Epidemiology and control of rinderpest

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Summary: Measures used in the control of rinderpest are discussed with respect to Africa and Arabia and trade in live animals is still regarded as the main danger of contaminating uninfected countries. While virulence can be used as a genetic marker for rinderpest, the dangers of mild field strains must also be considered.

KEYWORDS: Africa - Arab countries - Disease control - Epidemiology - Rinderpest virus - Trade in animals - Virulence.

Rinderpest arouses many emotions, but none more strong than the feeling of frustration born of our apparent inability to control this simple disease. We know rinderpest is principally transmitted by the movements of infected stock and that it can be curtailed by elementary zoo-sanitary measures — by the closure of markets, by the slaughter of infected animals or by quarantining infected herds. Or if political considerations preclude these steps the virus can be eliminated by the mass application of live attenuated vaccines which give a life-long immunity. We have, then, the means of control within our grasp; yet despite this knowledge the virus persists in Africa, in India and in the Middle East. In Africa, the last five years have seen the return of rinderpest to areas from which it has been absent for a decade or more and, in the Middle East, movements of infected livestock pose a continual threat to neighbouring countries.

How has the present situation arisen and what can be done about it? To start with, zoo-sanitary control requires co-operation on the part of the stock owner together with a veterinary service empowered and willing to take unpopular decisions. Additional requirements are adequate staffing levels, good communications, good diagnostic facilities and an adequate supply of vaccine. In times of financial hardship, or even against a background of civil disturbances, levels of staff training have fallen, diagnostic facilities have dwindled, vaccine manufacturers have lost basic biotechnological skills and machinery has broken down. In consequence, levels of vaccine output have declined, levels of vaccine administration have dropped, there has been a failure to control the movement of infected stock and a resurgence of infection has followed. Truly, the effectiveness of a veterinary service can be gauged by its ability to combat rinderpest.

This leads us to consider what should, and could, be done to retrieve the situation. One of the perceived dangers is that infected countries will learn to accommodate the disease now that the first epidemic wave has passed and stock losses are less severe. However, further heavy losses may be anticipated as herd susceptibility levels build up again and meanwhile the funding of control measures will eat into the limited resources available in this sector. In addition the presence of rinderpest will result in trade restrictions and a loss of export revenue. In considering the most effective way to assist national Governments with these problems, the Commission

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of the European Communities, through the agency of Directorate General 8, has
developed a plan aimed at restructuring veterinary services in a variety of African
countries. The concept is that rinderpest control will be achieved along with control
of a number of other diseases and, by creating revolving funds, it is intended that
the livestock sector will ultimately finance the service it receives.

What, then, remains for the epidemiologist to look at when, on the face of
things, our understanding of the life history of the virus is largely complete? While
the situation in Africa has been evolving we have been studying an adjacent area
with a similar set of problems — the Arabian peninsula. Table I shows that the
virus has caused a series of outbreaks in several countries bordering the Arabian
Gulf to the extent that, in some of them, it is considered endemic. However, most
outbreaks take place in quarantine areas and involve imported cattle or buffaloes.
It is possible, therefore, to suggest that the constant string of outbreaks is due to
the continual importation of infected animals and that the disease should be relati­
vely easy to control. As an example of what can be achieved we can point to Oman
where there have been no outbreaks since 1983 following the enactment of a decree
requiring valid health certification for all imported livestock, the quarantining of
such animals on arrival and control of livestock movement across the border with
the United Arab Emirates. I believe that other Gulf countries could be equally suc­
cessful with a little extra effort. The constant presence of rinderpest in this area,
with periodic extensions into Syria and Iraq, requires the creation of a “cordon
sanitaire” of vaccinated animals along the south-east border of Turkey.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>No. outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>Saudi Arabia</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Yemen Arab Republic</td>
<td>1</td>
</tr>
<tr>
<td>1982</td>
<td>Saudi Arabia</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Kuwait</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Oman</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Lebanon</td>
<td>1</td>
</tr>
<tr>
<td>1983</td>
<td>Syria</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Saudi Arabia</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Oman</td>
<td>1</td>
</tr>
<tr>
<td>1984</td>
<td>Kuwait</td>
<td>1</td>
</tr>
<tr>
<td>1985</td>
<td>Iraq</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bahrain</td>
<td>1</td>
</tr>
</tbody>
</table>

