Subcapsular Hematoma of Kidney with Rupture into the Perirenal Space After Extracorporeal Shock Wave Lithotripsy: A Case Report

LIANG-CHUNG HUANG, MENG-CHIA CHEN, CHE-WEI HSU

Complications after extracorporeal shock wave lithotripsy (ESWL) are usually mild. Severe complications, such as renal hematoma are uncommon. We report a case of kidney subcapsular hematoma and a rupture into the perirenal space after extracorporeal shock wave lithotripsy (ESWL). The patient received a transfusion due to decreased hemoglobin levels and an increased heart rate. He was discharged 5 days after admission and in a stable condition. The risk factor of hemorrhaging includes hypertension, diabetes mellitus (DM), obesity, shock wave number, coagulopathy and increasing age. Management is always conservative. The emergency physician should be alert about high risk patients and arrange further investigations.

Key words: extracorporeal shock wave lithotripsy (ESWL), complications, subcapsular hematoma

Introduction

Extracorporeal shock wave lithotripsy (ESWL) was first described clinically in 1980 by Chaussy et al. It is now a widely accepted modality for the treatment of renal and proximal ureteral stones. The complications of ESWL are thought to be due to the compressive and tensile force of shock waves directed at soft tissue, and the cavitation effect on individual cell integrity. The majority of complications are related to the passage of stone fragments, including flank pain, hematuria and ureteral obstruction. We present an uncommon complication of renal and perirenal hematoma induced by ESWL.

Case Report

A 58 y/o male came to our emergency department at night with a chief complaint of right flank pain. He received extracorporeal shock wave lithotripsy (ESWL) this afternoon for his right renal stone (1.2 x 0.8 cm). The lithotriptor is a Dornier Compact Delta. Lithotriptor, shock waves 3000, and the kilovolts (kV) value was not recorded. In the evening he suffered from severe right flank pain. Nausea, cold sweats were also noted. He denied chest pain, dyspnea, abdominal pain, and had no difficulty in urinating. A review of his medical history showed that he had uncontrolled diabetes mellitus, hyperlipidemia and hypertension. He suffered from a right ureter stone and had received extracorporeal shock wave lithotripsy (ESWL) several times in the past few years. No anticoagulant was used.

At presentation, his vital signs were as follows: 182/98 mmHg, 98 beats/min and respiratory rate: 18 breaths/min. no fever was noted. The physical examination revealed clear breathing sounds, and no heart murmur. The abdomen was soft with-
out peritoneal signs. No bruising over skin was apparent. Right flank knocking pain was obvious.

The laboratory data showed a hemoglobin (Hb) level of 13.7 g/dl, Bun: 17 mg/dl, Cr: 1.5 mg/dl, hematuria was noted. Due to his severe right flank pain, pethidine 50mg was given. But the pain only subsided a little. Abdominal and pelvis computed tomography (CT) was arranged. The image revealed a right kidney sub-capsular hematoma with a rupture to the perirenal space (Fig. 1). The patient was admitted. During the 2nd day, a follow up Hb level was 11.3 g/dl. Because of the decrease of Hb (13.7→11.3), and the increase in heart rate after admission (from 80/min to 96/min), two units of blood were transfused. The heart rate was gradually decreased, and the pain was relieved over the following days. The patient was discharged on the 5th day of admission and was symptom free and in a stable condition.

**Discussion**

Extracorporeal shock wave lithotripsy (ESWL) is a widely used, less-invasive method for the treatment of kidney and proximal ureter stones. The overall incidence of ESWL-related acute complications was estimated to be 3-7%\(^{(1-3)}\). These complications include infection, urinary tract obstruction, arrhythmia, small bowel and colon perforation, ureterocolic fistula formation, GI anastomosis dehiscence, cecal ulcers, colon erythema, bruising, bleeding from the rectum, pancreatitis, abscess formation, liver, kidney and spleen subcapsular hematomas, peripancreatic hematomas and ileus. The most severe acute complication reported was internal organ hemorrhage\(^{(4,5)}\). The kidney is the

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**Fig. 1** Non-contrast CT of abdomen and pelvis showed subcapsular hematoma with hyperdense appearance (short arrow) around right kidney and rupture into peri-renal space (long arrow)
most common organ to hemorrhage. The occurrence of sub-clinical hematomas of the kidney were estimated to be 15-30% if evaluated by routine CT or MRI scan\(^{(6,7)}\). Clinically significant hemorrhaging was less than 1\(^{%(8)}\). The incidence of subcapsular hematomas of the kidney in Taiwan is 0.068%, and is compatible with previous reports in other countries\(^{(9)}\).

