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GI foreign bodies elucidated

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Little has been published about the epidemiology of gastrointestinal foreign bodies in dogs and cats. Published literature on the subject is dominated by approaches to diagnosis and comparison of treatment methods for specific types of ingested objects. For this article, we examined a large number of canine and feline cases from the Banfield Medical Database to help characterize the Pets most likely to present to your hospital with a gastrointestinal foreign body. We will discuss the prevalence, signalment, recurrence and disease risk for different types of patients, and we will also introduce the epidemiologic concepts of pre- and post-test probability, sensitivity and specificity. Probability is integral to managing disease in clinical practice. With knowledge of disease probability and risk, veterinarians can more thoughtfully select and interpret diagnostic test results, guide therapy and prognosis, and advise their clients about a Pet's risk for disease.

Clinical decision making

Veterinarians make diagnostic decisions every day. However, it is critical to remember that the diagnostic process is imperfect. Pets rarely develop diseases characterized by pathognomonic findings. Good clinical decision making requires an ability to estimate the probability of disease in a particular patient. This estimate, termed the "pretest probability," is then modified by the

Evidence-Based Medicine Toolkit

Pretest probability: The probability that a Pet is diseased prior to screening or diagnostic testing, based on the prevalence of the disease in a defined population.

Post-test probability: The probability that a Pet is diseased after the interpretation of diagnostic testing.

Sensitivity: An attribute of a specific test, the true positive rate—*i.e.*, the percentage of individuals with the disease (based on a gold standard) who have a positive test.

Specificity: An attribute of a specific test, the true negative rate—*i.e.,* the percentage of individuals without the disease (based on a gold standard) who have a negative test.

Gold standard: The most definitive assessment of true disease status—*e.g.*, histopathologic diagnosis in oncology, assumed to have close to 100% sensitivity and specificity.

findings of the history, physical examination and diagnostic testing to generate a "post-test probability," or likelihood of disease.

All diagnoses are made with some degree of uncertainty, a result of biologic variability between individuals and within individuals from time to time. Establishing a diagnosis is a process of removing uncertainty until the veterinarian believes with a high degree of confidence that the suspected diagnosis is correct. Uncertainty and relative risk go hand in hand; the probability of disease is modified by the results of history, physical examination and laboratory test assessments. In the analysis described here, we use the Banfield Database to learn more about patient risk for gastrointestinal foreign bodies.

Methods of analysis

In addition to a case series, our analysis includes data from the general Banfield Pet population that is unaffected by gastrointestinal foreign bodies. Using data from both the affected and unaffected populations helps to estimate risk for all Pets seen in clinical practice.

For our case series and analysis, we considered Banfield hospital records from a five-year period: January 1, 2001, through December 31, 2005. Gastrointestinal foreign body cases were identified using a coded diagnosis of foreign body of the oral cavity, retropharynx, tonsil, esophagus or gastrointestinal tract. We characterized disease prevalence; age, gender and breed of the identified cases; and recurrence, presenting complaint, history and exam findings. Control records were chosen randomly from Pets without a foreign body diagnosis for the same time period. These records were compared to the case series populations for risk factor determination.

Table 1: Types of Foreign Body Diagnosis

Location of Foreign Body	Dogs	Cats
Gastrointestinal tract	76.2 (n=11,665)	80.9% (n=2,798)
Oral cavity	21.7% (n=3327)	18.2% (n=629)
Esophagus	1.1% (n=175)	0.7% (n=23)
Tonsils	0.9% (n=128)	0.0% (n=1)
Retropharynx	0.1% (n=8)	0.2% (n=8)

