PRELIMINARY RESULTS OF EXPERIMENTAL DEER PARAPOX AND ORF VIRUS INFECTION TRIALS IN RED DEER (Cervus elaphus)

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INTRODUCTION

A number of outbreaks of infection due to deer parapoxvirus (DPV) have occurred on New Zealand farms since late 1985 [1][2][3][4]. The majority of affected deer had lesions on the head, variably including the lips, muzzle, face, ears and velvet antlers. Deaths occurred on two properties where lesions were extensive, including legs and torso, and secondary bacterial infections were probably involved. The DPV strains from two widely separated properties were shown by restriction endonuclease analysis to be identical to each other but distinctly different from a typical orf isolate of sheep origin [4].

Prior to the New Zealand cases there have been few reports of naturally occurring parapoxvirus infections in deer [6]. However, experimental infections with orf have produced mild lesions in wapiti, mule and white-tailed deer [7], moose and caribou [10].

Little is known of the infectivity of DPV and orf for red deer or about the degree of immunity produced by these infections or the degree of cross-protection between orf and DPV. For these reasons experimental infections and cross-protection studies were undertaken.

MATERIALS AND METHODS

On December 16, 1986, eight 12-month old red stags (71 to 76 kg liveweight and velvet antlers 3 to 20 cm length) were anaesthetised, and their antlers were cut off to 0.5 to 1.0 cm below the pedicle/antler junction to promote rapid even antler regrowth. The stags were castrated to ensure that they remained in velvet throughout the trial.

On January 5, the castrates were brought in from pasture and over the next two weeks were held in a barn and barley/bran/pollard concentrate pelleted feed.

Primary inoculation - On January 19, the castrates were anaesthetised, and transferred into individual pens in two rooms of an isolation unit where they received their primary inoculation; four in one room received "Scabine"[1] and four in the other room received a DPV field isolate

suspension. Inoculation entailed scarifying, with an 18 gauge needle, a 2 cm^2 area of skin at the pedicle/velvet junction of the left antler and at the left commissure of the mouth and a 10 x 10 cm^2 closely clipped area of skin on the inside of the left thigh. Two drops of inoculum were scratched deeply into each site, but without causing bleeding.

Secondary inoculation – Four weeks after primary infection two deer from each room were exchanged and the inoculation procedures were repeated on the right side of each animal.

Monitoring – After primary and secondary inoculation blood samples for haematology and serology were collected on days 0, 1, 2, 3, 5, 7, 8, 10, 14, 21 and 28 post-inoculation (p.i.) and post secondary inoculation (p.s.i.). Photographs were taken to record the development and regression of lesions. On day 8 p.i. and day 9 p.s.i. the deer were anaesthetised and scabs were harvested from the inside of the thigh.

RESULTS

Primary inoculation:

Primary orf inoculation resulted in very mild scaliness for 7 or 8 days and mild hair loss on the velvet at the site of inoculation. There were negligible lesions at the corner of the mouth. On the thigh, in all 4 deer there was mottled erythema and numerous small scabs 1-3 mm diameter at day 8. The lesions had all regressed by 10-14 days p.i.

Primary DPV inoculation resulted in much more dramatic lesions than orf in all four deer. The velvet site of inoculation tended to thicken, darken, show hair loss and develop ulcers and scabs. The sites were 2-4 cm in diameter and healed in 10-14 days although some scab material persisted for up to 28 days p.i. The mouth sites developed ulceration especially at the muco-cutaneous junction, and skin swelling. The lesions were maximal at 7 to 8 days and had healed by 14 days with the formation of dry scabs, some of which persisted for up to 28 days. One animal developed about 6 small 2-3 mm raised scabby spots around the left eye and face.

On the inner thigh sites on day 8 there were marked erythematous areas with lines of cream to brown exudation overlying granulation tissue in the cross-hatched pattern of inoculation scratches. The removal of this material left raw weeping areas. By 28 days p.i. the lesions had healed almost completely except for a few small red spots or scabs.

