Major abdominal evisceration injuries in dogs and cats: 12 cases (1998–2008)

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Objective—To describe the clinical characteristics, treatment, complications, and outcome of dogs and cats treated surgically for major abdominal evisceration.

Design—Retrospective case series.

Animals—8 dogs and 4 cats.

Procedures—Medical records from January 1998 through March 2008 were reviewed to identify animals that underwent surgery for major abdominal evisceration. Data regarding cause of evisceration, signalment, physiologic variables, and hematologic variables were collected. Details of treatment, duration of hospitalization, and outcome were recorded. Linear regression analysis was performed to evaluate the association of signalment, physiologic variables, and hematologic variables on the number of days of hospitalization.

Results—Major abdominal evisceration was secondary to a traumatic event in 4 animals and to postsurgical dehiscence in 8 animals. All animals had evisceration of the intestines and gross contamination with dirt, leaves, or litter. Two animals eviscerated the spleen, and 1 animal had a perforated colon and was leaking feces into the peritoneal cavity. All animals underwent exploratory abdominal surgery. Surgical procedures performed included resection of compromised intestine, body wall repair, diaphragmatic hernia repair, nephrectomy, splenectomy, and primary colonic repair. All animals survived to discharge from the hospital. Median duration of hospitalization was 4 days (range, 1 to 7 days). Factors associated with an increase in duration of hospitalization included evisceration secondary to trauma, high lactate concentration at time of admission, and small body size.

Conclusions and Clinical Relevance—Despite the dramatic appearance of major abdominal evisceration in cats and dogs, prompt and aggressive medical and surgical intervention can provide a favorable outcome. (*J Am Vet Med Assoc* 2009;234:1566–1572)

Abdominal evisceration is defined as herniation of the contents of the peritoneal cavity through the body wall with exposure of the abdominal viscera.[1] Although there is a paucity of studies in the veterinary literature, evisceration in humans has been reported secondary to trauma and as a spontaneous event in patients with compromised integrity of the abdominal wall (eg, umbilical hernia). However, most cases of evisceration in humans result as postoperative complications following laparotomy, with mortality rates ranging from 18% to 36%.[1–9] To the authors' knowledge, the outcome for dogs and cats treated for major abdominal evisceration has not been reported.

Regardless of the inciting cause, exposure and contamination of the abdominal viscera warrants immediate surgical intervention.[10] Principles of preoperative treatment include hemodynamic stabilization, antimicrobial treatment, extension of the abdominal rent to prevent vascular compromise of eviscerated organs, and application of a sterile dressing until surgical intervention. Surgical principles include assessment of organ viability; cleansing, repair, and reduction of eviscerated organs; exploration of other intra-abdominal organs; lavaging of the peritoneal cavity with copious amounts of fluids; and debridement of wound edges prior to closure when they appear nonviable or infected. Because animals with abdominal evisceration need surgical treatment, it requires an owner to make a relatively large emotional and financial commitment for treatment. In addition, it can be difficult for practitioners to assist owners in the decision-making process because there is little information in the veterinary literature regarding the clinical course or outcome of dogs and cats undergoing surgical treatment for abdominal evisceration. The objective of the study reported here was to describe the clinical characteristics, treatment, complications, and outcomes in small animals treated surgically for major abdominal evisceration and to identify risk factors that affected survival and duration of hospitalization.

Materials and Methods

Case selection—The medical record database at the Matthew J. Ryan Veterinary Hospital of the University of Pennsylvania was searched for dogs and cats evaluated for a major abdominal evisceration injury from January 1998 through March 2008. Major abdominal evisceration was defined as herniation of most of the abdominal contents through the body wall. Minor abdominal evisceration was defined as herniation of only the omentum or herniation of the abdominal viscera without gross contamination. Records were included when they were complete and animals were

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treated surgically for an evisceration event. Records of animals treated for minor abdominal eviscerations were excluded. Telephone interviews were conducted to evaluate short-term (< 12 months) and long-term (≥ 12 months) complications and survival after discharge from the veterinary hospital.

