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Canine Pododermatitis Part 1 Causes and Clinical Presentations

Dr Heidi Schroeder, BVSc, MMedVet(Med)

Definition:
Pododermatitis is defined as inflammation of the skin and connective tissue of the paw(s). Affected tissues may include haired digital and interdigital skin, footpads, nail folds and nails. Pododermatitis is not a diagnosis, but rather describes a dermatologic reaction pattern.

Causes:
Canine pododermatitis is often associated with one or more causes and factors similar to otitis externa. Each case has one or more primary causes and is frequently complicated by secondary factors.

In many cases predisposing factors exist that predispose to the pododermatitis and in many, especially the chronic cases, there are perpetuating factors that prevent resolution of the condition. The most important primary causes are given in Table 1.

Table 1. The most important primary causes of canine pododermatitis

Allergic causes	Atopic dermatitis (CAD), food allergy/ cutaneous adverse food reactions (CAFR), contact allergy, flea allergy dermatitis (FAD)
Infectious causes	Superficial and deep bacterial and fungal infections; viral infections: Papilloma virus
Parasitic causes	Demodex, hookworms, ticks
Endocrine causes	Hypothyroidism, hyperadrenocorticism
Neoplastic causes	Cutaneous lymphoma, squamous cell carcinoma (SCC), mast cell tumour, melanoma
Autoimmune causes	Pemphigus complex, systemic lupus erythematosus
Immune mediated causes	Vasculitis, systemic lupoid onychodystrophy (SLO), cutaneous adverse drug reactions, toxic epidermal necrolysis, erythema multiforme
Idiopathic / Miscellaneous causes	Idiopathic hyperkeratosis, interdigital follicular cysts syndrome
Metabolic causes	Hepatocutaneous syndrome, Zn responsive dermatitis
Environmental causes	Trauma, foreign bodies, burns, frost bite, contact irritant dermatitis

Secondary factors are bacterial and yeast infections, predisposing factors include breed, conformation, obesity and trauma and perpetuating factors include fibrosis, scarring and interdigital cysts. These will be discussed later.

Clinical manifestations:
Although there are many causes and factors involved in most pododermatitis cases, these cases often have very similar clinical manifestations. Three different clinical manifestations have been described, namely Types 1, 2 and 3 Pododermatitis. The causes and clinical signs seen with each of these will be discussed.

Type 1 Pododermatitis:
Clinical signs:
Acute cases typically present with inflammatory erythema and alopecia of the paws and interdigital webs. Pruritus is variable but may be intense. Chronic cases present with lichenification and hyperpigmentation. Secondary superficial bacterial and/or *Malassezia* yeast infections are common.

Causes of Type 1 Pododermatitis:
The causes of type 1 Pododermatitis are given in Table 2.

Table 2. Causes of type 1 Pododermatitis (courtesy dr Rob Hilton)

Common causes	Less common causes
Allergies: Canine atopic dermatitis (CAD) "Food allergy"/CAFR	Allergies: Contact allergy Flea allergic dermatitis (FAD)
Pododemodicosis	Viral infections e.g. Papilloma virus
Malassezia dermatitis	Miscellaneous conditions: Hookworm dermatitis Minor trauma Burns
Dermatophytosis	

Allergic pododermatitis: Allergic pododermatitis is the most common cause of pododermatitis. Canine atopic dermatitis (CAD) and "Food allergy" (CAFR) are the most common causes of allergic pododermatitis.

A small number of cases are caused by contact allergy and flea allergic dermatitis (FAD). CAD and CAFR are clinically indistinguishable, as both conditions present with inflammatory erythema and pruritus of the dorsal and ventral interdigital skin, ventral inter-pad skin and flexor surface of front and extensor surface of rear paws. Nail bed involvement (paronychia) may be present in some cases. Typically, other ventral aspects such as the axillae and ventral abdomen, as well as the face, often including the ears, are often affected in both conditions. CAD is more common than CAFR. The pathogenesis of pododermatitis in CAD involves transcutaneous allergen absorption which initiates the allergy. Typically, in CAD, clinical signs such as licking, starts on front paws, then progresses to all 4 paws. In cases with contact allergy all 4 paws and with FAD only the back paws are affected. Secondary bacterial and/or *Malassezia* dermatitis are common. It is crucial to always address primary allergic skin disease and secondary infections simultaneously, otherwise cases may become chronic and unresponsive to therapy.

