CHEMICAL STUDIES OF PANCREATIC NONOPAQUE CONCRETIONS AND PROTEIN PLUG

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Summary

Chemical studies were performed on all or part of four X-ray translucent (nonopaque) concretions and one protein plug to investigate a possible relationship between these substances, and to find the similarities and differences between these materials and pancreatic stone protein. Through elemental analysis, infrared absorption spectrometry, quantitative analysis of protein, and amino acid analysis, nonopaque concretions and protein plug were found to consist mainly of protein. One nonopaque concretion contained a very small amount of crystalline which differed greatly from calcite type calcium carbonate as observed in pancreatic calcified stones. The pattern of amino acid composition was very similar between the concretions and the protein plug: rich in acidic amino acids, but poor in basic and aromatic residues. The aspartic acid content was the highest among detected amino acids. Comparison of amino acid composition between the nonopaque concretions which we analyzed and the pancreatic stone protein reported from Sarles' laboratory suggested that the concretions seem to contain some stone protein.

Key Words: Chemical analysis, Chronic pancreatitis, Pancreatic nonopaque concretion, Partially calcified stone, Protein plug.

Introduction

X-ray translucent (nonopaque) concretions or protein plugs in pancreatic ducts have a high possibility of becoming calcified stones. With the progress of endoscopic retrograde cho-langio-pancreatography, reports of nonopaque concretions are increasing1–5. Sarles reported that protein precipitation might be an important phenomenon at the beginning of chronic pancreatitis6). He also indicated that there had
been no prior reports of the precise chemical analysis of intraductal precipitates, including protein plugs and nonopaque concretions⁴). Pancreatic stone protein, on the other hand, seems to play a role in the spontaneous precipitation of calcium carbonate⁵,⁶). However, it has not been understood whether there are similarities or differences between protein plugs and nonopaque concretions, and between concretions and stone protein.

We recently reported the results of chemical analyses of one nonopaque concretion obtained from a nonalcoholic patient⁷). The present study is an extension of this case report. In this paper we present the results of chemical analyses of four nonopaque concretions and one protein plug, and discuss the similarities and differences between these substances, and between those and pancreatic stone protein.

Materials and Methods

Patients and materials

Four nonopaque concretions and one protein plug were obtained at operation in three patients with chronic pancreatitis. The term protein plug is used to mean an X-ray-translucent intraductal fine floating substance.

Case 1 was a 20 year-old nonalcoholic patient. A detailed clinical and laboratory description has been reported previously⁷). Three concretions were obtained at the time of pancreatico-jejunostomy. The largest one was soft, milky-white, and elastic (Fig. 1L). The smaller one had a slightly irregular surface (Fig. 1S), and the other was jelly-like (Fig. 1J). The first two were available for chemical analysis.

Case 2 was a 20 year-old nonalcoholic female patient suffering from frequent nausea and vomiting, poor appetite, and loss of body weight. Endoscopic retrograde pancreatography (ERP) demonstrated some filling defects in the side branches of the dilated main pancreatic ducts in the head and tail of the gland. Nonopaque concretions and protein plugs were removed on distal pancreatectomy. They were milky-white in color.

Case 3 was a 36 year-old male patient suffering from recurrent severe abdominal pain. He was a heavy drinker. ERP showed small filling defects in the main pancreatic duct in the head of the gland and the accessory pancreatic duct. Several small nonopaque concretions, which were obtained at pancreatico-jejunostomy, were black or dark gray in color, and somewhat harder in consistency than the concretions of the other two cases.

No calcification was detected on abdominal plain X-ray films and computerized tomographs in any case.

Chemical analyses

Five kinds of chemical analyses were performed on all or part of the nonopaque concretions and protein plug; elemental analysis, infrared absorption spectrum, quantitative analysis of protein, powder X-ray diffraction pattern, and amino acid analysis. In elemental analysis carbon (C), hydrogen (H) and nitrogen (N) were determined using CHN Corder MT-3 (yanaco), and calcium (Ca) was measured by gravimetric method, converting to calcium sul-