Medical records review—For each animal, signalment data were recorded, including species, age, sex, body weight, and breed. Physiologic variables determined at the time of admission, including rectal temperature, pulse rate, respiratory rate, and systolic blood pressure, were recorded. Hematologic variables determined at the time of admission, including PCV and concentrations of total solids, glucose, and lactate, were also recorded. Cause of evisceration was categorized as trauma or postsurgical dehiscence. For animals with postsurgical dehiscence, the number of days from the original surgery to admission because of the evisceration was recorded. Duration of evisceration prior to admission, treatment performed prior to admission by referring veterinarians, corrective procedures performed on an emergency basis prior to surgical intervention, and interval from admission to surgery were recorded. The need for intestinal resection and use of open abdominal drainage were also recorded. Number of days of hospitalization was recorded from the day of admission to the emergency service to the day of discharge from the hospital.

Statistical analysis—Descriptive statistics were calculated. Continuous data were expressed as median values and ranges; categoric data were expressed as frequencies. Linear regression analysis was performed to evaluate the association of signalment, physiologic variables, and hematologic variables on the number of days of hospitalization. Two-way interactions among the main effects were investigated. Univariate analysis was performed for each variable (species, age, body weight, trauma vs dehiscence, rectal temperature at admission, heart rate, systolic blood pressure, PCV, concentration of total solids, blood glucose concentration, blood lactate concentration, and intestinal resection and anastomosis), and variables with a value of $P < 0.2$ were considered for the final model. Variables that were not effect modifiers were retained in the final model when the value for that variable was $P \leq 0.05$. Model assumptions of normality and linearity were investigated by use of histograms and scatterplots. The constant variance of residuals was examined by use of the Cook-Weisberg test for heteroscedasticity. Fit of the overall model was evaluated via the F statistic and the proportion of variance of the original data explained by the model, adjusting for the degrees of freedom (adjusted R^2). All analyses, including plotting of graphs to evaluate model assumptions, were performed by use of standard software.[a]

Results

Medical records of 8 dogs and 4 cats were identified. Breeds of dogs included mixed-breed dog (n = 3 dogs), American Staffordshire Terrier (2), Boxer (1), Miniature Poodle (1), and Great Dane (1). Dogs comprised 5 spayed females, 2 castrated males, and 1 sexually intact male. Median age was 1.75 years (range, 0.2 to 9 years). Median body weight was 17 kg (37.4 lb), with a range of 5 to 61 kg (11.0 to 134.2 lb). Breeds of cats included domestic shorthair (n = 3 cats) and Persian (1). All cats were spayed females. Median age was 1.25 years (range, 1 to 2 years), and median body weight was 3 kg (6.6 lb), with a range of 2 to 3 kg (4.4 to 6.6 lb). Median rectal temperature in dogs at admission was 37.9°C (100.2°F), with a range of 35.9° to 41.2°C (96.6° to 106.2°F); median rectal temperature in cats at admission was 35.3°C (95.5°F), with a range of 33.8° to 38.9°C (92.8° to 102.0°F). Median heart rate at admission was 158 beats/min (range, 104 to 206 beats/min) for dogs and 180 beats/min (range, 108 to 220 beats/min) for cats. Median systolic blood pressure at admission was 103 mm Hg (range, 75 to 140 mm Hg) for dogs and 123 mm Hg (range, 58 to 140 mm Hg) for cats. Median PCV was 48% (range, 34% to 57%) for dogs and 49% (22% to 50%) for cats, and median total solids concentration was 5 g/dL (range, 4 to 7 g/dL) for dogs and 7 g/dL (6 to 8 g/dL) for cats. Median blood glucose concentration was 130 mg/dL (range, 97 to 207 mg/dL) for dogs and 202 mg/dL (range, 176 to 485 mg/dL) for cats. Median venous blood lactate concentration was 2.3 mmol/L (range, 1.6 to 8.9 mmol/L) for dogs and 2.8 mmol/L (2.6 to 3.9 mmol/L) for cats.

