CASE SERIES PEER REVIEWED | OPEN ACCESS

Subtotal cholecystectomy; A substandard bail-out technique?

Xin Yi Goai, Jia Han Chang, Casper Pretorius, Charbel Sandroussi, Christian Beardsley

ABSTRACT

Introduction: While the open approach was previously mandated as the salvage procedure in difficult cholecystectomies, subtotal cholecystectomy has since been implemented. While this technique may prevent biliary duct injury intraoperatively, it comes with major pitfalls.

Case Series: We present a series of four cases where a subtotal cholecystectomy was previously performed, in which further gallstone-related complications occurred.

Conclusion: We aim to increase awareness toward recurrent symptoms that may require further evaluation and repeat procedures in patients with previous cholecystectomy; and drawbacks relating to performing subtotal cholecystectomies—opting instead for open cholecystectomy, recruitment of another senior or specialist hepatobiliary surgeon and/or transfer to a tertiary center with the appropriate facilities.

Keywords: Bile duct injury, Case series, Hepatobiliary surgery, Subtotal cholecystectomy

How to cite this article

Goai XY, Chang JH, Pretorius C, Sandroussi C, Beardsley C. Subtotal cholecystectomy; A substandard bail-out technique? J Case Rep Images Surg 2024;10(1):19–25.

Xin Yi Goai[1], Jia Han Chang[1], Casper Pretorius[1], Charbel Sandroussi[2], Christian Beardsley[1]

Affiliations: [1]Mackay Hospital and Health Services, Mackay, Queensland, Australia; [2]Royal Prince Alfred Hospital, Sydney, New South Wales, Australia.

Corresponding Author: Xin Yi Goai, Mackay Hospital and Health Services, 475 Bridge Road, Mackay, Queensland 4740, Australia; Email: xy_goai@yahoo.com

Received: 08 October 2023
Accepted: 11 December 2023
Published: 05 February 2024

Article ID: 100132Z12XG2024

****

doi: 10.5348/100132Z12XG2024CS

INTRODUCTION

Severe acute cholecystitis can be a challenging scenario even for the experienced hepatopancreaticobiliary (HPB) surgeon. During the late nineties, a paradigm shift from conservative to operative management finally gathered momentum. Coupled with the uptake of laparoscopic surgery, surgeons began to take on more challenging cases with mostly excellent outcomes. However, paralleling this uptake was a significant rise in bile duct injuries (BDIs) compared to the open period. Various strategies have been advocated from early open conversion, to cholecystostomy with transfer to HPB service and also subtotal cholecystectomy. In this study, we review the incidence of subtotal cholecystectomies in our institution, and describe the cases where each had unique complications and their corrective operations.

CASE SERIES

We performed a retrospective review of patients who underwent cholecystectomy in Mackay Base Hospital from 1st of January 2020 to 31st of December 2021. We identified 397 cases of cholecystectomies were performed, of which 16 were subtotal cholecystectomies. There were 3 cases of BDIs encountered, with 1 Strasberg D injury. There were no BDIs in the subtotal cholecystectomy group. We identified four patients who were operated due to representation with complications of subtotal cholecystectomies. We present the cases in the following after obtaining consent and preserving anonymity including edited images to omit personal details.

Case 1

A 35-year-old gentleman presented with acute cholecystitis. Decision for a subtotal approach during laparoscopic cholecystectomy was made as the intraoperative cholangiogram (IOC) was unsuccessful. An endoloop was placed around the remnant gallbladder to avoid a BDI. Postoperative magnetic resonance cholangiopancreatography (MRCP) excluded choledocholithiasis and BDI. The patient was readmitted four months later with jaundice and right upper quadrant (RUQ) pain. Conjugated bilirubin levels were 74 µmol/L. Magnetic resonance cholangiopancreatography confirmed a remnant gallbladder with choledocholithiasis (Figure 1). The patient subsequently underwent a difficult open redo-cholecystectomy with common bile duct (CBD) clearance. A shrunken and fibrotic remnant gallbladder was encountered intraoperatively. After careful dissection and adhesiolysis, a successful IOC was obtained. He made an uneventful recovery with a normal liver function test (LFT) at his three-month clinic review.

