



Liver pucker sign: predictor of difficult laparoscopic cholecystectomy: a case series

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Introduction: Pucker sign is the depression of the liver in the region of the gallbladder due to a high degree of chronic contractive inflammation of the gallbladder. It usually develops in patients who have a delayed cholecystectomy after acute cholecystitis due to a high degree of chronic contractive inflammation of the gallbladder and contraction of the cystic plate. It is an essential finding either preoperatively or intraoperatively as it can act as a stopping rule during cholecystectomy (act as a guide that cholecystectomy will be difficult).

Case series: The authors here report three cases of pucker sign that were incidentally discovered during laparoscopy.

Discussion: Chronic cholecystitis is a prolonged, subacute condition caused by inflammation of the gallbladder, which mostly occurs in the setting of cholelithiasis. Laparoscopic cholecystectomy is the procedure of choice for symptomatic cholelithiasis. Hence, it would be beneficial to be aware of reliable signs that predict difficult Laparoscopic cholecystectomy. Pucker sign usually predicts increased operative difficulty as there is an operative danger of biliary or vascular injury.

Conclusion: The pucker sign is a novel indicator of significant persistent inflammation and heightened difficulty during surgery. It might establish a halting rule that modifies the procedure's management and raises its level of safety.

Keywords: cholelithiasis, chronic cholecystitis, gallbladder, laparoscopic cholecystectomy, liver

Introduction

Pucker sign is the depression of the liver in the region of the gallbladder due to a high degree of chronic contractive inflammation of the gallbladder^[1]. There is puckering in the anterior surface of the liver and liver edge^[1]. It usually develops in patients who have a delayed cholecystectomy after acute cholecystitis. There are very few cases reported as it is quite uncommon to have chronic retractive inflammation of this degree^[1].

Significant predictors of difficult laparoscopic cholecystectomy (LC) include sex (male), adhesion at Calot's triangle, gallbladder wall thickness (≥ 4 –5 mm), fibrotic gallbladder, past history of acute cholecystitis and cases of chronic cholecystitis^[2]. Chronic cholecystitis occurs due to prolonged inflammation of the gallbladder, which in 90% of cases develops due to the presence of gallstones^[3]. Other causes of chronic cholecystitis include the formation of strictures or neoplasms in the common bile duct^[4].

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HIGHLIGHTS

- Pucker sign is the depression of the liver in the region of the gallbladder due to a high degree of chronic contractive inflammation of the gallbladder in patients who have a delayed cholecystectomy after acute cholecystitis.
- Pucker sign usually predicts increased operative difficulty as there is an operative danger of biliary or vascular injury.
- It is an essential finding, either preoperatively or intraoperatively, as it might establish a halting rule that modifies the procedure's management and raises its level of safety.

One of the causes of biliary injury is marked inflammatory contraction of the gallbladder at the time of cholecystectomy^[5]. Hence, it is essential to identify signs that predict difficult cholecystectomy beforehand to prevent complications during the surgery.

Pucker sign is an essential finding, either preoperatively or intraoperatively, as it can act as a stopping rule during cholecystectomy^[1].

In our case, the course of inflammation in the gallbladders and surrounding tissues of three patients who developed chronic cholecystitis were tracked after operative findings suggested pucker sign in the liver. The severity of gallbladder contraction was estimated by measurement of gallbladder length and detection of surface puckering of the liver. We here report three cases of pucker sign that were incidentally discovered during laparoscopy and had to undergo subtotal cholecystectomy due to difficulty in surgery. Our case series has been reported in line with the PROCESS criteria^[6]. Our case series has also been registered with a unique identifying number (UIN): researchregistry10077

