Chapter 2

Evidence-Based Clinical Nutrition

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"Each time we learn something new and surprising, the astonishment comes with the realization that we were wrong before.... In truth, whenever we discover a new fact it involves the elimination of old ones. We are always, as it turns out, fundamentally in error."
Lewis Thomas

INTRODUCTION

Practitioners should know how to determine risks and benefits of nutritional regimens, including for nutritional care, and counsel pet owners accordingly. Currently, veterinary medical education and continuing education are not based on rigorous assessment of evidence for or against particular management options. Journals and textbooks, even those designed to rapidly access decisions while patients are in a clinical situation, may not help determine specific risks and benefits of nutritional management. Consequently, veterinarians have often had to rely on clinical experience and judgment, aided by opinions of colleagues and consultants who practice similarly. Evidence-based medicine (EBM) represents a major, but still untested, intellectual advance when making clinical decisions and determining patient care (Geyman, 2000; Keene, 2000; Moriello, 2003). This chapter will apply the basic elements of EBM to veterinary clinical nutrition and provide a statistical primer to help veterinarians interpret available information.

EBM CONCEPTS

EBM and its associated concepts were first advanced by a group at McMaster University Health Sciences Centre in Canada. The first publications emerged in the early 1990s (EBM Working Group, 1992; Sackett et al, 1996). The underlying concepts are rooted in clinical epidemiology and are not new. EBM seeks to establish clinical medicine as a verifiable scientific activity (Naldi et al, 2000).

Initially, EBM was defined as the "conscientious, explicit and judicious use of current best evidence from clinical care research in making decisions about the care of individual patients" (Sackett et al, 1996). EBM was later refined to integrate the best research evidence, clinical expertise and patient values (Sackett et al, 2000). Best research evidence means clinically relevant research, especially from patient-centered clinical studies. Clinical expertise is the ability to use clinical skills and past experiences to rapidly identify each patient's unique health state, establish a diagnosis and determine the risks and benefits of potential interventions facing that patient. Patient values include unique preferences, concerns and expectations that each person brings to a clinical encounter; these must be integrated into clinical decisions that best serve the patient. Integration of these three elements supposedly helps clinicians and patients form a diagnostic and therapeutic alliance that optimizes clinical outcomes and quality of life (Sackett et al, 2000).

EBM concepts also apply to dogs, cats and other nonhuman animals. Patient values must be extended to include the unique preferences, concerns and expectations of owners and their pet (i.e., patient). Regardless of the definition, use of current best evidence should not replace clinical skills, judgment or experi-

Table 2-1. Guidelines for quality of evidence that can be used for veterinary clinical nutrition.

Evidence grade	Evidence guidelines	Examples of nutritional studies
1	Evidence obtained from at least one properly randomized, controlled, clinical study that used the nutritional product in the target species with animals that had developed the disease naturally.*	Dietary modification for treatment of cats and dogs with naturally developing chronic kidney disease.
2	Evidence obtained from randomized, controlled, clinical studies conducted in a laboratory setting that used the nutritional product in the target species with animals that had developed the disease naturally.*	Effects of a dental food on plaque accumulation and gingival health in dogs. Energy restriction in obese cats and dogs fed foods varying in protein, fat, fiber and carbohydrate content.
3	Evidence obtained from one or more of the following:* At least one appropriately designed clinical study without randomization. Cohort or case-controlled analytic studies. Studies that used acceptable models of disease or simulations in the target species. Case series. Dramatic results from uncontrolled studies.	Use of foods using novel or hydrolyzed protein sources for animals with adverse food reactions. Myocardial failure in cats associated with taurine deficiency.
4	Evidence obtained from one or more of the following: Opinions based on clinical experience (textbooks, monographs or proceedings). Descriptive studies. Studies conducted in other species. Pathophysiologic justification. Reports of expert committees.	Hepatic disease and nutritional therapy. Nutritional management of most diarrheal diseases.

*Data published in peer-reviewed journals is preferred.

ence; however, it does provide another dimension to the decision-making process that also considers the patient's and owner's preferences (Forrest and Miller, 2002). Evidence-based clinical nutrition (EBCN) attempts to efficiently integrate medical and nutritional research with clinical practice.