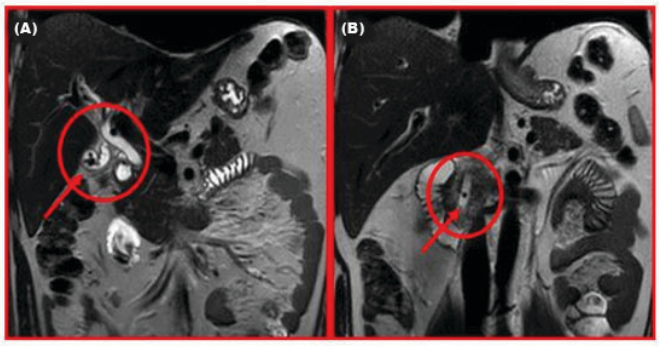


Figure 1: Case 1 perioperative images. (A) MRCP demonstrating remnant gallbladder with stones within and (B) choledocholithiasis.

Case 2

A 61-year-old female presented with pancreatitis approximately one year after a laparoscopic cholecystectomy at a private hospital. Computed tomography (CT) scan demonstrated fatty infiltration of the liver with a dilated cystic duct of 22 mm. Magnetic resonance cholangiopancreatography demonstrated a remnant or "neo-gallbladder" containing sludge and stones (Figure 2A). The prior operation report was retrieved to reveal that a long cystic duct stump was deliberately left in situ to avoid a BDI. Initial LFTs on readmission appear unobstructed and she settled with conservative treatment. However, she developed worsening LFTs on day three and underwent endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy (Figure 2B). Given her overall fitness and risk of recurring symptoms, the patient was consented for an elective laparoscopic redo-cholecystectomy and IOC. The procedure was challenging due to dense adhesions upon entry and between the neo-gallbladder and the porta (Figure 3). With assistance from a senior surgeon (CP), the operation was successful and the patient made an uneventful recovery.

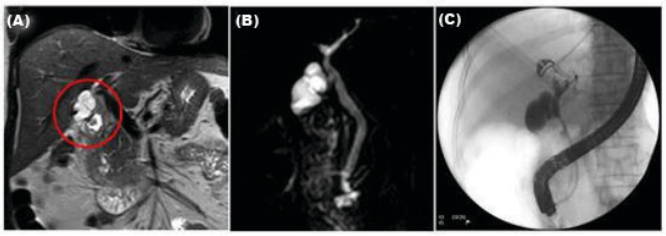


Figure 2: Case 2 perioperative images. (A) Coronal and (B) reconstructed MRCP views demonstrating remnant or neo-gallbladder. (C) ERCP IOC with balloon in situ for stone extraction and sphincterotomy.

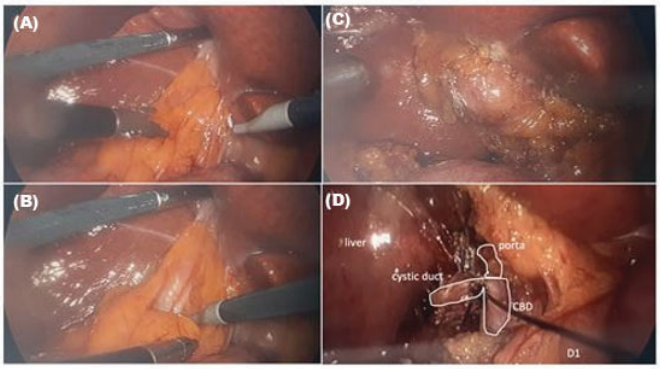


Figure 3: Case 2 intraoperative images. (A, B) Dissection complicated by dense adhesions between the neo-gallbladder and porta. (C, D) Remnant gallbladder isolated after careful dissection.

