The THAI Journal of SURGERY

Official Publication of the Royal College of Surgeons of Thailand

Vol. 26 July - September 2005 No. 3

The Anatomical Variations of Cystic Duct in Northeastern Thai Population

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Abstact

Background: **The anatomical characteristics of the cystic duct vary. Each is of great importance, particularly for gallbladder surgery, be it open cholecystectomy or laparoscopic cholecystectomy. Operation with bile duct injury, such as common hepatic duct or common bile duct injuries, may result in serious complications.**

Objectives: **To study the anatomical characteristics of the cystic duct and their variations from donated cadavers. The results should stand for the Northeastern population.**

Materials and Methods: **A descriptive study was conducted whereby medical data on dissection of the liver hilar were reviewed. Records of the findings were registered on the relevant form . Data of donors, from 2000-2002, were supplied by the Anatomical Department, Faculty of Medicine, Khon Kaen University.**

Results: **The studied group included 96 patients, of which 59.4% were male and 40.6% were female, aged between 20-91 years (average 66.27). The main causes of death included heart failure (29.17%) and cancer (8.33%). All patients were from Northeastern region, mostly from Nakorn Ratchasima province (21) and Khon Kaen province (20). The cystic duct usually joined the common hepatic duct (CHD) at the right of RHD (92.7%) and the pathway encountered included angular type (79.2%), parallel type (8.3%), anterior spiral type (6.3%) and short or absent type (5.2%). The length of the cystic duct is 0-6 cm (average 1.42 cm) . In addition, there are also anomalous characteristic, namely accessory duct (1.04%) and replaced duct (1.04%)**

Conclusions: **In the Northeastern population, the cystic duct joins the CHD mostly with a right angular junction and is on average 1.42 cm long. There are unusual anatomical variations which account for 7.28% and are divided into short or absent type (5.2%), accessory duct (1.04%) and replaced duct (1.04%)**

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The cystic duct leads from the infundibulum of the gallbladder and joins the common hepatic duct to form the common bile duct. It is 0-8 cm or approximately 5 cm long. The cystic duct usually enters the common hepatic duct from the right, forming an angle of 10-90 degree with it, or may enter from the left, the front or the back. It may spiral around or run parallel to the common hepatic duct before forming a common bile duct.

The anatomical characteristics of the cystic duct vary. Recognition of the anatomical variations is essential as it helps to understand the pathology of the bile duct, which is critical during surgery, particularly surgery of the gallbladder. Identification of the location of the cystic duct and of the type of, junction with, the common hepatic duct makes the operation more convenient, safer and also reduces complications resulting from injury to the bile duct or the common hepatic duct during the operation. For example the laparoscopic cholecystectomy can be very risky, if the common bile duct or the common hepatic duct is not dissected from the cystic duct when clamping or clipping. Accidental clipping of one of the ducts can cause congestion and bile leakage and as a result leads to jaundice. In such a case, a second operation is needed for some patients at a later stage.

Thus, the objective of this research is to study the anatomical variations of the cystic duct from donated cadavers in Northeastern Thailand so as to summarize the common characteristics of the population in this region which will be useful in treating patients, particularly, in biliary tract surgery.

Materials and Methods

For this descriptive study, data of 96 cases from the Northeastern Thailand, during 2000 to 2002, were collected from donated cadavers from the Department of Anatomy, Khon Kaen Hospital. Donors with operated gallbladder or liver hilum or donors with unclear anatomy such as liver cancer patients were excluded.

The data collection started at the gallbladder and then followed the cystic duct until it joined the common hepatic duct to form the common bile duct whereby observation on the relation of the cystic duct and the common hepatic duct was made, i.e. the location of the junction of the common hepatic duct and type and length of the cystic duct. Also data were collected to determine the accessory and/or replaced cystic duct for which the liver hilum was examined thoroughly by the same research group throughout the study and rechecked by mentor from the Department of Anatomy before the findings were recorded and pictures of the irregularities were taken.

Frequency data were collected and then converted into percentages. The length of the cystic duct is registered in centimeters.

Results

The data analysis on the variations of the cystic duct is divided into 2 parts as follows:

Summary of the samples used for the analysis.

The samples consisted of 96 donors under the following categories: gender 59.4% male and 40.6% female, age (yr) average 66.27 with maximum at 91 and minimum at 20, causes of death: heart failure 28 cases (29.17%), cancer 8 cases (8.33 %). (Table 1)

Residency: all resided in the Northeastern Thailand and scattered in 15 provinces with the most from Nakorn Ratchasima (21 cases). (Table 2)

Table 1 Summary of the cause of death

Causes of Death	Frequency	%	Accumulated %
Unspecified	31	32.29	32.29
Heart Failure	28	29.17	61.46
Allergic Reaction	3	3.13	64.59
Asthma	3	3.13	67.12
Accident	1	1.04	68.76
Liver Disease	1	1.04	69.80
Diabetes Mellitus	5	5.21	75.01
Lung Inflammation	4	4.17	79.18
Emphysema	1	1.04	80.22
Brain Hemorrhage	6	6.25	86.47
Meningitis	1	1.04	87.51
Epilepsy	1	1.04	88.55
Cancer	8	8.33	96.88
Paralysis	1	1.04	97.92
Food Poisoning	1	1.04	98.96
Tuberculosis	1	1.04	100.0
Total		**96**	**100.00**

Table 2 Number of cases in each province in the Northeastern Thailand

Province	Number of cases	%
Sakonnakorn	3	3.13
Khon Kaen	20	20.83
Nakorn Ratchasima	21	21.88
Ubonratchathani	4	4.17
Nongkhai	10	10.42
Mahasarakham	8	8.33
Nakornphanom	4	4.17
Udornthani	10	10.42
Kalasin	2	2.08
Roi-Ed	4	4.17
Chaiyaphum	4	4.17
Surin	1	1.04
Yasothorn	3	3.13
Srisaket	1	1.04
Buriram	1	1.04
Total	**96**	**100.00**

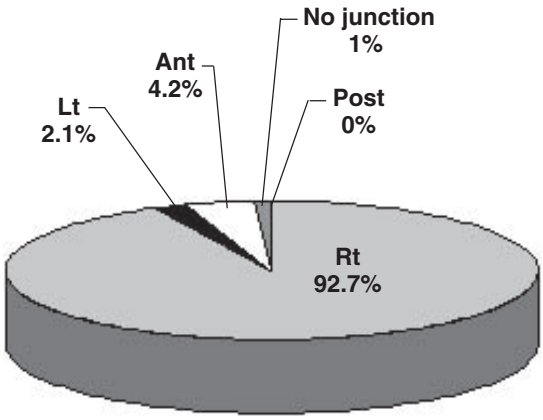

Figure 1 Entry site of cystic duct to common hepatic duct

Summary of frequency of each variation including the average length of the cystic duct

The anatomical variations which were found can be summarized as follows:

Entry site of cystic duct to common hepatic duct Studies showed that the cystic duct joined the common hepatic duct at the right in 92.7% of cases, at the left in 2.1%, at the front in 4.2% and 1% with no junction of the cystic duct and the common hepatic duct. No cases were observed where the cystic duct formed a posterior junction with the common hepatic duct. (Figure 1)

Pathway of cystic duct to common hepatic duct The investigation showed that there were various alternative pathways of the cystic duct before it joined the common hepatic duct, i.e. 1) cystic duct which coursed downwards forming an angle with the common hepatic duct before joining the common hepatic duct (angular type) at the right in 79.2% (76 cases), 2) cystic duct which coursed downwards parallel to the common hepatic duct before joining the common hepatic duct (parallel type) at the right in 8.3% (8 cases), 3) cystic duct which coursed downwards and spiralled around the common hepatic duct before joining the common hepatic duct (spiral type) at the front or the left in 6.3% (6 cases) and 4) cystic duct which joined the common hepatic and was very short (<0.5 cm) or no cystic duct at all (Short or Absent Type) in 5.2% (5 cases). (Figure 2)

Length of cystic duct The investigation showed that the average length of the cystic duct was 1.42 cm, the longest being 6 cm and the shortest 0 cm (short or absent type). (Table 3) If categorized based on pathway, cystic duct of angular type is 1.44 cm long, of parallel type 1.94 cm long, of spiral type 1.67 cm long and of short type 0 cm long. (Figure 3)

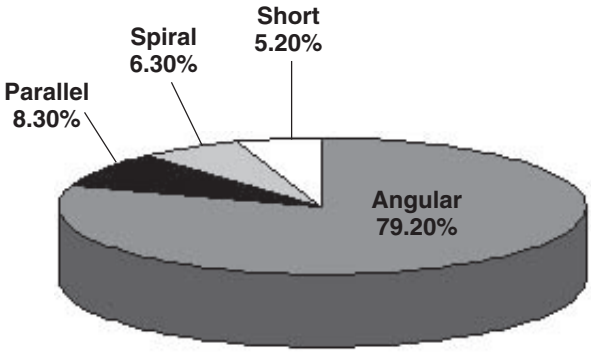

Figure 2 Pathway of cystic duct to common hepatic duct

Table 3 Statistics of cystic duct based on length

Pathways	Length in cm		
	Maximum	Minimum	Mean
Angular	6	0.5	1.44
Parallel	4	0.5	1.94
Spiral	3.5	1	1.67
Short	0	0	0
Total	**6**	**0**	**1.42**

Accessory Cystic Duct One case of an accessory cystic duct was found representing 1.04% of the sample. The duct joined the right hepatic duct.

