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Case Report

Single-Institution Case Series of Patients Undergoing Cholecystectomy for Gallbladder Torsion

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Gallbladder torsion is one subtype of acute cholecystitis. Because of the very low incidence of the condition, there are few reports analyzing multiple cases of gallbladder torsion. The preoperative diagnosis is difficult and reported to be made in only 26% of patients. Herein, we report 6 consecutive cases of gallbladder torsion in 7 years and highlight the clinical and radiologic findings that facilitate preoperative diagnosis. Between 2005 and 2011, a total of 6 patients received a diagnosis of and were treated for gallbladder torsion in Toyonaka Municipal Hospital. A total of 5 patients received a diagnosis of gallbladder torsion or were suspected of having gallbladder torsion preoperatively, and 1 additional patient was diagnosed intraoperatively. The computed tomography findings of both excessive gallbladder swelling and rotation of the gallbladder fundus were observed in 5 patients, which were indicative findings of gallbladder torsion. The remaining 1 patient received a diagnosis intraoperatively. The twisted cystic duct and artery had been observed as a "whirl sign" preoperatively in 2 patients. Emergency cholecystectomy was performed: laparoscopic cholecystectomy was performed in 4 patients and open cholecystectomy in 2 patients. The patients treated by laparoscopic approach showed more rapid recovery and shorter postoperative hospital stay before discharge. The radiologic findings of both excessive gallbladder swelling and rotation of the gallbladder fundus are indicative of gallbladder torsion. The laparoscopic

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cholecystectomy approach could be considered the first choice for patients with gallbladder torsion.

Key words: Gallbladder torsion – Emergency operation – Laparoscopic cholecystectomy – Open cholecystectomy – Gallbladder volvulus

Gallbladder torsion was first reported in the clinical literature in 1898,[1] and more than 500 cases of gallbladder torsion have been reported to date.[2] The frequency of this condition increases with age, with the peak incidence observed in elderly women. However, it remains a rare event. Possible causal factors include anatomic variation of the gallbladder mesentery, loss of visceral fat, liver atrophy, and presence of elongated mesentery with cystic artery and duct, which is known as "floating gallbladder."[3–7]

Torsion of the gallbladder presents as one subtype of acute cholecystitis. In the 2013 Revised Tokyo Guidelines for the management of acute cholangitis and cholecystitis,[8] it is stated that gallbladder torsion is one of the local complications of biliary peritonitis, pericholecystic abscess, liver abscess, emphysematous cholecystitis, gangrenous cholecystitis, and purulent cholecystitis, and torsion is graded as "moderate severity."[9] An urgent cholecystectomy should be performed in cases where torsion of the gallbladder is suspected because any more conservative treatment will not resolve this emergency condition. The preoperative diagnosis of gallbladder torsion is considered to be difficult. A systematic review conducted in 2012 found that a preoperative diagnosis of the condition was made in only 26% of patients.[10]

Until now, numerous individual case reports have been published worldwide, but because of the very low incidence of the condition, there are few reports analyzing multiple cases of gallbladder torsion. Recently we experienced 6 consecutive cases of gallbladder torsion. In this report, we highlight the clinical and radiologic findings that facilitated the preoperative diagnosis of 6 cases of gallbladder torsion. All of the patients received the emergency operation, and we also discuss the surgical outcome.

Case Presentation

Between January 2005 and November 2011, a total of 172 patients received a diagnosis of acute cholecystitis in the surgical department at Toyonaka Municipal Hospital (Osaka, Japan). Each of the patients was assessed according to clinical findings, blood test results, and computed tomography (CT) findings. The diagnosis of acute cholecystitis followed the diagnostic criteria of the Tokyo Guidelines for the management of acute cholangitis and cholecystitis. Of 172 patients, 5 patients received a diagnosis of gallbladder torsion or suspected gallbladder torsion preoperatively, and 1 additional patient was diagnosed intraoperatively. A total of 4 patients underwent laparoscopic cholecystectomy, and the remaining 2 patients underwent open cholecystectomy. The reasons to choose the open surgery were that the time delay being more than 3 days between the onset of symptoms and the operation was observed in patient 2, and biliary peritonitis was suspected in patient 3. Clinical, laboratory, and radiologic findings for these 6 patients were collected (age, sex, presence or absence of severe right upper quadrant abdominal pain, fever, white blood cell count, C-reactive protein, and CT findings).

