J Forensic Sci, March 2008, Vol. 53, No. 2
doi: 10.1111/j.1556-4029.2008.00658.x
Available online at: www.blackwell-synergy.com

CASE REPORT

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A Death Due to Perirenal Hematoma Complicating Extracorporeal Shockwave Lithotripsy

ABSTRACT: Perirenal hematoma is an occasional complication of extracorporeal shockwave lithotripsy (ESWL) which does not usually require treatment. A 79-year-old woman died 23 h after ESWL. Forensic autopsy was performed to determine whether medical treatment contributed to her death. The cause of death was hemorrhagic shock due to massive hematoma from a ruptured small vein in the perirenal adipose capsule. No injury to other organs was found and the patient had neither coagulation abnormality nor venous disease. Perirenal hematoma can easily be diagnosed with abdominal sonography, if pain or symptoms of anemia develop. Doctors must be aware of the possibilities of severe renal hematomas after ESWL.

KEYWORDS: forensic science, extracorporeal shockwave lithotripsy, perirenal hematoma, fatal case, autopsy

Extracorporeal shockwave lithotripsy (ESWL) is a widely used treatment for renal or ureteral stones. This treatment is considered safe. In a series of 12,901 consecutive patients treated with ESWL, only 64 had intrarenal or perirenal hematomas (*c.* 0.5%) and no deaths occurred (1). There have been several reports of serious complications, such as severe renal hematoma, renal laceration, rupture of the renal pelvis, and soft tissue trauma (2,3). Another study reported 10 renal hematomas (0.078%) in 12,800 patients treated with ESWL (4). Six cases were mild and resolved spontaneously; however, four cases were severe, one of which required nephrectomy and led to the patient's death from disseminated intravascular coagulation. We present a fatal case of hemorrhage in the perirenal adipose capsule following ESWL.

Case Report

A 79-year-old woman consulted a physician with complaints of hematuria. Abdominal sonography revealed bilateral nephrolithiasis. She then consulted a urologist, who diagnosed three stones in the dilated left renal pelvis and one stone in the left ureter at the L4 level (Fig. 1).

The patient had successfully undergone ESWL for right-sided nephrolithiasis 11 years earlier. Prior to ESWL no haemostatic disorders (platelet number: 292,000/μL, bleeding time: 3.0 min, prothrombin time: 11.4 sec, activated partial thromboplastin time: 26.6 sec) or a urinary infection was revealed by laboratory examinations, although hypertension was present as a risk factor for renal hematoma. Anticoagulants or platelet coagulation inhibitors had not been prescribed. The ESWL of the left lower ureteral stone was performed with a Dornier Compact lithotriptor (U-50, Wessling, Germany) using an electromagnetic energy source, with 2500 shockwaves at a rate of 70/min and an intensity of 35% of maximum from the back, under intravenous sedation and analgesia. Then, 2000 shockwaves were delivered to the left renal pelvis at a rate of 70/min and an intensity of 35% of the maximum. The maximal intensity of this type of lithotriptor is 80% according to the manufacturer's guidelines. During and shortly after ESWL, the patient had a stable blood pressure and reported no pain. She was returned to her room 2 h after ESWL without any complications.

Six hours after the ESWL, she complained of left-sided back pain and nausea. Abdominal sonography revealed a left perirenal hemorrhage. A decrease in the hemoglobin concentration from 13.7 g/dL (preoperative) to 10.1 g/dL also indicated hemorrhage. Two units of blood (400 mL) was ordered from the blood bank. Blood transfusion was started 8.5 h after the end of ESWL, but the patient showed no improvement. A total of 11 units of blood (2200 mL) and four units of fresh frozen plasma (320 mL) were infused over 14 h before the patient died of hemorrhagic shock 23 h after the end of ESWL.

