

# Isolated Gallbladder Injury in a Case of Blunt Abdominal Trauma

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## ABSTRACT

The diagnosis of blunt injury to the gallbladder may constitute a significant challenge to the diagnostician. There is often a delay in presentation with non-specific clinical symptoms. In the absence of reliable clinical symptoms, diagnostic imaging becomes an invaluable tool in the rapid identification of gallbladder injury. We present a case of isolated gallbladder injury following blunt abdominal trauma which was diagnosed by computed tomography and subsequently confirmed by cholecystectomy.

## CASE REPORT

### CASE REPORT

A 48-year-old male with a history significant for chronic alcohol abuse was admitted to the emergency department after being struck by a motorcycle while riding his bicycle. The patient was intoxicated at the time of admission and complained of diffuse epigastric pain. Physical exam revealed diffuse epigastric tenderness without peritoneal signs. Contrast enhanced computed tomography (CT) was subsequently obtained and revealed an enlarged, hydropic gallbladder measuring 13.3 x 5.9 cm (Fig 1a). The gallbladder also demonstrated active extravasation of intraluminal contrast, as well as intraluminal hematoma extending into and distending the gallbladder neck and cystic duct (Figs 1b and 2, respectively). There was mass effect present upon the adjacent duodenum, right anterolateral abdominal wall, as well as the right kidney and adrenal gland secondary to the marked enlargement of the gallbladder. Uncomplicated appearing pericholecystic and perihepatic fluid was present without evidence of other intraperitoneal injury.

The only evidence of more superficial injury was a nondisplaced fracture of the right 9th rib (Fig 3). The liver was, specifically, unremarkable. The patient was taken to surgery and successfully underwent cholecystectomy without complication. The gallbladder was found to be enlarged and to have been partially avulsed from the posterior edge of the liver, which was not identified on CT imaging. Unfortunately, intra-operative imaging or post-operative pathology was not

available. The patient's post operative course was unremarkable, and he was lost to follow up after discharge from the hospital.

### DISCUSSION

Gallbladder injury is unusual, occurring in approximately 2% of cases of blunt abdominal trauma [1-7]. Frequently, there is associated adjacent organ injury, the most common being the liver. Isolated gallbladder injury, as in this case, is far less common and given its rarity, the incidence is unknown [1,5]. In one study of 31 patients with injury to the gallbladder only one demonstrated isolated gallbladder injury [1]. The literature has described the bulk of gallbladder injuries, isolated or otherwise, as being secondary to blunt or penetrating abdominal trauma, with motor vehicle accidents being a common cause [1,2,4-6]. Injury is usually secondary to direct blow in blunt trauma or alternatively, shearing forces, which are more likely to cause an avulsion type injury [1].

Blunt traumatic injury to the gallbladder can be classified as contusion, avulsion, or laceration. Contusion, an intraluminal hematoma, is often undiagnosed due to a lack of acute signs or symptoms [1,6,8]. The natural course of the contused gallbladder is unknown as many patients may never present clinically. Laceration, which can result in perforation can occur as well, and may present as gallbladder leak [2,5,6]. The most severe injury, gallbladder avulsion, can be further

stratified by degree of avulsion from the liver: from being partially torn from the liver bed to complete separation from the liver and its attachments, i.e. traumatic cholecystectomy [2,6,9].

Injury is more likely to occur in a thin walled or distended gallbladder, such as in a fasting state. Additionally, alcohol increases risk of rupture as it increases sphincter of Oddi tone resulting in increased intraluminal pressure [10,11]. On the other hand, a thickened or diseased gallbladder wall, secondary to chronic inflammation, is protective [5,10,11]. It would be quite unusual, for example, to see gallbladder injury in the setting of gallstones, though the presence of stones themselves would not exclude injury [3,12].

Isolated traumatic gallbladder injury occurs infrequently owing to its anatomic location, protected by the adjacent liver and ribcage [1,11]. Patients with isolated gallbladder injury are at increased risk for significant morbidity and mortality due to the lack of specific presenting symptoms [1]. Symptoms of isolated gallbladder injury are often delayed, potentially increasing the risk of morbidity [1,11,12]. However, gallbladder injury is rarely isolated and overall patient morbidity is primarily dependent on the severity of the concomitant injuries, often adjacent organs, including the liver, duodenum and kidney (1,2,5).

Diagnostic peritoneal lavage, although a useful diagnostic tool in the evaluation of blunt abdominal trauma, is not particularly useful in detection of gallbladder injury, as only 45% of patients found to have gallbladder injury at surgery had positive lavage in one study [6]. Physical exam is often nonspecific and can be misleading [1,6].

