Diagnosis & Treatment of Demodicosis in Dogs & Cats

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PROFILE
Definition
Demodicosis occurs when Demodex mites, which are part of an animal’s normal flora, proliferate in the skin (most often the hair follicle).

Causes
• Three species of Demodex mites affect dogs: D canis, D injai (long-bodied mite; Figure 1), and D cornei (short-bodied mite).1,2
• Two species affect cats: D cati (long-bodied mite) and D gatoi (short- and wide-bodied mite; Figure 2).3

Signalment
• Demodicosis can develop at any age.
• No sex predilection is seen in dogs or cats.
• Breeds at highest risk for developing juvenile-onset generalised demodicosis due to D canis include Shar-peis, Pit Bulls, Boston Terriers, English Bulldogs, Boxers, Miniature Pinschers, Great Danes, and Pugs.4

Risk Factors
• Risk factors that affect both dogs and cats include chronic severe disease states, neoplasia, long-term glucocorticoid use, and chemotherapy.
• In dogs, risk factors for juvenile-onset generalised demodicosis include pyoderma, coccidiosis, hookworms, short hair coat, and lack of participation in a preventive care wellness plan.4
• Focal demodicosis is common in puppies, and physiologic stress and debilitation are risk factors.
• In cats, D gatoi is contagious. Cats at risk for this infestation tend to come from high density populations.

Pathophysiology
• Clinical disease results from overproliferation of mites in the skin due to defects or compromise of the skin’s immune system.
• Studies using dog leukocyte antigen class II have identified common markers in young dogs with generalised demodicosis, suggesting that this antigen may be an important immunologic risk factor for the disease in dogs.7
• Demodex mites found on skin scrapings, plucked hair, ear swabs, and faecal samples are considered clinically significant when interpreted in conjunction with typical clinical signs.9

Signalments and Clinical Signs

DOGS
Localised demodicosis
• Occurs primarily in puppies.
• Mites are found only in lesional areas; lesions focal and limited (1–4 sites).
• Signs include focal areas of hair loss, erythema, hyperpigmentation, and follicular plugging (comedones).
• Pruritus varies.

Juvenile generalised demodicosis
• Mean age of onset is 6 months.
• Begins as localised demodicosis and becomes more diffuse
• Mites can be found in lesional and non-lesional areas; all stages of life cycle are commonly found
• Signs include hair loss, erythema, hyperpigmentation, papular rash, follicular plugging, concurrent superficial or deep pyoderma (furunculosis), pain, fever, matting of hair coat, and skin exudation
• Pruritus is variable
• In some patients, presents only as deep pododematitis (swelling, lameness, pain, exudation, lichenification, proliferation of pedal tissue) and generalised or regional lymphadenopathy
• Dogs can be septic and severely debilitated by disease

Adult-onset demodicosis
• May be focal or generalised
• Occurs in dogs with concurrent systemic illness
• Proliferation of mites may precede signs of systemic illness
• In my experience, dogs with adult-onset demodicosis have no history of demodicosis as a young dog

D injai demodicosis
• Associated with wire-haired Fox Terrier dogs that have dorsal greasy skin of the trunk
• Usually pruritic and may be concurrent with atopic dermatitis
• Some dogs, especially terriers, may present with intense pruritus

Cats
Otic demodicosis
• Affects cats of any age; common in kittens
• Signs include ceruminous discharge and pruritus

D gatoi demodicosis
• Can occur in cats of any age
• Common signs are pruritus and evidence of contagion
• Can present as symmetric alopecia
• Pruritus can be severe and lead to self-trauma
• Often introduced into household after adoption of a new cat or kitten from a rescue center, shelter, or other high-density population

D cati demodicosis
• Not known to be contagious
• Signs can be similar to those of D gatoi
• Most often associated with systemic illness (eg, diabetes mellitus) or long-term use of glucocorticoids and progestins

Mixed infections
• Not uncommon

DIAGNOSIS

Definitive Diagnosis
Dogs
• Any finding of mites indicates demodicosis.

Mixed infestations of D canis and D injai can occur.
• Mites are found on deep-skin scrapings or via hair trichograms; the latter are useful for sampling sites that are close to the eyes or difficult to scrape (eg, interdigital areas).
• Hair plucking may be the diagnostic test of choice for sampling dogs with greasy hair.

Cats
• With otic demodicosis, mites are found on mineral oil cytologic testing of ear exudates.
• D cati mites tend to be easily found on skin scrapings.
• D gatoi mites can be difficult to find even when the patient is severely pruritic. For these mites, suggested tests include wide superficial skin scrapings, hair plucking, faecal flotations (Figure 3), or response to therapy.