Laparoscopic cholecystectomy was performed with a standard 4-port technique. After insertion of the first trocar, carbon dioxide was used for peritoneal insufflation, and abdominal pressure was maintained between 8 and 12 mmHg. Laparoscopic detorsion of the gallbladder was performed, and the cystic artery and cystic duct were freed from the surrounding tissue at the Calot triangle An effort was made to create the "critical view of safety" established by Strasberg and Brunt.[11] Intraoperative cholangiography was not routinely performed. The cystic artery was sealed and dissected using a laparoscopic Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, Ohio), and the cystic duct was intra-abdominally ligated and dissected.

The clinical characteristics, laboratory data, and radiologic findings pertaining to 6 patients who received a diagnosis of gallbladder torsion at our institute are shown in Table 1. The age of the patients ranged from 33 to 89 years. Half of the patients were older than 80 years. Median age was 76.5 years. A total of 4 patients were female and 2 were male. Upon presentation, each of the patients complained of sudden severe right upper quadrant

Table 1 Clinical, laboratory, and radiologic findings

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Age, y	33	84	69	88	66	89
Sex	Female	Female	Female	Male	Female	Male
Severe right upper quadrant abdominal pain	+	+	+	+	+	+
Fever (>38°C)	−	−	−	−	−	−
WBCs/μL	7400	8200	7300	7100	14200	12200
CRP, mg/dL	0.22	9.72	2.99	0.12	0.52	2.28
CT findings						
Ischemia of the wall	+	Not enhanced	+	+	+	+
Excessive swelling of gallbladder	−	+	+	+	+	+
Rotation of the fundus	−	+	+	+	+	+
Torsion of the cystic duct	−	−	−	−	+	+
Preoperative diagnosis	Acute cholecystitis	Suspected torsion of the gallbladder	Suspected torsion of the gallbladder	Suspected torsion of the gallbladder	Torsion of the gallbladder	Torsion of the gallbladder

CRP, C-reactive protein; WBCs, white blood cells.

abdominal pain. None displayed fever. Elevation of white blood cell count was not observed in 4 patients. In radiologic findings, ischemia of the gallbladder wall was frequently observed but was not specific to gallbladder torsion. The rotation of the gallbladder fundus, revealing an abnormal anatomic position, was observed in 5 patients. Moreover, these 5 patients showing the rotation of the gallbladder fundus had accompanying findings of excessive swelling of the gallbladder. Figure 1a and 1b show the CT findings, revealing both excessive swelling of gallbladder and the rotation of the fundus in patients 4 and 6. Both findings appear to be a useful preoperative indication of suspected gallbladder torsion. In 2 patients (patients 5 and 6), a multidetector CT study showed a twisted pedicle inferior to the liver, as well as a twisting of the cystic duct and cystic artery that could be observed as a "whirl sign" on contrast scans. Patient 1 revealed only ischemic change of the gallbladder wall, but this was not accompanied by any findings of excessive swelling of the gallbladder, rotation of the fundus, or torsion of the cystic duct, and was diagnosed as acute cholecystitis preoperatively. Laparoscopic cholecystectomy was performed. The cystic duct was twisted less than 180°, and the diagnosis of gallbladder torsion was done intraoperatively.

