GUIDELINES FOR THE MANAGEMENT OF EXUDATIVE DERMATITIS IN THE COMMON AND SHORT-EARED BRUSHTAIL POSSUM (*TRICHOSURUS VULPECULA AND T. CANINUS*) IN SOUTH-EAST QUEENSLAND

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BACKGROUND TO THESE GUIDELINES

Wildlife rehabilitators in South-east Queensland have long reported a destructive, ulcerative skin condition in Common and Short-eared Brushtail Possums (*Trichosurus vulpecula and T. caninus*), commonly referred to as exudative dermatitis. Affected possums regularly present to wildlife rehabilitators, veterinarians and animal welfare organizations, typically at an advanced stage of infection. Due to the extensive necrosis associated with exudative dermatitis, euthanasia is generally the outcome. The majority of possums also present in an emaciated state, which may indicate an underlying condition or disease.

Little research has previously been undertaken to determine the aetiological agent/s of exudative dermatitis wounds, and as such the precipitating factors responsible for the disease are uncertain (Rose, 2005). No prevalence studies or post-treatment follow-ups have been reported in the literature, and opinion varies as to the best practice for the treatment and management of possums with exudative dermatitis.

Exudative dermatitis in brushtail possums appears analogous to necrotizing fasciitis in humans (caused by Streptococcus pyogenes) and dogs (caused by Streptococcus canis and coagulase positive Staphylococcus). In 2001, The University of Queensland Veterinary Diagnostic Bacteriology Laboratory obtained a pure culture of a Group A streptococcal isolate (*S. pyogenes*) from the wound of a Common brushtail possum with exudative dermatitis (SM Moss, personal communication), providing possible indication that the disease may be similar to necrotizing fasciitis.

In 2008 a pilot study was undertaken in collaboration with The University of Queensland, School of Veterinary Science and various veterinary facilities throughout south-east Queensland to characterize exudative dermatitis lesions and attempt to isolate the organism(s) responsible for the disease. The study focused on the microbiology and clinical pathology associated with exudative dermatitis to assist in determining the aetiology of the disease in possums and whether it is associated with distinct blood profiles. This study has been the first to systematically profile the major bacterial species isolated from a significant number of possums with exudative dermatitis.

Prior to the completion of the 2008 study, limited research had been conducted into exudative dermatitis in possums and only one paper had been published, consisting of six case studies of Common brushtail possums with dermatitis and exudative dermatitis which presented to a veterinary surgery in New South Wales over a period of two years.

These guidelines have been based on the information provided in the 2008 study, which also includes previous published and unpublished information.

WHAT IS EXUDATIVE DERMATITIS

Exudative dermatitis is the term generally used to describe advanced stages of dermatitis (Figure 1).

The clinical signs of Exudative Dermatitis include:

- In early stages: lesions characterized by alopecia, matted fur and thickening of the skin, progressing to areas of scabbing and weeping sores.
- In the advanced stages: lesions become malodorous, ulcerative and exudative (Hemsley and Canfield, 1994; Rose, 2005).

Figure 1: Common brushtail possum with dermatitis (Left) and Short-eared brushtail possum with exudative dermatitis (Right)

The cause(s) of exudative dermatitis remains uncertain. To date, the aetiological agent/s responsible for the disease has not been determined, and the initiation of the disease may rely upon multiple factors (Rose, 2005).

Proposed causes include:

- Hypersensitivity reactions to brushtail possum mite
- Bacterial / fungal infection
- Fighting wounds or other traumatic injuries that become secondarily infected

Exudative dermatitis has been reported to occur most commonly in possums subjected to social stress (Munday, 1988; Rose, 2005). Other proposed risk factors in the development of exudative dermatitis include high population densities, heavy rains and high relative humidity.

Prevalence of exudative dermatitis in the wild is unknown, but anecdotal information from both wildlife rehabilitators and veterinarians suggest that the rate of disease is increasing. This is particularly the case in the Short-eared

brushtail possum, where exudative dermatitis has become increasingly more prevalent in previous years.