Cause of evisceration was characterized as postsurgical dehiscence in 4 dogs and trauma in 4 dogs; cause was characterized as postsurgical dehiscence in all 4 cats. In all animals with postsurgical dehiscence, the original surgical procedure performed was ovariohysterectomy, and the median interval between surgery and dehiscence was 4 days (range, 1 to 6 days). In the animals with trauma as the cause of evisceration, 2 were hit by a car, 1 had bite wounds, and 1 had a glass shard penetrate its abdomen. All animals had evisceration of the intestines and gross contamination with dirt, leaves, or litter. Two animals had evisceration of the spleen, and 1 animal had a perforated colon and was leaking feces into the peritoneal cavity.

Information regarding interval from the evisceration event to admission was available for all 12 animals. Specific information was available for 6 animals (including all of the traumatic evisceration events), and general information was available for the other 6 animals. Median interval from evisceration to admission for animals with traumatic evisceration was 32.5 minutes (range, 5 to 120 minutes). One animal with postsurgical dehiscence was considered to be clinically normal 5 minutes before the owner recognized the evisceration event, and it was admitted within 20 minutes after the evisceration event. A second animal was considered to be clinically normal 20 minutes before the owner recognized the evisceration event, and it was admitted within 1 hour after the evisceration event. Two animals were considered to be clinically normal 4 hours before admission, and 4 animals were considered clinically normal the evening before admission; the exact interval between the evisceration event and admission was not known for those 6 animals.

Prior to admission, 3 of 12 animals were treated or examined by a referring veterinarian. For 1 animal

with abdominal bite wounds, hair over the wounds was clipped, the area was cleaned, and a bandage was placed. The second animal was administered a tranquilizer. The third animal was briefly examined while in the owner's car but was not treated and was immediately referred to our veterinary hospital.

Emergency treatments of the animals with major abdominal evisceration were recorded for 8 of 12 animals. At admission, 5 of 8 were sedated, and the other 3 were anesthetized. For all 8 animals, the exposed viscera were thoroughly lavaged and replaced into the abdomen, and a sterile bandage was placed. In 1 animal, the wound was extended to allow replacement of the abdominal viscera. In another animal, partial omentectomy of severely contaminated omentum was performed by the emergency service, and in a third animal, 2 full-thickness jejunal lacerations were closed by use of skin staples prior to replacement of the intestines into the peritoneal cavity. The body wall of 3 of 8 animals was temporarily closed with suture or skin staples, whereas in the other 5 animals, moistened laparotomy sponges were placed over the exposed viscera, followed by a sterile bandage. Median interval from admission to surgery was 108.5 minutes (range, 30 to 291 minutes).

Surgical exploration of the abdomen, replacement of abdominal viscera into the peritoneal cavity, and repair of the body wall were performed in all 12 animals. Each of the 4 animals characterized as having major abdominal evisceration attributable to trauma required body wall repair. One of these animals underwent a splenectomy and had a rupture of the prepubic tendon, which was reconstructed by use of polypropylene mesh. Of the 3 remaining animals, 1 was treated by jejunal resection and anastomosis and had a primary repair of a perforated colon, 1 had a diaphragmatic hernia that was repaired, and 1 underwent nephrectomy and jejunal resection and anastomosis. Conversely, of the 8 animals with evisceration attributable to postsurgical dehiscence, only 2 required intestinal resection and anastomosis.

Four of 12 animals had resection of compromised intestines. Information regarding the amount of intestines resected was available for 3 animals and included 100% of the jejunum in 1 cat, 60% of the jejunum in 1 cat, and 20% of the jejunum in 1 dog. Intestinal resection was performed because of devitalization of the intestines secondary to damage of vessels in the mesentery in 2 animals, multiple full-thickness jejunal lacerations in 1 animal, and multiple puncture wounds and devitalization of the intestines in 1 animal. Three animals were treated by use of closed suction drainage, and 1 was treated by use of open abdominal drainage. Six animals were administered blood products, with 2 administered fresh-frozen plasma, human albumin, and packed RBCs; 2 administered fresh-frozen plasma only; 1 administered fresh-frozen plasma and packed RBCs; and 1 administered packed RBCs only.