The diagnosis of gallbladder injury is most effective with CT [2,5,12]. The identification of hyperdense blood within the gallbladder lumen is highly suggestive of gallbladder injury, given a history of trauma [2,4,5,12]. Our case was unusual in that the severity of hemorrhage into the gallbladder was substantial enough to cause marked dilatation of the gallbladder and cystic duct, as well as mass effect on the adjacent abdominal structures. In reviewing the literature, there were no examples which demonstrated such profound distention of the gallbladder. Coumadin use may increase the risk of hemorrhage into or adjacent to the gallbladder, with minimal or no history of trauma [13]. Milk of calcium, hyperdense sludge or vicarious excretion of IV contrast material, may all present as hyperdense fluid within the gallbladder, and may mimic hemorrhage into the gallbladder lumen [2,14]. However, none of these processes would be expected to demonstrate other sequelae of injury, such as pericholecystic fluid, or gallbladder dilation, as was seen in our case.

Additional CT findings of gallbladder injury include pericholecystic fluid, which may represent hemorrhage, extravasated gallbladder contents or edema [2,12,15]. Active extravasation of blood or contrast material, as seen in our case, may also be seen, although is quite unusual [16]. Other sensitive, though less specific findings suggestive of gallbladder injury on CT include thickening of the gallbladder

wall, and mass effect on adjacent organs such as the duodenum, liver or right kidney due to distention of the gallbladder. Irregularity of the gallbladder wall may be the only indication of underlying gallbladder injury [2,5,12], however the finding of a collapsed, otherwise unremarkable gallbladder on CT has been described as the result of extravasation of the gallbladder contents secondary to perforation [17]. Thus, there is no specific set of findings which are of diagnostic of gallbladder injury.

Ultrasound can be effective in the diagnosis of gallbladder injury as well, with the identification of heterogeneous hyperechoic blood within the confines of the gallbladder, or adjacent to the gallbladder, as pericholecystic fluid [2,3]. Although ultrasound is more useful for the evaluation of atraumatic gallbladder pathology, CT is more accurate in the setting of trauma for identifying blood as high density fluid or a fluid/fluid level within the gallbladder lumen, as well as better at characterizing any concomitant adjacent organ injury [17].

As injury to the gallbladder is not always detected with CT, in equivocal cases, where there is substantial clinical concern for gallbladder injury, hepatobiliary scintigraphy is a reliable indicator of bile leakage at the site of disruption [6,18]. Typically, delayed imaging may be required to identify extravasation of radioisotope from the biliary system [12,18]. Alternatively, MRI, with its superior soft tissue contrast resolution has shown efficacy in the detection of subtle areas of mural discontinuity in the setting of indeterminate CT findings [19].

The management of gallbladder injury is based on clinical symptomatology. Mild contusions or small lacerations may be treated conservatively. With larger laceration, perforation, or avulsion, surgical repair is warranted. With any injury requiring surgical intervention, cholecystectomy is often the treatment of choice, with gallbladder sparing procedures reserved for certain populations [1,11].

