ORIGINAL ARTICLE

Extrahepatic Biliary Anatomy Variation Encountered During Laparoscopic Cholecystectomy

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ABSTRACT

Background: Cholelithiasis is one of the common surgical problems worldwide, and cholecystectomy offers complete cure for the disease. Although cholecystectomy is one of the most common major surgical procedures, it comes with the surprise to the surgeon due to high association with congenital anomalies of extrahepatic biliary tree.

Objectives: The primary objective is to assess the variability of the anatomy of the extrahepatic biliary systems in terms of extrahepatic bile ductal anomaly including gallbladder and cystic duct, and vascular anomaly seen at Calot's triangle. The secondary objectives are to study demographic profile of gallstone patients and outcome of laparoscopic cholecystectomy.

Methods: The study was conducted at B. P. Koirala Institute of Health Sciences, Dharan, for 1 year (2014–2015). The inclusion criteria were all the patients undergoing laparoscopic cholecystectomy in the department of general surgery. The exclusion criteria were CBD stone, malignancy of extrahepatic biliary tree, cholecystectomy as a part of other surgery, and open cholecystectomy.

Results: In our study, among 335 patients, anatomical variation was noted in 33 patients (9.85%). There were 5 gallbladder anomaly, 11 cystic duct anomaly, 4 right hepatic artery anomaly, and 13 cystic artery anomaly. Biliary leakage present in two cases. There was no mortality.

Conclusion: Although congenital anomalies of extrahepatic biliary tree are not common, it can be of clinical importance and surprise if present. Hence, every surgeon should assess for these anomalies during laparoscopic cholecystectomy to prevent inadvertent ductal clipping, ductal injuries, strictures, and bleeding problems.

Key words: Cholelithiasis, cholecystectomy, extrahepatic biliary

INTRODUCTION

Cholelithiasis is one of the common surgical problems worldwide, and cholecystectomy offers complete cure for the disease.[1-3] Although cholecystectomy is one of the most common major surgical procedures, it comes with the surprise to the surgeon due to high association with congenital anomalies of extrahepatic biliary tree. Different studies show these anatomical variations to account from 9.6% to as high as 54%.[4,5,6] Hence, with this intent, we have carried out this study so that it helps lowering the incident of bile duct injury. Although many imaging and pre-operative diagnostic tools are available to assess the hepatobiliary anatomy, these both are unreliable and too expensive for most of the population of our country. The aim of the study is to assess the frequency of anatomical variations of extrahepatic biliary system in patients undergoing laparoscopic cholecystectomy.[7]

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METHODS

The study was conducted at B. P. Koirala Institute of Health Sciences, Dharan, for 1 year (June 2014–May 2015). Ethical clearance was ensured from the institutional ethical review board before the start of the study on June 8, 2014. There was no conflict of interest.

The inclusion criteria were all the patients undergoing laparoscopic cholecystectomy in the department of general surgery. The exclusion criteria were CBD stone, malignancy of extrahepatic biliary tree, cholecystectomy as a part of other surgery, and open cholecystectomy.

The patients were assessed for inclusion into the study as per the above inclusion criteria. Patients were admitted through OPD after completing full laboratorial and radiological workup for surgical and anesthetic fitness. All the patients were explained about the procedure in their native language and an informed written consent was obtained. The patient's name, address, contact number, age, sex, smoking history, and prior medical/surgical history (including chronic obstructive pulmonary disease,

diabetes mellitus, chronic cardiac diseases, or prior history of surgery) and an American Society of Anaesthesiologists classification were all noted. All the patients underwent laparoscopic cholecystectomy by a consultant surgeon or a senior resident as per the hospital protocol. Standard four ports were made for laparoscopic cholecystectomy.

Structures mainly assessed were gallbladder, cystic duct, supraduodenal part of common bile duct, cystic artery, and hepatic artery which were easily handled during laparoscopic cholecystectomy. However, the assessment of hepatic ducts, portal vein, and retroduodenal and pancreatic parts of common bile ducts was not done routinely due to the possibility of iatrogenic injuries. Operative photographs were taken during laparoscopic cholecystectomy that supplement in documenting the anatomy, after dissection of the cystic duct and the cystic artery.

