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Ascites, Pleural, and Pericardial Effusions in Acute Pancreatitis

A Prospective Study of Incidence, Natural History, and Prognostic Role

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Ascites and pleural and pericardial effusions can be observed during acute pancreatitis. The aims of this study were to evaluate their incidence, natural history, and prognostic role in patients with acute pancreatitis. One hundred patients consecutively admitted with a diagnosis of acute pancreatitis were prospectively submitted to abdominal, pleural, and cardiac ultrasonography at admission and during follow-up. Ascites was found in 18 patients, pleural effusion in 20, and pericardial effusion in 17. Twenty-four patients of this series had severe pancreatitis; three of them died. All effusions disappeared spontaneously in patients who survived pancreatitis up to two months after dismissal. At multivariate analysis ascites and pleural effusion were demonstrated to be accurate independent predictors of severity. The respective odds ratios were 5.9 [95% confidence interval (CI), 1.5–23.0%) and 8.6 (95% CI, 2.3–32.5%). Furthermore the presence of pleural effusion, ascites, and pericardial effusion were associated with an increased incidence of pseudocyst during follow-up. Ascites and pleural and pericardial effusions are frequent during acute pancreatitis. Pleural effusion and ascites are accurate predictors of severity in these patients.

KEY WORDS: acute pancreatitis; pleural effusion; pericardial effusion; ascites.

Ascites, pericardial effusion, and pleural effusion can be observed during acute pancreatitis (1–3). Their presence has been explained by different pathogenic mechanisms (4–6), but no prospective study has ever investigated their clinical relevance. The aims of this study were to detect ascites and pleural and pericardial effusions by ultrasonography in patients with acute pancreatitis. We also evaluated their natural history and their role in predicting a severe prognosis.

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MATERIALS AND METHODS

We have prospectively enrolled all patients ($N = 100$) consecutively admitted to our institution (1988–1992) with acute pancreatitis. The diagnosis of acute pancreatitis was made by consistent clinical findings and plasma amylase levels >900 IU/liter as well as by ultrasonographic, computed tomographic, or surgical evidence of pancreatic inflammation. There were 46 women and 54 men with a mean age (±SD) of 54.6 ± 18.5 years (range 12–84 years). Ultrasonography was performed in all patients within three days of admission using commercially available real-time sonographic units with 3.5-MHz or 5-MHz transducers. Ascites was diagnosed according to the suggestions of Goldberg et

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TABLE 1. RANSON'S CRITERIA OF SEVERITY

At admission
Age > 55 yr
WBC > 16,000/mm^3
Glucose > 200 mg/dl
LDH > 350 IU/liter
AST > 250 U/liter
During initial 48 hr
Hct decrease of > 10
BUN increase of > 5 mg/dl
CA^{2++} < 8 mg/dl
P_aO_2 < 60 mm Hg
Base deficit > 4 meq/liter
Fluid sequestration > 6 liter

TABLE 2. RESULTS OF STUDY*

	No eff.†	*Ascites*	*Pleural eff.*	*Pericardial eff.*	
				Moderate	*Discrete*
Incidence	60	18	20	4	13
Severe pancreatitis	4	10	14	0	7
Pseudocyst	5	7	8	2	5
Exitus	0	3	3	0	2

* Total patients with acute pancreatitis: $N = 100$; total patients with severe pancreatitis: $N = 24$; total patients with pseudocyst: $N = 16$; patients who died: $N = 3$; patients with two or three effusions: $N = 11$.

† No eff: Absence of effusion; pleural eff.: pleural effusion; pericardial eff.: pericardial effusion.

al (7), while pleural effusion was diagnosed using the criteria of Muller (8). All patients had echocardiography within three days of hospitalization. In two patients echocardiography was not carried out because of technical problems. M-mode and two-dimensional echocardiogram were performed using commercially available ultrasound machines. Pericardial effusion was considered present when an echo-free space that persisted throughout the cardiac cycle, between the posterior epicardium and a poorly moving or flat pericardium, was found. When an anterior echo-free space was also found a "discrete" pericardial effusion was diagnosed. Finally when the echo-free space was >1.0 cm a severe pericardial effusion was defined (9). Abdominal and pleural ultrasonography were repeated when clinically useful during hospitalization (at least once a week) and every month after leaving the hospital until the effusion disappeared. Echocardiography was carried out only at admission and every month after release until the effusion disappeared. All patients were checked for Ranson's prognostic indices (Table 1) (10). Acute pancreatitis was considered severe when: the patient died or organ failure and/or local complications were evident (10–12). We diagnosed organ failure when shock, pulmonary insufficiency, renal failure, and gastrointestinal bleeding were observed. Local complications were pancreatic necrosis, abscess, and pseudocyst.

