The Pleuropulmonary Manifestations of Pancreatitis*

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INTRODUCTION

The presence of certain classical signs, symptoms, and altered laboratory determinations are the most reliable factors available to diagnose accurately an acute episode of pancreatitis. In recent years, several roentgenologic features have come to be associated with pancreatitis and serve as corroborative evidence of the presence of the disease when some other stigmata may not be demonstrable. Ileus with air-filled loops of small bowel, widening of the duodenal sweep due to an edematous pancreatic head, and stippled calcification of the pancreas indicating previous insults to the organ are well-documented roentgenologic signs employed in the diagnosis of acute pancreatitis.1,2

Hulten,3 and Schieppati and Vernengo4 were among the first observers to report the x-ray evidence of pleural effusion accompanying acute pancreatitis. Case,1 in the Caldwell Lecture of 1939, referred to the formation of pleural exudates, particularly on the left side, in this disease. Glenn and Baylin5 confirmed this finding and postulated that coexistent inflammatory changes occurring in or beneath the diaphragm were the cause of fluid accumulation in the left hemithorax. In a report on several unusual features of acute inflammatory disease of the pancreas, Coffey6 noted the occurrence of left pleural effusion in six patients. Two of those requiring thoracentesis for massive collections subsequently were noted to have high titer of amylase in the pleural effusion.

The disproportionate elevation of pleural fluid amylase above that found in the serum has been demonstrated on several occasions.7-9

As interest has heightened in the subject of roentgen-ray changes accompanying pancreatic disease, the following intrathoracic changes have been reported: interlobar cicatrical adhesions,1 localized diaphragmatic elevation secondary to subphrenic collections,11 and empyema or supplicative mediastinitis following perforation of an infradiaphragmatic abscess.12,13 These changes, however, must be regarded as indicative of complications occurring late in the course of an episode of pancreatitis.

Focal plate-like atelectasis and basilar pneumonitis, in the absence of a history of prolonged recumbency, aspiration or previous operative procedures, occur with a fair degree of regularity.14,15 Pleural reaction or effusion, plate-like atelectasis and basilar infiltration are three findings easily detected by chest x-ray film examination, and may appear early in the course of an attack of acute pancreatitis when the proper diagnosis may not yet be apparent.

The following report deals with the occurrence of pleuro-pulmonary changes in acute pancreatitis and attempts to evaluate the specificity of these lesions in pancreatic disease.

MATERIAL

From the Departments of Medicine and Surgery of The Johns Hopkins Hospital, 155 clinically proved cases of acute pancreatitis were reviewed. All patients included in the study had normal chest x-ray films, either at the onset of their illness or at a prior examination. No patient was included who had a history of physical or roentgen-ray findings of chronic pulmonary disease. In no instance was a chest lesion considered significant if an operative pro-
procedure had been performed prior to the demonstration of the roentgen-ray change. Any patient with a positive chest x-ray film whose sputum culture grew out pathogens was eliminated. No patient was included more than once in the series in spite of subsequent acute attacks of pancreatitis. Finally, all diagnoses of acute pancreatitis were documented by serial serum amylase determinations.

In order to ascertain what the influence of another acute intra-abdominal inflammatory process might be upon the development of supradiaphragmatic disease, 100 case records of patients with uncomplicated acute cholecystitis were reviewed. The criteria for inclusion in the series were similar to those for the patients with pancreatitis.

**RESULTS**

From a total of 155 cases of acute pancreatitis, 22 (14.2 per cent) demonstrated radiographic evidence of acute nonbacterial pleuropulmonary disease. Only six patients (6.0 per cent) with acute cholecystitis were found to have chest roentgen-ray changes (Table 1).

