Double gallbladder—intraoperative finding at laparoscopic cholecystectomy: Literature review

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Abstract
Duplication of the gallbladder is a rare entity. It is often appreciated at surgery and has a higher propensity for complications and conversion to open surgery. We report a case of laparoscopic recognition and removal of a duplicated gallbladder opening into the bile duct through separate cystic ducts, in a young male presenting with biliary colics. Both cystic ducts were clipped and divided, and cholecystectomy completed laparoscopically. Although uncommon, awareness of this anomaly may contribute to minimising iatrogenic bile duct injuries.

Keywords
Duplication of the gallbladder, laparoscopic cholecystectomy

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Introduction
Duplication of the gallbladder is a rare congenital anomaly. Although autopsy studies show an incidence of 1 in 4000, reports of symptomatic cases are rare.¹ The anomaly results from the division and formation of an extra gallbladder primordium during the embryonic period.¹ In true duplications, both gallbladders may share a common cystic duct or have their own duct. Anatomical variations of the extrahepatic biliary tree may contribute towards iatrogenic bile duct injuries (IBDI). Furthermore, a missed accessory gallbladder may result in recurrent symptoms after cholecystectomy.²,³ Laparoscopic cholecystectomy for double gallbladders has been previously reported.⁴⁻⁶ We report on a case of laparoscopic cholecystectomy for gallbladder duplication recognized intraoperatively.

Case presentation
A 41-year-old male presenting with recurrent biliary colics of 6 months was booked for a laparoscopic cholecystectomy. Physical examination was normal except for right upper quadrant tenderness, and liver biochemistry was normal. Abdominal ultrasonography reported a thick-walled gallbladder with gallstones. Laparoscopic cholecystectomy was commenced using a conventional 4-port technique. Dense peri-cholecystic omental adhesions were taken down (Figure 1). As dissection progressed around the cysto-hepatic triangle, it became apparent that there were two gallbladders (Figure 2) draining separately into the bile duct through separate cystic ducts. Both cystic ducts were clipped and divided and both gallbladders removed laparoscopically (Figure 3). The patient was discharged the following day after an uneventful recovery and remains well 3 years after surgery. Histopathology showed chronic cholecystitis in both gallbladders.

Discussion
The first description of a duplicated gallbladder was in a sacrificial victim of Emperor Augustus in 31 BC, and Boyden¹ was first to describe it and its variable anatomy in 1926. Sherren⁷ documented the first case of a double gallbladder

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removed surgically in 1911. Since then, cases of double gallbladders and their laparoscopic removal have been documented, as summarised in Table 1.3–6,8,9–25

Duplication of the gallbladder has an incidence of approximately 1:4000 births.1 The incidence in adults at postmortem and radiology is approximately 0.02% and 0.03%, respectively, with an equal distribution between genders.8,26 The true incidence is likely to be higher since only those who became symptomatic and are imaged or are detected during surgery are reported.

Morphological and positional anomalies of the gallbladder include multiple gallbladders, malformation, deformation, ectopias, intrahepatic position, and the presence of heterotopic mucosa. Gallbladder duplication is a morphological anomaly, variations of which are described by Gross,27 Boyden, and Harlaftis classifications. The Harlaftis classification and its modification26 categorize true duplication into H- and Y-shaped subtypes. The H subtype has two cystic ducts that open separately into the bile duct, while the Y subtype has two cystic ducts that join prior to entering the bile duct28 Figure 4. The Y subtype is less likely to result in conversion to an open procedure than the H subtype.3,4

Non-regression and persistence of supernumerary buds and accessory vesicles originating from the hepatic antrum during the fifth to sixth week of embryogenesis,1 bifurcation of the cystic primordium and accessory cystic primordium28 and formation of two separate cystic primordia from the bile duct28 are mechanisms proposed for gallbladder duplication.

Gallbladder anomalies often go undetected on abdominal ultrasonography and in addition, may be mistaken for a choledochal cyst, gallbladder diverticulum or Phrygian cap.4 Magnetic resonance cholangiopancreatography and, to a lesser degree, endoscopic retrograde cholangiopancreatography, though diagnostic, are not usually performed in patients with uncomplicated symptomatic cholelithiasis.29 Where intraoperative cholangiography is routinely performed during cholecystectomy, it may reveal this anomaly, but there are no reports on its utility.30,31 As in our case, gallbladder duplication is mostly recognised intraoperatively during laparoscopic cholecystectomy.