Figure 2-1 is a conceptual model for evidence-based clinical decisions (Hayes et al, 1996). Analysis reveals that the best evidence-based clinical decisions are made when clinical expertise, research evidence, owner or patient preferences and available resources overlap. This model can be easily adapted to veterinary clinical nutrition in which assessment of the patient, food and feeding method lead to a comprehensive feeding plan based on the best current evidence (Thatcher et al, 2000). Clinical expertise is needed to obtain a dietary history and assess a patient's nutritional and health status. This assessment must often include other pets in the household. Clinical and nutritional expertise provides individualized care for a specific patient's needs. Owners exercise their preferences for medical and nutritional care by seeking second opinions, choosing alternate treatments, exercising economic constraints and adhering (or not) to recommended feeding or therapeutic plans. Today, more clinical and nutritional information is available to pet owners than ever before. Pet preferences are most commonly recognized in veterinary clinical nutrition through palatability choices for certain types of foods.

Integrating clinical expertise with current best evidence from medical and nutritional research is complex. Veterinarians usually attempt to base their decisions on the best evidence available. This evidence often represents extrapolations of pathophysiologic principles, studies conducted in other species and logical conclusions based on data derived from patients in clinical studies (Rosenberg and Sackett, 1996). The advent and proliferation of randomized, controlled clinical studies increased the quantity and quality of clinically valid evidence. When possible, veterinarians should use information derived from systematic, rigorously controlled clinical studies (obviously, larger trials involving more patients are preferable) to make diagnostic and therapeutic decisions. EBM and EBCN do not always provide definitive answers, but they do provide a framework for making decisions and understanding the risk-benefit relationship of various feeding and therapeutic plans. Understanding the rules of evidence is necessary to understand EBM and EBCN (Sackett, 1993; Berg, 2000).

RULES OF EVIDENCE

Scientific evidence is the product of appropriately designed and carefully controlled research. A single study does not constitute evidence; rather, it contributes to knowledge derived from multiple studies that have investigated the same scientific question. Unfortunately, no central repository for clinical nutrition information exists nor is there a system for establishing quality evidence. Several classification schemes are useful for establishing rules of evidence for recommendations about clinical nutrition.

One method is to use a pyramid to rank clinical evidence (**Figure 2-2**) (Forrest and Miller, 2002; SUNY, 2003). Traditional sources of evidence include textbooks, personal

journal collections, conference proceedings and clinical guidelines. Unfortunately, much of this evidence is not based on appropriately conducted clinical studies in the target species. Many clinical and nutritional interventions are used because the basic pathophysiologic rationale was reasonable, although clinical outcome data to document positive effects were lacking.

Strong EBM and EBCN evidence includes randomized, controlled clinical studies or systematic reviews of more than one study (i.e., meta-analysis). Epidemiologic studies (cohort studies or case-control studies), models of disease and case series are the next best evidence. Hierarchy of evidence is based on causation and bias control. As one ascends the pyramid, the number of studies and, correspondingly, the available literature decreases, whereas the relevance to answering clinical questions increases.

Quality of evidence guidelines, adapted from the U.S. Preventive Services Task Force, are excellent, rigorous applications of evidence-based appraisal systems (Geyman, 2000; Berg, 2000; McGowan et al, 1992; Polzin, 2003; Polzin, 2003a). Those guidelines have been modified to better fit the types of evidence encountered in veterinary clinical nutrition (**Table 2-1**) (Roudebush et al, 2004). Other classification schemes have been recommended for rules of evidence; however, they are very similar to the evidence pyramid and grades outlined here (Rosenberg and Sackett, 1996; Olivry and Mueller, 2003; Cook et al, 1995). It is beyond the scope of this chapter to describe strategies for finding clinical nutrition evidence. Numerous excellent articles, textbooks and websites provide detailed explanations about the evidence gathering process (Sackett et al, 2000; Miser, 1999; Safranek and Dodson, 2000; Hunt et al, 2000; Jahad and Haynes, 2000; Chi-Lum et al, 1997; Klemenez and McSherry, 1997; Greenhalgh, 1997).

