松仁会医学誌 56(1)：24 ～ 29，2017

症例報告

Isolated bladder rupture after trauma: A case with difficulty in diagnosing

Keisuke Takemura, Tatsuya Kawasaki, Takashi Yasuda, Takako Mikami, Tomoya Kotani, Satoru Sekoguchi, Shunsuke Hotta*, Hiroki Takeshita**, Michihiro Ishii**, Hirokazu Oyamada

Department of General Internal Medicine, Matsushita Memorial Hospital, Osaka Japan.
**Department of Urology, Matsushita Memorial Hospital, Osaka Japan.*
***Department of Surgery, Matsushita Memorial Hospital, Osaka Japan.*

Abstract: Computed tomography (CT) plays a pivotal role in the detection of traumatic abdominal injury, but its diagnostic accuracy is not as good in hollow organs as in solid organs. We report a case of isolated bladder rupture after blunt abdominal trauma, in which CT was less informative for the diagnosis. A 54-year-old woman with alcoholic liver cirrhosis presented to the emergency room of our hospital because of abdominal pain after falling down at home. CT images showed free, non-bloody fluid in the abdomen without any findings suggestive of solid organ injuries. Unexpectedly, after urinary catheter insertion, 4500 ml was drained for 1.5 hours and the ascites almost disappeared. Abdominal puncture showed levels of urea nitrogen and creatinine in the fluid were 66 mg/dl and 14.8 mg/dl, respectively. The conditions were considered consistent with a diagnosis of traumatic bladder rupture although cystography was not performed due to the concerns of inflammatory deterioration. In the retrospective review, CT failed to provide adequate imaging of the bladder due not only to its hollow structure but also to artifacts from bilateral artificial hip joint replacement. The clinical course was uneventful with conservative treatment with antibiotics.

Key Words: ascites, bladder, computed tomography, rupture, trauma

Introduction

An isolated bladder injury after abdominal trauma is relatively uncommon since the bladder is located in the bony pelvis and protected from external trauma[1]. We report a case of a significant amount of ascites due to isolated bladder rupture after trauma, in which the diagnosis was difficult to make because of comorbidities, such as alcoholic liver cirrhosis and bilateral artificial hip joint replacement.

Case report

A 54-year-old woman presented to the emergency room of our hospital with abdominal pain. The patient had been doing well four hours before presentation, when abdominal pain on the right side developed after she fell down in the corridor of her house and hit her abdomen on the floor. The patient reported that the pain gradually expanded to the whole of the abdomen and did not improve on rest. She had a medical history of

2017 年 3 月 31 日受付
連絡先：〒570-8540
大阪府守口市外島町 5 番 55 号
松下記念病院
総合診療科（竹村圭祐）
Email: takemura.keisuke@jp.panasonic.com
Tel: +81-66992-1231，Fax: +81-66992-4845

alcoholic liver cirrhosis (Child-Pugh class A), hysterectomy for uterine fibroid, panic disorder, and bilateral artificial hip joint replacement due to congenital hip dislocation. Medications included lansoprazole, levomepromazine maleate, clomipramine hydrochloride, bromazepam, setiptiline maleate, lormetazepam, etizolam, and mianserin hydrochloride. She drank in a binge pattern, consuming at least 60g of ethanol per day for 25 years, and did not smoke or use illicit drugs.

On physical examination, she was alert. The body temperature was 37.5℃, the blood pressure was 129/96mmHg, the pulse was 80 beats per minute, and the oxygen saturation was 97% while she was breathing ambient air. The abdomen was slightly distended and diffusely tender (more severe around the right flank), with normal bowel sounds and no rebound or rigidity. The reminder of the examination was normal. As shown in Table, the liver and renal functions were mildly impaired: aspartate aminotransferase, 43U/l; alanine aminotransferase, 47U/l; urea nitrogen, 20mg/dl; and creatinine, 1.7mg/dl. The lactate dehydrogenase was 359U/l and the C-reactive protein was 0.52mg/dl. The complete blood cell count was normal, as were glucose, electrolytes, and creatine phosphokinase. Ultrasonography showed an irregular surface and dull angular edge of the liver, diffusely rough intrahepatic echo pattern, and a moderate amount of ascites, findings consistent with liver cirrhosis. No abnormal findings suggestive of traumatic injury, e.g., liver or kidney laceration, were detected. Computed tomography (CT) of the abdomen without the administration of contrast material showed that the CT value of the ascites was low, a finding consistent with non-bloody fluid (Figure 1A). Admission was recommended but declined by the patient.

