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Study of the early management of acute pancreatitis

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Abstract

Background: Acute pancreatitis (AP) is a common acute surgical presentation with evidence-based guidelines for early management. The aim of this study was to assess the compliance to the published guidelines in patients presenting with AP in Western Sydney.

Methods: A retrospective case note audit was conducted for all patients with a confirmed diagnosis of AP from 2008 to 2011 in Western Sydney.

Results: There were 932 patients. The mortality was low for mild (0.7%) and severe (1.2%) AP. There was an under-utilization of ultrasound (U/S) with 239 (25.6%) patients not having a U/S. There was an over-utilization of early (within 72 h) computed tomography scanning for diagnosis (31.1%), assessment of severity (16.1%) and assessment for the presence of complications (7.3%). Inappropriate prophylactic antibiotic usage occurred in 15.3% patients. Of 373 cases of gallstone pancreatitis, only 231 (69.1%) had a cholecystectomy within 4 weeks of presentation. There was an under-utilization of early endoscopic retrograde cholangiopancreatography for associated cholangitis (12.5%). Only 16 (18.8%) patients with severe pancreatitis received enteric feeding. In patients with pancreatic necrosis, 50% had invasive intervention delayed beyond 4 weeks and 69% had minimally invasive procedures performed prior to necrosectomy. Patients having a minimally invasive procedure initially showed an improvement in mortality compared with those who had primary necrosectomy (0 versus 40%, $P = 0.025$).

Conclusions: Although morbidity and mortality were acceptable, there was a failure to comply with evidence-based guidelines for the early management of pancreatitis. The results support for the development and auditing of protocols for the early assessment and treatment of AP in all hospitals.

Introduction

Acute pancreatitis (AP) is a common acute surgical condition accounting for 2–3% of presentations with acute abdominal pain.[1,2] The annual incidence is 4.9–73.4 cases per 100 000 persons,[3,4] with the incidence in Australia at the higher end of the spectrum[5] noting that the incidence is increasing worldwide.[5,6]

As AP is common, and associated with substantial morbidity and mortality, it is important that management follows evidence-based guidelines to ensure the best patient outcomes. Previous studies have shown variable compliance with published guidelines for the management of AP, particularly in regard to timely surgical management of gallstone disease and use of intensive care facilities.[7–12] Recently, there have been two published evidence-based guidelines for the management of AP.[13,14] The aim of this study was to determine whether the management of AP in the Western Sydney population of New South Wales, Australia, complies with these recent guidelines.

Methods

A 4-year retrospective cohort analysis of patients presenting with AP to Westmead, Nepean and Blacktown/Mt Druitt Hospitals was undertaken between January 2008 and October 2011. Ethics approval was obtained from Sydney West Area Health Service Ethics Committee. Patients with AP were identified by the Health Information and Records Departments using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification diagnostic codes K85.0, K85.1, K85.2, K85.3, K85.8 and K85.9 (idiopathic AP, biliary AP, alcohol-induced AP, other AP, AP unspecified). The diagnosis of AP was confirmed if at least two of the following three features were

present: (i) abdominal pain characteristic of AP; (ii) serum amylase and/or lipase greater than three times the upper limit of normal; or (iii) radiographically demonstrated AP on computed tomography (CT) scan.[15] Patients were excluded from the study if they did not meet these criteria, if the file was not available in the medical records department or if they were under 16 years.