Sensitivity, specificity, positive and negative predictive values, and odds ratios with 95% CI were calculated for all the predictors. The significance of association with severe pancreatitis was tested by means of chi-square with Yates' correction when appropriate. Multiple logistic regression analysis was carried out to eliminate confounding factors and to evaluate the best predicting variables.

RESULTS

In our series, acute pancreatitis was associated with gallstones in 67 patients, alcohol in 4, endoscopic retrograde cholangiopancreatography in 15, and with other etiologies in 5; in nine patients acute pancreatitis was defined idiopathic. Only three patients died (pancreatic abscess and disseminated intravascular coagulation in one, pancreatic necrosis and respiratory distress syndrome in two cases). In another 21 patients pancreatitis was considered severe (local complications in 21, systemic complications in 13 patients). We diagnosed ascites by ultrasonography in 18 patients (Table 2). In only one of them ascites was evident at physical examination. Pleural effusion was present in 20 (left in 12, right in 4, bilateral in 4); in three of them the diagnosis was clear at physical examination (Table 2). Echocardiography showed pericardial effusions in 17 patients. In 13 of them a discrete effusion was diagnosed; in the other four only a posterior echo-free space was found (Table 2). No patient had any specific symptom for pericarditis, and none of them showed any significant alterations on physical examination and electrocardiogram. Ascites disappeared in all surviving patients before they were dismissed from the hospital. Three patients were dismissed with pleural effusion, but it disappeared within two months. Pericardial effusion was present in four patients at dismissal, but it disappeared within the first month of follow-up. We did not observe any new diagnosis of ascites or pleural effusion during ultrasonographic follow-up after admission.

We did not find any association between ascites, pleural and pericardial effusions, and patient age, gender, or etiology of acute pancreatitis. Ascites and pleural and discrete pericardial effusion along with some prognostic criteria suggested by Ranson (10) were demonstrated to be predictors of severity (Table 3).

Only five of 16 patients with bilateral or left pleural effusion also had pericardial effusion; likewise only three patients with ascites had also pericardial effusion.

The three patients who died had pleural effusion and ascites; two of them also had pericardial effusion, and the third was not submitted to echocardiography for technical reasons.

We diagnosed the presence of pseudocyst during

TABLE 3. SENSITIVITY (SENS), SPECIFICITY (SPEC), POSITIVE AND NEGATIVE PREDICTIVE VALUE (PPV, NPV), AND ODD RATIOS (OR) WITH 95% CONFIDENCE INTERVAL (CI) IN PREDICTORS OF SEVERE ACUTE PANCREATITIS*

	Sens	*Spec*	*PPV*	*NPV*	*OR*	*95% CI*
Fluid deficit, b†‡	16.7	100	100	79.2	25.8	1.3–519.5
Pleural effusion, a	58.3	92.1	70	87.5	16.3	5.1–52.3
Hypoxemia, a‡	29.2	96.1	70	81.1	10.0	2.3–42.8
Hyperglycemia, a§	33.3	94.7	66.7	81.8	9.0	2.4–33.6
Ascites b	41.7	89.5	55.6	82.9	6.1	2.0–18.1
Ranson's > 2, b¶	56.5	75.0	40.6	85.1	5.3	1.6–17.2
Pericardial eff., c**	30.4	92.0	53.8	81.2	5.0	1.5–17.0
Leucocytosis, a§	58.3	77.6	45.2	85.5	4.1	1.8–12.9
Hyperazotemia, c‡	50.0	75.0	38.7	82.6	3.0	1.2–7.8

* Total patients with Acute pancreatits: $N = 100$; patients with severe pancreatitis: $N = 24$).

† a, $P < 0.001$; b, $P < 0.005$; c, $P < 0.05$.

‡ During initial 48 hr: fluid deficit = estimated fluid sequestration more than 6000 ml; hypoxemia = arterial PO_2 below 60 mm Hg; hyperglycemia = blood glucose over 200 mg/100 ml; Leukocytosis = white blood cell count over 16,000/mm^3; hyperazotemia = blood urea nitrogen rise more than 5 mg/100 ml.

§ At admission: hyperglycemia = blood glucose over 200 mg/100 ml; leukocytosis = white blood cell count over 16,000/mm^3.

¶ Ranson's > 2: more than 2 Ranson's prognostic criteria (7).

** Only discrete pericardial effusion was considerated (with an anterior and posterior echo-free space < 1.0 cm between epicardium and pericardium).

hospitalization in 16 patients. Pseudocyst developed in 40% of patients with pleural effusion, in 38.9% of patients with ascites, and in 38.5% of patients with discrete pericardial effusion. On the other hand pseudocyst developed in 10% of patients without pleural effusion ($P < 0.01$), in 10.9% of patients without ascites ($P = 0.01$), and in 11.7% of patients without discrete pericardial effusion ($P < 0.05$). Furthermore, 30.5% of patients with at least one effusion developed a pseudocyst during follow-up, while only 7.8% of patients without any effusion developed pseudocyst ($P < 0.05$). At multivariate analysis, only pleural effusion, hyperglycemia, hypoxemia, and ascites were independent predictors; pleural effusion was the most accurate (Table 4).

