

The utility of early cross-sectional imaging to evaluate suspected acute mild pancreatitis

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Abstract

Background There are roughly 300,000 hospitalizations for acute pancreatitis annually in the United States. Many of the affected patients at our institution undergo computed tomography (CT) or magnetic resonance imaging (MRI) unnecessarily early during their admissions. We hypothesize that cross-sectional imaging within 48 h of admission in patients meeting the criteria for acute, mild pancreatitis is over-utilized and does not change management.

Methods We performed a retrospective analysis of patients with a discharge diagnosis of acute pancreatitis from our tertiary care institution from January 1, 2010 to December 31, 2015. Inclusion criteria were a lipase more than three times the upper limit of normal and clinical suspicion of pancreatitis. Exclusion criteria were an etiology of pancreatitis following endoscopic retrograde cholangiopancreatography, recurrent or chronic pancreatitis, severe pancreatitis, and ultrasound findings being the reason for imaging.

Results Of the 166 patients who met the criteria for analysis, 105 (63.3%) underwent cross-sectional imaging within 48 h of presentation (CT: 104, MRI: 1). Of the examined CTs, 27 (26.0%) showed no abnormality and 55 (52.9%) revealed uncomplicated pancreatitis. The remaining 22 (21.2%) demonstrated at least one of the following: local complications, biliary ductal dilatation or other findings. On thorough chart review, only two patients received a beneficial change in management as a result of the early imaging.

Conclusions This analysis supports current guidelines that early cross-sectional abdominal imaging (CT or MRI) in patients with suspected acute mild pancreatitis does not alter medical management. Early imaging may lead to unnecessary resource use and patient irradiation.

Keywords Pancreatitis, cross-sectional studies, quality improvement

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Introduction

Acute pancreatitis is responsible for roughly 330,000 emergency department visits and 240,000 hospital admissions in the United States (US) annually and its incidence continues

to rise worldwide [1-3]. Though the overwhelming majority (80%) of patients diagnosed with acute pancreatitis have mild, self-limited disease [4], this condition is responsible for \$2.5 billion of annual US health care expenditure [1].

National guidelines strongly recommend that the diagnosis of acute pancreatitis be based on the presence of 2 of the 3 following criteria: abdominal pain consistent with the disease, serum amylase and/or lipase greater than three times the upper limit of normal, and characteristic findings on abdominal imaging. Contrast-enhanced computed tomography (CECT) and magnetic resonance imaging (MRI) of the pancreas should be reserved for those patients in whom the diagnosis is unclear or who fail to improve clinically within the first 48-72 h after hospital admission, or to evaluate complications [5]. Since roughly 40% of cases of acute pancreatitis are related to gallstone disease [4,6,7], transabdominal ultrasound is recommended in all patients with acute pancreatitis [5]. Alcohol consumption (30%) is the next most prevalent cause of pancreatitis, and all other

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etiologies (hypertriglyceridemia, drug-related, autoimmune disease, others) are each responsible for 5% of cases or less [4]. Some of the reasons for the recommendation against the routine use of early cross-sectional imaging are that it does not contribute meaningfully to immediate care or prognosis [8,9], and it is inaccurate in detecting pancreatic necrosis [10].

Despite the straightforward national recommendations, it is our observation that patients at our institution often undergo cross-sectional imaging (CECT or MRI) early in their hospital course to evaluate their first episode of pancreatitis. We hypothesize that early cross-sectional imaging in patients who meet the criteria for an initial episode of acute, mild pancreatitis at presentation is over-utilized and does not affect management.

Patients and methods

This retrospective, single-center study examined all patients admitted to our tertiary care institution with a discharge diagnosis of acute pancreatitis between January 1, 2010 and December 15, 2015. Inclusion criteria were a lipase of greater than three times the upper limit of normal at our institution (>186 U/L) and abdominal pain suspicious for pancreatitis. These criteria were gathered via chart review of laboratory studies and clinical notes. Amylase data were not used because this test has lower sensitivity and specificity compared to lipase [11]. Since this study focused on initial cases of acute, mild pancreatitis, we excluded patients with recurrent or chronic pancreatitis, organ failure on admission [12], those with Bedside Index of Severity of Acute Pancreatitis scores of 3 or greater on admission [13], those who had imaging specifically to rule out a non-pancreatic process, and those who underwent imaging to further evaluate abnormalities seen on ultrasound. Patients who had undergone endoscopic retrograde cholangiopancreatography were also excluded, as it would be difficult to determine whether providers ordered imaging out of concern for perforation.

We evaluated all patients who underwent early cross-sectional imaging, defined as a CECT or MRI performed on the day of (Day 0) or the day after (Day 1) admission. This methodology included all patients who underwent cross-sectional imaging within 48 h of admission. We chose this method rather than a strict calculation relative to time of admission, so that we could better capture the decision-making processes of hospital providers, who typically round and make decisions on a daily schedule rather than based on the exact time since a patient's presentation.

Institutional Review Board (IRB) approval was granted for this study. All data were analyzed in a secure database to protect patient confidentiality, in accordance with our IRB's policy.