On the next day, she presented again to our hospital because of general fatigue and dizziness, along with long-lasting abdominal pain. She was oriented but lethargic. The body temperature

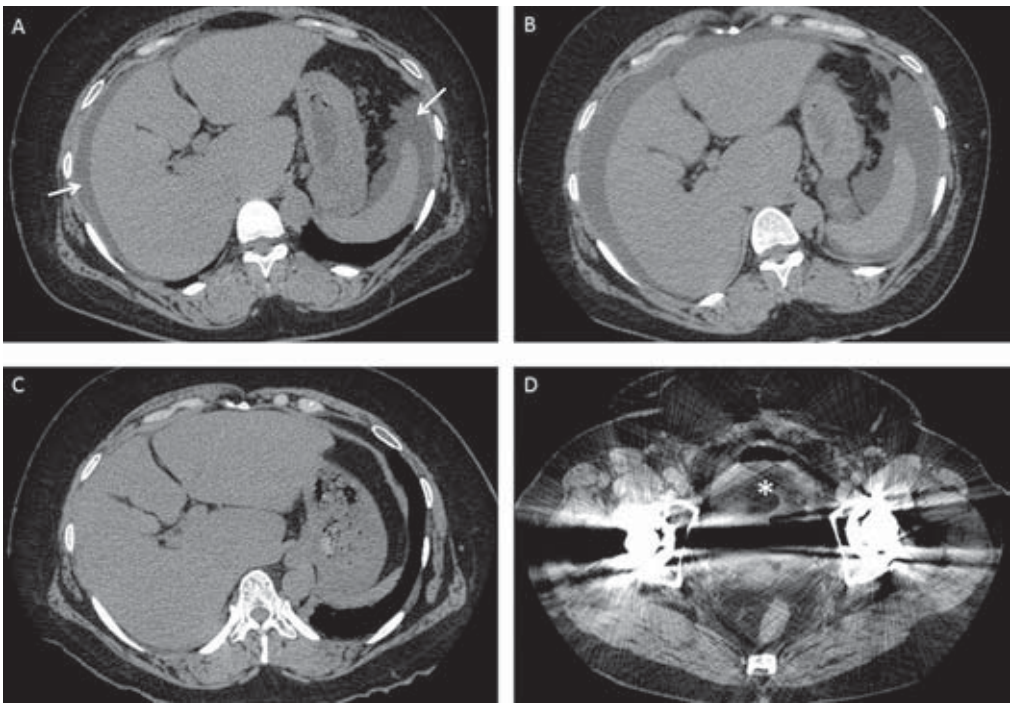

Figure 1 CT of the abdomen

An image without contrast material shows a moderate amount of ascites around the liver and spleen (A, arrows). On the next day, the ascites with a low CT value increases in volume (B). After insertion of a urinary catheter, almost no ascites is seen (C). Note that the bladder (D, asterisk) is difficult to assess due not only to its hollow structure but also to artifacts of the bilateral artificial hip joint.

was 38.2℃, the blood pressure was 126/92mmHg, the pulse was 102 beats per minute, and the oxygen saturation was 92% in ambient air. The physical examination was unchanged from the previous examination. An electrocardiogram showed no ST-segment changes and chest radiograph was unremarkable. The liver function remained unchanged but the renal function deteriorated with a urea nitrogen of 35mg/dl and a creatinine of 3.79mg/dl (Table). The electrolytes and complete blood cell count were normal. Urinalysis revealed clear, with 3+ occult blood, 3+ protein, 2+ glucose, 2+ white blood cell, a specific gravity of 1.009, and a pH of 8.0. Images of ultrasonography and CT showed an increase in ascites (Figure 1B), but otherwise no difference from the previous findings. A presumed diagnosis of acute kidney injury was made, and fluid hydration and antibiotic treatment with ceftriaxone were intravenously administered. Also, a urinary catheter was inserted and ascites puncture was performed. Unexpectedly, a urine volume of 4500ml was drained for 1.5 hours. Ascites analysis revealed cloudy red, with a white cell count of 725/μl (50% histiocytes, 45% neutrophils, and 5% lymphocytes), a protein of 0.4g/dl, a glucose of 156mg/dl, a lactate dehydrogenase of 125U/l, a specific gravity of 1.009, and a pH of 7.3. Of note, levels of urea nitrogen and creatinine in the ascites obtained by puncture were elevated up to 66mg/dl and 14.8 mg/dl, respectively. Given that CT images almost showed disappearance of the ascites after the drainage (Figure 1C), the patient was diagnosed with traumatic bladder rupture, although cystography was not performed due to the concerns of inflammatory deterioration. In the retrospective review of the CT images, lower abdominal organs including the bladder were difficult to assess due to artifacts of bilateral artificial hip joint (Figure 1D).

