

CASE REPORT

DIABETES MELLITUS, SALMONELLOSIS, FATTY LIVER, AND LIPID EMBOLISM

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Diabetes mellitus and salmonellosis are well known diseases. Generally, they are not difficult to recognize. When they occur together in a patient, however, they may not be easily distinguished from other maladies, and may even lead to unnecessary management as in the following case.

A 54-year-old man had diabetes mellitus for 2 years, and was treated regularly with an oral hypoglycemic agent. Three weeks before hospitalization, he experienced fever with chills, malaise, and generalized muscular pain. A private physician thought that he had influenza, and gave him treatment which resulted in some improvement within 1 week.

Two weeks prior to hospitalization, he had abdominal pain which was occasionally referred to his back, and intermittent pyrexia. He had 2 loose bowel movements and vomited three times within a day, leading to a tentative diagnosis of acute gastritis. One week before hospitalization, he developed anorexia and pain in the thoracolumbar region of his back. Loose bowel movements and pyrexia persisted.

Upon hospitalization, body temperature was 40°C, pulse rate 125 beats/minute, respiratory rate 20/minute, and blood pressure 170/100 mmHg. The conscious patient showed tenderness along the right subcostal region of the abdomen. The liver and spleen were not palpable.

Hemoglobin concentration ranged from 9 to 11 g/100 ml, 11 g/100 ml, leukocyte counts from 15,000 to 20,000 cells/mm³ with 60 to 62% neutrophils, 30 to 32% lymphocytes, and 4 to 5% monocytes. Plasma glucose ranged from 98 to 177 mg/100 ml, BUN 7 to 11 mg/100 ml, alkaline phosphatase 142 IU/l, SGOT 29 IU/l, serum amylase 45 IU/l, albumin 3.6 g/100 ml, globulin

4.7 g/100 ml, plasma cholesterol 188 mg/100 ml, triglyceride 396 mg/100 ml, calcium 10 g/100 ml, sodium 145 to 152 mEq/l, potassium 3.2 to 3.6 mEq/l, chloride 120 mEq/l, and carbon dioxide 20 to 32 mEq/l.

Hemoculture yielded growth of *Salmonella* group B. Computerized tomographic scan of the entire abdomen suggested a walled-off ruptured aortic aneurysm at the abdominal portion.

The clinical impression was *Salmonella* aortitis with mycotic aneurysm. This clinical diagnosis was regarded as explaining the pain in the back. Acute *Salmonella* cholecystitis, moreover, was considered to reasonably explain right subcostal pain in the abdomen.

In addition to medical treatment for salmonellosis, the patient underwent exploratory laparotomy, 1 week after hospitalization. Abdominal aortic aneurysm, however, was not found. Cholecystectomy was done. Additionally, acute pancreatitis was suspected.

The patient's postoperative course was stormy. The fever persisted and dyspnea ensued in spite of administration of antibiotic drugs and other supportive measures. His respiration was progressively laborious and consciousness became blurred. He eventually lapsed into coma and then died, 2 weeks after surgical intervention, or 6 weeks after onset of his ailment.

The excised thin-walled gallbladder showed only mild chronic cholecystitis (Fig 1). Organizing abscesses of the incisional wound of the anterior abdominal wall contained many Gram positive cocci. The lungs (1,550 g) exhibited severe congestion, edema, and bronchopneumonia. There was moderate atherosclerosis of the aorta. Aortic aneurysm, acute pancreatitis, and abnormality of the vertebral column were not noted.



Fig 1—Mild chronic cholecystitis. There were only few lymphocytes in wall of gallbladder. H and E, $\times 100$.