Results

One hundred sixty-six patients met the criteria for analysis (Table 1). These patients were predominantly African-American

(77.7%) and the etiology of pancreatitis was overwhelmingly related to alcohol (47.6%) or gallstone disease (24.1%).

Of the 166 patients included, 105 (63.3%) underwent cross-sectional imaging on Day 0 or Day 1 of hospital admission, 104 with CECT and one with MRI (Table 2). Of the 104 CECT patients, 55 (52.9%) had focal or diffuse pancreatic enlargement and/or peripancreatic inflammation without other abnormalities. These findings are consistent with uncomplicated pancreatitis [14]. Findings were normal in 26 (26.0%) of the patients who underwent early CECT and in the one patient who had early MRI.

Of the remaining patients, 10 (9.5%) had local complications of pancreatitis, such as an acute fluid collection (4), pseudocyst (1), or pancreatic necrosis (5). Two of the patients with pancreatic necrosis underwent repeat imaging during their hospitalization: one was found to have pseudocyst formation and the other walled-off necrosis. Neither of these patients

Table 1 Characteristics of patients admitted with acute mild pancreatitis (n=166)

Characteristics	Value
Mean age, years (standard deviation)	45.4 (14.0)
Male sex	85 (52.3 %)
<i>Race</i>	
African-American	129 (77.7%)
Caucasian	16 (9.6%)
Hispanic	15 (9.0%)
Other	21 (12.7%)
<i>Etiology</i>	
Alcohol	79 (47.6%)
Gallstone	40(24.1%)
Idiopathic	28 (16.9%)
Other	19 (11.4 %)

Table 2 Findings in patients who underwent early cross-sectional imaging (n=105)

Findings on early imaging	Imaging modality	
	CECT (104)	MRI (1)
Uncomplicated pancreatitis	55 (52.9%)	1 (100%)
Normal	27 (26.0%)	-
Local complications†	10 (9.5%)	-
Biliary ductal dilatation	7 (6.7%)	-
Other‡	9 (8.6%)	-
Alterations in management	2 (1.9%)§	-

†Acute fluid collection (4 patients), pseudocyst (one patient), pancreatic necrosis (5 patients)

‡Insignificant incidental findings or provided no new information

§Atypical Crohn's disease, neuroendocrine tumor

CECT, contrast-enhanced computed tomography; MRI, magnetic resonance imaging

required intervention for these findings. Seven (6.7%) patients had biliary ductal dilatation on CECT. However, the use of CECT was inappropriate in 5 of these cases, as this finding was present on right upper quadrant ultrasound, and CECT did not contribute further to management. Nine (8.6%) patients had other findings on CECT, which included incidental findings that were insignificant or information that had been obtained already via other imaging.

Two (1.9%) patients benefitted from CECT. One was diagnosed with biliary ductal dilatation and a pancreatic mass (neuroendocrine tumor). This patient did not initially undergo an ultrasound examination. Another patient also had biliary ductal dilatation and was ultimately diagnosed with an atypical presentation of Crohn's disease. This patient did have an ultrasound examination, which did not demonstrate the ductal dilatation found on CECT.

Of the 105 patients who underwent cross-sectional imaging, 25 (24%) had a repeat examination during their hospitalization. All had CECT as their initial imaging modality. Eighteen (17%) had this repeat imaging within 7 days of the initial imaging (Table 3) and it did not reveal new significant information in any case. Seven (6%) patients underwent repeat imaging seven days or more after initial imaging; this subset of patients had a higher frequency of local complications than the rest of the cohort, but no changes in management or interventions were required as a result of the repeat imaging findings. Of the patients who underwent early cross-sectional imaging, alcohol was the etiology of pancreatitis in 42.9% of cases, gallstones in 23.8%, idiopathic in 20.0%, and other causes in 13.3%.

Three patients died during the examined hospitalization. Two deaths were due to complications of pancreatitis (acute respiratory distress syndrome in one patient, decompensation of cirrhosis in the other) and one was due to a non-pancreatic cause.

Of the 166 patients analyzed, 50 (30.1%) underwent transabdominal ultrasound as their only form of imaging. An additional 35 patients underwent transabdominal ultrasound in conjunction with a cross-sectional modality, so a total of 85 (51.2%) had ultrasound as part of their evaluation.

