Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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BRIEF COMMUNICATIONS

Clinical Outcomes of Acute Pancreatitis in Patients With Coronavirus Disease 2019

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Acute pancreatitis (AP) is one of the most common gastrointestinal causes of hospitalization, with a reported annual incidence ranging from 4.9 to 35 per 100,000 individuals in the United States.[1] The diagnosis is established with at least 2 of the following criteria: abdominal pain consistent with AP; elevation in serum amylase and/or lipase greater than 3 times the upper limit of normal; and suggestive findings of AP in cross-sectional abdominal imaging. It may range from a mild acute interstitial pancreatitis to a more severe necrotizing pancreatitis with substantial associated morbidity and mortality.[2]

Since the emergence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic in December 2019, a few studies have reported a potential pancreatic injury in association with SARS-CoV-2 infection attributed to either a direct cytopathic effect of the virus or subsequent to the associated systemic inflammatory response.[3,4] SARS-CoV-2 was previously detected in several organs including the pancreas; the virus targets angiotensin-converting enzyme 2, which is highly expressed in the pancreatic β-cells. Viral-mediated damage has been seen to cause persistent hyperglycemia even in patients without preexisting diabetes.[5,6]

As little attention has been paid to the natural course of AP in patients with coronavirus disease 2019 (COVID-19), we report the clinical outcomes of these patients from 7 hospitals in Minnesota during a 4-month period.

Methods

A retrospective analysis of all patients managed within the MHealth Fairview System (an expanded collaboration among the University of Minnesota, University of Minnesota Physicians, and Fairview Health Services) between March 1 and June 30, 2020, was performed for the occurrence of AP. The study protocol was approved by the institutional review board. Inpatient adults with an established diagnosis of AP who underwent polymerase chain reaction (PCR) testing for SARS-CoV-2 on nasopharyngeal swabs, during the index admission or within 14 days before hospitalization, were included. Patients with positive PCR test results constituted 1 study cohort, and those with negative test results made up the comparison arm. Data were collected on baseline characteristics, etiology of AP, Bedside Index of Severity in Acute Pancreatitis (BISAP) scores, clinical and radiologic outcomes, length of stay, intensive care unit admissions, requirement of mechanical ventilation, and mortality. A Charlson Comorbidity Index, which predicts 10-year survival in comorbid patients, was calculated for all included participants.

The primary outcome assessed was index admission mortality. Secondary outcomes included organ failure, multiorgan failure (MOF), persistent organ failure (POF), length of stay, intensive care unit stay, need for mechanical ventilation, and pancreatitis-related outcomes (pattern, incidence of infected necrosis, splanchnic venous thrombosis, and acute endocrine insufficiency). A t test or analysis of variance was used for the comparison of continuous variables, and the chi-square test was used for the comparison of categorical variables. All analyses were performed by using SAS, version 9.4 (SAS Institute, Cary, NC).

Results

Table 1 displays the baseline characteristics and clinical outcomes of AP among individuals with and without positive SARS-CoV-2 PCR results. Out of 339 patients with AP treated during the study period, 75 patients (22%) with documented PCR testing for SARS-CoV-2 were included, of whom 14 patients (18.7%) tested positive for COVID-19. The demographic composition was similar in both arms, and no significant differences were observed in relation to age (mean ± standard deviation: 48.4 ± 14.1 years vs 55.2 ± 14.8 years; $P = .76$), sex ($P = .77$), ethnicity ($P = .77$), or body mass index ($P = .95$) between the COVID-19–positive and –negative cohorts.

Patients with AP and COVID-19 had higher Charlson Comorbidity Index ($P = .003$) and BISAP scores ($P < .0001$) on presentation. Alcoholic and idiopathic AP were the predominant diagnoses among the COVID-19–negative and –positive cohorts, respectively ($P < .0001$). Mortality was significantly higher in patients with AP and coexisting COVID-19 ($P = .004$). This cohort also showed a significantly higher incidence of MOF ($P < .0001$) and POF ($P < .0001$). However, there were no significant differences in AP pattern ($P = .63$), incidence of infected necrosis ($P = .74$),

Abbreviations used in this paper: **AP, acute pancreatitis; BISAP, Bedside Index of Severity in Acute Pancreatitis; COVID-19, coronavirus disease 2019; MOF, multiorgan failure; POF, persistent organ failure; PCR, polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.**

