GENITAL INFECTION OF PIGS WITH PORCINE PARVOVIRUS

By MARGARET H. LUCAS, SHEILA F. CARTWRIGHT and A. E. WRATHALL
Central Veterinary Laboratory, Weybridge, Surrey

INTRODUCTION

A previous report (Cartwright, Lucas and Huck, 1971) described the inoculation of sows with porcine parvovirus, strain 59e/63, at various times during gestation, using intravenous and oral routes and at insemination with the semen. Johnson and Collings (1969, 1971) also described the results of oral, intravenous and intramuscular inoculation of sows at various times during pregnancy with a strain of the same virus. These studies established that virus could pass the placental barrier.

In the previous study (Cartwright et al., 1971) only two sows were infected by incorporation of virus in the semen. Both had very small litters and in one, mummified foetuses were found.

To extend this work more sows were exposed by insemination with semen containing virus and, as well as this, the effect of inoculating virus into the preputial sac of a boar was studied.

MATERIALS AND METHODS

Twelve sows from a minimal disease herd were tested and found free of antibodies to the parvovirus 59e/63. To synchronize oestrus Methallibure* (5 g.) was given to each twice daily for 20 d., mixed with the feed. Pregnant Mare’s serum (900 i.u. subcutaneously) was given on d. 21 and chorionic gonadotrophin (500 i.u. intramuscularly) on d. 25. On the same day and on the following day the sows were inseminated artificially. Eight sows were inseminated with semen to which virus had been added. Two ml. of virus suspension having a haemagglutinating titre of between 1/1512 and 1/1024 and an infectivity titre in tissue culture of 10^5.5 TCID_50/ml., were added to 50 ml. of semen-buffer mixture immediately before insemination. Four control sows received the semen-buffer mixture only.

Vaginal swabs and in some cases faecal samples were taken at intervals and examined for virus. The sows were killed 30 d. after insemination, serum samples were collected and the genital tracts examined. Records were made of the number and size of the embryos, and the placental area and weight. The liver, allantoic fluid and placenta of each embryo and the liver of each sow were cultured. One boar was inoculated with virus into the preputial sac and the reproductive tract was examined for virus at post-mortem examination 5 d. later.

Haemagglutination inhibition tests were carried out as previously described (Cartwright, Lucas and Huck, 1969). Sera were heated at 56°C. for 30 min. and treated with 10 per cent. chick red cells before testing. Primary pig kidney monolayers were used for the isolation of virus (Cartwright et al., 1969).

RESULTS

The ovaries of some of the sows were abnormal, showing signs of over-stimulation probably due to the synchronization procedure. Three of the sows (1

* Aimax, I.C.I. Ltd.
control and 2 infected) were excluded from the experiment on this basis. A further 3 that returned to oestrus within 30 d. could have reacted abnormally to synchronization, but as this is not certain their results are included.

Nine sows were left in the experiment of which 6 had received virus-containing semen. Three of these were pregnant, one showed signs of embryonic loss without return to oestrus and 2 returned to oestrus 22 to 25 d. after insemination. Of the control sows 2 were pregnant and one returned to oestrus on the 17th day after insemination.

The results are shown in Table 1. Virus was not recovered from the foetuses or placentas of the controls (numbers 7, 8 and 9 in the Table). Of the 3 pregnant sows which had received virus, recoveries were made from 9 out of 10, 4 out of 9 and 0 out of 18 foetuses respectively. Only 2 placentas yielded virus and in each case there were isolations from the corresponding foetuses, but further attempts to recover virus from these 2 placentas were unsuccessful. Virus was recovered from the liver of one of the 2 pregnant sows that contained infected foetuses and in the other a viraemia was demonstrated 10 d., but not at 3 and 7 d. after inoculation. The virus was recovered from vaginal mucus samples from 5 out of 6 infected sows. Between 12 and 22 samples were taken from each sow at intervals throughout the 30 d. of pregnancy and virus recoveries were not limited to samples taken at any specific time during the 30 d.

**TABLE 1**

<table>
<thead>
<tr>
<th>Sow no.</th>
<th>Pregnant</th>
<th>Placenta</th>
<th>Foetus</th>
<th>Vagina</th>
<th>Liver</th>
<th>Blood</th>
<th>HI titre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+</td>
<td>0/10</td>
<td>9/10</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>20 480</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>2/9</td>
<td>4/9</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>40 960</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>0/18</td>
<td>0/18</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>512</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>0/6</td>
<td>0/6</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>160 000</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>0/4</td>
<td>0/4</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>10 240</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>2560</td>
</tr>
<tr>
<td>7</td>
<td>+</td>
<td>0/6</td>
<td>0/6</td>
<td>NE</td>
<td>-</td>
<td>NE</td>
<td>&lt;5</td>
</tr>
<tr>
<td>8</td>
<td>+</td>
<td>0/4</td>
<td>0/4</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>&lt;5</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

NE = not examined.

Haemagglutination inhibition titres in the sera collected from the sows at death varied from 1/512 to 1/40 960. There was no correlation between serum antibody titre in the sow and the presence of foetal infection.

The embryos and placentas were small for their ages, but in view of the large litter sizes the variations from average figures were probably not significant. The boar was killed 5 d. after inoculation and virus was recovered from the penis, prepuce and one testicle.

**DISCUSSION**

Serological results and evidence based on virus isolation suggest that porcine parvovirus infection is widespread in Britain (Cartwright and Huck, 1967;
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Johnson and Collings, 1969), Germany (Bachmann, 1969, 1970), Holland (Rondhuis and Straver, 1972), America (Mengeling, 1972), Japan (Morimoto, Kurogi, Miura, Sugimori and Fujisaki, 1972) and Australia (Smith, 1971; Johnson, 1973). The source of the virus strains isolated has frequently been a stillborn piglet and it has sometimes been found in boar semen. Field evidence suggests that the virus can produce breeding problems in sows (Cartwright and Huck, 1967; Cartwright et al., 1969).

In experimental infections (Johnson and Collings, 1969, 1971; Cartwright et al., 1971), neonatal and mature pigs responded to the virus by producing antibody, but clinical signs were usually mild or absent. If the animal was pregnant, however, the virus could sometimes be recovered from the foetuses.

The relationship between the time of inoculation of the sow and the effect on the foetuses has not been fully investigated, though Johnson and Collings (1971) discuss the possibility of immune tolerance in piglets infected during the early part of gestation, and active production of antibody by the foetus was noted by Johnson and Collings (1969) and Cartwright et al. (1971).

The evidence presented in this paper suggests that boars can become infected after inoculation of virus into the preputial sac and that after such exposure the virus can spread to the testicle. As virus may be present in vaginal mucus, boars could be infected at coitus and cause further sows to receive infected semen, but the importance of the venereal route in natural infections is not known. We lack sufficient experimental data to determine the effect of the parvovirus infection on the development of the foetuses.

SUMMARY

Experimental infection of sows with porcine parvovirus (strain 59e/63) is described. The virus was added to the semen immediately prior to artificial insemination and the sows were killed 30 d. later. Three out of 6 infected sows contained foetuses at 30 d. Of the 3 uninfected control sows 2 were pregnant. Virus was recovered from 9 out of 10 foetuses of one infected sow and 4 out of 9 foetuses from another infected sow. A boar was inoculated with the virus into the prepuce and virus was recovered 5 d. later from the penis, prepuce and testicle.

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REFERENCES


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