BACTERIAL PNEUMONIA

BASICS

OVERVIEW

- Inflammation in the lung as a response to disease-causing bacteria, characterized by accumulation of inflammatory cells and fluid in the lung, conducting airways (bronchi and bronchioles), and alveoli (the terminal portion of the airways, in which oxygen and carbon dioxide are exchanged)
- "Pneumonia" is inflammation of the lungs

SIGNALMENT/DESCRIPTION of ANIMAL

Species

- Dogs and cats; more common in dogs than in cats

Breed Predilection

- Dogs—sporting breeds, hounds, working breeds, and mixed-breed dogs (greater than 12 kg [26 lbs] of body weight)

Mean Age and Range

- Dogs—range, 1 month to 15 years; many cases in puppies less than 1 year of age

Predominant Sex

- Dogs—60% males

SIGNS/OBSERVED CHANGES in the ANIMAL

- Cough
- Fever
- Labored breathing
- Exercise intolerance
- Lack of appetite (known as "anorexia") and weight loss
- Sluggishness (lethargy)
- Nasal discharge
- Difficult or rapid breathing
- Abnormal breath sounds on listening to the lungs with a stethoscope (known as "auscultation")—increased intensity or breath sounds over the bronchi; short, rough snapping sounds (known as "crackles"); and squeaking or whistling sounds (known as "wheezes")
- Dehydration

CAUSES

Dogs

- *Bordetella bronchiseptica* and *Streptococcus zooepidemicus*—primary bacterial cause of pneumonia
- Gram-negative bacteria and *Mycoplasma* predominate in single bacterial and mixed-bacterial infections
- *Escherichia coli, Klebsiella pneumoniae, Pasteurella multocida, Staphylococcus, Streptococcus, Bordetella bronchiseptica, Mycoplasma*, and *Pseudomonas aeruginosa*—most common bacterial isolates
- Anaerobic bacteria (bacteria that can live and grow in the absence of oxygen)—found in lung abscesses and various types of pneumonia (particularly with aspiration or foreign bodies)

Cats

- Bacteria—*Bordetella bronchiseptica*, *Pasteurella*, and *Moraxella* most frequently reported; *Mycoplasma* considered a primary disease-causing microorganism (known as a "pathogen") in the lower respiratory tract
- Carrier state—may exist; periods of shedding *Bordetella bronchiseptica* after stress; infected female cats (queens) may not shed the organism during pregnancy (prepartum) but begin shedding it after delivering the kittens (postpartum), serving as a source of infection for kittens

RISK FACTORS

- Pre-existing viral infection
- Regurgitation (return of food or other contents from the esophagus or stomach back up through the mouth), dysphagia (difficulty swallowing), or vomiting (forceful ejection of stomach contents up through the esophagus and mouth)
- Functional or structural (anatomic) defects—paralysis of the voice box or larynx (known as "laryngeal paralysis"); enlarged esophagus (known as "megaesophagus"); cleft palate; inherited disorder in which the normal secretion clearance mechanism of the lungs is defective (known as "primary ciliary dyskinesia"); abnormally small windpipe or trachea (known as "tracheal hypoplasia")
- Foreign body in the bronchi (part of the airway)
- Reduced level of consciousness—stupor, coma, or anesthesia
- *Mycoplasma*, parasitic, or fungal respiratory infection
- Chest trauma or surgery

• Long-term (chronic) dilation of bronchi or bronchioles, as a consequence of inflammation or blockage of the airway (known as “bronchiectasis”)
• Drugs to decrease the immune response (known as “immunosuppressive drugs”)—such as chemotherapeutic drugs and steroids
• Severe metabolic disorders—excess levels of urea and other nitrogenous waste products in the blood (known as “uremia” or “azotemia”); sugar diabetes (diabetes mellitus); excessive production of steroids by the adrenal glands (known as “hyperadrenocorticism” or “Cushing’s disease”) and inadequate production of steroids by the adrenal glands (known as “hypoadrenocorticism” or “Addison’s disease”)
• Presence of pus-forming bacteria and their poisons in the blood or tissues (known as “sepsis”)
• Protein–calorie malnutrition
• Inability to develop a normal immune response (known as “immunodeficiency”)
• Age—very young more susceptible to fatal infections
• Abnormal function of cells that normally remove bacteria and foreign materials from the body (known as “phagocyte dysfunction”)—feline leukemia virus (FeLV) infection and diabetes mellitus
• Complement (a protein substance in the blood that contributes to the destruction and removal of bacteria from the body) deficiency—rare
• Selective immunoglobulin A (IgA) deficiency; immunoglobulin A is an immune protein, found in the intestines; it functions as a protective barrier to prevent limit antigens (substance to which the immune system is responding and producing antibodies) and disease-causing microorganisms from entering the body through the intestines
• Combined T-cell and B-cell dysfunction—rare; a lymphocyte is a type of white-blood cell, formed in lymphatic tissue throughout the body; lymphocytes are further divided into T lymphocytes (which are involved in cell-mediated immunity), so called “T-cells” and B lymphocytes (which produce antibodies as part of the immune process), so called “B-cells”

