Acta vet. scand. 2005, *46,* 87-93.

Prescribing Antimicrobial Agents for Dogs and Cats via University Pharmacies in Finland – Patterns and Quality of Information

By *K. Hölsö[1], M. Rantala[1,4], A. Lillas[2], S. Eerikäinen[3], P. Huovinen[4], L. Kaartinen[5]*

[1]Faculty of Veterinary Medicine, Helsinki University, Finland, [2]Faculty of Medicine, Helsinki University, Finland, [3]University Pharmacy, Helsinki, Finland, [4]National Public Health Institute, Turku, Finland and [5]National Agency of Medicine, Helsinki, Finland.

Hölsö K, Rantala M, Lillas A, Eerikäinen S, Huovinen P, Kaartinen L: Prescribing antimicrobial agents for dogs and cats via university pharmacies in Finland – patterns and quality of information. Acta vet. scand. 2005, 46, 87-93. – The aim of our study was to evaluate antimicrobial use in dogs and cats in Finland. Information on veterinary prescriptions was gathered from University Pharmacies (n=17) over a one-month period, April 2001. A total of 2719 prescriptions for veterinary use were delivered, of which the majority were for dogs (70%, n=1898) and cats (14%, n=384). The most prescribed therapy group was per-oral antimicrobial agents (53%, n=1449), of which 16% (n=237) were medicines approved for humans. The most commonly used substances for dogs and cats were betalactams, 66% and 78%, respectively. The proportion of fluoroquinolones was 3-5%. The average duration of the treatment periods was 10 days with the exception of treatment of cats with macrolide-lincosamides, where the mean period was 20 days. Indication was mentioned only in 37% of the prescriptions.

Prescription, antimicrobial agent, antimicrobial use, cat, dog, indication

Introduction

Reports on antimicrobial consumption and occurrence of antimicrobial resistance in veterinary medicine are provided from some countries (*FINRES-Vet* 2002-2003, *MARAN* 2002, *SVARM* 2002, *DANMAP* 2003, *NORM/NORM-VET* 2003). Consumption figures on antimicrobial agents in Finland are based on wholesalers' statistics and give a good overall estimate of total drug use in animals. However, this information gives only a rough estimate on how drugs are used in different animal species since several drugs are authorised for a number of species. In addition, these data do not provide any information on the amount of human medicinal products used for veterinary purposes. Earlier studies have shown that the majority of human medicines prescribed for veterinary purposes, especially antimicrobials, are used for companion animals (*Bingefors* 1985, *Grave et al.* 1992). The information on the amount of human medicines used for companion animals is important for making more accurate estimations of total antimicrobial consumption in these species. Studies of indication-based use of antimicrobials in animals are scarce (Watson 1990, *Watson & Maddison* 2001).

In accordance with the European Union rules (directive 2001/82/EEC) the first treatment option should be a veterinary product approved

for the particular animal species to be treated. If no such product is available, a veterinary product approved for another animal species should be used. The use of human medicinal products is allowed only if a suitable veterinary product for another animal species does not exist. Because consumer safety is not an issue in the treatment of companion animals – as it is in food-producing animals – veterinarians can use medicines for companion animals more liberally.

This survey was carried out to assess what kind of antimicrobial agents are prescribed via University Pharmacies for treating infections in companion animals in Finland, and how large a proportion of the veterinary antimicrobial prescriptions were human medicinal products. We also investigated the quality of information given on prescriptions, and gathered information from indications.

Materials and methods

In a cross-sectional retrospective prescription study, the University Pharmacies were asked to gather data of every veterinary prescription delivered during a one-month period, April 2001. At the time there were 17 University Pharmacies located in cities in different parts of the country: Helsinki (five), Joensuu, Jyväskylä (two), Kemi, Lahti, Lappeenranta, Oulu, Pori,