Postoperatively, all the patients were assessed for bleeding, biliary leakage, shoulder pain, and duration of hospital stay.

Statistics

All the data were entered into a computer and analysis was done using SPSS16. Descriptive statistics include mean, median, and range for continuous variables and absolute numbers with percentages for categorical variables.

RESULTS

A total of 335 patients were included in the study. The mean age of our study group was 40.22 ± 14.23 years (mean±SD) and majority patients were in age group 18–35 years comprising 44.5% followed by age group 36–52 years comprising 34.3%. In this study, of 335 patients, 255 (76.1%) patients were female and 80 (23.9%) patients were male with female:male ratio 2.8:1.

There was comorbity in about 25% patients as shown in Table 1.

A total of 33 patients (9.85%) had biliovascular variation. Cystic artery variation was most common (*n* = 13, 3.86%) followed by cystic duct anomaly (*n* = 11, 3.09%), gallbladder anomaly (*n* = 5, 1.49%), and right hepatic artery anomaly (*n* = 4, 1.19%) as shown in Table 2. Among cystic artery variation, aberrant cystic artery was most common (2.38%) followed by artery anterior to cystic duct (1.19%) and cystic artery arising above Calot's triangle (0.29%) as illustrated in Figures 1-3.

Cystic duct anomaly was the 2nd most common anomaly. Long cystic duct (1.49%) was most common among cystic duct anomaly followed by short cystic duct (1.2%) and aberrant cystic duct (0.6%) as illustrated in Figures 4 and 5.

Table 1: Comorbid conditions

Comorbid conditions	Frequency (%)
Hypertension	41 (12.23)
Prior surgery	30 (8.95)
Diabetes mellitus	13 (3.88)
Cardiac disease	10 (2.98)

Table 2: Extra hepatobiliary anatomy variation

Extra hepatobiliary anatomy variation	Frequency (%)
Gallbladder anomaly	
Hourglass appearance	3 (0.89)
Gallbladder fundus passing through liver	2 (0.6)
Total	5 (1.49)
Cystic duct anomaly	
Long cystic duct	5 (1.49)
Short cystic duct	4 (1.19)
Aberrant cystic duct	2 (0.6)
Total	11 (3.09)
Cystic artery anomaly	
Aberrant cystic artery	8 (2.38)
Artery anterior to cystic duct	4 (1.19)
Artery arising above Calot's triangle	1 (0.29)
Total	13 (3.86)
Right hepatic artery anomaly	
Moynihan's hump	4 (1.19)

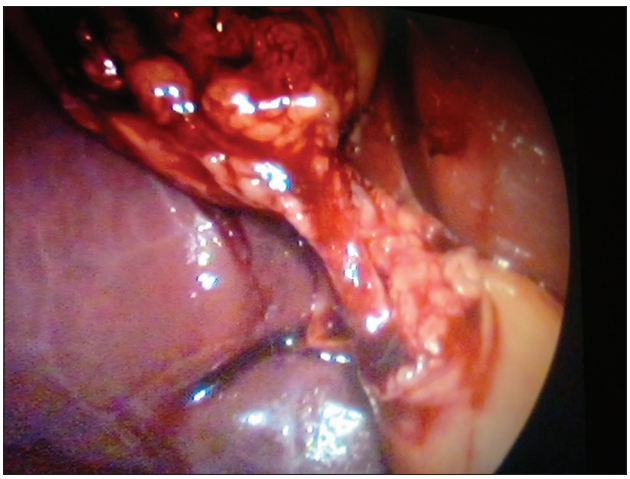

Figure 1: Anteriorly placed cystic artery

Gallbladder anomaly was found in 1.49%. Among which hourglass appearance gallbladder (0.89%) was most common followed by gallbladder fundus passing through the liver (0.6%) as illustrated in Figure 6.

Moynihan's hump was noted in 4 patients (1.19%) as illustrated in Figure 7.

