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Studies on human bile

III. Composition of duodenal bile from healthy young volunteers compared with composition of bladder bile from surgical patients with and without uncomplicated gallstone disease

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With 3 figures and 6 tables

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Studies on the influence of diet or pharmaca on the composition of human bile have been carried out in healthy young volunteers whose duodenal bile was collected after injection of cholecystokinin (1, 2, 3).

Since duodenal bile is a mixture of bladder bile with other secretions, primarily pancreatic juice, and changes in the composition may occur during the collection procedure through hydrolysis and absorption of certain of the components, it is of interest to compare the composition of duodenal bile collected from healthy young volunteers not receiving treatment with the composition of bladder bile from certain well defined groups of surgical patients.

In the present study, duodenal bile from 42 healthy young volunteers (Group V) was compared with bladder bile from 27 surgical patients not having gallstones or diseases of liver and biliary tract (Group A) and with bladder bile from 26 surgical patients having gallstones with known content of cholesterol and ash constituent, functioning gall bladder, essentially normal values in the usual liver function tests, and no icterus (group B, subgroups B₁ and B₂).

The components of the bile examined were: (besides pH) dissolved dry matter, cholesterol, lipid-soluble phosphorus, bile acids, and for part of the biles also the fatty acid composition of bile lecithin.

Experimental

Duodenal bile was collected (from the second to fourth part of the duodenum) as described in our previous study (1). This procedure was performed in the Gastroenterological Laboratory of the University Hospital. The several fractions of the volunteer's duodenal content, collected in centrifuge tubes packed in ice, were speedily brought to the Department of Biochemistry and Nutrition of the Polytechnic Institute. After rapid centrifugation, the pH was quickly determined, and those fractions having pH above 6.9 were combined for analysis.

Determination of the concentrations of dry matter, cholesterol, lipid-soluble phosphorus and the different fractions of glycine- and taurine-conjugated bile acids were carried out as
described previously (4), using Stövall’s paper chromatographic methods for determination of the bile acids.

For isolation of bile lecithin, the phosphatides were originally separated from non-phosphatidic lipids on a short column of silicic acid, whereafter lecithin was separated from other phosphatides by thin-layer chromatography as described in reference 1. Later it was found that separation on silicic acid column was unnecessary, i.e., the chloroform solution containing both phosphatides and non-phosphatidic lipids can be applied directly to the thin-layer plate. Methylation of the fatty acids of the lecithin and gas-liquid-chromatography of the methyl esters were carried out as previously described (1).

Bladder biles from surgical patients undergoing cholecystectomy and from patients being operated for duodenal or gastric ulcer were obtained by puncture of the vesica fellea. The samples were brought to the Department of Biochemistry and Nutrition as quickly as possible, centrifuged immediately upon arrival and analyzed as described.

Results and Discussion

The results are presented in tables 1-6 and figs. 1, 2 and 3.

From tables 1, 2 and 3 it is seen that the mean values for the concentrations of dissolved Dry Matter, Cholesterol, Lipid-soluble Phosphorus and Total Bile Acids1) are lower for the duodenal biles (group V) than for the bladder biles from patients not having gallstones or other diseases of the liver and biliary tract (group A) and from patients having gallstones but functioning gall bladder (group B) although the mean values for these components are lower in group B than in group A. (A closer consideration of the figures in group A shows that the mean values of the concentrations of dry matter, cholesterol (C), lipid-soluble phosphorus (P) and total bile acids (TBA) were somewhat higher for the bladder biles from patients having duodenal ulcer than for the bladder biles from patients having gastric ulcer. Likewise, the mean values of the concentrations of dry matter, C, P and TBA were somewhat higher for the 17 men than for the 10 women but here the differences were less pronounced).

The mean value of the ratio between Glycine-conjugation and Taurine-conjugation (ratio G/T) is somewhat lower in group V (1.81) than in group A (2.44) and in group B (2.53). Values above 4.0 occur only in one case in group V but in 5 cases in group A and in 3 cases in group B. High values of the ratio G/T are known to be favored by certain abnormal conditions, e.g. insufficient supply of sulfur-containing amino acids (Hellström & Stövall (6), Barry et al. (7)), deficiency of vitamin B6 (Bergeret & Chatagner (8), Doisy et al. (9)) and by hypothyroidism (Stövall (5), Hellström & Stövall (6)). Therefore, the somewhat lower mean value of ratio G/T in group V probably more nearly represents a normal value than do the mean values found in groups A and B.

The mean value of the ratio between Dihydroxycholanoic acids and Trihydroxycholanoic acids (ratio Di/Tri) is slightly lower in group V than in groups A and B but the difference is not significant.

The molar ratios Total Bile Acids/Cholesterol (TBA/C), Lipid-soluble Phosphorus/Cholesterol (P/C) and Total Bile acids/Lipid-soluble Phosphorus (TBA/P) in the

1) Apart from small amounts of certain bile acids not determined by the methods used, the amount of total bile acids (TBA) is equal to the sum of glycocholic acid (GC), glycocholenodeoxycholic acid (GCD), glycodeoxycholic acid (GD), taurocholic acid (TC), taurochenodeoxycholic acid (TCD) and taurodeoxycholic acid (TD). The method used does not separate the latter two bile acids from each other. They are determined as (TCD + TD).