Other postmortem findings were hyalinization of the islets of Langerhans, intercapillary glomerulosclerosis, and peritubular hyaline thickening of the basement membranes of the renal tubules as seen in periodic acid-Schiff (PAS) stain (Fig 2). Grossly, a 2,000 g liver showed thin and tense capsule, blunt edges, and bulging yellow cut surfaces. Microscopically, there were fatty metamorphosis, focal necrosis, proliferation of Kupfer's cells, and cholestasis (Fig 3). Many hepatocytes contained cytoplasmic vacuoles in paraffin-embedded section stained with hematoxylin and eosin. With frozen section and oil-red-O stain, droplets of lipid were detected in the perikaryon of the liver cells. Lipid droplets, moreover, were

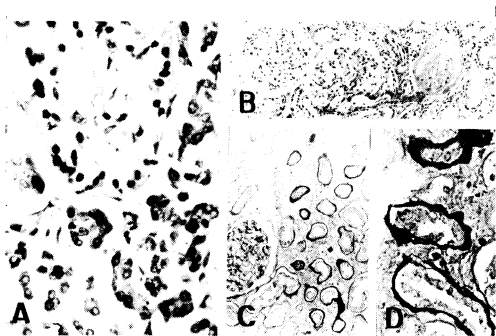


Fig 2—Pathologic hallmarks in diabetes mellitus. (A) Hyalinization of islets of Langerhans. H and E, $\times 400$. (B) Diffuse intercapillary glomerulosclerosis in one of three glomeruli. H and E, $\times 100$. (C) Peritubular hyaline cuffing of kidney. PAS, $\times 100$. (D) Distinct peritubular hyaline cuffing of kidney at higher magnification. PAS, $\times 400$.

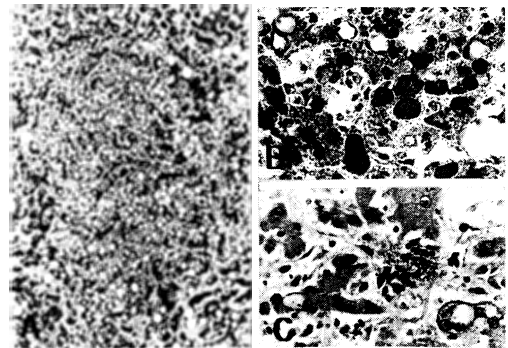


Fig 3—Hepatic alterations. (A) Fatty change. Note empty vacuoles in perikaryon of hepatocytes. H and E, $\times 100$. (B) Dark droplets of lipid in cytoplasm of liver cells. Frozen section with oil-red-O stain, $\times 400$. (C) Focal necrosis of liver cells. H and E, $\times 400$.

identified in lumen of small blood vessels of lungs prepared by frozen section and oil-red-O stain (Fig 4). There was hyperplasia of histiocytes in Peyer's patches, spleen, and bone marrow. Some histiocytes demonstrated erythrophagocytosis. A 1,440 g brain was hyperemic and edematous. There was proliferation of Alzheimer's astrocytes and ischemic neuronal degeneration as previously described (Shuagshoti and Wannakrairot, 1991). No lipid emboli were seen in the brain.

Hyalinization of the islets of Langerhans, intercapillary glomerulosclerosis, and renal peritubular hyaline cuffs confirmed diabetes mellitus (Cotran *et al*, 1989). Proliferation of the histio-

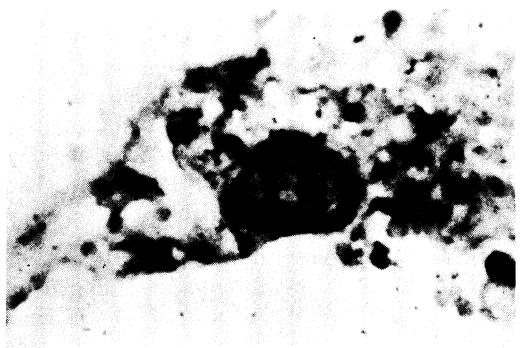


Fig 4—Lipid embolism in lung. Note intraluminal droplet of lipid in a small blood vessel of alveolar wall. Frozen section with oil-red-O stain, $\times 400$.

cytes, focal hepatic necrosis, and histiocytic erythrophagocytosis supported the diagnosis of salmonellosis, in addition to positive hemoculture of *Salmonella* group B (Cotran *et al.*, 1989). Hyperplasia of Alzheimer's astrocytes was compatible with hepatic encephalopathy (Shuangshoti and Wannakrairot, 1991).