All animals survived to discharge from the hospital. Median duration of hospitalization was 4 days (range, 1 to 7 days).

Univariate analysis revealed that 4 variables (age, body weight, lactate concentration at time of admission, and cause of evisceration) were associated ($P < 0.20$) with duration of hospitalization. Results of the final multivariable model were summarized (**Table 1**). Controlling for body weight and the lactate concentration at time of admission, animals with evisceration attributable to postsurgical dehiscence had a duration of hospitalization that was 2 days less, compared with the duration of hospitalization for animals with evisceration attributable to trauma. Controlling for the cause of evisceration and the lactate concentration at time of admission, each 10-kg (22-lb) increase in body weight was associated with a 1-day decrease in the duration of hospitalization. Controlling for the cause of evisceration and body weight, each 3 mmol/L increase in lactate was associated with a 1-day increase in the duration of hospitalization. For an animal with a body weight of 7 kg (15.4 lb) and lactate concentration at time of admission of 2.5 mmol/L, the expected duration of hospitalization for evisceration attributable to trauma was 5 days, whereas the expected duration of hospitalization for evisceration attributable to postsurgical dehiscence was 3 days. The overall fit of the model revealed a value for the F statistic of 31.26. The adjusted R^2 was 0.93. Because all of the animals survived to discharge, we did not perform an analysis of risk factors for fatalities.

Bacterial culture and antimicrobial susceptibility testing results were available for 9 of 12 animals, and 6 of the 9 had positive culture results. All 9 animals had aerobic and anaerobic cultures performed on samples acquired from the abdominal cavity at the time of surgery. Three animals yielded 1 bacterial species, including *Staphylococcus intermedius*, group D *Streptococcus* sp, and *Clostridium* sp. Three animals yielded multiple bacterial species, including 1 cat with *Enterobacter cloacae*, *Klebsiella pneumoniae*, and *Clostridium perfringens*; 1 dog with *E cloacae* and *Clostridium* sp; and 1 cat with *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*. All of the animals in the study were treated by IV administration of antimicrobials in the hospital and were continued on a course of orally administered antimicrobials at home. The most common intraoperative and perioperative antimicrobial combination was ampicillin and enrofloxacin (8/12 animals) with 3 of those 8 animals also receiving metronidazole. Three animals were treated with cefoxitin alone, and 1 was treated with ampicillin alone. Orally administered antimicrobials included amoxicillin and clavulanic acid only in 6 animals; amoxicillin, clavulanic acid, and enrofloxacin in 3 animals; amoxicillin, clavulanic acid, enrofloxacin, and metronidazole in 1 dog; and enrofloxacin only in 1 dog.

Two dogs were lost to follow-up monitoring. Both of these dogs were from local animal shelters and had

Table 1—Factors affecting the duration of hospitalization in 12 animals (8 dogs and 4 cats) with major abdominal evisceration.

Variable	Coefficient	*t*	*P* value*	95% CI
Postsurgical dehiscence†	–1.88	–4.18	0.014	–3.12 to –0.63
Body weight (kg)	–0.09	–4.70	0.009	–0.15 to –0.04
Lactate (mmol/L)	0.29	3.27	0.031	0.04 to 0.54

*Values were considered significant at $P \leq 0.05$. †Referent category is trauma.
95% CI = 95% confidence interval.

eviscerated after ovariohysterectomy. Both dogs underwent abdominal exploratory surgery and repair of the body wall. Ten animals were returned to our veterinary medical teaching hospital 2 weeks after surgery for suture removal. At suture removal, 7 animals were clinically normal, 1 cat (which had undergone resection of the entire jejunum) had persistent diarrhea and weight loss, and 2 dogs (which had undergone jejunal resection and anastomosis) had intermittent diarrhea. Follow-up information obtained by telephone interviews was available for 6 of 10 animals. Owners were questioned regarding immediate postoperative medical complications, short- and long-term medical complications, and outcome. Additionally, follow-up information was available in the medical records of 2 animals that had subsequent visits to our veterinary medical teaching hospital.

