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Brief Report

Assessing the CT findings and clinical course of ED patients with first-time versus recurrent acute pancreatitis

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ABSTRACT

Study objectives: The primary objective of this study was to compare Emergency Department patients with first-time versus recurrent acute pancreatitis.
Methods: This study was a retrospective chart review of patients with a diagnosis of acute pancreatitis who presented to a single academic urban emergency department from 2012 to 2016. Criteria for inclusion were clinical symptoms of pancreatitis, age greater than or equal to 18 years, ED diagnosis of acute pancreatitis, and an abdominal CT scan within 24 h of triage. Exclusion criteria were traumatic mechanism and pregnancy. Charts were reviewed by a minimum of two trained abstractors using structured data collection sheets and discrepancies were resolved by a third abstractor. Patients with first time acute pancreatitis versus recurrent acute pancreatitis were compared to determine differences in characteristics, management and disposition.
Results: 250 patients were included in the study. Of these, 165 patients had first-time acute pancreatitis and 85 patients had recurrent acute pancreatitis. Demographics, vital signs and initial lab values were the same in both groups. Patients with recurrent acute pancreatitis were more likely to have significant findings on CT (Modified CT Severity Index, 2.09 versus 1.43, $p < 0.05$), more likely to require IV opiates (96% versus 75%, $p < 0.001$) and less likely to need ICU admission (8% versus 19%, $p = 0.03$).
Conclusion: ED patients with recurrent acute pancreatitis demonstrated more significant findings on CT compared to patients with first-time acute pancreatitis but were less likely to require ICU admission.

1. Introduction

1.1. Background

Acute pancreatitis has an incidence of 5 to 35 per 100,000 people in the US and the incidence is rising [1,2]. Diagnosis is made through a combination of clinical symptoms, blood tests and imaging. Due to the severity of the pain and the inability to tolerate food or liquids, acute pancreatitis is commonly treated in the ED [3]. 17% of patients with acute pancreatitis develop recurrent acute pancreatitis and 8% of patients with recurrent episodes develop chronic pancreatitis [4]. Severe acute pancreatitis is associated with a mortality rate of 16.3% [5].

1.2. Importance

While the cornerstones of diagnosis of acute pancreatitis are the clinical presentation and elevated pancreatic enzymes, CT scan is commonly used to confirm the diagnosis and to estimate the severity of the disease [6]. Current risk stratification tools do not consider whether acute pancreatitis is recurrent or first-time as a marker of severity. Greater awareness of the severity of recurrent acute pancreatitis could expedite more aggressive efforts to avoid future morbidity and mortality.

1.3. Goals of this investigation

The objective of this study is to compare the differences in patients with first-time acute pancreatitis versus recurrent acute pancreatitis.

2. Methods

2.1. Study design and setting

This study is a retrospective chart review at a single academic urban emergency department from 2012 to 2016. This study was approved by the Institutional Review Board with a waiver of consent from all participants. For all subjects, data abstraction was performed from electronic chart review (Cerner) Charts were reviewed by a minimum of two

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trained abstractors using structured data collection sheets and discrepancies were resolved by a third abstractor. CT Scans were graded using the Modified CT Severity Index (MCTSI) which grades acute pancreatitis by the presence of inflammation, fluid accumulation, necrosis or extra-pancreatic findings [7].

2.2. Selection of participants

Eligible patients were screened through a query of the Cerner electronic medical record for patients with a final ED diagnosis of acute pancreatitis (ICD-9 577.0) After initial screening, a chart review was performed to confirm that patients met inclusion criteria including (1) clinical symptoms of pancreatitis (a chief complaint that listed symptoms such as abdominal pain, nausea or vomiting), (2) age greater than or equal to 18 years, (3) an abdominal CT scan within 24 h of triage and exclusion criteria including traumatic causes or pregnancy.

2.3. Data abstraction and quality assessment

Data was recorded in structured data collection sheets which included the following data elements: demographics, history of acute pancreatitis, history of recent alcohol use or alcohol abuse, opiate administration, white blood cell count and CT scan findings. Patients were categorized as having an episode of recurrent acute pancreatitis if a history of pancreatitis was documented anywhere in their electronic medical record. Patients were classified as first-time acute pancreatitis if the pancreatitis was not documented anywhere in their medical record. CT findings were graded using the Modified CT Severity Index (MCTSI), which was developed by Balthazar and colleagues to distinguish mild, moderate, and severe forms of pancreatitis [7,8]. As seen in Fig. 1, this index gives a score out of 10 indicating the amount of pancreatic inflammation and necrosis and is based on the presence of inflammation, fluid accumulation, necrosis, or extra-pancreatic findings. Scores of 0–2, 4–6, and 8–10 correlate to mild, moderate, and severe pancreatitis, respectively. Patients were considered to have significant comorbidity if they had any of the following: chronic renal insufficiency/failure, liver cirrhosis, congestive heart failure, immunocompromised, cerebrovascular disease or cancer [9].