Pododemodicosis: *Demodex canis* is a common cause of canine pododermatitis and therefore a mandatory differential diagnosis of any canine pododermatitis case. One or all paws may be affected. Pododemodicosis is a form of generalised demodicosis. It is most commonly seen in young dogs with generalised demodicosis but can present as a separate entity. It may follow resolution of generalised demodicosis. Perioral demodicosis is often seen with pododemodicosis. In cases with adult onset pododemodicosis, a serious attempt should be made to identify the underlying predisposing immunosuppressive disease, although in 30-40% of cases, no cause is found. Pododemodicosis cases typically present with alopecia, erythema, swelling, crusting, scaling and comedones of one or more paws. The comedones have a characteristic grey colour and should alert the

December 2020

clinician that demodex mites may be present. The foot pads may also be affected and are typically crusty and thickened. The mite infestations are often complicated by bacterial infections and may manifest with folliculitis and deep pyoderma. Long-haired breeds do not develop alopecia as often as short-haired breeds. This condition is often pruritic and wrongly diagnosed as an allergy. Therefore, demodicosis should be ruled out in every case presenting with pruritic paws and a pruritic face, before assuming it is an allergy and treatment is initiated.

***Malassezia* pododermatitis:** *Malassezia* pachydermatis may be a primary cause, although it is a common secondary factor in many cases of pododermatitis, especially in allergies caused by CAD and/or CAFR. The clinical signs include pruritus, erythema, greasy exudation and alopecia of the dorsal interdigital webs and between the foot pads as well as brown staining of the hair and proximal nails. It should be remembered that salivary staining also causes brown discoloration of hairs and therefore the yeast infections should always be confirmed with cytology (see later).

Dermatophytosis: Superficial fungal infections with *Microsporum* and in rare cases *Trichophyton* are among the common causes of pododermatitis. Typical clinical signs include any combination of hair loss, papules, scales, crusts, erythema, follicular plugging, hyperpigmentation and changes in nail growth and/or appearance. Typically, lesions are asymmetrical. Pruritus is variable, but in general is minimal to absent.

Type 2 Pododermatitis:
Clinical signs:
The lesions are typically deeper with erosions, ulcers, nodules and draining tracts present on the paws. This condition is often painful, may cause severe discomfort and limping is often present. Type 1 cases may progress to Type 2 if not managed and treated appropriately.

Causes of Type 2 Pododermatitis:

The causes of type 2 Pododermatitis are given in Table 3.

Table 3. Causes of type 2 Pododermatitis (courtesy dr Rob Hilton)

Progression of type 1 Pododermatitis	Pododemodicosis, allergies
Deep bacterial infections	*Staphylococcus pseudintermedius* Other gram + and gram - bacteria, anaerobes, atypical bacteria
Superficial fungal infections Deep fungal infections	Dermatophytosis, *Malassezia*, Candidiasis Phaeohyphomycosis, Sporotrichosis
Autoimmune & Immune mediated conditions	Pemphigus complex, vasculitis, drug eruptions
Foreign body reactions	
Neoplastic conditions	Squamous cell carcinoma (SCC), cutaneous lymphoma, melanomas, mast cell tumours
Miscellaneous/idiopathic conditions	Interdigital follicular cyst syndrome
Endocrine disease	Hypothyroidism, Hyperadrenocorticism

Bacterial pododermatitis: Bacterial pododermatitis is a common secondary factor in many pododermatitis cases but may also be a primary cause. *Staphylococcus pseudintermedius* is the most common cause. Other bacteria that may be cultured include other gram-positive and gram-negative bacteria, anaerobes and atypical bacteria e.g. mycobacteria, *Actinomyces* and *Nocardia*. Clinical signs vary depending on depth of infection.

