

Cystic Duct Anomalies and their Surgical Implications in Patients Undergoing Laparoscopic Cholecystectomy

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ABSTRACT

BACKGROUND: . During cholecystectomy, to avoid common bile duct injury or other per operative complication, the knowledge of cystic duct anomalies is imperative. This study aimed to highlight cystic duct anomalies identified during laparoscopic cholecystectomy and report their implications.

METHODS: This prospective study was conducted at Liaquat University of Medical & Health Sciences, Jamshoro over a period of six years (2009-2014) in the department of Surgery. Over this specified period a total of 775 patients underwent cholecystectomy and were included in this study.

RESULTS: Among 775 patients who underwent laparoscopic cholecystectomy, abnormal confluence was found in 7.22%, short cystic duct in 26.78%, long cystic duct in 17.86% and double cystic duct in 12.50%. Surgical problems encountered due to these variations were cystic duct avulsion, common bile duct injury, bleeding and bile leak.

CONCLUSION: During laparoscopic cholecystectomy, unidentified anatomical variations of cystic duct may cause drastic complications including ductal injuries which significantly increase morbidity and may raise mortality.

KEY WORDS: Cystic duct anomalies, laparoscopic cholecystectomy, biliary tree anomalies.

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INTRODUCTION

The anatomy of the cystic duct is not only of interest to anatomists but also equally interesting and important for surgeons. Anatomical variations in the biliary tree have been reported since the beginning of literature related to biliary system. However, these have been reported as small series or case reports. Anomalies of cystic duct are not uncommon during laparoscopic cholecystectomy, with variable frequency, ranging from 4% to 23%^{1,2}. The commonly reported anomalies include variation in the length of cystic duct, at the site of confluence³ absent or double cystic ducts^{2,4-11}. Since cyst duct has to be ligated individually during cholecystectomy, therefore any anatomical variation carries highest risk of per-operative or even post-operative complications. Pre-operative investigations such as endoscopic retrograde cholangiopancreatography (ERCP), Magnetic Resonance Cholangiopancreatography (MRCP), per-cutaneous Cholangiography (PTC) or intraoperative Cholangiography are potential investigations to identify these anomalies; however

these are not done as part of routine pre-operative work-up. Thus a very careful search must be done before proceeding to ligate cystic duct.

This prospective study was conducted to evaluate the anomalies of cystic duct and also to implicate their importance when they are encountered during laparoscopic cholecystectomy.

METHODS

This prospective study was conducted at Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan for over a period of six years from January 2009 to December 2014. Patients undergoing laparoscopic cholecystectomy for cholelithiasis were included. However those who were found to have carcinoma gall-bladder or stones in common bile duct (CBD) were excluded due to the risk of acquired distortion of the anatomy. All patients had baseline investigations for anesthesia fitness and ultrasound abdomen to confirm their diagnosis. Pre-operatively none of these patients underwent any diagnostic investigations ie: CT scan, ERCP, PTC or MRCP to evaluate any such

anomaly. All patients underwent cholecystectomy under general anesthesia and received standard pre, per and post-operative care under a single team of surgeons following the same management protocol. During surgery a careful search was carried out to evaluate any cystic duct anomaly with laparoscopic eye. If any anomaly was observed it was recorded immediately and the surgical difficulties faced due to that anomaly were also noted.

The data was recorded on a proforma and then entered into Statistical Package for Social Sciences (SPSS version 18.0, Chicago, Illinois, USA). The data presented as frequency tables.

RESULTS

A total of 775 patients underwent laparoscopic cholecystectomy for cholelithiasis and were included in this study. Mean age of the patients was 43.4 years, however majority of the patients were over 40 years of age (Figure I). Great majority of the patients (n=409, 52.77%) came with the complaint of pain in the right hypochondrium, followed by pain in upper abdomen (n=227, 29.29%). Frequency distribution of the symptoms is given in Table I.

Cystic duct anomalies were found in 56 (7.2%) patients. Short cystic duct was the most common anomaly seen in 15 (26.78%) patients, followed by long cystic duct (n=10, 17.86%). All the anomalies encountered in these patients are presented in Table II. Difficulties were encountered during 32 surgeries due to these anomalies. These problems include injury to CBD, (n=12, out of which five were identified on table and seven during post-operative period), bleeding (n=9), biliary leak (n=7) and cystic duct avulsion (n=4) (Figure II).

TABLE I: DISTRIBUTION LIST OF THE PATIENT'S SYMPTOMS UNDERWENT LAPAROSCOPIC CHOLECYSTECTOMY

Symptom	Number	Percentage
Pain in right hypochondrium	409	52.77
Pain in right hypochondrium and epigastrium	227	29.29
Pain in epigastrium	139	17.93
Dyspepsia	90	11.61
Fullness in epigastrium	86	11.09
Nausea and vomiting	53	6.84

TABLE II: FREQUENCY OF CYSTIC DUCT ANOMALIES FOUND DURING LAPAROSCOPIC CHOLECYSTECTOMY

Type of cystic duct anomalies	Number	Percentage
Short cystic duct	15	26.78
Long cystic duct	10	17.86
Double cystic duct	7	12.50
Low sited confluence	6	10.71
Cystic duct parallel to CBD with low insertion	5	8.93
Posterior spiral insertion	5	8.93
Absence of cystic duct	3	5.35
Anterior spiral insertion	2	3.57
Accessory cholecysto-hepatic duct	2	3.57
Insertion in right hepatic duct	1	1.78

