Emphysematous Pancreatitis. Radiological Curiosity or a Cause for Concern?

Jai Dev Wig, Rakesh Kochhar, Kishore Gurumoorthy Subramanya Bharathy, Ashwini Kumar Kudari, Rudra Prasad Doley, Thakur Deen Yadav, Naveen Kalra

Departments of General Surgery, Gastroenterology, and Radiodiagnosis, Post Graduate Institute of Medical Education and Research, Chandigarh, India

ABSTRACT

Context Emphysematous pancreatitis is a rare, potentially fatal variant of severe acute pancreatitis with gas in the pancreatic bed. There are isolated case reports describing this condition.

Objective This report summarizes our experience with the management of this condition in order to compare its clinical characteristics, microbiological and radiological features, surgical management and the outcome of patients with emphysematous pancreatitis and non-emphysematous infected pancreatic necrosis.

Setting The hospital records of the patients who underwent necrosectomy for infected pancreatic necrosis between 2002 and 2006 were reviewed.

Patients Fifty-seven patients were identified: 11 of them (19.3%) had gas in and around the pancreas on computed tomography and 46 (80.7%) had non-emphysematous infected pancreatic necrosis.

Main outcome measures The clinical characteristics and the hospital course of the two groups of patients were compared.

Results The mean age of 11 patients with emphysematous pancreatitis was 34.0±11.5 years and alcohol was the most common etiology (54.5%). The median computed tomography severity index was 10. All 11 patients with emphysematous pancreatitis had growth of organisms on culture of fine needle aspiration or pancreatic tissue obtained at surgery, with Escherichia coli in all of them. Polymicrobial infection was seen in 5 (45.5%) of them. In comparing patients having emphysematous pancreatitis with those having non-emphysematous infected necrosis, there was no significant difference in the severity of the disease (P=0.319), time to surgical intervention (P=0.553), incidence of organ failure (P=0.297), hospital stay (P=0.580) or mortality rate (P=0.739). The total number of locoregional complications was significantly higher in patients with emphysematous pancreatitis (P=0.049). However, when compared separately, the incidence of enteric fistula, bleeding, intra-abdominal collections and wound complications were similar in the two groups (P>0.250).

Conclusion Emphysematous pancreatitis is easily diagnosed on computed tomography and all patients require surgical intervention. The clinical course and prognosis is not different from that of infected pancreatic necrosis.

INTRODUCTION

Emphysematous pancreatitis (EP) is a rare and life-threatening necrotizing infection of
the pancreas [1]. It is associated with gas-forming bacteria and characterized by the presence of gas within or around the pancreas [2, 3, 4]. Computed tomography (CT) is the imaging modality of choice. It is both highly sensitive and specific in the detection of abnormal gas and is well-suited to reliably depict the anatomical location and extent of the gas. Although the identification of gas bubbles alone is not specific for the diagnosis of infection, their presence in an area of pancreatic necrosis on CT scan is considered a positive indicator of the presence of gas-forming organisms [5]. Most reports on EP are based on radiological detection on CT scan [6]. Though the outcome of EP is reported to be poor, there are very few reports on the clinical characteristics of EP. We herein report our experience with EP and compare it with non-emphysematous infected pancreatic necrosis.

PATIENTS AND METHODS
The hospital records of all patients who underwent pancreatic necrosectomy for infected pancreatic necrosis between 2002 and 2006 were analyzed. In this time period, 172 patients with severe acute pancreatitis were seen. Fifty-seven underwent necrosectomy for infected pancreatic necrosis. In 11 out of these 57 (19.3%), gas was detected in the pancreatic bed on contrast-enhanced CT scan. This subgroup of EP was reviewed in detail. Patients who developed gas after percutaneous intervention or surgery were excluded. Patients with severe acute pancreatitis were managed using a standard protocol which included prophylactic antibiotics, nutrition (nasojugal or parenteral) and supportive care for organ dysfunction. A CT scan was obtained for all patients. Image acquisition was at 5 mm intervals with intravenous contrast injected at the rate of 8 mL/second. The CT severity index (CTSI) [7] was calculated based on the extent of the necrosis and the number of fluid collections. Emphysematous pancreatitis was diagnosed when there was gas in the retroperitoneal, pancreatic bed on CT scan without any antecedent percutaneous or radiological intervention. Image-guided fine needle aspiration from pancreatic/peripancreatic tissue was done for microbiological studies if fever or leukocytosis persisted. Ultrasound-guided percutaneous drainage was employed as a temporary measure to drain localized peripancreatic collections. Contraindications to this procedure were the lack of an acoustic window and coagulopathy. A 9 French pigtailed catheter was placed using Seldinger’s technique. Patency was ensured by flushing with sterile normal saline. Review ultrasound was carried out every third day to confirm the position of the catheter and evaluate the size of the collection. The catheter was removed at the time of surgery when it acted as a guide to enter the lesser sac. Indications for surgical intervention were infected pancreatic necrosis, clinical deterioration, persistent organ dysfunction despite maximum intensive care and gas in and around the pancreas on CT. The necrotic material obtained at surgery was sent for aerobic and anaerobic bacterial cultures and the antibiotic therapy was changed according to the sensitivity report. All patients underwent pancreatic necrosectomy and postoperative closed lesser sac lavage [8].

