RUMINATIONS OF A GRUMPY OLD CHOOK VET

Chris Morrow
Bioproperties

Killed vaccines have taught us a lot about pathogens. The concept of virus neutralization antibodies was a model whose elucidation allowed us to understand how these vaccines worked. A simple system. Many viruses only have a few antigenic molecules.

The use of killed vaccines for bacteria is more complicated and gives rise to serotypes which often predict the range of protection of the killed vaccine's response. Here the inactivation process damages many antigens but also provides safety. Depending on the inactivation method sometimes only tough structures like LPS are the only survivors as antigenically relevant to protection.

Classically primary humoral antibody responses are transient but boosting with the same antigens may provide humoral antibody responses that last for life. For some pathogens humoral antibody is protective - especially for simple organisms. Although vaccinology has tried to investigate using adjuvants to provide more than humoral antibody as far as I know this has not been adopted in killed vaccines for chickens so far. Boosted killed vaccines can provide antibodies in temperate areas that last for life but interestingly in the tropics these often need topping up in lay (NDV and IBD especially). Boosting too often can be a problem.

Live vaccines are a lot more complicated. Giving them twice does see boosting of antigen responses but it often sees early termination of infections (maybe boosting is impossible if immunity is strong). If the idea is to boast less immunodominant antigens (possibly potential providing broader protection) then this might be prevented. The immunodominant antigens are often less broadly protective (the spike protein of IB).

Idea 1 – Giving two protectotypes of IB virus together provides protection to those two protectotypes but not broader but a second application will boost both. Giving them greater than 4 weeks apart sequentially may allow the second vaccine to replicate further allowing greater boosting of less immunodominant shared antigens (in all IB viruses) and provide broader protection against unrelated protectotypes. (Problem in Australia is that all our IB vaccines appear to be the one protectotype although they may be different serotypes). This could give sustainable IB control by vaccines.

Live vaccines also simulate natural infection and can stimulate immune responses other than just humoral antibody. Indeed humoral antibody in mycoplasma infections may be part of the mechanism that generates pathology. Maternal antibody is thought to allow survival of infected embryos and increase vertical transmission. MG and MS have few identified pathogenic mechanisms (peroxide generation?) and indeed survival is more important to an organism, so they have a lot of mechanisms to escape the immune response. Vaccine induced protection seems to be B-cell and T-cell based but humoral antibody contributes little. Mucosal immunity may be antibody mediated and seems to last about 3 months in a MG model.

Mucosal immunity is also big for coccidiosis, and it is well recognised that trickle infection in birds is important for maintenance of vaccine immunity. For example leaky coccidial treatments mean immunity will continue after treatment for the life of the flocks and are preferred if the outbreak is mild. The live mycoplasma vaccines maintain protection by colonizing for life.

So what about live/killed boasting – works well for many viral vaccines. Especially where protection is associated with humoral immunity (which we measure with ELISAs). For Pasteurella there are reasons why it may not be any use. The inactivation process in the production of killed PM vaccines probably antigenically destroys nearly all antigens except LPS. Unfortunately, challenging Heddleston (LPS) serotypes are broader than protectotypes explaining the effectiveness of real[1] autogenous vaccines but even these probably need to be given twice for optimal protection and the pressure on PM leads to escapee emergence.

Live PM vaccine registration claims to provide short protection from experiments in a laboratory model. PM challenges are notoriously difficult to really simulate field situation, and I think now that Australian field veterinarians who have used Live PM with two doses in their programmes have been surprised at the effectiveness. PM is a fickle pathogen: sometimes only the males die other times only the females, *ad nauseum.* This vaccine is ready to take on the world. Contraindicated in turkeys – don't know about ducks.

Idea 2 - So killed autogenous PM vaccines or live PM vaccines need to be given twice to get the best/maximum out of them. To do a single live/dead combination could be doing both vaccines a disservice with neither effectively boosted. Duration of immunity would be affected. Maybe doing both live and dead twice would be defendable.

Conclusion – the chicken is not a ruminant.

References.

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