Safety and efficacy of different Gumboro disease vaccines

J.J. (Sjaak) de Wit, DVM, PhD, dipl ECPVS
GD Deventer
The Netherlands

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Different kind of Gumboro disease vaccines

- Conventional vaccines
- Antigen/antibody complex vaccines
- Vectored vaccines
Conventional vaccines

• Too high MDA neutralize the vaccine virus
  – Vaccinating too early: vaccine will be neutralised in most of the birds
  – Vaccinating too late: birds with low MDA will be unprotected for a long time

• Protection one week after a successful vaccination

• Choice of mild, intermediate, intermediate plus/hot

• Application by drinking water systems: even if done properly, several factors may jeopardize vaccination
Antigen/Antibody complex vaccines

- Application at the hatchery (In ovo or day-old injection)
- Vaccine strain: intermediate plus/hot (for broilers only)
- Replication starts when the MDA is low enough (individual titre)
- Replication in field conditions can start after 2.5 to 4 weeks of age
- They spread
- In susceptible birds (i.e. without MDA) they can cause a significant immunosuppression
**Vectored HVT-IBD VP2 vaccines**

- Hatchery vaccination, in ovo or s.c.
- Replication starts right after application (HVT strain), independently from MDA against IBDV
- IBD immunization: induced by VP2
- Cannot be combined with other HVT vaccines
- High protection against vvIBDV after about 2-3 weeks
- Do not spread (missed is unprotected)
Safety and efficacy

– Clinical signs post vaccination and challenge

– Bursa-body weight ratio

– Bursa lesion score
Bursa: body weight ratio (x1000)

• Standardized way of determining the level of bursa atrophy, post vaccination and challenge

• B:BW ratio = \( \frac{\text{bursa weight} \times 1000}{\text{body weight}} \)

• A higher B:BW ratio is favourable (less atrophy)
Bursa lesion score

- Standardized way of determining the level of bursal damage by histology (HE staining)
- Lower is favourable (less atrophy)

- Lymphoid depletion recorded using the Muskett score:
  - 0: no histological abnormalities
  - 1: minor lymphoid depletion
  - 2: moderate lymphoid depletion
  - 3: lymphoid depletion
  - 4: severe lymphoid depletion
  - 5: very severe lymphoid depletion
Bursa lesion scores (Muskett)

- Score 0
- Score 1
- Score 2
- Score 3
- Score 4
- Score 5
Vaccination/challenge study 2010:
Safety and efficacy of VAXXITEK vs Hot IBD vaccine

- Commercial brown pullets (20 per group) and SPF pullets
- VAXXITEK (s.c.) day 1 or intermediate plus vaccine at day 21 (Deventer formula)
- Appropriate control groups
- Challenge with vvIBDV (D6948) at day 28 (100 LD$_{50}$)
- Clinical signs p.c., B/BWR (0 and 10 d.p.c.); Muskett score at 10 d.p.c.; serology
Clinical signs

• No clinical signs after challenge in the vaccinated groups

• 100% mortality in the non-vaccinated SPF birds

• 55% mortality in the non-vaccinated brown pullets
Body weight at 28 and 38 days of age

VAXXITEK groups statistically heavier than Hot vaccine (P< 0.01) at 28 & 38 days
Bursa/bodyweight ratio at 10 d.p.c.
Bursa lesion score (Muskett) at 10 d.p.c.
Histological results

Negative controls

VAXXITEK

Hot, 17 days p.v.

Positive controls vvIBDV

VAXXITEK + vvIBDV

Hot + vvIBDV
Summary experimental study

- Both VAXXITEK (day 0) and intermediate plus vaccine (day 21) gave full clinical protection against vvIBDV at day 28

- No bursal lesions in VAXXITEK vaccinated birds, not even after challenge

- Serious bursal lesions in intermediate plus vaccinated birds

- At 28 and 38 days of age the average body weights of the VAXXITEK vaccinated groups were significantly heavier than that of the intermediate plus vaccinated groups (P<0.01)
Vaccination/challenge study 2013: safety and efficacy