Data were collected using a data collection form that included demographics, co-morbidities, medications, laboratory and imaging results, surgical management, intensive care unit (ICU) management and morbidity and mortality. Data were obtained from the medical record and hospital electronic pathology database (CERNER). Severe AP was determined using the modified Glasgow criteria and defined as the presence of three or more criteria.[16] The aetiology of pancreatitis was determined as follows: gallstone pancreatitis if cholelithiasis or choledocholithiasis was demonstrated on abdominal ultrasound (U/S), abdominal CT scan or specific biliary imaging. Pancreatitis due to alcohol, trauma, endoscopic retrograde cholangiopancreatography (ERCP) and medications was based on history. Biochemical results pertaining to serum calcium, triglyceride levels and immunoglobulin 4 were reviewed to identify hypercalcaemia, hyperlipidaemia and autoimmune causes. Idiopathic pancreatitis was diagnosed where no other cause could be established. Pancreatic necrosis was diagnosed based on characteristic CT findings. Patients were classified as having infected pancreatic necrosis if there was evidence of gas in peri-pancreatic or pancreatic tissue or if there was positive microbiology results from pancreatic tissue culture. Statistical analysis of the data was conducted using the Statistical Package for the Social Sciences (SPSS for Windows, Version 14.0; SPSS Inc., Chicago, IL, USA) software for Windows. Statistical tests performed included chi-square test and logistic regression analysis. Two-sided $P < 0.05$ was considered statistically significant.

Results

There were 2414 admissions identified. Four hundred and ten of these represented multiple admissions, in which case data were collected from the first admission. A further 689 admissions were excluded as they did not meet the inclusion criteria. Three hundred and eighty-three admissions were excluded due to insufficient data in the medical records leaving 932 patients in the study.

Clinical data

There were 470 women and 463 men with a median age of 50 (range 16–95). Gallstones (373, 40.0%), idiopathic disease (239, 25.6%) and alcohol (205, 22.0%) were the most common aetiologies. The remaining 12.4% were caused by ERCP (3.9%), medications (2.6%) and other miscellaneous causes. Seven hundred and sixty-four (82%) patients had been or were able to be assigned a modified Glasgow score, 85 of which had severe pancreatitis (11.1%). A more detailed assessment of aetiology and clinical outcomes has been recently published.[17] Seventy-five (8.0%) patients suffered morbidity as a result of pancreatitis. Sixty-five patients (7.0%) suffered a specific pancreatic complication. The most common complications were pancreatic pseudocyst (37) and pancreatic necrosis (33). Nine patients (1%) died in this study, 1.2% of patients with severe pancreatitis and 0.7% with mild pancreatitis.

Audit of management

The management of the patients was compared against current published guidelines[13,14,18] (Table 1).

Mortality

The mortality for mild (0.7%) and severe (1.2%) pancreatitis was relatively low in this series.

Table 1 Management of acute pancreatitis compared with published guidelines

Audit categories	Audit recommendations	Audit findings
Mortality of mild pancreatitis	<10%[18]	1%
Mortality of severe pancreatitis	<30%[18]	1.2%
Idiopathic cases	<20%[18]	25.6%
Abdominal U/S	100%[13,14,18]	74.4%
Early routine CT for diagnostic purposes	0%[13,14,18]	31.1%
CT to assess severity	0%[14]	7.3%
Severe cases in ICU/HDU	100%[18]†	21.2%
Patients with persistent organ failure in ICU/HDU	100%[13,14]	87.8%
Prophylactic IV antibiotics	0%[13,14,18]	15.3%
Prophylactic IV antibiotics in sterile necrosis	0%[13,14]	52.3%
Appropriate empirical IV antibiotics in infected necrosis	100%[13]	83.3%
Definitive management of gallstones within 4 weeks in mild cases	100%[13,14]	38.3%
ERCP <72 h in severe gallstone pancreatitis	100%[18]‡	23.9%
ERCP <24 h in acute pancreatitis and concurrent acute cholangitis	100%[13,14]	12.5%
Enteric feeding commenced <48 h in severe pancreatitis	100%[14]	9.4%
In infected necrosis, intervention§ should be delayed until 4 weeks after initial presentation	100%[13,14]	50%
In infected necrosis, percutaneous or endoscopic drainage should be performed prior to endoscopic or surgical necrosectomy	100%[13,14]	69%

†This recommendation has changed in recent guidelines[13,14] which suggest that patients with severe pancreatitis as defined only by the revised Atlanta Classification, that is, persistent organ failure should be admitted to intensive care units whereas earlier guidelines did not specify a particular severity scoring system. ‡This recommendation has been removed from more recent guidelines[13,14] that state that there is little evidence that ERCP is beneficial in patients with severe gallstone pancreatitis without evidence of cholangitis. §Percutaneous catheter drainage, endoscopic drainage, percutaneous or open necrosectomy. CT, computed tomography; ERCP, endoscopic retrograde cholangiopancreatography; HDU, high dependency unit; ICU, intensive care unit; IV, intravenous; U/S, ultrasound.