Case series

Case 1

A 36-year-old female was referred to our OPD for elective LC. She had a history of dyspepsia for the last 4 years. She was hospitalized two years back with a diagnosis of acute calculous cholecystitis and was managed conservatively at another centre. She later presented with a feature of obstructive jaundice and cholangitis three months back. Ultrasonography revealed choledocholithiasis so she underwent endoscopic retrograde cholangiopancreatography for the clearance of common bile duct stones. She was scheduled for LC, and her ultrasound of the abdomen revealed a partially contracted gallbladder with multiple calculi, the largest one was 1.8 cm, the common bile duct was free of stone, and the rest of the ultrasound findings of the abdomen were normal. Her liver function tests were within normal limits. Baseline investigation and CRP were normal. During laparoscopy there was dimpling of the anterior aspect of the liver in the Gallbladder fossa, fundus, and the body of the gallbladder and the cystic duct were contracted (Fig. 1). Rouviers' sulcus, base of segment IV and umbilical fissure (R4U line) were visible. There was a thick fibrotic peritoneal covering at the calor's triangle, which was barely separable, and the cystic duct and Common bile duct junction were not recognizable. The critical view of safety could not be achieved, so a subtotal fenestrating cholecystectomy was performed. The operative duration lasted for 180 minutes and Nassar grade was 3. The postoperative period was uneventful, and the patient was discharged on the second postoperative day. The patient is doing fine six months after the follow-up.

Case 2

A 62-year-old male presented with a history of dyspepsia and flatulence for the last 10 years. He was diagnosed with symptomatic cholelithiasis 8 years back; however, he deferred surgery and was under proton pump inhibitors. He also gives a history of multiple hospital visits for biliary colic in the last 8 years; however, there is no history suggestive of cholecystitis, or jaundice. He is a regular alcohol consumer and drinks nearly 12 units per week since past 30 years. At the time of presentation to our OPD, his baseline investigations were normal. He had no stigmata of chronic liver disease and no radiological features of chronic liver

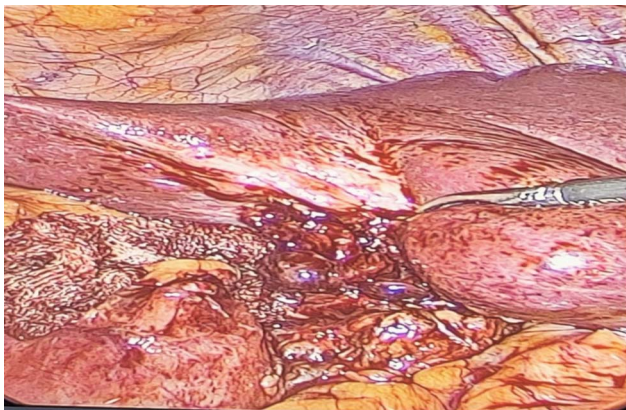


Figure 1. Puckering of liver at segment IV B/V of liver as seen during diagnostic laparoscopy.

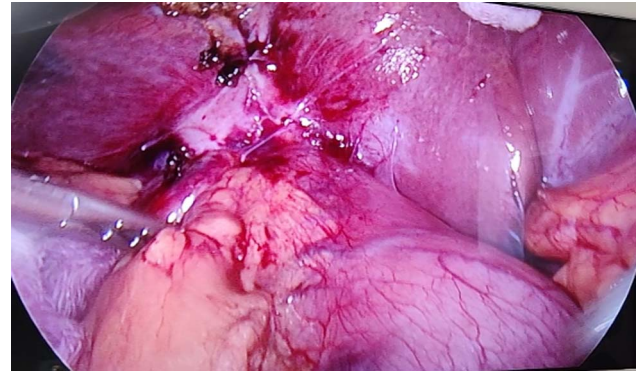


Figure 2. First part of duodenum adherent with the chronically contracted gallbladder.

disease. Liver function tests were normal. He is a known case of rheumatic heart disease under medication for atrial fibrillation and heart failure. During diagnostic laparoscopy, the gallbladder was not visible, the first part of the duodenum was adherent to the body of the gallbladder (Fig. 2, liver pucker sign was visible at the anterior aspect of segment IV B/V of the Liver (Fig. 3), the base of segment IV and Rouvier's sulcus was not visible, gallbladder wall was thick and oedematous. The Hartmann's pouch, cystic duct, and common bile duct were not clearly visible due to dense fibrotic chronic inflammation. So, a subtotal fenestrating cholecystectomy was done. The operative duration lasted for 220 min with Nassar grade was 4.

