Complications of open peritoneal drainage in nine dogs with gastrointestinal leakage

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Open peritoneal drainage (OPD) was performed in nine dogs with generalised bacterial peritonitis. The diagnosis of peritonitis was confirmed by cytological examination of the abdominal fluid demonstrating degenerate or toxic neutrophils with intracellular bacteria. The most common reason for peritonitis was gastrointestinal leakage due to surgical wound dehiscence. In each case, the cause of peritonitis was corrected and open peritoneal drainage was performed. Complications encountered with open peritoneal drainage were hypoalbuminaemia and fluid loss via the wound. Hypoalbuminaemia was severe enough in five cases to require at least one transfusion of plasma or whole blood. Although this study demonstrated a good survival rate, OPD can be recommended only for severe cases of peritonitis and in circumstances where the appropriate facilities are available. If OPD is considered an appropriate therapeutic option, the dog should be referred to a hospital that has adequate facilities for peri-operative monitoring and intensive care.

Keywords
Dog,
Peritonitis,
Open peritoneal drainage,
Hypoalbuminaemia.

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Introduction
Peritonitis is diffuse inflammation of the peritoneum and is most commonly associated with bacterial contamination from the gastrointestinal tract (Hosgood and Salisbury, 1988). Bacterial peritonitis may be diagnosed by demonstrating degenerate or toxic neutrophils and intracellular bacteria in peritoneal fluid. In a series of 50 dogs, Hosgood and Salisbury (1988) found that the majority of bacterial peritonitis cases (60%) resulted from leakage of gastrointestinal contents and 28% were due to breakdown of surgical wounds. Mortality in humans with bacterial peritonitis has been estimated to be between 20 and 50% (Dawson, 1962; Stephen and Lowenthal, 1978; Polk and Fry, 1980; Anderson et al., 1983), while in small animals it is reported to be between 30% and 69% (Muller et al., 2001; Hargreaves et al., 1986). The main aims in the treatment of bacterial peritonitis are to remove the underlying source of infection, to reduce the bacterial population within the peritoneal cavity, and to prevent recurrence (Bosscha et al., 1999). A number of approaches have been described for the therapy of peritonitis in small animals: open peritoneal drainage (laparostomy), sump-Penrose drainage and peritoneal lavage. In studies of closed drainage for peritonitis, mortality rates of 30% (Muller et al., 2001) and 46% (Lanz et al., 2001) have been reported. Mortality rates in studies where peritonitis was managed with open peritoneal drainage ranged from 21% (Greenfield and Walsh, 1987; Winkler and Greenfield, 2000) to 48% (Wolffson and Dulisch, 1986). A 100% recovery rate using open peritoneal drainage has been demonstrated in dogs with experimentally induced peritonitis (Orsher and Rosin, 1984).

Steinberg (1979) first described open peritoneal drainage in human patients. A later study by Kriwanek et al. (1998) concluded that open drainage of peritonitis resulted in good long-term results in human patients, but was not recommended for treatment of peritonitis secondary to neoplasia. Open peritoneal drainage (OPD) has been shown to encourage more complete drainage of the abdomen in a shorter time than other types of therapy (Hosgood et al., 1989). Sump-Penrose drainage was not as effective as OPD in a later study by Hosgood et al. (1991).
This retrospective study describes the use of OPD as therapy for generalised bacterial peritonitis in nine dogs and the complications associated with it.

Materials and methods
Inclusion criteria
Nineteen dogs were diagnosed with peritonitis at the University of Glasgow Veterinary School between 1995 and 2001. Fluid was collected either at surgery or by abdominocentesis. Cases were excluded if the records were incomplete (2), if peritonitis was managed by other forms of therapy (4), if peritonitis did not occur as a result of gastrointestinal leakage (2) or was secondary to alimentary neoplasia (2). The signalments of the nine remaining cases are summarised in Table 1. Generalised bacterial peritonitis was diagnosed by demonstrating highly cellular proteinaceous abdominal fluid (exudate), consisting mainly of degenerative or toxic neutrophils with intracellular bacteria.

The decision to use OPD rather than other forms of therapy for peritonitis, such as sump-Penrose drainage or peritoneal lavage, was based on the severity of the peritonitis and availability of facilities and resources to provide the required level of care necessary for OPD. All cases had received antibacterial therapy before the diagnosis of peritonitis was confirmed.