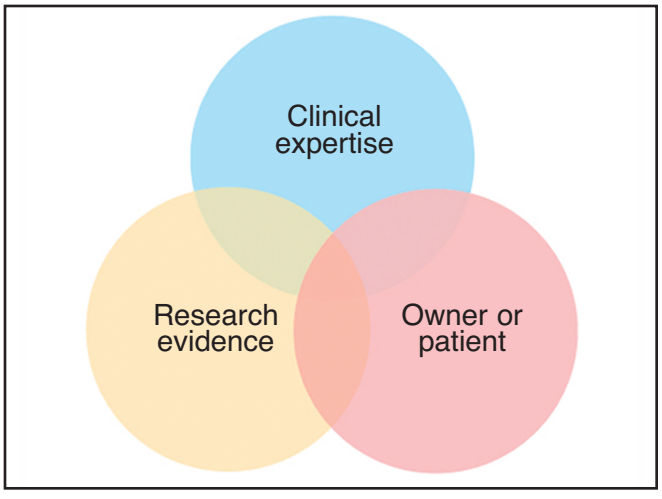

Figure 2-1. A conceptual model for making evidence-based clinical decisions. The best clinical decisions are made when clinical expertise, high-quality evidence obtained in controlled studies and owner or patient preferences overlap. (Adapted from Haynes RB, Sackett DL, Gray JMA, et al. Transferring evidence from research into practice: 1. The role of clinical care research evidence in clinical decisions. American College of Physicians Journal Club 1996; 125: A14-A16. Reprinted with permission).

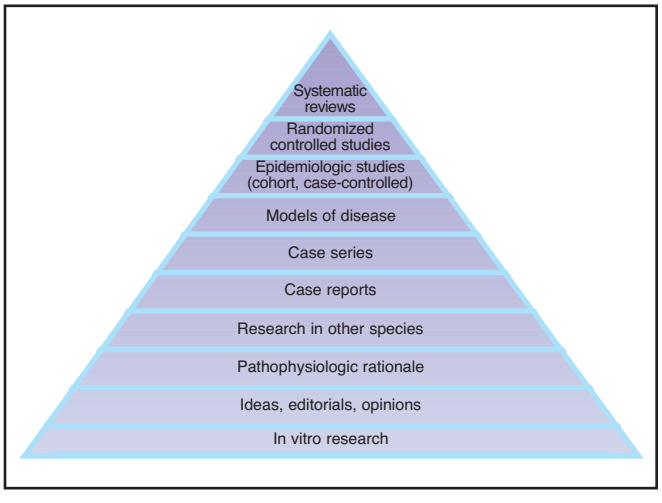

Figure 2-2. The evidence pyramid. The level of evidence for use of a diagnostic or therapeutic intervention increases as one progresses up the pyramid. (Adapted from SUNY Downstate Medical Center. Guide to research methods: the evidence pyramid. Medical Research Library of Brooklyn Web site. Available at http://library.downstate.edu/dbm. Accessed on November 2, 2003. Reprinted with permission.)

APPLYING EVIDENCE TO SPECIFIC PATIENTS

Many activities veterinarians perform in clinical medicine and nutrition have not been subjected to suitably designed scientific studies. Randomized, controlled studies are the reference criterion standard for therapeutic and nutritional interventions; however, these studies are imperfect and do not apply to studies of cause, diagnosis and prognosis (Sackett, 1993; Berg, 2000). Randomized, controlled studies are often not conducted on patients similar to those encountered in practice, and many clinical and nutritional interventions will never be subjected to such investigations. For example, randomized, controlled studies are often not conducted on patients with naturally occurring disease and many clinical and nutritional interventions will never be subjected to such investigations due to ethical or other reasons. Nonetheless, evidence from randomized, clinical studies currently is most likely to predict results in clinical practice. Randomized, clinical studies also serve as a scientific entry point for discussions with owners about therapeutic and nutritional options.

Several questions can be used to decide the applicability of evidence from clinical studies to nutritionally manage a specific patient (Strauss and Sackett, 1999; Dans et al, 1998; McAlister et al, 2000).

