Issues Concerning Antibiotic Resistance in Cage and Aviary Birds

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Abstract

A connection between antibiotic resistance in pet birds and humans has not yet been established but there are a number of aspects of bird keeping that could theoretically serve to increase antibiotic or bacterial load and prevalence of bacterial resistance. These factors are reviewed in light of the Joint Expert Technical Advisory Committee on Antibiotic Resistance report. Legislation forbidding extra-label usage of antibiotics would have a devastating effect on the ability of veterinarians to treat disease in birds and generic prudent use principles for antibiotics can be applied to avian practice to reduce what is perceived to be a minor risk of resistance spread. Research needs to be conducted to better assess the significance of pet birds in the spread of resistant bacteria before more specific advice regarding appropriate action can be given.

The worldwide use of antibiotics in animals has come under closer scrutiny in recent years because of the increasing ineffectiveness of antibiotics in human medicine due to the rapid emergence of antibiotic resistance. It is generally accepted that overuse or improper use of antibiotics in humans and inadequate infection control procedures are the main reason for this increasing ineffectiveness, but there is evidence that antibiotic use in animals has contributed to the process. The focus of this scrutiny has been on food producing animals and in Australia, in October 1999, the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) produced a comprehensive report: *The use of antibiotics in food producing animals: antibiotic resistant bacteria in animals and humans.*[2]

Antibiotics are used in cage and aviary birds therapeutically and prophylactically but they are not used as growth promotants and these species are not normally consumed by human beings. Consequently the risk of transfer of antibiotic resistance to human pathogens through these species has been perceived to be low. The significance, if any, of birds apart from poultry in the emergence of antibiotic resistance was not mentioned in the JETACAR report, nor did the literature review carried out by JETACAR identify a connection between the keeping of pet birds and the development of antibiotic resistance in human pathogens. However the committee' s brief was to focus on food producing animals, not companion animals or wildlife.

While objective evidence of a connection between antibiotic resistance in humans and bird keeping is lacking, in reviewing the JETACAR report from the perspective of a pet bird practitioner there would seem to be significant theoretical opportunities for antibiotic resistance to be transferred by close contact between humans and their domestic pet birds as well as by international movement of

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2 Commonwealth Dept of Aged Care & Dept of Agriculture, Fisheries and Forestry. Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) The use of antibiotics in food producing animals: antibiotic resistant bacteria in animals and humans. Oct 1999

live birds for the pet trade. These comments also apply to other 'minor' species kept as pets, such as small mammals and reptiles, but their specific cases should be considered separately.

Another view on human-animal pathogen transfer

Before speculating on a possible, albeit minor, role of pet birds in the increasing ineffectiveness of antibiotics in human medicine I would like to nest the current debate on human-animal pathogen transfer and emerging antibiotic resistance into a broader historical context. There is strong circumstantial evidence that the major killers of humanity since biblical times - influenza, small pox, tuberculosis, malaria, plague, measles and cholera are all infectious diseases that evolved from close human contact with birds and animals even though human epidemic illnesses are now predominantly confined to people. In order for epidemic illnesses to be sustained, there must be non-resistant populations in which virulent pathogens can spread, so epidemic diseases, for example Measles (related to rinderpest of cattle), would die out in human population numbering fewer than half a million people. It is probably not co-incidence that most shared human-animal pathogens evolved on the huge Eurasian continent where animal domestication first emerged to support dense populations of both animals and people.

When Eurasian-evolved pathogens were spread by European colonizers, they killed vast numbers of indigenous people on islands and other continents. The reverse situation, where local human diseases killed the Europeans occurred but was far less common. The Aborigines had no fatal pathogens to share with the European invaders of Australia two centuries ago and, as was the case in just about every war until World War II, more victims died of war-borne microbes than of battle injuries. Reflecting a common pattern, European victory was due as much to their having the nastiest germs to transmit as it was to the effectiveness of weapons or the military strategy. Globally evolving human-animal pathogen interrelationships have long played a decisive role as shapers of history.[3]

Aspects of bird keeping that might increase the risk of antibiotic resistance spread.
Birds make popular pets because, appropriately selected, they are beautiful, songful, form close bonds with humans and are generally easy to care for and inexpensive to keep. However, there are potential human health problems that may be associated with keeping birds, including psittacosis, allergic pneumonitis and viral, bacterial and fungal infections. While appreciating that the brief for JETACAR report was to focus on the current day interplay between food producing animals and antibiotic resistance in humans, issues apart from food consumption, for example proximity, relative numbers and susceptibility to infection of humans, birds and animals are all relevant in the evolution of human pathogens, including resistant bacteria. Thinking in this context, there are a number of aspects of bird keeping that might serve to increase the risk of development or spread of antibiotic resistance factors or indeed other pathogens from birds to people.