Data collection
Records were reviewed and details of signalment, cause of peritonitis, duration of open peritoneal drainage, culture results, antimicrobial selection, mortality, electrolyte and protein abnormalities, fluid requirements, transfusion records, dressing changes and pre-operative haematological and biochemical data were analysed (Tables 1 and 2).

Surgical technique
Intravenous compound sodium lactate solution (Hartmann’s, Aqupharm No.11; Animalcare Ltd. – 10ml/ kg/ h) was initiated prior to and continued throughout anaesthesia for exploratory surgery. Anaesthesia of suitable depth was attained. To allow for maximal visualisation, a ventral midline incision was extended from the xiphoid process to the pubis, and the abdomen was surgically explored. In five of the nine cases, a swab or sample of abdominal fluid was collected for culture and sensitivity to antimicrobial agents. Cytological examination of the fluid was performed in all cases. Abdominal organs were carefully examined in order to locate the lesion responsible for peritoneal contamination, which was corrected surgically (Table 1). The abdominal cavity was thoroughly lavaged with warmed saline (0.9% NaCl, Aqupharm No.1; Animalcare Ltd.) and then suctioned. Lavage was repeated until the abdominal aspirate was clear.

Table 1: Clinical data for nine cases of peritonitis managed with open peritoneal drainage

<table>
<thead>
<tr>
<th>Case</th>
<th>Breed</th>
<th>Age</th>
<th>Sex</th>
<th>Cause of peritonitis</th>
<th>Days until closure</th>
<th>Results of culture</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Labrador</td>
<td>2y</td>
<td>M</td>
<td>Traumatic rupture of stomach</td>
<td>6</td>
<td>Gram +ve rods</td>
<td>Resolved</td>
</tr>
<tr>
<td>2</td>
<td>Poodle</td>
<td>1y</td>
<td>M</td>
<td>Dehiscence of colonic biopsy site</td>
<td>4</td>
<td>N-on-haem. E. coli</td>
<td>Resolved</td>
</tr>
<tr>
<td>3</td>
<td>Cocker Spaniel</td>
<td>11m</td>
<td>M</td>
<td>Dehiscence of jejunal biopsy site</td>
<td>a) 3 b) 8</td>
<td>N-on-haem. E. coli</td>
<td>Initial closure after 3 days, but recurred. Re-opened and closed after further 8 days. Resolved</td>
</tr>
<tr>
<td>4</td>
<td>German Short-haired Pointer</td>
<td>3m</td>
<td>M</td>
<td>Dehiscence of ileal biopsy site</td>
<td>5</td>
<td>8-haem. E. coli</td>
<td>Resolved</td>
</tr>
<tr>
<td>5</td>
<td>Irish Setter</td>
<td>8y</td>
<td>M</td>
<td>Leakage from enterotomy site following F.b. removal</td>
<td>2</td>
<td>Not performed</td>
<td>Resolved</td>
</tr>
<tr>
<td>6</td>
<td>English Springer Spaniel</td>
<td>10y</td>
<td>M</td>
<td>F.b. perforation of ileum</td>
<td>5</td>
<td>Not performed</td>
<td>Resolved</td>
</tr>
<tr>
<td>7</td>
<td>Bull Mastiff</td>
<td>8y</td>
<td>M</td>
<td>F.b. perforation of jejunum</td>
<td>5</td>
<td>No bacteria isolated</td>
<td>Resolved</td>
</tr>
<tr>
<td>8</td>
<td>Bull Mastiff</td>
<td>2y</td>
<td>F</td>
<td>Dehiscence of enterectomy site</td>
<td>5 days after removal of F.b.</td>
<td>Not performed</td>
<td>Resolved</td>
</tr>
<tr>
<td>9</td>
<td>GSD</td>
<td>5m</td>
<td>M</td>
<td>Dehiscence of enterectomy site following surgery for intussusception</td>
<td>5</td>
<td>Not performed</td>
<td>Resolved</td>
</tr>
</tbody>
</table>