Details, including the type of operation performed and the clinical outcomes of the 6 cases, are shown in Table 2. The laparoscopic approach was chosen for 4 patients, and conversion to open cholecystectomy was not necessary. Figure 2 shows that the necrotic gallbladder was observed with an anticlockwise torsion of more than 360° in its mesentery in patient 6. In all patients, the gallbladder was attached to the liver only by the cystic duct and artery; this condition is described as a "floating gallbladder." Torsion can be classified as "incomplete," in which rotation is less than 180°, or "complete," in which rotation is more than 180°. A total of 3 cases represented complete torsion, and 3

Table 2 Type of operation performed and clinical outcomes observed

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Type of operation	LC	OC	OC	LC	LC	LC
Floating gallbladder	+	+	+	+	+	+
Complete torsion	−	+	−	+	−	+
Operation time, min	57	31	26	77	47	71
Complication	−	−	−	−	−	−
Postoperative hospital stay, d	2	7	16	5	7	5

LC, laparoscopic cholecystectomy; OC, open cholecystectomy.

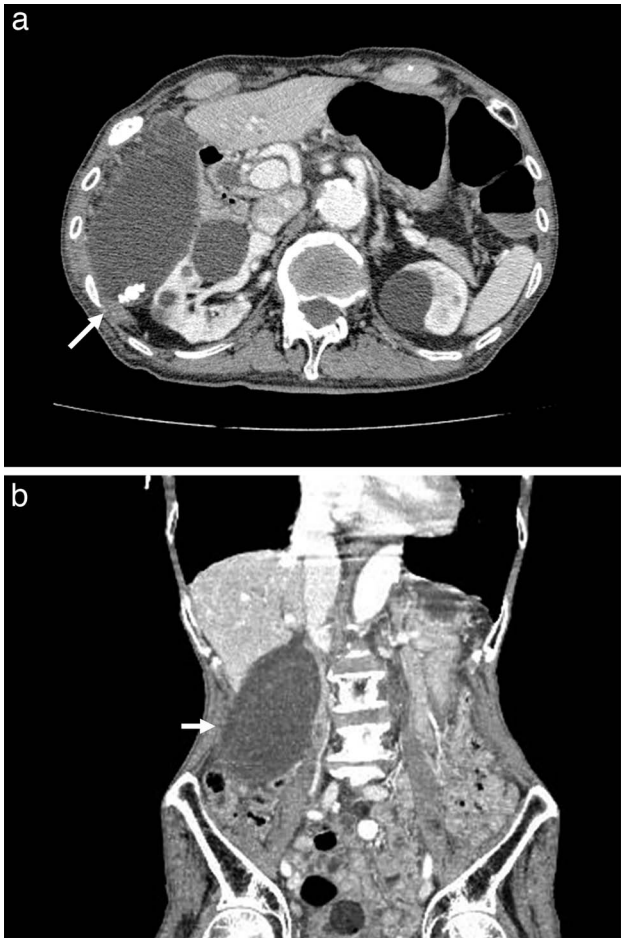

Fig. 1 (a) CT showed both excessive swelling of gallbladder and the rotation of the gallbladder fundus in an abnormal anatomic position in patient 6 (arrow). (b) Coronal CT scan demonstrated excessive swelling of the gallbladder extending from the inferior edge of the liver to the right lower abdominal space in patient 4 (arrow).

represented incomplete torsion. The operation duration ranged from 26 to 77 minutes. The durations of the open cholecystectomy procedures were shorter than those of the laparoscopic cholecystectomy procedures, and all fell within an acceptable range. All of the patients were discharged without any postoperative complications. The periods of postoperative hospital stay ranged from 2 to 16 days. The average length of hospital stay for patients receiving laparoscopic cholecystectomy is supposed to be shorter than that for patients receiving open cholecystectomy, indicating earlier recovery in the patients treated with laparoscopic procedures.

Fig. 2 At laparoscopy, necrotic gallbladder was observed with complete torsion of more than 360°.

Discussion

Gallbladder torsion, or volvulus, was first reported in 1898 by Wendel.[1] It remains a relatively uncommon event, occurring primarily in elderly women. Gallbladder torsion is defined as a rotation of the gallbladder on the mesentery along the axis of the cystic duct and cystic artery. The consequent obstruction of bile and blood flow leads to empyema formation and the development of necrosis of the gallbladder wall. Clinically, gallbladder torsion is an emergency surgical situation, and prompt cholecystectomy is necessary to avoid the morbidity and mortality associated with necrosis and perforation of gallbladder.