Exudative dermatitis appears similar to necrotizing fasciitis in humans and dogs (associated with *Streptococcus pyogenes* and *Strep. canis* respectively), and skin infections caused by *Staphylococcus aureus* (Figure 2 and 3)

Figure 2: Necrotizing fasciitis caused by *Strep. pyogenes* (left) and a *Staph. aureus* skin infection (right)

Figure 2: Necrotizing fasciitis caused by *Strep. canis* in a dog

RESEARCH FINDINGS FROM 2008 STUDY

In total, 43 possums with exudative dermatitis were sampled. Adult possums were the most predominant age class to present with exudative dermatitis (73-75%). No significant difference was found in the male to female ratio between Common and Short-eared brushtail possum. Facial lesions were the most frequently observed type of exudative lesions, followed by the rump, tail and hind limbs. The higher percentage of facial lesions in exudative dermatitis may indicate that lesions are initially caused from fight wounds between individual possums. Aggressive encounters are known to occur between possums, particularly adult males and can include sparing (Kerle, 2001), which could potentially lead to wounds on the face and upper body. Rump and tail lesions were also frequently seen and could be the result of bite wounds from an aggressor, or indeed from a dog. For the large majority of possums, exudative dermatitis lesions were found on multiple parts of the body.

Microbiology/Bacteria Results:

- A large number of bacteria were isolated from exudative dermatitis wounds, predominantly *Staphylococcus* spp. and *Streptococcus* spp. (both associated with infections incl. NF in humans and other animals)
- *Staphylococcus aureus* most common 87% of possums (suspect different phage type to human staph – therefore most likely not a zoonotic risk)
- The high prevalence of staphylococci and streptococci in this study would suggest that these bacteria play a central role in exudative dermatitis infections. The isolation of *Staphylococcus* spp. and *Streptococcus* spp. from samples in almost pure culture on initial culture media was unexpected, as due to the nature and extent of many of the exudative dermatitis lesions, increased presence of opportunistic bacteria and contamination was expected
- Number of bacteria showed resistance to antibiotics

- *Streptococcus canis* - supportive evidence for the theory that at least some possum streptococci may be acquired from canids, as *Streptococcus canis* is common opportunistic pathogen as well as a commensal organism in the mouth and mucous membranes of dogs (DeWinter et al. 1999; Prescott et al. 1995).

Clinical Pathology Results:

- Anaemia was the most prevalent finding in the possums in this study (55-58%)
- Anaemia was predominantly seen female possums (74%)
- Non-regenerative anaemia occurred in 70-80% of possums
- Causes of non-regenerative anaemia can include:
    - Chronic infection;
    - Cancer / leukemia;
    - Bone marrow dysfunction;
    - Chronic, poor nutrition;
    - Renal disease
- Indications of underlying health issues

Blood examination alone was unable to establish a definitive diagnosis in many possums, however it is suggested that an underlying immune-mediated disease could be a factor in the severity of exudative dermatitis in possums.

Histopathology Results:

Histopathology findings showed some indication of underlying condition /disease in 74% of possums. These included:

- Lymphoma & Tumours
- Hepatitis – mild and chronic cases
- Conjunctivitis (hypersensitivity process or immunocompromise)
- Orchitis (testicular inflammation, which in humans is often caused by sexually transmitted infections (STI's – e.g. Chlamydia and gonorrhea)
- Myocarditis (Inflammation of heart muscle - commonly due to viral infection)
- Pancreatitis
- Inflammation of kidneys (pyelonephritis – bacterial infection mainly associated with cystitis and prostatitis)

Further testing is currently underway and includes lymphoma work-ups and screening for Retrovirus (AIDS-like immunodeficiency which leads to increased susceptibility to infection disease & cancers).

RESEARCH RECOMMENDATIONS FOR TREATMENT

For many possums with exudative dermatitis, euthanasia will be warranted due to the severity and extent of lesions. Possums that are considered suitable for treatment need to be assessed on an individual basis, taking into consideration the overall health status and age of the possum, as well as clinical and microbial pathology findings.

