4.1 Immune response

Cellular and humoral immune response...

As opposed to vaccination, a natural BVDV infection induces a life-long protective immunity. The immune system of the cow reacts to acute infections with the formation of antibodies and an activation of T-lymphocytes (CD4+ and CD8+ T cells) which recognize different types of BVDV. The presence of neutralizing antibodies is confirmed as early as two weeks following the first virus contact. However the kinetics of the lymphoproliferation response seem to differ between cp and ncp viruses [73].

Cellular immune response: CD4+ plays the more important role in the fight against the virus than CD8+. Thus, an in vivo depletion of CD4+ led to a prolonged viraemic phase and an increased virus titre in the blood, combined with a prolonged nasal virus secretion, whereas an in vivo depletion of CD8+ did not influence the course of the illness [74]. CD4+ mainly targets NS3 and E2, but also C, Erns, Npro and NS23. The cellular as well as the humoral immune response can only be detected after the viraemic phase.

Humoral immune response: Antibodies predominantly target the surface protein E2 (strongly neutralizing) but also Erns (less neutralizing, [75]) and a few target E1. However, C – the main structural protein of BVDV – does not appear to induce any antibody formation. The non-structural protein NS23 provokes a strong humoral immune response. Antibodies against NS23 cross react with NS23 of classical swine fever and vice versa. In cp BVDV NS23 is split into NS2 and NS3 (marker for cp BVDV and the most conserved protein of the pestivirus family, [75]). It is also highly immunogenic.

The biotype involved appears to notably influence the course of the immune response. Parallel infections with homologous biotypes show that calves infected with ncp BVDV produce antibodies considerably more quickly and have higher antibody titres than animals infected with cp BVDV. In a primary infection the cellular immune response remained similar. However, in a secondary infection, the lymphocyte reactivity of animals that had initially been infected with cp BVDV was significantly better than that of animals that had initially been infected with ncp virus [76]. It appears that ncp BVDV is capable of weakening the cellular immune response in favour of the humoral immune response.
Neonatal calves

Calves are supplied with maternal antibodies via their colostrum uptake. In the first weeks of life these antibodies prevent a BVD infection. Protection lasts approximately 6 months, exceptionally even 9 months. A field study (466 calves on two farms) showed 50% of all calves at the age of 141 days to be seronegative for BVDV I, or at the age of 114 days to be negative against BVDV II. The decrease in the antibody titre depended significantly on the initial titre at the age of 1 to 3 days [77]. Maternal antibodies interfere with vaccines and can prevent the formation of an effective immunity. It is therefore recommended not to use these vaccines in calves of under 4-6 months of age, or else the vaccination should be repeated. The presence of maternal antibodies also causes the so-called diagnostic gap, i.e. the presence of virus antigens cannot be confirmed in very young animals. The duration of the diagnostic gap depends on the diagnostic method used: AG-ELISA, EIA around 14 days [78][79], AK ELISA about 6 months.