Figure 3: Demodex gatoi mites found on faecal sample from cat with pruritus, self-trauma, and hair loss on ventral abdomen (original magnification, 400×)

Differential Diagnosis
• Dogs: Canine demodicosis can mimic any skin disease; the rule of thumb is “demodicosis until proven otherwise.”
• Cats: Consider demodicosis in any cat with hair loss, symmetric alopecia, or pruritus.

Laboratory Testing
• Bacterial cultures of skin: Should be performed if deep pyoderma is present or if there is a history of glucocorticoid use or long-term antibiotic therapy (dogs)
• Complete blood count or serum biochemical profile: In dogs with deep pyoderma that may be septic or dehydrated
• Faecal flotation examination: In pruritic cats to identify D gatoi
• Genetic testing for ABCB1-δ genotype: To screen for drug sensitivity to avermectins in breed-sensitive dogs (eg, herding dogs, sight hounds); rec-
ommended for dogs with severe generalised demodicosis.1

- **Impression smears**: To diagnose concurrent microbial overgrowth in dogs and cats

**Additional Laboratory Testing**

1. Except for faecal flotation examinations in cats, laboratory testing is most helpful when searching for the underlying cause of adult-onset demodicosis in dogs or a medical condition associated with *D cati* in an adult cat. Testing may include but is not limited to:
   - Blood smear evaluation
   - Complete blood count
   - Faecal flotation
   - Infectious disease titers
   - Radiography of thorax and abdomen
   - Retroviral screening
   - Serum biochemical analysis
   - Urinalysis.

2. Fine-needle aspirates of lymph nodes may contain mites.

3. Skin biopsy may be helpful in Shar-pei dogs and dogs with severe pododermatitis.

**TREATMENT**

**Inpatient or Outpatient**

- Demodicosis in dogs and cats can be treated on an outpatient basis.
- Concurrent bacterial/yeast overgrowth must be treated so that therapy does not fail. If there is a lack of appropriate response, the skin should be cultured to rule out a possible methicillin resistant *Staphylococcus intermedius* group (SIG) infection.
- Dogs with adult-onset demodicosis and complications from underlying disease or dogs with deep pyoderma, fever, and sepsis may require hospitalisation for supportive care and diagnostic testing. Hospitalisation of cats is rare and is related to medical issues underlying *D cati* infestations.

**Medical**

- Treat fever, pain, sepsis, and dehydration in dogs with concurrent deep pyoderma.
- Provide pain medication for dogs with pododemodicosis if needed.
- Recommend sedation and clipping of the hair coat (especially long-haired breeds) to facilitate medicated bathing.
- Institute aggressive antimicrobial therapy pending culture and sensitivity.
- Initiate concurrent topical antimicrobial shampoo therapy (eg, benzoyl peroxide, chlorhexidine).
- Monitor patients with severe generalised demodicosis during initial therapy for development of peripheral edema; systemic miticidal drugs can cause massive mite kills and obstruction of lymphatics.

**Nutritional Aspects**

- Ensure that clients are feeding complete, balanced, age-appropriate diets, especially if the pet’s body condition is poor.

**Client Education**

**Dogs**

- Explain that localised demodicosis may progress to generalised demodicosis in about 10% of affected dogs.
- Clients need to thoroughly understand the cost and duration of treatment, especially for juvenile generalised demodicosis, and the possibility of relapse or lack of cure.
- Emphasise the need for a thorough workup of dogs with adult-onset demodicosis and the implications of underlying disease; provide the pros and cons of treatment options.

**Cats**

- Explain the contagious nature of *D gatoi* and the need to treat all in-contact cats.
- There is a strong likelihood of an underlying predisposing disease in cats with *D cati*, but cost of evaluation to uncover the cause needs to be considered.
- Emphasise the pros and cons of treatment.

