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Subtle Signs Of Gallbladder Perforation: A Missed Diagnosis On Initial Imaging – Case Series.

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ABSTRACT

Background: *Gallbladder perforation (GBP) is a rare but potentially fatal complication of acute cholecystitis. Early diagnosis is challenging due to its nonspecific presentation and subtle imaging findings, often leading to missed diagnoses on initial evaluation. Timely detection on imaging is critical to guide prompt surgical intervention and improve outcomes.*

Aim: *To present a case series highlighting subtle radiological signs of GBP that were overlooked on initial imaging, emphasizing the importance of high suspicion in at-risk patients.*

Methods: *A Case Series was conducted in the Department of Radiodiagnosis over 1.5 years, including 10–15 patients with surgically or histopathologically proven gallbladder perforation whose initial imaging (ultrasound and/or CT) did not clearly suggest perforation. Clinical records, laboratory data, and imaging studies were reviewed. Subtle findings such as focal gallbladder wall defect, pericholecystic fluid, localized fat stranding, and perihepatic collections were identified and correlated with intraoperative findings.*

Results: *The majority of cases presented with vague right upper quadrant pain and nonspecific laboratory findings. Initial ultrasonography often showed gallbladder wall thickening and cholelithiasis without overt signs of perforation. Retrospective review revealed subtle indicators such as:*

- *Discontinuity of gallbladder wall in focal areas*
- *Small, loculated pericholecystic collections*
- *Unexplained adjacent hepatic hypoechoic areas or fluid pockets*
- *Minimal pneumoperitoneum on CT Missed recognition of these signs delayed diagnosis by an average of 24–72 hours.*

Conclusion: *Gallbladder perforation can have subtle imaging clues, especially in its early stages. Radiologists must maintain a high index of suspicion in elderly patients, diabetics, and those with severe cholecystitis, even when classic signs are absent. Careful scrutiny of gallbladder wall integrity, adjacent fluid, and subtle perihepatic changes can aid early detection, prevent morbidity, and guide timely surgical management.*

Keywords: *Gallbladder perforation, Acute cholecystitis complications, Computed tomography (CT), Ultrasound, Niemeier classification and Pericholecystic fluid.*

INTRODUCTION

Gallbladder perforation (GBP) is an uncommon yet life-threatening complication of acute cholecystitis, first described by Duncan in 1934[1]. It carries high morbidity and mortality, especially when diagnosis is delayed [2]. The incidence ranges from 2–11% of patients undergoing surgery for acute cholecystitis [3]. Risk factors include advanced age, diabetes mellitus, immunosuppression, and delayed presentation [4].

Niemeier classified GBP into three types: Type I – acute free perforation into the peritoneal cavity, Type II – subacute perforation with pericholecystic abscess, and Type III – chronic perforation with cholecystenterostomy fistula [5]. While ultrasound (USG) is the first-line imaging modality for suspected gallbladder disease, and CT offers better anatomic detail, subtle wall defects or small pericholecystic collections may be overlooked, particularly in early stages [6,7].

Early recognition of subtle radiological signs is crucial to avoid diagnostic delay. This case series highlights imaging pitfalls and overlooked features in patients with proven GBP whose initial imaging was inconclusive, aiming to improve detection in similar future cases. To present a case series highlighting subtle radiological signs of GBP that were overlooked on initial imaging, emphasizing the importance of high suspicion in at-risk patients.

MATERIALS AND METHODS

Study Design: Retrospective observational case series.

Setting: Department of Radiodiagnosis, Sri Ramachandra University, Porur, Chennai.
Duration: 1.5 years.
Sample Size: 10–15 patients.
Inclusion Criteria:
- Surgically or histopathologically proven GBP.
- Initial imaging (USG and/or CT) performed at our center.
- No definitive diagnosis of GBP made on initial imaging.

Exclusion Criteria:
- Incomplete clinical or imaging records.
- Perforations secondary to trauma or neoplasia.

Methodology:
Patient records were retrieved from PACS and hospital archives. Imaging studies were reviewed independently by two radiologists (≥5 years' experience). Subtle signs on initial imaging were documented, including:
- Focal discontinuity in gallbladder wall
- Pericholecystic fluid/abscess
- Perihepatic or subhepatic fluid pockets
- Adjacent hepatic parenchymal hypodensity/hypoechogenicity
- Minimal pneumoperitoneum

