overall mortality, of the order of 10–25% in several collected series (Bigler, 1960; Marshall and Hartzog, 1964; Sarmiento, 1966). More frequent early surgical intervention with antibiotic cover might conceivably lead to a reduction in this figure.

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Lipomatous pseudohypertrophy of the pancreas associated with chronic pulmonary suppuration in an adult

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Summary

This report describes a man who died at the age of 43 of overwhelming pulmonary suppuration in association with pancreatic steatorrhoea. Autopsy revealed lipomatous pseudohypertrophy of the pancreas. The patient is the longest documented survivor with pulmonary complications of lipomatous pseudohypertrophy of the pancreas. The literature on this rare condition is reviewed.

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Case report

A 42-year-old insurance broker was first seen at the Brompton Hospital in July 1971. At the age of 8 investigations into recurrent lower respiratory tract infections had revealed a collapsed left lower lobe and a haemoglobin concentration of 8.6 g/100 ml. He received postural drainage and remained healthy during his school years. In his early 'teens he received a course of deep X-ray therapy for a low back pain with complete and permanent relief of symptoms. At the age of 20, he was discharged from

the Royal Navy following four episodes of pneumonia in 8 months, and over the next 10 years was absent from work up to 5 times annually as a result of pneumonia. Bronchography revealed a collapsed left lower lobe with extensive bronchiectasis: the remaining bronchial tree was normal. A left lower lobectomy was performed and symptoms were greatly relieved until the return of recurrent cough with copious purulent sputum 11 years later. Bronchography showed extensive bronchiectasis in the right middle and left upper lobes and lingula: the right lower lobe was markedly shrunken. He received a number of antimicrobial agents, but his sputum remained purulent; effort dyspnoea, and subsequently dyspnoea at rest developed. He had not smoked since his early teens.

Throughout adult life he had noticed up to three loose bowel actions daily, with pale, bulky stools. There was no relevant family history.

On examination he was a pale thin man of normal stature, who was breathless on talking. There was marked finger clubbing, and bronchial breathing with coarse rales throughout the right lower chest and in the left mid-zone.

Investigations

Chest radiograph: patchy consolidation throughout the lower half of each lung, with appearances of underlying bronchiectasis. $FEV_1/FVC = 0.8$ 1/1.5 l (predicted 3.6/4.5) Arterial blood gases pCO_2 32 mm Hg, pO_2 45 mm Hg, Hb 10.4 g/100 ml; ESR 118 mm in 1 hr; white cell count 18,500/cc.; 91% neutrophils; serum iron 46 mg/100 ml; TIBC 312 mg/100 ml. Serum B_{12} , folate, calcium, phosphorus, SGOT, SGPT, bilirubin, alkaline phosphatase, urea and electrolytes, amylase and alpha-1-antitrypsin were all within normal limits. Total plasma proteins 6.7 g/100 ml; albumen 2.7; globulin 4.0. A 24-hr urine collection contained 340 gm of protein but no sugar. Sputum cytology and *M. tuberculosis* cultures were repeatedly negative. Sweat sodium and chloride levels were within normal limits on two occasions.

Immunological investigations failed to demonstrate evidence of immune deficit. Cell-mediated immunity was intact (Tuberculin test, DNCB, *Candida* skin test), salivary and circulating immunoglobulins were not deficient, lymphocyte transformation, complement, serum bactericidal and opsonizing activity were normal, and challenge with oral poliovirus produced a normal antibody response.

Three-day stool collection contained an average of 24 g fat/24 hr. Faecal tryptic activity was one-eighth of normal. Xylose absorption test was normal. Rectal biopsy material contained no amyloid. Barium swallow meal and follow-through revealed no intrinsic bowel disease. Pancreatic calcification

was not demonstrated. Pelvic radiographs showed bilateral sacro-iliitis consistent with ankylosing spondylitis. Jejunal biopsy and estimation of urinary indicans were not performed.

Treatment

He was treated with physiotherapy, antibiotics and oral pancreatic supplements with improvement. His weight rose progressively for 3 months, his stool frequency diminished and his exercise tolerance improved. The average daily faecal fat fell to 8 g. His sputum, however, remained purulent and copious (150–200 g daily) and he was treated empirically with gamma-globulin with an initial reduction in volume and tenacity of the sputum but subsequent downward progression to death from sputum retention and respiratory failure in April 1972.