ETHICS
All patients were treated according to usual clinical practice, following the ethical guidelines of the Declaration of Helsinki. Written informed consent was obtained before interventional procedures. There was no a priori approval by any institutional review committee because this was a retrospective analysis of hospital records.

STATISTICS
Patients with EP were compared to patients without EP in relation to age, etiology, CTSI, microbiological results, locoregional complications, organ failure, hospital course and mortality. Statistical analysis was performed using SPSS version 11. The Mann Whitney U test was used to compare continuous variables, and the Fisher’s exact and the chi-square tests were used for discrete
variables. Two-tailed P values less than 0.05 were considered to be significant.

RESULTS

Fifty-seven patients with severe acute pancreatitis underwent necrosectomy for infected pancreatic necrosis between 2002 and 2006. Eleven of these patients (19.3%) had gas in and around the pancreas on CT scan. The clinical details of patients with EP and non-emphysematous infected pancreatic necrosis are compared in Table 1. There was no significant difference between the two groups with regards to age, gender and etiology. Patients in both groups presented predominantly in the mid-second to early third week of the onset of pancreatitis.

The subgroup of patients with EP classically had necrosis of the pancreas with air specks, soft tissue stranding in the peripancreatic, perigastric, pararenal spaces and multiple intraabdominal fluid collections (Figures 1 and 2). The CTSI was 6 in one patient, 8 in four patients and 10 in six patients. The culture of the fine needle aspiration (FNA) or tissue obtained at necrosectomy grew Escherichia coli in all 11 patients. Pseudomonas aeruginosa and Acinetobacter