JRT = Jack Russell Terrier  GSD = German Shepherd Dog  F.b. = Foreign body
y = year  m = month  M = male  F = female  N = neutered  haem. = haemolytic
1= Debride and two-layer closure (Connell pattern for mucosa, Cushing pattern for seromuscular layer)
2= Debride, two-layer closure with serosal graft patch (simple interrupted)
3= Debride, single layer closure with serosal patch graft (simple interrupted)
requiring volumes of between four and eight litres of saline. The falciform ligament was removed to allow for more effective drainage and haemorrhage was controlled using electrocautery. Surgical closure of the wound was similar in all cases. The wound was divided into cranial and caudal segments. The length of the cranial segment was approximately equivalent to the width of four fingers on the surgeon’s hand. Closure of the caudal wound segment was routine, with apposition of the external abdominal muscular fascia, subcutaneous fat and skin. The cranial wound segment was partly closed with a simple continuous suture of non-absorbable monofilament polyamide 6 suture (Ethilon; Ethicon Ltd.), through the incised margins of the external abdominal muscular fascia only, spaced and tensioned to allow the primary surgeon to insert fingers into the abdomen between the sutures.

A sterile bandage was applied immediately post-operatively. A sterile strip of semi-permeable polyurethane (Melolin; Smith and Nephew) was applied to the wound, followed by a sterile disposable nappy. Synthetic orthopaedic dressing (Soffban Plus; Smith and Nephew) and flexible cohesive bandage material (Co-Plus; Smith and Nephew) were then applied. Pethidine (Pethidine hydrochloride; M artindale Pharmaceuticals – 3mg/ kg intramuscularly q one to two hours) or morphine (M orphine sulphate; M edeva – 0.25mg/ kg intramuscularly q four to six hours) were administered peri-operatively.

Peri-operatively, broad-spectrum antimicrobial agents with activity against both aerobic and anaerobic bacteria were administered intravenously. Combinations of amoxycillin/clavulanate (Augmentin; Smith Kline Beecham – 10mg/ kg intravenously q eight hours) and metronidazole (T orgyl; Rhone M erial – 10mg/ kg intravenously q12 hours) or cefuroxime (Z inacef; Glaxo – 20mg/ kg intravenously q eight hours) and metronidazole (as above) were used before, during and after surgery. Choice of antimicrobial agent was reviewed once results of culture and sensitivity were known. Culture was not performed at closure of the abdomen in any of the cases.

Post-operative care
All male dogs had an indwelling urinary catheter placed for the duration of OPD, to prevent urine contamination of the wound and dressing. Females were catheterised for the first 24 hours post-operatively to monitor urine output. Oral fluids were offered within four hours of surgery, and a highly digestible diet (Selected Protein Diet, Pedigree) within 12 hours of surgery. Small frequent meals were offered, aiming to provide full nutritional requirements within three days of surgery. Nutritional requirements were calculated as described by Lippert (1992), with an illness factor of 1.25. Constant 24-h monitoring was provided for the duration of the open peritoneal drainage (see panel).

<table>
<thead>
<tr>
<th>Reference range</th>
<th>WCC (x10^9/ L)</th>
<th>Neutrophils (x10^9/ L)</th>
<th>Band neutrophils (x10^9/ L)</th>
<th>Bilirubin (µmol/ L)</th>
<th>AST (mmol/ L)</th>
<th>Albumin (g/ L)</th>
<th>Total protein (g/ L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.0 – 9.0</td>
<td>3.0 – 11.8</td>
<td>&lt;0.3</td>
<td>&lt;10</td>
<td>&lt;40</td>
<td>29 - 36</td>
<td>29-36</td>
</tr>
<tr>
<td>Case 1</td>
<td>9.77</td>
<td>3.13</td>
<td>4.49</td>
<td>ND</td>
<td>29</td>
<td>27</td>
<td>64</td>
</tr>
<tr>
<td>Case 2</td>
<td>8.13</td>
<td>6.83</td>
<td>0.08</td>
<td>4</td>
<td>80</td>
<td>27</td>
<td>45</td>
</tr>
<tr>
<td>Case 3</td>
<td>26.7</td>
<td>22.69</td>
<td>2.67</td>
<td>18</td>
<td>79</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Case 4</td>
<td>35.0</td>
<td>32.2</td>
<td>0.00</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>Case 5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>40</td>
<td>69</td>
</tr>
<tr>
<td>Case 6</td>
<td>7.8</td>
<td>5.07</td>
<td>1.482</td>
<td>1</td>
<td>38</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>Case 7</td>
<td>8.9</td>
<td>3.47</td>
<td>4.27</td>
<td>24</td>
<td>88</td>
<td>28</td>
<td>57</td>
</tr>
<tr>
<td>Case 8</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>17</td>
<td>44</td>
</tr>
<tr>
<td>Case 9</td>
<td>29.4</td>
<td>22</td>
<td>3.38</td>
<td>2</td>
<td>44</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>Mean</td>
<td>17.9</td>
<td>13.6</td>
<td>2.34</td>
<td>8.16</td>
<td>54</td>
<td>24.3</td>
<td>50.2</td>
</tr>
<tr>
<td>Median</td>
<td>9.77</td>
<td>6.83</td>
<td>2.67</td>
<td>3.0</td>
<td>44</td>
<td>23</td>
<td>49</td>
</tr>
</tbody>
</table>

