ACTA VET. BRNO, 56, 1987: 331-336

EVALUATION OF SEROCONVERSION IN VARIOUS LABORATORY ANIMAL SPECIES FOR PORCINE PARVOVIRUS

J. JEŘÁBEK, J. DRÁBEK, VÍTĚZSLAVA MAŇOUŠKOVÁ and L. DEDEK[1]

Department of Prevention of Swine Diseases, Animal Husbandry and Zoohygiene, University of Veterinary Science, 612 42 Brno, Bioveta, n.p., 683 23 Ivanovice na Hané [1]

Received January 14, 1987

Abstract

Jeřábek J., J. Drábek, Vítězslava Maňoušková, L. Dedek: Evaluation of Seroconversion in Various Laboratory Animal Species for Porcine Parvovirus. Acta vet. Brno, 56, 1987: 331-336.

In blood sera of rabbits, guinea-pigs, laboratory rats and white mice, specific antibodies were detected after vaccination and revaccination with an inactivated vaccine against porcine parvovirosis using the haemagglutination inhibition test. The strongest immune response was found in laboratory rats showing haemagglutionation inhibiting antibody titres in the range of 256-2048; guinea-pigs also showed aubstantial titres in the range of 16--1024. Lower immune responses were detected with white mice (titres 16-32) and rabbits (titres 8-128). These results indicate that the most suitable laboratory animals for efficacy testing of inactivated vaccines against porcine parvovirosis are laboratory rats and guinea-pigs.

Porcine parvovirus, rabbits, guinea-pigs, laboratory rats, white mice, HIT..

Porcine parvovirus (PPV) is a pathogen contributing significantly to reproductive failures of sows in Czechoslovakia (Štěpánek et al. 1979; Krpata 1981; Jeřábek et al. 1986b; Drábek et al. 1986).

Pigs are employed for testing the efficacy of vaccines against porcine parvovirosis (PP), but production of post-vaccination antibodies can also be detected in laboratory animals. Joo et al. (1982, 1984) successfully tested the efficacy of an inactivated vaccine against PP in guinea-pigs and rabbits. Also Jeřábek

et al. (in press) by studying seroconversion in pigs and guinea-pigs after administration of an inactivated vaccine against PP found that for the efficacy testing of this vaccine guinea-pigs can be employed. Savič et al. (1985) tested an inactivated vaccine against PP in pigs of various ages, white mice, guinea-pigs, rabbits, and one-month-old chickens. They found that blood sera of non-immunized white mice and guinea-pigs inhibited haemagglutionation by the porcine parvovirus. In non-vaccinated rabbits and chickens no antibodies against PPV were detected, but a slight reaction to vaccination was observed in chickens. On the basis of these results the authors recommend rabbits be used to test the efficacy of inactivated PP vaccines; they consider pigs to 4 months of age, guinea-pigs, chickens, and white mice to be unsuitable for this testing.

In both naturally infected swine herds and under experimental conditions in laboratory rats, antibodies against the PPV have been detected (Joo et al. 1976; Cutler et al. 1982). This prompted us to compare post-vaccination seroconversion after administration of an inactivated PP vaccine to common laboratory animals - rabbits, guinea-pigs, laboratory rats (Rattus norvegicus) and white mice (Mus musculus).

Materials and Methods

Laboratory animals

For comparison of post-vaccination seroconversion the following animals were used: 7 rabbits (body mass 2.25-3.0 kg), 11 guinea-pigs (body mass 340-400 g), 10 laboratory rats (body mass 180-210 g) and 10 white mice (mean body mass 20 g).

Blood samples were collected immediately prior to vaccination (in rabbits from v. saphena lateralis, in guinea-pigs by cardiac puncture, in laboratory rats by removing a piece of the tail) and at decapitation on d 28 after revaccination. For the group of vaccinated white mice 10 non-vaccinated mice from the same colony were used and blood-sampled at decapitation. From these, 4 samples from individual animals and 3 grouped samples obtained from 2 animals each, were prepared.

Vaccine

The animals were vaccinated with the same batch (No. V 061285) of a commercial inactivated vaccine against PP (Bioveta, n.p., Ivanovice na Hané, Czechoslovakia) diluted in a diluent provided by the same manufacturer. This diluent also served as an oil adjuvant. The vaccine was diluted according to the manufacturer's instructions for use in pigs (Jeřábek et al. 1985). Rabbits, guinea-pigs and laboratory rats were given i.m. injections of 0.5 cm^3 vaccine (i.e. one fourth of the vaccination dose for pigs), mice were given 0.2 cm^3 i.m. (i.e. one tenth of the vaccination dose for pigs). All animals were revaccinated in the contralateral thigh with the same dose of the vaccine on d 28 after vaccination.