Forensic autopsy was performed as part of an evaluation of the medical practice in our department. The deceased was 143.0 cm tall and weighed 57.7 kg with moderate obesity. An area of green-purple discoloration 1.0 × 1.5 cm in size was present on the left side of the lower back and was likely caused by the ESWL procedure. There was mild bleeding without fracture in the subcutaneous fat and intercostal muscle at the level of 10th to 12th ribs. The swollen left renal adipose capsule contained a hematoma weighing 268 g (Fig. 2*a*). There was also a large retroperitoneal hematoma derived from the left perirenal hematoma without any other organ injury. Injection of yellow poster paint into the left renal artery resulted in no leakage. Following injection of a green poster paint into the left renal vein, leakage of a small amount of green liquid was observed in the renal adipose capsule, but we could not identify the responsible vein or the renal body macroscopically (Fig. 2*b*). There were yellow-white calculi smaller than 0.5 × 0.3 × 0.3 cm: five in the left ureter, and one in the renal

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Received 21 April 2007; and in revised form 12 Aug. 2007; accepted 18 Aug. 2007.

FIG. 1—*Pelvic X-ray film with urinary tract contrast medium before ESWL. There are three stones in the left renal pelvis (arrows).*

pelvis. Heart weight was 333 g and there was slight atherosclerosis in the right coronary artery. Both lungs were severely edematous (left lung weight: 654 g, right lung weight: 633 g). There were no other abnormalities in other organs, such as the spleen (weight: 77 g), except for severe anemia in the major organs. Microscopic examination revealed enlarged blood vessels in the left renal capsule, but there was no apparent injury due to ESWL, degeneration, or malformation in the perirenal vessels (Fig. 2*c*). Additionally, there was no evidence of disease or degeneration of vessels, such as atherosclerosis. Renal or ureteral hemorrhage was not observed on both macroscopic and microscopic examination.

There was no evidence of petechia in the skin or gastrointestinal hemorrhage, another tendency of hemorrhage, which suggested she did not develop disseminated intravascular coagulation (DIC). Thus, the cause of death was judged to be hemorrhagic shock due to the rupture of small veins of the left renal adipose capsule.

Discussion

To our knowledge, this is the first autopsy case of hemorrhagic death following ESWL. By infusion of dye solution into the renal artery and vein, we determined that the hemorrhage was derived from damage to the small perirenal adipose veins. This method is useful when vessel injury is suspected but identification of the injured vessels is expected to be difficult. We demonstrate the leakage of colored fluid as evidence for vessel injury without causing artificial injury by autopsy.

In cases of hematoma following ESWL, there were underlying abnormalities such as coagulation disorders, antiplatelet therapy, and inherited connective-tissue diseases (5–7), which are risk