The correct preoperative diagnosis of gallbladder torsion is challenging. In 2012, Reilly *et al*[10] conducted a systematic review of cases of gallbladder torsion, and the data of 324 patients with gallbladder torsion since 1898 were collected. The authors reported that a preoperative diagnosis of gallbladder torsion was made in only 26% of cases within the last 20 years (32 cases out of 125 patients).[10] The symptoms of gallbladder torsion comprise acute onset of severe right upper quadrant abdominal pain, nausea and vomiting, and a tender palpable mass. These symptoms are mainly nonspecific, and their presentation varies with the type of torsion, which may be either complete or incomplete.[12–15] In this study, we assessed CT findings that were most helpful in the differential diagnosis of gallbladder torsion. CT

can play an important role in the diagnosis of gallbladder torsion. The observation of a distended gallbladder outside the normal anatomic fossa indicates the condition called a "free-floating gallbladder," which is one of the risk factors for gallbladder torsion. Multidetector CT scan was reported to be useful to diagnose gallbladder torsion before surgery.[16] Observation of a twisted pedicle of the cystic duct and cystic artery with a "whirl sign" appearance may be considered definitive findings in the diagnosis of gallbladder torsion.[2,10,17–19] In the series presented in this study, contrast-enhanced CT imaging was quite helpful in the process of diagnosis of gallbladder torsion. A preoperative diagnosis of gallbladder torsion was made in 83% of the cases. From our series, CT findings of both excessive gallbladder swelling and rotation of the gallbladder fundus were believed to be key findings indicative of gallbladder torsion. The CT image showing torsion of the cystic duct named a "whirl sign" was a definitive diagnostic finding for gallbladder torsion, and this sign was observed in 2 patients. Multidetector CT scan is widely used now, and more patients can receive a preoperative diagnosis of gallbladder torsion.

The treatment for gallbladder torsion is emergency cholecystectomy, which must be performed immediately to prevent the potential complications of gallbladder perforation and biliary peritonitis. Cholecystectomy can be performed using either a laparoscopic approach or an open approach.[20] In previously published case reports, the gallbladder was minimally adherent to the liver bed, allowing the laparoscopic procedure to be performed easily.[21–23] The laparoscopic cholecystectomy has been recommended because it is less invasive and patients have a more rapid recovery after the operation. In this series of gallbladder torsion patients, all patients underwent emergency cholecystectomy; 2 patients underwent an open cholecystectomy procedure and 4 underwent a laparoscopic cholecystectomy procedure. The operative duration of open cholecystectomy was shorter than that of laparoscopic cholecystectomy. Two patients treated with open cholecystectomy were very lean, and the twisted gallbladder was easily resected. This resulted in a shorter operative duration in the patients with open cholecystectomy. All of the patients were discharged from the hospital without any complications. The patients treated using a laparoscopic approach showed more rapid recovery and shorter postoperative hospital stay before discharge. The laparoscopic approach could be considered the recommended first choice for patients with a diagnosis of or suspected to have gallbladder torsion.

Conclusion

The diagnosis of this rare emergency condition can be facilitated by the observation that CT findings showing both excessive gallbladder swelling and rotation of the gallbladder fundus are indicative of gallbladder torsion. The laparoscopic cholecystectomy approach could be considered the first choice for patients with gallbladder torsion.

