RESEARCH COMMUNICATION
COMPARATIVE EFFICACY OF SIX BRUCELLA VACCINES IN GUINEA-PIGS

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ABSTRACT


Immunity assays in guinea-pigs based on spleen mass: body mass ratios showed that live vaccines were markedly more effective than inactivated oil adjuvant vaccines in providing protection against challenge with 5,000 virulent organisms.

Résumé

COMPARAISON D’EFFICACITÉ DE SIX VACCINS DE BRUCELLA CHEZ LE COBAYE

D’après des épreuves d’immunité basées sur le poids de la rate chez le cobaye, les proportions du poids du corps ont montré que les vaccins vivants étaient notablement plus efficaces que les vaccins inactifs avec adjuvant halteur pour protéger l’animal contre une épreuve de 5,000 organismes virulents.

INTRODUCTION

Despite the existence of a large volume of experimental data on the efficacy of various Brucella vaccines (Morgan, 1970), there is no consensus of opinion on which vaccine is the most efficacious (Crawford & Hidalgo, 1977). The lack of consensus may be attributed to the diversity of the experimental and assay procedures employed, the conflicting results reported by various workers and the limited number of direct comparative experiments.

To elucidate the question of the comparative immunogenicity of inactivated oil emulsion vaccines and live vaccines, 6 commercially available Brucella vaccines were assayed in guinea-pigs in this investigation.

MATERIALS AND METHODS

Experimental animals

Conventional albino guinea-pigs, raised at the Institute and mass-measuring 250–400 g, were used in the experiment. They were housed in wire cages and fed a commercial pelleted ration supplemented with ascorbic acid in the drinking water.

Vaccines

The various vaccines were administered according to the schedules and routes recommended by the manufacturers. For reasons of comparison, 1/4th of the recommended cattle dose was employed throughout, except in the case of the Onderstepoort Rev I vaccine, where 4(0.5 ml) of the sheep dose (2.0 ml) was used.

The following products were used:

(i) ‘Abortox’*. Prepared from inactivated rough B. abortus Strain 45/20 in an oil emulsion. Two injections of 0.3 ml each were given with an interval of 4 weeks between the injections.

(ii) ‘Duphavac’**. Prepared from inactivated B. abortus Strain 45/20 in an oil emulsion. Two injections of 0.2 ml each were given with an interval of 6 weeks between the injections.

(iii) ‘Abortane’*. Prepared from inactivated smooth B. melitensis Strain 53 H38 in an oil emulsion. One injection of 0.3 ml was given.

(iv) Onderstepoort S19,*** Prepared from B. abortus Strain 19 in freeze-dried form. The reconstituted vaccine contained 2×10^10 live organisms/ml and a single dose of 0.5 ml was applied.

(v) Onderstepoort Rev I,*** Prepared from B. melitensis Elberg Rev 1 in freeze-dried form. The reconstituted vaccine contained 3×10^10 live organisms/ml and a single dose of 0.5 ml was applied.

(vi) ‘Aborsec’*. Prepared from B. abortus Strain 19 in freeze-dried form. The reconstituted vaccine contained 2.4×10^10 live organisms/ml and a single injection of 0.5 ml was applied.

Experimental design

Six groups of 12 guinea-pigs each were used for each vaccine and 6 for the positive and negative controls. Immunization of all the groups was commenced simultaneously. The animals were bled and challenged 2 months after the commencement of the experiment by intramuscular injection of 5,000 organisms of B. abortus Strain 544. All the animals were mass-measured 6 weeks after challenge, sacrificed and the mass of their spleens determined.

RESULTS

The mean agglutination titres of sera collected before challenge, the mean spleen masses as well as the spleen mass: body mass ratios of the different groups are given in Table 1.

From these results it is evident that the immunity conferred by the 3 inactivated oil emulsion vaccines was markedly inferior to that afforded by the 3 live vaccines. The immunity provided by the 2 45/20 vaccines was particularly poor and, although all the sera were negative to the Rose Bengal plate test with both vaccines, one of the vaccines was not non-agglutinogenic. The 53H38 vaccine was somewhat better, but it gave rise to a comparatively high serum agglutinin titre and, in addition, was positive on the Rose Bengal plate test.

There was no essential difference in the efficacy of the 3 live vaccines. However, considering that the dosage of the Rev I vaccine was almost 10 times smaller than those of the S19 vaccines, Rev I vaccine appears to be the most immunogenic strain. This finding is in agreement with the findings of Alton (1970) and Horwell & Van Drimmel (1972).

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TABLE 1 Serological response and immunity of guinea-pigs given different Brucella vaccines

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Serological response at time of challenge</th>
<th>Immunity assays 6 weeks after challenge</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Mean serum agglutination titre in International Units</td>
<td>Rose Bengal plate test</td>
</tr>
<tr>
<td>'Abortox' (45/20).</td>
<td>0</td>
<td>Negative.</td>
</tr>
<tr>
<td>'Duphavac' (45/20).</td>
<td>46.3</td>
<td>Negative.</td>
</tr>
<tr>
<td>'Aborlane' (53H38).</td>
<td>144.0</td>
<td>Positive.</td>
</tr>
<tr>
<td>Onderstepoort S19.</td>
<td>107.7</td>
<td>Positive.</td>
</tr>
<tr>
<td>Ondersteport Rev I.</td>
<td>207.7</td>
<td>Positive.</td>
</tr>
<tr>
<td>'Aborsec' (S19).</td>
<td>314.0</td>
<td>Positive.</td>
</tr>
<tr>
<td>Infected controls.</td>
<td>0</td>
<td>Negative.</td>
</tr>
<tr>
<td>Non-infected controls</td>
<td>0</td>
<td>Negative.</td>
</tr>
</tbody>
</table>

CONCLUSIONS

The guinea-pig model is by no means the final criterion for assessing the immunogenicity of Brucella vaccines, but it is nevertheless acceptable for screening purposes and routine assay of vaccines (Todd, 1970). From the results reported here it can therefore be deduced that live Brucella vaccines are superior to inactivated products in their ability to protect against infection, a conclusion which supports the results reported by Alton, Jones, Garcia-Carrillo & Trenchi (1972) and Worthington, Horwell, Mulders, MacFarlane & Schutte (1974).

Since immunity to brucellosis is very relative and varies with the challenge dose used (Thornton & Muskett, 1972), inactivated oil adjuvant vaccines may be satisfactory when low exposure levels are encountered, but, where high exposure levels are common and solid immunity is essential, the use of live vaccines is indicated (Jones & Berman, 1976).

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REFERENCES


