

Common bile duct diameter by age groups in adult patients without bile duct pathology

Diámetro del conducto colédoco por grupos de edad en pacientes adultos sin patología de la vía biliar

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Abstract

Objective: To determine the average value of the diameter of the common bile duct by age group in adult patients without bile duct pathology. **Method:** A cross-sectional, observational, descriptive and prospective study in adults without bile duct pathology who underwent abdominal ultrasound. The internal diameter of the common bile duct was measured after questioning. In the descriptive analysis, absolute frequencies, percentages, mean and standard deviation were used in the inferential Student's *t* test and Pearson's correlation. **Results:** 608 patients without bile duct pathology were included, the mean diameter of the common bile duct was 4.04 ± 1.11 mm; with a minimum of 1.9 mm and a maximum of 8.8 mm. The mean for the population under 30 years was 3.8 ± 0.87 , for the 30-39 years group it was 4.27 ± 0.89 , for the 40-49 years group it was 4.39 ± 0.83 , for the 50-59 years 4.86 ± 1 , for the 60-69 years group it was 5.4 ± 0.95 , and for those over 70 years it was 6.9 ± 0.8 . **Conclusions:** The diameter of the common bile duct in adult patients without biliary pathology is greater at older age.

Keywords: Common bile duct. Bile duct. Anatomy.

Resumen

Objetivo: Determinar el valor promedio del diámetro del conducto colédoco por grupos de edad en pacientes adultos sin patología de la vía biliar. **Método:** Estudio transversal, observacional, descriptivo y prospectivo en adultos sin patología de vía biliar que acudieron a la realización de ultrasonografía abdominal. Se realizó la medición del diámetro interno del colédoco después de un interrogatorio. En el análisis descriptivo se utilizaron frecuencias absolutas, porcentajes, media y desviación estándar; en el inferencial, prueba *t* de Student y correlación de Pearson. **Resultados:** Se incluyeron 608 pacientes sin patología de vía biliar. La media del diámetro del colédoco fue de 4.04 ± 1.11 mm, con un mínimo de 1.9 mm y un máximo de 8.8 mm. La media para la población menor de 30 años fue de 3.84 ± 0.87 , para el grupo de 30-39 años fue de 4.27 ± 0.89 , para el de 40-49 años fue de 4.39 ± 0.83 , para el de 50-59 años fue de 4.86 ± 1 , para el de 60-69 años fue de 5.4 ± 0.95 y para el de mayores de 70 años fue de 6.9 ± 0.8 . **Conclusiones:** El diámetro del conducto colédoco en pacientes adultos sin patología biliar es mayor conforme avanza la edad.

Palabras clave: Colédoco. Vía biliar. Anatomía.

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Introduction

The common bile duct is formed by the confluence of the cystic duct and the common hepatic duct; its length ranges from 5 to 15 cm. It descends posterior to the superior portion of the duodenum and lies in the groove of the posterior aspect of the head of the pancreas. On the left side of the descending duodenum, the common bile duct comes into contact with the main pancreatic duct. The two ducts run obliquely through the wall of this portion of the duodenum, where they join to form the hepatopancreatic ampulla. The distal end of the ampulla empties into the duodenum via the major duodenal papilla. The circular muscle surrounding the distal end of the common bile duct thickens to form its sphincter. When this sphincter contracts, the bile returns to the gallbladder through the cystic duct, to be concentrated and stored¹.

The development of symptomatic choledocholithiasis depends on the size of the stone and the size of the bile duct, as well as the ease or probability of its expulsion into the duodenum. Ultrasound has shown a sensitivity close to 98% and a specificity of 75% for its diagnosis; allows taking measurements of both the stone and the morphological characteristics of the bile duct, such as diameter and degree of dilation². Biliary diseases and disorders associated with obstruction affect a significant part of the world population. The American Society for Gastrointestinal Endoscopy establishes that a diameter of the common bile duct > 6 mm is a predictor of bile duct obstruction³. Variations in the diameter of the bile duct related to age have been reported, which could be explained because as age increases, fragmentation of the few bands of myocytes of the smooth muscle of the bile duct and a decrease in elastic fibers occur⁴. In the present study, the average value of the diameter of the common bile duct was determined by age group in adult patients without bile duct pathology.

Method

Cross-sectional, observational, descriptive and prospective study carried out in the radiology and imaging service of the Hospital de Alta Especialidad UMAE No. 25 of the Mexican Institute of Social Security.

Patients over 18 years of age, of both sexes, who attended said service to perform an abdominal ultrasound and voluntarily accepted their participation, expressed by signing the informed consent, were

included. Patients with symptoms related to alterations in the bile duct or whose diagnostic impression was choledocholithiasis were excluded, as were those with a history of cholecystectomy or scheduled for this surgical procedure. Sampling was non-probabilistic for convenience, with a total sample of 608 participants.