Moderate hepatomegaly from fatty change, focal hepatic necrosis, proliferated Kupffer's cells and cholestasis were observed along with distention of the hepatic capsule. It is suggested that these pathologic changes, especially distended hepatic capsule and focal hepatic necrosis, produced abdominal and back pain in this patient. Chronic cholecystitis does not seem to have been responsible for abdominal pain.

Lipid embolism associated with fatty change of the liver is expected to be common. Unfortunately, frozen sections with oil-red-O preparations on lung, liver, kidney, and brain have not been done in most postmortem cases to support this expecta-

tion. Table 1 shows 4 examples, including the current case, of lipid embolism in relation to fatty liver experienced by Shuangshoti (1991).

The following cause of fatty liver may be summarized: (1) dietary factors such as excessive ingestion of fat, prolonged fasting, and insufficient intake of protein; (2) excessive partial hepatectomy; (3) endocrine factors such as in pancreatic and other forms of diabetes mellitus, injection of the extract of the anterior lobe of the pituitary gland, somatotropin or adrenocorticotropin. pregnancy, and beginning of sexual maturity; (4) toxic factors as in ingestion of phosphorus compounds such as zinc phosphide (Shuangshoti, 1961), chloroform, and alcohol; (5) infection; (6) environmental factors as in strikingly high or low temperature and hypoxia including severe anemia (Houssay *et al.*, 1955); and (7) unclear cause as in Reye's syndrome (Shuangshoti, 1991).

Traumatic and nontraumatic factors have been

Table 1

Summary of 4 postmortem cases of associated fatty liver and lipid embolism experienced by author.

Author	Age (yrs), sex	Underlying condition	Clinical manifestation	Duration of Illness	Condition, Weight of liver	Site of lipid emboli
Shuangshoti, 1991	63 F	Chronic interstitial pancreatitis, chronic nonspecific enterocolitis and chronic dermatitis compatible with pellagra and malnutrition	Diarrhea, anemia, pitting edema, loss of body weight, stupor and eventually coma	7 months	Severe fatty change, 2,000 g	Small blood vessels lungs
Shuangshoti, 1991	43 F	Chronic alcoholism and malnutrition	Anemia, jaundice, pitting edema, loss of body weight, terminally stupor and eventually coma	2 years	Cirrhosis, severe fatty change, 2,060 g	Brain (cerebri, corpus callosum, basal ganglia and pons) and kidneys
Shuangshoti, 1991	57 M	Heavy smoking, chronic obstructive pulmonary disease, cor-pulmonale, ischemic necrosis of colon and malnutrition.	Perforations of colon, small ulcers of stomach and duodenum with bleeding and terminal stupor	5 months	Severe fatty change, 500 g	Brain (centrum semiovale, corpus callosum and R occipital lobe) with recent infarct of R occipital lobe.
Shuangshoti, current case	54 M	Diabetes mellitus and salmonellosis.	Fever, abdominal and back pain to resemble acute cholecystitis, aortic mycotic aneurysm and acute pancreatitis, terminal hepatic encephalopathy and coma	6 weeks	Moderate fatty change, focal necrosis and cholestasis, 2,000 g	Small blood vessels of lungs

M = Male, F = Female, R = Right

suggested to play roles in pathogenesis of lipid embolism (Fulde and Harrison, 1991). Although the mechanism and mode of occurrence are obscure in the current patient it is suggested that diabetes mellitus and infection are responsible for the fatty liver. The cell membrane of hepatocytes containing excessive cytoplasmic lipid may be ruptured and release lipid content into sinusoids. Lipid droplets then enter the venous circulation and become emboli which may be entrapped in the pulmonary circulation. Terminal severe respiratory difficulty of the patient may have been related to pulmonary lipid embolism as well as to congestion, edema, and bronchopneumonia. Altered consciousness of the patient may have been associated with hepatic encephalopathy as well as to hypoxia of the brain.

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