Evaluation of the Most Frequently Prescribed Extemporaneously Compounded Veterinary Medications

AT A LARGE INDEPENDENT COMMUNITY PHARMACY

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Introduction

Although there has been an increase in the number of approved veterinary products on the market, it is still well recognized that extemporaneous drug formulation is essential to provide optimal pharmaceutical care to veterinary patients, especially when medications are not available in the desired dosage form for optimum efficacy. Lack of commercially available products; drug dose adjustment; high cost of finished drug products, especially those for certain neoplastic and immune-mediated diseases; ease of administration; and
The lack of recent literature data on the most commonly prescribed veterinary preparations was the main reason for this investigation. Thus, the primary objective of this study was to explore the variety of veterinary prescriptions requiring extemporaneous compounding at an independent pharmacy with extensive compounding abilities.

Abstract

Extemporaneous drug formulation is essential to provide optimal pharmaceutical care to veterinary patients. The need for this is exacerbated by the fact that commercially produced veterinary-specific products, without a human indication, require specialty veterinary manufacturing facilities and a new animal drug application process to gain marketing approval. This study examined the prescription patterns of extemporaneously compounded veterinary preparations in the compounding department at a large independent community pharmacy. Data was obtained from a total of 1348 prescriptions requiring extemporaneous compounding over the course of a two-year period (2014–2015). A database was constructed and each compounded prescription was allocated to a therapeutic category based on the American Hospital Formulary Service Drug Information. Data analysis showed that the most commonly prescribed preparations belonged to the central nervous system (39%), anti-infective agents (21%), and hormones (12%) therapeutic categories. Overall, suspensions were the most dispensed (47%), extemporaneously compounded dosage forms followed by solutions (28%), and capsules (10%). The majority (88%) of compounded preparations were administered by the oral route. The top three drugs that are compounded for veterinary medicine were (1) potassium bromide oral solution for canine epilepsy, (2) methimazole solution used to treat hyperthyroidism in cats, and (3) metronidazole suspension, an antibiotic for the treatment of diarrhea and other infections in dogs and cats. Remarkably, our findings are in good agreement with previously published survey data on the top drugs that are compounded for veterinary medicine. In the era of personalized medicine, veterinary extemporaneous compounding for specialized needs will continue to play an important role providing optimum therapy for veterinary patients.
Methods

The retail pharmacy has been in operation since 1971. They have performed extemporaneous compounding on an as-needed basis since that time. However, there was a substantial increase in the number of patients serviced in the late 1980s. In 1992, the retail pharmacy joined a professional compounding association (Professional Compounding Centers of America [PCCA]), built a dedicated compounding lab, and was able to dedicate full-time pharmacists’ hours to extemporaneous compounding of medications due to the need of this service in the local community. Today, multiple pharmacists and a full-time pharmacy technician staff the compounding lab attached to the retail pharmacy. Aside from basic equipment, the lab is stocked with a powder safe hood for weighing and manipulation of powder chemicals. To maintain pharmaceutical elegance of creams, ointments, and gels, the retail pharmacy uses an ointment mill and Unguator mixing technology. The pharmacy is also equipped with digital scales, tube sealers, and a convection oven.

The compounding records for veterinary preparations over the time interval from January 2014 to December 2015 were entered into a database that included:

- Dosage form
- Route of administration
- Dosing regimen
- Quantity
- Patient species
- Prescriber name

Each compounded prescription in the database was allocated to a therapeutic category based on pharmacologic-therapeutic classification in the American Hospital Formulary Service Drug Information (AHFS). The therapeutic categories classified by the AHFS included:

- Antihistamine drugs
- Anti-inflammatory agents
- Anti-infective agents
- Autonomic drugs
- Blood formation, coagulation, and thrombosis
- Cardiovascular drugs
- Central nervous system (CNS) agents
- Respiratory tract agents
- Gastrointestinal drugs
- Skin and mucous membrane agents
- Hormone and synthetic substitutes
- Vitamins
- Miscellaneous therapeutic agents

For the purposes of this study, we evaluated the three most frequently prescribed therapeutic categories, and then listed the most frequently compounded active pharmaceutical ingredient in these individual categories. We were also interested in evaluating the most commonly prescribed dosage forms, route of administration, and animal species.