Superficial infections mostly affect the interdigital webs. The paws generally manifest with inflammatory erythema and pruritus is common. Unlike superficial pyoderma elsewhere on the skin, pustules and collarettes are usually not seen with superficial bacterial pododermatitis. With deep pyoderma haemorrhagic bullae, swelling, draining tracts and crusting are often present. The interdigital webs, plantar aspects of the paws and the foot pad margins are mostly affected. As mentioned above, bacterial pododermatitis is almost always a secondary disease and always recurrent unless the predisposing cause is identified and corrected. The most common underlying causes of bacterial pododermatitis include allergies (CAD and/or CAFR) and *Demodex canis* and less commonly endocrinopathies (hypothyroidism, hyperadrenocorticism) and foreign bodies.

Neoplasia: Melanomas, squamous cell carcinomas, cutaneous lymphoma and mast cell tumours are common neoplasms of the paws. All of these have a guarded prognosis and early identification and intervention therefore crucial. Melanoma lesions are usually variably circumscribed (well to poor), coloured (grey, brown and black), range in size from 0.5 - 10 cm in diameter and are often ulcerated. Squamous cell carcinoma (SCC) lesions are typically proliferative, ulcerated and cauliflower-like. Cutaneous lymphoma (Mycosis fungoides) can manifest with foot pad lesions as well as skin lesions. The foot pads are frequently hyperkeratotic, ulcerated and depigmented. The skin lesions seen include erythema, scaling, plaques and depigmentation. Mast cell tumour lesions are usually solitary, soft to firm and the overlying skin erythematous, eroded or ulcerated.

Interdigital follicular cyst syndrome: This syndrome encompasses the following conditions which are all very similar and, in some cases, probably the same condition: Interdigital follicular cysts, sterile pyogranulomatous pododermatitis, conformational pododermatitis, recurrent interdigital furunculosis and idiopathic interdigital pododermatitis. The characteristic clinical features of all of these conditions include interdigital follicular cysts, recurrent interdigital pyogranulomatous dermatitis and inflammatory (draining) nodules in the dorsal interdigital spaces. It is common in young adult, large breed, short-coated breeds such as English Bulldogs, Great Danes, Labrador Retrievers, American Staffordshire Terriers, Bull Terriers, Boxers as well as Dachshunds. It is a multifactorial condition with primary, predisposing and perpetuating factors that lead to secondary infections. The pathogenesis is complicated but can be simplified as endogenous foreign body reactions to free keratin from follicular rupture and secondary bacterial infections which perpetuate the process of pododermatitis. The front paws, especially the lateral interdigital spaces of digits 4 and 5, are most commonly affected. Lesions may occur on all four paws and affect more than one interdigital space. The lesions that present on the dorsal aspects are the most obvious and are usually haemorrhagic bulla and recurrent haemorrhagic, draining lesions. There may also be scarring from previous ruptures. The dorsal lesions are often misinterpreted to be primary lesion. The ventral lesions are the most important and include comedones, alopecia, hyperkeratosis and callus formation. They occur on the opposite side of the dorsal draining tract. Failure to recognize the ventral pathology leads to treatment failure and recurrent draining lesions.

Type 3 Pododermatitis:
These are conditions of the foot pads that may extend into interdigital skin. These include hepatocutaneous syndrome, autoimmune and immune mediated conditions (e.g. pemphigus foliaceus and vasculitis), Zinc responsive dermatosis, idiopathic hyperkeratosis, Papilloma virus and hookworm dermatitis. Each of these are unique. The most common conditions will be discussed.

Pemphigus foliaceus: This is an uncommon, sterile, autoimmune, pustular skin disease that usually affects middle aged to older dogs. The pathogenesis involves autoantibodies that target the desmosomal proteins in the upper layers of the stratum corneum. This leads to acantholysis and subcorneal pustule formation. There are many triggers, including genetics and drugs. Primary lesions are pustules which are fragile and often difficult to find, and

crusts, which are remnants of dried-up pustules and more commonly seen. Lesions typically occur on the face (periocular and nose bridge), inner surface of pinnae and on the foot pads, but the lesions may be generalized. The foot pads are often swollen and hyperkeratotic with scaling, crusting, hardening and fissuring. Layers of dry pustules may be present on the edges of foot pads. There are usually no systemic signs, but the lesions may be painful.