Table 3 Findings in patients who underwent repeat cross-sectional imaging within 7 days of the initial imaging examination (n=18). The initial modality was CECT in all cases

Findings on imaging within 7 days	Repeat imaging modality	
	CECT (5)	MRI (13)
Uncomplicated pancreatitis	4	4
Normal	1	3
Local complications†	-	3
Other‡	-	6
Alterations in management	-	-

†Acute fluid collection (3 patients)

‡Insignificant incidental findings or confirmation of known findings

CECT, contrast-enhanced computed tomography; MRI, magnetic resonance imaging

Discussion

Our results indicate that early cross-sectional imaging and repeat cross-sectional imaging is over-utilized in patients with a first episode of mild, acute pancreatitis and does not significantly change their management. Almost two-thirds of patients (63.6%) underwent imaging on Day 0 or 1 of their hospital admission, despite having already met the criteria for the diagnosis of acute pancreatitis at presentation, based on national guidelines [5]. Of the 105 patients who underwent cross-sectional imaging within the first two days of admission, only 2 (1.9%) had changes in management attributable to the early imaging. Close examination of these two patients demonstrated that guideline-based practice might have led to similar care: one did not undergo an indicated ultrasound that would probably have found a biliary duct dilation prior to CECT; the other's management was unlikely to have been changed if the CECT had been obtained at the recommended 48-72 h after admission instead of on Day 1.

These findings agree with multiple other studies that early cross-sectional imaging is not always useful when managing pancreatitis and infrequently changes management [9,10,15]. Despite these studies, cross-sectional imaging has remained a part of usual practice and its use may even be increasing [15,16].

Repeating cross-sectional imaging was frequent in our cohort, as 25 of the 105 (24%) patients who underwent initial imaging underwent additional CECT or MRI during their hospitalization. In all cases, either the initial or the repeat imaging was redundant and did not contribute to care. This is a source of largely unnecessary imaging that has not been explored in previous studies.

In the current era of cost conscious medicine, unnecessary imaging in acute pancreatitis should be a focus of improvement. Patients with mild pancreatitis are estimated to have a mean cost of \$8130 for an admission alone [17], in addition to the cost of lost production [18]. Decreasing imaging may reduce those figures, not only because of the direct decrease in radiology costs, but also by eliminating unneeded consultations, tests, or medication adjustments (e.g., unwarranted antibiotic use) related to the imaging findings. The increased utilization of transabdominal ultrasound, already recommended for patients with uninvestigated pancreatitis, may prevent the reflexive ordering of cross-sectional imaging as an initial test. In our study, only 51.2% of patients underwent a transabdominal ultrasound.

Reduction in cross-sectional imaging may also benefit patients by reducing their exposure to radiation. While there are as yet no direct data regarding cancer risk [19], reduction in radiation exposure seems prudent and is a focus of investigation in the radiology community [20,21].

Although this study did not specifically focus on why cross-sectional imaging was used in our cohort, reasons that have been found for its overutilization in general include knowledge deficit, fear of missing a diagnosis, anxiety about medico-legal risk, and concerns about patient satisfaction [22,23]. Gastroenterologists are not often consulted on patients with mild, acute pancreatitis and practitioners who treat them may

not be familiar with guideline-based indications for cross-sectional imaging in these patients. Focusing on scenarios when consultants are not routinely involved in continuing medical education courses may be helpful. Imaging decision support may have a role in some healthcare systems to contribute to the prudent use of resources [22]. Making practitioners aware of their imaging ordering habits relative to colleagues may also be useful. Equipping practitioners with more specific knowledge about the dangers of radiation may help in instances where patient satisfaction is driving excessive imaging.

Fear of missing a diagnosis may have been reflected in the ordering habits we observed, as patients with idiopathic etiology were slightly overrepresented in the group who underwent imaging as compared to the overall cohort (20.6% vs. 16.9%). Patients with an alcoholic etiology were underrepresented in the imaging group as compared to the overall cohort (42.9% vs. 47.6%), which may indicate more confidence in the clinical diagnosis.

Imaging may play a role in helping to determine the severity of pancreatitis and for planning purposes in those patients who are at risk for developing severe pancreatitis and/or pancreatic-related necrosis, as perfusion CT has shown some promise in these situations [24]. However, our study shows that patients with mild, acute pancreatitis do not need this kind of predictive imaging routinely.

The size of the patient cohort is a strength of this study. Our inclusion and exclusion criteria yielded a population that has not been explicitly evaluated in prior literature on this topic. Weaknesses of this study include its retrospective nature and the fact that follow up was not examined for these patients. It is also difficult to know for certain if these patients actually did have a prior episode of pancreatitis not reported to the treating

physician. Associated medical comorbidities and their effects were not recorded, though our mortality rate was similar to that in other populations [13]. It is important to note that our population was largely African-American, and that our study took place in a teaching center.

This single-center trial demonstrates that early and repeated cross-sectional imaging is frequently performed in patients who present with acute, mild pancreatitis, but very rarely does this strategy lead to information that would not have been known if guideline-based practice had been followed.

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Summary Box

What is already known:

- Acute pancreatitis is a significant contributor to healthcare utilization
- Currently accepted guidelines recommend cross-sectional imaging only in certain situations for patients with acute pancreatitis

What the new findings are:

- For patients with mild acute pancreatitis, many decisions to obtain cross-sectional imaging do not follow guidelines
- Cross-sectional imaging performed against the recommendations of guidelines rarely contributes useful information
- Renewed emphasis on guideline-based care for those with mild acute pancreatitis may reduce costs and the harmful effects of excess imaging

- independent predictors in correlation with patient outcomes. *Radiology* 2011;**258**:174-181.
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