BOVINE PESTIVIRUS DISEASE :

AN INVESTIGATION OF A SEVERE OUTBREAK OF BOVINE VIRAL DIARRHOEA VIRUS INFECTION IN CALVES IN NEW ZEALAND.

PETER D. ANDERSON B.V.Sc.

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ERRATA

The following are corrections to the text since the thesis went to print :-

Page no. xi, line12 - **VIAS** should be "Victorian Institute of Animal Science"

Page no. 66, line1 - "Kruskat" should be "Kruskal"

Page no. 26, line8 - "Peyers patches" should be "Peyer's patches

Page no. 38, line 4 - "thosand" should be "thousand"

Page no. 101, line 11 - "severe pathology" should be "severe pathological changes"

ABSTRACT

An outbreak of bovine pestivirus disease, in which there was high mortality (37%) in 102 calves, was investigated. It was postulated that the severity of the outbreak may have been due to the presence of a highly virulent strain of bovine viral diarrhoea virus.

Nine calves from the field outbreak were transported to Massey University for detailed clinical, post-mortem and laboratory examination. Samples were also submitted from a further three animals on the farm.

The results of immunological and virological studies indicated that seven calves had acute bovine viral diarrhoea virus infection and five calves had mucosal disease. Although the mucosal disease cases showed more severe clinical signs, lesions were widespread in both groups.

A non-cytopathic bovine viral diarrhoea virus isolate from one calf was used as the challenge virus in a transmission experiment designed to investigate the pathogenicity of this strain. The 11 calves used in this experiment comprised of four unvaccinated, challenged calves, four vaccinated calves (two challenged, two in-contact), two unvaccinated, in-contact calves and a control (neither vaccinated nor in-contact). The experiment took place over a month, allowing multiple clinical examinations and sampling procedures to be carried out before necropsy.

The challenge virus caused mild disease, with lesions similar to those reported in experiments in which Type 1 bovine viral diarrhoea virus isolates were used. Following experimental challenge, virus was not recovered from the calves, but a serological diagnosis of bovine viral diarrhoea virus infection was made by demonstrating a greater than fourfold rise in titre of bovine viral diarrhoea virus antibody in all challenged calves. There were only minor changes in haematological indices in challenged calves. The six challenged calves showed two distinctive lesions in intestinal sections. These were crypt necrosis (of glands of Lieburkuhn) and cryptal prolapse (herniation of crypts into the submucosal site of Peyer's patches depleted of lymphocytes). In the disease outbreak, these lesions were only observed in the mucosal disease cases.

Focal haemorrhages at sites of lymphocytic nodules were found in the nasal cavity of all challenged and vaccinated calves in the transmission experiment, but not in the unvaccinated, in-contact calves or the control calf. These lesions have not been reported in natural infections.

Vaccination was only partially protective, and there was evidence of spread of bovine viral diarrhoea virus infection to one vaccinated, in-contact calf. Scoring of histological lesions allowed a measurement of the effect of vaccination. There was a 60% reduction in the total histological lesion score in the four vaccinated calves (two challenged, two in-contact) when compared with the four unvaccinated, challenged animals.

It was concluded that the high mortality seen in the calves in the field outbreak was due to mucosal disease, and that this was consequential to a high infection rate in the dams during pregancy at a time when the foetuses were at risk of becoming persistently infected (45-125 days of gestation).

The pathological "fingerprint" for bovine viral diarrhoea virus infection was found to be the concomitant finding of three lesions at necropsy. Firstly, erosive lesions in the squamous epithelium of the upper alimentary tract. Secondly, catarrhal enteritis, with the distinctive and characteristic microscopic lesions of crypt necrosis and cryptal prolapse. Thirdly, lymphoid tissue lesions, especially lymph node enlargement, lymphoid depletion and inflammation of Peyer's patches.

Despite the difficulties in pathotyping the challenge virus in the transmission experiment, there was little evidence that it was a Type 2 strain. Genetic typing of this virus, by sequencing of polymerase chain reaction products, would be useful in determining its place in the phylogeny of bovine pestiviruses.

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AI	artificial insemination
ATV	antibiotic-trypsin-versene
AV-4	averonite-four
BAHL	Batchelor Animal Health Laboratory
Belu	bovine embyonic lung
BDV	border disease virus
BRS	bovine respiratory syncitial
BRSV	bovine respiratory syncitial virus
BVD	bovine virus (or viral) diarrhoea
BVDV	bovine virus (or viral) diarrhoea virus
CAHL	Central Animal Health Laboratory
CNS	central nervous system
CP	cytopathic
CPE	cytopathic effect
DMSO	dimethyl sulphoxide
DNA	deoxyribonucleic acid
EBL	enzootic bovine leucosis
EDTA	ethylenediaminetetraacetic acid
ELISA	enzyme-linked immunosorbant assay
E-MEM	Eagles minimum essential medium
ES	equine serum
FEC	faecal egg count
GIT	gastro-intestinal tract
GM	growth medium
H&E	haemotoxylin and eosin
IBR	infectious bovine rhinotracheitis
IBRV	infectious bovine rhinotracheitis virus
IgG	immunoglobulin G
IP	immunoperoxidase
ISCOMs	immune-stimulating complexes
MCF	malignant catarrhal fever
MD	mucosal disease
MDBK	Madin Darby bovine kidney
MLV	modified-live virus
MM	maintenance medium
NADL	National Agriculture Department Laboratory
NCDI	National Centre for Disease Investigation
NCP	non-cytopathic
NY	New York
NY-1	New York-one
NZ	New Zealand
PBS	phosphate buffered saline
PCR	polmerase chain reaction
PI	persistently infected
p.i.	post-infection
PI3	parainfluenza-3
Pp	Peyer's patch

PSK	penicillin-streptomycin-kanamycin
RNA	ribonucleic acid
SFV	swine fever virus
SN	serum neutralisation
SNT	serum neutralisation test
SPF	specific pathogen free
$TCID_{50}$	tissue culture infective dose (50%)
TPB	tryptose phosphate broth
UAT	upper alimentary tract
URT	upper respiratory tract
USA	United States of America
VIAS	Veterinary Institute of Agricultural Science
WBC	white blood cell