

2nd International Avian Mycoplasma Conference: infection versus disease

The 2nd International Avian Mycoplasma conference recently brought together researchers, who were already in Brisbane for the International Organisation of Mycoplasma Conference, and poultry veterinarians from around the world, for one very long day of sessions. The talks were great but there was a sense of frustration amongst everyone that, after 30 years of work, we are not moving faster in the control of mycoplasma infections (wild strain freedom) on an industry basis.

We need to hurry this up as the ongoing treatment with antibiotics of the residual disease effects by these infections may be limited – not because of resistance development or threat to efficacy of useful human antibiotics, but because consumers do not want animals produced with the routine use of antibiotics.

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Although mycoplasma (*Mycoplasma gallisepticum* (MG) and *M. synoviae* (MS)) freedom as a steady state is the best position to be in (even if these flocks are totally susceptible) this has only been implemented outside elite breeding programs in the USA and UK broiler breeder segments and some layer operations on any massive scale starting in the 1970s.

Europe, Israel and Brazil breeder operations have certainly had successes against MG but MS may be relatively uncontrolled. Layers in many parts of the world are MS infected.

Controlling MG and MS infection with vaccines

Control of infection is not a claim made by mycoplasma vaccines in registration but it may be that this is the most important effect needed if we going to do something about mycoplasma epidemiology.

Maarten De Gussem showed data suggesting the use of MS vaccine in Belgium is decreasing MS infection compared to the

effects to date of the Dutch monitoring program.

MS appears a lot harder to control around the world than MG. Implementation of effective MG biosecurity (and a will to cull infected flocks) does not seem to put up a strong enough barrier to prevent MS infection (for example the Netherlands in the past).

The USA industry often argues that they already have very strong biosecurity but when they batted down the hatches in 2015 for avian influenza, a long running MS epidemic in Georgia was completely stopped.

With the threat of avian influenza abating, this epidemic is now starting up again. No MS vaccines were involved here. The industries are set up and going but it is generally agreed that they cannot afford to bear any extra cost of MS exclusion and the Netherlands' recent aim to go MS free in breeders will be interesting to watch.

Longer airborne transmission of MS compared to MG appears to be one factor, although having a big reservoir in commercial layers may also be an important factor!

The situation in Australia

Australia's attempt to control MG infection with vaccines was reviewed by Kevin Whithear. In the 1970s biosecurity could be made to work at the elite level but was hard to maintain in replacement breeders. The emergence of tylosin resistant MG strains made the need for a solution more critical in the early 1980s.

Killed vaccines did not help so the next step was the search for a strain similar to the F strain and finally the use of temperature sensitive mutants. Reflecting on the efficacy of vaccines he recalled the more live vaccine Australia used, the less problems they had.

Could Australia ever try to rely just on freedom now mycoplasma is under control? Again the economics probably dictate this is not possible.

The factors allowing mycoplasma exclusion in an area involves poultry factors – stocking density, farm placement, biosecurity – but may also require other

factors for freedom to be possible – routine access to advanced diagnostics and strain survey overview (USA and Iran) and the ability to cull flocks to stop epidemics starting.

Live vaccines certainly have a place, where exclusion is not historically possible or to control epidemics.

Mechanisms of protection

A comprehensive review of the possible mechanisms of protection against disease by Prof Glenn Browning concluded that local protection of the respiratory system probably relies on both B and T-cell arms of the chicken's immune system.

To get useful protection you probably need to have a large number of antigens recognised. Immune evasion mechanisms of MG and MS (the amount of the genome in a minimalist organism devoted to this aim is remarkable) to maintain their chronic infections suggests a high biological cost to the infected bird even in the absence of disease.

There is evidence of systemic immunosuppression with these organisms. The maintenance of protection probably requires the continual presence of the vaccine strain and the testing of MSH vaccinated flocks in Iran shows the vaccine in most flocks at moulting at 58-65 weeks of age.

Certainly, humoral antibody cannot be correlated with protection. Humoral antibody following vaccination was another controversial area. Some people are very comfortable at seeing no antibody before the point of lay especially after seeing antibody in the past from live vaccination.

The dose responsiveness of live vaccines in providing protection was an interesting problem. This divided the conference into two.

Eye drop administration is very costly in first world countries so other methods of administration are often tried with varying degrees of success.

Certainly in third world countries eye drop is more palatable. Routes other than eye drop vaccination probably need bird to bird transmission to immunise flocks but

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this is dangerous (bird to bird passage) and the immunity is not necessarily as strong.

One conclusion could be that sub-optimal vaccination with the current vaccines is going to need augmentation of the vaccination (a focus of USDA research in the last decade).

Another conclusion is that where full dose eye drop vaccination has been used, very little trouble has been seen (Japan vaccinating broiler breeders in the face of very low challenge). This is probably because with eye drop administration immunity develops in individuals simultaneously, probably limiting bird to bird transmission.

Other effects of live vaccine use

Prof. Naola Ferguson-Noel noted a further effect of live vaccine use. Generally, the more the vaccine was used the more the vaccine was found in the field, but the problems this causes depends on the vaccine strain properties.

Low initial transmissibility of a vaccine is a useful feature in a live vaccine (certainly transmissibility less than field strains).

In the USA, ts-11 has been used in broiler breeders in the face of epidemics largely because of its poor horizontal transmission in contrast to the F strain. Her studies also

suggest that pathogenicity does not appear to be correlated with vertical transmission.

The study of outbreaks in the USA when vaccines have been used in breeders has offered us some anecdotal evidence on a macro level about strain displacement.

Usage of ts-11 against an epidemic MG strain saw isolations of the vaccine-like strains go up, but also saw the disappearance of the epidemic field strain in monitoring of all strains going through the laboratory.

Worldwide, the use of F strain vaccine in breeders sees the more F strain related isolates from broilers and breeders being made in multiple areas (Jordan and Egypt).

The impact of these vaccine associated infections depends on many factors – the transmissibility and the pathogenic potential.

No evidence was presented to support the use of killed vaccines as useful for infection control in the field and some evidence that the benefits of these for disease prevention have to be balanced by the downsides of traditional adjuvants in commercial (and presumably autogenous vaccines) as some parts of the world want to inject more and more antigens. Researchers are looking at a live synthetic MG vaccine that may arrive in the future.

Antibiotic resistance was also covered by Inna Lysnyansky, but the dream of being able to infer antibiotic sensitivity directly

from field samples or cultures does not seem possible because of the emergence of novel mechanisms of resistance.

Koen de Gussem reviewed problems with antimicrobials in the field including the lack of science in some current dosing regimes.

DIVA tests and techniques

Maarten de Gussem noted that the biggest impact on poultry veterinary practice of the last decade has not been vaccines or antibiotics, but the emergence of DIVA PCR tests.

These tests are not yet perfect but are helping in asking useful questions. His idea of following mycoplasma infection populations before and after antibiotic treatment by qPCR to predict efficacy of antibiotic treatments warrant further validation in the field.

Prof. Amir reviewed DIVA techniques.

Conclusion

The conference concluded that live vaccines are the current best tools we have to stop mycoplasma infections where culling of positive flocks is not an option, but better diagnostics and more research to answer questions about strains and vaccine efficacy are needed. ■