The Common Bile Duct in Man:

Its Diameter and Circumference

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In 1890, Kümmell [19] reported the first successful choledochotomy and removal of stones. Since then, the question of when the common bile duct should be opened has been discussed repeatedly. Most authors [1, 2, 5-7, 9, 12-15, 17, 21, 24, 25] agree that one of the most frequently encountered indications for choledochostomy is the finding at operation of an abnormally dilated common bile duct. However, the estimation of what represents a dilated duct obviously depends on the surgeon.

In attempting to appraise the significance of a dilated common bile duct, it is necessary first to know the normal variations. Despite its importance, few authors have measured and recorded the size of the common bile duct. The present investigation was undertaken to collect data on the diameter and circumference of this duct.

Materials and Methods

Data from autopsies of 100 selected subjects (36 women and 64 men) whose ages ranged from 15 to 102 years, and who had an intact biliary system form the basis of this study. In no case was there a history of biliary trouble or any postmortem evidence of hepatobiliary disease. In all instances the union of the cystic duct with the choledochus and hepatic ducts was similar to that reported by Hess [17] in two-thirds of his patients.

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The age, sex, body length, and body weight were recorded for each subject and the external diameter, internal circumference, and thickness of the wall of the choledochus were measured in the upper portion. Metal calipers with a gauge screw were used for all measurements; the tips of the calipers were then applied to a metric ruler to give the readings in millimeters. Two graphs, one for the outer diameter and the other for the internal circumference of the choledochus, were plotted (Fig. 1, 2). The average values for these parameters were tabulated for all individuals according to six age groups (Table 1). The correlations between the external diameter of the duct and the age, body weight, and body length of the subject according to sex were calculated,[10] as were the relationships between internal circumference and these parameters.

Results

The outer diameters of the duct varied in all subjects (Fig. 1); the values ranged from 4 to 12 mm., with an average of 7.39 mm. The internal circumferences of the common bile duct also varied in all subjects (Fig. 2), ranging from 7.5 to 24 mm., with an average of 14.99 mm. The thicknesses of the duct walls varied from 0.8 to 1.5 mm., with an average of about 1.1 mm. The means of the outer diameters and inner circumferences of the ducts, with their cor-

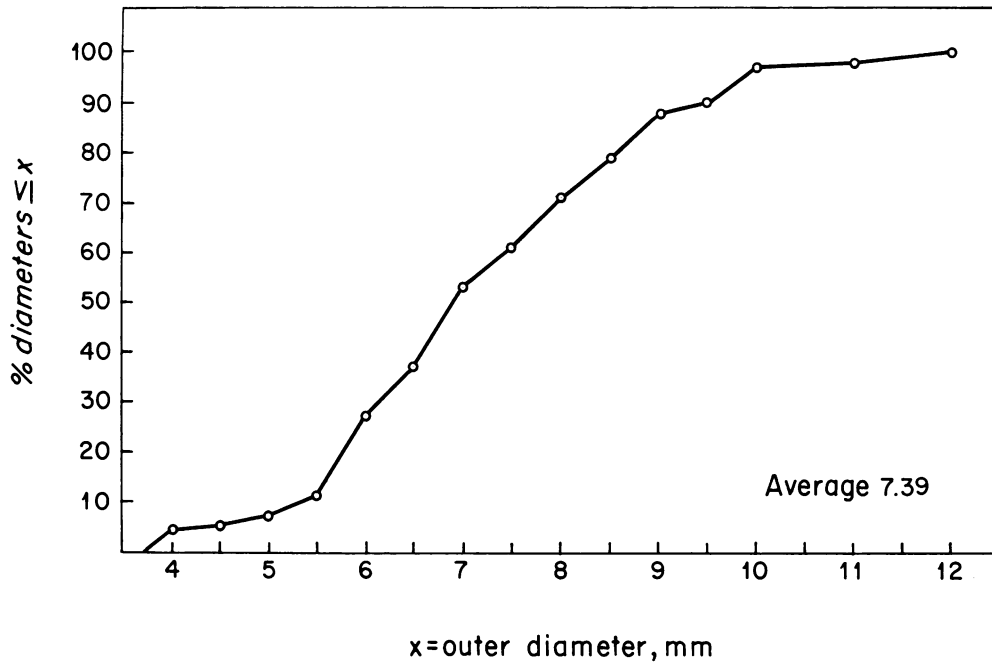

FIG. 1. Outer-diameter variations of the choledochus in 100 selected autopsies (subjects 15 to 102 years old) with normal biliary tract.

