Treatment for pancreatic abscesses via omentalization with abdominal closure versus open peritoneal drainage in dogs: 15 cases (1994–2004)

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Objective—To compare survival rate, duration of hospitalization, and complications in dogs with pancreatic abscesses treated with closed and open peritoneal drainage and evaluate a pancreatitis severity score for potential prognostic value.

Design—Retrospective case series.

Animals—15 dogs with pancreatic abscesses.

Procedure—Data regarding species, breed, age, initial clinical signs, CBC, serum biochemical abnormalities, pancreatitis severity score, anatomic location of the abscess, intraoperative bacteriologic culture results, treatment modality, postoperative complications, outcome (dismissed alive from the hospital, died in the postoperative period, or euthanized at surgery), and duration of hospitalization were evaluated.

Results—6 dogs survived, 6 dogs died or were euthanized after surgery, and 3 were euthanized during surgery. Five of 8 dogs treated with omentalization and abdominal closure survived, and 1 of 4 dogs treated with open peritoneal drainage survived. In several dogs, treatment required additional surgical procedures, which did not appear to affect outcome. Postoperative complications were similar among survivors and nonsurvivors. Mean duration of hospitalization for dogs treated with omentalization and abdominal closure was less than that of dogs treated with open peritoneal drainage. Neither pancreatitis severity score nor any individual components of the score were associated with outcome.

Conclusions and Clinical Relevance—Omentalization is a viable treatment option for pancreatic abscess in dogs. Furthermore, shorter hospitalization and better survival outcomes may make omentalization preferred over open peritoneal drainage. (J Am Vet Med Assoc 2006;228:397–402)

Development of a pancreatic abscess is an infrequent but serious complication of pancreatitis in dogs. Death has been reported in 4 of 9,3 3 of 6,1 and 6 of 72 affected dogs. In previous reports1,2 of pancreatic abscesses in dogs, treatment via closed and open peritoneal drainage for suspected septic peritonitis has been described. Nevertheless, most pancreatic abscesses in dogs yield negative results of bacteriologic cultures1,2,4 and are generally thought to be sterile abscesses or pancreatic phlegmons,1,3 and it may not be necessary to subject dogs to the potentially serious complications and additional surgical procedures associated with open peritoneal drainage.

The ability to physically drain the abdomen during septic peritonitis is challenging; however, development of open peritoneal drainage and advances in materials for use with closed abdominal drainage have improved treatment for peritonitis.4 A pancreatic abscess represents a serious localized aseptic peritonitis. Localized peritonitis of various causes has been effectively treated via repair of the primary insult, lavage, debridement, omentalization, and abdominal closure with or without external abdominal drainage.4,5 Omentalization represents an effective physiologic drain.

Open peritoneal drainage is indicated in selected cases of generalized septic peritonitis.11–20 This technique is thought to allow excellent drainage of the infected abdominal cavity and to increase oxygen tension to the detriment of anaerobic bacteria.14,16,18 Open peritoneal drainage has been associated with high morbidity and mortality rates and has been reported14 to have no advantage over closed abdominal procedures. Open peritoneal drainage also has reported14 complications of hypalbuminemia, hypoproteinemia, anemia, and nosocomial infections.

The omentum has several features that are advantageous in treatment for pancreatic abscesses. The omentum provides increased blood flow and induces and promotes angiogenesis.13,14 The omentum also contains lymphoid and myeloid cells for increased immune cell delivery. Additionally, macrophages in the omentum stimulate fibroblast function and proliferation, which aid and control wound healing.15 The omentum also provides effective drainage for exudates and effusions.2,12,16–21

Clinical use of the omentum has been reported in the surgical management of many intra-abdominal16–24,27 and extra-abdominal conditions.10,23,25,30 To the authors’ knowledge, omentalization has not been described for treatment of dogs with pancreatic abscesses, although the concept of omentalization of intra-abdominal abscesses has been promoted13 and omentalization has been.
been used successfully in treatment of dogs with pancreatic pseudocysts.  

The purpose of this retrospective study was to evaluate the hypothesis that dogs with pancreatic abscesses treated with omentalization and abdominal closure are more likely to survive, have shorter hospital stays, and have fewer complications than dogs with pancreatic abscesses treated with open peritoneal drainage. Preoperative findings as part of a PSS were evaluated for an association with outcome.