Case 3

A 74-year old female presented with RUQ pain and fever. She had a history of open cholecystectomy 30 years ago. She was morbidly obese [body mass index (BMI) 44.3 kg/m^2] and bedbound in her nursing home. Magnetic resonance cholangiopancreatography demonstrated a remnant gallbladder with stones but no choledocholithiasis (Figure 4). She underwent conservative management with intravenous antibiotics and settled during the admission. A senior HPB surgeon was consulted and a decision made for elective redo-cholecystectomy six weeks later. This was performed via an open approach due to anticipation of a complex redo environment. The operation was complicated by a shrunken and fibrotic remnant gallbladder, packed with stones and sludge, within dense adhesions with CBD and common hepatic duct. The patient made an uneventful postoperative recovery and was discharged on day six.

Case 4

An 81-year-old male with a background of metastatic renal clear cell carcinoma presented four years after his previous laparoscopic "subtotal" cholecystectomy with epigastric pain and raised lipase. After being extensively

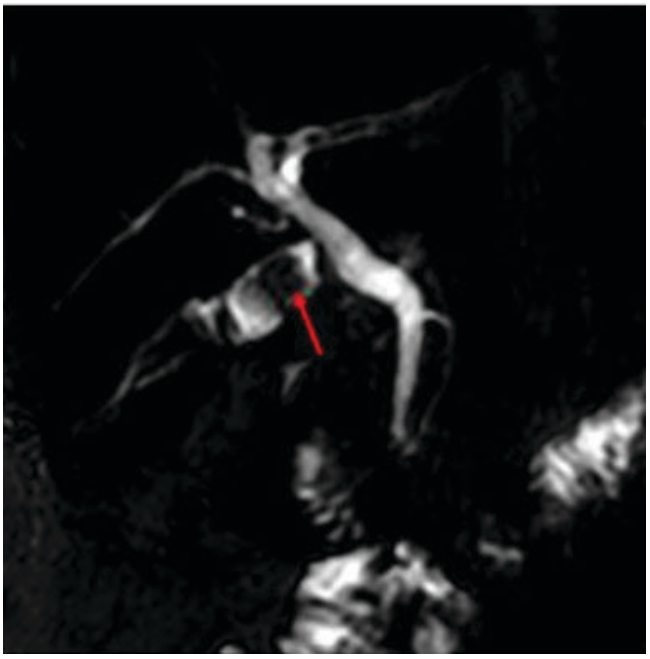


Figure 4: Case 3 perioperative images. Reconstructed MRCP displaying gallbladder with stones within (red arrow) and no choledocholithiasis.

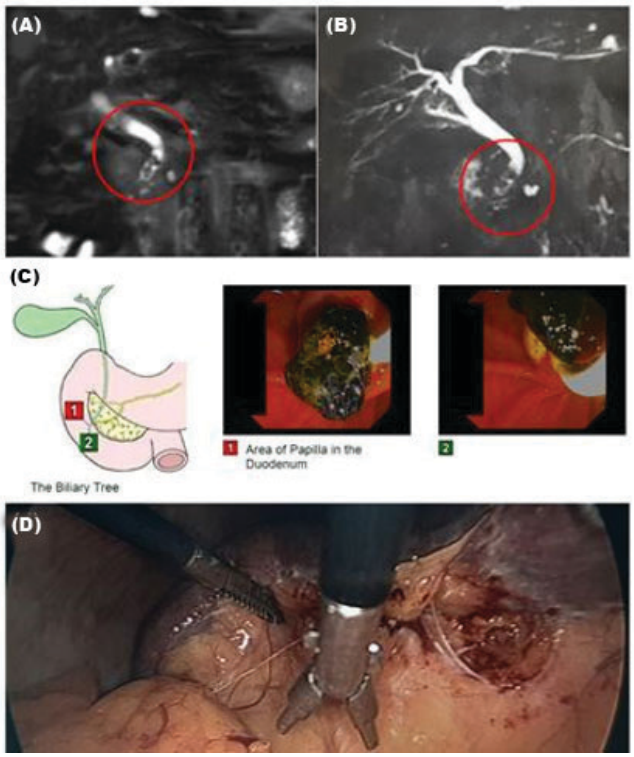


Figure 5: Case 4 perioperative images. (A) Coronal and (B) reconstructed MRCP demonstrating absent gallbladder with choledocholithiasis. (C) ERCP biliary sphincterotomy and balloon extraction of stones up to 8 mm diameter. (D) Dissection complicated by fibrosis and a densely wielded omentum to the porta.

