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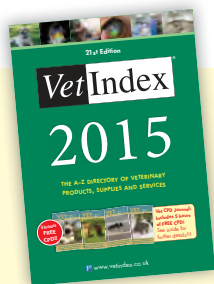
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Scaling and crusting in dogs: Part 1 – diagnostic approach

Scaling and crusting are common presentations in canine clinical practice. They can occur secondary to pruritus, infection, hormonal/nutritional/metabolic imbalances, and neoplasia, or be manifestations of a primary keratinisation defect. Primary keratinisation defects include idiopathic seborrhoea, ichthyosis, vitamin A-responsive dermatosis, zinc-responsive dermatosis, follicular dysplasia, acne, schnauzer comedo syndrome, and sebaceous adenitis. A primary keratinisation defect can be diagnosed only when secondary scaling and crusting disorders have been eliminated. A thorough, methodical diagnostic approach is required.

Key words: Scale, crust, keratinisation, pruritus, diagnosis, inflammation, primary, secondary.

Introduction

Over 20% of consultations in small animal practice are estimated to involve animals with a dermatological problem (Hill, 2006), the vast majority presenting with at least some degree of scaling and crusting. Scaling and crusting can occur secondary to pruritus, infection, hormonal/nutritional/metabolic imbalances, and neoplasia (secondary scaling and crusting disorders), or can indicate a primary, inherited keratinisation defect (Fig 1,2). Scaling and crusting in dogs are secondary in over 80% of cases (Shanley and Kwochka, 2003).

Lesion morphology

Scale

Scale is an accumulation of loose fragments of the horny layer (stratum corneum) of the skin (Miller, Griffin, Campbell, 2013). It may be seen when epidermal maturation, desquamation (shedding of corneocytes), keratinisation (synthesis of the principal fibrous proteins of the keratinocyte), apocrine or sebaceous glandular function, or intercellular lipid formation are abnormal. Scaling occurs frequently in chronic inflammation but also in primary keratinisation defects. Scale varies in colour (e.g. white, silver, yellow or brown) and consistency (e.g. fine, powdery, dry, greasy, loose or adherent) (Figure 3). The nature of the scale may be helpful in distinguishing certain secondary scaling disorders. Dry scale with minimal inflammation and pruritus may be seen in endocrinopathy, dermatophytosis, endoparasitism, cheyletiellosis, and demodicosis whereas waxy, greasy scale with inflammation and pruritus, is often associated with allergic dermatitis, sarcoptic mange and pyoderma (Figure 4).

Epidermal collarette

An epidermal collarette is a circular rim of scale from the remnants of a papule, pustule, vesicle or bulla (Figure 5). It is often seen in superficial bacterial folliculitis (pyoderma) but can also occur in other conditions including pemphigus foliaceus.

Follicular cast

A follicular cast is an accumulation of keratin and follicular material that adheres to the hair shaft. It can be seen in idiopathic seborrhoea, sebaceous adenitis and vitamin A-responsive dermatosis as well as in secondary scaling disorders such as dermatophytosis, demodicosis and pyoderma.

Comedones (singular: comedo)

Comedones are blackheads resulting from dilation of hair follicles with cornified cells and sebaceous material.

Crust

Crust is an accumulation of dried exudate, serum, pus, blood, cells, scales or medications on the skin surface. Primary crusting disorders include idiopathic seborrhoea and zinc-responsive dermatoses, and secondary crusting disorders include pyoderma and pruritic skin conditions. Crusts are rarely diagnostic but may contain important diagnostic indicators: dermatophyte spores and hyphae; acantholytic keratinocytes typical of pemphigus (Figures 6, 7, 8); and micro-organisms such as bacteria and yeasts.

Seborrhoea

Seborrhoea is a confusing term. In this article, the word is used only in the context of Primary Idiopathic Seborrhoea, believed to be a primary keratinisation disorder.



Figure 1: Crust and scale in a 12-year old Labrador with atopic dermatitis.



Figure 2: Focal crusting and alopecia in an English Bulldog with pyoderma.



Figure 3: Dry, diffuse, powdery, dorsal scale in a pruritic, atopic Greyhound.



Figure 4: Erythema, alopecia, papules and crusting in a West Highland White Terrier with allergic skin disease.



Figure 5: Epidermal collarette in a dog with superficial bacterial folliculitis.

