Extrahepatic Biliary Anatomy Variation Encountered During Laparoscopic Cholecystectomy

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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

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

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.

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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 comorbidity 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 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.

![Anteriorly placed cystic artery](image1.png)

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

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Table 1: Comorbid conditions

<table>
<thead>
<tr>
<th>Comorbid conditions</th>
<th>Frequency (%)</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>41 (12.23)</td>
</tr>
<tr>
<td>Prior surgery</td>
<td>30 (8.95)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>13 (3.88)</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>10 (2.98)</td>
</tr>
</tbody>
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Table 2: Extra hepatobiliary anatomy variation

<table>
<thead>
<tr>
<th>Extra hepatobiliary anatomy variation</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallbladder anomaly</td>
<td></td>
</tr>
<tr>
<td>Hourglass appearance</td>
<td>3 (0.89)</td>
</tr>
<tr>
<td>Gallbladder fundus passing through liver</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (1.49)</td>
</tr>
<tr>
<td>Cystic duct anomaly</td>
<td></td>
</tr>
<tr>
<td>Long cystic duct</td>
<td>5 (1.49)</td>
</tr>
<tr>
<td>Short cystic duct</td>
<td>4 (1.19)</td>
</tr>
<tr>
<td>Aberrant cystic duct</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Total</td>
<td>11 (3.09)</td>
</tr>
<tr>
<td>Cystic artery anomaly</td>
<td></td>
</tr>
<tr>
<td>Aberrant cystic artery</td>
<td>8 (2.38)</td>
</tr>
<tr>
<td>Artery anterior to cystic duct</td>
<td>4 (1.19)</td>
</tr>
<tr>
<td>Artery arising above Calot’s triangle</td>
<td>1 (0.29)</td>
</tr>
<tr>
<td>Total</td>
<td>13 (3.86)</td>
</tr>
<tr>
<td>Right hepatic artery anomaly</td>
<td></td>
</tr>
<tr>
<td>Moynihan’s hump</td>
<td>4 (1.19)</td>
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</tbody>
</table>
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 normal anatomy and common variants of extrabiliary system. 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.

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. Another study
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,\textsuperscript{[17]} 2.67% in Talpur et al.,\textsuperscript{[5]} 5.9% in Dawani et al.,\textsuperscript{[6]} 4–15% in Bergman study,\textsuperscript{[6]} 12.9% in Bergamaschi and Ignjatovic study,\textsuperscript{[18]} and 6.4% in Benson study.\textsuperscript{[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).\textsuperscript{[6]} There were aberrant cystic artery in 7.4% cases in Suzuki et al.\textsuperscript{[20]} and 3.7% in Dawani et al.\textsuperscript{[5]}

In our study, shoulder pain presents in 34 patients (10%) which was more than Talpur et al.\textsuperscript{[5]} 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.,\textsuperscript{[5]} 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%).\textsuperscript{[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.\textsuperscript{[20]}

**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.

REFERENCES