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Overcoming Surgical Adversity: Laparoscopic Cholecystectomies in Extreme Pathologies- A case series of complex challenges.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) is the gold standard for managing symptomatic gallstone disease, but its execution becomes highly challenging in cases with altered anatomy, severe inflammation, or vascular abnormalities. Conditions such as **gangrenous gallbladder, pseudo-Mirizzi syndrome, Mirizzi syndrome, cholelithiasis with portal cavernoma, and cholelithiasis with large liver haemangioma** pose significant technical difficulties, increasing the risks of **bile duct injury (BDI), excessive bleeding, and conversion to open surgery.**

The overall conversion rate for difficult LC ranges from **5% to 44.9%**, with gangrenous cholecystitis carrying one of the highest risks. In **portal cavernoma**, patients exhibit a network of **dilated collateral veins (55% with gallbladder varices and 45% with choledochal varices),** increasing the risk of **life-threatening intraoperative bleeding.** Similarly, Mirizzi syndrome and pseudo-Mirizzi syndrome present with **severe adhesions and external bile duct compression**, complicating the dissection process.
Alternative surgical approaches, including **fundus-first laparoscopic cholecystectomy (FFLC), subtotal cholecystectomy, and selective clipping strategies,** have been developed to improve safety in these complex cases. FFLC in particular, has been shown to **reduce conversion rates from 5.27% to 1.27%** by allowing retrograde dissection when the hepatocystic triangle is difficult to access.

This case series highlights a variety of challenging scenarios & demonstrates **bail-out strategies, challenges, and outcomes of laparoscopic cholecystectomy in difficult scenarios**, with a focus on **safe dissection techniques, vascular control, and the role of alternative approaches** to enhance patient safety and surgical success.

DISCUSSION

Laparoscopic cholecystectomy (LC) remains the preferred treatment for symptomatic gallstone disease; however, its execution becomes significantly more complex in cases such as **gangrenous gallbladder, pseudo-Mirizzi syndrome, Mirizzi syndrome, cholelithiasis with portal cavernoma, and cholelithiasis with large liver hemangioma.** These conditions present unique anatomical and pathological challenges, increasing the risk of **bile duct injuries (BDI), excessive intraoperative bleeding, and conversion to open surgery.** Successfully managing such cases requires a combination of **preoperative planning, intraoperative adaptability, and alternative dissection techniques** to ensure safe and effective outcomes.

1. Challenges in Difficult Laparoscopic Cholecystectomy:

Difficult LC is characterized by **severe inflammation, obscured anatomy, vascular anomalies, or dense adhesions**. The **risk of BDI** is nearly **twice as high in laparoscopic surgery** compared to open cholecystectomy, with up to **25% injuries involving vasculo-biliary structures**. Studies have reported **conversion rates up to 44.9% in acute cholecystitis** and significantly higher risks in complex cases like portal cavernoma.
In cases of **portal cavernoma (PC)**, cavernous transformation of the portal vein creates a **network of fragile, tortuous venous collaterals**, particularly in the **hepato-cystic triangle and gallbladder bed**. These patients have **twice the risk of gallstone disease due to gallbladder stasis** and often present with **gallbladder varices (55%) and choledochal varices (45%)**, increasing the risk of **catastrophic bleeding during surgery**.

2. Role of the Critical View of Safety (CVS) and Alternative Strategies:

The **Critical View of Safety (CVS)** is the gold standard for preventing BDI by ensuring proper anatomical identification. However, in **severely inflamed or vascularly distorted cases**, achieving CVS may be impossible. Alternative techniques, including **subtotal cholecystectomy, laparoscopic fundus-first dissection (FFD), intraoperative cholangiography (IOC), Indo-cyanin green (ICG) imaging and selective clipping strategies**, must be employed to enhance safety.