Conservative treatment with antibiotics was continued because the symptoms improved after the insertion of the balloon catheter, with stable vital signs. The levels of urea nitrogen and creatinine were normalized the next day after

Table Laboratory Data

Variable	Reference Range	One day before admission	On admission	Day 2
White-cell count (/μl)	4,000-9,000	7,500	7,100	6,300
Hemoglobin (g/dl)	11.5-16.5	12.7	14.2	12.8
Platelet count (/μl)	150,000-420,000	178,000	203,000	173,000
Bilirubin (mg/dl)				
Total	≤1.2	0.6	1.1	1.1
Direct	≤0.3	0.2	0.3	0.3
Aspartate aminotransferase (U/l)	≤30	43	32	23
Alanine aminotransferase (U/l)	≤30	47	45	30
Lactate dehydrogenase (U/l)	110-120	359	402	294
Total protein (g/dl)	6.7-8.8	6.4	7.7	6.0
Albumin (g/dl)	≥4.0	3.9	4.5	3.5
Sodium (mEq/l)	135-147	137	134	145
Potassium (mEq/l)	3.6-5.0	4.1	4.1	3.6
Chloride (mEq/l)	100-110	99	92	107
Urea nitrogen (mg/dl)	8-20	20	35	13
Creatinine (mg/dl)	0.45-0.81	1.76	3.79	0.75
Amylase (U/l)	37-125	55	83	81
Creatine kinase (U/l)	≤175	375	428	358
C-reactive protein (mg/dl)	≤0.25	0.52	5.19	11.64
Glucose (mg/dl)	70-109	145	166	146

admission (Table). Cultures of the ascites were later found to be sterile and the adenosine deaminase level was 3.7U/l (reference value, 5 to 18). The balloon catheter was removed eight days after admission because cystography showed no evidence of contrast leakage or findings suggestive of neurogenic bladder, such as a pine tree shape (Figure 2). The patient was discharged in good condition 15 days after admission.

Discussion

CT has been playing a pivotal role in the evaluation of patients after abdominal trauma, but attention should be paid because the diagnostic accuracy of CT for the detection of traumatic injury is not as good in hollow organs as in solid organs[2, 3]. Furthermore, in the current case, CT artifacts in the lower pelvis due to the bilateral artificial hip joint is likely to make the diagnosis difficult to establish. The coexistence of liver cirrhosis may be considered as another factor causing the delayed diagnosis because ascites is commonly found and spontaneous bacterial peritonitis can develop[4] although the albumin level was not low in our case. Instead, the diagnosis of an isolated bladder rupture was based on supportive findings including the ascites analysis and ascites disappearance after the urinary catheter insertion. The diagnosis may also be supported by the transient renal impairment because ascites associated with bladder rupture can lead to transiently increased serum levels of urea nitrogen and creatinine due to absorption of the ascites through the peritoneum.