2.4. Data analysis

Continuous and discrete data were summarized using mean or median (standard deviation or variance) and frequency (percentage), respectively. *t*-Test was used to compare normally distributed continuous variables, and Wilcoxon Rank Sum for non-normally distributed continuous variables. Chi-square/Fisher's exact test was performed to compare discrete variables. An alpha of 0.05 was used as the cutoff for significance. Recurrent pancreatitis was also modeled as a function of selected patient and clinical characteristics using logistic regression. Basic demographic variables were included including age, sex and BMI, as well as clinical and treatment characteristics that were hypothesized to be related to recurrent pancreatitis. All analyses were performed using SAS 9.4 (SAS Institute, Cary, NC)

2.5. Outcome measures

The primary outcome measured was the severity of pancreatitis using the MCTSI in first time vs. recurrent pancreatitis. Secondary outcomes included clinical characteristics, ICU admissions, total hospital length of stay, and amount of opiate received.

Modified CTSI Pancreatic inflammation
0: normal pancreas 2: intrinsic pancreatic abnormalities with or without inflammatory changes in peri-pancreatic fat 4: pancreatic or peri-pancreatic fluid collection or peri-pancreatic fat necrosis
Pancreatic necrosis
0: none 2: 30% or less 4: more than 30%
Extra-pancreatic complications
2: one or more of pleural effusion, ascites, vascular complications, parenchymal complications and/or gastrointestinal involvement
Total score
Total points are given out of 10 to determine the grade of pancreatitis and aid treatment:
0-2: mild 4-6: moderate 8-10: severe

* Scores are generated by estimating pancreatic inflammation and necrosis to give a score out of 10.

Fig. 1. Modified CTSI pancreatic inflammation 0: normal pancreas 2: intrinsic pancreatic abnormalities with or without inflammatory changes in peri-pancreatic fat 4: pancreatic or peri-pancreatic fluid collection or peri-pancreatic fat necrosis Pancreatic necrosis 0: none 2: 30% or less 4: >30% Extra-pancreatic complications 2: one or more of pleural effusion, ascites, vascular complications, parenchymal complications and/or gastrointestinal involvement Total score Total points are given out of 10 to determine the grade of pancreatitis and aid treatment: 0–2: mild 4–6: moderate 8–10: severe *Scores are generated by estimating pancreatic inflammation and necrosis to give a score out of 10.

3. Results

3.1. Characteristics of study subjects

In total, 250 patients were included in the study. Of these, 85 patients presented with recurrent acute pancreatitis and 165 patients presented with first-time acute pancreatitis. The median ages for first time and recurrent pancreatitis were 55 and 53, respectively. Females represented 37% (n = 76) of patients in the first-time pancreatitis group and 30% (n = 32) in the recurrent pancreatitis group. Patients with first-time pancreatitis reported a mean triage pain score of 8 while those with recurrent pancreatitis had a mean triage score of 9 (p = 0.002). The ICU disposition was 19% (n = 30) for first-time pancreatitis and 8% (n = 7) for recurrent pancreatitis (p = 0.03). Median initial lipase was 981 units/L for first-time pancreatitis and 579 units/L for recurrent pancreatitis (p = 0.0002) (Table 1).

We calculated the mean MCTSI score in both groups and found a significantly higher rate of severity in recurrent acute pancreatitis versus first-time acute pancreatitis (2.09 vs. 1.43, p < 0.05) (Fig. 1) 75% (n = 123) of the patients with first-time acute pancreatitis received opiates while 96% (n = 82) of recurrent pancreatitis patients received opiates (p < 0.0001). The quantity of intravenous opiates received, measured by morphine mg equivalents (MME), was significantly higher in the recurrent vs. first time patients (10 MME vs. 5 MME, p < 0.05).

When modeling recurrent pancreatitis as a function of selected patient and clinical characteristics using logistic regression (Table 2), it was found that intravenous (IV) opiates were more likely to be used in the patients with recurrent disease but IV fluid was less likely to be used. This suggests that clinicians are more focused on pain control with recurrent acute episodes and aggressive resuscitation with first-time episodes.

4. Discussion

In our study, ED patients with recurrent acute pancreatitis were more likely to present with more significant findings on abdominal CT than those experiencing a first-time episode of acute pancreatitis. This study underscores the progressive nature of acute pancreatitis and suggests that a history of recurrent episodes should be considered when deciding to perform an ED abdominal CT.

Our study should be viewed in the context of current guidelines that recommend that CT scans should not be performed routinely for acute pancreatitis in the first 48 h because of delayed presentation of complications such as pseudocysts or necrosis [10]. In this study, a relatively high rate of patients with first-time acute pancreatitis (n = 17, 10%) and with recurrent acute pancreatitis (n = 20, 23%) had a MCTSI score greater than or equal to four within 24 h of ED presentation. An MCTSI of four indicates signs of necrosis, inflammation or extra-pancreatic manifestations. Significant CT findings have the potential to change management including the use of antibiotics, surgical debridement or interventional radiology to drain infected pseudocysts.