Results

Over the study time period, the pharmacy filled about 10,000 total extemporaneously compounded prescriptions when numbers for all patients, human and animal, are considered. That number included a total of 1,348 extemporaneously prepared veterinary prescriptions, including refills, which were entered in the database and were grouped according to AHFS into 13 therapeutic categories. The 1,348 prescriptions came from a total of 801 unique prescriptions with the remainder being made up of ordered refills. Most prescriptions were for canine (33%) and feline (32%) species. Other animal species included:

- Guinea pigs
- Porcines
- Rabbits
- Sugar gliders
- Rodents
- Owls

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A summary of percentage of the most frequently dispensed extemporaneous prescriptions as a function of main therapeutic categories is displayed in Figure 1. The top three most frequently prescribed products belonged to the following therapeutic categories:

1. CNS agents
2. Anti-infective agents
3. Hormone and synthetic substitutes

### CENTRAL NERVOUS SYSTEM AGENTS
Medications belonging to the CNS category were by far the most commonly prescribed agents, accounting for 34% of all filled original prescriptions. Liquid prescriptions containing potassium bromide were the most commonly prescribed medication accounting for 20% of all filled original prescriptions. This was followed by diazepam and fluoxetine representing 2.8% and 1.7% of all prescriptions, respectively.

### ANTI-INFECTION AGENTS
Medications belonging to the anti-infective category accounted for 17% of all filled original prescriptions. Prescriptions containing metronidazole were the most commonly prescribed medications, accounting for 6.4% of all filled original prescriptions. This was followed by doxycycline and itraconazole representing 4.2% and 1.9% of prescriptions, respectively.

### HORMONES AND SYNTHETIC SUBSTITUTES
Medications belonging to this category accounted for 12% of all filled original prescriptions. Prescriptions containing methimazole were the most commonly prescribed medications belonging to this category accounting for 10.5% of all filled original prescriptions. Diethylstilbestrol accounted for 1.6% of prescriptions.

### DOSAGE FORMS
The prescriptions in the database contained the following dosage forms:

- Suspensions
- Syrups
- Solutions
- Powders
- Capsules
- Ophthalmic solutions
- Transdermals
- Suppositories
- Enemas

Overall, the majority of compounded preparations (75%) were liquid dosage forms. Suspensions and solutions accounted for 47% and 28% of all dosage forms as illustrated in Figure 2. The top 4 dosage forms compounded were:

1. Suspensions
2. Solutions
3. Capsules
4. Creams

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Orally administered dosage forms constituted the majority of compounded prescriptions as depicted in Figure 3, with topical, rectal, and ocular accounting for a small fraction of total prescriptions.

**TOP COMPOUNDED DRUG AGENTS**

The top three drug agents that were compounded for veterinary medicine were:

1. Potassium bromide oral solution to treat canine epilepsy
2. Methimazole solution to treat hyperthyroidism in cats
3. Metronidazole suspension, an antibiotic for treatment of diarrhea and other infections in dogs and cats as seen in Figure 4

Table 1 shows a comparison of the top 10 veterinary compounded preparations based on a survey conducted in 1999 and our current data. Although almost fifteen years separate the two surveys, examination of the data show remarkable similarities, especially in the top three veterinary compounded preparations.

Discussion

Extemporaneous compounding is historically one of the original methods of the practice of pharmacy. In today’s practice of medicine, most prescriptions can be dispensed from commercially available products. Extemporaneous compounding is a niche role that some pharmacies fulfill. However, with the needs of special...

FIGURE 2. Most frequently prescribed dosage forms.