**Conclusion**

This case illustrates the possibility of unexpectedly encountering rare anomalies of the biliary tract at laparoscopic cholecystectomy. Awareness of these anomalies and the knowledge
| No. | Authors | Year | Type of duplication | Presentation | Diagnostic modality | Procedure | Post op/Histology |
|-----|---------|------|---------------------|--------------|---------------------|-----------|------------------|
| 1   | Yorganci et al. | 2001 | Accessory GB | RUQ pain | Intraoperative | LC | Uneventful/chronic cholecystitis |
| 3   | Goel et al. | 2003 | Accessory GB | RUQ pain + dyspepsia | US/MRCP/ERCP | LC | Uneventful/cholesterolosis |
| 4   | Shirahane et al. | 2003 | Accessory GB | RUQ pain | US/ERCP | LC + Endoscopic nasobiliary tube to identify biliary tree anatomy | Uneventful— |
| 5   | Hishinuma et al. | 2004 | Accessory GB | Epigastric pain | ERCP/MRCP | LC | Uneventful/choleystitis |
| 6   | Sasaki et al. | 2005 | Accessory GB | Epigastric pain | ERCP/CT | LC | Uneventful/chronic cholecystitis |
| 7   | Vijayaraghavan and Belagavi | 2006 | H type (ductular) | RUQ pain | Intraoperative | LC + IOC | Uneventful/pyocele of GB + cystadenomatous changes |
| 8   | Desolneux et al. | 2009 | Y Shaped GB | RUQ Pain, fever, nausea, vomiting | MRCP | LC + IOC | Uneventful/NA |
| 9   | Causey et al. | 2010 | Bilobed GB | RUQ pain | Intraoperative | LC | Uneventful/chronic cholecystitis |
| 10  | Guaifarro-Salinas et al. | 2010 | H type | RUQ pain + vomiting | intraoperative | LC + IOC | Uneventful/chronic cholecystitis |
| 11  | Smelt et al. | 2011 | H type GB | RUQ pain | MRCP | LC | Uneventful/NA |
| 12  | Walbolt and Lalezarzadeh | 2011 | Trabecular | GS Pancreatitis | Intraoperative | LC + IOC | Uneventful/chronic cholecystitis |
| 13  | Bulus et al. | 2012 | Accessory GB | RUQ + Epigastric pain | Preoperative | LC | NA |
| 14  | Ghosh | 2014 | V type GB | RUQ pain, fever | Preop USS/MRCP | LC + IOC | uneventful |
| 15  | Pillay | 2015 | Y type GB | biliary colic | Preop US/CR/MRCP | LC | uneventful |
| 16  | Al Rawahi et al. | 2016 | Y type GB | RUQ pain, nausea, vomiting | Preop CT/MRCP-confirmed intra op (Intra hepatic 2nd GB) | LC | Uneventful/chronic cholecystitis |
| 17  | Yu et al. | 2016 | H type | Epigastric + RUQ pain | Perop CT/MRCP | LC + Lap CBD exploration | Uneventful/chronic cholecystitis |
| 18  | Musleh et al. | 2017 | H type | Recurrent RUQ pain | Preop CT/MRCP | LC | Uneventful/chronic cholecystitis |
| 19  | Painuly et al. | 2018 | H type | Recurrent acute cholecystitis | Intraoperative | LC | Uneventful/acute cholecystitis |
| 20  | Vezakis et al. | 2019 | Y type | Acute cholangitis | Preoperative ERCP, USS, MRCP | LC | Uneventful/chronic cholecystitis and adenomyomatosis |
| 21  | Zhou et al. | 2020 | H type | Upper abdominal pain, nausea | Preop MRCP | LC | Uneventful/chronic cholecystitis |
| 22  | Alsharekah et al. | 2020 | H type | Biliary colic | Intraoperative | LC + IOC | Uneventful/NA |
| 23  | Singh | 2020 | Y type | Epigastric pain | Intraoperative (preop CT done) | LC | Uneventful-chronic cholecystitis |

GB: gallbladder; LC: laparoscopic cholecystectomy; ERCP: endoscopic retrograde cholangiopancreatography; OIC: intraoperative cholangiography; MRCP: magnetic resonance cholangiopancreatography; USS: ultrasound scan; RUQ: right upper quadrant; CBD: common bile duct.
of operative strategies help minimise the risk of iatrogenic bile duct injuries and reduce conversion rates. Imaging suggestive of a biliary tract anomaly should trigger a high index of suspicion for other biliary anomalies. The case also highlights how meticulous, careful dissection of the cysto-hepatic triangle, even in the absence of preoperative imaging or intraoperative cholangiographic recognition of an anomaly, ensures safe laparoscopic cholecystectomy.

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References
1. Boyden EA. The accessory gall-bladder – an embryological and comparative study of aberrant biliary vesicles occurring in man and the domestic mammals. *Am J Anat* 1926; 38(2): 177–231.
2. Silvis R, van Wieringen AJ and van der Werken CH. Reoperation for a symptomatic double gallbladder. *Surg Endosc* 1996; 10(3): 336–337.
3. Yu W, Yuan H, Cheng S, et al. A double gallbladder with a common bile duct stone treated by laparoscopy accompanied by choledochoscopy via the cystic duct: a case report. *Exp Ther Med* 2016; 12(6): 3521–3526.
4. Al Rawahi A, Al Azri Y, Al Jabri S, et al. Successful laparoscopic management of duplicate gallbladder: a case report and review of literature. *Int J Surg Case Rep* 2016; 21: 142–146.