In the pancreatitis group, there were six instances of pleural effusion, one on the right side, four on the left, and one bilateral. Basilar infiltrates were diagnosed by x-ray film in nine patients, five on the right, three on the left, and one bilateral. "Pleural reaction" was interpreted in four patients, twice on the right side, once on the left, and once bilaterally. Plate-like atelectasis was present in three patients, on the

**Table 1—Pleuropulmonary Manifestations in Acute Pancreatitis (JHH—1952-1958)**

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<tr>
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<tr>
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<td>Pleural Reaction</td>
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**Figure 1A**

FIGURE 1A: Chest x-ray films of a 40-year-old man who, on the fourth hospital day, was found to have a serum amylase of 1110 and a concurrent pleural fluid amylase of 2988. A pseudocyst of the pancreas was later drained and the patient recovered uneventfully thereafter. PA and lateral chest films on the third hospital day demonstrated left pleural effusion. A follow-up chest film revealed complete resolution of the pleural effusion.

**Figure 1B**

FIGURE 1B: Chest x-ray films of a 40-year-old man who, on the fourth hospital day, was found to have a serum amylase of 1110 and a concurrent pleural fluid amylase of 2988. A pseudocyst of the pancreas was later drained and the patient recovered uneventfully thereafter. PA and lateral chest films on the third hospital day demonstrated left pleural effusion. A follow-up chest film revealed complete resolution of the pleural effusion.
right in two, and on the left in one (Table 2). In the latter case, it was associated with a markedly elevated diaphragm overlying a massive pseudocyst.

The therapy employed in the treatment of acute pancreatitis was, in all cases, quite individualized. However, continuous nasogastric aspiration, antibiotic therapy, intravenous fluid and electrolyte replacement, suppression of intestinal and biliary motility, and sedation were the principal adjuvants relied upon in most instances.Thoracentesis was performed in four cases and the amylase values confirmed the fact that the concentration of this enzyme is greater in the pleural fluid than in the serum when an effusion accompanies acute pancreatitis.

An example of this finding was a 40-year-old man who, on the fourth hospital day, was found to have a serum amylase of 1110 and a concurrent pleural fluid amylase of 2988. He developed a pseudocyst of the pancreas which later was drained operatively. The fluid contained within the cyst had an amylase value of 2430 units (Figure 1). The remainder of the patients with pleural effusion were clinically free of pseudocyst formation. There were two deaths in the group of six patients with effusion. Two of the four patients with pleural reaction succumbed. There was no death in the groups with either basilar infiltrates or atelectasis.

The occurrence of pulmonary infiltrates associated with pancreatitis is illustrated by the following case summary. A 51-year-old white man with a three-day history of crampy, aching peri-umbilical pain radiating to both flanks was admitted with an initial serum amylase of 750. He was treated nonoperatively over a period of the next two weeks. A chest film taken on the fourth hospital day showed the left costophrenic angle, as well as the left diaphragmatic leaf obliterated by an infiltrate which appeared to be present posteriorly. The remainder of the lung fields were clear. Repeat film taken on the eighth hospital day showed some clearing of the base of the left lung. On the 16th hospital day, he was explored intra-abdominally and found to have an extensive area of liquefaction necrosis in the retroperitoneal fat behind the splenic flexure. This was drained and the remainder of his hospital course was uneventful.

The charts of 100 patients with acute cholecystitis were reviewed also. In only

![Figure 2A](image1.png) ![Figure 2B](image2.png)

**Figure 2A** Chest x-ray films of a patient with left lower chest and left upper quadrant pain. Sputum and pleural fluid cultures were negative for tubercle bacilli. After several weeks, an open biopsy of the lung and parietal pleura was performed, and for the first time the pleural fluid was sampled for amylase. The biopsy report revealed normal lung and pleura. The pleural fluid amylase was 390 with a concurrent serum amylase of 240. The patient returned several months later with another attack of acute pancreatitis.
six instances could reports of positive chest changes be found. Basilar atelectasis occurred in four patients, while pleural reaction was noted in two (Table 3). None of these patients expired, and their chest roentgenologic changes were quite minimal and transient. There was no indication that the course of their biliary disease was altered by the presence of these chest lesions, nor that the lesions occurred in more severely ill patients. On the other hand, there was an impression gained that the patients with pleural or pulmonary parenchymal lesions accompanying pancreatitis seemed to experience a more fulminating variety of their disease as demonstrated by the fact that four of the 22 patients with chest roentgenologic changes had pseudocysts requiring surgical procedures, and four patients with roentgenologic changes died. At the time of the latest follow-up, the chest lesions of all surviving pancreatitis patients showed thorough resolution.