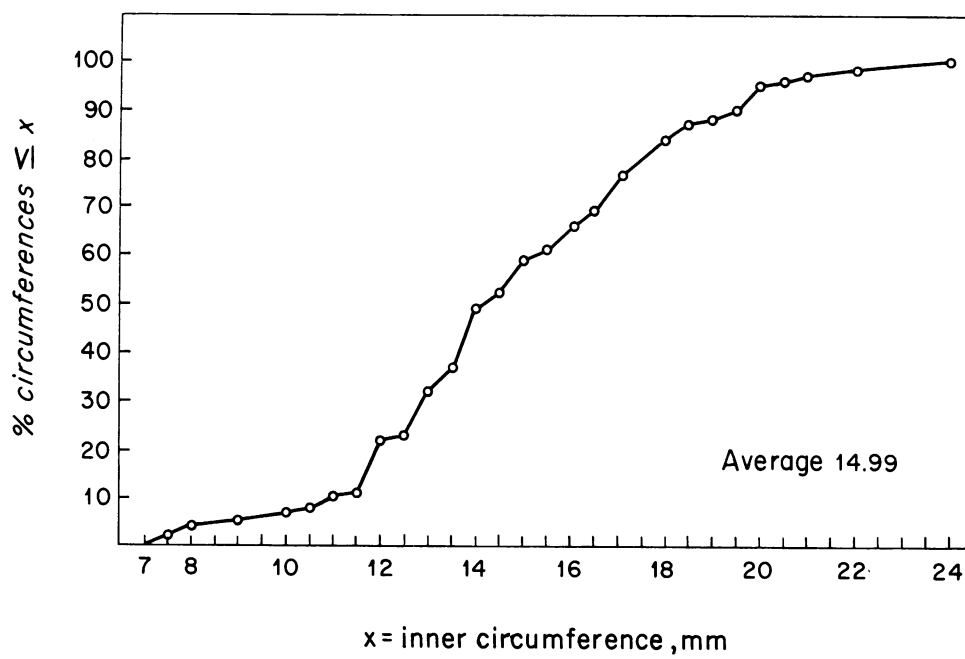

FIG. 2. Inner-circumference variations of the choledochus in 100 selected autopsies (subjects 15 to 102 years old) with normal biliary tract.

TABLE 1. *Caliber Variations of the Choledochus in 100 Selected Autopsies Involving Normal Biliary Tract*

Age group, yr.	No.	Outer diameter, mm.		Inner circumference, mm.	
		Mean	SD	Mean	SD
35 and younger	7	6.21	1.822	12.29	3.695
36 to 44	7	6.36	1.345	12.79	3.026
45 to 54	14	7.18	1.613	14.61	3.306
55 to 64	21	7.02	1.401	14.43	2.917
65 to 74	33	7.65	1.670	15.48	3.385
75 and older	18	8.39	1.389	16.97	2.810
Total	100	7.39	1.641	14.99	3.368

responding standard deviations for the different age groups, are presented in Table 1.

Correlations between age of the subject and diameter of the duct and between the subject's age and the duct's circumference revealed that both diameter and circumference increased with increased age. The outer diameter of the duct increased 0.43 mm. in women and 0.32 mm. in men for each 10-year increase in age, whereas the internal circumference of the duct increased 0.86 mm. in women and 0.70 mm. in men for each 10-year increase in age. No relationship was noted between body weight and either the diameter or the circumference of the duct in either sex. There was no relationship between body length and the diameter or between body length and the circumference of the duct.