FIGURE 3. Route of drug administration.

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populations such as hospice, pediatrics, and veterinary patients, along with the prescribers desire to tailor medication regimens to specific patient needs, extemporaneous compounding fills a major gap in the care of these patients. Extemporaneous compounding is emerging as a specialized area of pharmacy practice with the emphasis on personalized and patient-centered health care. Sherr and Karara have noted that it would be important for compounding pharmacies to explore opportunities for marketing their services to veterinary clinics in order to provide optimum care for the veterinary patient.

In the present study, the total number of veterinary prescriptions (1348) provided enough volume to examine the prescription patterns of extemporaneously compounded veterinary medications at a large independent community pharmacy. Remarkably, our findings are in agreement with previously published survey data on the top drugs that are compounded for veterinary medicine. Davis reported that the top three drugs that were compounded for veterinary medicine were:

1. Potassium bromide
2. Metronidazole suspension
3. Methimazole oral liquid

This is in agreement with our data. It was interesting to note the similarities as well as the differences in the older survey and our data. There was very little change in the majority of the commonly prescribed drugs. The top three drugs in both lists contained:

1. Potassium bromide (for seizure prevention)
2. Methimazole (for hyperthyroidism)
3. Metronidazole (for bacterial infections)

The use of diethylstilbestrol, commonly used for urinary incontinence in spayed dogs, is no longer prescribed as often as it had been; the amount of side effects and blood-work monitoring required has caused the drug to fall out of favor. Cyclosporine used as an eye drop can no longer be compounded due to a usage patent. Since the Davis publication, this chemical is now available commercially. The price of the commercial product and the lack of prescription insurance for most animals make this an impractical option for many pet owners.

In place of cyclosporine, we now typically use tacrolimus. Chloramphenicol, an inexpensive broad spectrum antibiotic, is not used as often as it was back in 1999. Since that study, the rate of antibiotic resistance has gone up along with concerns of bone marrow suppression, and hepatic monitoring requirement has caused this medication to be a last-line therapy. It is also interesting to note that no pain medications made the 1999 list, but two medications for pain—gabapentin and piroxicam—were included in our results. Piroxicam also has an added indication in canine patients for bladder cancer.

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<th>TABLE 1. Comparison of the Top Ten Veterinary Compounded Preparations.</th>
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*Active ingredients in different dosage forms and strengths.*
A report by an independent pharmacy shows that top compounded medications for companion animals were: aminopentamide, cisapride, cyclosporine, diethylstilbestrol, methimazole, metronidazole, tacrolimus and trilostane.\textsuperscript{9}

Due to the limitations in data collections, not all prescriptions contained the species of the animal that was being treated. When this information was available, canines and felines made up the majority of the animals. Some of the other animals that were serviced by the pharmacy were:

- Guinea pigs
- Sugar gliders
- Chinchillas
- Rodents
- Birds

Limitations to the findings of our study related to the fact that it was conducted at one site. While study findings are similar to that of the cited 1999 study,\textsuperscript{4} it may not be representative of prescribing habits in other locations. Also, the pharmacy where the study was conducted has invested considerable resources on the infrastructure of the compounding lab and on educating the public and prescribers on the use and availability of extemporaneous-prepared formulations. This may not be typical for other community pharmacies that provide compounded drug formulations to patients. We are hopeful that this report would stimulate more research into the unmet compounding needs in the area of veterinary drug compounding.

### Conclusions

Veterinary prescriptions belonging to the therapeutic categories of CNS agents, anti-infective agents, and hormone and synthetic substitutes were the three most commonly prepared extemporaneous medications. Overall, the most dispensed extemporaneously compounded dosage forms were suspensions, solutions, and capsules. Canine and feline patients were the most treated patients seen by the pharmacy. Overall, veterinary compounding is a large part of the compounding pharmacy’s workflow, making up approximately 15% of all the compounding prescriptions dispensed.

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### References


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