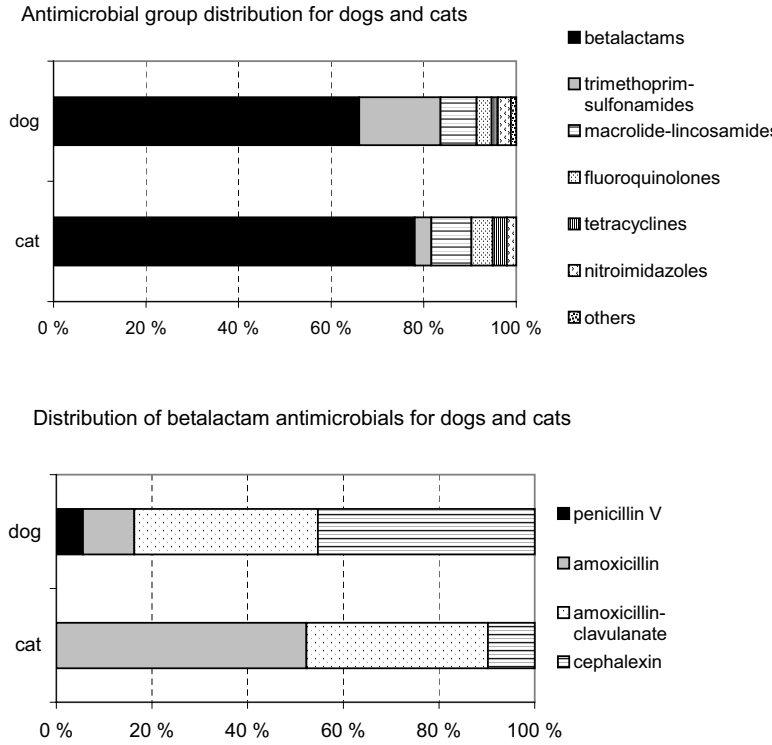

Figure 1: Upper panel: prescribed per-oral antimicrobials for dogs (n=678) and cats (n=196). Lower panel: Distribution of per-oral betalactam antimicrobials for dogs (n=448) and cats (n=153).

Salo, Savonlinna, Tampere and Turku. We chose to use University Pharmacies as sources for data collection, because their location is representative of the most populated areas in Finland. The following information was collected from prescription records: animal species, trade name of the product, strength of the formula, package size, duration of the treatment period and indication. The pharmacies were also asked to provide the number of all prescriptions dispensed during the follow-up period. Human and veterinary drugs and active substances were coded. Data was sorted by animal species and whether the drug was approved only for human use. Antimicrobial agents were further divided into subgroups according to their active substances, and mean treatment periods for different groups were calculated.

Results

All 17 University Pharmacies provided the requested information. A total of 2719 drug prescriptions for veterinary use were dispensed during April 2001 via University Pharmacies. The proportion of veterinary prescriptions varied from 0.01% to 17% between pharmacies and the mean was 1%. The majority of veterinary prescriptions were written for dogs (70%, n=1898) and cats (14%, n=384). The rest was for horses (3%, n=80) and for other species (5%; cows, rodents, fish, pigs, birds etc.). Species was not mentioned in 8% of the prescriptions.

Antimicrobial agents were the most commonly prescribed medicines for animals and represented 53% of all veterinary prescriptions. Oral antimicrobial agents were prescribed in 1038 prescriptions, of these 678 (65%) were for dogs and 196 (19%) for cats. Thirty-six percent of all canine prescriptions contained an oral antimicrobial agent, and the respective percentage for cats was 51%. The distribution of different antimicrobial groups prescribed for dogs and cats is presented in Figure 1. Of canine oral antimicrobial prescriptions, 66% (n=448) were betalactams. Amoxicillin-clavulanate and cephalexin were the most used betalactams and represented 83% of all betalactams for dogs (Figure 1). Betalactams made 78% (n=153) of feline oral antimicrobial prescriptions (Figure 1). The distribution of betalactams in cats was the following: amoxicillin 52%, (n=80), amoxicillin-clavulanate 38% (n=58) and cephalexin 10% (n=15) (Figure 1).

A human medicinal product had been prescribed for veterinary use in 851 cases (31% of all drugs for veterinary use). Of these 179 were oral antimicrobial agents and 59 topical antimicrobial products. Human medicinal products

Table 1. Number (%) of human medicines prescribed for animals within different antimicrobial groups.

Antimicrobial group	Human approved product	Veterinary approved product	Total
Betalactams	73 (11%)	586 (89%)	659
Trimethoprim-sulfonamides	35 (18%)	163 (82%)	198
Macrolide-lincosamides	17 (22%)	61 (78%)	78
Fluoroquinolones	10 (26%)	28 (74%)	38
Tetracyclines	9 (35%)	17 (65%)	26
Aminoglycosides	-	4 (100%)	4
Nitroimidazoles, nitrofurans and antifungals	35 (100%)	-	35

Table 2. The mean duration of the treatment periods in days (range) with different antimicrobials. Only prescriptions in which length of the treatment period has been mentioned were included.