**MEDICATIONS**

**Dogs**

- **Amitraz**1,2
  - Product availability is variable.
  - Use once weekly (extra-label use) by sponging onto the whole body; do not rinse off; apply thoroughly; do not let dog become wet between treatments.
  - Clip long-haired dogs to maximise wet between treatments.
  - Do not use on dogs with deep pyoderma or open areas of sloughed skin.
  - Do not use concurrent monoamine oxidase inhibitors (MAOIs), clomipramine, selegiline, selective serotonin-reuptake inhibitors (fluoxetine, sertraline, paroxetine), tricyclic anti-depressants (clomipramine, amitriptyline), opioids, or such over-the-counter medications as dextromethorphan.3
  - Apply the product in the veterinary clinic; use good ventilation. Ensure that individuals applying the solution do not have respiratory disease or blood glucose issues, are not pregnant, and are not taking MAOIs.
  - Apply the product in the veterinary clinic; use good ventilation. Ensure that individuals applying the solution do not have respiratory disease or blood glucose issues, are not pregnant, and are not taking MAOIs.
  - Adverse effects include pruritus, polyuria/polydipsia, sedation, tremors, collapse, and hypothermia.
  - Use yohimbine to treat toxicosis.

- **Metaflumizone plus amitraz** is labeled for the treatment of demodicosis in veterinary patients, but the
manufacturer has made the decision to discontinue the manufacture and sale of this product. There have been rare pemphigus foliaceus–like drug reactions associated with the use of this drug combination.4

Ivermectin (extralabel use)
• 300 to 600 µg/kg po q 24h
• Aqueous formulations are more palatable than propylene glycol–based formulations.
• Adverse effects include lethargy, muscle tremors, mydriasis, ataxia, severe neurotoxicosis (depression, stupor, coma, ataxia, seizures, death), and blindness.
• ABCB 1-delta gene (MDR1) testing can be used to screen for sensitivity.
• Do not use in ivermectin-sensitive dogs or breeds.
• Dogs should have a negative heartworm test result before use.2

Milbemycin oxime
• 1.5 to 2 mg/kg po q 24h.2

10% Moxidectin and 2.5% imidacloprid
• Can be used every other week; however, weekly applications appear to be more effective.5,6

Doramectin
• 600 µg/kg body weight SC once weekly. Do not use in ivermectin-sensitive dogs. Shown to be effective in 2 small studies.7,8

Cats
Feline otic demodicosis
• Topical ivermectin or topical milbemycin oxime1,2

Generalised demodicosis due to *D gatoi* or *D cati*1,2
• Lime sulfur (topical leave-on agent) safest treatment: use once or twice weekly for 6 weeks; higher concentration recommended for faster resolution (1:15 dilution in water; mix thoroughly; cats tolerate better if water is warm). Apply thoroughly (rose-garden sprayer can be used) and soak coat and skin.
• Do not rinse off solution. Keep cats warm. Use in well-ventilated area.
• Milbemycin oxime: 1.0 to 2.0 mg/kg q 24h. Well tolerated by most cats; can cause vomiting and diarrhoea and, rarely, neurologic signs.
• Aqueous ivermectin: 300 to 600 µg/kg orally q 24h; can be mixed in canned cat food; neurotoxicosis may develop.
• Doramectin: 600 µg/kg once weekly by SC injection.7
• 10% Moxidectin and 2.5% imidacloprid: used in small number of cats anecdotally; administered weekly or every other week.

Response to treatment trial
• Treat all cats suspected of having *D gatoi* infestation for at least 6 weeks.

FOLLOW-UP

Patient Monitoring
• Treatment continues in dogs until at least 2 or preferably 3 consecutive skin scrapings are negative at 1- to 2-week intervals.
• The most common treatment error is stopping treatment too soon.

Complications
• Relapse of generalised demodicosis in dogs is not uncommon.
• Adult cats or dogs with demodicosis due to an underlying disease may not be able to achieve remission unless that disease is treated, cured, or controlled.

FUTURE FOLLOW-UP
• Dogs with generalised demodicosis will require lifelong monitoring for relapses. A dog is considered “cured” when no relapses have occurred for at least 1 year.
• Cats with *D gatoi* can be cured, and relapse is not an observed problem. *D cati* infestation will not resolve unless medical disease is treated or managed.

Precautions/Interactions
• Dogs without an ivermectin-sensitive genotype can show signs of toxicosis if ivermectin is given with P-glycoprotein inhibitors.
• Some more commonly used agents in veterinary dermatology include erythromycin, itraconazole, ketoconazole, cyclosporine, and tacrolimus. (Note: Oral tacrolimus use to date has been limited but may increase as this drug becomes more affordable.9)
• In most cases, application of topical tacrolimus will not result in significant absorption. In humans, however, if the agent is used over large areas, significant absorption is possible.10
• Do not use glucocorticoids in these patients.