[1] Orf/Scabby mouth vaccine, Coopers Animal Health Ltd

Secondary inoculation:

In all cases the lesions p.s.i. were milder and healed more quickly than those from primary infection.

The two deer initially inoculated with orf and rechallenged with orf failed to develop lesions on the mouth, and had slightly scaly lesions on the velvet, and at 9 days p.s.i. had pale scars and either no lesions or a few tiny scabs on the inner thigh.

The two deer initially inoculated with DPV and challenged with orf also failed to develop mouth lesions p.s.i. One developed a slightly scaly hairless spot on the velvet and 9 days p.s.i. both had a few small dry encrusted lines of scabs which lifted off leaving no erythema. By 14 days p.s.i. there were no lesions.

The two deer initially inoculated with orf and challenged with DPV developed slight scaliness on the antlers and the mouth but were normal 14 days p.s.i. On their inner thighs 9 days p.s.i. there were multiple, small dry yellow scabs, sometimes confluent, along the lines of scratches. There was slight erythema, but the skin had healed and did not exude when the scabs were harvested.

The two deer initially inoculated with DPV and rechallenged with DPV had negligible lesions on the velvet and mouth and milder lesions on the inner thigh than the above two DPV challenged deer p.s.i. They had a few dried scabs over 30 - 60% of the inner thigh area and slight erythema.

No scabs or erythema were detected in any deer after 14 day p.s.i.

All the deer except one ate well throughout the trial. The exception developed a scour and inappetance the day after it was moved into the isolation unit. It was treated with parenteral tetracyclines and oral scour medicine and it recovered in a few days. In no case did the mouth lesions appear to interfere with eating and all deer gained weight during the trial.

More detailed results on haematology, serology, virus isolation and analysis will be presented elsewhere.

DISCUSSION

These results demonstrate that red deer are susceptible to experimental infections with DPV and orf although the latter produces much milder lesions. An experimental infection of two wapiti calves (*C. elaphus nelsoni*) with orf virus produced a similar result [7]. These authors described very mild transient oral lesions but failed to infect nasal or

axillary sites. They concluded that contagious ecthyma (orf) "would not seriously impact on free-ranging deer". This is a conclusion with which we agree.

It appears that in deer primary infection with either strain confers strong but not complete immunity to reinfection with the same virus four weeks later, and a moderate degree of cross-protection with the other virus. Both viruses are in the parapoxvirus family and preliminary hybridisation studies have shown about 60% homology between DPV and orf DNA [4] suggesting that they share a proportion of antigenic determinants which may assist the development of cross-protection.

In a similar experimental DPV infection trial in sheep (Buddle and Horner, pers. comm.) lesions were either very mild or undetectable. No cross protection with orf was demonstrable.

In deer the severity of the lesions varied between inoculation sites with the inner thigh having much more severe lesions than the mouth or the velvet for both primary and secondary infections. The mouth and velvet sites appeared to be much less susceptible to experimental reinfection four weeks after primary infection than the inner thigh. Similarly with experimental orf infection in sheep there is a higher susceptibility and shorter duration of immunity present at sites on the innner thigh and udder, compared with lips and feet [5][9]. The duration of the immunity is not known but orf vaccination in sheep is reputed to protect against reinfection of the mouth for 6 to 8 months. In the field, where the animals are probably being continually challenged, the duration of immunity to the development of lesions is effectively life long [8].

In this trial there were no apparent effects of DPV on the wellbeing of the deer. The lack of systemic effects is witnessed by no significant haematological changes, no loss of appetite and positive weight gains. Thus uncomplicated DPV infections appear to be confined to the skin and as long as lesions on the mouth do not interfere with eating their effects are likely to be minor. However, a proportion of field cases appear to develop secondary bacterial infections leading to more severe clinical illnesses and, in some cases, death.

The results of this trial indicate that the vaccination of deer with either orf or DPV may prevent severe DPV infections. However, routine vaccination of young or replacement deer could only be justified on properties where DPV already exists and has caused problems.

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