The current understanding of pancreatitis is that disease progresses from acute to chronic pancreatitis due to accumulated damage from prior attacks [11]. Patients with a higher CT severity index have been shown to have higher mortality and morbidity [12]. In our study, the higher MCTSI scores in recurrent episodes may reflect progression of disease over time.

We did not demonstrate that patients with recurrent attacks also demonstrated greater clinical severity. In fact, patients with first-time acute pancreatitis were admitted to the ICU at a higher rate and higher lipase levels than patients with recurrent disease. It is interesting to note that none of the commonly used clinical risk assessment scores such as the Atlanta classification, the Ranson's Criteria, the Acute Physiology and Chronic Health Evaluation (APACHE) score or the Modified Glasgow Acute Pancreatitis Severity Score consider a history of acute pancreatitis to be a predictor of disease severity [13]. In addition, the relative amount of lipase elevation is not known to correlate with disease severity. In fact, patients with recurrent episodes of acute pancreatitis may not mount a lipase elevation due to the observation that the pancreas will eventually become “burned out” and lose exocrine function.

Our study is significant in that it focuses on characterizing differences between recurrent episodes of acute pancreatitis and first-time acute pancreatitis. Since most cases of acute pancreatitis are caused by modifiable risk factors such as alcohol abuse or biliary disease, a better understanding of disease progression may help clinicians address these risk factors at the time of the first event or sooner. For patients with the first episode of acute pancreatitis, providing alcoholism treatment, encouraging dietary modifications and referring to gall bladder surgery may lead to a decrease in recurrence and avoidance of the worsening sequelae [14]. ED intervention for an acute event has been shown to be an effective means of secondary prevention for other chronic diseases [15].

4.1. Limitations

Our findings should be considered with the following design features. First, study participants were required to have a CT scan within 24 h of ED presentation. However, this requirement differs from current clinical practice, in which not all patients presenting to the ED with

Table 1
ED patients with acute pancreatitis

	First time N = 165	Recurrent N = 85	p value
Body mass index (BMI) (median)	26.87	26.46	0.32
Age (years) (median)	55	53	0.31
Female	37%	30%	0.20
Fever (>38 °C)	1.8%	0%	0.21
Triage pain score (median)	8	9	0.002
Initial creatinine mg/dL (median)	0.8	0.8	0.44
Triage Heartrate (bpm) (median)	88	86	0.99
WBC > 12,000/mm^3 (%)	27.8%	18.8%	0.12
HCT (%)	39%	39%	1
Lactate (mmol/L)	2.48	1.55	0.18
Initial lipase units/L (median)	981	579	0.0002
Significant co-morbidity	24%	27%	0.55
Alcohol positive	58%	52%	0.41
Symptom duration <48 h	33.7%	42.4%	0.18
Received opiates	75%	96%	<0.0001
Median IV opiates (morphine mg equivalents)	5	10	<0.05
Median liters IV fluid in first 24 h	3	2	0.10
ICU dispo	19%	8%	0.03
Median total hospital LOS (days)	2	2	0.96
Median MCTSI	1.43	2.09	<0.001
MCTSI 0 (n, %)	68, 41%	24, 28%	
MCTSI 2 (n, %)	81, 49%	41, 48%	
MCTSI 4 (n, %)	13, 8%	13, 15%	
MCTSI 6 (n, %)	4, 2%	6, 7%	
MCTSI 8 (n, %)	0, 0%	1, 1%	

Table 2
Predictors of recurrent pancreatitis

	Odds ratio	95% confidence interval
Body mass index (BMI)	1.00	(0.95, 1.04)
Age (years)	1.00	(0.97, 1.02)
Female vs. male	0.64	(0.34, 1.20)
Triage temperature	0.98	(0.47, 2.07)
Triage systolic blood pressure	1.00	(0.99, 1.01)
Initial creatinine mg/dL	0.97	(0.82, 1.16)
Triage heartrate (bpm)	1.00	(0.98, 1.06)
Significant co-morbidity vs. none	1.08	(0.50, 2.33)
Alcohol positive vs. negative	0.73	(0.39, 1.36)
IV opiates (morphine mg equivalents)	1.09	(1.04, 1.13)
Liters IV fluid in first 24 h	0.74	(0.61, 0.90)
Total hospital LOS (days)	0.99	(0.93, 1.05)

suspected acute pancreatitis receive a CT scan in the first 24 h [10,16]. We may have been more likely to enroll patients in whom radiation exposure was of less concern, diagnosis was less clear or clinical severity was higher. Second, our study was limited to a single tertiary care center in the US with easy access to intensivists and advanced imaging which may limit the generalizability. Third, a power analysis was not completed a priori and sample size was chose based upon dates of electronic medical record query. Fourth, while we queried whether patient had a history of alcohol abuse or biliary disease, we did not distinguish if the suspected cause of acute pancreatitis was alcohol-related or gallstones. Finally, our study was a retrospective review which may lead to unknown confounders between the two groups.

5. Conclusion

In conclusion, ED patients with recurrent acute pancreatitis are more likely to present with a more severe episode of acute pancreatitis than patients presenting with first-time acute pancreatitis as measured by CT scan of the abdomen.

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