Serological examination

Blood sera collected prior to vaccination and 28 d after revaccination (including control sera from non-vaccinated mice) were stored at -20°C. All samples were simultaneously processed for the haemagglutination inhibition test (HIT) to detect the presence of haemagglutination inhibiting antibodies (HIA) directed at PP; the standard method as is routinely used in our laboratory was employed (Jeřábek et al. 1986a).

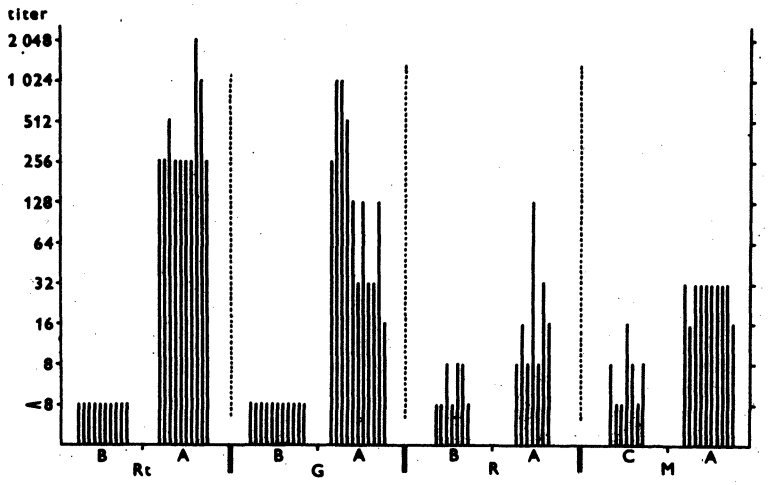

Fig. 1. Comparison of titres (reciprocal values) of haemagglutination inhibiting antibodies in laboratory rats (Rt), guinea-pigs (G), rabbits (R) and white mice (M) vaccinated with an inactivated vaccine against porcine parvovirosis. B - prior to vaccination, A - after revaccination, C - control mice.

Results

All blood sera of guinea-pigs and laboratory rats collected before vaccination yielded negative HIT results (HIA titres < 8). Results obtained with rabbit sera were not as uniform. In 3 of 7 sera a HIA titre of 8 was found. Similar results were obtained with sera from non-vaccinated mice. From these mice, only 3 samples (2 of them collected from individual animals, 1 was grouped sample from 2 animals) no HIA were found (titres < 8). In two grouped samples and one individual sample titres of 8 were found; one individual sample was as high as 16 (Fig. 1).

Apart from 2 rabbits, in all other experimental animals after vaccination and revaccination, HIA production was detected. However, the detectable antibody levels varied with the species. The strongest and most uniformly detected immune response as measured by antibody production was found in laboratory rats. The rats produced HIA titres in the range of 256-2048; the production in the guinea-pigs was substantial also, ranging from titres of 16--1024. Fewer antibodies were formed in white mice (titres 16-32) and in rabbits (titres 8-128) (Fig. 1).

Discussion

Possibilities to test the efficacy of vaccines against PP are determined by 1) the epizootiological status of PP, and, to a certain extent, 2) the economic aspects of selecting and maintaining suitable experimental animals. Given the spread of PP in other countries (Stein and Leman 1982) and in Czechoslovakia (Ječábek et al. 1986b) there are difficulties in obtaining conventionally-reared pigs that have had no contact with porcine parvovirus. Furthermore, for the economic reasons, laboratory animals are much more suitable for the efficacy testing of the PP vaccine.

In addition to rabbits and guinea-pigs that were employed by Joo et al. (1982, 1984) we elected to evaluate also laboratory rats and white mice. Our best results were obtained from laboratory rats; guinea-pigs yielded good results, too. Poor haemagglutination inhibition was found in white mice and rabbits. The potential use of rabbits or white mice for this test is further complicated by the fact that low concentrations of haemagglutination inhibiting antibodies were detectable prior to vaccination in 3 of 7 rabbits and in several non-vaccinated mice. Our findings in mice agree with those of Soviet authors (Savič et al. 1985), whereas for rabbits and guinea-pigs our results differ. In guinea--pigs, we obtained results similar to those of Joo et al. (1984), but we differ from them regarding our results for rabbits. Our results indicate that guinea-pigs, hetherto routinely employed for efficacy testing of vaccines against porcine parvovirosis in our laboratory (Ječábek et al. 1985), could only be successfully replaced by laboratory rats.