FIGURE I: AGE DISTRIBUTION OF THE PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY

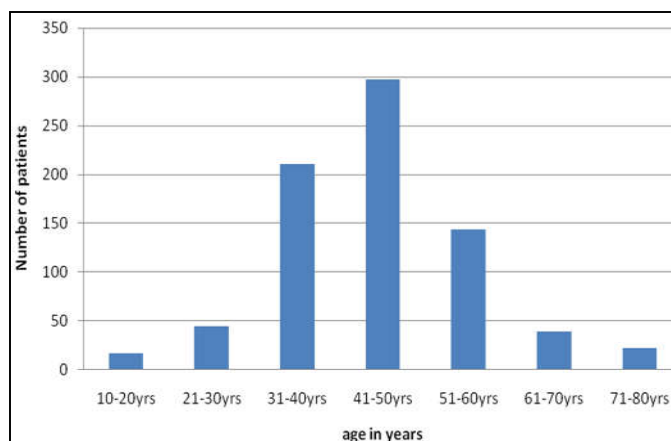
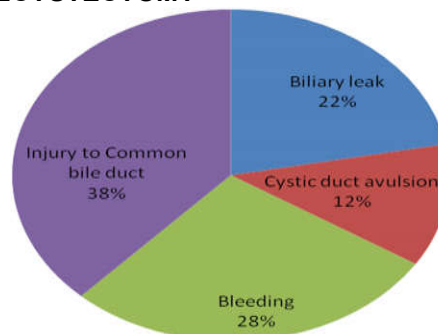


FIGURE II: PRE-OPERATIVE COMPLICATIONS ENCOUNTERED DURING LAPAROSCOPIC CHOLECYSTECTOMY



DISCUSSION

The cystic duct is an important structure to be identified and ligated individually during cholecystectomy. The added benefit of laparoscopic procedure is the magnified view with high resolution that greatly helps in the identification of the cystic duct and its anomalies if present.

The prevalence of cystic duct anomalies was 7% in this study. These anomalies resulted in per-operative difficulties and also post-operative complications. The literature shows variable results depending on the number of cases; however it ranges from 4% to 23%^{1,2,4,7,12-14}. Most of these studies reported all the related anomalies of the entire biliary tree. In contrast our study was focused only on cystic duct anomalies.

Since the ancient period six variations in the cystic duct have been known by the anatomists and surgeons, including: normal cystic duct, fibrous band between normal cystic duct and hepatic duct, low insertion cystic duct, spiral confluence, accessory cystic duct and absent cystic duct¹⁵. However with time passed by and after introduction of laparoscopic cholecystectomy, the identification of the variation has become more convenient.

The variation in the length of cystic duct was most frequently found anomaly in our series. Which has also been reported in the past, where out of 13 cystic duct anomalies 11 were related to its size (short=8, long =3). The variation in the site of confluence is quite well reported in the literature, where a number of varieties have been found and reported as case reports and small series. The anomalies include low insertion, insertion into left or right hepatic ducts, anterior or posterior spiral type insertion, insertion into left or right hepatic duct, anterior or posterior spiral type insertion or pre-hepatic insertion^{2,3,12}. In our study the most frequently found anomalous site was low insertion, which accounts for 10% of anomalies. There are a number of studies stating similar pattern of occurrence of low insertion. A study from China analyzed 1100, including analyzed confluence of cystic and common bile ducts¹⁶ reported 5.9% (n=65) abnormal insertions and low insertion was most commonly seen ie: 54 cases out of 65¹⁶. Another study from China focused on low insertion of the cystic duct and found that 5.4% (n=191 out of 3546) patients found to have low insertion of cystic duct².

Anterior and posterior spiral insertions have also been reported in the literature but as case reports or part of the biliary tree anomalies encountered during cholecystectomy³. In our study two patients had anterior spiral insertion and five had posterior spiral insertion. Insertion to right hepatic duct seems to be relatively uncommon. Literature reports a few case reports and said to be rare^{13,17,18}.

The double cystic duct, which if not identified on time may result in disastrous outcome. In our study over 12% of patients were found to have double cystic duct. This anomaly has previously been reported in the literature with low prevalence rate^{1,4,8,11}. Similarly accessory cysto-hepatic duct and absence of cystic duct have been known as the anomalies of the cystic duct by the surgeons and anatomists for a long period. However its rate of occurrence among cystic duct anomalies has been precisely given in one study¹⁶.

The complications encountered during surgery due to abnormal cystic duct were relatively low. The rate of complications however is confounded by the expertise of the operating team. However with a careful search of the anomalies these complications can further be minimized.

CONCLUSION

Cystic duct may demonstrate a variety of anatomical variations which can cause technical difficulties during surgery especially laparoscopic cholecystectomy. The only way to identify these anomalies and to reduce subsequent morbidity is to keep these in mind before embarking upon surgery.

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