CASE SUMMARIES
Case 1:
This case describes a 68-year-old female with a known history of diabetes mellitus and hypertension who presented with acute onset right upper quadrant abdominal pain, fever, and mild jaundice for three days. On initial evaluation, ultrasonography revealed multiple gallstones, diffuse gallbladder wall thickening, and mild pericholecystic fluid collection, findings suggestive of acute calculous cholecystitis; however, no obvious mural discontinuity was appreciated at the time of the primary scan. Retrospective re-evaluation of the ultrasound images, in light of later clinical and operative findings, demonstrated a subtle 4 mm defect in the gallbladder fundal wall with an adjacent localized hypoechoic fluid pocket, which had initially been overlooked. Contrast-enhanced CT of the abdomen was subsequently performed, revealing a faint focal wall discontinuity at the fundus with a small volume of localized perihepatic fluid, without generalized biliary peritonitis. These imaging features were consistent with a contained perforation of the gallbladder. The patient underwent emergency laparotomy, where operative findings confirmed a fundal perforation with a localized pericholecystic abscess, corresponding to Niemeier type II gallbladder perforation. Cholecystectomy with drainage of the localized collection was performed, and the patient's postoperative course was uneventful, with resolution of symptoms and no complications on follow-up. This case highlights the importance of meticulous evaluation of gallbladder wall integrity on imaging, particularly in elderly, comorbid patients, as subtle perforations may be missed on initial assessment, potentially delaying definitive surgical intervention.
Case 2:
This case involves a 72-year-old male with significant comorbidities, including chronic obstructive pulmonary disease (COPD) and chronic kidney disease, who presented with progressive abdominal distension, hypotension, and clinical features suggestive of sepsis. Initial ultrasonography was technically limited due to overlying bowel gas; however, it demonstrated minimal free fluid in Morrison's pouch. Careful retrospective review of the ultrasound images revealed subtle echogenic foci within the gallbladder lumen producing dirty acoustic shadowing, findings suspicious for intraluminal air. Subsequent contrast-enhanced CT of the abdomen confirmed the presence of free intraperitoneal fluid, multiple small air pockets in the gallbladder fossa, and a distinct wall defect at the gallbladder neck, consistent with perforation. These findings correlated with an acute free perforation of the gallbladder. Emergency exploratory laparotomy was performed, which revealed a ruptured gallbladder neck with widespread bile peritonitis, classifiable as Niemeier type I perforation. The patient underwent cholecystectomy with thorough peritoneal lavage. Due to hemodynamic instability and comorbid status, postoperative ICU care was required; nevertheless, the patient made a gradual recovery and was discharged in stable condition. This case underscores the diagnostic challenge of gallbladder perforation in patients with suboptimal ultrasound windows, emphasizing the role of meticulous image review and adjunct CT imaging in timely diagnosis, particularly in critically ill, high-risk individuals.

Case 3:
This case describes a 65-year-old female with a history of diabetes mellitus who presented with right upper quadrant abdominal pain and low-grade fever of a few days' duration. Initial ultrasonography demonstrated multiple gallstones and diffuse gallbladder wall thickening, findings consistent with acute calculous cholecystitis; however, no wall discontinuity was appreciated at first interpretation. On retrospective review of the ultrasound images, a focal echogenic interruption in the gallbladder wall was noted near the neck region, raising suspicion for a localized perforation. Contrast-enhanced CT of the abdomen was subsequently performed, which revealed pericholecystic fluid extending into the subhepatic space without diffuse intraperitoneal contamination. Emergency laparotomy confirmed a neck perforation of the gallbladder associated with a localized pericholecystic abscess, corresponding to Niemeier type II perforation. Cholecystectomy with drainage of the localized collection was performed, and the postoperative course was uneventful. The patient was discharged on postoperative day six in good condition. This case illustrates how subtle wall defects may be overlooked on initial imaging and highlights the importance of careful retrospective image analysis in suspected complicated cholecystitis, especially in high-risk patients with comorbidities such as diabetes.

Case 4:
This case concerns a 58-year-old male with no known comorbidities who presented with abrupt onset of severe generalized abdominal pain. Initial ultrasonography was limited by suboptimal gallbladder visualization, revealing only minimal free fluid in the peritoneal cavity and no definitive signs of gallbladder pathology. On retrospective review, however, a subtle discontinuity of the gallbladder fundal wall was suspected. Urgent contrast-enhanced CT of the abdomen demonstrated moderate-volume ascites, pneumoperitoneum with free air beneath the diaphragm, and features suggestive of hollow viscus perforation, with the gallbladder fundus identified as the likely source. Emergency exploratory laparotomy revealed a perforation at the gallbladder fundus with diffuse bile peritonitis, consistent with Niemeier type I gallbladder perforation. Cholecystectomy with thorough peritoneal lavage was performed; however, the patient's condition deteriorated rapidly in the postoperative period, and despite aggressive supportive care in the intensive care unit, he succumbed to septic shock on the second postoperative day. This case highlights the fulminant course and high mortality risk associated with free perforations of the gallbladder, emphasizing the critical need for prompt recognition and surgical intervention.

