Antimicrobials and animal health: a fascinating nexus

Lord Soulsby*

House of Lords, London SW1A 0PW, UK

The concern about transmission of resistant enteric organisms from livestock to humans via the food chain has substantially lessened owing to the banning of the use of antibiotics as growth promoters in young animals. Nevertheless, therapeutic use in animals is high and resistance is increasing in production species and companion animals. Environmental spread via commensal organisms is of increasing concern.

Keywords: antibiotic growth promoters, multidrug resistance transfer, companion animal use, environmental spread of resistance

Introduction

A major concern of the use of antimicrobials in food-producing animals has been the transfer of resistance via the food chain to humans. This has particularly generated strong debate on the role of antibiotics as growth promoters in young animals such as chickens, piglets and calves, where the addition of small quantities of antibiotics, well below the normal therapeutic doses, will greatly enhance growth, a fact discovered in the USA in the 1940s when chickens were fed fermentation by-products of chlortetracycline. Since then, antibiotic growth promoters have been used extensively in livestock production, often being relied upon not only to enhance growth but also to compensate in part for poor husbandry practices.

Antibiotic use in animals showed the same dramatic increase as in humans and on the therapeutic side, many serious infections of farm livestock were amenable to treatment and cure. Examples are mastitis, due to staphylococci and streptococci, pneumonia due to Pasteurella spp. and the various enteritides due to Salmonella and other Gram-negative organisms. With the increased use of therapeutic antibiotics in livestock and the expansion of antibiotic growth promoter use, animal use of antibiotics dominated the antibiotic field. Added to such use has been their widespread administration in companion animals, including fish, and their use in horticulture for the control of fungal and other infections of fruits and trees.

The Swann Report

In due course, resistance to antibiotics began to appear, first in human patients in hospital environments, of which penicillin-resistant Staphylococcus aureus and then methicillin-resistant S. aureus (MRSA) were dominant. Concerns about antibiotic resistance, especially associated with antibiotics that were used both in human patients and as growth promoters in livestock, led to the Swann Report (1969),1 in which it was recommended that antibiotics used in human medicine should not be used as growth promoters. Swann also recommended that a committee with authority to review and recommend antibiotic use in man, animals and horticulture be set up. Such a committee was not established until the House of Lords Science and Technology Subcommittee on ‘Resistance to antibiotics and other antimicrobial agents’ in 19982 reminded the Government of the serious situation with respect to resistance and pressed for the long awaited (30 years!) ‘Swann Committee’. The Specialist Advisory Committee on Antimicrobial Resistance was the result.

Antimicrobial use in animals

A feature of resistance to antibiotics is often the multiple nature of the resistance and the ability to transfer some forms of resistance to other organisms. The concern of the transfer of multiple resistance via the food chain to human patients has occasioned much debate and although clear evidence of multidrug-resistant enteric organisms leading to antibiotic-resistant human infections is sparse, all authorities believe that the prudent use of antibiotics in food-producing animals should have high priority.3 To this end on 1 July 1989, an EU-wide ban on the use of four growth-promoting antibiotics came into effect. These were spiramycin, tylosin, bacitracin zinc and virginiamycin. This was later ratified by the UK. The result of this ban was a dramatic fall in the sales of antimicrobial growth-promoting products in the UK. Thus in 1998, 141 tonnes of active growth-promoting ingredients were sold and by 2005, this had reduced to 14 tonnes. Remaining antibiotic growth promoters (monensin, avilamycin, salinomycin and flavomycin) came under an EU-wide ban in...
January 2006 and it was projected that a further dramatic
decrease in sales will occur. Of sales of antimicrobials in 2005
for use in food-producing animals, 97% were for therapeutic
purposes and only 3% were for growth promotion.4

Although the important concern of antibiotic use in growth
promotion has been attended to by banning certain antibiotics as
growth promoters, the overall sales of therapeutic antimicrobials
for food animals have remained much the same over the last
8 year period, between 37.1 and 42.0 tonnes of active ingredient,
and sales for use in non-food-producing animals varied between
19 and 34 tonnes of active ingredient.2 The demand for anti-
biotics in food animals varies with respect to diseases to be con-
trolled. In pigs, for example, the occurrence of porcine
dermatitis and nephropathy syndrome and post-weaning multi-
systemic wasting syndrome often leads to secondary infections
requiring antimicrobial usage.

Although concern is centred on animal-derived bacteria
causing problems in humans (zoonoses), there are occasions
when infections pass the other way, as is the case with
multidrug-resistant Salmonella Newport that can cause severe
clinical disease in cattle and horses and is increasingly common
in humans. Apart from its pathology, Salmonella Newport readily transfers resistance to other organisms. The most likely
route by which multidrug-resistant strains of Salmonella
Newport may enter the UK is via animal feed ingredients,
human travellers and horses.

Although sales of antibiotics for use in non-food-producing
animals (e.g. companion animals) are much lower than in food
animals, nevertheless, they are widely used in veterinary care for
companion animals; although the concerns to human health via
the food chain do not apply, nevertheless, resistance due to
overuse is much the same as in human use. Some resistances
pose the same problems as in human patients, thus in animal
surgery, MRSA is an increasing issue in dogs and possibly also
in horses. It is still unclear whether the source of these organ-
isms is animal or human, but because of the widespread pre-
sence of MRSA as a commensal in man, it is likely that human
sources are responsible for problems in animal surgery and
medicine.

The widespread use of antibiotics in the human, animal and
horticultural fields raises the concerns of the acquisition of
resistance by commensal organisms in waste materials from hos-
pitals, farms, fisheries and food-processing plants. Reservoirs of

Antibiotic Resistance (ROAR) network, which is part of the
Alliance for the Prudent Use of Antibiotics, is concerned with
environmental spread of resistance in commensal organisms and
the transfer of this between commensals and pathogens.
Resistant-enteric bacteria have been found in wildlife (wild
rodents) where no contact with domestic livestock or medicine
is evident. Whether such infections are manifestations of
environmental contamination as envisaged by ROAR or are
natural resistant populations existing independent of antibiotic
usage in man and animals is unclear at present.

Criticism has been directed to the use of antibiotics in live-
stock production; however, this sector of agriculture has
responded to criticism by the foundation of Responsible Use of
Medicines in Agriculture, being a consortium of veterinarians,
agriculturists and pharmaceutical organizations. In addition to
collection and analysis of data referring to antimicrobial sales
and usage, it produces guidelines and advice on antimicrobial
use. This is a welcome illustration of private sector concern and
action, addressing the nexus between animal and human use of
antibiotics.

**Transparency declarations**

None to declare.

**References**

Committee on the Use of Antibiotics in Animal Husbandry and
Veterinary Medicine. Published by HMSO, 1969.

2. House of Lords Select Committee on Science and Technology.
Session 1997–8, 7th Report. Resistance to antibiotics and other anti-
Office.

3. Piddock LJV. Fluoroquinolone resistance. BMJ 1998; 317:
1029–30.

4. Veterinary Medicines Directorate 2006. Sales of Antimicrobial
Products Authorised for Use as Veterinary Medicines Antiprotozoals,
Antifungals, Growth Promoters and Coccidiostats in the UK in 2005.
www.vmd.gov.uk/publications/antibiotic/salesanti05.pdf (13 February
2007, date last accessed).