The approach to demodicosis and our emphasis in South Africa differs slightly to that in the article. We have outlined additional information according to the subheadings in the article. See page 12. Editor
Additional points on Demodicosis

By Dr Heidi Schroeder BVSc MMedVet (Med)
Small Animal Physician
Edited - Dr L van der Merwe

Causes:
Recent evidence has indicated that it is likely that all three forms of canine demodex mites are, in fact, *De-
modex canis*. They all however, seem to respond in a similar manner to treatment protocols 1.

Signalment:
In South Africa, the Scottish Terrier and Boerboel also seem to be predisposed to demodicosis. Feline demodi-
cosis is not very common but may be under-diagnosed.

Definitive Diagnosis:
1. **Skin scrapings:** the number of mites per scrape (dead or alive), of each life stage should be recorded at each visit to help monitor response to treatment.
2. **Trichograms (hair pluck)** are used to find adult mites on hair shafts in areas difficult to scrape e.g. peri-
bital and interdigital areas. Hairs are plucked with a forceps and placed into a drop of mineral oil on a slide. Trichography is easy but is not as reliable as a skin scraping.
3. **Skin biopsies** for histopathological examination may be necessary when skin scrapings are negative for mites, but the clinical suspicion is high. This is often necessary for patients with thick skin, e.g. Shar-Pei dogs and in chronic pedal demodicosis.
4. **Cytology** of exudates can reveal mites in cases where mites are abundant. Secondary bacterial pyo-
derma is diagnosed where bacteria are found inside the neutrophils.

Laboratory Testing:
Serology or PCR for *E canis* is indicated, as South Africa is an endemic region. The MDR -1 gene (multidrug re-
sistant gene) is now called the ABD8-δ genotype. Test-
ing for this genotype is recommended for all dogs, but especially shelties, collies and other herding breeds be-
ing placed on macrocyclic lactone therapy. Some prod-

TREATMENT:

**Amitraz:**
Amitraz is an approved treatment for canine demode-
cosis. It is a topical medication applied as a rinse every 7-14 days. The recommended concentration varies between 0.025% - 0.06%. Clinical efficacy increases with shorter treatment intervals and increasing concentra-
tions. A benzoyl-peroxide shampoo prior to the rinse is beneficial due to its follicular flushing and ker-

Studies have shown that amitraz rinses are less effec-
tive in adult onset demodicosis as only 33% of dogs showed a response in contrast to 66% of dogs with juvenile onset demodicosis2. Higher concentrations with shorter treatment intervals may be required in these cases. Daily topical footbaths with amitraz are indicated for dogs with pedal demodicosis. The use of amitraz is not recommended in younger dogs (<4-6 months) and signs of toxicity/adverse effects include depression, sedation, ataxia, bradycardia, polyuria, polydipsia, hypothermia and hyperglycaemia. Patients with diabetes mellitus should ideally not be treated with amitraz. Certain toy breeds e.g. Chihuahuas, are more likely to experience the side effects of this drug. Yohimbine, a α2-adrenergic antagonist at 0.1mg/kg im, is the antidote when side effects are severe.

**Ivermectin**
Ivermectin is the first choice for many dermatologists, although it is not licensed for use in canine demodic-
cosis. It is easy to administer and is cost effective. The oral route is most effective and a number of studies evaluating daily administration showed good treat-
Genetic diseases affect many canine breeds, for which there is no cure. The genetic tests on offer at Inqaba Biotechnical Industries (Pty) Ltd are used by responsible breeders as a tool that ensures puppies are genetically healthy. It’s not the years in your dog’s life that you remember; it is the life in it.

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Ment success. This is in contrast to studies evaluating weekly injections of ivermectin, which gave variable and inconsistent results. The most current practice guidelines recommend oral ivermectin at a dose of 0.3 – 0.6mg/kg daily (300-600µg/kg) for the treatment of generalised demodicosis. The lower dose of 0.3mg/kg is usually effective. Some veterinarians use the injectable ivermectin formulation orally. A pharmacokinetics study has determined that the terminal drug half-life, as well as mean tissue residence time is the same using the oral or SQ route of both injectable ivermectin as well as doramectin. In fact, the oral administration of the drug actually showed an increased maximum plasma concentration and more rapid absorption. The advantage of this is that the volume of administration is much less as the injectable is more concentrated. However, there are no publications on the effect on efficacy. Two-thirds of dogs with adult onset demodicosis respond to ivermectin therapy. Due to the severe side effects, especially in herding breeds, it has been recommended to gradually increase the daily ivermectin dose over 5 days. A starting dose of 0.05mg/kg on day 1, 0.1mg/kg on day 2, 0.15mg/kg on day 3, 0.2 mg/kg on day 4 and 0.3mg/kg on day 5 is recommended. Mydriasis and ataxia are signs indicating ivermectin sensitivity.