worked up for other causes, MRCP demonstrated an absent gallbladder with choledocholithiasis (Figure 5A and 5B). Complete removal was achieved via ERCP biliary sphincterotomy and balloon extraction (Figure 5C). The patient provided a clear history of biliary colic despite having had a cholecystectomy, and thus, due to concerns of a biliary remnant with risks of recurrence, an elective laparoscopic "completion" cholecystectomy and biliary tree exploration was performed. Dissection was complicated by fibrosis and a densely wielded omentum to the porta (Figure 5D), requiring an hour of careful combination of bipolar electrosurgical adhesiolysis and sharp dissection.

DISCUSSION

Cholelithiasis represents a substantial burden of acute and chronic surgical disease. Up to 15% of the population may at some point be affected by gallstones [1, 2]. Furthermore, with rising rates of obesity and metabolic syndrome, this is forecasted to affect younger patients [3, 4]. The incidence may increase up to 20% after bariatric procedures [5]. Complications of cholelithiasis include cholecystitis, pancreatitis, choledocholithiasis, cholangitis and rarely, cholecystoenteric fistula [1]. The link between cholelithiasis and gallbladder cancer remains debated as it is a rare entity compared to the incidence of cholelithiasis [1, 6].

While majority of cholecystectomies performed are for uncomplicated biliary colic, acute cholecystitis and chronic cholecystitis may pose substantial operative challenges to surgeons. Acute cholecystitis was traditionally managed conservatively, now trending toward operations during index admission [7, 8]. Theoretically, this avoids risks of operating in a "redo environment" with substantial fibrosis, although rates of BDIs are equivalent [8]. Furthermore, even in uncomplicated biliary colic, aberrant and non-classical anatomy may arise in up to 40% of patients, with significant variations in 10% of patients [9–11]. Coupled with increasing patient complexity and the advent of laparoscopic surgery, published rates of BDIs have risen from 0.1% in the "open" era to 0.4% in the "laparoscopy" era—a fourfold increase [12, 13].

With difficult gallbladders, four entities may challenge and interact with one another to form the perfect melee for surgeons:

1. Acute inflammation causing a technically difficult gallbladder with significant edema obscuring standard landmarks and difficulty in obtaining laparoscopic retraction and vision.
2. Chronic inflammation leading to fibrosis of gallbladder and fusing of cystic duct to extrahepatic tree or other gastrointestinal structures such as duodenum and colon.
3. Non-classical anatomy in a substantial minority of patients and coupled with above factors present a substantial risk of BDI.

4. Patient-specific factors such as prior surgery or obesity, the latter resulting in further challenges secondary to fatty liver and a more challenging operative environment.

Add in the reality that many acute cholecystectomies are performed after-hours with junior assistants, the stage is set for iatrogenic BDI. To counter this, several authors have attempted to elucidate strategies to avoid BDIs [14–17]. To summarize, these strategies usually encompass surgical vigilance and awareness, a dissection of the critical view of safety [14, 15], adequate cephalad and rightward retraction of gallbladder fundus [14], safe use of energy devices, appropriate use of "bail-out" techniques as indicated [17], and contentiously, intraoperative cholangiography [18].

Indocyanine green (ICG) is a non-toxic, fluorescent iodide dye, coupled with the advent of near-infrared cholangiogram (NIRC) to aid visualization of extrahepatic biliary structures [19–21]. When administered intravenously, it binds to plasma proteins and undergoes hepatic excretion in the form of bilious secretion, allowing for differentiation of extrahepatic biliary structures under a near-infrared laser, which can be toggled on and off conveniently [19–21]. It does not involve radiation and does not require radiographers, radiology equipment, nor the donning of lead shields [19, 20]. Indocyanine green-assisted NIRC has been shown to decrease operative time, rates of conversion to an open technique, and rates of subtotal cholecystectomies [21]. While it can be injected directly into the gallbladder, it is typically less invasive via preoperative intravenous administration [19]. Thus, there is a reduced risk of BDIs by Olsen-Reddick cannulation and contrast administration through the bile duct [19]. On the other hand, ICG does not delineate intrahepatic anatomy nor detect choledocholithiasis [19]. Studies have shown that poorer views are obtained in environments with thick peritoneal adiposity, dense adhesions, and/or inflammation, albeit overcome by dissection and exposure of Calot's triangle [20]. Leakage during direct administration into the gallbladder contaminates the operative field [19]. Additionally, ICG is contraindicated in patients with iodine allergy [19]. Regrettably, both ICG and NIRC face limited availability, particularly in regional centers where the case series are based [21]. Introducing this technology as a routine aid is expensive due to the need for specialized equipment and a learning curve, and it remains unclear whether it is superior to IOC in cholecystectomy [21].