WCC = white cell count. ND = no data. AST = aspartate aminotransferase.
Intravenous fluid therapy was administered for the duration of OPD regardless of oral intake. All cases (n=9) received compound sodium lactate solution (Hartmann’s, Aqupharm No. 11; Animalcare Ltd.). Fluid rates were adjusted following assessment of peripheral perfusion (pulse rate and quality) and urine output. Patients were also assessed for clinical signs of fluid overload such as chemosis, pulmonary oedema and tachypnoea. The aim was to achieve adequate urinary output of 1 to 2 ml/kg/h and to prevent symptoms of fluid overload. Gelatine (H aemaccel; Intervet) or hydroxyethyl starch (eloHaes; Fresenius Kabi) were initiated as constant rate intravenous infusions (10 to 20 ml/kg/24 h) if clinical signs of poor peripheral perfusion, hypotension or decreased urine output were detected.

PCV, albumin, TP and electrolytes were measured every six to eight h for the duration of OPD. Potassium (potassium chloride 15%; Martindale Pharmaceuticals) was added to the intravenous crystalloids according to the degree of hypokalaemia present (MacIntyre, 1997).

Plasma or whole blood transfusions were administered if serum albumin concentration decreased to 15 g/L (cases 3, 5, and 7) or if clinical symptoms of hypotension such as poor peripheral pulses or indirect measurement of mean arterial pressure decreased below 60 mmHg (cases 1 and 9). Plasma was administered in preference to whole blood, which was administered only if facilities for separation of plasma were unavailable. On each occasion one unit of blood (450 ml) or plasma (approximately 250 ml) was transfused at a rate of 22 ml/kg/day.

Dressings were changed every four to six h for the first 24 h and, thereafter, a minimum of once daily or more frequently if the dressing became saturated. Adhesions were broken down once daily by inserting a sterile gloved finger into the abdominal cavity between the sutures. Pethidine (3 mg/kg intramuscularly) was administered 15 minutes prior to attempts to break down adhesions. The animal was encouraged to stand for dressing changes and a sterile drape was placed underneath, in case herniation of abdominal contents occurred. Sterile gloves were worn when changing dressings. Any herniated omentum or gut was carefully pushed back into the abdomen. Dressings were inspected and weighed at each change to assess the consistency and volume of the fluid draining from the abdomen. The combined weight of semi-permeable polyurethane and nappy recorded after each dressing was used to estimate the fluid loss from the wound. Absence of intracellular bacteria and a decrease in the cellularity and quantity of fluid draining from the peritoneal cavity were used as the criteria for secondary closure of the abdomen. At the time of secondary closure, non-absorbable suture material was removed and further inspection of the abdomen was performed. Previous surgical interventions were examined for integrity, all of which were intact. Granulation tissue was debrided from the wound edges. The wound edges were debrided to allow routine midline

<table>
<thead>
<tr>
<th>Case</th>
<th>Albumin (g/L)</th>
<th>Day of occurrence following open drainage</th>
<th>Transfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>1</td>
<td>Plasma x 1</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>2</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>4</td>
<td>Blood x 2;  Plasma x 3</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>4</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>1</td>
<td>Blood x 1</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>2</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>4</td>
<td>Blood x 1</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>3</td>
<td>Blood x 1</td>
</tr>
</tbody>
</table>

Schedule of post-operative care during open peritoneal drainage

- Indirect blood pressure monitoring (Dinamap) q30 minutes for first 12 to 24 h post-operatively, then discontinued;
- Pulse rate, respiration rate, pulse quality q one h for first 24 h, then q four to six h;
- Mucous membrane colour, capillary refill time (CRT) q two h for first 24 h, then q four to six h;
- Urine output and specific gravity q two h for duration of bladder catheterisation;
- Demeanour q two to four h;
- Subjective assessment of analgesia requirements q two to four h;
- Recumbent animals turned q four h;
- Temperature q four hours for first 24 h, then q eight h;
- Case 3: central venous pressure monitored q one h for the first 24 h;
- Packed cell volume (PCV), total protein (TP), albumin, electrolytes q six to eight h;
- Constant or intermittent ECG monitoring.