Pet birds (budgerigars, pigeons, canaries, aviary birds):

- are often kept as large populations of multi-age flocks where immunosuppression and stress is common. Risk of transfer of resistance factors could be high.
- show clinical signs that are often subtle and non-specific. In such circumstances therapies may not be well targeted and inappropriate antibiotics may be selected.
- are often given drinking water medication. Because of erratic water consumption this mode of delivery may not achieve optimal drag dose rates for all birds.
- are often given antibiotics extra-label, so dosages and treatment times may not be optimal for a particular species. Experimental data is often not available.

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[3] Diamond J (1998) Lethal Gift of Livestock. Chapter in Guns, Germs and Steel. Vintage. pp 195-214

- are popular pets for seniors, retirement villages, nursing homes and kindergartens, settings in which they may come into close contact with immunosuppressed people.
- With racing pigeons and at bird dealers stressed birds from many different sources are housed together giving an ideal opportunity to spread pathogens, including antibiotic resistant bacteria or resistance factors.

Birdkeepers

- are often untrained hobbyists and unaware of issues relating to antibiotic resistance. Management may be sub-optimal and open selling or inappropriately obtained antibiotics (eg tetracyclines) are widely and inexpertly used.
- may be elderly and/or immunosuppressed and hence more susceptible to contracting infections.
- may have have low disposable incomes or be reluctant to spend money on veterinary care for their birds. Recommendations for specific diagnostics, including antibiotic sensitivity testing, are frequently declined.
- have difficulty in maintaining biosecurity. For example their birds may contact wild birds in outdoor aviaries or sick birds when taken to shows or races.
- frequently have very close contact with their birds as the birds sit on their shoulders, kiss their lips and share their food. Birdkeepers are also brought into close contact with droppings and aerosolled feather dust when cleaning bird enclosures.

Veterinarians

- have generally received limited training in avian medicine so clinical skills and therapies
- may not be as well targeted as in other species.
- may be perceived by bird owners as self serving rather than acting responsibly if they decline to supply antibiotics except within the requirements of the law and based on prudent use principles for antibiotics. This is particularly so when the value of individual pet birds, and the disposable income of their owners, are both low.

Research

- funds available are far lower for pet birds than for commercial poultry. The need to monitor antibiotic resistance patterns has not been considered a priority.

Resistance patterns in pet bird isolates

In spite of the above concerns, bacterial isolates with multiple resistance patterns are not commonly encountered in companion bird practice in Australia and most pet bird isolates will be sensitive to at least one of the commonly used antibiotics (eg amoxicillin and clavulonic acid, enrofloxicin, lincomycin and spectinomycin). Multi-resistant isolates are commonly reported in literature relating to avian practice overseas, although a connection between resistant bird strains and resistant human strains has not yet been established.

A disconcerting pattern of multi-resistant bacteria was encountered in isolates from budgerigars legally imported through the Spotswood Quarantine Station and seen at Highbury Veterinary Clinic in the mid 1990s. This pattern is perhaps not surprising considering the overseas source of the budgerigars and the procedures to which they were submitted during importation: drinking water treatment with doxycycline, housing in a multi-age/multi-source flock and major stress factors operating during the importation process. Following their introduction into local aviaries, multiple resistance was not only seen in the imported birds but also in bacterial isolates from birds coming into contact with them.

Circumstantially it appeared that mixing birds in the quarantine station may have allowed overseas strains of bacteria to spread resistance factors. There is currently a moratorium on legal importation of Psittaciformes and this multi-resistant pattern has not been recognised in recent times. Psittacine importation is currently under review.

Relevance of pet birds in emerging antibiotic resistance.

The four key factors that influence the emergence and spread of antibiotic resistance were identified in the JETACAR report as antibiotic load, antibiotic regimen, bacterial load and prevalence of bacterial resistance. Clearly these are all issues with bird keeping even though pet birds are not consumed as food. The report developed an antibiotic-resistance management program to address these factors contained 22 recommendations grouped into seven categories: Regulatory Controls, Monitoring and Surveillance, Infection Control and Hygiene Measures, Education, Further Research, Communication and Co-ordination of Resistance Management.

Reducing risk of antibiotic resistance is important for the sake of both human and avian patients and many of the initiatives being taken in the food producing industries are recognised as relevant in pet bird practice. However there are significant difficulties in applying these principles in avicultural communities for both social and scientific reasons. With little direct evidence of spread of antibiotic resistance from birds to humans, establishing whether this connection currently exists and continuing to monitor for possible emergence should receive priority. It is readily possible to demonstrate that tetracyclines, which have been widely available over the counter, are far less effective against bacteria encountered in avian practice than S4 antibiotics such as amoxicillin with clavulonic acid, but a human connection is not clear cut. Arguing the case for tighter controls on antibiotics in the avicultural community would be better received if objective evidence of both increased resistance of specifically avian pathogens as well as a bird-human antibiotic resistance connection could be demonstrated.

