Risk factors, prognostic indicators, and outcome of pyothorax in cats: 80 cases (1986–1999)

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Objective—To identify risk factors associated with development of pyothorax in cats, assess survival rates for cats that are treated, determine prognostic indicators, and determine recurrence rates.

Design—Retrospective study.

Animals—80 cats with pyothorax and 212 control cats.

Procedure—History; month of evaluation; physical examination findings; results of hematologic, serum biochemical, and retrovirus testing; radiographic findings; outcome; recurrence rate; and necropsy findings were recorded. For control cats, age, sex, breed, indoor versus outdoor status, vaccination history, and single- versus multi-cat household status were recorded.

Results—Cats from multi-cat households were 3.8 times as likely (95% confidence interval, 1.9 to 8.2) to develop pyothorax, compared with cats from single-cat households. Indoor or outdoor status was not a risk factor. Cats with pyothorax were significantly younger (mean, 3.83 ± 3.43 years) than controls (mean, 5.62 ± 2.57 years). Nonsurvivors had significantly lower heart rates than survivors. Hyperpalsivation was significantly more common in nonsurvivors (11/39, 26.8%) than survivors (1/39, 3%). Overall, 48.8% (39/80) of cats survived. When cats that were euthanatized without treatment were excluded from analyses, the survival rate was 66.1% (39/59). Pyothorax recurred in 1 of 17 cats for which follow-up information was obtained.

Conclusions and Clinical Relevance—Cats with pyothorax that received treatment had a fair to good prognosis, with low recurrence rates in survivors. Hypersalivation and low heart rate were associated with worse clinical outcome. Cats with pyothorax were likely to come from multi-cat households. (J Am Vet Med Assoc 2002;221:819–824)

Pyothorax is characterized by the accumulation of a septic purulent fluid within the pleural space. In a previous retrospective study on pyothorax in cats, it was suggested that outdoor, sexually intact male domestic shorthair cats were more likely to develop pyothorax, but there were no control groups evaluated to substantiate this conclusion. To our knowledge, risk factor analysis for the development of pyothorax in cats has not been published. Common clinical signs that have been reported include dyspnea, signs of depression, lethargy, pallor, and anorexia. Poor prognosis and frequent recurrence have been reported with pyothorax in cats; however, in 1 study, 12 of 20 (60%) cats survived. Of the 40% that did not, half of the cats were euthanatized and the other half died while hospitalized. Only 1 cat of 12 survivors was known to have recurrence of the disease 7 months later and was euthanatized at that time. An association between feline pyothorax and time of year (fall) was also documented.

The purpose of the study reported here was to evaluate selected risk factors associated with the development of pyothorax in cats, determine whether there was an association between season and occurrence of disease, assess survival rates and outcome predictors for cats that were treated, and determine recurrence rates for survivors. Appropriate treatment was defined as administration of fluids, antimicrobial treatment based on culture and susceptibility results, and thoracic drainage.

Criteria for Selection of Cases

Medical records of all cats in which pyothorax was diagnosed from March 1986 through December 1999 at the Veterinary Hospital of the University of Pennsylvania (VHUP) were evaluated. Cats were included if the diagnosis of pyothorax was made at necropsy or on the basis of thoracocentesis with cytologic evaluation of pleural fluid that revealed suppurrative inflammation with intracellular bacteria.

Procedures

Data extracted from the records of cats with pyothorax included signalment; historical information; month of evaluation; physical examination findings; laboratory data including results of CBC, serum biochemical analysis, and retrovirus status; radiographic findings; treatment; outcome; necropsy findings; and recurrence. Historical information included indoor versus outdoor status, vaccination history, single- versus multi-cat household, history of wounds, initial complaint, and the number of days since the cat was last thought to be clinically normal. Surviving cats were compared with all cats that did not survive (non-survivors). The nonsurvivors were subdivided into 2 groups: cats that died and cats that were euthanatized. The survivors were also compared with cats that died. Long-term follow-up was attempted for the 22 survivors of pyothorax that were evaluated between 1993 and 1999.

Control cats were randomly selected from all cats evaluated through the Emergency Service at the VHUP for conditions other than pyothorax during the study.
period. Two hundred twelve control cats were selected, and age, sex, breed, indoor versus outdoor status, vaccination history, and single- versus multi-cat household status were recorded.