DISCUSSION

It is generally recognized that in a small percentage of patients with acute inflammatory disease of the abdomen, transient pleuropulmonary lesions may be demonstrated radiographically during the acute phase of their primary illness. These supradiaphragmatic changes are probably related to the location and intensity of the inflammatory process beneath the diaphragm. The development of basilar plate-like atelectasis is fostered by the presence of diaphragmatic irritation and visceral displacement or distension. The radiographic appearance of pleural reaction may result from a contiguous inflammatory process in the underlying diaphragmatic leaf, or the retroperitoneal or extrapleural tissues to which an organ such as the pancreas had direct access. It appears then that these changes are relatively nonspecific and that even in the presence of acute pancreatitis they are simply pulmonary and pleural manifestations of intra-abdominal inflammatory disease. The association of nonbacterial basilar infiltrates with acute pancreatitis may be due to a high incidence of unrecognized tracheal aspiration soon after the onset of the illness. Any other relationship could not be uncovered by this study.

The occurrence of pleural effusion concomitant with pancreatitis appears, however, to be a bona fide manifestation of that disease. The mechanism by which the effusion forms has never been demonstrated with certainty. However, it has been shown that stimulation of the pancreas in patients with or without disease of that organ will cause the discharge of pancreatic enzymes into the thoracic duct lymph. This pathway of secretion undoubtedly accounts for the early rise of serum amylase in an acute episode of pancreatitis. It is not difficult then to accept a proposal that a transmural migration of pancreatic fluid from the thoracic duct occurs. A sterile chemical inflammation is induced which then allows permeation of the parietal pleura. The effusion, which is rich in amylase content, is usually self-limiting and will either resorb or fail to recur following thoracentesis and the subsidence of the acute attack.

All but one of the observed cases of pleural effusion were detected early in the course of the illness. Two patients with pleural effusion were misdiagnosed clinically, one as having tuberculous pleural effusion and the other as effusion secondary to congestive heart failure. Only when serum amylase determinations were performed seven to ten days after admission was the proper diagnosis made and treatment instituted.

A patient not included in the present series was admitted recently with a several months' history of intensive left lower chest and left upper quadrant nonradiating pain. A chest x-ray film revealed a significant
left pleural effusion which was found to be blood on several thoracenteses (Figure 2). A presumptive diagnosis of tuberculosis was made, but sputum and effusion cultures failed to grow tubercle bacilli. As a result, an open biopsy of the lung and parietal pleura was performed, and for the first time the pleural fluid was sampled for amylase determination. The resultant value was 390 with a concurrent serum amylase of 240. Hammarsten, et al., have found that in patients with proved acute pancreatitis with pleural effusion the amylase content of the effusion is invariably higher and declines more slowly than the simultaneous serum amylase. They also demonstrated that in a number of other diseases accompanied by pleural effusion (heart failure, tuberculosis, Hodgkin’s disease, carcinoma of the lung, postpneumonic effusion, cirrhosis, and empyema), the pleural fluid amylase was invariably lower than the serum amylase.

The clinical manifestations of pancreatitis are protean in their presentation, and the severity of the symptoms is not always commensurate with the gravity of the illness. Any measure which can be taken which will afford early recognition of the disease and immediate institution of therapy may be of life-saving significance. Should the impression be valid that pleural reaction or effusion occurs in patients with less than favorable prognoses, the chest x-ray film examination becomes a diagnostic tool of immeasurable value.

SUMMARY

One hundred and fifty-five cases of clinically proved pancreatitis were reviewed in order to determine the incidence of concurrent acute chest roentgenologic changes. The criteria for inclusion in this series necessitated that all patients have the established diagnosis of pancreatitis, supported by one or more elevated serum amylase determinations. All patients under consideration had normal chest x-ray films, either at the onset of their illness or at a prior examination. None had a history of physi-cal or roentgenologic findings of chronic pulmonary disease. No chest lesion was considered significant if an operative procedure had been performed prior to the demonstration of the roentgen change. Any patient with a positive chest x-ray film whose sputum culture grew out pathogens was eliminated.