Short-term (< 12 months) follow-up information was available for 4 animals (3 cats and 1 dog). The cat had diarrhea at the time of suture removal and continued to have diarrhea 1 month after surgery; the cat was then lost to additional follow-up monitoring. One dog had no ongoing complications 3 months after intestinal resection and anastomosis, nephrectomy, and repair of the body wall. The remaining 2 cats were clinically normal.

Long-term (> 12 months; range, 14 to 84 months) follow-up information was available for 6 animals. One dog died of unrelated causes 4 years after surgery, and 5 animals were still alive and were clinically normal. Two dogs that underwent intestinal resection and anastomosis had intermittent diarrhea for 3 to 4 months after surgery, but they eventually had full resolution of the problem.

Discussion

Small animals with abdominal evisceration reportedly have a poor prognosis[11]; however, to our knowledge, no studies have been conducted to evaluate small animal patients with evisceration injuries. All of the dogs and cats in the retrospective case series reported here survived to discharge from the veterinary hospital, which suggested that the prognosis for animals with evisceration injuries may not be poor when there is immediate surgical intervention and appropriate perioperative management.

In humans, the incidence of acute, postoperative fascial dehiscence is reportedly low, but it has important prognostic implications because the mortality rate is high (18% to 36%).[1] The mean interval from surgery to fascial dehiscence and evisceration in humans is approximately 7 days, with serosanguineous discharge from the incision site detected in most patients prior to dehiscence.[4,12,13] The most common cause of fascial dehiscence in humans is technical failure as a result of suture tearing through the fascial layer. Risk factors for development of fascial dehiscence in humans include age (neonates and elderly), primary surgery (colorectal surgery vs other abdominal surgeries), type of incision (median vs transverse), low serum albumin concentration, hemodynamic instability, sepsis, obesity, uremia, malignancy, corticosteroid treatment, hypertension, and emergency surgery (vs elective surgery).[4,6,13–15] Additionally, postoperative risk factors include wound hematoma, wound infection, postoperative ileus, and an increase in intra-abdominal pressure (as a result of coughing, vomiting, and severe ascites).[7,13,15,16]

Few large studies of traumatic evisceration injuries have been conducted; however, investigators conducted a retrospective study[17] of a human population that had evisceration secondary to penetrating abdominal injuries and compared survival rates among groups with evisceration injuries of differing severity. In that study,[17] 12 of 104 (11.5%) patients had massive disembowelment (ie, evisceration of multiple loops of intestines). Only 1 of these 12 patients died, and the cause of death was exsanguination secondary to concurrent injuries, rather than factors related to the evisceration injury. Overall mortality rates did not differ among those with various severities of abdominal evisceration, massive disembowelment, and a control group with omental evisceration only. Analysis of these results suggests that traumatic evisceration injuries may represent a subset of the population of evisceration injuries with a clinical outcome that differs from that for patients with postsurgical dehiscence.

Small intestinal evisceration can be a postcastration complication in horses, with mortality rates ranging from 13% to 28%.[18–20] Clinical features negatively influencing survival include an increased length of bowel eviscerated, treatment by resection and anastomosis, and use of an inguinal approach for surgical correction.[20] One dog with partial evisceration was reported in a retrospective study[21] of traumatic body wall herniation, and that dog survived until discharge. In a study[22] of short-bowel syndrome in dogs, postoperative evisceration was reported in a dog after ovariohysterectomy. Despite treatment via resection of the entire jejunum and a portion of the ileum, that dog was alive 27 months after surgery and was able to maintain its body weight; the dog reportedly had 2 or 3 bowel movements/d with intermittent loose feces. Finally, evisceration was reported in 2 animals in a retrospective study[23] of pneumoperitoneum in dogs and cats, but separate survival data for these 2 patients were not included.