Statistical analyses—All statistical analyses were performed by use of a commercially available statistical software program. For descriptive purposes, continuous variables are expressed as mean ± SD, or median and range, depending on data distribution. Categoric variables are expressed as a percentage of the total, and odds ratios are expressed as point estimates with 95% confidence intervals.

Comparisons between groups with nonparametric continuous or ordinal variables were made by use of the Wilcoxon rank sum test, whereas comparisons between groups with normally distributed continuous variables were made by use of the unpaired Student t test. Proportions between groups for dichotomous variables were compared by use of the Pearson χ² or Fischer exact test, where appropriate. Values of P < 0.05 were considered significant.

Results

Ninety cases of cats with pyothorax were identified in the medical records. Eighty-five cats met the criteria of diagnosis of pyothorax on the basis of results of thoracocentesis and cytologic evaluation of the pleural fluid or postmortem examination findings. Five cats were excluded because the medical records could not be located for evaluation, leaving 80 cats included in the study. Thirty-nine (47.5%) cats with pyothorax survived; of the 41 nonsurvivors, 14 (17.5%) died, and 27 (33.75%) were euthanatized.

In this study, there were 61 (76.2%) domestic shorthair, 7 (8.8%) domestic long hair, and 12 (15%) purebred cats (4 Himalayan, 3 Siamese, 2 Persian, 2 Maine Coon, and 1 Japanese Bobtail). The control population of 212 cats had a similar distribution of breeds, with 187 (88.2%) domestic shorthair, 6 (2.8%) domestic long hair, and 19 (9.0%) purebred cats (6 Persian, 5 Siamese, 2 Russian Blue, and 1 each of 6 other breeds).

There were 49 (61%) males (20 sexually intact) and 31 (39%) females (15 sexually intact) in the pyothorax group, compared with 134 (63%) males (32 sexually intact) and 78 (27%) females (23 sexually intact) in the control group. There was no significant difference in sex distribution between the 2 groups (P = 0.072). The cats with pyothorax were significantly (P = 0.006) younger (n = 78; mean, 3.83 ± 3.43 years) than the controls (n = 208; mean, 5.62 ± 5.27 years). Two cats with pyothorax and 4 control cats were of unknown age.

Cats with pyothorax were 3.8 times (95% confidence interval, 1.9 to 8.2) as likely to come from multi-cat households, compared with control cats (P < 0.001). Cats with pyothorax were 1.6 times (95% confidence interval, 0.9 to 2.8) as likely to have outdoor access, compared with controls, but this was not significant (P = 0.08). Vaccination status was not significantly different between cats with pyothorax and controls; 14 of 77 (18.2%) cats were never vaccinated, compared with 24 of 202 (11.9%) control cats (P = 0.17).

A larger percentage of cats with pyothorax (18.75%) were evaluated through the Emergency Service at the VHUP in August, compared with other months; this was not associated with an increased number of all cats evaluated on an emergency basis in August (Fig 1).

Recent history of a bite or other external wound was documented in only 11 of the 76 cats (14.5%) that had recent medical history recorded. The most common initial clinical signs in cats with pyothorax included decreased appetite or anorexia (67/78 cats [83.3%]), lethargy (62/78 [79.5%]), and dyspnea (60/78 [76.9%]). Less common complaints included hypersalivation (12/78 [17.9%]), weight loss (11/78 [14.1%]), signs of pain (10/78 [12.8%]), and ocular or nasal discharge (7/78 [9%]). The only complaint that was significantly (P = 0.002) different between survivors and nonsurvivors was that nonsurvivors were more likely to have hypersalivation (11/39 [26.8%]), compared with survivors (1/39 [3%]). Two of the nonsurvivors did not have initial clinical signs recorded.

Physical examination findings were recorded in 71 of 80 (89%) cats. Median body weight was 3.2 kg (7 lb; n = 63; range, 0.5 to 8.2 kg [1.1 to 18 lb]). Median rectal temperature was 101.8 F (n = 67; range, 90.7 to 103.4 F). Median respiratory rate was 60 breaths/min (n = 65; range, 28 to 140 breaths/min). Significant differences were not detected between survivors and nonsurvivors for weight, temperature, or respiratory rate.