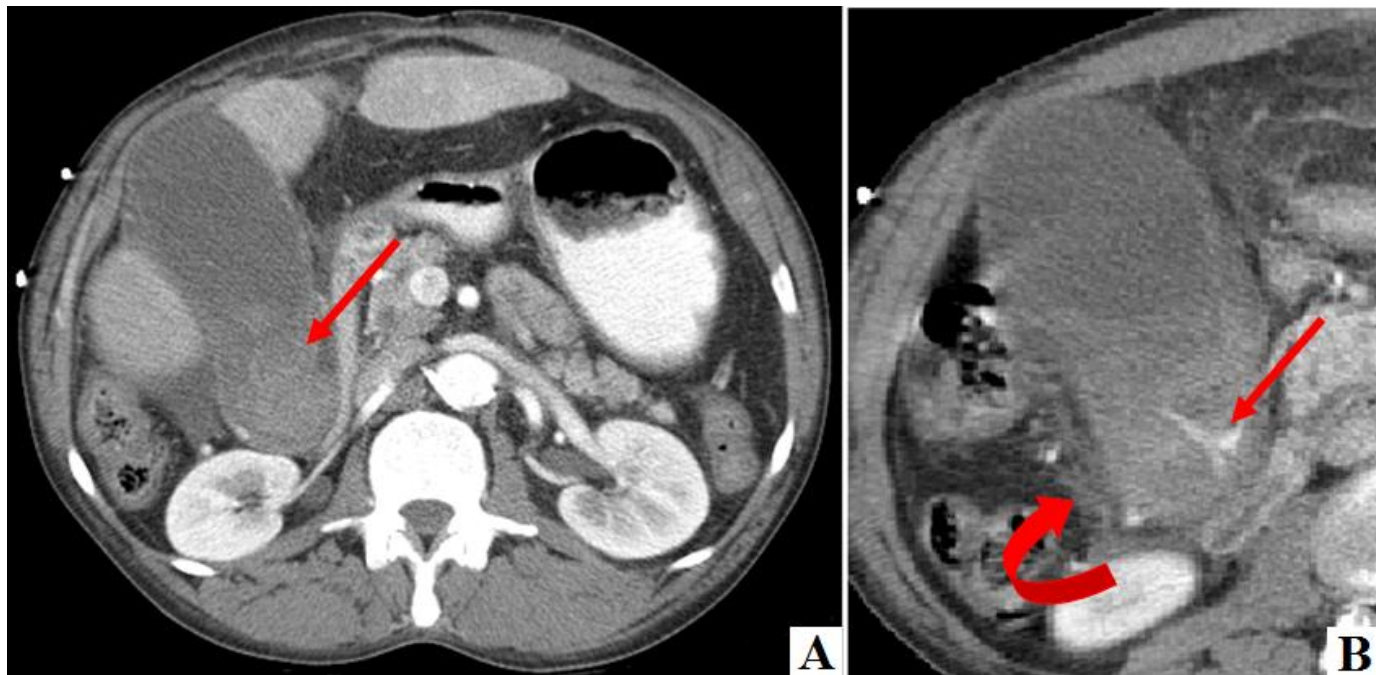
#### TEACHING POINT

Traumatic injury to the gallbladder is uncommon, occurring in approximately 2% of patients presenting with abdominal trauma. Isolated injury of the gallbladder is even more unusual. While gross distention of the gallbladder with hyperdense fluid on CT is suggestive of gallbladder injury given a history of trauma, the astute radiologist must be aware of other etiologies that could mimic hemorrhage. Additionally, irregularity in the gallbladder wall or the presence of a collapsed gallbladder with pericholecystic fluid should also raise the suspicion of gallbladder injury.

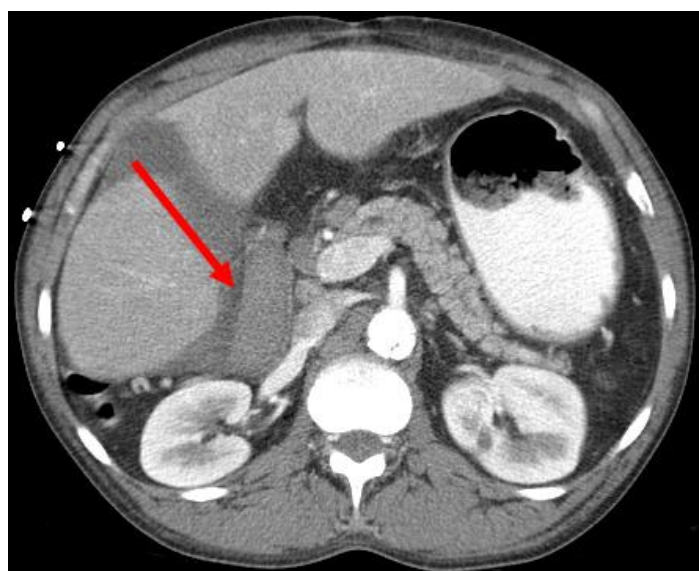
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FIGURES



**Figure 1:** Contrast enhanced axial CT of the abdomen in a 48 year old male with isolated trauma to the gallbladder. There is a hydroptic gallbladder with hyperdense fluid (arrow) (a) and extravasated contrast within the lumen (arrow) as well as simple appearing free fluid adjacent to the gallbladder (curved arrow) (b) consistent with traumatic gallbladder injury. (Protocol: 288mAs 120kV 3.75mm slice thickness 125ml Optiray 350)



**Figure 2 (left):** Contrast enhanced axial CT of the abdomen in a 48 year old male with isolated trauma to the gallbladder. There is dilatation of gallbladder neck as well marked dilatation of the cystic duct, also filled with hyperdense fluid (arrow) also suggestive of gallbladder injury (Protocol: 288mAs 120kV 3.75mm slice thickness 125ml Optiray 350)