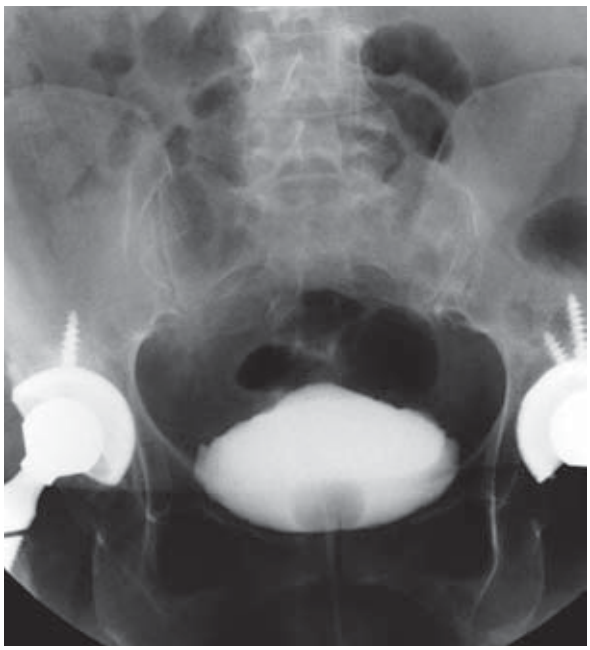

Figure 2 Cystography

Cystography, performed eight days after admission, showed no evidence of contrast leakage. No findings suggestive of neurogenic bladder, such as a pine tree shape, are present.

It is worth noting that isolated free fluid without solid organ injury as assessed by CT is a clinical dilemma in the management of patients with blunt abdominal trauma[2, 5], as seen in our case. In a retrospective study of 121 consecutive patients after blunt trauma of the abdomen, seven patients (6%) had isolated free fluid with no CT findings suggestive of solid or hollow organ injuries[5]. Of all the seven patients, three underwent operative intervention and one of which was found to have a bladder rupture.

Bladder trauma that could cause a rupture can be categorized as blunt, penetrating, or iatrogenic[1]. It is noted that bladder rupture may be followed by blunt injuries when the bladder is distended with urine. Penetrating or iatrogenic mechanisms can develop regardless of the conditions of the bladder. In our case, blunt trauma is the most likely cause of the rupture of the bladder, although it remains unclear whether the bladder was distended when our patient had the trauma. The incidence of bladder injuries in patients with blunt abdominal trauma is reported to be 1.6%, of which approximately 80% of the patients had pelvic fracture[6]. In our case, no evidence of pelvic fractures was detected.

Bladder injuries are categorized as intraperitoneal bladder rupture (almost 40%), extraperitoneal bladder ruptures (around 55%), and bladder contusions; combined intraperitoneal and extraperitoneal bladder ruptures are present

in 5% to 8% of all bladder ruptures[1]. The symptoms of bladder rupture include suprapubic tenderness and discomfort, an inability to void, hematuria, ileus, absent bowel sounds, abdominal distension, and urinary ascites. A diagnosis of bladder rupture is commonly made based on abnormal CT cystogram[7,8], which was not applied in our case. It is important to recognize, however, that bladder injuries may be missed even on CT cystogram because of the low-pressure and large-compliance storage system of the bladder[7,8].

Observation or catheter drainage alone seems acceptable strategies in patients only with bladder contusions, but otherwise interventions, such as surgical repair or laparoscopic repair, are likely to be the standard of care[9,10]. In the present case, conservative treatment including catheter drainage and intravenous antibiotics was continued without complications. Our case may indicate that conservative therapy may be an alternative treatment option in some patients with an isolated rupture of the bladder.

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診断が困難であった外傷性膀胱破裂の 1 例

竹村圭祐，川崎達也，安田孝志，三上貴子，小谷知也，世古口悟，堀田俊介*，
竹下宏樹**，石井博道**，小山田裕一

松下記念病院　総合診療科
*松下記念病院　泌尿器科
**松下記念病院　外科

要旨：コンピュータ断層撮影（computed tomography, CT）は外傷性腹部損傷の検出に重要な役割を果たすが，管腔臓器における診断精度は実質臓器ほど良好でないことが知られている．今回，CTでは診断が困難であった鈍的腹部外傷後の膀胱破裂の 1 例を経験したので報告する．症例はアルコール性肝硬変の既往がある 54 歳の女性で，自宅で転倒後に腹痛が出現したため当院の救急外来を受診した．CT検査では実質臓器の損傷を示唆する所見はなかったが，腹腔内に非血性の腹水が貯溜していた．尿道カテーテルを挿入後，1.5 時間で 4500 mlの排液を認め，腹水はほぼ消失した．腹腔穿刺による腹水検査では尿素窒素が 66 mg/dl，クレアチニンが 14.8 mg/dlであった．膀胱造影は未施行であるが，最終的に外傷性の膀胱破裂と診断した．CTの再読影では，膀胱はその管腔構造に加えて両側の人工股関節置換によるアーチファクトのため評価が困難であったが，抗生物質の投与を含む保存的治療で治癒した．

キーワード：外傷，コンピュータ断層撮影，破裂，腹水，膀胱