Vyhodnocení sérokonverze u různých laboratorních zvířat po aplikaci inaktivované vakcíny proti parvoviróze prasat

V krevních sérech králíků, morčat, laboratorních potkanů a bílých myší byly testem inhibice hemaglutinace prokazovány specifické protilátky po vakcinaci a revakcinaci inaktivovanou vakcínou proti parvoviróze prasat. Nejvýraznější imunitní odpověď byla u laboratorních potkanů, u kterých byly zjištěny titry hemaglutinaci inhibujících protilátek v rozmezí 256 - 2048. V pořadí podle intenzity imunitní odpovědi následovala morčata, u nichž byly

zjištěny titry protilátek v rozmezí 16 - 1024. Podstatně méně výrazná byla imunitní odpověď u bílých myší (rozmezí titrů 16 - 32) a u králíků (rozmezí titrů 8 - 128). Z použitých laboratorních zvířat jsou pro ověřování účinnosti inaktivované vakcíny proti parvoviróze prasat nejvhodnější laboratorní potkani a morčata.

Конверсия сыворотки у кроликов, морских свинок, лабораторных крыс и белых мышей после применения инактивированной вакцины против парвовироза свиней

В кровяной сыворотке кроликов, морских свинок, лабораторных крыс и белых мышей проверкой на ингибирование гемагглютинации специфические антитела после вакцинации и повторной предварительной прививки инактивированной вакциной против парвовироза свиней. Самым выразительным был иммунитеттный ответ у крыс, у которых были установлены титры ингибирующих гемагглютинацию антител в пределах 256 - 2 048. По интенсивности иммунитетного ответа следовали морские свинки, титры антител которых достигали пределов 16 - 1 024. Менее выразительным был ответ у белых мышей (предел титров 16 - 32), кроликов (предел титров 8 - 128). Из числа используемых лабораторных животных для проверки действенности инактивированной вакцины против парвовироза свиней самым пригодным являются лабораторные крысы и морские свинки.

References

CUTLER, R. - MOLITOR, T. W. - SAUBER, T. E. - LEMAN, A. D.: Role of the rat in the transmission of porcine parvovirus. Am. J. vet. Res., 43, 1982: 493-496.

DRÁBEK, J. - JEŘÁBEK, J. - DEDEK, L.: Ekonomický význam parvovirózy prasat. Veterinářství, 36, 1986: 461-463.

JEŘÁBEK, J. - DEDEK, L. - ŠIMKOVÁ, L. - MAŇOUŠKOVÁ, V. - DRÁBEK, J.: Imunoprofylaxe parvovirózy prasat. /Project report/ Brno, University of Veterinary Science, 1985, 94 p.

JEŘÁBEK, J. - MAŇOUŠKOVÁ, V. - DEDEK, L.: Sérokonverze u prasat a morčat po aplikaci inaktivované vakcíny proti parvoviróze prasat. Imunoprofylaxia, in press.

JEŘÁBEK, J. - MAŇOUŠKOVÁ, V. - ŠIMKOVÁ, L. - DEDEK, L.: Test inhibice hemaglutinace /HIT/ k sérologické diagnostice parvovirózy prasat. Imunoprofylaxia, 1986a: 57-66.

JEŘÁBEK, J. - ŠIMKOVÁ, L. - MAŇOUŠKOVÁ, V. - DRÁBEK, J. - DEDEK, L.: Imunoprofylaxe parvovirózy prasat. Veterinářství, 36, 1986b: 55-58.

JOO, H. S. - DONALDSON-WOOD, C. R. - JOHNSON, R. H. - WATSON, D. L.: Antibody to porcine, feline and rat parvoviruses in various animal species. Res. vet. Sci., 21, 1976: 112-113.

JOO, H. S. - MOLITOR, T. W. - LEMAN, A. D.: Antibody responses in laboratory animals inoculated with inactivated porcine parvovirus vaccine. In: International Pig Veterinary Society Congress. Proceedings. Mexico, 1982: 192.

JOO, H. S. - MOLITOR, T. W. - LEMAN, A. D.: Antibody responses of guinea-pigs, rabbits and pigs to inactivated porcine parvovirus vaccines. Vet. Microbiol., 9, 1984: 27-33.
KRPATA, V.: Protilátky proti porcinnímu parvoviru u prasat. Veterinářství, 31, 1981: 273-274.
SAVIČ, O. M. - ORLJANKIN, B. G. - SERGEJEV, V. A.: Antigennaja aktivnosť inaktivirovannych preparatov parvovirusa svinéj. Bjull. Vsesojuz. Inst. eksp. Veter. 60, Moskva, 1985: 14-20.
STEIN, T. E. - LEMAN, A. D.: Epidemiologic and economic analysis of parvovirus infection in swine. In: International Pig Veterinary Society Congress. Proceedings. Mexico, 1982: 197.
ŠTĚPÁNEK, J. - MACHATÝ, J. - MENŠÍK, J.: Izolace parvoviru z mrtvě narozených selat v souvislosti s rozsáhlým výskytem poruch v průběhu březosti u prasnic. Vet. Med. (Praha), 24, 1979: 149-158.