Received: 7.12.2006 **Accepted: 18.5.2007**

Original Article

Diameter of common bile duct: what are the predicting factors?

Atoosa Adibi, Behrooz Givechian***

Abstract

BACKGROUND: This was a study to determine the correlation between the common bile duct (CBD) diameter and demographic data, fasting, and the history of opium addiction.

METHODS: This was a cross-sectional study on 375 patients (>16 years old) including 219 females and 156 males. They had no evident hepatobiliary or pancreatic disease and underwent abdominopelvic ultrasonography for measurement of their CBD diameter. Ultrasound (US) was performed to measure CBD diameter at the porta hepatis (proximal part) and behind the head of the pancreas (distal part). Correlation coefficients for the association between CBD diameter and predictive factors were calculated. t-test was applied to compare the means between the groups.

RESULTS: The mean CBD diameter (1 standard deviation), in proximal and distal parts were 3.64 mm (±1.2) and 3.72 mm (±1.2), respectively. The CBD diameters (proximal and distal) were significantly ($P<0.05$) correlated with age ($r = 0.55$ and 0.54, respectively), BMI ($r = 0.25$ and 0.27, respectively) and portal vein diameter ($r = 0.24$ and 0.22, respectively). Distal diameter of CBD was significantly larger in opium addicts (5.66 ± 2.65) in comparison with non addicts (3.68 ± 1.17, $P = 0.04$).

CONCLUSIONS: CBD diameter associates with age, BMI, portal vein diameter and opium addiction. CBD dilatation, if it can not be explained by age, opium usage or large BMI, should be evaluated further to rule out obstruction.

KEY WORDS: Common bile duct, predicting factors, ultrasonography.

JRMS 2007; 12(3): 121-124

Over the last two decades ultrasonography has become an important device to evaluate pathologies of the biliary tree [1] and represents a major diagnostic tool in suspected bile duct obstruction [2]. With the development of high resolution scanners the luminal diameter of the common bile duct (CBD) can be assessed accurately. Despite these technical developments, controversy persists concerning the effects of cholelithiasis, cholecystectomy, age, sex and weight on the CBD diameter [3,4]. Because a dilated extrahepatic duct distinguishes obstructive from non-obstructive causes of jaundice, accurate standards for normal measurements must be available [5]. We should consider that in patients with gall bladder stones, and ultrasonographic CBD dilatation, there is a much higher likelihood of ductal stones [6,7]. The purpose of our study was to determine association between CBD diameter and age, sex, body mass index (BMI), fasting duration, addiction, portal vein diameter and liver span.

Methods

Patients: Between June and August 2006, 383 (223 women and 160 men) consecutive patients older than 16 years old who were referred for

*Assistant Professor, Department of Radiology, Al-Zahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran.
e-mail: a_adibi@med.mui.ac.ir (Corresponding Author)
**Medical Student, Al-Zahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran.

abdominopelvic ultrasound examination for any reason underwent ultrasonographic evaluation of their CBD. Patients' age, sex, height, weight, fasting duration and history of opium usage were recorded. They were not included in the study if they had any history of pancreatic, liver or biliary disease. They were also excluded if they had intrahepatic bile duct dilatation, hepatomegaly (liver span >15 cm), pancreatic mass, or abdominal ileus which interfered with ultrasonography. So, eight cases were excluded, five because of abdominal ileus, two with hepatomegaly, and one with a pancreatic head mass and mild intrahepatic biliary dilation. 375 cases remained in study (219 females and 156 males).

Scanning technique: The term CBD denotes the common channel of either the common hepatic or the true common bile duct, because cystic duct insertion can not be shown. All examinations were performed by a single radiologist and CBD diameters were determined with a real time scanner (curve linear array probe, 3.5-5 MHz, Toshiba, model Just Vision, 1999). Examinations were performed in the supine position, and in maximal inspiration. At first, we measured the liver span in the parasagittal plane in the midclavicular line, and then by using the right anterior subcostal window, the diameter of the CBD and portal vein were measured at porta hepatis (as proximal CBD diameter recorded). Finally, the CBD diameter (as distal part of CBD) was measured in longitudinal view, behind the pancreatic head. Measurements were made from inner to inner walls of the ducts by using electronic calipers.

Statistical analysis: Analysis was performed with Statistical Package for Social Science Software (SPSS version 11.0 Chicago, IL, USA). The data were presented as mean (± SD) and frequency (%), where appropriate. Correlation coefficients were evaluated using Spearman correlation test. To evaluate the normality of data distribution, the Kolmogorov-Smirnov test was used. To compare CBD diameter regarding sex and opium addiction, independent-sample t test was used. Also, logistic regression analysis was used to assess the association of predicting variables with CBD diameter, as the dependent parameter. P value <0.05 was considered statistically significant.

Results

The participants aged between 16-97 years (mean age of 44.47 ± 17.14 years) and included 219 (58.4%) women and 156 (41.6%) men. There were nine opium addicted cases and 26 cases with asymptomatic gallbladder stones. The mean CBD diameters of proximal and distal parts were 3.64 mm (± 1.2) and 3.72 mm (± 1.2), respectively. Strong correlation between proximal and distal parts was found (r = 95%, P<0.05). CBD diameter was significantly correlated with age, BMI and portal vein diameter, but not with duration of fasting or liver span (table 1). CBD diameter in opium users was significantly higher than that in non-opium users (table 2). No association was found between CBD diameter and sex or gallbladder stones (table 2).