Autopsy

This showed bilateral bronchiectasis and purulent retained secretions, together with generalized emphysema and focal collapse and consolidation. Lymph nodes in the superior mediastinum, at the lung hila and in the mesentery were grossly enlarged and histologically showed reactive hyperplasia of lymphoid follicles and of pulp histiocytes.

The pancreas was enlarged and grossly infiltrated with fat: histologically (Fig. 1) there was no visible exocrine portion, the ducts and islet tissue were preserved, and the organ was infiltrated with normal adipose tissue, the appearances being those of lipomatous pseudohypertrophy. No evidence of amyloid was found in any organ, and in particular, the kidneys were free of infiltration. The small intestine was normal.

FIG. 1. Section of pancreas showing absence of exocrine tissue, generalized infiltration by adipose tissue and preservation of islet tissue.

Discussion

Lipomatous pseudohypertrophy of the pancreas was first described by Hantelmann in 1931. The characteristic pathological changes are:

- (1) increase in size and weight of the organ;
- (2) virtually complete absence of the exocrine portion with replacement by normal adipose tissue;
- (3) preservation of the duct system and the islets of Langerhans.

These features were all present in this patient. This condition should be distinguished from the fatty infiltration of the pancreas which occurs in several conditions including diabetes, calculi and malignancy where it appears to be a response to loss of functional pancreatic tissue. The abnormality is apparently congenital, probably present at birth, and of, as yet, unexplained aetiology. In experimental animals, an identical pathological process has been produced by exposure to coxsackie and foot-and-mouth virus (Pappenheimer, Kunz and Richardson, 1951; Platt, 1958).

Lipomatous pseudohypertrophy is usually associated with steatorrhea and may be confused clinically with coeliac disease. It may be distinguished from cystic fibrosis by the finding of normal sweat electrolytes. The diagnosis may be confirmed in life by pancreatic biopsy (Bodian, Sheldon and Lightwood, 1964) or at autopsy; the risk of pancreatic fistulae following biopsy in this condition is considered low because of the absence of proteolytic enzymes.

Reviewing the literature, Bodian *et al.* (1964) considered eighteen previously described cases confirmed at autopsy, and added two new cases diagnosed by pancreatic biopsy. They reviewed eight more with a highly suggestive clinical picture but no histological confirmation.

The majority of patients present with failure to thrive and die in infancy. Recurrent lower respiratory tract infections are prominent and in approximately one-third of cases, pneumonia appears to have been the direct cause of death. Only three patients have survived to adult life (Salm, 1960). The present case is the third longest survivor and the only adult with chronic pulmonary supuration.

Although there is good evidence that lipomatous pseudohypertrophy of the pancreas is associated with increased susceptibility to pulmonary infection, the mechanisms responsible for the association are unknown. Several possibilities present themselves. Resistance to infection may be lowered by loss of essential nutrients due to steatorrhoea; however, there is no convincing evidence that patients with malabsorption are more prone to pulmonary infec-

tion. Another possible link between pancreatic insufficiency and infection is the bone-marrow dysfunction described by Schwachmann *et al.* (1964). They described five patients with pancreatic insufficiency associated with anaemia, thrombocytopaenia and neutropaenia with hypoplasia of the corresponding bone-marrow precursors. However, none of their cases had pulmonary complications. Hudson and Aldor (1970) reported a 16-year-old boy with pancreatic insufficiency, neutropaenia and a deficiency in serum IgA, G and M and, in addition, respiratory infections. His parents and his sister had varying degrees of selective immunoglobulin deficiency, but no pulmonary infection.

The patient described in this paper probably had ankylosing spondylitis. His pulmonary pathology was quite unlike that associated with ankylosing spondylitis (Davies, 1972), in which apical consolidation and fibrosis extend to the upper- and mid-zones and the pulmonary changes are bilateral and ultimately lead to cavity formation. Such cavities are often subsequently colonized by *aspergilli*, and mycetoma formation is a recognized sequel. Clinically these changes closely resemble pulmonary tuberculosis and patients may commonly be treated in error with anti-tuberculosis chemotherapy.

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