Antimicrobial (n=dogs/cats)	Dog	Cat
Penicillin V or amoxicillin (73/80)	8.6 (5-15)	9.4 (5-14)
Amoxicillin-clavulanate (172/58)	9.5 (5-21)	8.6 (3-10)
Cephalexin (203/15)	11.4 (3-40)	9.2 (7-14)
Trimethoprim-sulfonamides (119/7)	8.7 (6-10)	11.3 (7-30)
Macrolide-lincosamides (53/17)	11.0 (3-25)	20.0 (7-48)
Fluoroquinolones (22/9)	10.6 (7-14)	12.0 (8-21)

represented 17% (n=179) of all oral antimicrobial agents for veterinary use. No difference was detected in the proportion of prescribed human oral antimicrobial agents for dogs (15%) compared with cats (16%). Nitroimidazoles, nitrofurans and antifungals prescribed were all human medicinal products, but of betalactams the respective proportion was only 11% (Table 1). Topical antimicrobial agents had been written in 411 prescriptions; 67% were for dogs, 7% for cats and the rest for other species. The indication for the majority of topical antimicrobials was treatment of canine or feline skin, ear or eye infections. Most frequently preparations contained polymyxin B (n=106), fusidic axid (n=96), or chloramphenicol (n=79). Mupirocin was prescribed in three cases for dogs.

The duration of the treatment period was not mentioned in 239 (23%) of oral antimicrobial prescriptions. The mean duration of the treatment period of the most frequently used oral antimicrobial agents varied from 9 to11 days in dogs and from 9 to 20 days in cats (Table 2). In cats, long treatment periods especially with azithromycin and erythromycin were used, but indication was not mentioned in any of these prescriptions. Neither of these two macrolides was prescribed for dogs.

There was no information on the indication in 65% of cats' and in 73% of dogs' antimicrobial prescriptions. In the prescriptions in which indication was mentioned, the majority of the betalactams in dogs was used for treatment of skin or wound infections. However, a relatively large proportion of dogs' betalactam prescriptions, 17%, were written for unspecified infections. Most of the trimethoprim-sulphonamides for dogs were used for urinary and gastrointestinal infections. In cats, most of the betalactams were for the treatment of urinary infections and so were the fluoroquinolones. Unspecified infection was mentioned as an indication in 11% of betalactam prescriptions for cats.

Discussion

In our study, oral antimicrobials were the most commonly prescribed medicines (38%) for companion animals. If topically administered antimicrobials are taken into account, the proportion of antimicrobials was even higher. Our result was in agreement with *Grave et al.* (1992), who reported that systemic antimicrobials were the most commonly prescribed medicines for animals in Norway. We detected no significant difference in the use of human medicinal antimicrobial agents between dogs and cats: 15-16% of per-oral antimicrobial prescriptions for both of these species were human medicinal products. In the Norwegian study 80% and 50% of antimicrobials for cats and dogs, respectively, were human medicines (*Grave et al.* 1992). In Sweden, 20% and 13%

of antimicrobial prescriptions for dogs and cats were human medicines during the period 1990-1998 (*Odensvik et al.* 2001). These differences may reflect differences in availability of authorised veterinary medical products.

According to our results, the most used antimicrobial group in dogs and cats was betalactams. Betalactam use in dogs was predominantly cephalexin and amoxicillin-clavulanate. In cats approximately one half of the used betalactams was amoxicillin and the other half was amoxicillin-clavulanate. Betalactams were also the most popular antimicrobial group used for cats and dogs in Sweden (*Odensvik et al*. 2001). In Australia cephalexin and amoxicillin-clavulanate were the most used antimicrobials both in feline and canine practice (*Watson* 1990, *Watson & Maddison* 2001). This is in contrast to Norway, where during the period 1990-1998, 75% of the prescribed veterinary antimicrobials for cats and dogs were trimethoprim-sulphonamides (*Odensvik et al.* 2001). In dogs, trimethoprim-sulphonamides followed betalactams in our study (Figure 1). In cats, the second most used antimicrobial class after betalactams was macrolide-lincosamides. Only a few percent of prescriptions for both species were fluoroquinolones, but according to the sale statistics of National Agency of Medicine (www.nam.fi) there seems to be a trend of increased use of fluoroquinolones for companion animals in Finland. The proportion of human medicines varied within different antimicrobial groups, being lowest in the betalactam group, which indicates a good availability of betalactams as veterinary products in Finland.