Table 1. Comparison between emphysematous pancreatitis and non-emphysematous infected pancreatic necrosis.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Emphysematous pancreatitis (n=11)</th>
<th>Non-emphysematous infected pancreatic necrosis (n=46)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years; mean±SD, range)</td>
<td>34.0±11.5 (17-62)</td>
<td>33.4±11.9 (18-80)</td>
<td>0.357&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Males</td>
<td>9 (81.8%)</td>
<td>36 (78.3%)</td>
<td>1.000&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Females</td>
<td>2 (18.2%)</td>
<td>10 (21.7%)</td>
<td></td>
</tr>
<tr>
<td>Etiology:</td>
<td></td>
<td></td>
<td>0.891&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Alcohol</td>
<td>6 (54.5%)</td>
<td>28 (60.9%)</td>
<td></td>
</tr>
<tr>
<td>- Gallstones</td>
<td>3 (27.3%)</td>
<td>12 (26.1%)</td>
<td></td>
</tr>
<tr>
<td>- Idiopathic</td>
<td>2 (18.2%)</td>
<td>6 (13.0%)</td>
<td></td>
</tr>
<tr>
<td>Duration of symptoms prior to admission (days; median, range)</td>
<td>15 (4-40)</td>
<td>11 (1-30)</td>
<td>0.716&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CTSI (median, range)</td>
<td>10 (6-10)</td>
<td>8 (4-10)</td>
<td>0.319&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Monomicrobial</td>
<td>6 (54.5%)</td>
<td>34 (73.9%)</td>
<td>0.275&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Polymicrobial</td>
<td>5 (45.5%)</td>
<td>12 (26.1%)</td>
<td></td>
</tr>
<tr>
<td>Timing of surgery after the onset of pancreatitis (days; mean±SD, range)</td>
<td>28.1±11.3 (12-48)</td>
<td>32.1±11.5 (14-55)</td>
<td>0.553&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Locoregional complications:</td>
<td>11 (100%)</td>
<td>32 (69.6%)</td>
<td>0.049&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Enteric fistulae</td>
<td>4 (36.4%)</td>
<td>9 (19.6%)</td>
<td>0.251&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Bleeding</td>
<td>3 (27.3%)</td>
<td>8 (17.4%)</td>
<td>0.429&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Post operative intra abdominal collection</td>
<td>2 (18.2%)</td>
<td>6 (13.0%)</td>
<td>0.644&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Wound dehiscence</td>
<td>2 (18.2%)</td>
<td>9 (19.6%)</td>
<td>1.000&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Multiorgan failure</td>
<td>5 (45.5%)</td>
<td>13 (28.3%)</td>
<td>0.297&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Percutaneous intervention</td>
<td>5 (45.5%)</td>
<td>19 (41.3%)</td>
<td>1.000&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Mortality</td>
<td>1 (20.0%)</td>
<td>8 (42.1%)</td>
<td>0.615&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Duration of hospital stay (days; median, range)</td>
<td>46 (17-64)</td>
<td>44 (17-217)</td>
<td>0.580&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mortality</td>
<td>4 (36.4%)</td>
<td>21 (45.7%)</td>
<td>0.739&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mann-Whitney U test
<sup>b</sup> Chi-squared test
<sup>c</sup> Fisher’s exact test
SD: standard deviation
CTSI: computed tomography severity index
aeromonas were the other commonly isolated microorganisms. The infection was polymicrobial in five patients and monomicrobial in six patients. The details of the bacteria isolated in the two groups are given in Table 2.

The timing of surgical intervention was in the fourth and fifth weeks of disease with no statistically significant difference between the two groups. Locoregional complications were encountered significantly more often in patients with EP (P=0.049). However, when the single complications were analyzed, there was no statistically significant difference in the incidence of gastrointestinal fistulae, bleeding, intra-abdominal collections or wound complications (P>0.250). Five out of the 11 EP patients (45.5%) developed multiorgan failure (defined as per Atlanta guidelines [9]). Respiratory failure was seen in all five patients, renal failure in three and hypotension requiring inotropes in two patients. The incidence of organ failure was similar in the two groups (P=0.297). Preoperative percutaneous drainage did not alter the outcome. One out of the five patients who underwent percutaneous intervention died in the EP group while 8 out of the 19 in the non-emphysematous infected necrosis group died (P=0.615). The median duration of the hospital stay and the mortality rate again did not differ significantly (P=0.580 and P=0.739, respectively) (Table 1).

DISCUSSION

EP is a rare variant of severe acute pancreatitis characterized by gas formation within and around the pancreas [1, 4, 10]. There are only scattered case reports in the literature, most of them dealing with radiological features. Attention was focused on EP after the advent of the CT scan. In a report of 450 patients undergoing CT for evaluation of a pancreatic pathology, 9 (2%)
had intrapancreatic air, in 8 it was due to an abscess and in one due to an enteric fistula [11]. In another report of 259 patients, 7 (2.7%) had gas documented in the retroperitoneum [12]. In a recent report of 14 necrosectomies over 4 years, three patients had EP [13]. In the present series, 11 (19.3%) of the 57 patients undergoing necrosectomy for infected pancreatic necrosis had EP, all diagnosed on CT scan preoperatively. This is the largest clinical series on EP.

The details of management and outcome in EP have rarely been given in large series of patients undergoing necrosectomy. The word ‘emphysematous’ has serious connotations when prefixed to cholecystitis and pyelonephritis. EP has in fact been reported together with emphysematous infections of the gallbladder, kidney, urinary bladder and intestines [3]. This study compares the clinical course and outcome of EP with that of infected pancreatic necrosis which includes a seriously ill subgroup of severe acute pancreatitis with mortality rates as high as 40% [14].

There is no known predisposition to EP. However, diabetes mellitus is known to predispose to gas gangrene [3]. There are also reports of EP associated with tuberculosis [15] occurring in HIV infected individuals [16]. In this study, the prevalence of diabetes was similar in patients with or without EP, and there were no specific factors contributing to immunocompromise [16].