Survivors had lower respiratory rates (n = 34; mean ± SD, 57 ± 18 breaths/min), compared with cats that died (12; mean ± SD, 72 ± 29 breaths/min), although this was not significantly (P = 0.085) different. Heart rate was recorded in 65 cats, and mean heart rate was 171 ± 41 beats/min. Mean heart rate was significantly (P = 0.008) higher in survivors (n = 36; mean ± SD, 185 ± 37 beats/min) than nonsurvivors (29; mean ± SD, 152 ± 40 beats/min). Similarly, the mean heart rate of survivors was significantly higher than cats that died (n = 11; mean, 151 ± 45 beats/min; P = 0.015). Bradycardia was significantly (P = 0.012) more common in cats that were hypothermic. In cats (n = 50) that were normothermic (rectal temperature ≥ 100 F) on initial evaluation, mean heart rate was higher (178.1 ± 34.5 beats/min). In cats (n = 13) that were hypothermic (rectal temperature < 100 F), mean heart rate was lower (147.1 ± 51.1 beats/min).

Figure 1—Monthly distribution of cats with pyothorax (open bars) compared with all cats evaluated on an emergency basis during the same months (solid bars).
Other physical examination findings included increased respiratory effort in 62 of 66 (93.9%) cats, abnormal lung sounds on auscultation in 59 of 64 (96.5%) cats, abnormal mucous membrane color in 55 of 57 (96.5%) cats, and poor pulse quality in 38 of 56 (67.8%) cats. Additional findings included mental dullness in 44 of 46 (95.6%) cats, dehydration in 47 of 51 (92.2%) cats, and poor body condition in 30 of 45 (66.7%) cats. None of these physical examination findings were significantly different between groups.

Complete serum biochemical analysis was performed in 49 of 80 cats. Abnormalities included hyponatremia (n = 61; mean ± SD, 143.0 ± 6.9 mEq/L; reference range, 148 to 157 mEq/L), hypochloremia (46; mean, 113.1 ± 5.8 mEq/L; reference range, 115 to 128 mEq/L), total hypocalemia (47; mean, 8.5 ± 1.3 mEq/L; reference range, 9.0 to 11.6 mEq/L), hyperbilirubinemia (49; mean, 2.2 ± 0.6 mg/dl; reference range, 2.7 to 3.9 mg/dl), high aspartate aminotransferase activity (13; mean, 72.0 ± 49.9 U/L; reference range, 1 to 37 U/L), and high total bilirubin concentration (40; mean, 0.69 ± 0.68 g/dl; reference range, 0.1 to 0.5 g/dl). Mean cholesterol concentration was within reference range for all cats; however, cholestrol concentration was significantly (P = 0.034) lower in survivors (n = 36; mean, 120 ± 52 mg/dl) than in cats that died (6; mean, 175 ± 70 mg/dl). No other differences in serum biochemical values were detected between groups.

White blood cell counts were performed in 51 of 80 cats and differentials in 49 of 80. Mean WBC count for all cats was 28,323 ± 21,980 cells/µL (reference range, 5,500 to 19,500 cells/µL). Mean neutrophil count for all cats was 20,881 ± 14,845 cells/µL (reference range, 2,500 to 12,500 cells/µL). Mean number of band neutrophils was 2,470 ± 3,427 cells/µL (reference range, 0 cells/µL). The WBC count was significantly (P = 0.024) higher in survivors (n = 37; mean, 31,610 ± 23,111 cells/µL; range, 4,400 to 97,000 cells/µL) compared with cats that died (7; mean, 12,793 ± 6,204 cells/µL; range, 550 to 19,300 cells/µL). Similarly, cats that died (n = 6) had lower neutrophil counts (mean, 10,716 ± 3,902 cells/µL; range, 550 to 15,440 cells/µL), compared with survivors (37; mean, 22,185 ± 15,678 cells/µL; range, 2,379 to 66,000 cells/µL), but this difference was not significant (P = 0.058). No other differences were detected between groups.

Sepsis or systemic inflammatory response syndrome (SIRS) was diagnosed in our cats on the basis of their having at least 3 of the following 4 criteria: rectal temperature > 103.5°F or < 100.0°F; heart rate > 225 beats/min or < 140 beats/min; respiratory rate > 40 breaths/min; and WBC count > 19,500/µL or < 5,000/µL or band neutrophil fraction > 5%. Thirty-two of the 80 cats with pyothorax fit the criteria for sepsis or SIRS, 29 of 80 did not, and 19 of 80 did not have enough information recorded in the medical record to make that determination.