Table 1: Lesions in primary and secondary scaling and crusting disorders

Lesion	Secondary scaling and crusting disorders	Primary scaling and crusting disorders
Scale	Chronic inflammation	Primary idiopathic seborrhoea Ichthyosis Follicular dysplasia
Epidermal collarette	Pyoderma Immune-mediated disease	
Follicular cast	Demodicosis Dermatophytosis	Primary idiopathic seborrhoea Vitamin A-responsive dermatosis Sebaceous adenitis
Comedones	Demodicosis Dermatophytosis	Vitamin A-responsive dermatosis Schnauzer comedo syndrome
Crust	Pyoderma Pruritus	Primary idiopathic seborrhoea Zinc-responsive dermatosis Superficial necrolytic dermatitis
Follicular papules and pustules	Pyoderma Demodicosis Dermatophytosis	
Non-follicular papules and pustules	Flea allergy dermatitis Sarcoptic mange	
Follicular and non-follicular papules and pustules	Pemphigus foliaceus Allergic dermatitis	



Fig 6: Generalised scaling and crusting in a 7-year old cross breed dog with pemphigus foliaceus.

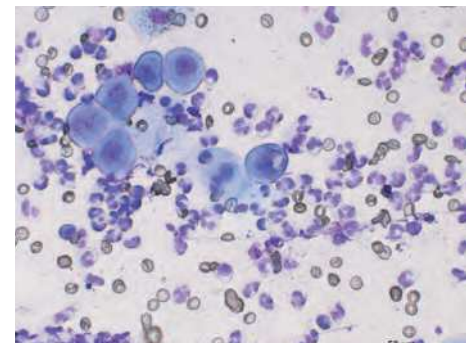


Figure 8: Acantholytic cells, neutrophils (degenerate and non-degenerate) and some cocci.



Figure 7: Focal crusts on the ventral abdomen of a 10-year old Jack Russell Terrier with pemphigus foliaceus.

Photo courtesy of T. Whitbread

Diagnostic approach to crusting and scaling

A methodical diagnostic plan and a co-operative owner are required. The aim of any investigation should be to make a definitive diagnosis and institute appropriate, specific treatment. Secondary scaling and crusting disorders (Table 2) are common and need to be eliminated before primary keratinisation defects (Table 3) can be diagnosed.

History

A complete medical and dermatological history is essential. The patient, home environment and skin condition should each be considered in detail.

The patient

The age (Table 4) and breed (Table 5) of dog may suggest particular conditions (Shanley and Kwochka, 2003). If endocrinopathy is suspected, sex hormone abnormalities appropriate to the individual's gender should be considered.

Family history of skin disease (allergy, idiopathic seborrhoea), general health status, appetite and thirst, change in weight, muscle weakness, and history of systemic disease (hypothyroidism, Cushing's disease) may also provide pointers to the diagnosis.

Home environment

The diet should be checked for nutritional deficiencies, imbalances or inadequacies (vitamin A-responsive dermatosis, zinc-responsive dermatosis). The presence of in-contact animals should be noted along with evidence of contagion to animals and people (cheyletiellosis, scabies, dermatophytosis).

Adequacy of flea control should be assessed.

The skin condition

The following factors should be noted:

Approximate duration – acute (e.g. sarcoptic mange) or chronic (e.g. allergy, endocrinopathy).

Age of onset – this may suggest certain conditions (Table 4).

Initial presenting sign – this may be difficult for the owner to remember in chronic cases but can provide important information.

The presence of pruritus – Many scaling disorders are complicated by staphylococcal and yeast overgrowths which may induce pruritus and further scaling. The level of pruritus should, therefore, be assessed following resolution of secondary

Table 2: Secondary scaling and crusting disorders

Pruritus typically present

- Scabies, pediculosis
- Allergic skin diseases (atopy, flea bite hypersensitivity, food allergy)
- Pyoderma
- *Malassezia* dermatitis

Pruritus typically absent

- Demodicosis
- Endocrinopathy (hypothyroidism, Cushing's disease, sex hormone disorders)
- Nutritional deficiencies/imbalances
- Metabolic disorders (e.g. superficial necrolytic dermatitis (Fig 9,10), diabetes mellitus)

Pruritus variable

- Cheyletiellosis
- Pemphigus foliaceus and other auto-immune disorders
- Dermatophytosis
- Epitheliotropic lymphoma (Figure 11) and other cutaneous neoplasms
- Superficial necrolytic dermatitis
- Adverse drug reaction
- Demodicosis

Table 3: Scaling and crusting disorders thought to be associated with a primary keratinisation defect