Details on the treatment recommendations & considerations are provided below.

TREATMENT RECOMMENDATIONS

All possums presenting with exudative dermatitis must be presented to a veterinarian for full assessment, diagnosis and treatment (where suitable).

Although many veterinarians have been presented with exudative dermatitis possums, up-to-date information and particularly recent research may not be familiar to them. Wildlife rehabilitators are encouraged to present these guidelines to their consulting veterinarian, in particular the information pertaining to treatment recommendations and microbiology/clinical pathology.

As exudative dermatitis wounds are associated with different bacteria, often as mixed infections, it is highly recommended that wound samples (swabs) be taken and submitted to a pathology laboratory as part of a possum's treatment regime. The use of antibiotics should be based on the results of antimicrobial sensitivities. Based on the 2008 research findings, the use of tetracycline (eg. Doxycycline ®) and enrofloxacin (eg Baytril®) in particular is not recommended due to the highly resistant nature of many bacteria associated with exudative dermatitis lesions to these drugs.

Clinical pathology (particularly haematology) is also useful to assist in ascertaining potential under-lying conditions such as anaemia (in particular non-regenerative anaemia), possible viral infections, and/or immune-mediated diseases such as leukaemia.

For all possums with exudative dermatitis, it is recommended that treatment be based on definitive clinical and microbiological diagnosis (treatment can be started before this is undertaken and then modified as required). These results will also provide the treating veterinarian with a greater understanding of the possum's health profile and, as such, whether treatment should be considered.

TREATMENT CONSIDERATIONS

Aside from clinical and microbial pathology, there a number of considerations that needs to be taking into account prior to treating possums with exudative dermatitis. These considerations are discussed in more detail below and include:

- Extent and degree/severity of dermatitis
- Body condition and age
- Length of treatment
- Suitability for release – importance of release site
- Suitable rehabilitator
- Suitable facilities – including quarantine considerations

Extent of Dermatitis

When assessing the extent of exudative dermatitis lesions, euthanasia is recommended in possums where lesions cover more than a total of 20% of the body (Figure 4).

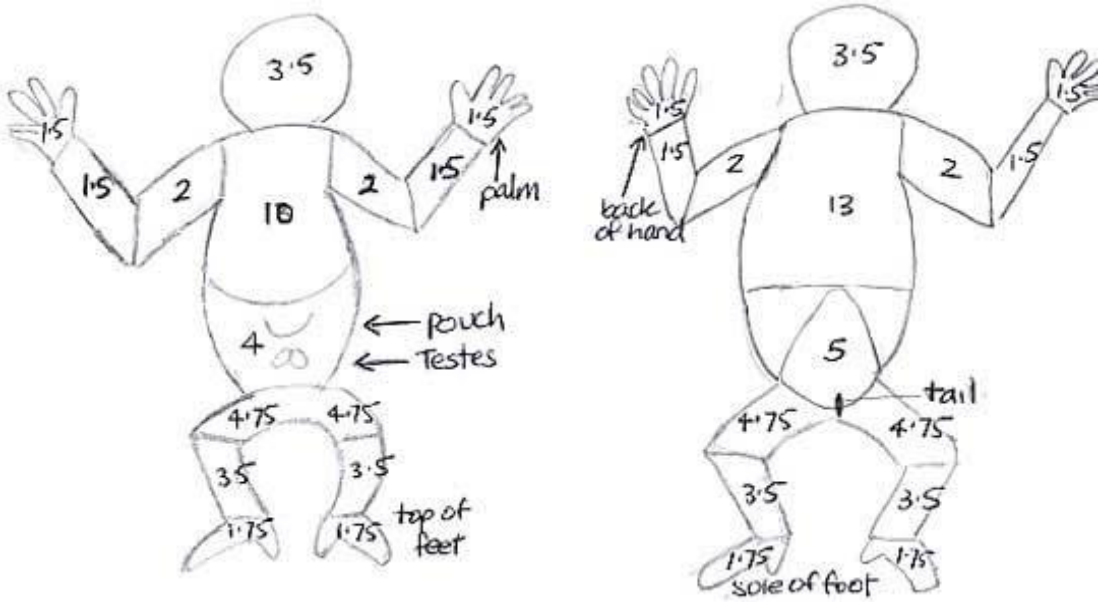


Figure 4: Areas are based on surface areas for adults - the tail is included in the buttocks area. Fowler (2006).