Two of 46 cats had positive results for FeLV and 1 of 35 cats had positive results for FIV. Both cats that had positive FeLV results were euthanatized, and the cat that had positive FIV results survived. Of the FeLV-positive cats, 1 was treated despite having positive results, but it was difficult to determine from the record whether the other cat was euthanatized because of its retrovirus status (it was euthanatized the same day as the test results were received), its clinical condition, or financial concerns.

Thoracic radiography was performed on 63 cats. Fifty-six (88.9%) cats had bilateral pleural effusion, and 7 (11.1%) had unilateral effusion. Eight cats underwent thoracic ultrasonography. All cats had an echogenic pleural effusion, a tentative diagnosis of consolidated or collapsed lung lobes was made in 6 cats, and lung lobe abscess was tentatively diagnosed in 2 cats.

Bacteriologic culture results were available in 54 cats. Aerobic cultures only were submitted from 12 cats, while both aerobic and anaerobic cultures of the pleural effusion were submitted from the remaining 42 cats. Effusions from 2 cats yielded no growth of bacteria; however, these 2 cats had received antimicrobial treatment prior to culture. Of the remaining 52 cats, the most common bacteria cultured were Pasteurella spp (n = 21), Clostridium spp (20), Fusobacterium spp (9), Bacteroides spp (8), and Actinomyces spp (8). Thirty-three of the cats had multiple bacterial species cultured from the pleural effusion.

Injectable antimicrobials were administered during hospitalization to 53 of 80 cats. Most cats received multiple antimicrobials to provide broad-spectrum coverage while awaiting culture and susceptibility results on the pleural effusion. The most common antimicrobials prescribed were ampicillin (n = 44 [83.0%]), gentamicin (33 [62.3%]), metronidazole (22 [41.5%]), cephalosporins (12 [22.6%]); 9 cats received cefoxitin, 2 cats received cephalothin, and 1 cat received ceftazolin, enrofloxacin (10 [18.9%]), and clindamycin (9 [16.9%]).

Forty-eight cats had thoracostomy tubes placed to facilitate pleural drainage; 28 (48.3%) had bilateral tubes, and 20 (34.5%) had unilateral tubes. Thirty-five cats with thoracostomy tubes survived, 8 died, and the remaining 5 cats were euthanatized. Thoracostomy tubes were placed significantly (P = 0.007) more often in cats that survived (36/39 [92.3%]) than cats that died (ie, were not euthanatized; 8/14 [57.1%]). Thoracocentesis was the only method of drainage in the remaining 3 of 39 (7.7%) survivors. The pleural space in some cats was lavaged with sterile saline (0.9% NaCl) solution or other isotonic fluids with thoracostomy tubes, but the use of this treatment was not always readily determined from the medical records. For cats treated via thoracostomy, tubes were maintained a median of 5 days (range, 0.5 to 16 days). Thoracostomy tubes were maintained significantly (P = 0.001) longer in survivors (median, 5 days; range, 3 to 16 days), compared with nonsurvivors (median, 2 days; range, 0.5 to 8 days).

Thoracotomy was performed in 5 cats when it was determined that medical management was failing. This was determined by radiographic evidence of pleural effusion that was not removable despite appropriate thoracic tube placement or was not resolving after many days of medical management (3/5 cats) or when
lung lobe abscesses were tentatively diagnosed via thoracic ultrasonography (2/5). All 5 cats that underwent thoracotomy survived.

Duration of hospitalization ranged from < 24 hours to 20 days. The survival rate for cats still alive 24 hours after admission was 77.6% (6 died, 5 were euthanatized, 38 survived). Of 31 nonsurvivors hospitalized < 24 hours, 21 were euthanatized without treatment, 1 was euthanatized after attempted treatment, and 9 died. Duration of hospitalization was significantly \( P = 0.003 \) longer for cats that underwent thoracotomy (13 ± 5.8 days) than for other surviving cats (4.9 ± 3.3 days).

Twenty-one of the 27 (77.8%) cats that were euthanatized received no treatment. Thirty-nine of the 59 (66.1%) cats that received treatment survived. Survival rate for the surgery group (5/5) was significantly \( P = 0.024 \) higher, compared with the nonsurgery group (34/54; 62.9%).