Table 2: Canine Breed Proportions and Risk for Gastrointestinal Foreign Body

Breed	Dogs with gastrointestinal foreign body	Dogs without gastrointestinal foreign body	Relative Risk*
Dachshund (n=925)	3.7%	2.5%	1.5
Beagle (n=840)	3.3%	2.4%	1.4
Labrador Retriever (n=3289)	12.8%	9.5%	1.4
Golden Retriever (n=1102)	4.2%	3.2%	1.3
Boxer (n=818)	3.1%	2.5%	1.2
Rottweiler (n=882)	3.3%	2.7%	1.2
Pit Bull (n=1175)	4.2%	3.8%	1.1
Yorkshire Terrier (n=644)	2.3%	2.2%	1.1
Pomeranian (n=542)	1.8%	2.0%	0.9
Chihuahua (n=1365)	4.2%	5.4%	0.8
German Shepherd (n=1249)	3.9%	4.8%	0.8
Shih Tzu (n=996)	3.1%	3.9%	0.8
Mixed Breed (n=1009)	2.9%	4.2%	0.7
Poodle (n=426)	1.3%	1.8%	0.7
Chow Chow (n=437)	1.1%	2.0%	0.6

* % dogs with gastrointestinal foreign body ÷ % dogs without

To calculate the relative risk for gastrointestinal foreign bodies, we examined the distribution of potential risk factors in both the case and unaffected populations. A risk factor is simply an intrinsic or extrinsic factor that is found more often in individuals with a disease. It can be causal (deterministic) or the result of other associations. A relative risk greater than 1 suggests a positive association between an outcome and a factor, whereas a relative risk equal to 1 reflects no association. A relative risk less than 1 suggests an inverse relationship between a factor under study and a disease outcome.

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DataSavant's mission is to:

- Explore the health and well-being of Pet populations
- Evaluate new clinical treatments
- Monitor Pets as sentinels of zoonotic disease in family environments
- Transform Pet medical data into knowledge, *i.e.*, open new windows into Pet health care using the Banfield medical caseload and database.

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Table 3: Feline Breed Proportions and Risk for Gastrointestinal Foreign Body

Breed	Cats with gastrointestinal foreign body	Cats without gastrointestinal foreign body	Relative Risk*
Siamese (n=351)	5.4%	4.4%	1.2
DMH (n=944)	13.3%	13.2%	1.0
DSH (n=4422)	62.3%	61.5%	1.0
Himalayan (n=103)	1.4%	1.5%	0.9
DLH (n=691)	8.7%	10.6%	0.8
Persian (n=164)	2.0%	2.6%	0.8

* % cats with gastrointestinal foreign body ÷ % cats without

Table 4: Reported History and Exam Findings for Cases of Gastrointestinal Foreign Body

	Dogs	Cats
Vomiting	24.6%	27.5%
Diarrhea, vomiting or excess gas	10.8%	12.1%
May have swallowed foreign objects	10.1%	9.3%
Could have gotten into garbage	6.9%	4.2%
Change in appetite	5.9%	7.4%
Painful abdomen	5.0%	4.7%
Vomited after eating	4.3%	5.6%
Exposure to garbage	3.2%	0.7%
Chewing inappropriate things	2.4%	1.3%
Trouble breathing	2.0%	1.6%
Coughing	1.7%	1.2%
Painful intestines	1.5%	1.9%
Stomach painful	1.4%	1.0%
Abdomen distended	1.3%	1.7%
Mass in abdomen	1.0%	2.6%
Chewing	0.7%	0.1%
Blood in diarrhea	0.56%	2.5%
Distended stomach	0.5%	0.5%
Pica	0.2%	0.08%
Masses in stomach	0.1%	0.4%

Prevalence and pretest probability

Disease prevalence (the proportion affected in a defined population at a specific time) can be used as an estimate of pretest probability–*i.e.*, the probability that a Pet is diseased prior to screening or diagnostic testing. Pretest probabilities can also be generated for Pets with a specific clinical sign (*e.g.*, the prevalence of foreign bodies in a population of dogs that present with a history of vomiting) or a patient attribute (*e.g.*, the prevalence of foreign bodies in a population of 2-year-old dogs). Once the initial test results are known, the pretest probability can be modified to further elucidate or rule out the suspected diagnosis.