We have also, within obvious limits, investigated the virulence of contemporary
field strains (Table II), measuring the mean survival time in cattle between the onset
of pyrexia and death. While all strains so far examined cause 100% mortality it was
possible to suggest a difference between Arabian and African strains and to suggest
that the virus that swept from Sudan into Nigeria in 1983 did not originate from
Arabia. We can also link the 1982 outbreak in Lebanon with the presence of a simi­
larly virulent virus in Kuwait. When contrasted with the 33% mortality observed
with a Nigerian strain isolated in 1964, and with the total lack of mortality with an
Egyptian isolate from 1984, virulence can be seen to have value as a genetic marker. But, if there is genetic variation among strains of rinderpest, this may also be reflected in minor degrees of antigenic variation and I would like to suggest the value of attempting to subdivide field strains using a panel of monoclonal antibodies. This might well provide us with the ability to back-trace the origin of outbreaks to source and convince Gulf States that their viruses come from India and not from Africa.

Finally, I would like to look at a slightly different problem but one that I think poses some difficulties for future control. Remember that, up to now, we have considered strains that are highly virulent and therefore easy to diagnose clinically and confirm in the laboratory. Between 1967 and 1981 Egypt considered itself free of rinderpest but, in 1982, widespread outbreaks were reported, continuing, at a diminished level, into 1983 and 1984. The authorities had considerable difficulties in accepting this situation and mucosal disease was advanced as an alternative cause. In August 1984, 500 cattle were assembled at a fattening co-operative at Kafr Mahfouz in Fayoum Governorate. They were vaccinated against rinderpest before arrival. In October another 30 animals were added to the herd but were not vaccinated before arrival. Within 12 days of arrival animals in this second group became ill from an infectious disease that transmitted throughout the new group and, to a limited extent, among the original group. Rinderpest virus was isolated at Pirbright from a blood sample collected late in the outbreak.

The field pattern was, at first, difficult to understand. While it was clear that infection had entered the co-operative along with the purchase of live animals the veterinary services were adamant that there was no rinderpest in village livestock. The puzzle was only solved when we infected experimental cattle (Table III) and

### TABLE III

**Behaviour of rinderpest Egypt 84/1 in British Friesian heifers**

<table>
<thead>
<tr>
<th>Animal</th>
<th>No. days pyrexia</th>
<th>No. days clinical signs</th>
<th>No. days antigen positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF36</td>
<td>7</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>PF37</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PF38</td>
<td>7</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
discovered that we were dealing with an extremely mild field strain. Whilst the duration of pyrexia was normal, the number of days when the disease could be clinically diagnosed was greatly reduced and in some animals a diagnosis was impossible. In addition there was a reduction in the appearance of viral antigen in the ocular secretion, making the confirmation equally difficult. It would seem then that we have a field strain that is mild enough to go unnoticed in village cattle and not until cattle are under some additional stress, such as introduction to a feed lot, does frank disease and mortality appear. At the village level this virus will be very difficult to detect and, based on the completely different character of this virus, I am prepared to suggest that it was an unsuspected resident in Egypt for many years when vaccinal coverage declined to a level where a large outbreak could occur. The elimination of such field strains will require a new generation of diagnostic tests and could well prove the most difficult part of rinderpest control.

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Résumé : Les mesures de prophylaxie mises en œuvre contre la peste bovine sont envisagées dans le contexte de l’Afrique et de l’Arabie. Le commerce des animaux vivants est toujours considéré comme le principal danger de contamination des pays indemnes. Bien que le pouvoir virulent du virus bovipestique puisse être utilisé comme marqueur génétique de la maladie, il convient de tenir compte des dangers que présentent les souches virales hypovirulentes du terrain.


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EPIDEMIOLOGÍA Y CONTROL DE LA PESTE BOVINA. — W.P. Taylor.

Resumen : Se contemplan en el contexto de Africa y Arabia las medidas de control aplicadas contra la peste bovina. Se sigue considerando el comercio de animales vivos como el principal peligro de contaminación de los países libres de la enfermedad. Aunque se puede utilizar el poder virulento del virus bovinepestoso como marcador genético de la enfermedad, procede que se tengan en consideración los peligros que presentan las cepas viricas hipovirulentas de campo.

PALABRAS CLAVE : Africa - Comercio de animales - Control - Epidemiología - Países Arabes - Virulencia - Virus de la peste bovina.