Of 44 cats diagnosed with pyothorax between 1993 and 1999, follow-up was attempted for the 22 survivors. Follow-up ranged from 4 months to 6 years after discharge. Sixteen (73%) cats had no recurrences, 1 (4.5%) had recurrence that was successfully treated with thoracotomy, and 5 (22.7%) were lost to follow-up.

Postmortem examinations were performed on 25 cats. An antemortem diagnosis of pyothorax had not been made in 7 of these cats. Pleuritis, pleuropneumonia, or pneumonia, as well as pyothorax, was diagnosed in 15 cats, but the underlying causes of the septic processes were not identified. Four cats had lung lobe abscesses, 4 cats had puncture wounds into the thoracic cavity, 1 cat had intrabronchial plant material and secondary bronchial rupture, and 1 cat had a foreign body granuloma that was secondary to aberrant migration of a Cuterebra larva.

**Discussion**

There is a paucity of reports regarding pyothorax in cats in the veterinary literature, and none have been able to correlate historical, clinical, or laboratory data with prognosis or survival; however, 1 report\(^1\) suggested that outdoor, sexually intact male cats are at higher risk for pyothorax. Results of the risk factor analysis in our study indicated that cats with access to the outdoors and sexually intact male cats had higher risk of pyothorax, compared with controls, but these findings were not significant. Cats with pyothorax were significantly younger than the control population in our study, and it has been reported that young cats are more likely to develop pyothorax.\(^1\) Cats with pyothorax were also found to more likely come from multi-cat households, compared with controls in this study. To our knowledge, this factor has not been previously evaluated. This may be attributable to inter-cat aggression within households, resulting in small bite wounds that go unnoticed by the owners. These wounds may either directly cause small punctures into the thorax or result in abscesses that rupture inward into the thoracic cavity, leading to bacterial contamination and ultimately pyothorax.

A greater number of cases were seen in August, compared with other months of the year. A previous study\(^2\) documented an association between pyothorax and the fall season. Possible explanations for this seasonal variation include increased exposure to the outdoors and, therefore, other cats. However, there was no significant difference between indoor-only cats and cats that had exposure to the outdoors. Because we found that cats from multi-cat households were more likely to develop pyothorax, perhaps the indoor cats were fighting more often during the summer months, in response to outdoor cats that were visible or audible to the cats inside, female cats coming into heat, or other unknown stimuli. The late summer peak in our cases may have been the result of increased fighting throughout the summer, with healing of the wounds and development of pyothorax days to weeks later. This may be the reason so many of the cats did not have obvious bite wounds or other cause for the pyothorax at the time of evaluation. The pleural effusion may have become severe enough to cause respiratory distress for the owners to detect a problem and have the cats examined.

Hypersalivation was a common physical examination finding in nonsurviving cats. The mechanism of this is unknown. Hypersalivation may be a marker of severity and reflect increased pain, nausea, or secondary hepatic dysfunction. Hypersalivation is associated with signs of pain, particularly of the oropharyngeal region, and difficulty swallowing. A large volume of pleural effusion may make swallowing difficult for cats with pyothorax. Nausea often causes increased salivation as a precursor to vomiting. The cats in our study may have had nausea because of pain, uremia, or hepatic dysfunction. Evaluation of this finding in other causes of severe infection or sepsis in cats may help determine the importance and specificity of this sign. No other clinical sign was found to be significantly different between survivors and nonsurvivors, except heart rate.

Heart rate was significantly lower in nonsurvivors. The finding of bradycardia in cats with sepsis has been reported,\(^3\) although the mechanism causing the bradycardia remains unclear. Bradycardia was associated with hypothermia, but hypothermia was not seen in all cats that were bradycardic. The combination of hypothermia and bradycardia seems to indicate severe illness in cats. Survivors had a lower respiratory rate than cats that died, although the difference was not significant. Nonsurvivors may have had more severe disease, resulting in more pleural effusion or pulmonary parenchymal disease, causing tachypnea.