Criteria for Selection of Cases  

Medical records from the University of Missouri Veterinary Medical Teaching Hospital were searched to identify all cases of pancreatic abscess in dogs from January 1994 through December 2004. Inclusion criteria required surgical exploration of the abdomen and an intraoperative diagnosis consistent with a pancreatic abscess. Cases were excluded if histologic evaluation did not reveal inflammatory findings consistent with pancreatic abscess formation. Dogs that were euthanized during surgery were censored from survival data.

Procedures  

Data recorded included breed, age, initial clinical signs, initial results of CBC, initial serum biochemical abnormalities, PSS, anatomic location of the abscess, results of bacteriologic culture of samples obtained during surgery, histopathologic diagnosis, treatment modality, postoperative complications, outcome, and duration of hospitalization.

For the purpose of this study, a pancreatic abscess was defined as a collection of mucopurulent necrotic tissue in the pancreatic parenchyma evident grossly as a firm to friable mass with cavities containing yellow to greenish-brown exudates. In some instances, the pancreatic abscess was surrounded by firm fat and minimally involved pancreatic tissue that was edematous, thick, or firm, and occasionally, the abscess extended into adjacent tissues. In some instances, the omentum was adhered to the surface of the pancreatic abscess.

Severity of the pancreatic abscess was quantified by use of a PSS based on organ system compromise. This system was used in an effort to determine its usefulness for evaluation of pancreatic abscesses. The system assessed severity on the basis of WBC count >24 × 10³ cells/µL, renal dysfunction (BUN >40 mg/dL or creatinine concentration >3.4 mg/dL), high serum activities of hepatic enzymes (ALP, AST, or ALT activity >3 times the upper limit of the reference range), and acid-base abnormalities (bicarbonate concentration <13 or >26 mmol/L or anion gap <15 or >38 mmol/L) or endocrine pancreas dysfunction (blood glucose concentration >234 mg/dL or β-hydroxybutyrate concentration >1 mmol/L). Each organ system was given a value of 0 (normal) or 1 (abnormal), and these values were added to give severity indices of 0 to 4. Not all variables used in the original PSS index were available in our data; therefore, a modified scoring system based on available serum biochemical values was used. Reference values of the established PSS were extrapolated in some instances, to accommodate the reference ranges of our laboratory. This PSS score was not used clinically for management of the dogs in this study.

Omentalization was considered part of the surgical procedure if the surgery report indicated that the cavitary mass was evacuated of abnormal tissue and exudates and packed with omentum that was sutured in place or if the procedure was described as omentalization of the pancreas (Figure 1). Open peritoneal drainage was defined as incomplete closure of the abdominal incision after the initial exploratory surgery followed by surgical closure at a later date.

Statistical analysis—Dogs that were not euthanized during surgery were assigned to group 1 (omento-lization with abdominal closure) or group 2 (open peritoneal drainage) to compare survival rates, PSS, duration of hospitalization, and complications. Comparisons of survival rates between groups were made by use of the χ² test. The Wilcoxon rank sum test was used to compare results of PSS between survivors and nonsurvivors. Spearman rank correlation analysis was used to compare correlations between PSS and survival and duration of hospitalization between groups.

Figure 1—Intraoperative photographs of a dog with a pancreatic abscess. A—Photograph obtained during debridement. Cranial is to the right. Most of the abscess was on the lateral aspect of the mesoduodenum. D = Duodenum. BW = Body wall. Inset: photograph of a portion of the inflammatory tissue that was removed. B—Photograph obtained during omentalization of the abscess. Cranial is to the right. Notice that the omentum [central portion of the photograph] covers the surface of the duodenum. D = Proximal portion of the duodenum. BW = Right portion of the body wall. Arrows indicate the descending portion of the duodenum.
Results

Records of 15 dogs met the inclusion criteria. Affected dogs included 5 crossbreds, a Yorkshire Terrier, a West Highland White Terrier, a Siberian Husky, a Labrador Retriever, a Wheaton Terrier, a Miniature Doberman Pinscher, a Dalmatian, a Miniature Schnauzer, a Shetland Sheepdog, and a Weimaraner. Mean ± age was 8.3 ± 3.8 years (range, 1.2 to 14 years). There were 9 castrated males, 1 sexually intact male, and 5 spayed females.