5. Musleh MG, Burnett H, Rajashanker B, et al. Laparoscopic double cholecystectomy for duplicated gallbladder: a case report. *Int J Surg Case Rep* 2017; 41: 502–504.

6. Painuly G, Gupta A, Singhal M, et al. Laparoscopic management of a case of accessory gall bladder with review of literature. *J Minim Access Surg* 2018; 14(4): 335–337.

7. Sherren J. IX. A double gall-bladder removed by operation. *Ann Surg* 1911; 54(2): 204–205.

8. Hishinuma M, Isogai Y, Matsuura Y, et al. Double gallbladder. *J Gastroenterol Hepatol* 2004; 19(2): 233–235.

9. Vezakis A, Pantiora E, Giannoulopoulos D, et al. A duplicated gallbladder in a patient presenting with acute cholangitis. *Ann Hepatol* 2019; 18(1): 240–245.

10. Yorganci K, Kabay B and Aran O. Laparoscopic double cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 2001; 11(2): 126–128.

11. Goel A, Strivastava KN and Rana AK. Double gallbladder – a laparoscopic management. *Surg Laparosc Endosc Percutan Tech* 2003; 13(5): 348–349.

12. Shirahane K, Yamaguchi K, Ogawa T, et al. Gallbladder duplication successfully removed laparoscopically using endoscopic nasobiliary tube. *Surg Endosc* 2003; 17: 1156–1157.

13. Sasaki A, Yoshida T, Lalisako K, et al. Laparoscopic cholecystectomy for a double gallbladder of the duodenal type. *Surg Laparosc Endosc Percutan Tech* 2005; 15(6): 355–358.

14. Vijayaraghavan R and Belagavi C. Double gallbladder with different disease entities: a case report. *J Minim Access Surg* 2006; 2(1): 23–26.

15. Desolneux G, Mucci S, Lebigot J, et al. Duplication of the gallbladder: a case report. *Gastroenterol Res Pract* 2009; 2009: 483473.

16. Causey MW, Miller S, Colby A, et al. Gallbladder duplication: evaluation, treatment and classification. *J Pediatr Surg* 2010; 45: 443–446.

17. Guajardo-Salinas GE, Martinez-Ugartel ML, Abourajily G, et al. The use of intraoperative cholangiogram during laparoscopic double cholecystectomy. *J Surg Case Rep* 2010; 7: 51–54.

18. Smelt JLC, Wright H, Sagar J, et al. Laparoscopic removal of a double gallbladder for cholelithiasis: a case report. *Ann R Coll Surg Engl* 2011; 93: e105–e106.

19. Walbolt TD and Lalezarzadeh F. Laparoscopic management of a duplicated gallbladder: a case study and anatomic history. *Surg Laparosc Endosc Percutan Tech* 2011; 21(3): e156–e158.

20. Bulus K, Koyuncu A and Coskun A. Preoperative diagnosis of double gallbladder: a case report. *Turk J Gastroenterol* 2012; 23(2): 172–174.

21. Ghosh SK. Laparoscopic cholecystectomy in double gallbladder with dual pathology. *J Minim Access Surg* 2014; 10(2): 93–96.

22. Pillay Y. Gallbladder duplication. *Int J Surg Case Rep* 2015; 11: 18–20.

23. Zhou D, Huang Y, Kong Y, et al. Complete laparoscopic cholecystectomy for a duplicated gallbladder: a case report. *Medicine (Baltimore)* 2020; 99(1): e18363.

24. Alsharedah AH, Aloibah SM, Khan BF, et al. Laparoscopic management of gallbladder duplication: a case report. *Cureus* 2020; 12(9): e10675.

25. Singh JP. Duplication of the gallbladder as an operative surprise: a case report with review of the literature. *Case Rep Surg* 2021; 2021: 6668302.

26. Skandalakis JE, Gray SW, Ricketts R, et al. The extrahepatic biliary ducts and the gallbladder. In: Jacob SW (ed.) *Embryology for surgeons. The embryological basis for the treatment of congenital anomalies.* 2nd ed. London: Lippincott Williams and Wilkins, 1994.

27. Gross RE. Congenital anomalies of the gallbladder. *Arch Surg* 1936; 132(1): 131.

28. Harlafitis N, Gray SW and Skandalakis JE. Multiple gallbladders. *Surg Gynecol Obstet* 1977; 145(6): 928–934.

29. Botsford A, McKay K, Hartery A, et al. MRCP imaging of duplicate gallbladder: a case report and review of the literature. *Surg Radiol Anat* 2015; 37(5): 425–429.

30. Manson JM. Intraoperative cholangiography and bile duct injury in laparoscopic cholecystectomy. *Surg Endosc* 2004; 14: 94.

31. Massarweh N and Flum D. Role of intraoperative cholangiography in avoiding bile duct injury. *J Am Coll Surg* 2007; 204(4): 656–663.