Idiopathic pancreatitis

The incidence of idiopathic pancreatitis was 25.6%. All patients with idiopathic pancreatitis had the LFT reviewed. If there was an elevation of LFT twofold above the upper limit of normal, they were considered as possible biliary aetiology. The incidence of idiopathic pancreatitis taking this into account was reduced to 21%.

Abdominal imaging

Six hundred and ninety-three (74.4%) patients in this study had a U/S examination of the gallbladder looking for a biliary cause during the admission. Of the 239 patients who did not receive a U/S, 117 had a previous cholecystectomy but 122 had no history of cholecystectomy.

Early (within 72 h) CT scans were performed in 290 (31.1%) patients to confirm the diagnosis, despite the majority of these patients having typical pancreatic pain and elevated enzymes. A further 68 (7.3%) patients had an early CT scan to assess severity of pancreatitis and 50 (5.4%) patients to assess for localized complications of pancreatitis.

ICU/HDU admission

Sixty-nine patients (7.4%) were admitted to a critical care bed: 59 (6.3%) to intensive care unit (ICU) and 10 patients (1.1%) to high dependency unit (HDU). The median length of stay in ICU/HDU was 6 days (range 1–106) and 36 (52.2%) patients admitted to ICU required artificial ventilation. Eighteen (21.2%) patients with severe pancreatitis (a Glasgow score of 3 or more) were admitted to ICU/HDU. Overall 41 (4.4%) patients developed persistent organ failure during admission and 36 (87.8%) of these were managed in ICU/HDU.

Antibiotics

Two hundred and eighty-six (30.7%) patients received IV antibiotics during admission. Indications for antibiotic use included established extra-pancreatic infection (107, 37.4%), fever (24, 8.4%), sterile pancreatic necrosis (13, 4.5%) and infected pancreatic necrosis (10, 3.5%) (Table S1). Eleven (52.4%) patients with sterile necrosis were commenced on antibiotics with no clear indication. There were 143 (15.3%) patients commenced on IV antibiotics with no appropriate indication.

Laparoscopic cholecystectomy (LC)

Of the 373 patients with gallstone pancreatitis, 231 (61.9%) underwent LC, 148 (64.1%) were performed during the index admission and 83 (35.9%) on a subsequent planned admission, usually within 4 weeks. LC was performed in a further 20 patients in this study, six in patients with alcohol pancreatitis, six in idiopathic pancreatitis and eight in patients with other miscellaneous causes of pancreatitis.

ERCP

A total of 109 patients had ERCP during the admission, 49 (45.0%) of which were performed within 72 h of admission. There were 46 patients with severe gallstone pancreatitis, 11 (23.9%) had an early ERCP and 20 (43.5%) had an ERCP beyond 72 h to manage CBD stones. Fifty-six patients had associated cholangitis and all had an ERCP performed; seven (12.5%) within 24 h, 32 (57.1%) within 72 h and 17 (30.4%) occurred after 72 h.

Nutritional support

Thirty-six (3.9%) patients had enteric feeds with a nasogastric or nasojejunal tube for a median of 12 days (range 1–58). Sixteen (18.8%) patients with severe pancreatitis received enteral feeding compared with 20 (2.9%) patients with mild pancreatitis. Eight (50%) patients with severe pancreatitis were commenced on enteric feeds greater than 48 h from admission.