Group 1 included 8 dogs, and group 2 included 4 dogs. Six dogs survived, 6 died or were euthanized in the postoperative period, and 3 were euthanized at surgery. Most of the dogs that survived to dismissal from the hospital were treated in the later years of the study period. Four of the 6 survivors were treated in 2004; 1 dog that survived was treated in 2000, and the other dog that survived was treated in 1997. Of the 6 dogs that survived, 5 were treated via omentalization (group 1): 1 in 1997, 1 in 2000, and 3 in 2004. The only surviving dog that was treated via open peritoneal drainage (group 2) was treated in 2004. Three nonsurviving dogs in group 1 were treated in 2000, 2001, and 2003, respectively. No significant (P = 0.22) difference in survival rate was found between groups 1 and 2 by use of a χ² test.

All dogs had a history of recent vomiting and lethargy. Other clinical signs included anorexia (n = 6) and icterus (1). One dog with vomiting had a history of pancreatitis 8 years previously, with no other problems since that time. Four dogs were referred with a tentative diagnosis of pancreatitis. Four dogs had concurrent diseases that included insulinoma (n = 1); lymphosarcoma, megaesophagus, and aspiration pneumonia (1); hyperadrenocorticism (1); and diabetes mellitus (1).

Abnormalities in hematologic and serum biochemical markers examined for the PSS were detected in most of the dogs. Although many of the results were outside the reference range, few were sufficiently abnormal to affect the PSS. Although it was possible to calculate the PSS for individual dogs, changes in laboratory reference values over the study period precluded direct comparisons of individual biochemical variables. Changes seen in the serum biochemistry results were similar to those previously reported and those for pancreatitis in general.

Changes in WBC counts were common and did not often affect the PSS. Median WBC count was 21.5 × 10⁹ cells/μL and 41.5 × 10⁹ cells/μL for survivors and nonsurvivors, respectively (P = 0.25).

Median and mode PSS of all surviving dogs was 2. Median PSS for dogs that died or were euthanized in the postoperative period was 1.3, with a mode value of 1. Median and mode PSS for group 1 (n = 8) was 2. Median PSS for group 2 (n = 4) was 1.3, with a mode value of 1. The Wilcoxon rank sum test was applied to the results, and no significant (P = 1.0) difference was found.

Hyperbilirubinemia was detected in 8 dogs in this study; 3 of the 8 were among the dogs that survived to dismissal from the hospital. Total bilirubin values for these 3 dogs were 6.0, 8.5, and 0.8 mg/dL, respectively (reference range, 0.1 to 0.6 mg/dL). Two of the 8 were among the dogs that died or were euthanized in the postoperative period; values for those dogs were 0.9 and 0.8 mg/dL, respectively. The other 3 dogs with hyperbilirubinemia were euthanized at surgery; values for these dogs were 14.7, 3.4, and 0.5 mg/dL, respectively. Two of the 3 dogs with hyperbilirubinemia that survived were from group 1; their values were 8.5 and 6.0 mg/dL, respectively. The third dog with hyperbilirubinemia that survived was from group 2 and had a total bilirubin value of 0.8 mg/dL. The 2 dogs that died in the postoperative period that had hyperbilirubinemia were from group 2.

Samples of the pancreatic abscesses were obtained from 12 dogs for bacteriologic culture; 3 yielded positive results for Staphylococcus epidermidis, which was considered a contaminant. Two of these 3 dogs survived, whereas 1 dog from group 2 died from septic peritonitis; a mixed bacterial population was observed cytologically (no culture was performed).

In 2 dogs, abdominal fluid was detectable via ultrasonography prior to surgery. Cytologic evaluation of the fluid revealed inflammation consistent with pancreatitis. Neither sample contained bacteria; bacteriologic cultures of the pancreas yielded negative results. One dog was in group 1 and survived, and the other dog was euthanized during surgery.

Abscesses were found in different sites in the pancreas (the location of the abscess was not recorded for 4 dogs). Abscesses were located in the entire pancreas (n = 1), the body or central portion only (1), central and right lobe (1), the right lobe only (7), and the left lobe only (1).

The locations of abscesses in the 6 dogs that survived were the right lobe (n = 4) and the central portion (1); location was not described for 1 dog. Among the dogs that died or were euthanized in the postoperative period (n = 6), the abscess was located in the right lobe only (3), body and right lobe (1), entire pancreas (1), and left lobe only (1). The location of the abscess was not described in the 3 dogs that were euthanized at surgery.

