Vaccination against Lumpy skin disease virus

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Why to vaccinate?

• Feasible control varies between geographical regions and farming practices – North versus South
• In the field the first cases of LSD are not detected early enough for a stamping-out policy to be effective as a sole control measure
• Skin lesions contain such a high titre of virus that vectors get swiftly contaminated and start to transmit the disease
• Time window between infection and viraemia (1 to 5 days) during which there is no way to detect infected animals
• Early stages and mild cases difficult to recognize even for the most experienced vets
• Outbreaks are likely to start again in spring time - Skin lesions are well hidden under a long winter coat
• Free-ranging beef cattle versus dairy cattle
• Consequently a sufficient herd immunity needs to be in place!
Harmonized regional vaccination campaigns provide best protection

- Struggle to control cattle movements - Unauthorized cattle movements occur within affected countries and across the borders
- Farmers may own grazing lands and families are divided on both sides of the borders and price of cattle determines the direction of transboundary movements
- Transhumance and nomadic farming practices are difficult to suddenly halt and if prevented is likely to become swiftly an animal welfare issue
- High cattle density in the village and communal grazing limit the efficacy of the short distance movement restrictions due to vector transmission
- Cattle ID and vaccination record databases throughout the region are not yet leak-proof

Where to vaccinate

- In case a country is divided into vaccinated and non-vaccinated zones
- Regional vaccination should be preferred to ring-vaccination
- Limits of the vaccinated zones should be based on epidemiological and geographical parameters rather than the classical radius shape.
- Vaccinate around infected farms and the holdings around slaughterhouses and temporary slaughter plants, animal markets and cattle collection and resting places
- Protection and surveillance zones with radius (>50 km of diameter) appropriate for a vector-borne disease
Live versus inactivated pox vaccines

- Only live vaccines currently available against LSDV – all of them require authorisation by the local authority for use in cattle
- Inactivated vaccine in the pipeline
- No DIVA vaccines – serology is of no use in surveillance in vaccinated population
- A live pox vaccine generates more broad protective immunity than an inactivated one
- However, inactivated vaccines could be used for cattle imported from disease-free regions
- Vaccination with inactivated vaccine in a disease-free country of origin

Choosing a vaccine against LSDV

- Live homologous (attenuated LSDV containing) vaccines are known to provide good protection in cattle in case
- Protection provided by non-homologue (SPPV against LSDV) vaccines needs to be demonstrated
- SPPV/GTPV vaccines may be used for cattle against LSDV if combined with sufficient vaccination coverage (100%) and other appropriate control measures are in place
- **Importantly** only a vaccine with demonstrated efficacy should be used – vaccine challenge experiment has been carried out at CODA CERVA, including all commercially available vaccines against LSD
- SPPV/GTPV vaccine in regions where SPP and GTP are endemic
Two equally effective live attenuated LSDV vaccines

- LSDV containing vaccines:
  - LSDV Neethling strain by Onderstepoort Biological Products (OBP)
  - Attenuated LSDV field strain by MSD Animal Health
- Onset of vaccination campaigns may be delayed because
  - A tendering process prior to purchase of vaccine - Price varies (approximately € 1.4-1.8) according to ordered amounts
  - Delays by the manufacturers
  - Feasible package size to suit the numbers of vaccinated animals to avoid waste of vaccines
  - OBP vaccine 25 and 50 doses vials
  - MSD Lumpyvax 10 and 100 doses vials
- Are the vaccines produced according to Good Manufacturing Process (GMP) standards?

Sheeppox and goatpox vaccines against LSD

- Gorgan goatpox vaccine (Lumpyshield, Jovac, Jordan) has been demonstrated to provide good protection against LSDV
- Sheeppox virus (SPPV) vaccines against LSDV:
  - Yugoslavian RM65 SPPV vaccine (at a 10 times stronger dose than used for sheep) is commonly used for cattle in the Middle East
  - Romanian SPPV vaccine for cattle in Egypt
  - Bakirköy SPPV (3 or 10 times the sheep dose) used in cattle in Turkey and in some northern Caucasus countries
Newest vaccine – Lumpyshield (Attenuated Gorgan Goatpox strain)

- A commercially available GTPV vaccine, same strength for cattle and goats
- Good protection in cattle against highly virulent Ethiopian LSD field strain (Gari et al 2015)
- Efficacy has been evaluated by scientist at Coda Cerva – publication is ongoing
- Ideal product for those regions where both LSD and GTP coexist
- Practically no side effects in cattle
- One vaccine for both cattle and goats – reduces the price
- Price (enquiry 24/2/2017) 1US $/dose
- Why GTPV provides better protection against LSD than SPPV – likely be genetic

Vaccination strategy

- LSDV is stable and survives well in the environment – freezing winter temperatures below zero Celsius degree do not disinfect the country from LSDV
- Annual vaccinations
- Vaccination coverage needs to be kept at 100%
- New animals should be immunized before introduction to affected farms
- Calves from vaccinated/naturally infected mothers should be immunized at the age of 3 to 4 months – individually or during next round of vaccinations
- Calves from naïve mother can be vaccinated at any age
- Domestic buffaloes should be vaccinated
Vaccination of breeding animals

- Pregnant cows can be vaccinated
- Vaccinated bulls did not excrete vaccine virus into semen
- After a challenge with a virulent field virus vaccination prevented the excretion of the field virus to the semen

Adverse reactions

- Local reaction at the vaccination site should be accepted
- Attenuated LSDV vaccines cause a general reaction in a minority of vaccinated animals (Neethling disease)
- Attenuated SPPV and GTPV vaccines only rarely cause adverse reactions
- Adverse reactions caused by two LSD vaccines could be investigated in Croatia (no interference by the field strain)
Why clinical signs are often detected in vaccinated animals?

- Vaccination campaigns are started when the disease is already circulating in the country/territory
- Development of protection takes ~ three weeks during which time animals still may get infected by the field virus
- Insufficient vaccination coverage – pockets with unvaccinated animals left within vaccinated zones
- “Missing” of some animals during mass vaccination, particularly with free-ranging beef cattle
- Failure of the vaccine virus to protect or over-attenuated vaccine - Inappropriate storage or a failure of the cold-chain, exposure to direct sunlight
- Poorly administrated vaccine or an incorrect dosage (mass vaccinations, free-ranging beef cattle not used to handling)
- Interfering maternal antibodies in calves less than three to four months of age
- Needles not changed between animals - contaminated needles or diluents

Success of the vaccination campaign depends on

- Efficacy of the vaccine product and sufficient vaccination coverage (80-100%)
- Capacities of veterinary services to carry out vaccination campaign
- Electronic database including cattle ID/ vaccination/health records/ cattle movement history
- The other supporting control/eradication measures and surveillance programmes
- Control of cattle trade and movements
- Stamping-out policy in place
- Diagnostic capacity of national reference laboratory to investigate adverse reactions
Remaining questions

- Are annual vaccinations really required? Would vaccination every second year be sufficient?
- Can LSDV vaccine be administrated simultaneously with the other obligatory vaccines
- Does vaccination with attenuated LSDV interfere other cattle testing regimes (such as intradermal tuberculin testing)
- What would ideal timing to vaccinate those calves that born after the vaccination campaign – once a year campaign or individually when coming to age of 3 to 4 months

Thank you for your attention!

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