The selected patients were explained the objectives and risks of the study, and their voluntary participation was requested by signing an informed consent. Once the participation was accepted, a direct questioning was carried out in order to obtain the sociodemographic and general variables, as well as relevant information on their non-biliary pathology in case it existed. To obtain the information, a self-designed data collection instrument was used. After the interrogation, an abdominal ultrasound was performed and the internal diameter of the common bile duct was measured. The data obtained were captured in the data collection instrument and captured in the Microsoft Excel database.

The diameter of the common bile duct in each patient was determined by ultrasonography, measuring from the inner edge to the inner edge, and was expressed in millimeters. The patients were grouped by age into the following groups: 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and over 70 years. In addition, the weight, height, and body mass index (BMI) of each participant were included, as well as the presence of comorbidity.

Statistical analysis was performed using the IBM Stata statistical program in its version MP14. To verify the normality of the distribution of the variables, the Kolmogórov-Smirnov statistical test was used. The descriptive data were expressed in frequency and absolute percentage, as well as in mean and standard deviation. For inferential statistics and to contrast hypotheses, the Pearson correlation analysis between age and common bile duct measurements was used; For comparisons of sex, BMI, and the rest of the variables, the Student's t-test for independent samples was used. A $p < 0.05$ was interpreted as significant.

The research protocol was approved by the Local Research Committee and by the Research Ethics Committee of the institution. The procedures of this study adhered to ethical standards, the Regulations of the General Law on Health in Research and the principles of the Declaration of Helsinki. Informed consent was formulated in writing and obtained in accordance with the standards that guide the informed consent process in clinical studies, research, or

Table 1. Clinical characteristics and diameter of the common bile duct, according to age group, in 608 patients without bile duct disease

	Total (n = 608)	Age groups (years)						p
		< 30 (n = 200)	30-39 (n = 152)	40-49 (n = 121)	50-59 (n = 72)	60-69 (n = 40)	> 70 (n = 23)	
Sex								
Male	230 (37.83%)	81 (35.2%)	62 (26.9%)	32 (13.91%)	26 (11.3%)	14 (6.08%)	15 (6.52%)	0.369
Female	378 (62.17%)	119 (31.39%)	90 (23.74%)	89 (23.48%)	46 (12.13%)	26 (6.8%)	8 (2.11%)	
Weight (kg)	66.33 ± 10	63.2 ± 9	66.1 ± 9.7	68.4 ± 10	71 ± 10	64.6 ± 9.1	71.6 ± 11	0.212
Size (m)	1.64 ± 0.07	1.64 ± 0.07	1.64 ± 0.07	1.64 ± 0.08	1.63 ± 0.08	1.64 ± 0.8	1.63 ± 0.8	0.331
Body mass index (kg/m ²)	24.5 ± 3.3	24.9 ± 3.3	24.4 ± 3.2	24.1 ± 3	23.8 ± 3.3	24.5 ± 2.7	24 ± 2.7	0.814
Bile duct diameter (mm)	4.4 ± 1.11	3.84 ± 0.8	4.27 ± 0.8	4.39 ± 0.8	4.86 ± 1	5.4 ± 0.9	6.9 ± 0.8	0.001

Data are presented in absolute frequencies and percentages, and in means ± standard deviation.

clinical trials involving human beings. The researcher agreed to protect the confidentiality of the data. Participant names were not used in the present study and instead unique coding by participant number was used; In addition, the information was stored in a password-protected file, whose access, as well as that of the database, was only granted to researchers and collaborators.

Results

608 patients without biliary pathology who underwent bile duct ultrasound were included, of which 230 (38%) were male and 378 (62%) female. The mean age was 38.5 ± 15.1 years, with a minimum of 18 and a maximum of 86 years. The sample was divided by age groups: 200 (33%) under 30 years of age, 152 (25%) from 30-39 years of age, 121 (20%) from 40-49 years of age, 72 (12%) from 50-59 years of age, 40 (6.5%) from 60-69 years and 23 (4%) over 70 years. The mean weight was 66.33 ± 10.09 kg, with a minimum of 45 kg and a maximum of 103 kg. The mean height was 1.64 ± 0.07 cm, with a minimum of 1.4 m and a maximum of 1.85 m. The average BMI was 24.5 ± 3.34 kg/m², with a minimum of 18 kg/m² and a maximum of 38 kg/m²; 358 (59%) patients had normal weight, 218 (36%) were overweight, 29 (5%) grade I obese, and 3 (0.5%) grade II obese (Table 1).

Regarding the diameter of the common bile duct, the mean was 4.4 ± 1.11 mm, with a minimum of 1.9 mm and a maximum of 8.8 mm. The mean for the group under 30 years old was 3.84 ± 0.87 mm, for the 30-39 group it was 4.27 ± 0.89 mm, for the 40-49

group it was 4.39 ± 0.83 mm, for the 50-59 group. years old was 4.86 ± 1 mm, for those aged 60-69 it was 5.4 ± 0.95 mm and for those over 70 years old it was 6.9 ± 0.80 mm. A statistically significant difference was found between the age groups, with patients over 70 years of age showing larger diameters compared to the other age groups ($p < 0.001$) (Table 1).