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References

1. Wendel AV. A case of floating gallbladder and kidney complicated by cholelithiasis with perforation of the gallbladder. *Ann Surg* 1898;**27**:199–202
2. Yokoi T, Miyata K, Yuasa N, Takeuchi E, Goto Y, Miyake H *et al*. Twisted cystic artery disclosed by 3-dimensional computed tomography angiography for torsion of the gallbladder. *Am J Surg* 2011;**201**(5):e33–e34
3. Chiow AK, Ibrahim S, Tay KH. Torsion of the gallbladder: a rare entity. *Ann Acad Med Singapore* 2007;**36**(8):705–706
4. McHenry CR, Byrne MP. Gallbladder volvulus in the elderly: an emergent surgical disease. *J Am Geriatr Soc* 1986;**34**(2):137–139
5. Nicholas JM. Image of the month: gallbladder volvulus. *Arch Surg* 2002;**137**(6):741–742
6. Stieber AC, Bauer JJ. Volvulus of the gallbladder. *Am J Gastroenterol* 1983;**78**(2):96–98
7. Tarhan OR, Barut I, Dinelek H. Gallbladder volvulus: review of the literature and report of a case. *Turk J Gastroenterol* 2006;**17**(3):209–211
8. Takada T, Strasberg SM, Solomkin JS, Pitt HA, Gomi H, Yoshida M *et al*. TG13: updated Tokyo Guidelines for the management of acute cholangitis and cholecystitis. *J Hepatobiliary Pancreat Sci* 2013;**20**(1):1–7
9. Yamashita Y, Takada T, Strasberg SM, Pitt HA, Gouma DJ, Garden OJ *et al*. TG13 surgical management of acute cholecystitis. *J Hepatobiliary Pancreat Sci* 2013;**20**(1):89–96
10. Reilly DJ, Kalogeropoulos G, Thiruchelvam D. Torsion of the gallbladder: a systematic review. *HPB (Oxford)* 2012;**14**(10):669–672

11. Strasberg SM, Brunt LM. Rationale and use of the critical view of safety in laparoscopic cholecystectomy. *J Am Coll Surg* 2010; **211**(1):132–138
12. Kalimi R, Zarcone J III, McNelis J. Acute necrotizing torsion of the gallbladder. *Am Surg* 2001;**67**(8):748–751
13. Rajagopal R, Rajagopal A. Acute torsion of the gall bladder. *Am J Surg* 2001;**182**(5):534–535
14. Shaikh AA, Charles A, Domingo S, Schaub G. Gallbladder volvulus: report of two original cases and review of the literature. *Am Surg* 2005;**71**(1):87–89
15. Caliskan K, Parlakgumus A, Koc Z, Nursal TZ. Acute torsion of the gallbladder: a case report. *Cases J* 2009;2:6641
16. Chou CT, Chen RC, Yang AD, Wu HK. Gallbladder torsion: preoperative diagnosis by MDCT. *Abdom Imaging* 2007;**32**(5): 657–659
17. Boonstra EA, van Etten B, Prins TR, Sieders E, van Leeuwen BL. Torsion of the gallbladder. *J Gastrointest Surg* 2012;**16**(4): 882–884
18. Chung JC, Song OP, Kim HC. Gallbladder torsion diagnosed by MDCT and MRCP. *Abdom Imaging* 2010;**35**(4):462–464
19. Tajima Y, Tsuneoka N, Kuroki T, Kanematsu T. Clinical images: gallbladder torsion showing a "whirl sign" on a multidetector computed tomography scan. *Am J Surg* 2009; **197**(1):e9–e10
20. Pottorf BJ, Alfaro L, Hollis HW. A clinician's guide to the diagnosis and management of gallbladder volvulus. *Perm J* 2013;**17**(2):80–83
21. Christoudias GC. Gallbladder volvulus with gangrene: case report and review of the literature. *JSLS* 1997;**1**(2):167–170
22. Reddy PK, Muralidharan M, Venkatasubramanian R, Yuvaraja S. Laparoscopic derotation and cholecystectomy for torsion gallbladder. *JSLS* 2005;**9**(2):238–240
23. Garciavilla PC, Alvarez JF, Uzqueda GV. Diagnosis and laparoscopic approach to gallbladder torsion and cholelithiasis. *JSLS* 2010;**14**(1):147–151