Serum biochemical abnormalities included hyperammonia, hypercholesterolemia, hypoalbuminemia, and increased total bilirubin concentration and aminotransferase activity. Hyperammonia and hypercholesterolemia may be explained by hypovolemia secondary to decreased sodium and chloride intake (anorexia) and loss of fluid into the thoracic cavity. Hypovolemia causes activation of antidiuretic hormone and aldosterone, resulting in water and sodium retention by the kidneys. The decrease in albumin is
likely a result of increased vascular permeability, loss of protein into the pleural effusion, and decreased synthesis from the liver, as well as dilutional effects from antidiuretic hormone activation. Hypoalbuminemia has been reported in cats with sepsis. Increases in total bilirubin concentration and alanine transaminase activity were also found in the cats in that study, but there was no increase in aspartate aminotransferase activity. Sepsis-induced cholestasis has been described in dogs but not in cats. Because alkaline phosphatase and γ-glutamyltranspeptidase activities were not increased, cholestasis seems an unlikely cause of the increased aspartate aminotransferase and bilirubin. Alanine transaminase activity is commonly increased by hepatocellular or myocyte damage. Some possible mechanisms of hepatocellular damage in our cats with pyothorax included hypoxia-induced damage secondary to poor perfusion from hypovolemia and sepsis, inflammation from concurrent processes such as pancreatitis, and infection within the liver caused by hepatic abscesses. Hepatocellular damage often causes a concurrent increase in alanine transaminase activity, which was not seen in our cats. None of the serum biochemical abnormalities were significantly different between survivors and nonsurvivors, even when survivors were compared with cats that died. Cholesterol was significantly lower in surviving cats than in cats that died, although the mean cholesterol values for both groups were within reference range. The etiopathogenesis for this difference is unknown.

Leukocytosis with neutrophilia and left shift was the most consistent CBC finding. We speculate that the lower WBC and neutrophil counts in cats that died were probably secondary to the severe sepsis and sequestration of neutrophils in the pleural space of cats with more severe disease. Surviving cats had WBC counts up to 97,000 cells/µl. Cats that died had significantly lower WBC counts, up to 19,300 cells/µl. This is in contrast to results of a recent study in which it was reported that extreme neutrophilic leukocytosis (50,000 cells/µl or more) in cats was associated with high mortality rate. The population of cats in that study included 7 with pyothorax.

Guidelines for the clinical diagnosis of sepsis or SIRS in cats have recently been reported. The diagnosis of sepsis or SIRS requires that cats have at least 3 of the following 4 criteria: rectal temperature > 39.7 C (103.5 F) or < 37.8 C (100.0 F), heart rate > 225 beats/min or < 140 beats/min, respiratory rate > 40 breaths/min, and WBC count > 19,500 cells/µl or < 5,000 cells/µl or band neutrophil fraction > 5%. Thirty-two of our 80 cats had these criteria at the time of examination, 29 did not, whereby another 19 did not have sufficient information in the record to make this determination. Pyothorax is likely to progress to sepsis and SIRS in cats if they do not receive appropriate veterinary care.

A recent study revealed that the most common bacterial isolates from cats with pyothorax were the anaerobes Peptostreptococcus spp, Bacteroides spp, Fusobacterium spp, and Prevotella spp, and the aerobes Pasteurella spp and Actinomyces spp. These findings were similar to those in a previous report. The culture results that were obtained from cats in our study were similar. The most likely sources of the bacteria that cause pyothorax are the oral cavity of other cats transmitted by bite wounds to the thorax or environmental contamination from penetrating thoracic injuries. Other possibilities include rupture or perforation of the esophagus, trachea, or bronchi; migrating foreign bodies (grass awns) or lung parasites; bacterial pneumonia leading to lung abscesses and rupture; or iatrogenic from thoracocentesis or thoracotomy. Only 11 cats in our study had a recent history of bites or other wounds. Although positive results of bacterial cultures are almost always obtained from pleural effusion, the inciting cause of pyothorax is not identified in most cases. The study that reported the highest rate of success in determining the inciting cause of pyothorax identified the cause in 7 of 15 of cases. In our study, the inciting causes of pyothorax were identified in 10 of 25 cats that had postmortem examinations and were consistent with reported causes. The cause of pyothorax was not identified in any of the 5 cats that underwent thoracotomy.

Most cats had bilateral pleural effusion evident radiographically, which is similar to another report. Seven cats that had unilateral disease that may have been secondary to a more localized process or the ability to wall off a particular area of the pleural space. Cats have been reported to have a complete mediastinum, but because of the frequency of bilateral thoracic effusions, it seems unlikely that the mediastinum is intact in most cats.