There was biliary leakage in drain in 2 patients (0.6%) as shown in Table 3. We had 2 cases (0.6%) of minor biliary

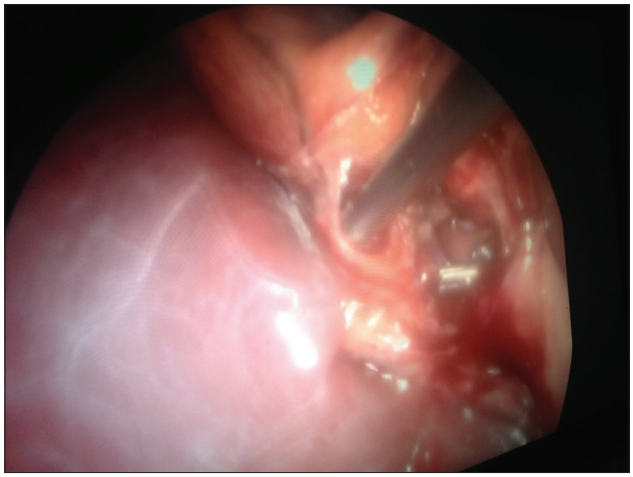

Figure 2: Aberrant cystic artery

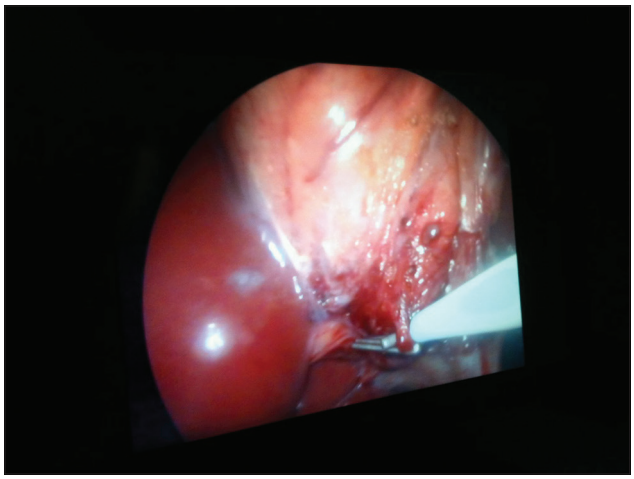

Figure 3: Aberrant cystic artery

injury. One patient had bilious drain on the 2nd post-operative period and subsequently requires redolaparoscopy on the 5th post-operative period and was found to have leak from duct of Luschka which was managed with prolene suture. Patient progressively improves and discharged. Another patient developed pain abdomen and multiple episodes of vomiting on the 2nd post-operative period. Transabdominal ultrasonography showed generalized intra-abdominal collection and bilious on aspiration. Pigtail catheter was kept in the right subhepatic space and pelvis under ultrasound guidance, but the patient condition did not improve. Redolaparoscopy planned on the 6th post-operative period where there was also biliary leak from biliary radicles from liver bed which was tied with prolene. Drain was kept. Biliary drainage appears on the 3rd post-operative period. Patient again planned for redo on the 7th post-operative day. Exploratory laparotomy done and biliary radicle in liver bed was tied. Postoperatively, patient gradually improves and discharged.

DISCUSSION

The success and safety of laparoscopic and open cholecystectomy depends on the basic knowledge of