Twenty-two patients (14.2 per cent) were noted to have x-ray findings of pleural effusion, pleural reaction, plate-like atelectasis, or basilar infiltrates. Nine of these reactions were in the left chest, nine in the right, and three bilateral.

One hundred cases of acute cholecystitis were also reviewed, and a 6 per cent incidence of minimal, transient chest roentgenologic changes were noted.

Familiarity with the significance of these roentgenologic changes in acute pancreatitis will help establish the early recognition of this potentially lethal disease.

RESUMEN

Ciento cincuenta y cinco casos de pancreatitis clínicamente demostrado fueron revisados para determinar la frecuencia de alteraciones comitant es en el torax. El criterio para la inclusión de esta serie requirió que todos los enfermos tuviesen un diagnóstico fundado de pancreatitis sustentado por una o más determinaciones de amilasa sérica elevada. Todos los enfermos considerados tenían radiografía de torax normales ya al principio de la enfermedad o antes. Ninguno tuvo antecedentes físicos o a los rayos X de enfermedad pulmonar crónica. Ninguna lesión consideró de significación si había el antecedente de una intervención quirúrgica antes de descubrirse el cambio radiológico.

Cualquier enfermo en quien hubiese una radiografía positiva y cuyo esputo mostrase crecimiento de algún germen patógeno se eliminó.

Vientidos enfermos (14.2 por ciento) tenían hallazgos de derrame pleural, reacción pleural, atelectasía en placas o infiltrados basales. Nueve de estas reacciones fueron en el lado izquierdo del torax, nueve en el derecho y tres fueron bilaterales.

Cien casos de colecistitis aguda también se revisaron y un 6 por ciento de cambios radiológicos mínimos y transitorios se observaron.

La familiaridad con la significación de estos cambios radiológicos en la pancreatitis aguda ayudará a descubrir tempranamente esta enfermedad potencialmente letal.
RESUME

L'auteur passe en revue 155 cas de pancréatite cliniquement démontrée pour déterminer la fréquence des altérations radiologiques aigües du thorax. N'étaient compris dans ce groupe que les malades ayant un diagnostic certain de pancréatite établi par une ou plusieurs preuves de l'élévation de l'amylase du sérum. Tous les malades pris en considération avaient des clichés radiologiques du thorax normaux, soit lors de l'apparition de leur maladie ou au cours d'un examen antérieur. Aucun n'avait dans ses antécédents une constatation radiologique ou physique d'affection pulmonaire chronique. Aucune lésion thoracique ne fut considérée comme significative si une opération chirurgicale avait été pratiquée avant la mise en évidence de l'altération radiologique. Tout malade ayant montré un cliché radiologique du thorax positif et dont l'expectoration avait révélé à la culture des germes pathogènes a été éliminé.

On nota que 22 malades (14,2%) avaient des signes radiologiques d'émanchesment pleural, de réaction pleurale, d'atélectasie ou des infiltrats de bases. Dans neuf cas parmi ces réactions, les altérations étaient situées dans le thorax gauche, neuf dans le droit et de trois étaient bilatérales.

100 cas de cholestéatite aiguë furent également passés en revue, et un taux de 6% d'altérations radiologiques du thorax minimes et transitoires fut noté.

La connaissance et la signification de ces altérations radiologiques dans la pancréatite aiguë permettra d'établir le diagnostic précoce de cette affection qui peut entraîner la mort.

ZUSAMMENFASSUNG


22 Patienten (14,2%) wurden ermittelt, die Röntgenbefunde in Form pleuraler Ergüsse, pleuraler Reaktionen, plattenförmiger Atelektase oder basilärer Infiltrate aufwiesen. 9 von diesen Reaktionen betrafen die linke Thoraxhälfte, 9 die rechte und 3 waren beiderseits.

100 Fälle von akuter Cholecystitis wurden ebenfalls durchsucht und ein Vorkommen minimaler flächiger Thoraxröhrenveränderung in 6% festgestellt. Verträglichkeit mit der Bedeutung dieser röntgenologischen Veränderungen bei akuter Pankreatitis wird dazugehört, diese potentiell letale Erkrankung frühzeitig zu erkennen.

References