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Mucosal immunity from live vaccines, relevance, induction and practical veterinary implications.

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The problem

Traditionally a lot of vaccines for systemic poultry diseases causing agents make humoral antibody. This can often be correlated with induction of immunity or quantify immunity and can often be conveniently monitored from the veterinarian's office to monitor vaccination application. Certainly most killed vaccines aim to produce humoral antibody. Of course some vaccines (usually chronic infections) like Marek's and coccidiosis vaccines cannot be monitored in the field by humoral antibody assessment. Newer vaccines, especially against chronic bacterial infections – those with the potential to exclude wild strains often don't produce humoral antibody. In the case of MG and MS this is confusing as we have used antibody in non vaccinated flocks for years in the laboratory.

Are birds with no measurable MG antibody after ts-11 vaccination protected against MG disease

Birds from two flocks vaccinated with ts-11 that had minimal antibody response (RSA test) were taken to the laboratory and challenged with MG at 17 weeks. Tracheal mucosal thickening after challenge was measured to evaluate protection. Non vaccinated control groups were included.

Results

In non-vaccinated (NV) control birds typical MG disease was seen in tracheal sections and this was significantly absent in field vaccinated birds with no statistical difference between challenged (C) and non-challenged (NC) controls. They resisted challenge.

Table showing tracheal mean tracheal mucosal thickness two weeks after challenge

Group	Age vac wk	RSA reactors (score range)*	Tracheal mucosa µm†
ts-11/C	3	0% (0-0)	101±5[a]
ts-11/NC	3	0% (0-0)	98±5[a]
ts-11/C	6	40% (0-1)	105±5[a]
ts-11/NC	6	20% (0-0.5)	105±6[a]
NV/C	NV	0% (0-0)	273±44[b]

In another (laboratory) experiment another group was included; vaccinated with an MG Bacterin – despite massive production of humoral antibody in these birds no protection in the trachea could be demonstrated.

Group	n	RSA Score	Mucosa µm
ts-11*	10	1.8±1.1	71.4[b]
Bacterin*	10	3.7±0.5	251.1[c]
Unvaccinated*	10	0	253.6[c]
Not challenged	10	0	44.3[a]

Implications/conclusions

- ⇨ Humoral antibody is not correlated with immunity with ts-11 vaccination
- ⇨ Field experience worldwide is that the vaccines make a variable amount of antibody (might be associated with the amount of tracheitis at the time of vaccination) and in fact this may abruptly decrease after a couple of years (Morrow and Whithear 2011) once field strains have been pushed off the farm.
- ⇨ Other groups have shown that killed MG vaccines only decrease tracheal MG populations in vaccinated birds. This is in contrast to ts-11 and MSH where field strains are excluded under field challenge conditions.
- ⇨ There is evidence of antagonism between live and killed MG strains (Glisson and Kleven 406-15). More is not necessarily better. The effect of killed vaccines may be enough to limit the immunogenic stimulation from live vaccines.
- ⇨ Despite attempts to improve MG antigens/tests antibody demonstration is not always possible in vaccinated birds. This is more pronounced in broiler breeders compared to layers.
- ⇨ Similarly with live *Pasteurella* vaccination and live *Salmonella* vaccination antibody response may not be universal. Even NDV V4 vaccination has seen this lack of correlation between antibody and protection.
- ⇨ Penultimate thought – For AEV we want to have antibody before the beginning of lay – in fact we don't even care if it is from the vaccine or field challenge. This is not a chronic infection. Antibody here is not differentiating between field and vaccine response.
- ⇨ Live vaccines need lab techniques that can identify the vaccine and auditing of administration.

References

Glisson, J. R. and S. H. Kleven. (1984) "*Mycoplasma gallisepticum* vaccination: effects on egg transmission and egg production." Avian Dis. 28(2): 406-15.
Morrow C and Whithear K, (2011) Mycoplasma *ts* vaccines – 20 years of field experience, pen trials and myths. International hatchery practice 25(5): p14-15.