Some authors have suggested that veterinarians may adopt drugs with wider spectrum in small animal practice without clear justification (*Bingefors* 1985, *Warren et al.* 2001). Especially the use of new-generation antimicrobials should be carefully considered (*Barton* 2001). In our study, the use of mupirocin may be an example of unnecessary antimicrobial use in veterinary medicine. Mupirocin is used for eradication of methicillin resistant *Staphylococcus aureus* (MRSA) from carriers in human medicine. It can also be used for treating skin infections in companion animals (*Werckenthin et al.* 2001), but resistance situation among canine staphylococci does not justify the use of this product in veterinary medicine in Finland (*Rantala et al.* 2004). The other concern is the use of macrolides for long periods. Especially the use of long-acting macrolides has been associated to development of resistance (*Baquero* 1999). Azithromycin has been suggested as an option in treating chlamydia infections in cats (*Owen et al.* 2003). In this study, azithromycin and erythromycin were the second most used drugs in cats after betalactams. The mean treatment period was 20 days, but no indications were mentioned. Azithromycin has not been proven to have better efficacy than doxycycline in treating chlamydia infection in cats (*Owen et al.* 2003) and we did not found controlled studies about its use in other feline infections. The third concern is the relatively liberal use of wider-spectrum betalactams, amoxicillin-clavulanate and first generation cephalosporins, in companion animals especially for unspecified infections.

Legal regulations require that indication should be given in prescriptions along with other information. In our study, the lack of this information in more than 60% of prescriptions made it impossible to get reliable results of the indication-based use of antimicrobials. *Grave et al.* (1991) reported that only one fifth of veterinary prescriptions gave full information, which is demanded by legislation also in Norway. The absence of important written information may lead to incompliance of the implementation of the prescribed treatment by animal owners. It has been shown in studies made in human medicine that it is important for drug compli-

ance how information is given in prescriptions, especially in short term therapy (*Morris & Halperin* 1979).

In conclusion, antimicrobials are the most commonly prescribed medicines in companion animal practice and also human medicines are frequently used for treating infections in dogs and cats. A more suitable drug formula, strength, package size or non-availability of a comparable veterinary product may be reasons why human medicines are so widely used in companion animal practise. The results of this study indicate that part of the antimicrobial use may be inadequately justified, and there is a need for further surveys about indication-based use of antimicrobials in veterinary medicine. Without this information it is impossible to estimate how the recent national recommendations of antimicrobial use (*MMM* 2003) are followed. Lack of important information on prescriptions may also lead to drug incompliance and inadequate treatment of infectious diseases, which can, in turn, lead to development of antimicrobial resistance. Deficiencies in drug prescriptions is also an important issue to take into consideration when teaching veterinary students.

References

Baquero F: Evolving resistance patterns of *Streptococcus pneumoniae:* a link with long-acting macrolide consumption? J. Chemother.,1999, *11 Suppl 1,* 35-43.

Barton MD: Is it reasonable to use third generation cephalosporins to treat animals? Aust.Vet. J., 2001, *79,* 620.

Bingefors K: The use in animals of drugs licensed for human use: the situation in Sweden. Proceedings of the 3rd Congress of the European Association of Veterinary Pharmacology and Toxicology; 1985 Aug 25-29; Ghent, Belgium, pp. 513-520.

DANMAP 2003: The use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, foods and humans in Denmark. ISSN 1600-2032. Available from: http://vetstat.dfvf.dk/DANMAP_2003.pdf

FINRES-Vet 2002-2003: Finnish veterinary antimicrobial resistance monitoring and consumption of antimicrobial agents. National Veterinary and Food Research Institute (EELA), Helsinki, Finland. ISSN 1458-6878. Available from: http://www.eela.fi/

Grave K, Bangen M, Engelstad M, Søli NE: An evaluation of the information given on veterinary prescriptions in Norway. Compliance with the legal regulations. J. Vet. Pharmacol. Ther., 1991, *14,* 150-155.