Because of the close proximity of the pancreatic abscesses to the duodenum, stomach, and bile duct, several dogs required multiple surgical procedures, including jejunostomy feeding tube placement (n = 12), biopsies (liver, kidney, stomach, or adrenal gland [5]), cholecystoduodenostomy (3), duodenal resection and anastomosis (2), partial pancreatectomy (2), and cholecystojejunostomy (1). In 2 dogs, jejunostomy feeding tube placement was the only additional surgical procedure; 1 of those dogs survived. Of the 2 dogs that had duodenal resection and anastomosis, neither dog survived to dismissal. Of the 3 dogs that had cholecystoduodenostomies, 2 survived. All 3 dogs that had cholecystoduodenostomies had high total bilirubin concentrations before surgery; the 2 that survived had extremely high bilirubin concentrations (6.0 and 8.3 mg/dL). One dog had duodenal resection and anastomosis and cholecystojejunostomy but did not sur-
vive. Both dogs that had a partial pancreatectomy along with other surgical procedures did not survive.

Omentalization with abdominal closure was used as the single direct treatment of the pancreatic abscess (group 1) in 8 of the 12 dogs that underwent surgery and recovered; 5 of the 8 dogs in group 1 survived.

Open peritoneal drainage (group 2) was used in 4 dogs, and 1 survived. In group 2, open peritoneal drainage was used along with omentomization in 2 dogs but neither survived. Open peritoneal drainage and partial omentectomy were used in 1 dog that did not survive. 

In 4 dogs, peritoneal fluid was obtained for concentration.

Low platelet count, and high fibrin degradation products, prolonged prothrombin and partial thromboplastin times, were present prior to surgery in 4 dogs via a combination of prothrombotic and thromboembolism. MODS/SIRS = Multiple organ dysfunction syndrome/systemic inflammatory response syndrome.

Discussion

The time frame of this study (1994 to 2004) was chosen because it allowed open peritoneal drainage to be compared with omentomization. Open peritoneal drainage was the predominant treatment modality from 1994 to 1998. After that time, only 1 dog (in 2004) was treated via open peritoneal drainage. Pancreatic omentomization was first performed in this series of cases in 1997. Advances in postoperative care may have played a role in the outcome of these latter cases. Because of the retrospective nature of this study, the wide variation in treatment protocols, and the small number of cases, it was difficult to determine significant differences between groups for any variables.

High WBC count prior to surgery did not appear to be associated with outcome, although there was an insufficient number of cases to determine statistically whether WBC count differed between survivors and nonsurvivors. In 3 previous studies of pancreatic abscesses, leukocytosis was detected in 13 of 20 dogs. Leukocytosis is also a common finding in dogs with pancreatitis and has been used as part of the PSS index to estimate prognosis, although previous reports indicate WBC counts in dogs with pancreatitis or pancreatic abscess are not useful for assessment of severity of disease or estimation of prognosis.
High activities of ALP and ALT were common findings in survivors and nonsurvivors. The magnitude of the value did not appear to be associated with outcome, although there was an insufficient number of cases to determine statistically whether these values differed between survivors and nonsurvivors. In 2 previous studies⁵ of pancreatic abscesses in dogs, high activities of ALP and ALT were reported in some dogs.

High total bilirubin concentration did not appear to be associated with outcome, although there was an insufficient number of cases to determine statistically whether values differed between survivors and nonsurvivors. Bile obstruction is a known potential complication of pancreatitis and was reported in all 5 dogs with a pancreatic abscess in 1 study.⁶ In 1 dog in that study, hyperbilirubinemia was associated with common bile duct obstruction; patency was reestablished via catheterization. The markedly high total bilirubin concentrations among the surviving dogs in the present study may have been caused by acute obstruction that could be corrected via surgery. The mildly high total bilirubin concentrations in nonsurviving dogs in this study may have been caused by decreased liver function that can occur secondary to severe pancreatitis.

As in the present study, in previous studies,⁷⁻¹² negative results of bacterial cultures of samples taken from pancreatic abscesses have generally been reported. Antimicrobials administered prior to surgery could diminish the likelihood of successful culture. Conversely, pancreatic abscesses may truly be caused by sterile necrosis. In our study, only 5 Staphylococcus (considered to be a skin contaminant) was cultured from samples obtained at surgery in 3 dogs. In 1 dog treated via open peritoneal drainage, bacteria were cultured from a necropsy specimen obtained from the area of the pancreatic abscess; this may have represented a nosocomial infection secondary to open peritoneal drainage.