With regard to bail-out techniques, three options commonly exist; open cholecystectomy, subtotal cholecystectomy completed either laparoscopically or open, or cholecystostomy and abdominal drainage with transfer to a HPB center (Figure 6). While open cholecystectomy would appear to be gold standard in cases of a difficult gallbladder, several issues exist. Firstly, the bile duct can still be injured where the patient's anatomy and disease culminate in high risk pathology. Secondly, with the current paradigm of surgical teaching, few trainees are exposed to open cholecystectomy as an elective operation. Furthermore, anecdotally open cholecystectomies are performed as a bail-out procedure whereby the trainee is unlikely to be the primary operator. These factors have led to the idea of laparoscopic subtotal cholecystectomy as a safe alternative to open conversion.

In brief there are two main models (Figure 7) of subtotal cholecystectomy [17, 22]:

1. Subtotal fenestrating cholecystectomy; partial cholecystectomy with extraction of stone/s, and subsequent drainage, often necessitating postoperative ERCP if biliary fistula ensues.
2. Subtotal reconstituting cholecystectomy; partial cholecystectomy with extraction of stone(s) and closure of fundus.

Subtotal cholecystectomy can be performed in circumstances of severe cholecystitis, Mirizzi syndrome and where portal hypertension may jeopardize safe

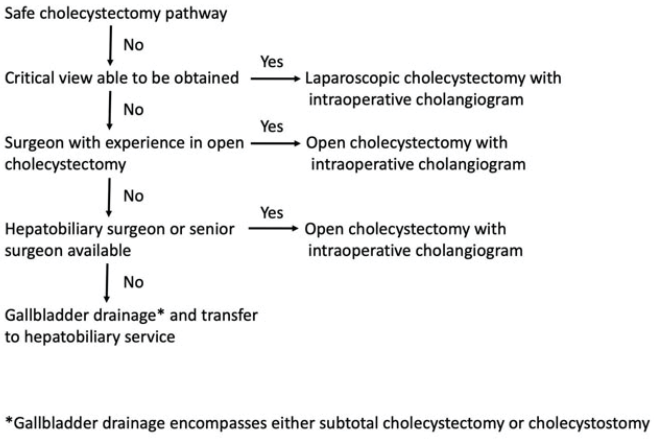


Figure 6: Step-wise approach to safe cholecystectomy and recommended "bail-out" techniques.

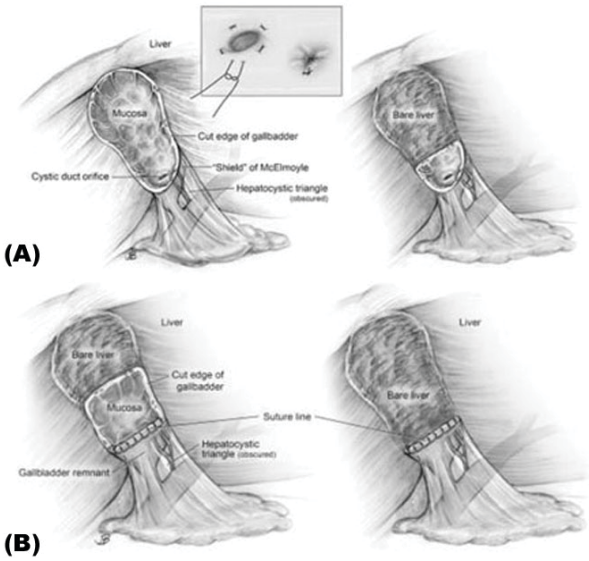


Figure 7: Subtypes of subtotal cholecystectomy [19]. (A) Subtotal "fenestrating" cholecystectomy. (B) Subtotal "reconstituting" cholecystectomy.