Some of the uncertainty in the diagnostic process is a result of variations in the ability of diagnostic tests to accurately identify a diseased or nondiseased patient. "Sensitivity" refers to the percentage of individuals with the disease who have a positive test–*i.e.*, the true positive rate. "Specificity" refers to the percentage of individuals without the disease who tested negative–*i.e.*, the true negative rate. Sensitivity and specificity can be used to compare diagnostic tests and to help interpret test results in an individual with certain characteristics.

Results

We identified 15,303 dogs from a total of 2,129,161 (with complete breed and age data) with a recorded diagnosis of gastrointestinal foreign body. The overall prevalence of gastrointestinal foreign body (first diagnosis) in the canine population was 0.72 percent. We identified 3,459 cats from a total of 781,970 (with complete breed and age data) with a diagnosis of gastrointestinal foreign body for a disease prevalence of 0.44 percent. A sample of 12,315 dogs and 3,597 cats were chosen to represent the control population for this analysis.

Table 1 (page 17) details the distribution of the five types of gastrointestinal foreign bodies in dogs and cats. On average, dogs were 2.7 years old when diagnosed with a gastrointestinal foreign body and weighed 36.8 pounds. Cats were 3.3 years old on average and weighed 9.5 pounds. In the

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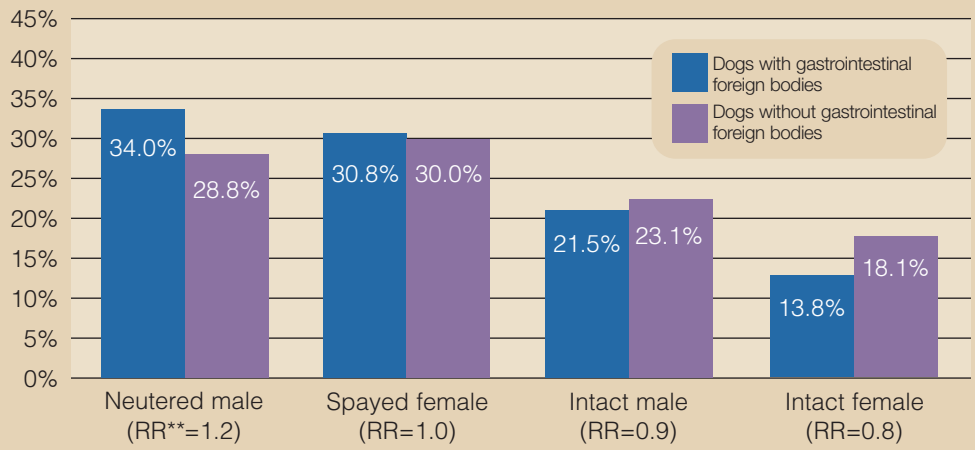
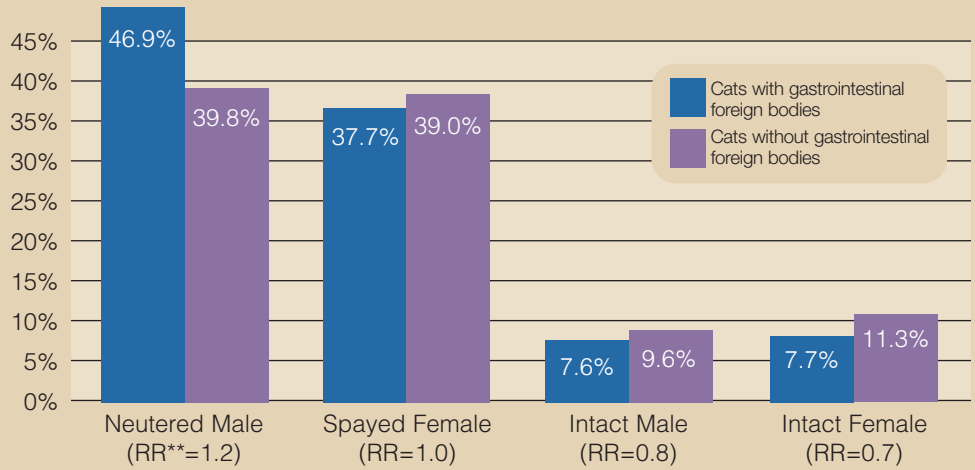
Figure 1: Gender Distribution of Dogs Diagnosed with Gastrointestinal Foreign Bodies*