- Were study outcomes clinically relevant?
- Are there differences between animals in the study and my patient that may alter expected treatment response?
- Are there potential drug-nutrient interactions that may alter the expected treatment response?

- Are there differences in the nutrient contents of the food (or supplements) that may alter the expected treatment response?
- Is the food (or supplement) readily available and economically feasible?
- Is the feeding plan intervention feasible in the owner's setting?
- What are the patient's likely benefits and risks from the various nutritional management options?
- How will the owner's values and patient's preferences influence the decision about nutritional management?
- Does the patient have other health conditions that substantially alter the potential benefits and risks of nutritional management?

EVIDENCE-BASED TREATMENT DECISIONS: A FRAMEWORK FOR CLINICAL PRACTICE

EBM involves making clinical decisions by carefully identifying, evaluating and applying the most relevant information. In EBM, the first step is to identify and define the medical problem to learn what additional information is required. After the need for additional information is identified, it must be retrieved and evaluated to ensure validity. After the information is judged valid, it is next necessary to apply it to the care of your patient. This brief section will focus on how to evaluate information about treatment after it has been retrieved and conclude with a few general comments about applying treatments to individual patients.

The first step in making good treatment decisions is to decide whether the patient requires treatment or not and to identify the specific goals of treatment. Potential treatment goals include eliminating or decreasing current clinical signs, preventing recurrence of disease, slowing progression of disease and curing the disease. After the treatment goals have been identified and treatment has been initiated it is important to periodically assess progress toward these goals and to make changes as appropriate.

After the decision to treat has been made and the treatment goals identified, the next step is to decide on the specific treatment modality or modalities (pharmacologic agents, surgery and nutrition) that will achieve the treatment goals. Experienced clinicians make treatment decisions based on their own uncontrolled clinical experience. Clinicians judge the efficacy of a treatment by comparing current clinical impressions with clinical impressions before the new treatment was available. Unfortunately, this approach can lead to erroneous conclusions. Part of human nature is to remember our successes and either forget our treatment failures or attribute them to other factors (e.g., poor owner compliance). Another risk when judging the efficacy of a treatment based on clinical impressions is that neither the clinician nor the pet owner is masked to treatment so there is increased potential for bias in subjective assessments (placebo effect).

Alternatively, treatment decisions can be based on critical analysis of formal, prospective randomized clinical trials designed to determine if differences exist in clinically relevant outcomes between treatments. In clinical trials, researchers apply a treatment or intervention and observe the effect of treatment on outcome. The value of interventional compared to observational studies is the ability to determine causality.

The purpose of clinical research is to draw inferences about what really happened in the study patients and to apply those inferences to the universe of all patients with the same problem. Errors are inherent in all clinical research studies. The key issue is whether the errors change the conclusions of a study significantly. The challenge is to design and complete a study that adequately controls for random and systematic errors. Randomly assigning patients to treatment can eliminate the influence of confounding variables. Masking the veterinarian and pet owner to treatment can reduce the possibility that clinical assessments are biased. Randomized, controlled masked clinical trials are considered the gold standard of clinical research because they provide the best way to reduce bias. Bias is anything that produces results or conclusions that differ from the truth. Sources of bias can be found in the design, implementation and analysis of the study.

In general, clinical trials are expensive, time consuming and difficult to conduct. Consequently, well-designed, well-executed clinical trials are unavailable to guide every treatment decision. Nonetheless, a systematic approach to evaluating support for each treatment option is valuable to the clinician. The critical evaluation of a clinical trial depends on more than checking for appropriate randomization and the presence of a control group. The following series of questions can guide the clinician through a systematic assessment of the validity of a clinical trial.

Was Assignment to Treatment Truly Randomized?

Did every patient enrolled in the study have an equal and known probability of receiving the treatment(s) compared? Proper randomization applies a previously established method for assigning patients to a treatment group using a set of computer-generated random numbers. The random assignment of patients to treatment groups is critical for establishing the basis for statistical testing of the differences in the clinical outcomes observed between groups. In blocked randomization, age, sex and other baseline characteristics that may influence clinical outcomes are distributed equally between treatment groups and do not confound interpretation of results. When block randomization is done properly any differences in baseline characteristics between the groups are due to chance and addressed by the statistical tests. Proper random assignment guarantees that no one can influence assignment to treatment. This prevents the investigator from knowingly or unknowingly assigning a particular patient to a specific treatment because the patient seems particularly suited to receive the active or control treatment, thereby eliminating an important potential source of bias.