- Acne
- Ear margin dermatosis
- Epidermal dysplasia
- Ichthyosis
- Idiopathic seborrhoea
- Schnauzer comedo syndrome
- Sebaceous adenitis
- Vitamin A-responsive dermatosis

Table 4: Age predisposition to onset of crusting and scaling disorders

Age of onset of crusting and scaling	Secondary scaling and crusting disorders	Primary scaling and crusting disorders
Young (0-4 years)	Infectious and parasitic causes (e.g. scabies, cheyletiellosis, pediculosis, demodicosis)	Congenital disorders (e.g. idiopathic seborrhoea, ichthyosis, acne, epidermal dysplasia, Schnauzer comedo syndrome)
Middle-age (5-8 years)	Endocrinopathy (e.g. hypothyroidism, Cushing's disease, sex hormone disorders) Auto-immune disorders (e.g. pemphigus foliaceus)	
Old dog (> 9 years)	Endocrinopathy Auto-immune disorders Cutaneous neoplasms (e.g. epitheliotropic lymphoma) Metabolic disorders	



Figure 9: Perivulval erythema, scaling and crusting in a 10-year old female neutered Cavalier King Charles Spaniel with superficial necrolytic dermatitis.



Figure 10: Crusting and fissuring on the footpads of a 10-year old Cavalier King Charles Spaniel with superficial necrolytic dermatitis.



Figure 11: Erythema and scaling (exfoliative erythroderma) in a 4-year old Airedale Terrier with epitheliotropic lymphoma.

yeast or bacterial dermatitis. Persistent pruritus is suggestive of sarcoptic mange or allergic dermatitis. Pruritus is variable in dermatophytosis, pemphigus and cheyletiellosis, and usually absent in demodicosis, endocrinopathies and metabolic disorders, nutritional deficiencies and imbalances, and cutaneous neoplasia.

Seasonality – flea allergy dermatitis and pollen hypersensitivities are more prevalent in warmer months.

Prior history of skin disease – may indicate recurrent pyoderma, *Malassezia* dermatitis or allergic dermatitis.

Response to prior therapy – response to glucocorticoids is typically good in dogs with allergies and poor in dogs with scabies.

Clinical examination

Every investigation of crusting and scaling must involve a thorough general and dermatological examination of the whole animal, not just the affected area of skin or coat as highlighted by the owner.

General demeanour and level of pruritus should be assessed initially, before a closer inspection, in good lighting, is conducted. Points to note include lesion distribution (Table 6), morphology (Table 1) and

Table 5: Some breed predispositions to primary keratinisation disorders

Breed	Primary keratinisation disorder
Akita	Sebaceous adenitis
Basset	Idiopathic seborrhoea
Boxer	Acne
Cocker Spaniel	Idiopathic seborrhoea, nasodigital hyperkeratosis, vitamin-A responsive dermatosis
Dachshund	Ear margin dermatosis
Doberman	Idiopathic seborrhoea, acne, follicular dysplasia
English Bulldog	Acne
Irish Setter	Idiopathic seborrhoea
Labrador Retriever	Idiopathic seborrhoea, vitamin-A responsive dermatosis
Samoyed	Sebaceous adenitis
Schnauzer – miniature	Schnauzer comedo syndrome
Siberian Husky	Zinc-responsive dermatosis
Springer spaniel	Idiopathic seborrhoea, nasodigital hyperkeratosis, psoriasiform-lichenoid dermatosis
Standard Poodle	Sebaceous adenitis
Vizsla	Sebaceous adenitis
West Highland White Terrier	Idiopathic seborrhoea, epidermal dysplasia, ichthyosis

Table 6: Examples of associations between lesion distribution and underlying aetiology

Initial site	Progression	Differential
Intertriginous areas*, nipples	Generalised	Primary idiopathic seborrhoea
Dorsal head, neck and chest	Trunk and proximal extremities	Sebaceous adenitis
Periocular, perioral areas, dorsal bridge of nose, pinnae, footpads, scrotum, vulva, elbows and pressure points	Remaining localised	Zinc-responsive dermatosis
Feet, face, ears, ventrum	Variable	Atopic dermatitis
Dorsal lumbosacral region, ventrum, limbs	Variable	Flea allergy dermatitis
Dorsum	Dorsum	Flea allergy dermatitis Cheyletiellosis
Ventral neck, chest and abdomen	Marked ceruminous otitis externa Generalised	Vitamin A-responsive dermatosis Sarcoptic mange
Medial pinnae, external ear canal and inguinal region	Variable	Lichenoid psoriasiform dermatosis
Pinnal margin(s)	Remaining localised Generalised	Ear margin dermatosis Sarcoptic mange
Chin	Remaining localised	Acne
Nasal planum, footpads	Remaining localised	Nasodigital hyperkeratosis