TREATMENT

HEALTH CARE

• Inpatient—recommended with signs involving multiple body systems (such as lack of appetite [anorexia], high fever, weight loss, and sluggishness [lethargy])
• Maintain normal hydration—important to aid the normal secretion clearance mechanism of the lungs; use a balanced electrolyte solution
• Administration of medication in a fine spray (known as “nebulization”) with saline aerosol—results in more rapid resolution, if used with physiotherapy and antibiotics
• Physiotherapy—mild forced exercise; efforts to dislodge secretions in the lungs and to induce coughing (known as “coupage”); windpipe manipulation to stimulate mild cough; and postural drainage; may enhance clearance of secretions; always do immediately after nebulization; avoid allowing the patient to lie in one position for a prolonged time
• Oxygen therapy—for severe breathing difficulties (known as “respiratory distress”)

ACTIVITY

• Restrict during treatment (inpatient or outpatient), except as part of physiotherapy after administration of medication in a fine spray (nebulization)

DIET

• Ensure normal intake of food, with foods high in protein and calorie or energy density
• Feeding directly into the intestinal tract (known as “enteral feeding”) or through the veins (known as “parenteral nutrition”)—indicated in severely ill patients
• Use caution in feeding animals with an enlarged esophagus (megaesophagus); lack of normal function of the voice box or larynx (known as “laryngeal dysfunction”) or surgery on the voice box or larynx; and disease of the throat or pharynx (known as “pharyngeal disease”)

SURGERY

• Surgical removal of a lung lobe (known as “lung lobectomy”)—may be indicated with lung abscesses or foreign body in the bronchus with secondary pneumonia; may be indicated if patient is unresponsive to conventional treatment and disease is limited to one or two lobes of the lung(s)

MEDICATIONS

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

Antibiotics

• Antibiotics are best selected based on results of bacterial culture and susceptibility testing from transtracheal wash (a technique in which samples from the lower airways are obtained for bacterial culture and/or for evaluation through a microscope) or other diagnostic techniques

• Reasonable initial antibiotic choices pending culture results include amoxicillin–clavulanic acid, cephalexin, chloramphenicol, enrofloxacin, or trimethoprim-sulfonamide
• Gram-positive cocci—ampicillin, ampicillin-sulbactam; amoxicillin; amoxicillin–clavulanic acid; azithromycin; chloramphenicol, erythromycin; gentamicin; trimethoprim-sulfonamide; first-generation cephalosporins
• Gram-negative rods—amikacin; chloramphenicol; gentamicin; trimethoprim-sulfonamide; enrofloxacin; marbofloxacin; carboxypenicillins
• *Bordetella*—tetracyclines; amikacin; chloramphenicol; gentamicin; enrofloxacin; kanamycin; azithromycin
• *Mycoplasma*—doxycycline, enrofloxacin, marbofloxacin, chloramphenicol
• Anaerobes (bacteria that can live and grow in the absence of oxygen)—amoxicillin–clavulanic acid; chloramphenicol; metronidazole; clindamycin; ticarcillin-clavulanic acid
• Continue treatment for at least 10 days beyond clinical resolution; usually 3 weeks or longer

Expectorants

• Recommended by some veterinarians; no objective evidence that they increase movement of mucus or mobilization of secretions

FOLLOW-UP CARE

PATIENT MONITORING

• Complete blood count (CBC) should be performed periodically; CBC should return to normal as the patient responds to treatment
• Arterial blood gases, to monitor levels of oxygen and carbon dioxide in the blood—most sensitive monitor of progress
• Listen to the patient's lungs (auscultate) thoroughly several times daily, while hospitalized
• Chest X-rays—improve more slowly than the clinical signs

PREVENTIONS AND AVOIDANCE

• Vaccination—against upper respiratory viruses; against *Bordetella bronchiseptica*, if dog is boarded or exposed to large number of other dogs
• Catteries—environmental strategies to lower the number of cats or the close proximity in which they are housed (known as "population density") and improve hygiene help control outbreaks of bordetellosis (infection caused by *Bordetella*)

POSSIBLE COMPLICATIONS

• Young dogs infected with *Bordetella bronchiseptica* may develop long-term (chronic) inflammation of the bronchi (bronchitis)

EXPECTED COURSE AND PROGNOSIS

• Prognosis—good with aggressive anti-bacterial and supportive therapy; more guarded in young animals, patients with decreased ability to develop a normal immune response (immunodeficiency), and patients that are debilitated or have severe underlying disease
• Prolonged infection—potential for long-term (chronic) inflammation of the bronchi (bronchitis) or chronic dilation of bronchi or bronchioles, as a consequence of inflammation or blockage of the airway (bronchiectasis) in any patient
• High death rates are associated with severely low levels of oxygen in the blood (known as "hypoxemia") and presence of pus-forming bacteria and their poisons in the blood or tissues (sepsis)

KEY POINTS

• Inflammation in the lung as a response to disease-causing bacteria, characterized by accumulation of inflammatory cells and fluid in the lung, conducting airways (bronchi and bronchioles), and alveoli (the terminal portion of the airways, in which oxygen and carbon dioxide are exchanged)
• More common in dogs than in cats
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