The high survival rate in our population of dogs and cats with major abdominal evisceration injuries was unexpected and was likely multifactorial in nature. Given the acute, dramatic character of the injury, most animals are promptly provided emergency care and their condition stabilized. Rapid provision of emergency care allows veterinary practitioners to intercede before more severe states of shock, blood loss, and compromise of the abdominal organs develop. In a study[21] of traumatic abdominal wall hernias, survival rates were 73% and 80% for dogs and cats, respectively. A hernia was not identified in 5 of the animals until > 24 hours after admission, and approximately 60% of the animals had concurrent injuries outside of the abdominal and thoracic cavities. Rapid recognition of evisceration injuries and provision of prompt medical and surgical care may be a contributing factor to the overall good prognosis for animals in our population. In addition, many of the animals in our study population had major abdominal evisceration after ovariohysterectomy. These animals

typically were young, otherwise healthy animals; thus, they were more apt to recover successfully after major surgery.

All of the animals in our study that developed a postoperative major abdominal evisceration had recently undergone ovariohysterectomy. The preponderance of wound dehiscence leading to abdominal evisceration in animals undergoing ovariohysterectomy is likely a reflection that it is one of the most frequently performed abdominal procedures in small animals, rather than being a direct consequence of the procedure. Intrinsic factors that can influence wound repair in animals include hypoproteinemia, anemia, uremia, diabetes mellitus, hyperadrenocorticism, liver disease, and infection.[24] Because of the retrospective nature of the study reported here, it was not possible to determine whether a preexisting condition (eg, wound infection) caused disruption of the incisions. Additionally, because none of the original surgeries were performed at our veterinary medical teaching hospital and thus no surgery reports were available, it was not possible to determine whether surgeon experience or technique contributed to wound dehiscence. Although eviscerations after surgery in our study were classified as postoperative events, it was difficult to determine the cause of the evisceration injury. If an animal has been licking or chewing the incision, the cause of the evisceration event may be more aptly characterized as traumatic (eg, self-inflicted trauma), rather than secondary to intrinsic factors predisposing to wound dehiscence.

Several studies[25–30] have been conducted to evaluate complications after ovariohysterectomy in small animals, and the incidence of major complications in those studies was low. In several of those studies, wound dehiscence is indicated as a complication; however, no detail is provided regarding the severity of the dehiscence, and major abdominal evisceration injuries are not reported. A small but significant increase in intra-abdominal pressure has been reported in dogs undergoing elective ovariohysterectomy.[31] This may be secondary to increased abdominal pain that causes splinting of the abdominal muscles, or it may be secondary to mild ascites after the procedure. It is unknown whether a mild increase in intra-abdominal pressure would contribute to the development of incisional complications in some animals and lead to wound dehiscence and subsequent evisceration.

In the study reported here, animals with evisceration attributable to postsurgical dehiscence had a shorter duration of hospitalization (2 days shorter), compared with the duration of hospitalization for animals with evisceration attributable to trauma. This was likely secondary to the increased severity of the wounds associated with traumatic evisceration versus postsurgical dehiscence evisceration. In this case series, only 2 of 8 animals with evisceration after ovariohysterectomy required treatment via major surgical procedures, whereas all 4 animals with traumatic evisceration required treatment via major surgical procedures.

In the population of animals in our study, each 10-kg increase in body weight was associated with a 1-day decrease in the duration of hospitalization. It is difficult to explain the reasons that animals with a higher body weight required less time in the hospital. It is possible that this type of injury has a larger relative impact on animals of a smaller body size, but factors specifically related to body size that may be responsible for this difference could not be determined from this study. This finding may also be attributable to nonclinical factors. Different clinicians managed each case, and various reasons (including client financial resources) for decisions involved in case management could have impacted the results. Larger animals cost more to maintain in a veterinary hospital than do smaller animals because of doses needed for fluid administration, medications, and blood products. It is possible that larger animals were discharged earlier than smaller animals because of financial concerns or other unmeasured variables.