Discussion

Our results showed a significant correlation between CBD diameter and age, BMI and portal vein diameter. Ninety five percent confidence interval (CI) for CBD diameter in proximal part was 3.52-3.70 mm and in distal part was 3.60-3.85 mm which were in the range of the reference studies [4]. There was a strong correlation between diameter of CBD in proximal and distal parts. This was expected because the normal CBD is a tube with a constant diameter. This study showed a strong correlation between CBD diameter and age but there was not any significant difference between two sexes. These results are in agreement with the studies of Wu et al [3], Kaim et al [2], Niederau et al [4] and Bowie [8]. The enlargement of CBD diameter by increasing age may be explained by fragmentation of the longitudinal smooth myocyte bands and intervening connective tissues, and loss of the reticulo-elastic network of duct wall by ageing [2]. In contrast, Horrow et al [5] did not find an association between age and

Table 1. Correlation coefficients between proximal and distal CBD diameter and predicting factors.

	MEAN ±SD(RANGE)	PROXIMAL	DISTAL
Age(Yr)	44±16(16-97)	0.54(<0.001)	0.53(<0.001)
BMI	27.7±5.0(13.6-52.9)	0.26(<0.001)	0.28(<0.001)
Fasting duration(hr)	6.1±4.2(0.5-48)	0.07(0.13)	0.08(0.11)
Liver span	113±17(68-150)	0.07(0.13)	0.06(0.22)
Portal vein diameter	9.75±1.25(6.5-13.5)	0.23(<0.001)	0.23(<0.001)

*data presented as r (P value)

Table 2. Univariate analysis of CBD diameter regarding sex, cholecystectomy and opium usage.

	Male sex		Cholecystectomy		Opium user	
	yes	No	Yes	No	Yes	no
Proximal (p-value)	3.74±1.30	3.57±1.15	4.13±0.97	3.63±1.22	5.37±2.67	2.60±1.13
	(0.13)		(0.14)		(0.03)	
Distal (p-value)	3.83±1.29	3.65±1.22	4.13±0.97	3.71±1.25	5.66±2.65	3.68±1.17
	(0.18)		(0.22)		(0.04)	

*Data presented as mean±SD.

diameter of the CBD in an asymptomatic population. Horrow did not consider the respiratory phase for duct measurements which was accounted for in our study; maximum ultrasonographic CBD diameter can increase in deep inspiration [9]. We also did account for BMI which we found has a correlation with CBD diameter. This was expected because CBD is a part of the body habitus. This would be the same for portal vein diameter, which has a strong correlation with CBD diameter. The current results did not show any correlation of duct size with fasting duration and liver span. While normal non-obstructed CBDs should have a roughly constant diameter without change due to different meals, it would be expected not to find any correlation of their diameter by hours of fasting. Our study suggested an association between CBD diameter and addiction, though a more precise study with larger samples is recommended. The study of Chuah et al [10] also showed significantly larger CBD in opium addicts. CBD dilatation in opium addicts is probably due to morphine and opioids which cause sphincter of Oddi spasm, increasing CBD pressure chronically, resulting in functional obstruction of the CBD. We were not able to find the effect of gallstones on the CBD diameter. Because of the small number of cases with incidental gall

bladder stones in our study, another specific study on these patients is recommended. In conclusion, CBD diameter correlates with age, BMI, portal vein diameter and opium addiction. Fasting duration, liver span and sex do not alter CBD diameter significantly. If CBD dilatation can not be explained by age, opium usage or a large BMI, the patient should be further evaluated to rule out an obstruction.

References

1. Reinus WR, Shady K, Lind M, Scott R. **Ultrasound evaluation of the common duct in symptomatic and asymptomatic patients**. *Am J Gastroenterol* 1992; 87(4):489-492.
2. Kaim A, Steinke K, Frank M, Enriquez R, Kirsch E, Bongartz G et al. **Diameter of the common bile duct in the elderly patient: measurement by ultrasound**. *Eur Radiol* 1998; 8(8):1413-1415.
3. Wu CC, Ho YH, Chen CY. **Effect of aging on common bile duct diameter: a real-time ultrasonographic study**. *J Clin Ultrasound* 1984; 12(8):473-478.
4. Niederau C, Muller J, Sonnenberg A, Scholten T, Erckenbrecht J, Fritsch WP et al. **Extrahepatic bile ducts in healthy subjects, in patients with cholelithiasis, and in postcholecystectomy patients: a prospective ultrasonic study**. *J Clin Ultrasound* 1983; 11(1):23-27.
5. Horrow MM, Horrow JC, Niakosari A, Kirby CL, Rosenberg HK. **Is age associated with size of adult extrahepatic bile duct: sonographic study**. *Radiology* 2001; 221(2):411-414.
6. Majeed AW, Ross B, Johnson AG, Reed MW. **Common duct diameter as an independent predictor of choledocholithiasis: is it useful?** *Clin Radiol* 1999; 54(3):170-172.
7. Gronroos JM, Haapamaki MM, Gullichsen R. **Effect of the diameter of the common bile duct on the incidence of bile duct stones in patients with recurrent attacks of right epigastric pain after cholecystectomy**. *Eur J Surg* 2001; 167(10):767-769.
8. Bowie JD. **What is the upper limit of normal for the common bile duct on ultrasound: how much do you want it to be?** *Am J Gastroenterol* 2000; 95(4):897-900.
9. Wachsberg RH. **Respiratory variation of extrahepatic bile duct diameter during ultrasonography**. *J Ultrasound Med* 1994; 13(8):617-621.
10. Chuah SY, Leong CK, Pang CW. **Dilated common bile duct in opium addicts with and without biliary symptoms --implication for research in AIDS cholangiopathy**. *Singapore Med J* 2003; 44(5):261-267.