3. Fundus-First Laparoscopic Cholecystectomy (FFLC) in Complex Cases:

FFLC is an established **alternative approach** when conventional Calot's triangle dissection is unsafe. **By starting from the fundus and proceeding retrogradely**, the gallbladder is gradually separated from the liver bed before addressing the cystic duct and artery. This approach has been beneficial in:

a) **Gangrenous gallbladder**, where inflammation distorts normal anatomy.
b) **Pseudo-Mirizzi syndrome**, where inflammatory adhesions externally compress the bile duct.
c) **Cholelithiasis with portal cavernoma**, where dissection in the hepato-cystic triangle risks major bleeding.

CASES

CASE 1: GANGRENOUS GALL BLADDER

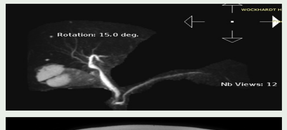
- 35/F
- C/O: Fever, chills, pain abdomen, vomiting
- P/A: Epigastric tenderness+
- Labs: Hb:10.4, TLC:7000, Plt:238000, CRP:300.25, T.bili:0.74, D.bili:0.47 ALP: 113, SGOT:25, SGPT:28
- CT: 2.6 cm calculus, GB perforation
- Intra-op: Dense omental and colonic adhesions, frozen Calot's triangle, posterior wall of GB gangrenous with abscess cavity extending into the liver.
- Bail-out procedure: Fundus first technique.
- HPE: Acute cholecystitis, transmural necrosis.

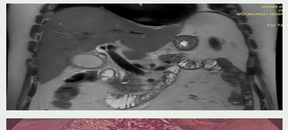


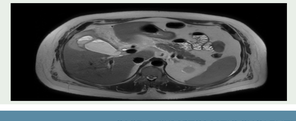


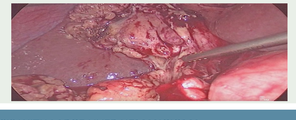
CASE 2: PSEUDO MIRIZZI SYNDROME (ACALCULUS CHOLECYSTITIS)

- 51/M
- C/O : Pain abdomen, fever, chills, vomiting
- O/E: Icterus+
- P/A: Murphy's sign+
- Labs: Hb:12.4 TLC:15160, Plt:249000, CRP:223, Creat:1.43, T.bili:2.70, D.bili:2.50 ALP: 165, SGOT:143, SGPT:68, GGT:188
- CT/MRCP: GB distended, sealed perforation at fundus, localized collection, Compressed CHD between GB neck and portal vein, Mild IHBR-D.
- ERCP: Narrowing at CHD, cholangitis, CBD stenting done
- Intra-op: Dense omental and colonic adhesions, frozen Calot's triangle, GB neck compressing CHD, empyema with type-2 perforation, no calculus.
- Bail-out procedure: Fundus first approach.
- HPE: Emphysematous cholecystitis.





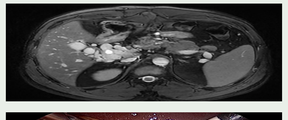




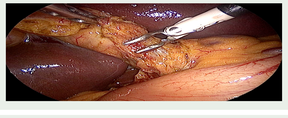
CASE 3: CHOLELITHIASIS WITH PORTAL CAVERNOMA

- 38/M
- C/O Epigastric pain, vomiting
- O/E: Icterus+
- PA: Epigastric tenderness
- Labs: Hb:13.5 TLC:5200, Plt:124000, T.bili:5.75, D.bili:4.01, ALP:226, SGOT:71, SGPT:133, GGT:558
- CT/MRCP: Portal cavernoma, Calculus cholecystitis, Choledocholithiasis.
- ERCP: choledocholithiasis, CBD stenting.
- Intra-op: Portal cavernoma, multiple collaterals in GB fossa
- Bailout and strategy: Fundus first approach, meticulous dissection and ligation of collaterals with bipolar.
- HPE: Cholecystitis.



