One Health: It's for all of us; Understanding Demodicosis in Dogs and Man.

Pamela Kelly[1,2], Ruth Foley[2], Solene Gatault[2], Frank Powell[2], Rory Breathnach[1,2]
[1] University Veterinary Hospital, University College Dublin, Ireland
[2] The Charles Institute of Dermatology, University College Dublin, Ireland

Introduction

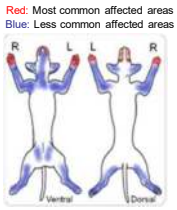
Demodex mites are found living in hair follicles and sebaceous glands of most mammals. While these tiny mites most often live in harmony with their host, their over-population can result and or contribute to serious skin disease. In humans two species are known; *Demodex folliculorum* and *Demodex brevis*. Their over-population has been implicated in several human skin conditions including pityriasis folliculorum, rosacea, blepharitis and perioral dermatitis. In dogs there are three recognised species; *Demodex canis, Demodex cornei* and *Demodex injai*. An over-proliferation of D*emodex* mites in dogs results in a potentially life-threatening skin disease known as canine demodicosis.

Clinical classification and features

Canine demodicosis classification:
Localised lesion distribution
Generalised lesion distribution
Juvenile onset (<18 months of age)
Adult onset (>4year of age).
Lesions consist of areas of scaly, alopecic, lichenified, hyperpigmented, erythematous or pustular rashes.

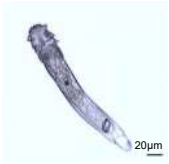
Demodex canis


Canine demodicosis

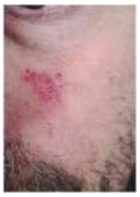


Lesion distribution

Human demodicosis classification:
Primary demodicosis; absence of concurrent or underlying inflammatory skin disease
Secondary demodicosis; secondary to immunosuppression
Rosacea; possible role of *Demodex* mites
Predominantly affects the skin of the face.
Lesions consist of areas of erythema, pustules, papules, nodules and occasionally conjunctivitis.



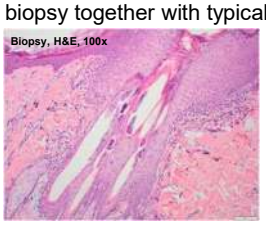
Demodex folliculorum


Rosacea


Lesion distribution

Diagnosis

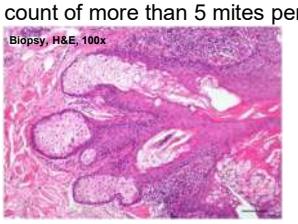
Canine:
Finding of *Demodex* mites within a skin scraping, trichogram or by biopsy together with typical clinical signs is indicative of demodicosis.



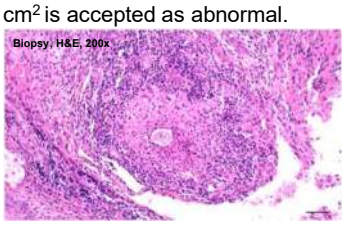
Numerous *Demodex* mites within dilated keratin filled hair follicles (canine)

Perifollicular granuloma centred on *Demodex* mite remnants (canine)

Human:
Meeting phenotypic criteria. Standardised skin surface biopsy; a count of more than 5 mites per cm^2 is accepted as abnormal.



Demodex mites within the follicular lumen extending into the sebaceous glands (human)



Perifollicular granuloma centred on a *Demodex* mite remnant (human)

Treatment

Canine:
Challenging, consist of ascaridal and antimicrobial therapy. Treatment failures due to owner non-compliance, financial constraints, poor drug efficacy and occasional death of patient due to secondary septicaemia. Ivermectin was the treatment of choice, however this has potentially life-threatening side effects (neurotoxic) and cannot be given to Collies (MDR1 gene mutation). Today there are several promising not yet licenced medications within the isoxazoline family.

Human :
Topical and or systemic ascaridal and antimicrobial therapies. Topical ivermectin, permethrin, sodium sulfacetamide/sulphur cleansers, metronidazole cream, azeliac acid cream/gel are commonly used together with antibiotics including doxycycline, minocycline, as well as erythromycin and metronidazole.

Pathogenesis

Canine:
Poorly understood. Modulation of the immune system is likely.
Genetic: certain breeds are predisposed to developing demodicosis.
Activation of immunosuppressive pathway: increased occurrence in dogs on immunosuppressive therapy or with systemic diseases such as neoplasia, hypothyroidism and diabetes mellitus.
Activation of innate immune response via Toll like receptors on keratinocytes

Human:
Poorly understood. Modulation of the immune system is likely.
Activation of immunosuppressive pathway: increased numbers of *Demodex* mites in patients receiving immunosuppressive therapy or with immunosuppressive diseases.
Activation of innate immune response via Toll like receptors.
Modulation of the adaptive immune response: downregulation of T cell expression.

Conclusion/Future research

Our future research is to provide new understanding of the pathogenesis of these important and related diseases through interdisciplinary collaboration. Our main focus is on the role of the innate immune response to *Demodex* mite over-proliferation.

References:
Lacey et al. Br J Dermatol. 2018 Aug;179(2):420-430.
Chen et al. Br J Dermatol. 2014 Jun;170(6):1219-25.
Ferrer et al. Vet Dermatol 2014; 25: 427–e65

"Funding is acknowledged from the UCD Wellcome Institutional Strategic Support Fund, which was financed jointly by University College Dublin and the SFI-HRB-Wellcome Biomedical Research Partnership (ref 204844/Z/16/Z)".