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Table 1. Baseline Characteristics and Clinical Outcomes of Patients With AP, Divided by Status of SARS-CoV-2 PCR Testing

Variable	SARS-CoV-2 PCR negative (n = 61)	SARS-CoV-2 PCR positive (n = 14)	*P* value
Age, *y*, mean (±SD)	48.4 (±14.1)	55.2 (±14.8)	.76
Sex: female, n (%)	34 (56)	7 (50)	.77
Race: white, n (%)	48 (79)	11 (79)	.77
BMI ≥30 kg/m^2, n (%)	18 (29.5)	4 (28.6)	.95
CCI score, n (%)			
1–2	57 (93.4)	9 (64.3)	.003
3–4	4 (6.6)	5 (35.7)	
≥5	0	0	
Etiology, n (%)			
Alcohol	39 (64)	3 (29)	<.0001
Gallstone	19 (31)	1 (7)	
Idiopathic	1 (2)	8 (57)	
Other	2 (3)	1 (7)	
BISAP score, n (%)			
<3	58 (95)	8 (57)	<.0001
≥3	3 (5)	6 (43)	
Pattern, n (%)			
Interstitial	55 (90)	12 (86)	.63
Necrotizing	6 (10)	2 (14)	
Organ failure, n (%)			
None	47 (77)	4 (29)	<.0001
Isolated circulatory	0	0	
Isolated respiratory	2 (3)	0	
Isolated renal	9 (15)	2 (14)	
Renal and respiratory combined	3 (5)	6 (43)	
Triple organ failure	0	2 (14)	
Persistent organ failure, n (%)	5 (8)	8 (57)	<.0001
Infected necrosis, n (%)	3 (5)	1 (7)	.74
Splanchnic venous thrombosis, n (%)	4 (7)	2 (14)	.31
Acute endocrine insufficiency, n (%)	4 (7)	1 (7)	>.99
ICU stay, *d*, mean (±SD)	0.75 (±3.6)	3.6 (±4.3)	.35
Mechanical ventilation, n (%)			
None	58 (95)	8 (57)	.62
Noninvasive	3 (5)	4 (29)	
Invasive	0	2 (14)	
LOS, mean (±SD)	6.5 (±6.7)	10.8 (±7.2)	.67
Mortality, n (%)	1 (2)	3 (21)	.02

BMI, body mass index; CCI, Charlson Comorbidity Index; ICU, intensive care unit; LOS, length of stay; SD, standard deviation.

splanchnic venous thrombosis ($P = .3$), or acute endocrine insufficiency ($P > .99$) between the 2 cohorts.

Discussion

We report here the clinical outcomes of patients with AP admitted to our hospital system during the onset of the US COVID-19 outbreak. Overall, morbidity and mortality were significantly greater in patients with AP with positive PCR results, suggesting a deleterious relationship between the 2 processes. Whether the SARS-CoV-2 aggravated the ongoing inflammatory state of pancreatitis and resulted in worse outcomes is not certain, but it is plausible. Of note, because AP was the primary admission diagnosis in the majority of the study population, the higher in-hospital mortality in patients with concomitant AP and COVID-19 is not simply explained by an overall sicker COVID-19 cohort. Furthermore, it appears that the severity of AP on presentation was a major contributor to mortality, as predicted by higher BISAP scores in this cohort.

The coexistence of AP and COVID-19 has also resulted in a higher incidence of MOF and POF, perhaps signifying overactivation of the inflammatory cascade. Although both AP and COVID-19 have been linked to thrombotic and glycemic complications,[7,8] we did not observe a significant difference in the incidence of splanchnic venous thrombosis or acute endocrine insuffiency between these cohorts. The risk of future diabetes mellitus was difficult to determine given the lack of long-term follow-up.

This study has several limitations. First, we did not collect detailed data on some features of COVID-19, such as inflammatory makers, that may prove important to stratify disease severity. Second, this was an observational study from different hospitals, and therefore, data documentation was not standardized. Despite these limitations, the size of this cohort allows us to present a reasonable picture of AP in patients with coexisting COVID-19.

In summary, these data suggest a yet to be delineated complex interaction between AP and COVID-19 that places the patient at a higher risk of MOF, morbidity, and mortality. A better understanding of this relationship will better guide clinicians on early management strategies and focus medical resources toward those patients at risk for worse outcomes.

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Conflicts of interest
The authors disclose no conflicts.