PRRS Integrated PRRS Solutions Web

Uses of serology

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Highlights

Serology is the most simple and economic tool for the PRRSV diagnosis. Nevertheless, it has many practical limitations, especially in the diagnosis of outbreaks of this disease in sows.

The seroconversion can be detected a week right after the infection, depending on the virus strain, the technique used and the infective dose the animals are exposed to; this can be delayed until the third or fourth week after the infection.

The limited interest of serology in adult animals is due to three reasons:

The infected animals will develop antibodies that will have a half-life long enough to be present when the infection has been solved.

In many cases, the reinfections do not give place to a clear anamnestic response, and therefore the diagnosis cannot be based on the determination of a change in the titre of antibodies.

There are no marked vaccines available in the market that allows telling apart the vaccinal antibodies from the infection antibodies, and this impedes the use of serology on vaccinated farms.

The serology is useful to establish the moment of the infection in non-vaccinated growing animals by means of the use of the serum profiles.

The S/P ratio values do not have a direct correlation with the titre of antibodies, the time passed after the infection or the kind of strains (this is, field strains or vaccinal strains) with which the animals have become infected.

MSD Animal Health

In order to understand the value of serology in the diagnosis of the disease, we must know the dynamics of the appearance of antibodies and the characteristics of the different kinds of antibodies produced after the infection.

Any age animals seroconvert quickly after the exposure to the virus. As a general rule, we can say that the IgM antibodies can be detected on the fourth or fifth day after the infection, and the IgG antibodies approximately on the seventh-ninth day after the infection, although the seroconversion time may vary depending on the strain that causes the infection, the infective dose that the animals are exposed to and, above all, the diagnostic kit used.

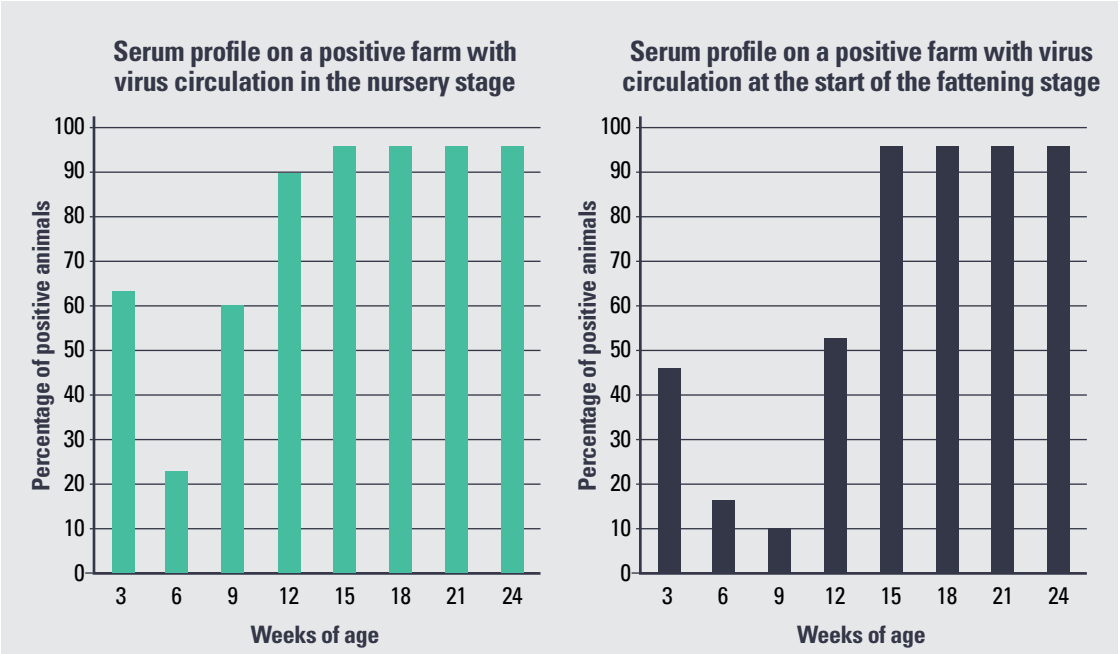
The antibodies detected by the diagnostic kits are those against common viral antigens that react with different isolates, including isolates that are not related, as in the case of those with a different genotype (PRRV1 and PRRSV2). This entails an important advantage, because it limits the effect of one of the virus' traits that is more relevant for the diagnosis: variability.