Pancreatic necrosis

There were 33 (3.5%) patients with pancreatic necrosis. Seventeen (51.5%) patients with necrosis did not require surgical intervention with a zero mortality. Details of radiological, endoscopic and surgical interventions performed in these patients are shown in Table S2. Outcomes for patients with pancreatic necrosis are shown in Table S3. Sixteen (48.5%) patients required intervention with 81% (13/16) morbidity and 13% (2/16) mortality. Patients who required intervention were 14 times more likely to develop general morbidity (odds ratio (OR) 14.08, $P < 0.05$, confidence interval (CI) 2.6–75.8). Intervention was performed within 4 weeks of admission in eight (50%) patients. Patients who received early intervention had a higher morbidity and mortality compared with those who received intervention after 4 weeks (eight of eight patients (100%) versus five of eight patients (63%), $P = 0.055$). Mortality was 13% (1/8) versus 0% ($P = 1.0$). CT-guided drainage was the most commonly performed intervention (eight), followed by open necrosectomy (seven), percutaneous necrosectomy (four) and endoscopic drainage (four). The majority of patients (69%) had CT-guided or endoscopic drainage prior to more invasive interventions. Patients who had either CT-guided or endoscopic drainage performed first had a lower mortality rate; 0% (0/11) versus 40% (2/5) ($P = 0.025$).

Nineteen (58%) patients developed complications of necrosis, which included acute necrotic collection (17), colonic necrosis (three), gastro-pancreatic fistula (one) and splenic vein thrombosis (one). Complications were seven times more likely to occur in those with infected necrosis compared with sterile necrosis (OR 6.67, $P < 0.05$, CI 1.2–38.2). Patients with infected necrosis were five times more likely to suffer general morbidity (OR 4.88, $P < 0.05$, CI 1.0–23.6) and 14 times more likely to develop multiple organ dysfunction syndrome (OR 14.29, $P < 0.05$, CI 1.4–144.4) compared with those with sterile necrosis.

Discussion

This audit has found that AP in Western Sydney is associated with low mortality overall and in patients with severe disease. Our mortality rate of 1% is lower than rates of 1.5–4.2% reported in large epidemiological studies of pancreatitis worldwide.[19–22] Another recent Australian study has demonstrated a low mortality rate of 0.08%.[23] The lower mortality in Australian studies has been attributed to earlier recognition of severe pancreatitis and the appropriate use of intensive care support.[23] Supporting this hypothesis, 88% of patients with persistent organ failure in our study were admitted to ICU/HDU, consistent with the current guidelines.[13,14]

Although the clinical outcomes are good, there was poor compliance with published guidelines as evidenced by (i) overuse of early CT scanning; (ii) under-utilization of U/S; (iii) inappropriate use of

prophylactic IV antibiotics; (iv) incomplete definitive management with LC for gallstone AP; (v) inadequate usage of ERCP for associated cholangitis; (vi) poor compliance for early enteric feeding in severe AP; and (vii) poor compliance with delaying beyond 4 weeks of invasive intervention in patients with infected pancreatic necrosis.

Deficiencies in the appropriate use of imaging were clearly identified in this study. Guidelines recommend that all patients with AP should have an abdominal U/S to demonstrate or exclude gallstone aetiology.[13,14,18] Only 74% of patients had an abdominal U/S. If all patients had a U/S, it is likely that more patients would have had gallstones identified and therefore a reduction in the incidence of idiopathic pancreatitis.