The duration of hospitalization of the animals in our study increased with increasing lactate concentration measured at time of admission. Physiologic and pathophysiologic aspects of lactate production have been reviewed.[32,33] Lactate is an end product of glucose metabolism and is produced from pyruvate by lactate dehydrogenase. Most lactate is produced by anaerobic metabolism during periods of oxygen deficiency. Type A lactic acidosis includes an increase in lactate concentration secondary to a decrease in oxygen delivery or an increase in oxygen demand. Type B lactic acidosis encompasses clinical disorders that result in increased lactate concentration in animals with normal blood oxygen content and systemic arterial blood pressure. In traumatically injured patients, an increase in lactate concentrations is primarily type A lactic acidosis, with decreased oxygen delivery secondary to blood loss and hypovolemic shock. The blood lactate concentration in clinically normal dogs is approximately 1.5 mmol/L. In 1 study[34] in which investigators evaluated lactate concentrations in critically ill dogs, those that had major trauma typically had higher median lactate concentrations than dogs in other disease categories (eg, metabolic, neurologic, or intoxication).

Although the value of lactate concentration as an indicator of disease severity in humans is widely recognized, the prognostic value of lactate concentration in small animals is less well known. In a study[34] in which investigators evaluated median lactate concentration among critically ill dogs, median lactate concentration in nonsurvivors was significantly higher than median lactate concentration in survivors and a control group of clinically normal dogs. In another study[35] in which investigators evaluated dogs with gastric dilatation and volvulus, a preoperative lactate concentration > 6 mmol/L was associated with a higher mortality rate than the mortality rate for a lactate concentration < 6 mmol/L. Additionally, dogs with gastric necrosis in that study[35] had a higher median lactate concentration than those without gastric necrosis, which suggested that preoperative lactate concentration may be a predictor of gastric necrosis. Finally, in a study[36] of dogs with babesiosis, blood lactate concentrations > 45 mg/dL at time of admission as well as persistently high lactate concentrations in serial blood samples were associated with higher mortality rates.

Analysis of studies[37–39] in critically ill humans and humans with trauma injuries suggests that serial mea-

surements of lactate concentrations are better predictors of response to treatment and outcome than single measurements. A study[40] in which investigators evaluated serial blood lactate concentrations in ill dogs revealed that a high lactate concentration 6 hours after initiation of treatment was associated with a poor prognosis in systemically ill dogs, whereas an initial lactate concentration > 2.3 mmol/L was not significantly correlated with survival. Dogs with an initial lactate concentration > 2.3 mmol/L that did not have a decrease in lactate concentration of ≥ 50% had a higher mortality rate than for those that had such a decrease. Because of the emergency nature of major abdominal evisceration injuries, only 1 lactate concentration was obtained prior to surgical intervention in the animals in our study; therefore, resolution of lactate concentrations could not be determined. However, the relationship of an increase in lactate concentrations associated with an increase in duration of hospitalization suggests that these animals may require more intensive postoperative care.

Some of the limitations of the study reported here included its retrospective nature and small sample size. Additionally, animals with major abdominal evisceration injuries that were not treated surgically were not evaluated. An accurate assessment of overall mortality rate or determination of the number of animals admitted for evisceration injuries was precluded by the inability to identify patients admitted with evisceration injuries and that died or were euthanatized without surgical intervention.

The survival of all 12 animals in this study precluded the evaluation of survival as an outcome measure; therefore, only duration of hospitalization could be evaluated. The use of duration of hospitalization as an outcome was potentially biased because of potential extrinsic factors, such as the experience of the attending clinician or financial constraints of clients. Similarly, a potential bias existed in this study because of the number of surgeons who managed the animals and their individual differences regarding surgical decisions.

Although all the animals in this study survived until discharge, cause of injury (traumatic vs postsurgical dehiscence), body weight, and higher lactate concentration at admission were all significantly associated with a longer duration of hospitalization. Major abdominal evisceration injuries can be devastating injuries, but prompt medical attention and surgical intervention may be associated with a relatively good prognosis. Animals should not be euthanatized solely on the basis of the visually shocking nature of the injury. Prompt emergency care (including hemodynamic stabilization, antimicrobial treatment, and application of a sterile dressing) and surgical exploration to determine viability of abdominal organs, lavage of abdominal contents with copious amounts of fluids, reduction of eviscerated organs, and repair of defects are principles of treatment.

a. Stata statistical software, version 10, StataCorp, College Station, Tex.

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