Most cases of EP have been attributed to gram negative organisms, the most common being *Escherichia coli* [11, 17], and others being *Klebsiella species*, *Pseudomonas* and *Enterobacter* [13]. *Clostridium perfringens* has also been implicated in gas gangrene of the pancreas [4, 17]. EP rarely occurs as a result of an infection with *Mycobacterium tuberculosis* [15]. In our study, all 11 patients with EP were infected with *Escherichia coli*, with 5 patients having polymicrobial infections. In contrast, *Escherichia coli* was found in 50% of the patients with infected pancreatic necrosis without EP (P=0.002) and was still the most common organism isolated. Polymicrobial infection was seen in 26.1% of the patients in the non-emphysematous subgroup. However, this difference did not reach statistical significance (Table 1). No anaerobic organisms were isolated in culture.

The other important cause of EP is enteropancreatic fistula. The fistulization occurs between the pancreas and the duodenum, jejunum or colon. A suggestion has been made that the fistula may result from the rupture of a pancreatic pseudocyst [11]. One patient with EP had multiple fistulae between the pancreas, duodenum, jejunum and colon at the index operation. He required a left hemicolectomy, transverse colostomy and primary repair of the small bowel fistulae (Figures 3 and 4). Three other patients developed enteric fistulae in the postoperative period. One patient required a right hemicolecctomy in a second operation; the other two were managed conservatively.
Interestingly, although the incidence of enteric fistulae was higher in patients with EP as compared to those with non-emphysematous infected pancreatic necrosis, (36.4% versus 19.6%), this did not reach statistical significance (Table 1). Endoscopic evaluation was not a routine preoperative investigation in patients with EP in this study and there was no way of predicting which patients with EP went on to develop enteric fistulae. Further studies are required to clarify this issue.

Gas within the pancreas is a rare occurrence in patients with a patulous ampulla of Vater, duodenal diverticulum, penetrating duodenal ulcer or following instrumentation. Such patients may have a benign clinical course despite alarming radiological findings. In this study, EP refers to a subgroup of patients with infected pancreatic necrosis who invariably require intensive care. Image-guided percutaneous catheter drainage was employed as a temporizing measure prior to surgery in both groups (an average of 42% of patients) in order to drain localized collections. Gas in the retroperitoneum was diagnosed in all 11 patients prior to any intervention. It has been suggested that the presence of EP is an indication for surgical intervention [4, 10], although there is a recent report of successful conservative management of EP [1]. In this series, all 11 patients with EP underwent necrosectomy with closed lesser sac drainage and postoperative lavage, a technique which has been described elsewhere [8]. The recommended surgical approach is organ-preserving debridement combined with a postoperative management strategy which maximizes the evacuation of retroperitoneal debris and exudates [8]. The same approach was followed in patients without EP.

Contrary to the comments in the literature, patients with EP did not differ from those with non-emphysematous infected pancreatic necrosis in terms of severity of disease, duration of hospital stay and mortality. The incidence of locoregional complications and organ failure were also similar in the two groups. One possible explanation for this observation may be the strategy of intensive care offered to all patients with severe acute pancreatitis, and timely surgical intervention for them. Early and prompt recognition of EP is another aspect.

We conclude that gas in and around the pancreas on CT scan suggests a diagnosis of EP. This implies infected pancreatic necrosis which calls for intensive care and surgical intervention. With an aggressive management strategy, the clinical outcome of patients with EP can be expected to be similar to that in patients with non-emphysematous infected pancreatic necrosis. At the same time, we reiterate the need for prompt diagnosis of EP.

Received November 10th, 2007 - Accepted December 24th, 2007

Keywords Pancreatitis, Acute Necrotizing; Tomography, X-Ray Computed

Abbreviations EP: emphysematous pancreatitis

Conflict of interest The authors have no potential conflicts of interest

Correspondence Jai Dev Wig
Department of General Surgery
Postgraduate Institute of Medical Education and Research
Chandigarh 160012
India
Phone: +91-172.275.6624
Fax: +91-172.274.4401
E-mail: jdwjsini@hotmail.com

Document URL: http://www.joplink.net/prev/200803/09.html

References
3. Grayson DE, Abbott RM, Levy AD, Sherman PM. Emphysematous infections of the abdomen and pelvis:


