

Comparative Study of Common Bile Duct Diameter between Normal and Post Cholecystectomy Cases Using Trans-abdominal Ultrasonography

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ABSTRACT

Background

Increase in common bile duct diameter can occur because of different causes. Post cholecystectomy status is one of the potential causes. Many studies done in the past show different results and are hence inconclusive.

Objective

To see if the post cholecystectomy cases would have a statistically significant change in common bile duct diameter.

Method

We carried out a study in 100 cases (46 post cholecystectomy cases and 54 cases with intact gall bladder, measuring their common bile duct diameters and performing an unpaired t test to see if the mean in common bile duct among these two groups of cases was statistically significant.

Result

One hundred cases, 46 post cholecystectomy cases and 54 cases with intact gall bladder were included in our study. An unpaired t-test was used to compare the common bile duct diameters in these two groups. Our findings showed that the difference in common bile duct diameter between the cases with intact gall bladder and those who underwent cholecystectomy was significant for both one tailed and two tailed studies ($p < 0.001$). Hence, it can be stated that post cholecystectomy status increases the common bile duct diameter.

Conclusion

An increased Common bile duct diameter in post cholecystectomy case could be because of the post cholecystectomy status itself and not due to some other obstructive cause. So careful decision is necessary before subjecting the patient to further invasive/non-invasive investigations and treatments.

KEY WORDS

Cholecystectomy, Common bile duct, Diameter, Dilatation, Ultrasonography

INTRODUCTION

Common bile duct (CBD) diameter can increase because of different obstructive causes like periampullary growth, choledocholithiasis and periampullary diverticulum. Age and cholecystectomy status are also cause of increase in CBD diameter.¹ It was thought that after cholecystectomy, caliber of CBD increased to take over the storage function of gallbladder. Early studies were based on demonstration of dilatation in animals at reoperation and autopsy. Many studies done in the past showed disparity in their results.² A study done four decades back concludes that CBD diameter does not alter significantly in post cholecystectomy patients.³ However, recent study has shown that CBD caliber increases significantly in post cholecystectomy cases.^{4,5} It has also to be kept in mind that according to the study done by Wu et al. about four decades ago, age has a major role to play in the diameter of CBD as it increases by 1 mm every decade.⁶ Widening of CBD in elderly could be because of loss of elastic fibres in the duct or because of compensatory dilatation of proximal duct secondary to sclerosis in the distal part.^{7,8} Few consecutive studies supported this statement.^{9,10} However, other studies done further later showed controversies.^{11,12} The inconsistent result shown by the old studies may be attributed to limitations in methodology in the old studies.²

It is imperative that measurement of CBD should be accurate and repeatable. There are few difficulties that have to be taken into consideration. The diameter of CBD is not uniform. Sonologically, it is difficult to differentiate between the common hepatic duct and common bile duct and the measurement can be taken from either of them.¹³ Also, a consensus has not been established regarding a normal range of CBD diameter. So it is sensible to measure the widest part of common hepatic duct (CHD) or common bile duct.^{13,14}

Hence we carried out this study to make it clear whether the diameter of CBD changes significantly after cholecystectomy.

METHODS

A quantitative, observational case control study was carried out between the cases who had undergone cholecystectomy in the past and the controls who had not undergone the surgery. The participants included in this study were the randomly selected cases who came to the department of radiology Dhulikhel Hospital, Kathmandu University Hospital from January 2019 to December 2020 for ultrasound of abdomen and pelvis as advised by the doctors of different departments of the Hospital. Hundred cases were included in the study. All the participants underwent abdominal ultrasound scan for suspected pathologies other than that of hepatobiliary system. The participants were informed about the procedure. Subsequently, informed

consents were taken from them. The participants who were found to have hepato-biliary pathology like hepatitis, biliary calculi/strictures/neoplastic growths were excluded from the study. For the post cholecystectomy cases, at least one year of post cholecystectomy status was made as the minimum requirement criteria. A minimum of 6 hours fasting was needed to get enrolled in the study in order to let the bile ducts get filled with good amount of bile secretions and also to get a better acoustic window for the structures to visualize. Abdominal ultrasound was then performed with special focus on the hepatobiliary system. Ultrasound machine used for the study was Aloka Prosound Alpha 6. The person who did the scan were the consultant radiologists working in the Hospital. Scanning were done in various planes, viz, sagittal, transverse and oblique in the intercostal, subcostal and subxiphoid regions. The maximum diameter of the CBD (or CHD) was then taken. The data was recorded in the proforma. The data thus collected was then analyzed using the computer software: Microsoft EXCEL and SPSS. Unpaired t test was applied to see if the mean in common bile duct among these two group of cases was statistically significant.

RESULTS

Among the 100 participants, 46 were the post cholecystectomy cases and 54 were the ones with intact gall bladder (table 1). Thirty nine were males and 61 were females (table 2). Age of the participants varied from seven years to 86 years. For convenience, age wise participants were categorized into four groups: less than 50 years, 50 years to 59 years, 60 years to 69 years, and 70 years and above.

Table 1. Mean CBD diameter in post cholecystectomy cases and cases with intact gall bladder.

GB Status	Mean	N	Std. Deviation
Post Op	7.2152	46	1.75245
Intact GB	4.7130	54	1.32224
Total	5.8640	100	1.97558

Table 2. Mean CBD diameter in male and female.

Sex	Mean	N	Std. Deviation
Male	5.6410	39	1.89885
Female	6.0066	61	2.02566
Total	5.8640	100	1.97558

Sex wise diameter of CBD was calculated and the result is as shown in the table 2. Mean CBD diameter in male and female considering the status of GB is shown in table 3. This table shows that in male as well as female, mean CBD diameter is greater in the post cholecystectomy cases as compared to those with intact GB. Considering both age and status of GB, CBD diameter was calculated and the

Table 3. Mean CBD diameter in male and female with post cholecystectomy status and intact gall bladder.

Sex	GB Status	Mean	N	Std. Deviation
Male	Post Op	6.7625	16	1.68082
	Intact GB	4.8609	23	1.65851
	Total	5.6410	39	1.89885
Female	Post Op	7.4567	30	1.76941
	Intact GB	4.6032	31	1.02094
	Total	6.0066	61	2.02566

result is shown in table 4. This table shows that in each age group, diameter of CBD in post cholecystectomy group is larger than that in the cases with intact GB.

In order to see if the difference in CBD diameter between participants with post cholecystectomy status and participants with intact GB is statistically significant,

Table 5. Independent sample test.

		Levene`s Test for Equality of Variances				Significance			
		f	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
CBD diameter	Equal variances assumed	5.870	0.017	8.125	98	< 0.001	< 0.001	2.50225	0.30795
	Equal variances not assumed			7.947	82.712	< 0.001	< 0.001	2.50225	0.31486

an unpaired t-test was done. The test showed that the difference is statistically significant (p value less than 0.001) for both one tailed as well as two tailed study (table 5). This study hence proves that the increase of CBD diameter in post cholecystectomy participants as compared to the participants with intact gall bladder is statistically significant.

DISCUSSION

As per our finding, cholecystectomy status leads to a significantly increased CBD diameter. In normal cases, gallbladder functions to store and concentrate the bile formed by the hepatobiliary system and releases after ingestion of food. In post cholecystectomy cases, because of the absence of GB, it is believed that the storage function of the bile duct is taken over to some extent by the biliary tree itself, thereby increasing the caliber of the bile ducts, mainly, the extrahepatic bile duct (CBD).² Though many researches show results in favour of this statement, it still remains unproven and more researches are required to further strengthen it.

The rationale for choosing USG for this study is clear. USG is a cheap, easily available tool and it has got no significant adverse effect. Ultrasonography is a very good imaging modality for the evaluation of GB and hepatobiliary system.¹⁵ Gall bladder and bile ducts both appear anechoic

Table 4. Mean CBD diameter in different age categories with regards to GB status.

Age	GB Status	Mean	N	Std. Deviation
less than 50 years	Post Op	6.7800	10	1.31301
	Intact GB	4.1091	22	1.11009
	Total	4.9438	32	1.70803
50-59 years	Post Op	6.1867	15	1.75738
	Intact GB	4.5750	12	.75934
	Total	5.4704	27	1.60404
60-69 years	Post Op	7.8500	12	1.52405
	Intact GB	4.7600	10	.95126
	Total	6.4455	22	2.02102
70 years and above	Post Op	8.5667	9	1.36290
	Intact GB	6.1600	10	1.60153
	Total	7.3000	19	1.90584

against the background of isoechoic liver tissue. The liver offers a very good acoustic window allowing clear visualization of the biliary system and gall bladder.

This research aims to help clinicians utilize USG imaging to make important clinical decisions in the patients with obstructive jaundice. Biliary obstruction is a common problem and many patients from every part of the country are referred to our hospital for better management. Often, proper visualization of the obstructive pathology (stones, strictures, neoplastic growths) is difficult. Caliber of the visualized bile ducts can give us idea about the presence/absence of distal obstruction. Idea about the post cholecystectomy caliber of CBD is hence essential before assuming whether there is an obstructive pathology. It thus makes it easier to decide if further evaluation (ERCP, MRCP) is necessary or not in post cholecystectomy cases who have larger than expected CBD caliber.

Many factors that determine the diameter of CBD are taken into consideration while selecting the cases and listed in the exclusion criteria. As mentioned earlier, age is one of the confounding factors as progressing age can also cause significant increase in the CBD diameter. It can sometimes be difficult to differentiate whether the increase in diameter is because of the post cholecystectomy status or merely due to increasing age.¹⁶ In order to minimize this error, an effort has been made to include the cases with intact GB

as well as post cholecystectomy from all age groups. But it cannot be denied that some error might have occurred as a result of this factor.

If follow up size of CBD is taken in short interval, no significant change in the diameter of CBD may be seen.^{3,17,18} But if follow up is done after a long interval of time, significant increase in diameter of CBD can be seen.^{5,19} In our study, in post cholecystectomy cases, CBD diameter documentation time ranged from 1 year to 27 years with a mean of 9.67 years. So there is no uniform time interval between the time of surgery and measurement of CBD diameter.

The cases included in the study were selected randomly from the ones who came to our ultrasound department to

have an abdominal scan for causes other than hepatobiliary symptoms. There was no room for selection bias.

CONCLUSION

This study shows that the cases who have undergone cholecystectomy will have increased CBD diameter as compared to those who have not undergone surgery. It suggests clinicians to expect larger CBD diameter in the post cholecystectomy cases and hence to avoid further unnecessary investigation and interventions. In future, other imaging modalities like MRCP or Endoscopic ultrasonography can also be used to carry out similar studies.

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