The predisposing factors of hemorrhages include: hypertension, diabetes mellitus, obesity, increased patient age, coagulopathy, use of anticoagulants and increased shock wave number.

One report showed that the number of stones and being older than 50 are also risk factors\(^{(9)}\). In our case, our patient has hypertension, diabetes mellitus and is over 50.

Histopathologically, thin walled arcuate veins in the corticomedullary junction are especially vulnerable to shock waves\(^{(10)}\). It is also thought that hypertension can cause atherosclerosis of the renal vessel and make it more vulnerable. One study showed that hypertension can increase the incidence of renal hematoma to 2.7%, compared with an overall incidence 0.54\(^{%(11)}\).

The symptoms and signs of renal hematoma are severe flank pain, cold sweating, hematuria and even hypovolemic shock signs, including palpitation, syncope, orthostatic hypertension and a decrease in hemoglobin. The hematuria generally settled within 2-3 hours after ESWL. Persistent hematuria (>24 hours) and flank pain unrelieved by analgesics warrant further investigation.

The management of renal hematoma is usually conservative, includes pain control, fluid resuscitation, a follow up Hb test and vital signs, but surgical treatment or embolization were also reported\(^{(12-15)}\). Kaude JV performed IVU, isotopic renogram, and MRI before and soon after ESWL and concluded that this caused a similar or even identical renal contusion as an external trauma, resulting in interstitial edema, urine extravasation, and parenchymal bleeding in up to 63% of cases\(^{(16)}\).

Therefore post-ESWL renal injury may be seen as a blunt renal trauma. The American Association for the Surgery of Trauma (AAST) has created a renal organ injury scale (Table 1) that correlates with patient outcomes, thus serving as a guide for appropriate and selective management. This renal injury scale has been prospectively validated and found to correlate directly with the need for surgical intervention.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Contusion Hematoma Microscopic or gross hematuria; urologic studies normal</td>
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<tr>
<td>II</td>
<td>Hematoma Subcapsular, nonexpanding without parenchymal laceration</td>
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<tr>
<td></td>
<td>Laceration Nonexpanding perirenal hematoma confined to renal retroperitoneum</td>
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<tr>
<td></td>
<td>&lt;1.0 cm parenchymal depth of renal cortex without urinary extravasation</td>
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<tr>
<td>III</td>
<td>Laceration &gt;1.0 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration Vascular Parenchymal laceration extending through the renal cortex, medulla, and collecting system</td>
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<tr>
<td>V</td>
<td>Laceration Vascular Main renal artery or vein injury with contained hemorrhage</td>
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<tr>
<td></td>
<td>Completely shattered kidney</td>
</tr>
<tr>
<td></td>
<td>Avulsion of renal hilum which devascularizes kidney</td>
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Advance one grade for bilateral injuries up to grade III

Accessible online at http://www.aast.org/library/traumatools/injury scoringscales.aspx#kidney
Subcapsular hematoma and perirenal hematoma are grade I and II respectively. All Grade 1 and 2 renal injuries can be managed non-operatively. The kidney and the adipose capsule are enclosed in a sheath of fibrous tissue called the Gerota’s fascia, which is continuous with the subperitoneal fascia. Gerota’s fascia is dense, collagenous, and elastic connective tissue, and constitutes the outer limit of the perirenal space. Active bleeding may stop on its own when tamponade develops within Gerota’s fascia. However, when Gerota’s fascia has been violated, tamponade will not occur, and the hematoma will extend to the pararenal space. Chih-Yuan Fu et al. suggest that the discontinuity of Gerota’s fascia and the expansion of pararenal hematoma seemed to be associated with the need for angioembolization.