As well as considering the extent of coverage of exudative dermatitis wounds, careful assessment of the location of wounds is also required. Euthanasia is recommended for possums with wounds that occur in areas where scar tissue will result in restriction of movement, such as near joints of limbs/digits, and around the face, particularly the eyes and mouth.

Figure 5: Examples of locations of exudative dermatitis wounds where euthanasia is recommended due to complications associated with scar tissue.

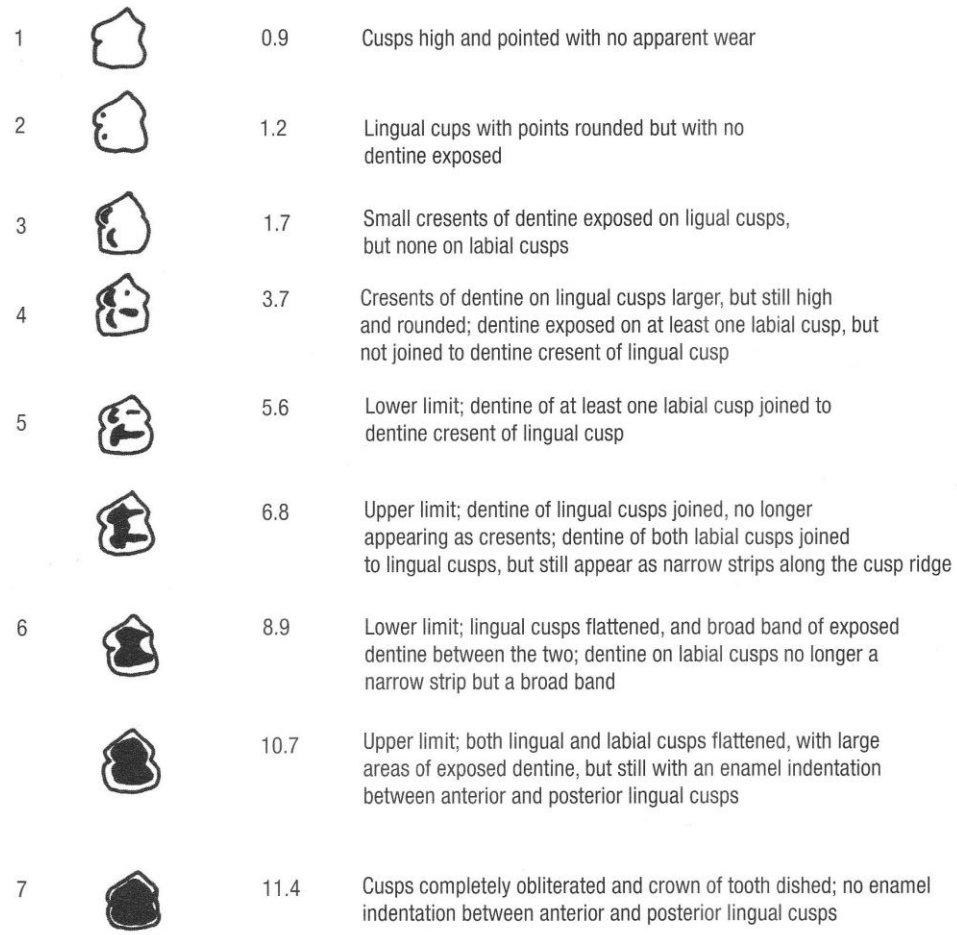
Degree/Severity of Dermatitis

The depth of exudative dermatitis wounds needs to be considered especially in relation to the associated healing time and increased likelihood of scarring. Exudative dermatitis wounds can be classified into superficial and partial/full-thickness wounds based on the depth of the lesion (following the same classification as for burns wounds). Examples of these are provided in the figures below. Euthanasia is recommended in cases of partial thickness and full thickness lesions, especially in cases where bone is exposed.