Replaced Cystic Duct One case of a replaced duct was found representing 1.04% of the sample. The duct joined the right hepatic duct.

Discussion

From the study, the conclusions can be drawn that the cystic duct is 0-6 cm long, (average 1.42 cm) and mostly courses downwards and joins the common hepatic duct at the right (92.7%) forming an angle to the common hepatic duct (angular type) before forming a common bile duct (79.2%).

There are 5 characteristics of cystic duct's pathway before forming common bile as follows: 1) angular type - cystic duct runs downwards forming an angle with the common hepatic duct before joining the common hepatic duct in 79.2% (76 cases). 2) parallel type - cystic duct runs downwards parallel to the common hepatic duct before joining the common hepatic duct. Usually the 2 ducts will be spiralled by adhesion before joining together in 8.3% (8 cases). 3) spiral type - cystic duct runs downwards and spirals around the common hepatic duct before joining the common hepatic duct in 6.3% (6 cases). 4) short or absent type - cystic duct joins the common hepatic and is extremely short or no cystic duct at all in 5.2% (5 cases). 5) replaced cystic duct - abnormal cystic duct leading from gallbladder and joins right hepatic duct in 1.04% (1 case)

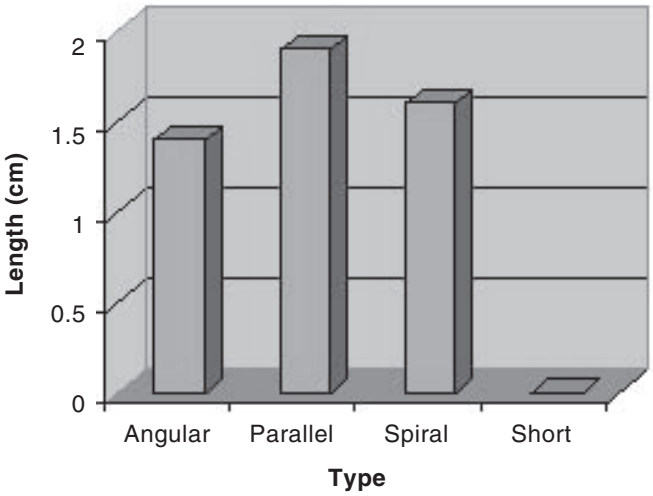

Figure 3 Length of cystic duct

Comparing the above variations to the results from overseas studies[1-4], according to the study of Kune GA and Moosman DA, there are similar variations of cystic duct with angular type being mostly found followed by parallel type and spiral type consecutively. However, study of Berci G shows that spiral type is found the most, followed by angular type and parallel type consecutively. Moreover, 2 more variations are found namely short or absent duct and replaced duct which were not found in other studies as shown in Table 4.

In addition, we encountered another variation of cystic duct other than normal cystic duct, namely accessory duct which leads from the gallbladder and joins the right hepatic duct (1.04%). This variation can cause complications in cholecystectomy and should be dealt with carefully.

Conclusion

This investigation shows that in the Northeastern population the most common arrangement is a cystic

Table 4 Pattern of cystic duct

Source of Research Variation	Khon Kaen 2004 (N = 96)	Moosman DA 1951 (N = 1000)	Kune GA 1970 (N = 1000)	Berci G 1981
1. Angular	79.2	75	75	17
2. Parallel	8.3	20	20	7
3. Spiral	6.3	5	5	76
4. Short or Absent	5.2	0	0	0
5. Replaced Cystic Duct	1.04	0	0	0

duct which joins the common hepatic duct at the right and forms an angle to the common hepatic duct (angular type) before forming a common bile duct. The cystic duct is on average 1.42 cm long.

Also there are unusual anatomical variations as follows: short or absent type in 5.2%, accessory duct in 1.04% and replaced duct in 1.04%. These variations are dangerous and special attention should be given during cholecystectomy. They account for 7.28%.

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