TABLE 4. ESTIMATED LOGISTIC MODEL FOR PREDICTING PRESENCE OF SEVERE ACUTE PANCREATITIS

	OR	*95% CI*
Pleural effusion	8.6	2.3–32.5
Hyperglycemia	8.3	1.7–41.5
Hypoxemia	7.8	1.2–48.8
Ascites	5.9	1.5–23.0

DISCUSSION

In this study we have demonstrated that ascites and pericardial and pleural effusions may frequently complicate acute pancreatitis. In all our patients pleural and pericardial effusions were asymptomatic, small and, in most of the patients, occasionally diagnosed by ultrasonography. Only one patient had massive ascites, and he died of pancreatic abscess.

In our population we observed a low mortality (3%) for a selection of patients admitted in a department of internal medicine. It is unlikely that this selection may have biased our results because our prevalence of severe pancreatitis is similar to that given in other reports (13, 14).

Pleural effusion and ascites were shown to be independent predictors of severity, and their presence was associated with development of pseudocyst during follow-up. In our experience pleural effusion was more accurate than Ranson's criteria in predicting severity, but a larger series of patients will be necessary to confirm this result. Several reports have described the presence of ascites and pleural or pericardial effusions during acute pancreatitis (1–3). Ours is

the first prospective study in which ultrasonography was used to diagnose effusions. We used ultrasonography because it is inexpensive, noninvasive, and more accurate than other techniques in diagnosing effusions (7–9).

Ascites is a well-known complication of acute pancreatitis (15) and in our study we showed an incidence of 18%. Pleural effusion was a complication in 20% of our patients. This incidence is larger than the 4–17% reported in literature (14), probably because ultrasonography is highly sensitive in diagnosing pleural effusion (8). Left-side effusion was more frequent than bilateral or right-side effusion according to other reports (16). Pericardial effusion has been reported in several case reports and in a small series of patients with alcohol-induced acute pancreatitis (6). Our incidence, 18%, is lower compared to 48% reported in alcoholic acute pancreatitis (6). In our population, alcohol was associated with acute pancreatitis in only four patients: three of them had pericardial effusion. The low prevalence of alcoholic pancreatitis in our series is due to the low prevalence of alcoholism in Sicily; on the other hand, we have a relatively high prevalence of ERCP-related pancreatitis because of the presence in our department of an endoscopic unit with a large number of interventional biliary sphinterotomies performed each year. Discrete pericardial effusion was a predictor of severity at univariate analysis, but this result was not confirmed at multivariate analysis. Discrete pericardial effusion was also significantly associated to the development of pseudocyst during follow-up.

The mechanism causing pleural and pericardial effusion in acute pancreatitis is not completely known, while ascites seems to be secondary to a pancreatic duct disruption with leakage of pancreatic secretions directly into the peritoneal cavity (4). A direct link between the pleural space and the pancreatic bed or an intraabdominal or intrathoracic pancreatic pseudocyst may explain some large pleural effusions (17), but a more likely course is via the transdiaphragmatic lymphatic channels. In fact this interpretation may explain the high incidence of small pleural effusions diagnosed in our series and the predilection for the left-side effusion shown in several studies and confirmed in our population: in fact, pancreatic lymphatics are juxtaposed to the left hemidiaphragm (18). The mechanism of pericardial effusion is also not fully understood. A communication from the pancreatic bed to the pericardial space has been demonstrated in some patients (6). In patients with a mediastinal pseudocyst or pancreatic pleural effusion, results of endoscopic or operative pancreatography have shown that the communication of the pleural space with the pancreatic bed has usually been through the posterior mediastinum and the aortic or esophageal hiatus. Such a communication may overlie the posterior pericardium or enter the pericardial space, producing pericardial effusion. Our experience does not confirm this hypothesis: in fact only five of 16 patients with left pleural effusion had also pericardial effusion, and 12 patients with pericardial effusion had no effusion in left pleural space. Alternatively, it is likely that pancreatic enzymes may be transported hematogenously or across the diaphragm through lymphatics or that the pericardial effusion may be due to pericardial fat necrosis (6).

We conclude that ascites and pleural and pericardial effusions are frequent during acute pancreatitis, but they usually disappear spontaneously in the first weeks after remission of the disease. Pleural effusion and ascites are accurate predictors of severe pancreatitis, so we suggest searching for them by ultrasonography in all patients admitted in hospital with acute pancreatitis. Larger studies are needed to clarify the clinical utility of detecting pericardial effusion in patients with acute pancreatitis.

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