**Figure 3 (left):** Contrast enhanced axial CT of the abdomen in a 48 year old male with isolated trauma to the gallbladder. The only additional injury, a non-displaced fracture of the right 9th rib (arrow). (Protocol: 288mAs 120kV 3.75mm slice thickness 125ml Optiray 350)

<b>Etiology</b>	Blunt or penetrating injury, typically a direct blow to the abdomen. Motor vehicle accident is a common cause.
<b>Incidence</b>	The gallbladder is injured in approximately 2% of blunt trauma. The incidence of isolated gallbladder trauma is substantially lower (3% of gallbladder trauma)
<b>Gender Ratio</b>	There is no gender predominance
<b>Age Predilection</b>	There is no definable age predilection
<b>Risk Factors</b>	A thin gallbladder wall is more susceptible to perforation. Therefore a fasting state at the time of injury would increase the risk of rupture. Additionally, alcohol increases the risk of rupture due to increased sphincter of Oddi tone and increased intraluminal pressure. However, an inflammatory state, which thickens the gallbladder wall, is protective.
<b>Treatment</b>	Treatment is dependent on the type and severity of injury. For gallbladder contusions or small lacerations, expectant management can be considered. For more severe injury (large laceration, perforation or avulsion), cholecystectomy is recommended.
<b>Prognosis</b>	Prognosis is usually dictated by the severity of associated injuries. Because of its rarity, the prognosis in isolated gallbladder injury is difficult to determine. When other organs are injured prognosis is dependent of severity of concomitant organ injury, and prompt diagnosis.
<b>Findings on Imaging</b>	CT is the most useful imaging tool. Hyperdense fluid within the lumen of a dilated, hydropic gallbladder is consistent with hemorrhage. Pericholecystic fluid or hyperdense fluid is also suggestive of injury though less specific. Mass effect of the gallbladder upon the adjacent organs can also be seen. Alternatively, irregularity of the gallbladder wall or thickening of the gallbladder wall can also be seen. Decompression of the gallbladder in a fasting patient is a potential sign of injury.

**Table 1:** Summary table for isolated gallbladder injury

Disease	US	CT	MRI
<b>Gallbladder Injury</b>	<ul style="list-style-type: none"> <li>• Heterogeneous hyperechoic fluid, may or may not layer is indicative of blood.</li> <li>• Pericholecystic fluid may be seen as well.</li> <li>• A decompressed gallbladder may be evident if there is perforation</li> </ul>	<ul style="list-style-type: none"> <li>• Hyperdense intraluminal fluid-hemorrhage</li> <li>• Extravasation of contrast/blood</li> <li>• Wall Thickening</li> <li>• Mass effect on duodenum, liver, right kidney</li> </ul>	<ul style="list-style-type: none"> <li>• GB collapse</li> <li>• Intraluminal hemorrhage</li> <li>• Pericholecystic fluid</li> <li>• GB wall defect on post-gadolinium</li> </ul>
<b>Milk of Calcium</b>	<ul style="list-style-type: none"> <li>• Hyperechoic material in the dependent portion of the gallbladder</li> <li>• May shadow</li> </ul>	<ul style="list-style-type: none"> <li>• Hyperdense layering material in the dependent portion of the gallbladder</li> </ul>	<ul style="list-style-type: none"> <li>• Layering T1 and T2 dark signal within the gallbladder</li> </ul>
<b>Vicarious excretion of contrast</b>	<ul style="list-style-type: none"> <li>• Hyperechoic material in the dependent portion of the gallbladder</li> </ul>	<ul style="list-style-type: none"> <li>• Hyperdense layering material in the dependent portions of the gallbladder</li> </ul>	<ul style="list-style-type: none"> <li>• Layering T1 and T2 dark signal within the gallbladder</li> </ul>
<b>Sludge</b>	<ul style="list-style-type: none"> <li>• Hyperechoic material in the dependent portion of the gallbladder</li> </ul>	<ul style="list-style-type: none"> <li>• Increased density material in the dependent portion of the gallbladder</li> </ul>	<ul style="list-style-type: none"> <li>• Layering material within the gallbladder of variable T1 and T2 intensity</li> </ul>

**Table 2:** Differential diagnosis table for gallbladder injury

**ABBREVIATIONS**

CT = Computed tomography  
 MRI = Magnetic resonance imaging  
 US = Ultrasound

**KEYWORDS**

Gallbladder; Trauma; Computed tomography

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