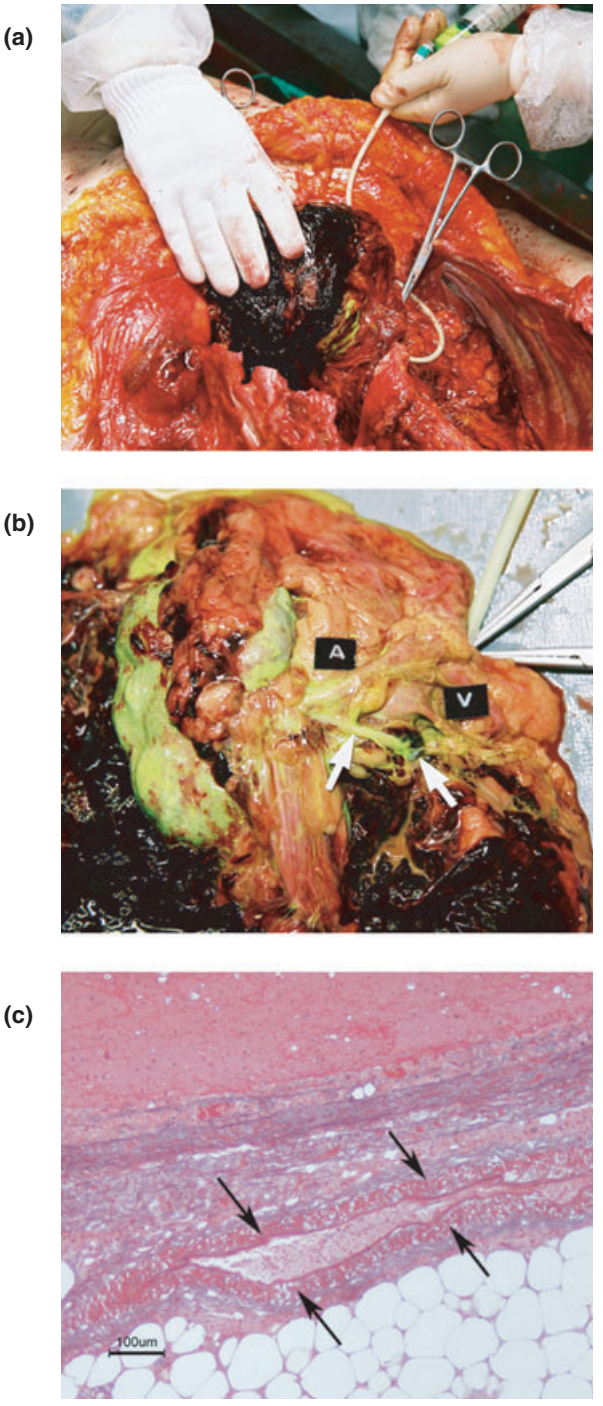

FIG. 2—*(a) The left renal adipose capsule was markedly swollen and contained a massive hematoma weighing 268 g. Green poster paint was injected into the left renal vein. (b) The leakage of a small amount of green poster paint was observed in renal adipose capsule (arrows, A: left renal artery, V: left renal vein). (c) Microscopic examination revealed the enlarged blood vessels in the left renal capsule (arrows) (Elastica-Masson staining). Above is hematoma; below is adipose tissue.*

factors. In the present case there were no hemostatic disorders, prescription of anticoagulants, or platelet coagulation inhibitors. When deciding whether to perform ESWL, we must determine whether such abnormalities are present. Most patients recover from intrarenal or perirenal hematoma, without blood infusion or a surgical operation. We could not clarify the reason hemorrhage from

perirenal tissue had not stopped spontaneously, but we speculate hypertension caused the vulnerability or calcification of blood vessels in perirenal tissue.

In animal (dog or pig) studies, nephron injury was found in all kidneys after ESWL, and the severity of nephron injury increases with the frequency of ESWL (8) and the kidney size (9). In our patient, the frequency of ESWL was determined according to the manufacturer's guidelines and was considered to be standard, whereas the kidney was of normal size (weight 83 g).

As in most cases of hemorrhagic death following a medical procedure, the management of blood pressure and hemoglobin concentration are the most important factors. Perirenal hematoma can be easily diagnosed with abdominal sonography, if pain or symptoms of anemia develop. Additionally, care must be taken to avoid delays in the ordering, preparation, and commencement of blood transfusion. We could not determine why the patient's physicians did not perform surgical treatment, including nephrectomy to save her life. In Japan there have been no previous cases of death due to perirenal hematoma after ESWL. Her physicians likely believed that the perirenal hematoma could be treated conservatively.

To determine the cause of such accidents and to prevent future accidents, all similar cases should be reported. Unfortunately, we could not determine why there was such severe and rapid development of hemorrhage without overt injury of visible vessels. On the other hand, in Japan, physicians who report such iatrogenic deaths to the police according to the Medical Act may be prosecuted (10), and most physicians believe that informed consent exempts them from reporting iatrogenic deaths (11).

In conclusion, a perirenal hematoma is an occasional complication of ESWL, but deaths are rare. This is the first autopsy case of hemorrhagic death following ESWL. Doctors must take care to avoid delays in the ordering, preparation, and commencement of blood transfusion.

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