Case 3

A 47-year-old female presented to surgical OPD with a history of dyspepsia and flatulence for the last 2 years. She had no history of cholecystitis or any other upper gastrointestinal disease that required hospitalization. She was regularly taking acid-lowering drugs intermittently. At the time of presentation, the patient was clinically well, baseline investigations were normal, and liver function tests were also normal; however, ultrasound revealed a well-distended gallbladder with large solitary calculi 2.7 cm within the gallbladder. During the diagnostic laparoscopy, there was a liver pucker sign in segment IV B/V of the liver, and

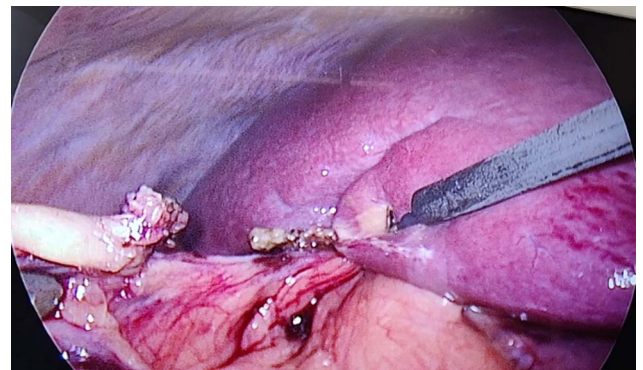


Figure 3. Puckering of liver at segment IV B/V of liver as seen during diagnostic laparoscopy.

constriction was present at the junction of the fundus and body of the gallbladder (Fig. 4). Large calculi was present at the fundus, which was hindering the surgeons from grasping the gallbladder. The gallbladder looked intrahepatic due to liver puckering in segment IV B/V (Fig. 5). The infundibulum of the gallbladder and R4U line were clearly visible. During the dissection of Calot's triangle, the cystic duct was easily separable; however, structures behind the cystic duct had dense fibrotic inflammation, so a critical view of safety could not be achieved. Additionally, the cystic artery was densely adherent to the wall of the liver. Hence, a subtotal fenestrating cholecystectomy was done after intraoperative time out and opinion with expert team members. Nassar grade was 2. On the first postoperative day, the patient had severe right upper quadrant pain, ultrasound guided aspiration of the abdomen showed mild collection in the peritoneal cavity that was sanguinous in nature. The patient was discharged on the fifth postoperative day. However, she again presented to the emergency room on the 10th postoperative day with abdominal pain and fever. A contrast enhanced computed tomography abdomen was done, which revealed intraperitoneal collection with Strasberg A bile duct injury. On aspiration, peritoneal fluid was bilious in nature, hence, it was treated with a percutaneous pigtail catheter and 200 ml of bilious fluid was drained. The patient was then managed with antibiotics and intravenous fluid. During follow-up after 6 months, the patient is doing fine with normal Liver function test and normal USG findings.

Discussion

Chronic cholecystitis is a prolonged, subacute condition caused by inflammation of the gallbladder, which results in the failure of the emptying of the gallbladder. It mostly occurs in the setting of cholelithiasis^[3]. There is a blockage of the cystic duct causing oedema and inflammation of the gallbladder. The other causes of chronic cholecystitis include stricture formation or neoplasm in the common bile duct causing stasis of bile flow, ultimately resulting in chronic cholecystitis^[4].

Symptomatic cholelithiasis is one of the common gastrointestinal illnesses, with prevalence of 11–36%. Cholecystectomy is the procedure of choice for symptomatic cholelithiasis^[7]. Since cholecystectomy is still one of the commonest reasons for admission to the hospital with mortality varying from 0.45 to 6%, it is of utmost importance to predict the adversity of the

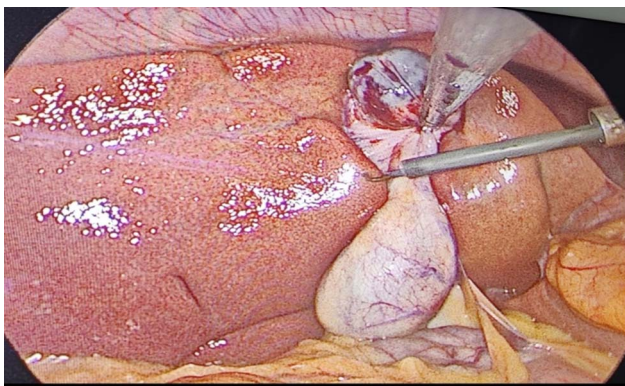


Figure 4. Constriction seen at the junction of fundus and body of gallbladder.