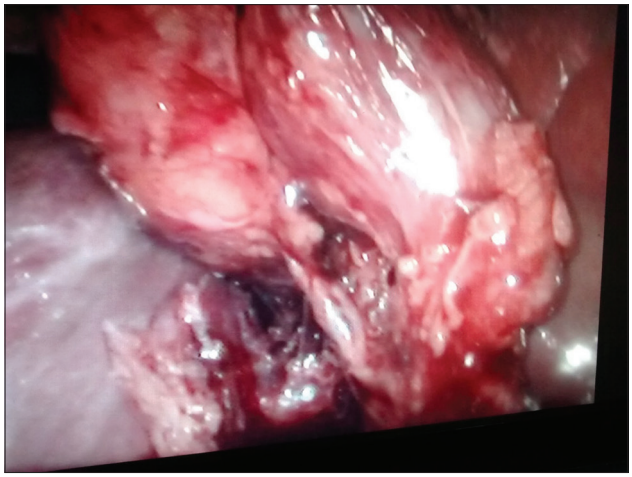

Figure 4: Aberrant cystic duct

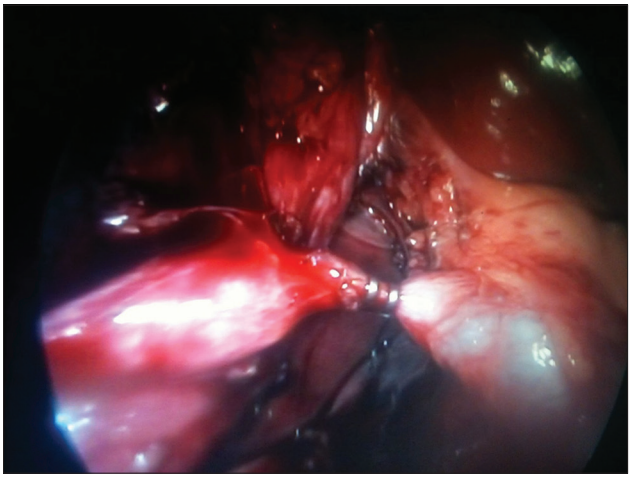

Figure 5: Short cystic duct

Figure 6: Hourglass appearance

normal anatomy and common variants of extrabiliary system.[8] Biliary tract has more anomalies in 1–13 cm of the space in the cystic duct region than in any other part of the body.[9]

In this study, the age of the patients ranged from 18 to 70 years with mean age of 40 ± 14. There was similar result in study conducted by Dawani *et al*.[5] Another study

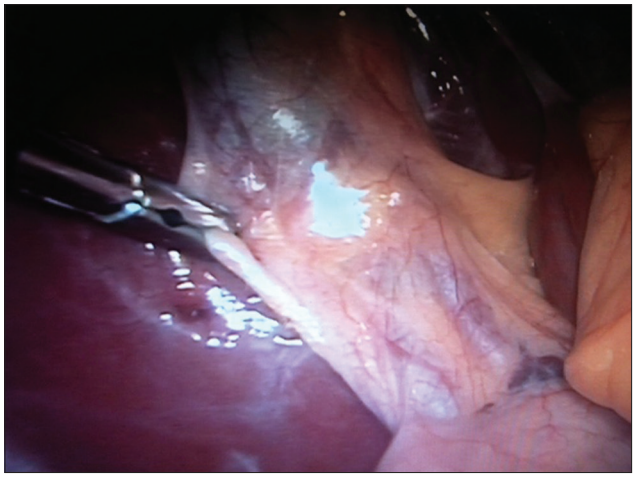

Figure 7: Moynihan's hump

Table 3: Post-operative course

Post-operative characteristic	Frequency (%)
Shoulder pain	34 (10)
Drainage	
Bloody >150 mL/day up to 48 h	10 (2.98)
Serosanguinous >150 mL/day up to 48 h	13 (3.88)
Biliary leakage	2 (0.6)

Majority (56.2%) of patient discharged within 24-h post-operative hospital stay

conducted by Talpur *et al*. (39.85 ± 18.82 years) and Khan (46.13 ± 7.77 years) were similar.[10, 6] We found that there were a total of 80 males (23.9%) and 25 females (76.1%) with male:female ratio 1:2.8. In the study of Dawani *et al*., in 2013**,** there were 11.8% male and 88.2% female patients with male:female ratio 1:7.5.[5] Another study conducted by Talpur *et al*., in 2010, includes 85% female and 15% male patients of gallstone disease and Khan in 2012 includes 82.7% female and 17.3% male gallstone patients.[10, 6]

