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Seroconversion, neutralising antibodies and protection in bluetongue serotype 8 vaccinated sheep

C.A.L. Oura[a,*], J.L.N. Wood[b], A.J. Sanders[a], A. Bin-Tarif[a], M. Henstock[a], L. Edwards[a], T. Floyd[b], H. Simmons[c], C.A. Batten[a]

[a] Institute for Animal Health, Pirbright Laboratory, Ash Road, Pirbright, Woking, Surrey GU240NF, UK
[b] Cambridge Infectious Diseases Consortium, Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, UK
[c] VLA Weybridge, New Haw, Addlestone, Surrey KT15 3NB, UK

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ABSTRACT

Bluetongue virus serotype 8 (BTV-8) has caused a major outbreak of disease in cattle and sheep in several countries across northern and western Europe from 2006 to 2008. In 2008 the European Union instigated a mass-vaccination programme in affected countries using whole virus inactivated vaccines. We evaluated vaccinal responses in sheep and the ability of the vaccine to protect against experimental challenge. Sheep vaccinated 10 months previously under field conditions were challenged with BTV-8. One of 7 vaccinated sheep became infected, as evidenced by detection of viral RNA by real-time RT-PCR and by virus isolation. The remaining 6 sheep appeared fully protected from virus replication. None of the vaccinated sheep showed clinical signs of BTV and there was a good correlation between the presence of neutralising antibodies on challenge and protection. Commercially available ELISAs were evaluated for their ability to detect antibodies in sheep vaccinated on a single occasion. The sandwich (double antigen) ELISA assays were found to be more sensitive at detecting antibodies in vaccinated sheep than the competitive ELISAs.

1. Introduction

Bluetongue serotype 8 (BTV-8) successfully overwintered in many countries in northern and western Europe over the winter of 2006/2007 and emerged in the summer of 2007 to cause devastating effects to the livestock industries of many countries including the Netherlands, France, Belgium and Germany [1,2]. BTV-8 arrived on the south-eastern shores of the UK in the summer of 2007 [3,4]. Once the ability of the virus to overwinter in northern Europe was confirmed the need for rapid and immediate control of the disease became apparent before it spread to all corners of Europe and beyond.

After much debate about the advantages and disadvantages of the use of live attenuated and inactivated vaccines against BTV [5], countries in northern and western Europe decided to use inactivated as opposed to live attenuated vaccines in their BTV-8 control plans. In the autumn of 2007 countries started to place orders for inactivated vaccine against BTV-8. In October 2007 the UK put in an order for 22.5 million doses of the Intervet-manufactured Bovilis-BTV-8 vaccine. The first 9 million doses of the vaccine were released to farmers in the high risk areas of the east and south of the UK at the end of April 2008. As more doses of vaccine became available to the UK farmers, the protection zone (PZ) moved northwards and westwards until it covered the whole of England and Wales by September 2008. The combination of high levels of vaccine coverage in areas where BTV-8 circulated in 2007 before the 2008 transmission season and the cold wet summer provided an explanation for the lack of BTV circulation detected in the UK throughout 2008 [6].

The BTV-8 inactivated vaccines used across Europe in 2008 were produced rapidly and were licenced for emergency use without any associated efficacy guarantees. Although many millions of animals in Europe have now been vaccinated, there remain some unanswered questions about the immunological mechanisms resulting in vaccine efficacy (ability to protect clinically and to prevent onward transmission), the antibody responses to the products, particularly in sheep which only receive one dose, the duration of immunity, and both the extent and length of colostral antibody protection in lambs and calves born from vaccinated dams. This is the first published study detailing the efficacy of the BTV-8 Bovilis vaccine in sheep and the first study evaluating the long-term (10 months) protective properties of any BTV-8 inactivated vaccine on the market.

Soon after the vaccination campaign started in the UK it was found that many sheep that had received one dose of vaccine did not have detectable antibodies when tested with competitive ELISAs

* Corresponding author. Tel.: +44 01483 232441.
E-mail address: chris.oura@bbsrc.ac.uk (C.A.L. Oura).

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