Are the Subjects in the Clinical Trial Adequately Described and Similar to your Patient?

Is there sufficient demographic and clinical detail provided about the study patients for you to determine similarity between them and your patient? Are the patients in the study similar enough to your patient that you are comfortable applying the study results?

Were Treatment Groups Similar at the Start of the Study?

Were there any differences in key baseline characteristics that might influence the clinical outcome between the treatment groups at the start of study? For example, in a study of spontaneous chronic kidney disease was the severity of kidney disease comparable in the treatment groups at the onset of the study?

Aside from the Investigated Treatment, were the Groups Treated Equally?

With the exception of the treatment under investigation, were all disease-related interventions identical between treatment groups? Are the details of patient management adequate to make this assessment? Could the difference in outcome be attributable to treatment differences that are not part of the stated objective of the study?

Were all Patients that Entered the Study Accounted for at the Conclusion of the Study?

Can you reconcile the number of patients in the title or methods section of the article with the tally of the final disposition of patients? If patients were lost to follow-up or dismissed from the study, were they included in the statistical analysis of the data? If yes, how were these missing data points handled? Does management of these missing data points change the study conclusions?

Are the Study Results Believable?

Was the clinical outcome of interest defined based on clear, explicit and, if possible, objective criteria? Are the results of the clinical trial consistent with those of other studies? Are the results of the clinical trial biologically plausible? Is there a biologic precedent for the putative mechanism of action?

Were Findings both Clinically and Statistically Significant?

Clinical significance refers to the medical importance of the findings. Was the magnitude of the observed treatment effect large enough to make a difference in how you manage your patient? A finding in a clinical trial can be statistically significant but clinically insignificant. Was the endpoint studied a clinical or surrogate outcome? Clinically relevant endpoints, such as survival and quality of life, are the most meaningful to veterinarians and pet owners. Surrogate markers indirectly assess the risk of a clinical outcome (e.g., serum creatinine in kidney disease and shortening fraction in heart disease). Showing a treatment causes favorable changes in surrogate markers doesn't necessarily prove better clinical outcomes. Surrogate markers are frequently used in veterinary medicine because resources are limited and studies with clinical outcomes typically take longer and are more expensive. Statistics can be viewed as a quantitative method of good clinical decision making. From a clinician's perspective, statistics provide a way to assess the level of confidence in whether the treatment described in a clinical trial will be effective in your patient. The probability of accepting an ineffective treatment (false positive) is expressed by the p value. The p value describes how often differences in the treatment effect as large or larger than those observed in the clinical trial will occur in a long series of identical trials if in fact no true treatment effect exists. If $p = 0.05$ and the identical study is repeated 20 times the same result will be obtained 19 of 20 times. The smaller the p value, the more accurate the conclusion that a treatment effect truly exists. Most articles describing veterinary clinical trials specify the likelihood of accepting an ineffective treatment (a type I error) but relatively few specify the risk of not recognizing an effective treatment (a type II error). The risk of not recognizing an effective treatment can be calculated and is known as β. In clinical trials it is typical to set the risk of accepting an ineffective treatment (p value) at 0.05 and the risk of not recognizing an effective treatment at 0.20 (20% risk). These risk levels are known as standard or conventional levels of statistical significance. If the true state of affairs is that the treatment is different than the control and the study is designed to accept the conventional levels of risk, then the power of the study is 1 - 0.20 or 80%. The power of a clinical trial is analogous to the sensitivity of a diagnostic test.

Was the Study of Sufficient Size and Duration?

The p value is influenced by group size and the variability in the measurement in question. In general, if a measurement is very precise and has nearly the same value each time it is measured it is possible to demonstrate statistical significance with smaller numbers of patients. The number of patients in a study indirectly influences clinician confidence in the results. Group size is related by square root to confidence in the research findings. In order to double confidence in the research findings, it is necessary to quadruple the number of patients in the study. The duration of a study must be adequate to assess the treatment goal. For example, if the goal is to prevent the recurrence of calcium oxalate uroliths, the duration of the study must be long enough to assess whether the treatment under investigation has a clinically significant effect.