Figure 6: from left to right - Examples of superficial, partial-thickness and full-thickness exudative dermatitis wounds

***Age**:*

The age of the possum should be determined prior to treatment being considered. For younger animals, the weight and size give a good indication of age, however for adult possums the most reliable indication of age is based on tooth wear. Tooth wear is assessed based on the wear of the upper left first molar of the possum (Figure 7). Possums will need to be sedated or anaesthetized prior to being able to do this. The following chart (Figure 8) provides information on tooth wear class (1-7) and the estimated age class for each.



1		0.9	Cusps high and pointed with no apparent wear
2		1.2	Lingual cups with points rounded but with no dentine exposed
3		1.7	Small cresents of dentine exposed on ligual cusps, but none on labial cusps
4		3.7	Cresents of dentine on lingual cusps larger, but still high and rounded; dentine exposed on at least one labial cusp, but not joined to dentine cresent of lingual cusp
5		5.6	Lower limit; dentine of at least one labial cusp joined to dentine cresent of lingual cusp
		6.8	Upper limit; dentine of lingual cusps joined, no longer appearing as cresents; dentine of both labial cusps joined to lingual cusps, but still appear as narrow strips along the cusp ridge
6		8.9	Lower limit; lingual cusps flattened, and broad band of exposed dentine between the two; dentine on labial cusps no longer a narrow strip but a broad band
		10.7	Upper limit; both lingual and labial cusps flattened, with large areas of exposed dentine, but still with an enamel indentation between anterior and posterior lingual cusps
7		11.4	Cusps completely obliterated and crown of tooth dished; no enamel indentation between anterior and posterior lingual cusps

Figure 3. Estimates of age (years) in brushtail possums using tooth wear. Position and area of dentine (shaded) exposed in classes of tooth wear of first molar (M^1) of the upper jaw. Derived from Winter (1980) and Cowan and White (1989).

Figure 8: Tooth wear chart for brushtail possums

***Body Condition**:*

Body condition needs to be assessed for all possums where treatment is considered. Those individuals in poor body condition are not considered suitable for treatment due to the likelihood of underlying nutritional problems, difficulty with finding adequate resources in their home range and possible chronic/underlying disease or condition.

Figure 9: Brushtail possum showing good (L) and poor body condition (R)

***Length of treatment**:*

Adult possums have very defined territories and any prolonged period in captivity is likely to minimise the chances of the possum having a territory to be released back into. There is much debate as to the length of time a possum can be removed from its territory prior to it being taken over by another individual. The shortest amount of time a possum is in captivity will give the animal the greatest chance of having success at re-establishing its territory. Aside from territory issues, possums held in captivity for prolonged periods of time will lose muscle tone and fitness (particularly if they are required to be held in small enclosures for long periods of time while wound healing occurs).

Suitability for release

Consideration needs to be made as to whether the treated possum will be suitable for release. Factors that affect this decision include the presence of scar tissue which limits mobility, the length of time a possum has been in care and whether the possum has a reasonable chance of survival once released.

It is imperative that possums treated for exudative dermatitis are released back to the location from which they were rescued. If this information is not available then euthanasia is strongly recommended. As there is a strong possibility that exudative dermatitis is the secondary result of some other underlying disease/condition (of particular concern is retrovirus) it is vital that animals not be translocated to minimize the potential of disease transfer.