There was a high rate of inappropriate early CT scanning. One-third of patients in this study had a CT scan performed <48 h from admission for diagnostic purposes, while current guidelines state that CT is not required for diagnosis of AP in the majority of cases.[13,14] The guidelines recommend that CT scanning should be performed in patients who fail to improve clinically after 4–5 days to assess the severity and extent of necrosis, as this time interval is when the presence of pancreatic necrosis is most obvious.[13,14] Early CT does not change management, increases the risk of contrast allergy and nephrotoxicity and increases the duration of hospital stay.[24,25]

Fifteen per cent of patients in this study received IV antibiotics with no appropriate indication. Current guidelines recommend that antibiotics should be given for extra-pancreatic infection (including cholangitis), and are not recommended for prophylaxis.[13,14,18] This recommendation is based on meta-analyses that have failed to show improvement in outcomes with prophylactic antibiotics[26] and studies demonstrating an increased risk of pancreatic fungal infection with routine antibiotic use.[27]

Although 40% of patients had biliary pancreatitis, less than 70% had a LC within the recommended 4-week time frame. Previous audits worldwide have found the majority of patients do not have cholecystectomy performed within 4 weeks of admission.[8,9,12] Reasons for non-compliance in previous studies were limitations in access to operating theatre time rather than poor clinical decision making.[9,12] Given that a delay of more than 4 weeks is associated with recurrent gallstone pancreatitis or presentations with other complications of gallstones disease,[28] it is important that the study hospitals address this shortfall. Nepean and Westmead Hospitals have adopted an Acute Surgical Unit model for the care of acute general surgical admissions with a protocol to perform LC during the index admission for biliary pancreatitis.

One outcome that deviated greatly from audit standards was urgent ERCP for patients with concurrent cholangitis. Current guidelines recommend that ERCP should be performed <24 h in patients with concurrent cholangitis.[13,14] Only 12.5% of patients with concurrent cholangitis underwent ERCP within the first 24 h, whereas 57% underwent ERCP within the 72 h. The difficulty in obtaining timely ERCP has also been seen in previous audits worldwide, with compliance rates of generally <50%.[7,9,12] This is likely to stem from limited hospital resources, particularly as two of the study hospitals do not have ERCP facilities and patients must await transfer to a specialist unit.

Early nutritional support with nasoenteric or nasogastric feeding has been demonstrated to result in improved clinical outcomes in patients with severe pancreatitis with reduced infective complications, reduced bed stay and a tendency towards improved mortality.[29] Enteral nutrition is recommended in all patients with severe pancreatitis, and best outcomes are seen when commenced within 48 h.[14] This was used in less than 20% of patients with severe pancreatitis in this study, and less than 10% of patients were commenced on enteric feeds within 48 h. Based on the guidelines early enteric feeding is required in all patients with moderately severe and severe AP.

In patients with pancreatic necrosis, there was some deviation from guideline standards. Fifty per cent of patients received invasive interventions for infected necrosis, including either percutaneous/endoscopic drainage or percutaneous/open necrosectomy, within 4 weeks of admission. Current guidelines recommend that intervention should be delayed for at least 4 weeks in infected necrosis to allow liquefaction of contents and the development of walled-off necrosis.[13,14] Delaying invasive intervention in this group of patients is known to decrease morbidity and mortality.[30] It is also recommended that the optimal intervention strategy involves firstly performing percutaneous or endoscopic drainage followed by percutaneous, endoscopic or open necrosectomy if required.[13,14] By performing minimally invasive approaches first and delaying necrosectomy, there is a decreased risk of organ failure, surgical complications and mortality.[31,32] Sixty-nine per cent of patients in our study received minimally invasive interventions before necrosectomy, demonstrating fair compliance with guidelines. We also demonstrated a significant decrease in mortality and morbidity when the initial intervention occurred after 4 weeks. The morbidity and mortality was also reduced in patients who had minimally invasive interventions first.

This study highlights poor compliance with a number of guideline standards. Suboptimal adherence to management guidelines is not unique to the study hospitals, and audits of AP overseas have shown similar deficiencies.[7,9,12,33] The study hospitals have initiated protocols for the early assessment and treatment of AP and further audits will assess the compliance and subsequent outcomes. We recommend the adoption and auditing of strict protocols for the management of patients presenting with AP by surgical departments.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Indications for IV antibiotics in acute pancreatitis.
Table S2. Radiological, endoscopic and surgical interventions in pancreatic necrosis.
Table S3. Outcomes for patients with pancreatic necrosis.