dissection of the critical view [23–25]. It should be noted that in the "reconstituting" subtotal cholecystectomy, the surgeon has effectively created a neo-gallbladder. Moreover, if the cystic duct is uncontrolled, the omentum plugs the defect and creates a neo-gallbladder [22, 26]. The reconstituting subtotal cholecystectomy is intended to reduce rates of biliary fistula; however, nearly 10% of patients in this group still required an ERCP [27], albeit lower than in a large meta-analysis [28].

A systematic review on subtotal cholecystectomies recorded laparoscopic completion in 70% of cases, and with scarce BDI incidence at 0.08%. Unfortunately, rates of postoperative biliary fistula approached 20%. Reoperation rates were 2% [28]. While the immediate problem of acute cholecystitis may be solved with these strategies, risk of complications from the remnant gallbladder increases in the long-term postoperative period. Performing a "redo-cholecystectomy" is not without risks and requires a greater level of vigilance to prevent BDIs.

Patients must be informed that they have a remnant gallbladder and to seek surgical advice if symptoms recur. We recognize that an important factor to take into account is that a significant number of subtotal procedures are not always accurately documented. Within Mackay Base Hospital, a search was conducted by clinical coding. Over a two year period encompassing 2020 and 2021, there were 16 recorded subtotal cholecystectomies among a total of 397 cholecystectomies performed. Adding to the confusion is the fact that many surgeons label an operation a subtotal cholecystectomy when the posterior wall of the gallbladder is left in situ with a clipped cystic duct. This is not a "subtotal" cholecystectomy per definition by Strasberg et al. [17, 22]. Conversely, it is possible for a surgeon to perform an inadvertent "subtotal" if the cystic duct is left excessively long or includes Hartmann's pouch. During that same reporting period, we encountered four patients representing and requiring repeat/completion cholecystectomy. Of note, three of the four prior operations notes were retrieved—as one was done decades ago—which were then titled as "laparoscopic"- or "open cholecystectomy," rather than "subtotal cholecystectomy."

The patients in our case series presented within a wide range of timeframes, with relatively severe complications from the remnant gallbladder. Preoperative workup with MRCP or ERCP is essential but while a neo-gallbladder may be diagnosed with these modalities, occasionally the neo-gallbladder may not be detectable and surgeons must rely on their clinical instinct that patients' symptoms may be related to a remnant gallbladder. All abovementioned patients required challenging and potentially dangerous "completion" or "redo"-cholecystectomies. The incidence of recurrent biliary complications approached 20%, a figure that many patients and surgeons would find unacceptable. Hence, subtotal cholecystectomy should be reserved as a last-resort strategy due to risks of complications in the long-term postoperative period as well as the risks of the redo-operation itself.

CONCLUSION

This article presents four patients who developed complications from remnant gallbladders post-subtotal cholecystectomy, highlighting that this bail-out operation is not without consequences. Given this, we advocate that surgeons should instead opt for open conversion and complete cholecystectomy, recruitment of a second experienced surgeon and/or transfer to a tertiary facility with HPB specialty. Lastly, surgeons should accurately document subtotal procedures into the operation report, and patients must be informed when a subtotal cholecystectomy is performed and to seek surgical advice if symptoms recur.