Were Those Making Clinical Assessments (Veterinarian and Pet Owner) Masked (Blinded) to Treatment?

Masking prevents biased assessments of subjective outcomes. Unmasked clinicians may also give special attention to patients receiving the "test" material. This can take the form of additional diagnostic tests or additional treatments. This is sometimes called co-intervention. For example, an unmasked investigator consciously or unconsciously eager to demonstrate a positive "test" effect in a trial of an obesity drug might recom-

mend increased exercise. Masking can be difficult to achieve and maintain because of logistical considerations or telltale effects of a treatment on clinical signs or laboratory tests. Logistical considerations include the physical appearance and aroma of the test material. At the conclusion of the study participants can be asked to pick the "test" material if an investigator is concerned about masking. If the percent guessing correctly is high, this should be taken into consideration when evaluating the results of the study.

REFERENCES

The references for **Chapter 2** can be found at www.markmorris.org.

CASE 2-1

Lethargy and Inappetence in a Scottish Terrier

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Patient Assessment

A six-year-old intact male Scottish terrier was examined for lethargy of several days' duration and mild inappetence. The dog weighed 9.5 kg (20.9 lb), and had a normal body condition score (3 on a 5-point scale). Several peripheral lymph nodes were enlarged and splenomegaly was diagnosed. Results of per rectal palpation and ocular fundic examination were normal. Analysis of a hemogram revealed mild normocytic, normochromic, nonregenerative anemia. Results of a serum biochemistry analysis were within reference ranges, except for mild increases in hepatic enzyme activity. Thoracic radiography revealed sternal lymphomegaly. Abdominal ultrasonography revealed mesenteric lymph node enlargement; however, the liver and spleen appeared normal. Microscopic examination of a fine-needle aspirate obtained from a peripheral lymph node revealed a homogenous population of immature lymphoid cells consistent with high-grade lymphoma.

The tentative diagnosis and treatment options were discussed with the owner, who selected chemotherapy. The owner wanted to know whether nutritional therapy or dietary supplements would be appropriate for the dog.

Question

As the attending veterinarian, you must answer the following question: In dogs with lymphoma, do dietary supplements or therapeutic foods influence survival or quality of life when used in conjunction with standard treatments such as chemotherapy?

Answer

A literature search revealed two, randomized, controlled clinical studies in which clinicians used single-agent chemotherapy (i.e., doxorubicin) and a therapeutic food in dogs with lymphoma. One of these studies was published in a peer-reviewed journal, whereas the other was a research abstract at a major veterinary meeting. Both studies indicated that dogs with lymphoma that consumed a therapeutic food supplemented with fish oil and arginine, combined with doxorubicin therapy had a significantly longer disease-free interval, longer survival time and improved quality of life, compared with dogs eating a standard food while receiving similar chemotherapy. These published data are Grade 1, which is the highest quality of evidence for recommending nutritional management for dogs with lymphoma. The patient described in the case is similar to dogs enrolled in the published studies, and the food used in those studies is identical to a commercially available therapeutic food.[a]

Another literature search did not reveal published clinical studies in which nutritional supplements were effective in dogs with multicentric lymphoma. Any recommendations for use of supplements should be made on the basis of expert opinions, clinical experience, studies in other species or pathophysiologic justification. These are Grade 4 evidence, which is the weakest form of evidence for making a nutritional recommendation.

Endnote

a. Prescription Diet n/d Canine, Hill's Pet Nutrition Inc., Topeka, KS, USA.