TABLE 3: Lowest recorded concentration of serum albumin following initiation of open peritoneal drainage
coeliotomy closure in three layers, as described previously. Final wound closure was similar in all cases.

**Results**

Seven male dogs and two female dogs aged three months to 10 years, with a median of two years, were treated using open peritoneal drainage. Nine breeds of dogs were included in this study (Table 1). Peritonitis occurred due to dehiscence of intestinal biopsy sites (6), foreign body perforation of bowel (2) and blunt abdominal trauma resulting in perforation of stomach wall (1). Nine cases underwent abdominal closure and survived to be discharged. The mean duration of open peritoneal drainage was 5.3 days (median = 5 days). Peritonitis recurred following closure in case 3 and OPD was repeated. This dog recovered following the second closure after a total of 11 days of open drainage.

Positive culture was obtained in four of five cases (Table 1). Bacteria isolated from the abdominal fluid included E. coli (n=3) and Gram-positive rods (n=1). The Gram-positive rods could not be further classified.

Anaemia was found in three cases. Three cases had a neutrophilia prior to surgery and five cases had a significant left shift (Table 2). Significant biochemical abnormalities were increased concentrations of aspartate aminotransferase (AST) and bilirubin and decreased levels of total protein (TP) and albumin (Table 2). Eight cases were hypoalbuminaemic prior to surgery. Hypobilirubinaemia was documented in two cases (3 and 7).

Moderate to severe hypoalbuminaemia (<21g/L) occurred in all nine dogs during the first four days of open abdomen (Table 3). Five animals required one or more plasma or blood transfusions. Case 3 required five transfusions (two blood transfusions and three plasma transfusions) due to the severity of hypoalbuminaemia and the associated symptoms. Seven cases were given synthetic colloids. Cases 1, 4, 5, 6, 8 and 9 received gelatine (Hæmacel; Intervet – 20ml/ kg/ 24h). Aggressive fluid therapy using crystalloids was required, particularly in the first 24 to 48 h. Fluid rates (compound sodium lactate with potassium supplementation) in excess of 5 to 10ml/ kg/ h were needed during this period in conjunction with constant rate infusions of colloids (synthetic or natural) in cases 1, 4, 5, 6, 7, 8 and 9.

All cases demonstrated fluid losses in excess of 40 to 50ml/ kg/ day via the abdominal wound during the first 24 to 48 h of open drainage. Losses from the wound gradually decreased over a period of several days up until the point of closure. The fluid was usually purulent in the initial stages, becoming more serous with resolution of peritonitis. Fibrin tags were also present on the abdominal dressings. Cases 1 and 3 demonstrated pitting oedema associated with severe hypoalbuminaemia. Herniation of abdominal contents occurred infrequently and usually involved small bowel protrusion between abdominal sutures. These loops of bowel were easily returned to the abdominal cavity at the time of dressing changes. OPD was well tolerated by all patients.

One year after discharge, five out of nine animals were alive, with the remaining four cases lost to follow-up.

**Discussion**

Complications reported with open peritoneal drainage in human patients include massive fluid loss, electrolyte abnormalities and hypoproteinaemia (Bosscha et al., 1999). Open peritoneal drainage is considered to be an effective form of therapy, but is only recommended in patients requiring multiple operations or where the abdomen cannot be closed due to risk of complications (Bosscha et al., 1999). Long-term results with open management were good in a study of 147 people, 72 of whom had severe intra-abdominal infection with peritonitis (Kiwanek et al., 1998). Seventy-five per cent of these patients described their quality of life as good following open drainage and were able to return to work. However, medical literature suggests that open drainage should only be performed after failure of closed treatment due to the problems encountered with the former (Schein, 1991).