Suitable rehabilitator

An important consideration in treatment is whether there is a suitable rehabilitator available to care for the possum. As many wildlife rehabilitation groups are struggling to meet the demand of caring for possums, consideration needs to be made as to whether there is a suitable rehabilitator available. Ideally, rehabilitators that care for exudative dermatitis possums should not undertake rehabilitation of healthy individuals (including orphans) for the duration of having an exudative dermatitis possum in their care.

A suitable rehabilitator must:

- have access to a supporting veterinarian for assessment, diagnosis and treatment.
- have a knowledge and high level of competence in wound management as well as medication administration
- have adequate facilities including bedding, feeding equipment and hospital cages and aviaries that are quarantined from other wildlife
- have confidence in handling and caring for possums (particularly adults)

- have access to the individual possum's natural diet

The cost involved in caring for exudative dermatitis possums needs to be considered, especially if the veterinary facility is unable to cover the cost of clinical and microbial pathology diagnosis. These costs are generally quite high, and are payable even if results indicate that the possum requires euthanasia. There is also the non-financial cost of resources that could possibly be used better on an animal with a greater chance of survival and release success.

Suitable facilities

Any rehabilitator caring for possums with exudative dermatitis must have appropriate facilities and equipment available. Ideally, all equipment and housing used for these possums should be kept isolated from those used for healthy individuals or individuals of different species. All equipment and bedding used in the treatment of possums with exudative dermatitis must be thoroughly cleaned and disinfected between patients as well as prior to use on any other species. This is particularly pertinent with carry baskets/rescue cages that are frequently used for a number of different animals.

FURTHER RESEARCH REQUIREMENTS

Since completion of this research, further investigation has been undertaken into the microbiology and histopathology of lesions. Results from these will become available over time.

Further research into exudative dermatitis is still required in order to achieve greater understanding of the disease process and associated pathology. Of particular importance would be:

- Assessment of clinical pathology samples to determine whether viruses may be involved in the disease (e.g. Retrovirus).
- Undertaking prevalence studies to determine the extent of exudative dermatitis in wild possum populations, and the associated microbiology

and clinical pathology for possums that are healthy, and at various stages of the disease.

- Monitoring possums with exudative dermatitis in the wild to determine potential survivability and mortality associated with the disease.
- Undertaking treatment trials on possums with exudative dermatitis to determine effectiveness of different treatments, and radio-tracking possums that have been treated for exudative dermatitis to establish post-release survivability, provide information on possible re-infection with the disease, and assist in determining whether the disease is worth treating.

Until such time as this information is known or becomes available, veterinarians and rehabilitators are encouraged to undertake good management and practices if the decision is made to treat possums with exudative dermatitis. Of particular importance is clear diagnosis based on clinical and microbial pathology and a realistic understanding of the associated treatment considerations.

GLOSSARY

Aetiological agent – the cause of a disease

Microbiology – the study of microscopic organisms (e.g. bacteria and viruses) and their effects on other living organisms

Clinical pathology – the study of the causes of disease, especially the changes in body tissues and organs. Diseased tissues, fluids (e.g. blood) or other material from a living patient are examined using a number of clinical techniques such as microbiology, histopathology, chemistry and haematology.

Molodorous – having an unpleasant, ill-smelling or bad odour

Exudative – oozing of fluid or other material from cells and tissues usually as a result of injury or inflammation.

Ulcerative – causing ulceration (a discontinuity of the skin or a break in the skin that stops it from continuing its normal functions)

Anaemia – a disorder of the blood in which there is a decrease in the number of red blood cells or less than the normal quantity of haemoglobin (iron-containing protein in blood that transports oxygen) in the blood.

Regenerative anaemia - occurs when the body loses blood faster than it can be regenerated, despite the fact that new red blood cells are being produced in the bone marrow.

Non-regenerative anaemia – occurs when the body has lost the ability to make new red blood cells in the bone marrow.

Histopathology – the study of the microscopic changes in tissues caused by disease

Haematology – concerned with diseases of the blood and blood-forming tissues (e.g. bone marrow)

Translocated – the release, introduction or reintroduction of plants, animals or habitat from one location to another.

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