*An intertriginous area is where two skin areas may touch or rub together. Examples are the axilla, the anogenital region and between the digits.

configuration (Table 7), character of scale, and evidence of fleas or other ectoparasites. Ideally, this information should be noted on a diagram which should form part of the clinical records. Where appropriate, the owner's permission to clip the hair should be sought to allow a clearer view of the skin.

Diagnostic procedures

After taking the history and carrying out a careful physical examination, a differential diagnosis of between two and six conditions can usually be constructed. To reduce this list, careful selection of appropriate tests is required.

Skin scrapings, hair plucks, coat brushings, tape strips, impression smears, cytology, fungal and bacterial culture, intradermal and *in vitro* allergy tests, haematology and biochemistry profiles, hormonal assays, dietary trials, and skin biopsies may be indicated to help diagnose primary keratinisation defects and eliminate causes of secondary scaling and crusting (Craig, 2014). Primary idiopathic seborrhoea is a diagnosis of exclusion and can, therefore, be made only after eliminating all other differentials (even in a Cocker Spaniel!).

When taking skin biopsies, lesion sites should be clipped only gently, preferably with scissors. If used, clippers should not touch the skin surface. Lesions should be biopsied along with adherent crust and scale (Gross et al. 2005), and never prepped or scrubbed beforehand. Taking four or more samples increases the likelihood of obtaining optimal information.

Conclusion

A detailed diagnostic approach is required. However, this is time-consuming and not always possible or practical. Before embarking on a detailed investigation, the cost, logistics and possible outcomes should be discussed fully with the owner. In addition to the underlying causes of the scaling and crusting, the life-style, patience, finances, attitude and co-operation of the owner are all important factors in determining a successful outcome. In difficult cases, prompt referral may be indicated.

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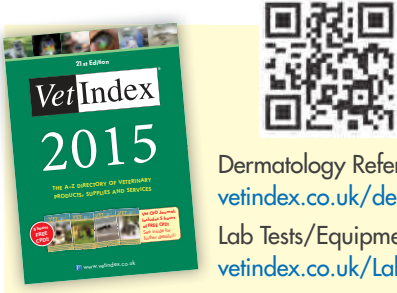
Table 7: Examples of associations between lesion configuration and underlying aetiology

Lesion configuration	Differential
Annular	Spreading pyoderma Demodicosis Dermatophytosis
Single	Acral lick dermatitis Cysts and tumours
Polycyclic – irregular curved shapes	Spreading pyoderma Demodicosis Pyotraumatic dermatitis
Grouped	Pyoderma Insect bites Contact dermatitis Calcinosis cutis
Serpiginous – snake-like pattern	Sarcoptic mange Demodicosis
Central healing (target lesions)	Sarcoptic mange Demodicosis

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1. Which of the following statements is most accurate?

- A) Scale refers to an accumulation of dried exudate, serum, pus, blood, cells, crust or medications on the skin surface
- B) Crust refers to an accumulation of loose fragments of the stratum corneum
- C) Crust refers to an accumulation of dried exudate, serum, pus, blood, cells, scales or medications on the skin surface
- D) The terms scale and crust are interchangeable

2. A follicular cast usually indicates the remnants of a papule, pustule, vesicle or bulla. True or false?

3. Which of the following is not thought to be a primary keratinisation disorder?

- A) Idiopathic seborrhoea
- B) Sebaceous adenitis
- C) Pemphigus foliaceus
- D) None of the above

4. Vitamin A-responsive dermatosis typically presents initially on the ventral neck, chest and abdomen.

True or false?

5. The Cocker Spaniel appears to be predisposed to which of the following conditions?

- A) Idiopathic seborrhoea, vitamin A-responsive dermatosis and nasodigital hyperkeratosis
- B) Idiopathic seborrhoea, vitamin A-responsive dermatosis and zinc-responsive dermatitis
- C) Idiopathic seborrhoea, zinc-responsive dermatosis, and ear margin dermatosis
- D) Idiopathic seborrhoea, zinc-responsive dermatosis, and nasodigital hyperkeratosis

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