Histopathological Characterization of the lesions of Contagious Ovine Digital Dermatitis (CODD), and Immunolabelling of Treponema-like organisms

J.W. Angell, H.E. Crosby Durani, J.S. Duncan, S.D. Carter, R. Blundell

Introduction
Contagious ovine digital dermatitis (CODD) is a cause of severe lameness in sheep and the three Treponema phylogroups Treponema medium/Treponema vincentii-like, Treponema phagedenis-like and Treponema pedis have been associated with clinical disease. The aims of this study were: (1) to describe the histopathological changes associated with each previously established grade of clinical lesion, and (2) to investigate immunohistochemically the association of the Treponema-like organisms with the observed histopathological changes.

Sampling sites
a) Distal skin and coronary band
b) Dorsal hoof wall and laminae
c) Solar hoof and laminae
d) Distal phalanx

H & E Anti Treponema spp. IHC

Clinically normal
a) Mild lymphoplasmacytic dermatitis of the distal digital skin; b) background IHC labelling.

This mild perivascular, dermal, mainly lymphoplasmacytic ‘background’ infiltrate noted in all specimens.

CODD grade 1
a) superficial inflammatory exudate and intracorneal pustules in dorsal horn adjacent to CB; b) extracellular IHC labelling of eroded material of skin/dorsal horn at CB, and IHC labelling within a fissure extending into the epidermis, the IHC labelling becoming more intense at the deepest point.

More severe inflammatory infiltrate, mildly supplicative (pus), with some pustules in the horn.

CODD grade 2
a) partial separation of dorsal horn and superficial exudate; b) increased detail of separation with IHC labelling between the layers.

Horn beginning to separate; IHC labelling noted at the leading edge of the pathological process.

CODD grade 3
a) intracorneal pustule in the dorsal horn; b) IHC labelling of the pustule; c) Warthin Starry highlighting spirochaetal organisms.

Pustules in horn; IHC labelling associated with the pustules; spirochaetal organisms evident.

CODD grade 4
a) supplicative inflammatory infiltration surrounding a fissure in dorsal horn; b) very scant, superficial IHC labelling in the fissure.

Still inflamed but IHC labelling was much less compared to more ‘active’ lesions.

CODD grade 5
a) moderate multifocal chronic lymphoplasmacytic dermatitis of the distal haired skin/CB; b) mild background IHC labelling of the superficial stratum corneum.

A lessening of the inflammation and associated IHC labelling almost to background levels.

Concluding discussion
This study documents for the first time the histopathological changes associated with clinical lesions of each grade and provides clear evidence of how the lesions develop as the disease progresses. In viewing and interpreting the pathological changes described the background infiltrate should be borne in mind. Acute changes were first observed at the coronary band, followed by very severe necrotizing and fibrinosuppurative lesions with separation of the horn in tissues from lesion grades 2 and 3. Tissues from grade 4 lesions showed signs of chronicity (e.g. granulation tissue), but with supplicative lesions still present. Grade 5 lesions showed evidence of healing, albeit with mild intracorneal supplicative changes still present in some cases. The histological changes in the low-grade lesions clinically appear to commence at the coronary band and then the lesion appears to progress distally down the dorsal horn while the initial site (coronary band) heals. Furthermore, the presence of Treponema-like organisms associated with active lesions add weight to the hypothesis that these bacteria are involved in the aetiopathogenesis of the disease.

Abbreviations
CB: Coronary band
H & E: Haematoxylin and eosin
IHC: Immunohistochemistry

Acknowledgements
This study was supported by a grant from the British Veterinary Association Animal Welfare Foundation, from the Norman Hayward Fund.

Article published in Journal of Comparative Pathology: DOI:10.1016/j.jcpa.2015.10.178