REFERENCES

1. Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: Cholelithiasis and cancer. Gut Liver 2012;6(2):172–87.
2. Tazuma S. Gallstone disease: Epidemiology, pathogenesis, and classification of biliary stones (common bile duct and intrahepatic). Best Pract Res Clin Gastroenterol 2006;20(6):1075–83.
3. Greer D, Heywood S, Croaker D, Gananadha S. Is 14 the new 40: Trends in gallstone disease and cholecystectomy in Australian children. Pediatr Surg Int 2018;34(8):845–9.
4. Khoo AK, Cartwright R, Berry S, Davenport M. Cholecystectomy in English children: Evidence of an epidemic (1997–2012). J Pediatr Surg 2014;49(2):284–8.
5. Manatsathit W, Leelasinjaroen P, Al-Hamid H, Szpunar S, Hawasli A. The incidence of cholelithiasis after sleeve gastrectomy and its association with weight loss: A two-centre retrospective cohort study. Int J Surg 2016;30:13–8.
6. Shrikhande SV, Barreto SG, Singh S, Udwadia TE, Agarwal AK. Cholelithiasis in gallbladder cancer: Coincidence, cofactor, or cause! Eur J Surg Oncol 2010;36(6):514–9.
7. Gutt CN, Encke J, Köninger J, et al. Acute cholecystitis: Early versus delayed cholecystectomy, a multicenter randomized trial (ACDC study, NCT00447304). Ann Surg 2013;258(3):385–93.
8. Menahem B, Mulliri A, Fohlen A, Guittet L, Alves A, Lubrano J. Delayed laparoscopic cholecystectomy increases the total hospital stay compared to an early laparoscopic cholecystectomy after acute cholecystitis: An updated meta-analysis of randomized controlled trials. HPB (Oxford) 2015;17(10):857–62.
9. Chaib E, Kanas AF, Galvão FHF, D'Albuquerque LAC. Bile duct confluence: Anatomic variations and its classification. Surg Radiol Anat 2014;36(2):105–9.
10. Smadja C, Blumgart LH. The biliary tract and the anatomy of biliary exposure. In: Blumgart LH, editor.

Surgery of the Liver and Biliary Tract. 3ed. Volume 1. Edinburgh: Churchill Livingstone; 2000. p. 19.
11. Kostov DV, Kobakov GL. Six rare biliary tract anatomic variations: Implications for liver surgery. Eurasian J Med 2011;43(2):67–72.
12. Kapoor VK. Epidemiology of bile duct injury. In: Kapoor VK, editor. Post-cholecystectomy Bile Duct Injury. Singapore: Springer; 2000. p. 11–9.
13. Richardson MC, Bell G, Fullarton GM. Incidence and nature of bile duct injuries following laparoscopic cholecystectomy: An audit of 5913 cases. West of Scotland Laparoscopic Cholecystectomy Audit Group. Br J Surg 1996;83(10):1356–60.
14. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll Surg 1995;180(1):101–25.
15. Strasberg SM. A perspective on the critical view of safety in laparoscopic cholecystectomy. Ann Laparosc Endosc Surg 2017;2(5):91.
16. Vettoretto N, Saronni C, Harbi A, Balestra L, Taglietti L, Giovanetti M. Critical view of safety during laparoscopic cholecystectomy. JSLS 2011;15(3):322–5.
17. Gupta V, Jain G. Safe laparoscopic cholecystectomy: Adoption of universal culture of safety in cholecystectomy. World J Gastrointest Surg 2019;11(2):62–84.
18. Debru E, Dawson A, Leibman S, et al. Does routine intraoperative cholangiography prevent bile duct transection? Surg Endosc 2005;19(4):589–93.
19. Serban D, Badiu DC, Davitoiu D, et al. Systematic review of the role of indocyanine green near-infrared fluorescence in safe laparoscopic cholecystectomy (Review). Exp Ther Med 2022;23(2):187.
20. Bandari M, Pai MV, Acharya A, Augustine AJ, Murlimanju BV. Anatomical mapping of the biliary tree during laparoscopic cholecystectomy by using indocyanine green dye. J Minim Access Surg 2022;18(2):218–23.
21. Lim SH, Tan HTA, Shelat VG. Comparison of indocyanine green dye fluorescent cholangiography with intra-operative cholangiography in laparoscopic cholecystectomy: A meta-analysis. Surg Endosc 2021;35(4):1511–20.
22. Strasberg SM, Pucci MJ, Brunt LM, Deziel DJ. Subtotal cholecystectomy-"Fenestrating" vs "Reconstituting" subtypes and the prevention of bile duct injury: Definition of the optimal procedure in difficult operative conditions. J Am Coll Surg 2016;222(1):89–96.
23. Bornman PC, Terblanche J. Subtotal cholecystectomy: For the difficult gallbladder in portal hypertension and cholecystitis. Surgery 1985;98(1):1–6.
24. Beldi G, Glättli A. Laparoscopic subtotal cholecystectomy for severe cholecystitis. Surg Endosc 2003;17(9):1437–9.
25. Chowbey PK, Sharma A, Khullar R, Mann V, Baijal M, Vashistha A. Laparoscopic subtotal cholecystectomy: A review of 56 procedures. J Laparoendosc Adv Surg Tech A 2000;10(1):31–4.
26. Bodvall B, Overgaard B. Cystic duct remnant after cholecystectomy: Incidence studied by cholegraphy in 500 cases, and significance in 103 reoperations. Ann Surg 1966;163(3):382–90.
27. Cottier DJ, McKay C, Anderson JR. Subtotal cholecystectomy. Br J Surg 1991;78(11):1326–8.
28. Elshaer M, Gravante G, Thomas K, Sorge R, Al-Hamali S, Ebdewi H. Subtotal cholecystectomy for "difficult gallbladders": Systematic review and meta-analysis. JAMA Surg 2015;150(2):159–68.