In this study, pancreatic abscesses occurred more frequently in the right lobe of the pancreas than elsewhere. It is difficult to determine a reason for the apparent predilection for the right lobe. It is possible that this was a random sample error attributable to the small study population. A recent study¹³ found no predilection for pancreatitis in any particular location in the pancreas. If frequent occurrence in the right lobe is real, it is difficult to explain on the basis of anatomic differences in the pancreatic and accessory pancreatic ducts. The shorter, larger diameter of the accessory duct of the right lobe, compared with the pancreatic duct of the left lobe, and the absence of the pancreatic duct in some dogs⁴ could explain the increased occurrence of abscess formation in the right lobe, if a bacterial pathogen could be isolated as the underlying cause of the abscess formation. It would be interesting to determine whether dogs with a right lobe pancreatic abscess have a pancreatic duct. This would be difficult and impractical to determine at the time of surgery; however, careful necropsy examination for the pancreatic duct may shed more light on this disease process.

Surgical procedures in addition to pancreatic omentalization or open peritoneal drainage were commonly performed because the pancreas is in close proximity to several vital structures. Blockage of the bile duct is a known complication of pancreatitis and can also occur with pancreatic abscess formation. Dogs that required cholecystoduodenostomy to reroute the flow of bile did not appear to have worse outcomes than dogs that did not require this procedure. Complications attributable to leakage from the procedure did not appear to play a role in a dog that died and was examined at necropsy.

In this study, 5 of 8 dogs that received omentalization survived. This result was better than previous reports of survival for 5 of 9,³ 3 of 6,¹ and 1 of 7² dogs. Additionally, 2 dogs that were treated via omentalization had serious concurrent medical conditions that may have affected their ability to recover, regardless of surgical technique. Censoring these 2 dogs from the survival data yielded a survival rate for pancreatic omentalization of 5 of 6 dogs.

Disseminated intravascular coagulation is a severe and often fatal complication in dogs with severe pancreatitis¹ and may be of concern in dogs with pancreatic abscess formation as well. Although 2 of 4 dogs with disseminated intravascular coagulation survived to dismissal from the hospital, postoperative septic peritonitis also does not appear to influence outcome; 2 of 5 affected dogs survived. Three of 4 dogs in which a mixed population of bacteria was detected via cytologic examination or in which mixed populations were grown in culture did not survive. One study⁸ that examined closed-suction drains for treatment of dogs and cats with generalized peritonitis found that postoperative septic peritonitis did not affect outcome, regardless of type or number of types of microorganisms cultured.

In the present study, median duration of hospitalization after omentalization was 5 days. For dogs treated with open peritoneal drainage, median duration of hospitalization was 12 days. Although this difference did not quite reach significance (perhaps because of the small sample size), the shorter duration of hospitalization associated with omentalization was clinically important. In a previous study,¹ dogs that survived were hospitalized 13, 17, and 19 days after surgery with open peritoneal drainage. In the present study, the dog that received open peritoneal drainage and survived was dismissed from the hospital 10 days after surgery. Therefore, omentalization of pancreatic abscesses appears to have the advantage of quicker recovery and shorter duration of hospitalization.

There were limitations in the study inherent to retrospective analyses. Case selection for omentalization or open peritoneal drainage was based on clinician preference. Omentalization has been the preferred method of correction of pancreatic abscess at our facility since approximately 1999. Classically, dogs with severe peritonitis have been treated via open peritoneal drainage. This can lead to selection bias that increases the mortality rate for dogs treated via open peritoneal drainage. The dog with the highest PSS was treated with open peritoneal drainage; however, the median PSS was comparable between the 2 groups.

The PSS may not reflect the true severity of pancreatic abscesses. Not all indices originally described in the PSS were determined for all dogs in this study; serum AST activities and bicarbonate and ß-hydroxy-
butyrate concentrations were not regularly evaluated. Total carbon dioxide was assessed as a substitute for bicarbonate, to assist in assessing acid-base balance. The PSS was developed to assist in evaluating acute pancreatitis on the basis of the involvement of other organ systems, whereas pancreatic abscesses generally represent a chronic complication of pancreatitis. In the present study, neither PSS nor any of its components were associated with outcome.

Historically, the omentum has been blamed for the inability to properly treat peritonitis via open or closed peritoneal drainage because it physically interferes with drainage. In the past 20 years, however, the omentum has gained popularity as the organ of choice for physiologic drainage for several intra-abdominal conditions; pancreatic abscess should be added to this list.

Serious postoperative complications were seen in both groups and were too few in number to analyze statistically. It is interesting, however, that 3 dogs had no postoperative complications; all 3 dogs were in the omentalization group.

References