Comment

The common bile duct as described by Gray [16] is formed by the junction of the cystic and hepatic ducts and descends along the right border of the lesser omentum behind the superior portion of the duodenum, in front of the portal vein, and to the right of the hepatic artery. From here it runs in a groove near the right border of the posterior surface of the head of the pancreas where it lies in front of the inferior vena cava and where it is occasionally completely imbedded in the pancreatic substance.

The cystic duct as described by Hess [17] is extremely variable in length, course, and shape. The height of the termination of the cystic duct also varies considerably. In about two-thirds of all cases, the cystic duct terminates by running obliquely downward to the junction of the common hepatic duct and choledochus, which divides into the shorter hepaticus and the longer common duct. In another 18%, its downward course is steeper and terminates so low that the hepatic duct is longer than the common duct. In 2%, the cystic duct joins the main biliary passage at a right angle. In 1.5%, the cystic duct does not run downward but instead courses upward and terminates close to the bifurcation (0.5%), in the bifurcation itself (0.25%), or in the right hepatic radicle (0.75%).

The literature reveals different opinions regarding the size of the common bile duct in man. Gray [16] stated that the common bile duct is about 7.5 cm. long and has the diameter of a goose quill or soda-fountain straw. Cunningham [8] noted that the usual width of the common bile duct is 0.6 cm. (¼ inch). According to Thorek [26] the diameter of the duct is about 0.75 cm. whereas Behrend and Behrend [3] have stated that the duct has a diameter of 5 mm. Benson,[4] in a postmortem study of 47 subjects, each with an apparently normal biliary system, found that the internal circumference of the common bile duct varied from 9 to 20 mm., with an average of 12.3 mm.; these measurements were not altered by peptic ulcer, gastric cancer, or general peritonitis. Ogilvie [22] stated that the common bile duct should be considered di-

lated if its diameter is larger than that of a lead pencil. In his study of the influence of cholecystectomy on the normal common bile duct, Qvist [23] collected follow-up data on 105 patients in whom the common duct has been classified as normal on preoperative films—that is less than 8 mm. in diameter—and found, as did many other workers, that 8 mm. was a more accurate value. Previously, the upper limit had been 5 mm.

Ferris and Vibert [11] measured the external diameter of the upper portion of the common bile duct immediately after its isolation in the gastrohepatic ligament in 112 consecutive patients who underwent biliary operations, most commonly because of cholelithiasis. Operative cholangiograms were taken subsequently of all 112 patients. Pathologic changes were not noted in the common duct of 98 patients and the external diameters of the duct in these patients averaged 8.8 mm. In a series of 73 patients who had undergone cholecystectomy, Le Quesne and associates [20] measured the diameter of the common bile duct as revealed on operative cholangiography and repeated the measurements 12 months or more after operation and intravenous cholangiography. They suggested that, as seen radiographically, an image of 10-mm. diameter represents the usual upper limit of normal and that an image of 12 mm. or greater is evidence of dilatation of the duct. Jonson [18] studied the width of the common bile duct in cholangiographs of 39 patients who had normal roentgenographic findings, and noted that the average width was 5.9 mm.

Summary

Autopsy studies were made on 100 selected subjects whose ages ranged from 15 to 102 years and who had intact biliary tracts.

The outer diameters and inner circumferences of the ducts averaged 7.39 and 14.99 mm., respectively.

Correlations between caliber variations of the duct and age of the subject revealed a definite increase of both outer diameter and inner circumference with age in both men and women. No relationship between caliber variations and body length or body weight was noted.

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Book Reviews

Arteriography Principles and Techniques. Emphasizing Its Application in Community Hospital Practice: JOSEPH L. CURRY, M.D., WILLARD J. HOWLAND, M.D., Philadelphia, W. B. Saunders Co., 1966, 328 p., Illustrated. $14.00.

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Care of the Trauma Patient: Ed. G. TOM SHIRES, M.D., New York, McGraw-Hill, 1966, 696 p., $19.50.

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Fifty-seven contributing authors (comprising an international roster of surgeons interested in the hand) to a volume of 64 loosely related individual articles; profusely illustrated by contributors' drawings and photographs; bibliography appended to each article; good index; graceful foreword by Sumner L. Koch. Expensive for a resident, but fitting in a surgical department library.