Case 5:
This case involves a 70-year-old female with a history of hypertension and coronary artery disease who presented with longstanding dyspeptic symptoms and a recent onset of right upper quadrant abdominal pain. Initial ultrasonography demonstrated a contracted gallbladder with diffuse wall thickening, findings suggestive of chronic cholecystitis; no definite perforation was noted at the time. On retrospective review of the ultrasound images, a small hypoechoic collection adjacent to the gallbladder was appreciated, raising suspicion for a localized complication. Contrast-enhanced CT of the abdomen revealed a small, well-defined, loculated fluid collection in the subhepatic space, closely related to the gallbladder wall. Intraoperatively, a sealed perforation was identified on the gallbladder wall with dense omental adhesions effectively containing the leak, consistent with Niemeier type II perforation. Cholecystectomy with drainage of the localized collection was performed, and the patient's postoperative recovery was smooth, with discharge in stable condition. This case underscores that sealed perforations may present subtly, often mimicking uncomplicated chronic cholecystitis on initial imaging, and highlights the value of careful image reassessment and correlation with clinical presentation to guide timely surgical management.

Case 6:
This case describes a 62-year-old male with a known history of diabetes mellitus who presented with fever and right upper quadrant abdominal pain. Initial ultrasonography revealed diffuse gallbladder wall thickening with mild pericholecystic fluid, suggestive of acute cholecystitis, but no obvious perforation was appreciated. On retrospective review of the ultrasound images, a 5 mm defect in the gallbladder wall at the body region was identified, associated with a localized hypoechoic collection. Contrast-enhanced CT of the abdomen confirmed the presence of a well-defined pericholecystic fluid collection adjacent to the body of the gallbladder without evidence of free intraperitoneal bile or air. Surgical exploration revealed a body wall perforation with a localized abscess, consistent with Niemeier type II perforation. Cholecystectomy with drainage of the abscess was performed, and the postoperative course was

uneventful. The patient was discharged in good condition on the eighth postoperative day. This case highlights how focal wall defects in the gallbladder may be subtle on initial imaging, and that retrospective review combined with CT correlation plays a crucial role in identifying contained perforations, particularly in high-risk patients such as diabetics.

Case 7:

This case describes a 75-year-old female with a history of diabetes mellitus and chronic obstructive pulmonary disease who presented in septic shock, with marked abdominal distension and systemic signs of severe infection. Initial ultrasonography demonstrated a markedly distended gallbladder containing echogenic intraluminal debris, suggestive of acute complicated cholecystitis. No definite perforation was noted initially; however, retrospective review of the sonographic images revealed a focal interruption in the gallbladder wall at the fundus. Contrast-enhanced CT of the abdomen showed a large perihepatic fluid collection containing mixed-density material, minimal pneumoperitoneum, and inflammatory changes in the surrounding fat planes, consistent with perforated gallbladder and associated peritonitis. Emergency laparotomy revealed a Niemeier type I perforation at the fundus with extensive pus and bile throughout the peritoneal cavity. Cholecystectomy with thorough peritoneal lavage and drainage was performed. The patient required prolonged postoperative intensive care due to her comorbid status and septic shock but eventually recovered and was discharged in stable condition. This case illustrates the fulminant presentation of free gallbladder perforation in elderly patients with significant comorbidities and highlights the importance of timely recognition and surgical intervention to improve survival outcomes.

Case 8:

This case involves a 54-year-old male with a history of alcoholic liver disease who presented with right upper quadrant abdominal pain and anorexia. Initial ultrasonography demonstrated multiple gallstones with mild diffuse gallbladder wall thickening, findings consistent with calculous cholecystitis. No overt perforation was reported on the initial scan; however, retrospective review of the images revealed a focal area of wall irregularity at the gallbladder neck, raising suspicion for localized wall disruption. Contrast-enhanced CT of the abdomen showed inflammatory changes around the gallbladder with a poorly defined, heterogeneously enhancing soft tissue density adjacent to the neck region, consistent with a pericholecystic phlegmon. Surgical exploration confirmed a contained perforation at the gallbladder neck with surrounding inflammatory tissue, corresponding to a Niemeier type II perforation. Cholecystectomy with careful dissection of the inflamed neck region was performed, and the patient's postoperative recovery was uneventful. This case highlights that in patients with chronic liver disease, the imaging features of contained gallbladder perforation can be subtle and may mimic uncomplicated cholecystitis, underscoring the importance of meticulous image reassessment and correlation with clinical findings.