Likewise, a directly proportional correlation was found between the diameter of the common bile duct and age, so it is concluded that this tends to be greater as age increases ($r = 0.5890$; $p < 0.001$). The mean common bile duct diameter in women was 4.41 ± 1 mm and in men it was 4.38 ± 1 mm, with no statistically significant difference ($p = 0.369$). The direct correlation between age and the diameter of the common bile duct was greater in the group of men ($r = 0.633$; $p < 0.001$) than in the group of women ($r = 0.554$; $p < 0.001$). Regarding the diameter of the common bile duct according to BMI, for those with normal weight the average was 4.3 ± 1 mm, for those who were overweight it was 4.4 ± 1.1 , for those with grade I obesity it was 4.9 ± 1.2 mm and for those with grade II obesity it was 4.8 ± 1.3 mm.

Discussion

The standard measurements of the common bile duct diameter are 6 mm in patients with a gallbladder and 8 mm in those without it; however, this is based on old measurements made in autopsies or by abdominal ultrasonography without discriminating the presence or not of a biliary pathology that could influence the measured values. Most of the available studies that

correlate the diameter of the common bile duct with age are old or have been performed in populations from other countries; an example is the study by Wu et al.⁵ in 203 patients, in whom with various measurements the entire extrahepatic duct was visualized and it was determined that the internal diameter of the common bile duct could be up to 10 mm, and that there is a slight increase in the size of the duct as age advances. In our study, the maximum measurement of the common bile duct diameter was 8.8 mm. There is currently little evidence on the estimation of normal values of the common bile duct in asymptomatic patients. Zuleta et al.⁶, in a prospective study carried out with 100 patients with the objective of evaluating the size of the common bile duct in patients with and without a gallbladder, they found that the average size of the common bile duct was 4.88 mm, that in patients with an intact gallbladder it was 4.16 mm and that in those undergoing cholecystectomy it was 4.92 mm, which confirms that patients with cholecystectomy present a compensatory dilation due to the absence of the reservoir function of the gallbladder. This study mentions not finding a relationship between age and the size of the common bile duct, which is in contradiction with the study carried out by Benjaminov et al.⁷ in 647 patients, in which they found diameters of 4.4 mm in patients without a history of gallbladder surgery aged 18-49 years, of 4.9 mm in those aged 50-59 years, of 5.4 mm in those over 60 years of age, of 5.9 mm in those over 70 years of age and 6 mm in those over 80 years of age, concluding that the diameters increase proportionally with each decade. Both studies find similar normal measurements of common bile duct diameter, with a range of 4-4.5 mm. Park et al.⁸, in a study that included 398 patients, found an average value of 6.7 mm, while Matcuk et al.⁹, in a study carried out with more than 4000 patients in California, found an average of 3.8 mm, for which the reported normal ranges can vary from 3.8 to 6.7 mm.

Csendes et al.⁴ measured the common bile duct in 85 patients before and 12 years after performing a cholecystectomy. In the initial measurement, they found a greater diameter in patients 61 years of age and older (5 ± 0.8 mm), compared to those under 60 years of age (4.62 ± 0.8 mm), which are measurements similar to those found in the present study. In addition, they demonstrated that in the post-cholecystectomy measurements, the diameter of the common bile duct increased more in the group over 61 years of age, which was attributed to the effect of age. Variations in diameter according to age could be explained by the fragmentation of the few bands of myocytes from the smooth

muscle of the bile duct and the decrease in elastic fibers with increasing age⁴.

The literature mentions the following dimensions of the common bile duct (length/diameter): 50/5 mm; 60/6 mm; 70/4-5 mm; 80/4-8 mm; 72/5 mm; 90/5-6 mm; and 100/6-8 mm¹⁰. Pina et al.¹¹ dissected 40 bile ducts and reported that the common bile duct had an average length of 6.19 mm and a diameter of 6.31 mm.

Previous investigations show that the normal average of the common bile duct diameter is influenced by multiple factors, genetic and environmental, for which reason the determination of normality depends on each study population. The results obtained in our study are similar to those of Benjaminov et al.⁷ and Matcuk et al.⁹, and in the same way it was concluded that as age increases there is a significant increase in the diameter of the common bile duct, which is what the present study evaluated.

Conclusions

The diameter of the common bile duct in patients without biliary disease is greater with increasing age. There is no standardized normal value for the diameter of the common bile duct obtained by ultrasonography in the Mexican population, and for this reason the present study is relevant.

The limitations of the study were that, despite having a large sample, it is not fully representative of the Mexican population; for this, it would be necessary to carry out a multicenter study that included samples from each State. It is also important to emphasize that, if tools such as endosonography were available, the measurement of the diameter of the common bile duct would be more accurate.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of people and animals. The authors declare that the procedures followed complied with the ethical standards of the responsible human

experimentation committee and in accordance with the World Medical Association and the Declaration of Helsinki.

Data confidentiality. The authors declare that they have followed the protocols of their work center regarding the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appears in this article.

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