**VAXXITEK vs antigen/antibody complex vaccine**

- Commercial broilers (20 per group)
- **VAXXITEK** or antigen/antibody complex vaccine (s.c.) day 1
- Appropriate control groups
- Challenge vvIBDV at day 28 (D6948) (100 LD$_{50}$)
- Clinical signs p.c., B/BWR (0 and 10 d.p.c.), Muskett score at 10 d.p.c., serology
- SPF birds were added to an antigen/antibody complex vaccine vaccinated group of commercial broilers to study vaccine spreading and safety to SPF broilers and SPF layers.
Clinical signs post challenge

• No clinical signs after challenge in both vaccinated groups

• 80% mortality in the non-vaccinated SPF layers

• No mortality in the SPF broilers
Bursa/bodyweight ratio at 0 and 10 d.p.c.

Mean Bursa:body weight ratio at 0 and 10 days post vvIBDV challenge of 28-day-old vaccinated broilers and control birds
Bursas at 10 d.p.c.
## Muskett score at day of challenge (D28)

<table>
<thead>
<tr>
<th>Vaccinated group</th>
<th>Mean Muskett score at 28 d.p.v.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaxxitek</td>
<td>0.0</td>
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<tr>
<td>Antigen/antibody complex vaccine</td>
<td>4.2</td>
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<tr>
<td>Negative control</td>
<td>0.0</td>
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</tbody>
</table>
Safety post vaccine spreading

- Commercial broilers vaccinated with Ag/Ab complex vaccine at day-old ("shedders")
- Unvaccinated day-old SPF White Leghorn commingled in the same isolator with broilers vaccinated ("contacts")
- Unvaccinated SPF broilers commingled with SPF layers
- Unvaccinated SPF broilers not in contact with SPF layers
- Clinical signs and lesions
- B/BW ratio at 19 – 28 – 35 days
Safety post vaccine spreading

<table>
<thead>
<tr>
<th>Vaccine/contact birds</th>
<th>Mean B/BW ratio*1000</th>
<th>Morbidity (%)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 19^A</td>
<td>Day 28^A</td>
<td>Day 35^A</td>
</tr>
<tr>
<td>Ag/Ig complex vaccine</td>
<td>1.38</td>
<td>0.61</td>
<td>-</td>
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<tr>
<td>vaccinated commercial</td>
<td></td>
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<td></td>
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<tr>
<td>broilers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unvaccinated SPF</td>
<td>-</td>
<td>1.40</td>
<td>-</td>
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<tr>
<td>layers in contact with</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vaccinated broilers</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unvaccinated SPF</td>
<td>1.35</td>
<td>0.93</td>
<td>0.83</td>
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<td>broilers in contact</td>
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<tr>
<td>with the SPF layers</td>
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<tr>
<td>Unvaccinated SPF</td>
<td>1.35</td>
<td>2.56</td>
<td>2.97</td>
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<tr>
<td>broilers without</td>
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<tr>
<td>contact with the SPF</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>layers</td>
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</tbody>
</table>

^A the SPF broilers were hatched at day 15 of the study
Safety post vaccine spreading

- **CLINICAL SIGNS** and **LESSIONS** in “CONTACTS”:
  - 47% WL SPF showed IBD clinical signs
  - 23% mortality in WL SPF at 18-19 days:
    - IBD signs
    - Bursa lesions (Muskett score 5)
    - Very severe lympho-depletion

- **Ag/Ab complex vaccine strain** confirmed by PCR and sequencing
Summary experimental study

• Both VAXXITEK and Ag/Ab complex vaccine gave full clinical protection against vvIBDV at day 28

• No bursal lesions in VAXXITEK vaccinated birds, not even after challenge

• Serious bursal lesions in Ag/Ab complex vaccine vaccinated birds

• Mortality in SPF layers after spread of vaccine strain from Ag/Ab complex vaccine vaccinated birds
Conclusions

- Vaccines of all types are capable to induce full protection against clinical signs post challenge with vvIBDV:
  - **Conventional vaccines**: complications of application in the field, do cause damage to the bursa
  - **Ag/Ab complex vaccines**: reliability of application in the hatchery, do cause damage to the bursa, can cause mortality in pullets
  - **Vectored HVT-IBD VP2 vaccines**: reliability of application in the hatchery, completely safe to the bursa and birds
Thank you for your attention