Bibliography

Ogilvie GK, Fettman MJ, Mallinkrodt CH, et al. Effect of fish oil, arginine and doxorubicin chemotherapy on remission and survival time for dogs with lymphoma. Cancer 2000; 88: 1916-1928.
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CASE 2-2

Polydipsia and Polyuria in a Male Domestic Shorthair Cat

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Patient Assessment

A 12-year-old neutered male domestic shorthair cat was examined for routine health maintenance. The cat's body weight was 3.4 kg (7.5 lb) with a normal body condition score (3 on a 5-point scale). The owners reported a recent increase in water consumption and frequency of urination. Results of physical examination were unremarkable, except for mild periodontal disease. Laboratory tests performed included a hemogram, urinalysis and serum biochemistry profile. Azotemia was detected, with an increase in serum creatinine concentration (2.5 mg/dl; reference range, 0.4 to 1.8 mg/dl) and a urine specific gravity of 1.018. Results of other laboratory tests were within reference ranges. Subsequent microbial culture of a urine sample yielded negative results. The tentative diagnosis was naturally developing, Stage 2 chronic kidney disease.

Question

As the attending veterinarian, you must answer the following question: For cats with chronic kidney disease, does dietary management delay the onset of uremic crises, reduce the risk of future uremic crises or delay death?

Answer

A literature search found a randomized, controlled clinical study that evaluated the effect of dietary modification for treatment of cats with naturally developing chronic renal failure. Analysis of that study indicated that a food formulated for renal conditions benefited cats with uremic crises and decreased mortality in those with mild to moderate naturally developing chronic kidney disease, compared with results attained with an adult maintenance food. Cats fed the therapeutically formulated food had reduced mortality compared with cats fed the adult maintenance food.

The study represents Grade 1 evidence, which is the highest quality. Your patient is similar to cats enrolled in a published clinical study, and the food used in the study is a commercially available therapeutic food that is readily available and economically feasible.[a] Based on this evidence, use of the therapeutically formulated food and other tenets of conservative medical management should be recommended for your patient, providing owner and patient preferences are satisfied.

Endnote

a. Prescription Diet k/d Feline, Hill's Pet Nutrition Inc., Topeka, KS, USA.

CASE 2-3

Severe Halitosis and Reluctance to Eat in an Irish Setter

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Patient Assessment

A seven-year-old, 30-kg (66-lb) male Irish setter was examined for severe halitosis and reluctance to eat dry food. Abnormal findings during examination of the oral cavity included moderate accumulations of plaque and calculus on both dental arcades, periodontitis, exposure of the furcation of tooth roots and loss of attachment; these findings were most prominent around the caudal mandibular premolars and molars. Results for the remainder of the physical examination were unremarkable. The dog was given antibiotics to help control infection of oral tissues while further diagnostic evaluations were performed. Results of a hemogram, serum biochemistry analysis and urinalysis were within reference ranges.

The dog was anesthetized, and supragingival scaling followed by root planing and subgingival curettage was performed. Severe periodontal disease was found around the left mandibular teeth (fourth premolar and first molar). These teeth were extracted. An

osseopromotive bioactive material[a] was placed into the sockets, and extraction sites were sutured. The remaining teeth were polished. Oral antibiotics and a canned recovery-type food were dispensed. Two weeks later, the extraction sites were healed, and the owner commented that the dog is more active.

Question

As the attending veterinarian, you must answer the following question: For dogs treated to correct dental plaque and calculus, gingivitis and oral malodor, does dietary management delay the onset or reduce the severity of further dental disease?

Answer

A literature search revealed a number of randomized, controlled clinical studies that evaluated the effect of dietary modification for dogs with plaque and calculus accumulation, gingivitis and oral malodor. Those studies were conducted in a laboratory setting and involved use of a nutritional product in dogs with naturally developing oral disease. Analysis of results of those studies revealed a significant reduction of plaque, calculus, gingivitis and oral malodor when feeding a therapeutic food specially formulated for dogs with dental conditions, compared with feeding a typical dry food. This constitutes Grade 2 evidence, or the second highest quality of evidence. This patient's condition is similar to that of dogs used in the published studies; the food used was a commercially available therapeutic food[b] that is readily available and economically feasible. Based on this evidence, use of the therapeutic food specially formulated for dogs with dental conditions should be recommended for patients, providing owner and patient preferences are satisfied.

Endnotes

a. Bioglass, Nutramax Laboratories Inc., Baltimore, MD, USA.
b. Prescription Diet t/d Canine, Hill's Pet Nutrition Inc., Topeka, KS, USA.