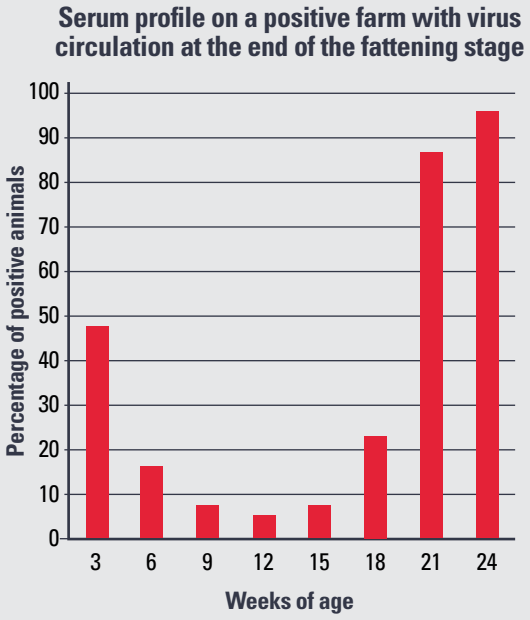
Regarding the techniques used for the serological diagnosis of the disease; not very far from its description, indirect immunofluorescence (IFI) techniques were developed, and they have been used mainly in the US; immunoperoxidase monolayer techniques (IPMA), which have had a greater use in Europe, and ELISA techniques, that have quickly become generalised, with the rest of the techniques falling into disuse or having been limited to experimental studies. This is because the ELISA techniques are easier to standardise and automate, and they require less experience for their interpretation, making their repeatability much higher. They also have the additional advantage of being cheaper. Due to all this, in this chapter we will only speak of the pros and cons of the ELISA techniques.

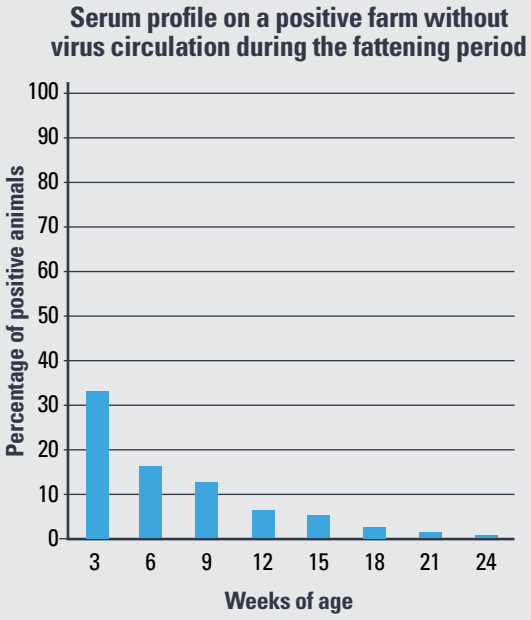
When we think about the serological diagnosis, we must bear in mind that the dynamics of the appearance (and disappearance) of the antibodies are variable depending on the kind of antibody considered and the antigen that they recognise. Therefore, the promptness with which the presence of antibodies is detected after the infection will depend on the diagnostic technique used. As a rule, the assays that detect IgM antibodies can also quickly detect the seroconversion. On the contrary, the detection of IgG antibodies is slightly delayed, and the seroconversion happens between the first and the second week after the infection, although sometimes it appears on the third or even the fourth week.

The fact that the IgM antibodies appear rapidly after the infection and that they disappear quite fast has stimulated the development of ELISA techniques that detect specifically this kind of antibodies; since the seropositivity is a clear indicator of a recent infection. Nevertheless, its use has not become widespread because of the greed of these so early antibodies for the antigen that they recognise is relatively low, and this makes its specificity, and to a lower degree its sensitivity, not very high. Also, the development and the generalised implementation of molecular diagnostic techniques, specifically the reverse transcription and polymerase chain reaction (RT-PCR), that is able to detect the presence of the nucleic acid of the virus in different biological samples with a high sensitivity has reduced the practical usefulness of the detection of IgM antibodies. On the other hand, the early development of IgG antibodies makes the

Figure 1. Possible serum profiles found on farms depending on the moment of the virus circulation.







detection of seroconversion possible as of the second week after the infection, and this has also helped to limit the practical usefulness of the specific detection of IgM antibodies. Nevertheless, there are commercial kits on the market that, due to their design, are able to detect IgM and IgG antibodies, and this increases the sensitivity of the technique in the first week after the infection, allowing to detect the infection earlier.

