Investigation of a Case of Significant Mortality in Ostrich Chicks

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Summary

This paper outlines the investigation of a case of high mortality in ostrich chicks on a South Australian ostrich chick-rearing farm. During the 2000/2001 breeding season more than 2,500 chicks less than 2-3 weeks of age had died, representing a mortality rate of approximately 65%. The main presenting signs seen in the chicks prior to death were diarrhoea and depression. These symptoms were not exhibited for long prior to death and in many cases the chicks appeared to have died prior to exhibiting any symptoms.

As part of the detailed investigation into the management of the farm and the cause of the disease, a number of chicks were autopsied. Most of these autopsies revealed varying degrees of intestinal haemorrhage or congestion throughout the intestinal tract. Two bacteria were cultured from intestinal sites - E.coli and Clostridium sp. The major histopathological lesion was significant ulceration of the large intestine with masses of bacteria adherent to the surface epithelium. These bacteria were demonstrated later to be consistent with ***Clostridium*** sp. There was also some subtle invasion of the epithelium by these same organisms in the small intestine. ***Coronavirus*** particles were found in 2 of the 3 intestinal contents samples examined by electron microscopy. All of the above results indicated that the cause of death was the Clostridial infection. However, it is unclear, at this stage if the Clostridia are the primary aetiological agent or acting secondarily to the Coronavirus. The significance of the Coronavirus presence is yet to be determined.

This paper details the nature of the investigation, various management factors that may have been contributing to the disease outbreak, the interpretation of the results of the investigation and steps taken to both control and prevent further outbreaks.

Introduction

Commercial ostrich farming presents many significant challenges, but, of these, chick rearing of hatchlings to 3-4 months of age represents the most difficult aspect of ostrich farming. In Australia there are very few successful ostrich chick-rearing farms that involve large numbers of chicks. This is a critical phase of commercial ostrich farming and, if significant problems exist at this level, then substantial financial losses can result. In a study by van Zyl *(1)* analysing profitability on a specific ostrich farm in South Africa, it was shown that a 10% increase in chick mortality rates created a 35% reduction in profit. This was second only to "income per slaughter bird" as important factors influencing profitability. However, chick rearing problems not only influence profitability directly through mortalities, but also indirectly through treatment costs, poor growth rates, higher feed costs, inadequate meat yields, poor hide quality and increased labour costs. There is a definite need to develop existing chick rearing experience and facilities and to encourage the development of

new chick rearing farms and farmers if the Australian ostrich industry is to compete successfully in the world market.

In recent years in Australia, the challenges of ostrich chick rearing have become even greater through financial constraints placed on ostrich farmers. This has resulted in some cost-cutting measures such as reduced veterinary involvement and disease investigation, a reduction in labour and the consequent sacrifice of many sound management principles, particularly related to preventative health. *(2)*

The reduction of involvement of veterinary services in ostrich farming is a complex issue and has led to a self-perpetuating cycle. The unwillingness of ostrich farmers to involve vets has led to a reduction in the exposure of inexperienced vets to ostrich problems resulting in a fall in the level of expertise which has subsequently then led to a drop in the level of confidence in veterinarians by ostrich farmers and an even greater reluctance to consult veterinarians! Even experienced veterinarians are not called in at all or not until very late in the disease or problem history, making it difficult to rapidly turn around it's course. This case highlights the need for greater veterinarian and ostrich farmer cooperation as, I believe that the losses suffered would have been substantially less if veterinary intervention had occurred much earlier in the course of the disease outbreak.

History of the Problem

In May 2001, I attended a chick rearing property in South Australia to investigate a problem of significant mortality in ostrich chicks. Over the previous 6-7 months more than 2,500 chicks of less than 2-3 weeks of age had died. Although significant on-farm treatment and trial work had been performed over the preceding months, minimal numbers of autopsies had been done and only one significant veterinary investigation was carried out (in late October, 2000). This veterinary investigation involved autopsies, histopathology and culture/sensitivity testing, but the results were inconclusive and the investigating veterinarians were unable to provide sufficient answers or definite directions for treatment. Because the veterinarians had little experience in ostrich farm management they were also unable to suggest any management procedural changes to prevent further deaths occurring. The farmer then continued trialing different treatment and management techniques but many of these trials were either incomplete or involved changes to several procedures at once. Thus, no real conclusions or clear directions resulted from these trials.