Hepatocutaneous syndrome (AKA necrolytic migratory erythema, superficial necrolytic dermatitis, metabolic epidermal necrosis, diabetic dermatopathy): This condition is uncommon in dogs and very rare in cats. It usually affects older dogs. It is a necrotising dermatitis and hyperkeratosis associated with internal disease, usually chronic liver disease (cirrhosis, drug-induced hepatitis (phenobarbital) and chronic active hepatitis) and glucagonoma.

The pathogenesis is incompletely understood, but one proposed explanation is that low plasma amino acid concentrations caused by internal disease, result in depleted epidermal protein and subsequent keratinocyte damage which causes the clinical signs seen. Skin signs may present before signs of liver disease. The foot pads, mucocutaneous junctions (lips, nasal planum, genitalia) and friction points (elbows, hocks, distal extremities) are typically affected.
The foot pad lesions are painful and include hyperkeratosis, cracks, fissures, erosions and crusting and are often the reason for seeking veterinary attention. Lesions elsewhere include erythema, erosions, ulcerations, alopecia, crusting, scaling, hyperkeratosis. Concurrent lethargy, inappetence, weight loss and diabetes mellitus are common.

Symmetric Lupoid Onychodystrophy (SLO): SLO is a rare disease, with a suspected immune mediated pathogenesis. It affects young to middle-aged dogs, especially German Shepherds and Rottweilers, but any breed may be affected. The principal feature of SLO is nail loss (onychomadesis). Initially 1 or 2, but within few months, all nails may be lost. All four paws are typically affected, often the front paws more severely. The affected paws are frequently painful. Claws usually grow back, but are misshapen, brittle, discoloured and friable and usually slough subsequently. Paronychia is not a common feature. Apart from the claw lesions, affected dogs are healthy. Some cases have been linked to "food allergy" (CAFR).

Secondary factors:
Secondary infections with *Staphylococcus pseudintermedius, Streptococcus, E. coli, Klebsiella, Pseudomonas* and *Malassezia* are very common. Pododermatitis cases are especially predisposed to infections due to close contact with soil based potential pathogens, a moist and altered micro-environment, inflammation and an altered barrier function. There can be multiple infections at different depths, especially in chronic cases.

Predisposing factors:
The most important predisposing factors are given in Table 4.

Table 4. The most important predisposing factors of canine pododermatitis.

Short hair coat breeds	English Bulldogs, Great Danes, Bassets, Mastiffs, Bull Terriers, Staffordshire Terriers, Boxers, Dachshund
Paw shape	Breeds with wide-based paws and/or greater distance between pads are more likely to bear weight on haired skin between pads, e.g. Labrador Retrievers, English Bulldogs, German Shepherds, Pekinese
Increased weight bearing	Obesity, large breed dogs, more pressure on interdigital spaces when walking, excessively splayed feet
Altered weight bearing	Dogs with arthritis, other joint problems, congenital/acquired anatomic deformities put more pressure on interdigital spaces when walking, excessively splayed feet
Licking, pruritic behaviour	Paw licking, chewing can cause hair and skin irritation
Environment	Trauma – feet subject to large variety, front feet more e.g. rough ground, tar, soil
Way of life	Digging, working, hunting, aid dogs, outdoor dogs
Systemic disease	Immunosuppression, neoplastic disease, debilitation

Perpetuating factors:
These are factors that prevent resolution and include persistent endogenous foreign body reactions (keratin) which cause interdigital follicular cysts and sinus tracts; weight bearing on haired skin which results in plantar paw trauma and irritation; deep tissue pockets; fibrosis and scarring; conjoined pads and new pad formation.

The SAVA Stress Management Hotline is there to assist members who are experiencing personal problems by offering access to professional counselling/advice.

The hotline can assist with referrals or simply offer much needed emotional support when anxiety, depression, anger, grief, loneliness and fear are at their highest.

The following SAVA members are available on the SAVA stress management hotline. If required, they will refer you to professionals.