The absolute surgical indication is persistent, life threatening hemorrhaging related to the kidney, renal pedicle avulsion (grade 5), and expanding, pulsatile, or uncontained retroperitoneal hematomas. Relative indications for renal exploration include incomplete staging, devitalized renal parenchyma, vascular injury, and urinary extravasation. These situations are rare in post ESWL renal injury. A consultation with the urologist is needed when a large hematoma or unstable hemodynamic status is noted.

The most important late complication of a nonoperative approach is the Page kidney. The term “Page kidney” refers to the occurrence of hypertension secondary to renal compression usually associated with a perirenal or subcapsular hematoma. This phenomenon was first described by Page in 1939. The underlying pathophysiology is thought to result from renal ischemia and hypoperfusion, which consequently activates the renin-angiotensin-aldosterone system.

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\text{trauma \rightarrow perirenal hemorrhage \rightarrow fibrosis \rightarrow compression of renal parenchyma \rightarrow increased interstitial pressure \rightarrow decreased renal perfusion \rightarrow renin release \rightarrow generation of angiotensin II \rightarrow hypertension.}
\]
The discovery of hypertension varied from 24hr to 12 years but generally was less than 1 year.

The incidence of post-traumatic hypertension is affected by the severity of renal trauma and the prevalence of preexisting essential hypertension, which itself is affected by the age, sex, and race of the population. Monstrey and colleagues retrospectively reviewed 435 kidney trauma patients and performed literature analysis of another 223 cases of post-traumatic hypertension. The report concluded that renal trauma could not be linked to an increased incidence of hypertension.

At present, there are no definitive guidelines for the management of Page kidney. Previously, the management focused on surgical intervention. However, nowadays, conservative management is the usual recommended first-line treatment in such cases. With improvements in the range of oral antihypertensives, conservative treatment is more efficient and can provide a good quality of life for the patient. In the event of persistent hypertension that is not responsive to treatment, surgical decompression might be required. There are two main aims of treatment: to decompress the subcapsular hematoma and to remove the fibrocollagenous shell. Héctor Pastor Navarro et al. reviewed the 7 cases of severe hematoma which occurred in the 4,815 extracorporeal shock-wave lithotripsy procedures performed at their department in the 1992-2007 period. They opted for delayed drainage in 4 out of 7 patients, and patients undergoing drainage had a very good course, required less controls, and retained normal kidney function. They suggest that once the immediate acute condition has been resolved and patient and hematoma size are stable, the hematoma should be evacuated as a delayed emergency procedure 8-15 days after its occurrence, when
active bleeding will have stopped and fibrosis has not yet occurred.

Other complications including perinephric abscess, urinoma, extravasation of urine, arteriovenous fistula, and pseudoaneurysm were also reported in blunt renal trauma (24).

Long-term prognosis is always good without adverse effects on blood pressure or renal function (25). Patients with solitary or received bilateral ESWL should be closely followed for blood pressure and renal function.

**Conclusion**

When patients present with severe symptoms and signs after ESWL, especially those with risk factors. The physician should keep in mind the possibility of internal organ bleeding. Image studies such as abdominal echo and CT should be arranged. Sufficient pain control and fluid resuscitation, including blood transfusion should be initiated. An operation is necessary if hemodynamic instability is noted. Long-term follow-up of renal function and blood pressure is also needed.

**References**

體外震波碎石術後併發腎臟包膜下及周邊血腫：
一個病例報告

黃亮中 陳孟佳 許哲偉

體外震波碎石(ESWL)術後產生的併發症通常都很輕微，嚴重的併發症，如腎臟血腫，並不常見。我們報告一病例：58歲男子接受體外震波碎石(ESWL)後，併發腎臟包膜下血腫並破入腎臟周邊。病人因血紅素下降而有輸血，住院五天後病情穩定出院。術後併發出血的危險因子包括：高血壓，糖尿病，肥胖，震波次數，凝血功能異常及年紀較大者。治療通常為保守性治療。急診醫師面對有高危險因子的病患，應保持警覺並安排進一步的檢查。

關鍵詞：體外震波碎石術(ESWL)，併發症，包膜下血腫

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