Likewise, the time during which it is possible to detect the presence of antibodies will vary substantially depending on the technique used and on the variations in the individual response of the animals, with pigs that can be seronegative 4-5 months after the infection whilst other will be positive for longer periods of time. The fact that the antibodies developed after the infection may be detected for longer periods of time, summed to the fact that most of the pig population becomes infected at some time of their lives and to the widespread use of vaccines that do not allow to identify vaccinated animals from those infected, limits the practical use of serology in the diagnosis of outbreaks of the disease, because the animals may be seropositive as a consequence of an old infection not related to the process observed, or as a result of earlier vaccinations.

This evidence is aggravated by another peculiarity of the infection with this virus in which the repeated exposure of the animals to the same antigens does not result, systematically, in an evident and durable secondary or anamnestic response. As a consequence, and depending on the antigenic features of the strain that causes the reinfection of the animals, we sometimes see a secondary response, but other times the titre of antibodies can remain unaltered or, in the best-case scenario, experience a transient increase that is not always easy to detect by means of diagnostic techniques. This poor secondary response is also seen after the vaccination of the animals, which may not experience a significant change in the amount of antibodies detectable in the circulating blood after repeated revaccinations.

As a consequence of all that has been explained, we can say that there are three reasons why serology has a limited value in adult animals:

1. The infected animals will develop antibodies that will have a half-life long enough so they are present when the infection has been solved, making the diagnosis difficult.
2. In many cases, the reinfections do not result in a clear anamnestic response, so we cannot reliably base the diagnosis on the determination of a change in the titre of antibodies.
3. There are no marked vaccines available in the market that allows telling apart the vaccinal antibodies from the infection antibodies, preventing the use of serology on vaccinated farms.

Due to all this, in the adult animals, the usefulness of serology is limited to the detection of seroconversion in the adjustment of the replacement sows and to the monitoring of the health status in negative populations, normally artificial insemination centres or genetics or in production farms that are negative to the virus.

On the contrary, serology is useful for detecting the infection in growing animals that, theoretically, once they have lost the maternal antibodies, will be seronegative until they come into contact with the virus, moment in which they will seroconvert, except on farms where the piglets are vaccinated. This causes that frequently, serum profiles are carried out to establish the moment when these animals become infected, being this accompanied sometimes by RT-PCR techniques to refine the diagnosis even more.

This is especially important when we wish to establish the existence of a secondary response and the

paired samples are not tested at the same time, in the same assay. Likewise, the use of different kits to monitor the evolution of a population over time is not recommended, because the different techniques commercially available differ in terms of sensitivity and specificity and on the antibodies detection dynamics, complication the comparison of the results obtained with different kits. For the same reason, it is essential to know the technique used by the laboratory, including the sensibility and specificity data provided by the manufacturer. This will allow making a correct interpretation of the results.

Regarding the use of serology for the diagnosis we must highlight that the sensitivity and specificity of the different tests commercially available varies according to their design. Therefore, when serial samples are going to be tested or when we wish to compare the results obtained in the same populations, but in different moments over time, it is essential to use the same commercial kits to guarantee the uniformity of the results and to be able to establish comparisons. Due to the same reason, it is necessary to know the technique used in the laboratory to test the samples, including the sensibility and specificity data provided by the manufacturer. On the other hand, we must bear in mind that the numerical values obtained for each sample may vary between tests, because the kits are designed, solely, for distinguishing the positive and the negative animals, and not for quantifying the amount of antibodies present in the sample. Therefore, in the particular case of the paired samples tests, they must be tested simultaneously to avoid the intra-assay variability. The obedience of these rules will allow a better interpretation of the results.

Finally, as we have mentioned, the diagnostic kits are not designed to determine the titre of antibodies. Due to this, the use of the numerical values in which the results of the technique are shown (as, for instance, the S/P value) to estimate the titre of antibodies of the animals is not suitable, because it does not offer a reliable measurement and there can be variations between assays. Likewise, the numerical values obtained in a test will depend on the antigenic composition of the strain that has caused the infection and on the intensity of the immune response stimulated on the animals, without taking into account the individual variability regarding the response. This turns into the fact that with the days post-infection being equal, the numerical values differ between animals and strains, so it is neither correct to use these values to predict how much time has passed after the infection. Although, generally, higher values point towards more recent infections and lower values towards older infections, the correlation is not perfect. Due to the same reason it is wrong to assume that low values belong to vaccinal antibodies and high values belong to infections with field viruses.

References

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