Ken Pettey	082 882 7356	ken.pettey@up.ac.za
Tod Collins	083 350 1662	collins@nudvet.co.za
Aileen Pypers	072 599 8737	aileen.vet@gmail.com
Willem Schultheiss	082 323 7019	willem.schultheiss@ceva.com
Nico Schutte	023 626 3516	doknico@tiscali.co.za
Ian Alleman	072 558 4883	accommodation@nieu-bethesda.com
Ellené Kleyn	082 881 8661	elly1@mweb.co.za
Mike Lowry	084 581 2624	mikelowry@sai.co.za

QUESTION 1

Which of the following statements is TRUE?
Canine pododermatitis is
a. often associated with one or more causes and factors similar to otitis interna
b. defined as inflammation of the skin and connective tissue of the nail(s)
c. always associated with predisposing and perpetuating factors
d. not a diagnosis, but rather describes a dermatologic reaction pattern
e. a specific condition with only one cause

QUESTION 2

Which of the following statements is FALSE:
a. Pododermatitis cases often have very similar clinical manifestations
b. Three different clinical manifestations have been described, namely Types 1, 2 and 3
c. Secondary factors are bacterial and yeast infections
d. Predisposing factors include breed, conformation, obesity and trauma
e. Perpetuating factors promote resolution of the condition

QUESTION 3

Which of the following statements regarding Type 1 Pododermatitis is TRUE:
a. Acute cases typically present with lichenification and hyperpigmentation
b. Pruritus is variable but may be intense
c. Secondary deep bacterial and/or *Malassezia* yeast infections are common
d. Common causes include viral infections, hookworm dermatitis and contact allergy
e. Uncommon causes include CAD, CAFR, pododemodicosis and *Malassezia*

QUESTION 4

Which of the following statements regarding Allergic pododermatitis is FALSE:
a. Allergic pododermatitis is the most common cause of pododermatitis
b. CAD and CAFR cause lesions on the flexor surface of the front and extensor surface of the rear paws
c. In CAD only the front paws are affected and in FAD only the back paws
d. Secondary bacterial and/or Malassezia dermatitis are common
e. It is crucial to always address allergic skin disease and secondary infections simultaneously

QUESTION 5

Which of the following statements is TRUE? Pododemodicosis
a. is a form of localised demodicosis
b. is often seen with periocular demodicosis
c. cases typically present with alopecia, crusting and scaling
d. cases typically have characteristic black coloured comedones
e. cases are often complicated by fungal infections

QUESTION 6

Which of the following statements regarding Type 2 Pododermatitis is FALSE
a. Type 2 cases present with lesions such as ulcers, nodules and draining tracts on the paws
b. Type 1 cases may progress to Type 2 if they are not managed and treated appropriately
c. Type 2 pododermatitis is often painful and may cause severe discomfort and limping
d. Causes include viral infections, deep bacterial infections and superficial fungal infections
e. Interdigital follicular cyst syndrome is a type 2 pododermatitis

QUESTION 7

Which of the following statements regarding bacterial pododermatitis is FALSE
a. Bacterial pododermatitis is a common secondary factor but may also be a primary cause
b. *Staphylococcus pseudintermedius* is the most common cause
c. Superficial infections generally manifest with pustules and collarettes
d. Deep infections generally present with haemorrhagic bullae, swelling and draining tracts
e. Bacterial pododermatitis is less commonly caused by endocrinopathies and foreign bodies

QUESTION 8

Which of the following statements is TRUE? Interdigital follicular cyst syndrome
a. is common in adult, large breed, long-coated breeds
b. is a multifactorial condition with primary, predisposing and perpetuating factors that lead to secondary infections
c. is characterised by inflammatory (draining) nodules in the ventral interdigital spaces
d. only affects the front paws
e. typically affects the lateral interdigital spaces of digits 1 and 2

QUESTION 9

Which of the following statements is FALSE
a. With Pemphigus foliaceus, the foot pads are often swollen and hyperkeratotic with scaling
b. Hepatocutaneous syndrome is a necrotising dermatitis associated with internal disease
c. In hepatocutaneous syndrome the skin signs usually follow the signs of liver disease
d. The principle feature of SLO is nail loss (onychomadesis)
e. With SLO the nails usually grow back, but are misshapen, brittle, discoloured and friable

QUESTION 10

Which of the following is not a predisposing factor for pododermatitis
a. Paw shape
b. Decreased weight bearing
c. Altered weight bearing
d. Licking, pruritic behaviour
e. Systemic disease

SAVC CPD Accreditation Code: AC/0225/20
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