****

Author Contributions

Xin Yi Goai – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Jia Han Chang – Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Casper Pretorius – Conception of the work, Design of the work, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Charbel Sandroussi – Conception of the work, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Christian Beardsley – Conception of the work, Design of the work, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement

Written informed consent was obtained from the patient for publication of this article.

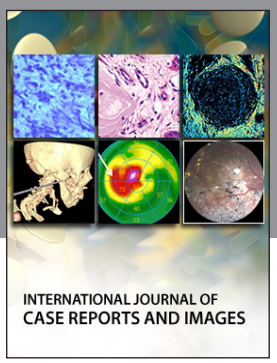
Conflict of Interest
Authors declare no conflict of interest.

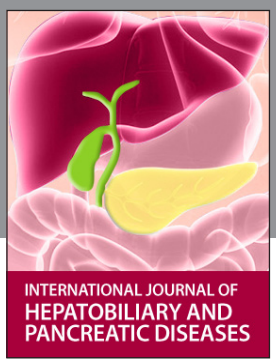
Data Availability
All relevant data are within the paper and its Supporting Information files.

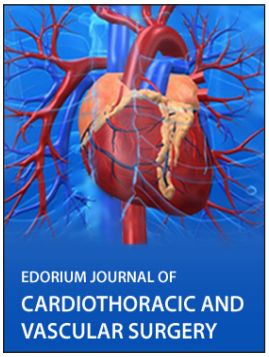
Copyright
© 2024 Xin Yi Goai et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

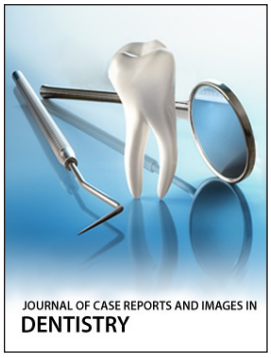
Access full text article on other devices

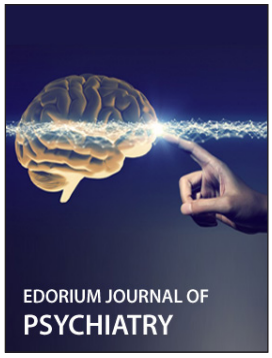
Access PDF of article on other devices

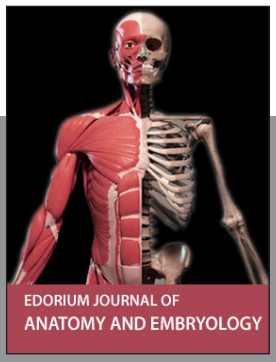


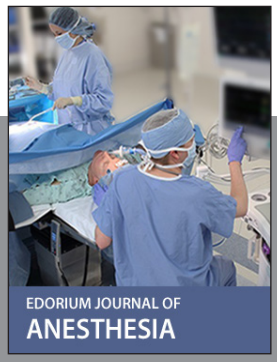












Submit your manuscripts at

www.edoriumjournals.com