

RESEARCH COMMUNICATION

COMPARATIVE EFFICACY OF SIX *BRUCELLA* VACCINES IN GUINEA-PIGS

C. M. CAMERON, Veterinary Research Institute, Onderstepoort 0110

ABSTRACT

CAMERON, C. M., 1979. Comparative efficacy of six *Brucella* vaccines in guinea-pigs. *Onderstepoort Journal of Veterinary Research*, 46, 229-230 (1979).

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 basés 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 inactivés avec adjuvant huileux 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, $\frac{1}{10}$ th of the recommended cattle dose was employed throughout, except in the case of the Onderstepoort Rev I vaccine, where $\frac{1}{4}$ (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) 'Duphovac'**. 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) 'Aborlane'*. Prepared from inactivated smooth *B. melitensis* Strain 53 H38 in an oil emulsion. One injection of 0,3 ml was given.

* Iffa Mériou, 17 rue Bourgelat, Lyon, France

** Philips-Duphar BV, Amsterdam, Holland

Received 20 July 1979—Editor

- (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 I in freeze-dried form. The reconstituted vaccine contained 3×10^9 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 $2,4 \times 10^{10}$ 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 Drimmelen (1972).

* Iffa Mériou, 17 rue Bourgelat, Lyon, France

*** Veterinary Research Institute, P.O. Onderstepoort 0110, R.S.A.

COMPARATIVE EFFICACY OF SIX *BRUCELLA* VACCINES IN GUINEA-PIGS

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

Vaccine	Serological response at time of challenge		Immunity assays 6 weeks after challenge	
	Mean serum agglutination titre in International Units	Rose Bengal plate test	Mean spleen mass in grams	Spleen mass: body mass ratio
'Abortox' (45/20).....	0	Negative.....	10,16	1: 64,0
'Duphovac' (45/20).....	46,3	Negative.....	10,46	1: 65,6
'Aborlane' (53H38).....	144,0	Positive.....	6,84	1: 110,1
Onderstepoort S19.....	107,7	Positive.....	1,81	1: 410,3
Onderstepoort Rev I.....	207,7	Positive.....	1,60	1: 525,8
'Aborsec' (S19).....	314,0	Positive.....	2,09	1: 342,6
Infected controls.....	0	Negative.....	12,80	1: 63,7
Non-infected controls.....	0	Negative.....	0,92	1: 963,3

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, Mülders, 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).

ACKNOWLEDGEMENTS

The author wishes to thank Mr W. F. Botha and Mr W. J. P. Fuls for their careful execution of the experiment and Dr K. Ogonowski for doing the serological tests.

REFERENCES

ALTON, G. A., 1970. Vaccination of goats with reduced doses of Rev I *Brucella melitensis* vaccine. *Research in Veterinary Science*, 11, 54-59.

ALTON, G. G., JONES, L. M., GARCIA-CARRILLO, C. & TRENCHI, A., 1972. *Brucella melitensis* Rev I and *Brucella abortus* 45/20 vaccines in goats: Immunity. *American Journal of Veterinary Research*, 33, 1747-1751.

CRAWFORD, R. P. & HIDALGO, R. J., 1977. Bovine brucellosis. An international symposium. Texas A & M University Press, College Station & London.

HORWELL, F. E. & VAN DRIMMELEN, G. C., 1972. *Brucella melitensis* strain Rev I as a vaccine for cattle. *Journal of the South African Veterinary Medical Association*, 42, 233-235.

JONES, LOIS M. & BERMAN, D. T., 1976. The role of living vaccines in prophylaxis. International Symposium on Brucellosis (II) Rabat 1975. Developments in biological standardization, 31, 328-334.

MORGAN, B. W. J., 1970. Reviews of the progress of dairy science. Section E. Diseases of dairy cattle. Brucellosis. *Journal of Dairy Research*, 37, 303-360.

THORNTON, DENISE H. & MUSKETT, J. C., 1972. The use of laboratory animals in the potency test of *Brucella abortus* S19 vaccine. *Journal of Comparative Pathology*, 82, 201-208.

TODD, R. G., 1970. British Veterinary Codex Supplement. The Pharmaceutical Press, London.

WORTHINGTON, R. W., HORWELL, F. D., MÜLDERS, MARIA S. G., MacFARLANE, I. S. & SCHUTTE, A. P., 1974. An investigation of the efficacy of three *Brucella* vaccines in cattle. *Journal of the South African Veterinary Association*, 45, 87-91.