Case 9:

This case describes a 60-year-old female with a history of diabetes mellitus who presented with right upper quadrant tenderness and nausea. Initial ultrasonography revealed a distended gallbladder containing multiple calculi, without obvious perforation. On retrospective review of the ultrasound images, a hypoechoic tract was noted extending from the gallbladder towards the hepatic flexure of the colon, raising suspicion for a fistulous communication. Contrast-enhanced CT of the abdomen demonstrated an air–fluid level in the gallbladder fossa with adjacent inflammatory changes, findings consistent with a cholecystoenteric fistula. Surgical exploration confirmed a Niemeier type III gallbladder perforation with cholecystoenteric fistula formation between the gallbladder and the hepatic flexure. Cholecystectomy with fistula repair was performed, and the patient had an uneventful postoperative recovery. She was discharged in good condition following repair. This case highlights the rare presentation of type III gallbladder perforation, in which fistula formation can be suspected preoperatively through careful review of subtle ultrasonographic and CT findings, enabling definitive surgical planning.

Case 10:

This case involves a 78-year-old male with a history of diabetes mellitus and hypertension who presented with severe abdominal pain and vomiting. Initial ultrasonography demonstrated a markedly distended gallbladder with mild pericholecystic fluid, suggestive of acute cholecystitis. No perforation was reported on the primary scan; however, retrospective review revealed a tiny focal defect in the gallbladder wall at the body region. Contrast-enhanced CT of the abdomen showed a large, well-defined loculated subhepatic abscess closely abutting the gallbladder, with surrounding inflammatory fat stranding, indicating a contained perforation. Surgical exploration confirmed a Niemeier type II gallbladder perforation at the

body, with an associated subhepatic abscess. Cholecystectomy with drainage of the abscess was performed. The patient recovered well postoperatively and was discharged in stable condition. This case underscores the importance of revisiting initial imaging when clinical suspicion persists, as subtle wall defects may be the only early indicator of a contained gallbladder perforation.

Case 11:

This case describes a 63-year-old female with no significant past medical history who presented with fever and localized right upper quadrant tenderness. Initial ultrasonography demonstrated diffuse gallbladder wall thickening with surrounding pericholecystic edema, consistent with acute cholecystitis, but no definite perforation was identified. On retrospective review of the ultrasound images, a subtle discontinuity in the gallbladder wall at the fundus was noted, raising suspicion for a contained perforation. Contrast-enhanced CT of the abdomen confirmed the presence of minimal perihepatic fluid without evidence of generalized peritonitis. Surgical exploration revealed a Niemeier type II perforation at the gallbladder fundus with localized inflammatory changes. Cholecystectomy was performed, and the patient's postoperative course was uneventful, with discharge in good condition. This case highlights how even minimal fluid and subtle wall defects on imaging can represent early, contained perforations, and that careful image reassessment is key to timely diagnosis and management.

Case 12:

This case involves a 69-year-old male with a history of hypertension who presented with right upper quadrant pain and generalized malaise. Initial ultrasonography demonstrated gallbladder sludge and diffuse wall thickening, without evidence of perforation. On retrospective review, a small hypoechoic area was noted adjacent to the gallbladder fundus and contiguous with the hepatic parenchyma, raising suspicion for localized extension of inflammation. Contrast-enhanced CT of the abdomen revealed a hypodense, wedge-shaped area within the adjacent liver, consistent with a localized hepatic abscess secondary to gallbladder pathology. Surgical exploration confirmed a Niemeier type II perforation at the gallbladder fundus with direct extension into the hepatic tissue, forming a localized hepatic abscess. Cholecystectomy with drainage of the abscess was performed, and the patient had an uneventful postoperative course, being discharged in stable condition. This case highlights the potential for gallbladder perforations to directly invade adjacent liver parenchyma, resulting in localized hepatic abscess formation, and underscores the value of combined ultrasound and CT correlation in diagnosis.

DISCUSSION

Gallbladder perforation, although uncommon, can have devastating consequences if not promptly recognized. The delay in diagnosis in our series averaged 36 hours, similar to findings by Derici et al. [8], where mortality was significantly higher in delayed cases.

USG remains the first-line modality but is operator-dependent and may miss small perforations [9]. CT, particularly with multiplanar reconstruction, can detect subtle wall defects and small loculated collections [10]. In our series, retrospective review revealed overlooked focal discontinuities and minor fluid collections in the majority of patients.

The commonest type in our study was Type II perforation, aligning with other Indian series where pericholecystic abscess formation is predominant due to delayed presentation [11]. The single mortality in our series was a Type I perforation with bile peritonitis and sepsis.

Our findings underscore that in elderly or high-risk patients with acute cholecystitis, even minimal pericholecystic fluid or questionable wall irregularity should prompt further evaluation with CT. Subtle adjacent hepatic changes should also raise suspicion for impending or contained perforation.

CONCLUSION

Gallbladder perforation can present with imaging findings so subtle that they are easily missed on first review. Radiologists should actively search for focal wall defects, pericholecystic collections, and minimal free fluid in high-risk patients. A high index of suspicion and prompt cross-sectional imaging can reduce diagnostic delays and improve surgical outcomes.

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