In our study, there were 5 patients (1.49%) with gallbladder anomalies which were similar to study conducted by Talpur *et al*. where 2% had gallbladder anomalies.[6] Hassan conducted another study where he found 1.6%.[4] In gallbladder anomalies, there was hourglass appearance in 3 patients (0.85%) and gallbladder fundus passing through the liver in 2 patients (0.6%). Rajguru *et al*. found 3.33% hourglass appearance gallbladder.[11]

There were cystic duct anomalies in 11 patients (3.28%) in our study. There were 5 (1.49%) long cystic duct, 4 short cystic duct (1.2%), and 2 (0.6%) aberrant cystic duct anomalies in our study. Talpur *et al*. found 4.35% cystic duct anomalies in which short cystic duct in 8 patients (2.67%) and aberrant cystic duct anomalies in 2 patients (0.6%).[6] Khan studied 300 cases in which there were cystic duct anomalies in 25 patients (8.33%).[10] Among which there were 4 short cystic duct (1.2%) and 1.7% long cystic duct.[10] There were 4.4% cystic duct anomalies in Hassan *et al*. study.[4] Dawani *et al*. found 1% long cystic.[5] Larobina and Nottle found short cystic duct in 4 patients (2.15%).[12] Lamah and Dickson got aberrant cystic duct in 5 patients (0.24%);[8, 13] the incidence of accessory bile ducts varies from 1%[14] to 30%;[15] the true congenital absence of cystic duct is very rare.[16] Double cystic duct is also rare but well described in the literature and may be responsible for post-operative biliary leak. No double cystic duct or its absence was seen in this series. Most cases of short cystic duct were due to severe fibrosis and stone impaction at the junction of contracted chronically inflamed gallbladder.

In the present study, Moynihan's hump was present in 4 patients (1.19%). Different studies had variable frequency of Moynihan hump ranging from 1% in Ayyaz *et al*. study,[17] 2.67% in Talpur *et al*.,[6] 5.9% in Dawani *et al*.,[5] 4–15% in Bergman study,[14] 12.9% in Bergamaschi and Ignjatovic study,[18] and 6.4% in Benson study.[19]

In our study, there was cystic artery anomaly in 13 patients (3.88%). Among them, there were aberrant cystic artery in 8 patients (2.38%), artery anterior to cystic duct in 4 patients (1.19%), and artery arising above Calot's triangle in 1 patient (0.19%). In the study conducted by Talpur *et al*., there were cystic artery anomalies in 10.67% among which aberrant cystic artery in 2.33%, artery anterior to cystic duct in 2.675% ($n = 8$), and artery arising above Calot's triangle in 1% ($n = 3$).[6] There were aberrant cystic artery in 7.4% cases in Suzuki *et al*.[20] and 3.7% in Dawani *et al*.[5]

In our study, shoulder pain presents in 34 patients (10%) which was more than Talpur *et al*.[6] Shoulder pain was due to pneumoperitoneum created by carbon dioxide which irritates diaphragm which, in turn, irritates phrenic nerve. There was biliary leakage in drain in 2 patients (0.6%) comparable to study conducted by Talpur *et al*.[6] in which biliary leakage present in 1.67% cases. Reoperation was done in 2 patients (0.6%) which was similar to Balija *et al*. study (0.6%).[21] In our study, there was no mortality.

In our study, mean hospital stay was 4 ± 1 days which was similar to 3.6 ± 1.5 days in Khan.[10]

CONCLUSION

We had total of 33 patients (9.85%) with biliovascular variation. We had cystic artery variation as the common anomaly. Aberrant cystic artery anomalies were seen in 2.38% cases while long cystic duct seen in 1.49% cases.

We conclude that anatomic variations are not uncommon in our setup. Both aberrant cystic artery and long cystic duct are the common anatomic variants in our patients. These anatomic variants are prone to injuries during cholecystectomy.

Congenital anomalies and anatomical variations of extrahepatic biliary tree though are not common but can be of clinical importance and surprise if present. Hence, every surgeon should assess for these anomalies during laparoscopic cholecystectomy to prevent inadvertent ductal clipping, ductal injuries, strictures, and bleeding problems. Awareness of these anomalies will decrease morbidity, conversion, and reexploration in these patients.

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