In most cases, broad-spectrum antimicrobials for gram-positive, gram-negative, and anaerobic bacteria were prescribed until culture and susceptibility results were available. On the basis of our culture results (in which it was found that most cats were infected with a mixed population of bacteria and that both aerobes and anaerobes were common), this broad-spectrum approach is appropriate.

Placement of thoracostomy tubes was the preferred method of drainage of the pleural effusion. Thoracostomy tubes allow for more complete drainage of the thoracic cavity and are usually less stressful for cats than restraint for multiple thoracocenteses. Lavage of the thoracic cavity was performed in some cats, but the percentage was difficult to determine from the medical records. Many cats that were treated with lavage only had this procedure performed at the time of placement of the thoracostomy tubes and did not have ongoing lavage treatments as has been sometimes advocated. Warm physiologic saline or other balanced electrolyte solutions were used, with at least 1 cat receiving gentamicin in the lavage solution; chymotrypsin, streptokinase, and heparin were not added to the lavage solutions as has been recommended in various reports. At this time, we do not recommend or perform lavage unless the pleural effusion is too thick to aspirate through the thoracic tube. This is because of the risks of placing a large volume of fluid into the thorax without the ability to retrieve it and potential introduction of a nosocomial infection resistant to the antimicrobials that the cat is already receiving. Pleural lavage was more commonly used in the earlier part of the study period.
Thoracotomy was performed in 5 cats after it was judged that medical management was failing. This is consistent with current recommendations in the literature, although at one time, thoracotomy had been recommended as the preferred treatment for all cats with pyothorax. Failure of medical management was determined by inability to aspirate effusion through properly placed thoracostomy tubes or lung lobe abscesses suspected on thoracic ultrasound. Advantages of thoracotomy include full surgical exploration of the thoracic cavity and removal of all exudate from the pleural space with lavage. Disadvantages include increased cost and length of stay in the hospital, pain associated with thoracotomy, and the risk of general anesthesia in septic cats. All 5 of the cats that had surgery survived. The underlying etiopathogenesis was not identified in any of the cats that underwent surgery, and no abscesses were found in the 2 cats that were suspected to have lung abscesses on the basis of thoracic ultrasound.

The cats in this study had a fair to good survival rate (39/59; 66.1%) if they were not euthanized within the first 24 hours of examination. The cats in the most critical condition may have been euthanized on admission to the hospital, resulting in the higher than expected survival rate in the remaining cats. The reason for euthanasia was not available in the record but may have been related to financial constraints as well as prognostic recommendations.

Cats that received surgical intervention had a high survival rate. This may be attributable to these cats having a better ability to wall off the septic process, which made drainage of the effusion difficult. Another possibility is that these cats were well stabilized with volume resuscitation and appropriate antimicrobial treatment prior to general anesthesia. These cats were hospitalized a mean of 6.6 days before surgery (range, 1 to 13 days) and treated with fluids, antimicrobials, and transfusions, if needed. Although persistence of septic foci may be expected to be correlated with worse outcome, cats in this study that underwent surgery had a better prognosis. This may have been attributable to the establishment of a route of drainage of the pleural space with thoracostomy tubes.

Follow-up was attempted for 22 of the surviving cats and was successful in 17 cats. Follow-up periods ranged from 4 months to 6 years. Of those 17 cats, 1 cat had recurrence of pyothorax 11 months later and was successfully treated via thoracotomy with no subsequent recurrences. Overall, the recurrence rate was low (5.9%). However, a potential for bias exists because of the large number of cats for which we had no follow-up information. If all the cats that were lost to follow-up had recurrence, the recurrence rate would increase to 27.2%. If none of these cats had recurrence of pyothorax, the rate would only be 4.5%.

In our study, cats from multi-cat households were identified to be at increased risk for development of pyothorax. Younger cats also seemed to be at increased risk. When evaluating clinical signs and physical examination findings, cats with lower heart rates and cats that were hypersalivating on initial examination had lower survival rates. Cats with bradycardia should be recognized as critically ill patients and should be aggressively resuscitated. It is our impression that pyothorax is a treatable disease process with a fair to good prognosis if it is recognized and treated before severe sepsis and septic shock develop.

References