Grave K, Bangen M, Engelstad M, Søli NE: Prescribing of veterinary and human preparations for animals in Norway. Was the preparation approved for the animal species for which it was prescribed? J. Vet. Pharmacol. Ther.,1992, *15,* 45-52.

MARAN 2002: Monitoring of antimicrobial resistance and antibiotic usage in animals in the Netherlands in 2002. Available from: http://www.cidc-lelystad.nl/docs/MARAN-2002-web.pdf

MMM 2003: Ministry of agriculture and forestry: Recommendations for the use of antimicrobial agents in the treatment of the most significant infectious diseases in animals, Memorandum 2003:9a Edita, Helsinki, Finland.

Morris LA, Halperin JA: Effects of written drug information on patient knowledge and compliance: a literature review. Am. J. Public Health, 1979, *69,* 47-52.

NORM/NORM-VET 2003: Usage of antimicrobial agents and occurrence of antimicrobial resistance in Norway. ISSN 1502-2307. Available from: http://www.vetinst.no/Arkiv/Zoonosesenteret/NORM_NORM-VET_2003.pdf

Odensvik K, Grave K, Greko C: Antibacterial drugs prescribed for dogs and cats in Sweden and Norway 1990-1998. Acta Vet. Scand., 2001, *42,* 189-198.

Owen WM, Sturgess CP, Harbour DA, Egan K, Gruffydd-Jones TJ: Efficacy of azithromycin for the treatment of feline chlamydophilosis. J. Feline Med. Surg., 2003, *5,* 305-311.

Rantala M, Lahti E, Kuhalampi J, Pesonen S, Järvinen A-K, Saijonmaa-Koulumies L, Honkanen-Buzalski T: Antimicrobial resistance in *Staphylococcus* spp., *Escherichia coli* and *Enterococcus* spp. in dogs given antibiotics for chronic dermatological disorders, compared with non-treated control dogs. Acta Vet. Scand., 2004, *45,* 37-45.

SVARM 2002: Swedish Veterinary Antimicrobial Resistance Monitoring, National Veterinary Institute, Uppsala, Sweden. ISSN-1650-6332. Avail-

able from: http://www.sva.se/pdf/svarm2002.pdf

Warren AL, Townsend KM, King T, Moss S, O'Boyle D, Yates RM, Trott DJ: Multi-drug resistant Escherichia coli with extended-spectrum ß-lactamase activity and fluoroquinolone resistance isolated from clinical infections in dogs. Aust. Vet. J., 2001, 79, 621-623.

Watson ADJ: A survey of antimicrobial drug use in cats. Aust. Vet. Pract., 1990, *20,* 188-193.

Watson ADJ, Maddison JE: Systemic antibacterial drug use in dogs in Australia. Aust. Vet. J., 2001, *79,* 740-746.

Werckenthin C, Cardoso M, Martel J-L, Schwartz S: Antimicrobial resistance in staphylococci from animals with particular reference to bovine *Staphylococcus aureus,* porcine *Staphylococcus hyicus* and canine *Staphylococcus intermedius.* J.Vet.Res., 2001, *32,* 341-362.

Sammanfattning

Målet med vår studie var att utvärdera användningen av antimikrobiella substanser hos hundar och katter i Finland. Uppgifterna samlades från djurrecept expedierade från 17 Universitets Apotek under en månads tid, april år 2001. Sammanlagt 2719 djurrecept expedierades, varav största delen var ämnade för hundar (70%, n=1898) och katter (14%, n=384). Antibiotika för oralt bruk var den mest förskrivna läkemedelsgruppen (53%, n=1449). Av dessa var 16% produkter godkända för humant bruk. De mest använda antimikrobiella substanser för hundar och katter var betalaktamer, 66% respektive 78%. Andelen fluorokinoloner var 3-5%. Kurernas längd var i medeltal tio dagar, med undantag av makrolider-linkosamider förskrivna för katter, för dessa var kurens längd i medeltal 20 dagar. Det fanns indikation nämnt på endast 37% av recepten.

(Received March 1, 2005; accepted March 20, 2005).

Reprints may be obtained from: Merja Rantala, National Public Health Institute, Antimicrobial Research Laboratory, Kiinamyllynkatu 13, 20520 Turku, Finland. E-mail: merja.rantala@ktl.fi, tel: +358-2-331 6629