Figure 5. Puckering of liver at Segment IV B/V of liver as seen during diagnostic laparoscopy.

surgery preoperatively for a better outcome^[8,9].

Laparoscopic cholecystectomy is a widely used minimally invasive technique for removing diseased gallbladder and has replaced open surgeries since the 1990s^[10,11]. The complications of laparoscopic cholecystectomy include bleeding, infection, and damage to surrounding structures with bleeding being the most common one as the liver is a vascular organ. However, the most severe complication is bile duct injury which gives rise to remote complications like anastomotic strictures, recurrent cholangitis, and secondary biliary cirrhosis^[11,12].

SAGES has recommended strategies for safe cholecystectomy, and achieving a critical view of safety is mandatory to reduce bile duct injury. However, it may not be feasible in every case and may need to abandon the procedure or perform bail-out surgeries to avoid biliovascular injury^[13]. There are various factors that predict the likely outcome of laparoscopic cholecystectomy and conversion to open surgeries like age, sex, weight of the patient, preexisting comorbid conditions, past history of cholecystitis, obscure biliary anatomy, presence of dense pericholecystic adhesions, intraoperative bleeding and suspicion of choledocholithiasis^[13]. One of the causes of biliary injury is marked inflammatory contraction of the gallbladder at the time of cholecystectomy^[5].

Liver pucker sign develops due to a high degree of chronic contractive inflammation of the gallbladder and contraction of the cystic plate. There are cases where patchy gangrene was present in the gallbladder suggesting it to be ischaemic inflammation^[1]. In our cases, the findings of the pucker sign were incidental during laparoscopy. The reduced gallbladders were adherent to the liver and were covered by surrounding organs such as the colon omentum and gastric antrum. Also, in conjunction with the fibrosis and contraction, the liver surface and free edge of the liver in the region of the gallbladder were also notably distorted. The surface of the liver in the region of the gallbladder appeared sunken, and the liver edge was puckered down. In Case 3, the cystic duct was visibly clear, but the artery and the remainder of Calot's triangle were fibrotic, impeding the dissection. Fenestrating subtotal cholecystectomy emerges as a viable bail-out option in such situations, which is feasible through either open conversion or laparoscopic intervention under the guidance of a skilled surgeon^[14]. In this instance, an

intraoperative consultation was sought from an expert team member, and the procedure was safely performed using a laparoscopic approach.

Liver pucker sign usually predicts increased operative difficulty as there is an operative danger of biliary or vascular injury^[1]. The importance of identifying the liver pucker sign preoperatively or intraoperatively will help in proper management as surgeons can ask for assistance from another surgeon or send the case to a tertiary care centre, thus increasing the safety of the cholecystectomy^[1,15]. Strasberg in his case series in 2008, followed up on a case of cholelithiasis and had done subsequent imaging where he had found that there was contraction of the cystic plate with time due to chronic inflammation^[16]. The detection, as well as the progression of liver pucker signs, can be done preoperatively with the help of computed tomography^[1]. Once identified, we can predict that the cholecystectomy might be difficult and can be prepared accordingly during the time of surgery to prevent vasculo-biliary injuries.

Conclusion

To summarize, the liver pucker sign is a novel indicator of significant persistent inflammation and heightened difficulty during surgery. It might establish a halting rule that modifies the procedure's management and raises its level of safety. For the purpose of developing an effective treatment strategy, it would be beneficial to be aware of reliable signs that predict difficult LC.

Ethical approval

Patient anonymity is maintained throughout this manuscript. Ethical approval and consent was obtained for publication from the patient.

Consent for publication

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

U.L.: drafting the work, manuscript writing and editing. S.A.: drafting the work, manuscript writing and editing. B.R.M.: drafting the work, manuscript writing and editing.

Conflicts of interest disclosure

All authors declare that they have no conflicts of interest.

Research registration unique identifying number (UIN)

Not applicable.

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Data availability statement

Research data associated with case series are available.

Provenance and peer review

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