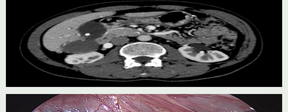


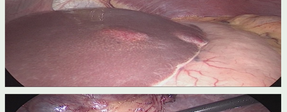


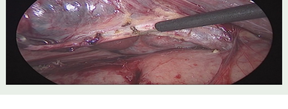


CASE 4: SYMPTOMATIC CHOLELITHIASIS WITH LARGE LIVER HEMANGIOMA

- 52/M
- C/O: Pain abdomen, dyspepsia
- PA: Mild RH tenderness
- CT: Large hemangioma 8.2 x7.6x10.4 cm in segment: V,VI,VII,VIII, exophytic, indenting posterior surface of GB.
- Intra-op: Dense omental, duodenal and colonic adhesions, large exophytic hemangioma.
- Labs: CBC,LFT:WNL
- Operative Strategy: Achieving critical view of safety, meticulous dissection at GB fossa.
- HPE: Cholecystitis.



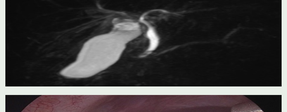


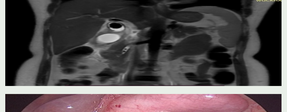




CASE 5: CALCULUS CHOLECYSTITIS WITH CHOLEDOCHOLITHIASIS WITH MIRIZZI SYNDROME.

- 38/F
- C/O: Epigastric pain, nausea, vomiting
- PA: Murphy's sign +
- Labs: Hb:11.4,TLC:14580, Plt:278000, T.bili:0.42, D.bili:0.8, ALP: 92, SGOT:28, SGPT:18, GGT:59, CRP:270
- CT/MRCP: Acute calculus cholecystitis, Mirizzi syndrome, choledocholithiasis
- ERCP: Choledocholithiasis, CBD stenting.
- Intra-op: Dense omental adhesions, tense thick-walled GB, frozen Calot's triangle.
- Bail-Out: GB decompression, fundus first approach.
- HPE: Acute on chronic cholecystitis.









DISCUSSION

d) **Cholelithiasis with large liver hemangioma**, where excessive traction can rupture the hemangioma.
e) **Mirizzi syndrome**, where close proximity to the common bile duct requires careful dissection.

In **portal cavernoma**, FFLC is particularly advantageous as it avoids excessive traction on fragile collateral veins. In these cases:

a) **Any sudden or aggressive retraction should be avoided** to prevent venous rupture.
b) **Collateral veins in the hepatocystic triangle must be clipped rather than cauterized** (Hem-o-lock or titanium clips preferred).
c) **Cystic duct varices should be clipped en bloc with the cystic duct**, as attempting to dissect them separately may cause life-threatening hemorrhage.
d) **Minimal use of energy devices in the Calot's triangle** prevents collateral vein rupture.
e) **Selective use of subtotal cholecystectomy is recommended in extreme cases.**

FFLC has been shown to **reduce conversion rates from 5.27% to 1.27%** in difficult cases while minimizing BDI risk. However, it carries risks such as **hemorrhage from the liver bed, gallstone migration into the common bile duct, and vascular injuries**.

4. Minimizing Complications and Enhancing Surgical Safety:

To further improve surgical outcomes in difficult LCs:

a) **Preoperative imaging (MRCP, CT angiography) is crucial in identifying vascular anomalies, bile duct compression, and gallbladder varices.**
b) **Intraoperative cholangiography (IOC), intra-operative ICG imaging should be selectively used to confirm bile duct anatomy.**
c) **In cases of portal cavernoma, meticulous dissection and careful vascular handling selective clipping and ligation of collaterals is required.**
d) **Clip ligation should always be preferred over electrocautery in the hepatocystic triangle and gallbladder bed.**
e) **Energy devices should be used sparingly and cautiously to prevent collateral vessel rupture.**

CONCLUSION

Difficult LC requires **meticulous dissection, strategic surgical modifications, and bailout techniques** such as **fundus-first dissection, subtotal cholecystectomy, and selective clipping** to navigate distorted anatomy safely. In portal cavernoma cases, **careful vascular handling and preoperative planning are critical to preventing catastrophic bleeding.**
Our case series highlights the **efficacy of FFLC and alternative techniques in reducing conversion rates and complications**, reinforcing their role in the surgical management of complex gallbladder disease.

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