The main presenting signs seen in the chicks prior to death were diarrhoea and depression. These symptoms were not exhibited for long prior to death and, in many cases, the chicks appeared to have died prior to exhibiting any symptoms.

After reviewing the history of the disease and the symptoms exhibited by the chicks, I was suspicious that an infectious aetiological agent was involved. Given this suspicion and the fact that only few hatches remained during the present season, I advised trial antibiotic treatment on some hatchlings prior to my visit to the farm the following week to assess the management, the facilities on the property and fully investigate the cause of the problem. This treatment resulted in a significant alteration to the previous mortality pattern of the chicks. Notably most chicks that would have previously died were still living and the emergence of diarrhoea in many chicks had been stopped by direct oral treatment with tetracyclines. Eventually, this strategy was insufficient to completely halt the problem and the deaths re-emerged at similar rates.

Farm Visit Findings

The farm was essentially dedicated to egg incubation and hatching as well as chick rearing of hatchlings up to about 40 kilograms body weight (3-5 months of age).

Eggs were sourced from breeding birds at 3 locations:

- a nearby very large commercial ostrich breeding farm
- the majority of the owner's breeding birds located on a property some 250 kilometres away
- a few breeding birds actually located on the chick rearing farm itself

Once the chicks reached their target weight they were trucked back to the nearby large commercial ostrich breeding farm, to the owner's other property 250 kilometres away or to various other ostrich farms, some interstate, for growing to processing age and weight.

Farm Management Aspects

My overall impression of the farm was that it was, in fact, very well managed and the facilities were above the average Australian ostrich industry standard.

However, some areas that required attention included:

Eggs were stored off farm where no, or minimal, egg disinfection, turning or fogging occurred. A few breeder birds were located on the chick-rearing farm but no egg storage facilities were used for eggs produced from these birds. No disinfection of eggs occurred, apart from dry scraping of significantly contaminated eggs. Prior to incubation, the eggs were fogged with Virkon S (peroxygen compounds).

During incubation the eggs are now fogged 3 times weekly – this had been increased from the less frequent level that was previously employed during the season. There was a higher than acceptable level of "rotten" eggs in the incubators.

The overall level of hatchability was acceptable at 64% as this figure also included infertile eggs. Infertile and early embryonic deaths were included in the one total, being 20%. A higher than normal amount of assistance is given to hatching.

Pea straw substrate was being used in the brooder area – previously grey, non-slip plastic mats were used.

Pea straw is also now used in the concrete-floored chick sheds. The concrete flooring is *usually* cleaned out prior to the entry of the next batch of chicks, but this was not always the case. There is generally only a weeklong spell in the chick sheds/runs between batches.

Numbers of chicks (100-200 per batch) were not excessive given the area of the runs but were definitely too high for the area of the sheds, given that they are permanently located, minimally ventilated and the chicks are not moved out of these areas until 6-8 weeks of age.

Flood irrigation was being used to irrigate the lucerne growing in the 80-metre long chick pens. The runs were flood irrigated from the shed to the end of the run. This may have created the possibility of rapidly spreading faecal-borne agents from the areas of high density around the sheds to the lower areas of the rest of the runs.

Chicks were graded and relocated according to size from as early as 4 weeks of age. Although this is an accepted and necessary management technique in chicks older than 2-

3 months of age, it is dangerous and against good disease prevention practice to perform this earlier than 2-3 months of age.
There was evidence of metabolic bone disease in the chicks, as they grow older than 4 weeks of age. This may be due to a malabsorption syndrome after surviving the previous enteritis problem, but may also be due to the feeding of an unbalanced diet, particularly in relation to Calcium/Phosphorus levels.
The overall level of egg productivity was high (~ 65 eggs per hen)

Testing Procedures Performed During this Visit

A number of chicks that had been found dead that day or the night before were autopsied. Some gross autopsies showed evidence of yolk sac infection at a higher than normally accepted frequency, suggesting incubation and hatching techniques required review. Most chicks exhibited varying degrees of intestinal haemorrhage or congestion throughout the intestinal tract on gross autopsy. Most had a normal level of proventricular contents including lucerne leaf, pellet material and some grit with no evidence of impaction. Cultures were taken from various organs and tissue samples were taken and fixed in formol saline for histopathological examination. A sample of the water used for the chicks was also submitted for bacterial analysis.