Doramectin (Dectomax®)
Doramectin is reported as successful in treating canine demodicosis but is also not licensed for use in dogs. The recommended dose is 0.6mg/kg SQ once a week or 0.3mg/kg orally twice a week. The drug is not safer than ivermectin – thus the same incremental increase is recommended.

Milbemycin Oxime (Milbemax®)
Milbemycin is a licensed drug for the treatment of demodecosis and an alternative in ivermectin and doramectin sensitive breeds. The recommended dosage is 1-2mg/kg/day orally and it is therefore very expensive.

2.5% Moxidectin + 10% Imidacloprid (Advocate®)
A study has shown that the weekly application of Advocate® can be recommended as effective for the treatment for canine demodicosis without the potential for toxicity associated with ivermectin, where the 10mg/ml solution was used orally at 500µg/kg oid. It is important to note that this product is not very effective against ticks.

When to stop treatment: Treatment should only stop when no parasites can be demonstrated on multiple skin scrapes taken 2 weeks apart. Clinical signs will subside long before this and the disease will relapse if treatment is stopped too early.

REFERENCES
Question 1: Which of the breeds listed below is NOT predisposed to juvenile canine demodicosis?
   a. Scottish terrier
   b. Labrador retriever
   c. Pug
   d. Shar pei
   e. Bull dog

Question 2: Which of the statements below is incorrect?
   a. Demodex can be contagious in cats
   b. Demodex can be contagious in dogs
   c. Demodex is a normal inhabitant of the skin.
   d. Chronic use of immunosuppressive drugs is a risk for developing demodicosis
   e. Focal demodex is common in puppies

Question 3: Which of the clinical signs listed below is NEVER present in juvenile demodicosis?
   a. Patchy Alopecia
   b. Superficial pyoderma
   c. Deep pyoderma
   d. Lymphadenopathy and fever
   e. Muco-cutaenoeus dermatitis

Question 4: Which of the statements below is not of value when making a definitive diagnosis of demodicosis?
   a. Seeing all stages of parasites on a deep skin scraping
   b. Seeing parasites in a faecal flotation
   c. Seeing parasites on the hairshafts in a hair pluck
   d. The presence of an eosinophilia in the blood smear.
   e. Performing a skin biopsy

Question 5: Which of the conditions listed below is NOT one which would predispose a patient to developing demodicosis?
   a. Addisons disease
   b. Chronic ehrlichiosis
   c. Hypothyroidism
   d. Canine cushings disease
   e. Diabetes mellitus

Question 6: Which of the following is NOT true of juvenile demodicosis.
   a. Affects puppies at about 4-6 months of age
   b. Short-haired breeds are predisposed.
   c. The history of dogs with adult onset demodicosis normally shows an episode of juvenile demodicosis.
   d. May present as localised or generalised demodicosis
   e. May present only as severe pododermatitis

Question 7: Which of the facts listed below does NOT apply to Amitraz?
   a. Amitraz is registered for use in canine demodicosis
   b. Amitraz is indicated as initial treatment in demodicosis complicated by deep pyoderma
   c. Amitraz is more effective if used after a benzoyl peroxide shampoo bath.
   d. Amitraz has no known breed sensitivities
   e. Amitraz causes depression and ataxia as a mild side effect

Question 8: With regard to ACBC-δ-1 gene-deficient dogs – which of the statements below is incorrect?
   a. Herding dogs, collies and sight hounds are sensitive breeds
   b. Doramectin is safer than Ivermectin
   c. The test to evaluate a patient for ivermectin sensitivity is available in laboratories in South Africa.
   d. Gradual titration of the dose will help limit side effects
   e. Moxidectin preparations are safer than the avermectins

Question 9: Which of the following statements regarding demodicosis in dogs is correct?
   a. Underlying disease conditions are found in all dogs affected with adult onset demodicosis
   b. The recommended treatments amitraz and Ivermectin are 100% effective in curing the disease
   c. Affected dogs have an inherent immunological defect allowing infection to occur, and should preferably not be used for breeding
   d. Side effects of medication, if present, will decrease in severity during the first week of treatment.
   e. The disease can always be managed on an outpatient basis

Question 10: Which of the treatments listed is the safest treatment for demodicosis in cats?
   a. Topical ivermectin
   b. Topical lime sulphur “leave on” agent
   c. Topical milbemycin
   d. 2.5% Moxidectin +10% imidaclopramide
   e. Ivermectin per os

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