All cases in this study developed peritonitis following leakage of gastrointestinal contents. This is in keeping with results of previous studies, which showed that leakage of gastrointestinal contents was the leading cause of peritonitis in animals (Greenfield and Walshaw, 1987; Hosgood and Salisbury, 1988; Lanz et al., 2001). Six of the nine cases resulted from dehiscence of intestinal wounds following surgery. This may have reflected the presence of underlying intestinal pathology or the presence of foreign bodies. Lymphocytic-plasmacytic inflammatory bowel disease was subsequently diagnosed in cases 2 and 3 and a suppurative enteritis in case 4. Infiltration of the intestinal wall with inflammatory cells in these cases may have contributed to wound dehiscence. Intestinal foreign bodies are considered a risk factor for wound breakdown, with a dehiscence rate of 27.7% in one study by Allen et al. (1992). Hypoalbuminaemia prior to intestinal surgery may have been a contributory factor. Surgical factors could not be assessed as several surgeons were involved in the management of these cases. The duration of open peritoneal drainage in this study was slightly longer (mean = 5.3 days) than similar studies in dogs and cats (Wolfson and Dulisch, 1986; Greenfield and Walshaw, 1987). Hypoproteinaemia occurred more commonly and was more severe than reported in other similar studies (Wolfson and Dulisch, 1986; Greenfield and Walshaw, 1987). However, a more recent study by Staatz et al. (2002) reported that
Open packing of peritoneal cavity in generalized bacterial peritonitis. I ntravenous crystalloid therapy was required for the duration of the open abdomen to prevent dehydration. This was in keeping with the findings of similar studies (Greenfield and Walshaw, 1987; Winkler and Greenfield, 2000).

The most common sequelae to this type of therapy in previous studies (Woolfson and Dulisch, 1986; Greenfield and Walshaw, 1987; Orsher and Rosin, 1984) were hypoproteinaemia, dehydration and nosocomial infections. This correlates closely to complications experienced in human medicine (Bosscha et al., 1999) and to the findings of this retrospective study. However, fistula formation, which was reported to be a common problem in humans treated with this technique (Bosscha et al., 1999), did not occur in any of the cases in this study. Evidence of nosocomial infection was not detected in any of the cases in this study; however, culture of peritoneal fluid at closure was not performed in any case. Bandaging materials provided a physical barrier reducing the risk of nosocomial infection and herniation of abdominal contents. Simple gauze dressings have been reported to protect the open wound in humans (Maetani and Tobe, 1981). In this study, semi-permeable polyurethane was chosen as the primary layer of the dressing as this provided an absorbent sterile layer, which was in direct contact with the open wound. A sterilised disposable nappy was applied over the semi-permeable polyurethane, which provided an extremely absorbent surface to collect draining fluid. Abdominal dressings were also essential to prevent self-mutilation of the exposed intestines.

In this retrospective study, all nine cases survived to be discharged. This gives a lower mortality rate than previously reported in the veterinary literature (Woolfson and Dulisch, 1986; Greenfield and Walshaw, 1987; Winkler and Greenfield, 2000; Staatz et al., 2002). Previous studies of canine cases of peritonitis managed with open peritoneal drainage have shown mortality rates ranging from 21% (Greenfield and Walshaw, 1987) to 48% (Woolfson and Dulisch, 1986). The lower mortality rate in this study could not be attributed to any differences in surgical technique. Six cases received blood or plasma transfusions at the time of surgery or during open drainage. This may have had a positive impact on survival compared to other studies. King (1994) suggested that administration of colloids to dogs and cats with peritonitis did not affect the outcome, but only three of 23 cases were treated with OPD and so direct comparisons cannot be made. Plasma transfusions were not administered to any of the 25 cases of peritonitis managed with OPD in a study by Woolfson and Dulisch (1986) and in only one case in a series of 24 reported by Greenfield and Walshaw (1987). Synthetic colloid administration was not documented in either of these studies. In a more recent report, Staatz et al. (2002) also hypothesized that an improved survival rate in a group of seven dogs managed with OPD may have been attributable to peri-operative administration of plasma and blood.

Conclusion

OPD may result in better survival rates than those previously reported. Significant medical complications (hypoproteinaemia and fluid losses via the open wound) can be associated with this technique. These complications mean that OPD can be recommended only for severe cases of peritonitis and only where the available facilities can cope with the complications. If OPD is considered an appropriate therapeutic option, it would be prudent to refer the dog to a hospital that has adequate monitoring and intensive care facilities. Plasma or synthetic colloid administration is recommended for hypoalbuminaemic animals managed with OPD. Further studies of a larger population of animals managed using OPD are warranted to investigate the impact of plasma or synthetic colloid administration on survival.

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References