*Total number of affected dogs was 15,303.
**RR=relative risk

Figure 2: Gender Distribution of Cats Diagnosed with Gastrointestinal Foreign Bodies*



*Total number of affected cats was 3,459.
**RR=relative risk

control Pet populations, cats were 4 years old and 8.8 pounds on average; dogs were 3.6 years old and 34 pounds. The diagnosis was recurrent in 5.3 percent of cats and 10.2 percent of dogs.

In our analysis, Dachshunds, Beagles, Labrador Retrievers and Golden Retrievers were overrepresented (*i.e.*, at more risk for foreign body ingestion than the general population) (*Table 2*, page 17). Siamese cats were at a slightly higher risk than the unaffected feline population (*Table 3*, page 18). Mixed Breed dogs, Poodles and Chow Chows were underrepresented in our case

In light of risk and probability, a 2-year-old neutered male Beagle with a history of vomiting would have a higher pretest probability of foreign body ingestion than a middle-aged spayed female Chow Chow with the same history.

series and at less risk for foreign body ingestion. Persian and Domestic Longhaired cats were also at less risk. Neutered males were more likely to be diagnosed with gastrointestinal foreign bodies in both the canine and feline Pet populations compared with the unaffected population (*Figures 1* and *2*, page 20).

"Vomiting," "diarrhea, vomiting or excess gas" and "may have swallowed foreign objects" were the most common exam or historical findings for dogs and cats with gastrointestinal foreign bodies (*Table 4*, page 18). Data from the presenting complaint field of PetWare,® Banfield's proprietary software system, were available for 1,007 canine cases; this field listed the type of foreign body. "Bones" were most frequently mentioned (51 percent), followed by "plastic" (12.7 percent), "dental" (11.4 percent), "skin" (6.4 percent), "toy" (5.9 percent), "nail" (3.9 percent) and other (8.7 percent). Ninety-four feline records listed the type of foreign body: "plastic" (26.6 percent), "rubber" (26.6 percent), "dental" (18.1 percent), "skin" (8.5 percent), "toy" (8.5 percent), "bone" (6.4 percent) and other (5.3 percent).

Discussion

In the "average" Banfield Hospital, a dog diagnosed with a gastrointestinal foreign body is most likely to be a young neutered male from one of the following breeds: Dachshunds, Beagles, Labrador Retriever or Golden Retriever. Cats at greatest risk for foreign body ingestion are younger neutered Siamese males. Ten percent of dogs had recurrent diagnoses compared with 5.3 percent of cats. In light of risk and probability, a 2-year-old neutered male Beagle with a history of vomiting would have a higher pretest probability of foreign body ingestion than a middle-aged spayed female Chow Chow with the same history. Their different pretest probabilities would potentially influence the veterinarian's choice of further diagnostics and interpretation of the results.

Pretest probability is useful for determining diagnostics, therapy and prognosis. With an understanding of the probabilities inherent to the diagnostic process, practitioners can better understand their diagnostic and treatment options and discuss their recommendations more effectively with clients. In future articles, DataSavant will quantify the concepts presented here and apply them to the population of Pets seen at Banfield, The Pet Hospital.

Elizabeth Lund, DVM, MPH, PhD, joined Banfield in April 2006 as senior director of research for DataSavant. As an epidemiologist, her professional experience over the last 18 years has included research in academia, industry and public health. In addition to her veterinary degree, Dr. Lund has a master's in public health and a PhD in epidemiology/informatics. She and her husband, Jim, have four children (Jessica, Alyssa, Will and Nick) and four Pets (a dog, cat, chinchilla and hamster).