The culture results obtained from these samples were non-specific. The liver and yolk sac samples from one of the chicks yielded "a heavy growth of mixed skin and enteric flora". The histopathology results from the tissues taken from these gross autopsies showed only significant congestion of the intestinal sections, but it should be noted that autolysis was present in the intestine of some of the chicks sampled for histopathology. Autolysis can occur very quickly after the death of ostrich chicks leading to disruption of the superficial epithelium of the intestinal mucosa and possibly preventing recognition of pathology in this area of the intestine.

The result of the water sample showed a heavy growth of mixed environmental flora.

Follow-Up Testing

In view of ongoing problems at the farm and the lack of definitive answers found with the initial testing results, it was decided that further testing was required. Some affected live chicks were submitted to the IDEXX/VPS vet lab in Adelaide after I had significant discussions with Dr Peter Phillips, requesting a thorough work-up including a search for possible Coronaviral involvement.

The results of this last investigation were much more rewarding and can be summarised as follows:

Culture

Two species of bacteria were cultured from intestinal sites - one was an *E.coli* (resistant to Penicillin, Tetracyclines and Doxycycline) and the other was *Clostridium sp.*

Histopathology

Significant ulceration of the large intestine was found, with masses of bacteria adherent to the surface epithelium. These bacteria were demonstrated later to be consistent with

Clostridium sp. There was also some subtle invasion of the epithelium by these same organisms in the small intestine.

Electron Microscopy

Coronavirus particles were found in 2 of the 3 intestinal contents samples examined by electron microscope.

Conclusions

Cause of Death

All of the above results indicate that the chicks are dying secondary to the Clostridial infection. The Clostridial bacteria are either acting primarily or, given the finding of Coronavirus particles, they may be invading secondary to damage created by the Coronavirus. The significance of the Coronavirus is still unclear as, although Coronavirus infection in ostrich chicks has been previously reported, the intestinal lesions are not necessarily consistent with lesions previously reported as being associated with Coronaviral infections in ostrich chicks. *(3,4)*

Method of Spread

Both Clostridia and Coronavirus are likely to be spread from chick to chick via faecal ingestion. There is not enough yet known about Coronaviral infection in ostrich chicks, but in some cases in Australia that I have been involved with, it has been suspected that the Coronavirus may have been introduced by wild bird species. Some Coronaviral infections in poultry have been shown to be egg transmitted, but the primary method of spread is through the faeces from chick to chick. *(5,6)* Clostridia are normal inhabitants of the intestinal tract of ostrich chicks, but can dramatically increase in numbers in certain favourable conditions. The lack of adequate fibre intake, excessive lucerne intake and sudden changes in diet have been implicated as possible predisposing factors in some Clostridial disease outbreaks.

Environmental Resistance

Coronaviruses are not likely to survive for any long periods in the environment and are sensitive to most disinfectants. Clostridial bacteria, however, can produce spores that are very resistant and can survive for a long time in the environment, especially in contaminated environments such as chick-shed floors.

Immunity

In Coronaviral enteritis infections in turkeys, recovered birds are solidly immune but they may continue to spread the virus for several months after recovery from the infection. *(6)* It is likely that survivors of a Clostridial infection would also have reasonable immunity against further infection, unless the survival has been purely based on the protection of antibiotics.

Recommendations for Treatment, Control and Prevention

Because two infectious agents have been identified as possible aetiological agents and it is unclear which of these agents is likely to be the primary pathogen, steps have to be taken to deal with both agents.

The Coronavirus is a challenge as it is not possible to be certain of its source. Instead we need to minimise its likelihood by reducing faecal contamination in the sheds through decreased stocking densities, being aware of possible wild bird contamination of feed and water containers and increasing egg hygiene. Ideally, it would be interesting to use recovered birds only as breeding stock as it may well be that they could transfer immunity through the eggs to the hatchlings.