Benefits of allowing off-label antibiotic use in birds and other 'minor' species Veterinary practice for avian and exotic pets would be severely compromised if antibiotics were restricted to solely registered uses. Indeed, many of our patients would die or suffer from otherwise treatable diseases if legislation were to forbid off-label use.

It is generally not in the financial interests of drug companies to carry out necessary testing to register their products for minor species because the amount of drug used is often small. Individual species may vary in their response, so testing on a single avian species cannot be confidently extrapolated to all birds, the testing needs to be repeated for each species. While it is not economic for drug companies to conduct trials, an expanding database is accumulating of trials and clinical data conducted by veterinarians working with minor species so that reasonable information on which to base treatment is now available and continues to expand. The overall community benefits of permitting extra-label usage in minor species would seem to far outweigh the potential risk of resistance transfer. However, the situation needs to be carefully monitored and action taken where appropriate to minimise potential risk.

Regulatory Controls

There is scope for tightening regulatory controls on antibiotics used in pet bird medicine. Veterinary Boards currently appear to have difficulty in controlling the activity of several veterinarians who provide dubious diagnosis of avian disease based on faecal samples sent through the mail, then based on this tenuous connection supply antibiotics by post to pigeon fanciers and birdkeepers throughout Australia. Antibiotics are also sold informally thorough bird clubs. The audit trail proposed in Recommendation 3 of the JETACAR report and the proposal to classify all antibiotics as S4 (Recommendation 6) and the harmonising of regulations throughout Australia (Recommendations 7 and 8) could be useful in curtailing these practices.

Monitoring and Surveillance

Monitoring sensitivity patterns of pet bird isolates should be possible by reviewing submissions to commercial veterinary laboratories. Studies could also be done starting from humans infected with multi-resistant bacteria and trying to trace back whether there might be any pet bird connection. Establishing whether this connection currently exists or might be evolving should receive high priority.

Infection Control and Hygiene Measures

Biosecurity, hygiene, vaccination, eradication, husbandry and medication are adjuncts and alternatives to antibiotics that have formed cornerstones of preventative health programs in poultry.[4] The closed aviary concept and biosecurity principles are also taught and advocated by non-poultry avian veterinarians, including geographical isolation, quarantine, control on the movement of people, separation from wild birds and animals, rodent control and secure dead bird disposal. In practice these principles are difficult for many birdkeepers to grasp and implement and they are conscientiously observed by only a minority of aviculturists. There would be scope for wider adaptation if the importance of minimising antibiotic treatment could be clearly demonstrated. Implementation for racing pigeons, dealers and show stock would remain problematic. Hygiene, disinfection and sanitation procedures are generally easier to teach and apply.

While Australian vaccine manufacturers are willing to develop new vaccines for poultry, the economics are less sustainable for the diversity of species and limited markets that characterise pet bird practice. Eradication is a desirable goal but often elusive. There is scope to adopt husbandry practices that reduce stress and optimise bird immunity. There are medical alternatives to antibiotics including probiotics, prebiotics, organic acids, enzymes, immunomodulators and herbal therapies whose use could perhaps be expanded to enable a reduction in antibiotic use. Given the difficulty in altering current practices, objective data demonstrating the actual occurrence of emerging antibiotic resistance would be important in convincing bird keepers of the need for change and the justification for additional inconvenience and expense involved.

Education

Recommendation 17 of the JETACAR report was that learned professional societies develop continuing education programs on the issue of antibiotic resistance, including a focus on the prudent use principles, antibiotic use guidelines and alternatives to antibiotic usage.

The relevance of the JETACAR report to avian practice is to be discussed in a session planned for the Association of Avian Veterinarians conference later this year. Once there is consensus amongst avian veterinarians regarding recommendations, strategies to educate other veterinarians and bird keepers about the need to exercise care in the use of antibiotics in birds can be devised. In devising these strategies, it would be useful if comments by avian veterinary practitioners could be backed by authorities that are not perceived to have a conflict of interest in subverting easy access to antibiotics by aviculturists. Involvement in the discussion of a JETACAR representative (or its successor) could be useful in this regard.

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[4] Grimes T (2000) Preventative management programs for maintaining health adjuncts to antibiotics. *Dander* May 2000, pp 8-12

Further Research

Highest priority needs to be placed on monitoring avian and human bacterial isolates to determine whether a possible connection between antibiotic resistance in pet birds and in humans exists. This should attract funding ear marked for human health. Other recommendations for research related to antibiotic resistance, eg molecular epidemiology, population dynamics of antibiotic resistance, pharmacoepidemiology, efficacy studies and, particularly, rapid diagnostic tests are relevant to good veterinary medical practice generally and should be supported.