greyhounds compared with 35% average body fat for mixed breeds).[25] Many safe anesthetic protocols are available for greyhounds. Monitoring preoperative and postoperative temperatures is important, as it is for any pet.

Anesthetic hyperthermia

Malignant hyperthermia and nonmalignant hyperthermia, or stress hyperthermia, can affect greyhounds. Malignant hyperthermia is a rare inherited genetic disorder of skeletal muscle that results in the mutation of calcium channel protein within muscle cells. This mutation results in muscle contraction and increased metabolism, which leads to the production of not only excess carbon dioxide but also excess heat, resulting in a life-threatening hyperthermia.[26] Malignant hyperthermia can be triggered by gas anesthetics (not injectable anesthetics), extreme exercise, and stress. It is most likely to occur during the procedure or while the dog is exposed to inhalant anesthetics. The only treatment for true episodes of malignant hyperthermia is an intravenous injection of the muscle relaxant dantrolene in addition to supportive intravenous fluid therapy, immediate removal of the patient from gas anesthetics, external cooling, and respiratory support.[27] Even with appropriate treatment, this disease can be fatal. Malignant hyperthermia is definitively diagnosed based on the results of a caffeine contracture test on fresh muscle tissue and suggestive serum chemistry and blood gas analysis results (elevated creatinine kinase or aspartate transaminase activities, elevated CO_2 concentrations, low pH, and, occasionally, low bicarbonate concentrations) during a malignant hyperthermia episode.[27] An erythrocyte osmotic fragility test can also be performed, but finding a commercial laboratory that performs this test may be difficult.[28]

Stress hyperthermia is more commonly seen in greyhounds than true malignant hyperthermia.[29] It can occur at any time but is more likely in recovery. Greyhounds are well-known for their large muscle mass. Many greyhounds also suffer from separation anxiety or stress when hospitalized. I think both of these factors may help explain why greyhounds seem to suffer from stress hyperthermia more than other breeds. As animals awake from anesthesia, many shake or shiver as a natural response to mild hypothermia, pain, or disorientation. In some greyhounds, this response seems to be exaggerated, and many continue the warming process beyond normal body temperatures and may reach in excess of 105 F (40.5 C). These animals may respond well to supportive treatment (anti-inflammatories, intravenous fluids, external cooling, pain medications, muscle relaxants, and respiratory support) without the use of dantrolene if the condition is diagnosed early enough. Many anesthesiologists say that if a dog survives an episode of anesthetic hyperthermia without receiving dantrolene then the dog does not have malignant hyperthermia.[29]

Malignant hyperthermia is most likely to occur while the dog is exposed to inhalant anesthetics.

Anesthetic agents

Greyhounds have lower hepatic clearance of thiobarbiturates than nongreyhounds, which results in prolonged recoveries after repeated doses of the drug. Complete recovery in these cases may take up to eight hours, compared with one or two hours in nongreyhounds. Many anesthesiologists think that a single injection of a thiobarbiturate will not be harmful to a greyhound,[29] but I think that too many other safer anesthetics are available to justify its use.

A ketamine-diazepam combination and propofol are the two most commonly used injectable anesthetic protocols (tiletamine/zolazepam is an alternative to ketamine and diazepam but anecdotally seems to result in rougher recoveries).[26] As with any breed, premedication to decrease stress and pain will result in less stressful recoveries. Lower doses of acepromazine should be used in greyhounds (< 0.1 mg/kg), as greyhounds appear to be more sensitive to acepromazine's effects, which can prolong sedation and worsen hypothermia.[29] Acepromazine is usually administered intramuscularly with an opioid. Maintaining anesthesia with isoflurane or sevoflurane is preferred because they are metabolized to a lesser degree than halothane or methoxyflurane, though halothane is considered acceptable. Halothane is more well-known for triggering malignant hyperthermia than isoflurane or sevoflurane.

Conclusion

Greyhounds have many idiosyncrasies that can affect their medical care. Being aware of these idiosyncrasies will pre-

vent misdiagnoses and allow for more appropriate treatment and diagnostic testing. Many studies are pending publication that will describe additional idiosyncrasies. For those veterinarians interested in learning more about greyhounds and interacting with other veterinarians who also work with greyhounds, please visit the Greyhound Health Research and Information Network Web site at www.ghrin.org.

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CE Questions 2 CE hours

You can earn two hours of Continuing Education credit from Kansas State University by answering the following questions on greyhound idiosyncrasies. Circle only the best answer for each question, and transfer your answers to the form on page 612.

Article #1

1. Which is a common finding on a complete blood count in a greyhound?
a. High platelet count
b. Low PCV
c. High neutrophil count
d. High PCV
e. High lymphocyte count

2. Which is a common finding on a serum chemistry profile in a greyhound?
a. Low BUN concentration
b. High creatinine concentration
c. High T_4 concentration
d. Low alanine transaminase activity
e. High globulin concentration

3. Which is true regarding greyhound thyroid hormone concentrations?
a. Caudal thigh alopecia is a common sign of hypothyroidism.
b. Greyhounds often have normal thyroid concentrations below the reference ranges listed by most laboratories.
c. A low total T_4 is adequate to establish a diagnosis of hypothyroidism in a greyhound.
d. Appropriate clinical signs must be present to establish a diagnosis of hypothyroidism in a greyhound.
e. B and D

4. Which statement is true regarding heart murmurs in greyhounds?
a. Heart murmurs in greyhounds are innocent and not indicative of heart pathology.
b. Heart murmurs in greyhounds are always clinically relevant and indicative of heart pathology.
c. Heart murmurs in greyhounds may be innocent physiologic murmurs or can be indicative of heart pathology.
d. Physiologic heart murmurs in greyhounds are normally a grade V or VI.
e. Physiologic heart murmurs in greyhounds are normally holosystolic.

5. Which statement is true regarding corns in greyhounds?
a. They can cause marked lameness in a greyhound.
b. Surgery is the treatment of choice and is curative.
c. Corns may return after surgical removal.
d. A and B
e. A and C

6. What is the most common cause of multiple toenail loss on multiple paws in a greyhound?
a. Pododermatitis
b. Dermatophytosis
c. Trauma
d. Symmetrical lupoid onychodystrophy
e. Squamous cell carcinoma

7. Which statement is true regarding malignant hyperthermia?
a. It must be treated with the muscle relaxant dantrolene.
b. Not all anesthetic hyperthermia in greyhounds is caused by malignant hyperthermia.
c. Inhalant, not injectable, anesthetics may result in malignant hyperthermia.
d. Elevated creatinine kinase or aspartate transaminase activities and acidosis are suggestive of malignant hyperthermia.
e. All of the above

8. Which statement is true regarding anesthesia in greyhounds?
a. Isoflurane and sevoflurane are both appropriate for use in greyhounds.
b. Thiobarbiturates should be avoided.
c. Malignant hyperthermia, stress hyperthermia, and hypothermia are all risks associated with anesthesia in greyhounds.
d. Lower doses of acepromazine should be used in greyhounds.
e. All of the above

9. Which would be the most reasonable next step in working up a healthy greyhound with a mildly elevated creatinine concentration and normal BUN concentration?
a. Complete urinalysis
b. Measurement of glomerular filtration rate
c. Starting a therapeutic renal diet and rechecking blood work in four weeks
d. Ultrasonography
e. Radiography

10. What is a primary differential diagnosis for a greyhound with less than 100,000 platelets?
a. Normal for the breed
b. Tick-borne disease
c. Immune-mediated thrombocytopenia
d. All of the above
e. None of the above

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