In the case of the Clostridia, unfortunately the lab was unable to identify the exact Clostridial species involved. This would be helpful if the chicks were dying at an older age, as we may then have been able to select an appropriate Clostridial vaccine to protect them.

The issue of vaccination of ostriches to protect against Clostridium perfringens infection is a complex one. Clostridial enteritis in infant chicks has not been commonly diagnosed in Australia but, as has been shown in this case, does sporadically occur. Published investigative studies on Clostridium perfringens disease in ostriches in South Africa implicate Cl. Perfringens Types A, B & D as potentially causative.*(7,8,9)* For this reason, it is recommended that, if a Clostridial perfringens vaccination program is instigated on an ostrich farm, it should be based on a Clostridial vaccine incorporating all potentially pathogenic Cl. perfringens types. The Vaxall 8 vaccine, a vaccine manufactured in Australia by Fort Dodge and currently unavailable for use in Australia, would offer protection against all Clostridium perfringens types. The timing of the initial vaccination is dependent on the age at which the clinical disease is seen on the particular farm. However, a period of approximately 10 days is required before chicks would acquire a level of vaccine protection and, in the case of Clostridial vaccines, maximum protection is not achieved until after a second vaccination 4 weeks after the first. So, given the fact that most chicks were dying before they are 2 weeks of age, it is not feasible to protect the chicks from infection through vaccination of the chicks. Vaccination of the adult breeders may offer protection against Clostridial infection to the hatchlings.

Recommendations for immediate action *on the farm were:*

Inclusion of Zinc Bacitracin in the revised Chick Starter ration fed to the chicks at the recommended level of 200gram of Zinc Bacitracin/tonne of feed

Increase the level of egg hygiene and disinfection. This would include:

Disinfection of dirty or faecal contaminated eggs **as soon as possible after collection and prior to storage**
Rejection of any eggs that have severe faecal contamination, have been very wet or are very dirty
Fog eggs during storage once daily using Virkon S solution
Be vigilant in checking for rotten eggs in the storage area and incubators
Stop intervening in the hatching process and only assist those hatchlings that are malpositioned or are slowing after internal or external pipping. Eggs should never be opened if internal pipping has not occurred and the chick is clearly not malpositioned. Although this will unlikely affect the incidence of the Clostridial or Coronaviral deaths and will increase the labour involved in hatching, it *will* substantially reduce the incidence of yolk sac infections.
Try to trace the predominant source of the rotten eggs and the most contaminated eggs.
Devote attention to nest sites between seasons and replace sand and improve drainage as required.

Rear chicks ***off-farm*** for, at least, the initial period of the coming season. It is suspected that the current chick rearing pens and sheds are contaminated and it will be necessary to give these areas the longest possible spell before reuse. It would be preferable to utilise a more temporary and

mobile method of rearing at the new location for this period incorporating a deep litter system in the sheds such as straw or rice hulls.

When/if going back to the original chick rearing area it is advised to:

Reduce the numbers of chicks **per shed**. The sheds are likely the major source of faecal-oral transmission between chicks and it may be that they have finally become contaminated with pathogen levels to offer a significant risk to the chicks.
High pressure wash and disinfect the sheds, feed and water containers and any associated equipment before, and during the spelling period
Try to get the chicks out of the runs before 6 weeks of age, if possible and move them to larger runs with shelter sheds e.g. hay bale enclosures
Do not draft chicks on size before 6-8 weeks of age as this leads to rapid contamination of all chick areas and unnecessary challenge of pathogens between chicks
Consider grading the hatchlings into A and B grades (B grades being any assisted hatch chicks and chicks with hatch weights below 7-800grams). Run these two grades of chicks in separate batches. This will take the pressure off the necessity to draft in the first 6-8 weeks, as the smaller chicks will be in the one run anyway. Smaller weak chicks are more likely to succumb to infections and can lead to contamination risk of healthier chicks.
Considering that faecal spread is the greatest mode of transmission 2 pairs of boots should be located at the entrance to each chick pen so that cross contamination is reduced.

Review the nutrition for the chick production phase as the growth related leg problems might not be due to a malabsorption secondary to the infection, but may be due to an imbalanced diet.*(10)*

Closely monitor the performance of the chicks of the early hatches of the ensuing season and act quickly if problems begin to emerge.

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