

Abdominal aortic rupture after extracorporeal shockwave lithotripsy: A rare case report and literature review

Journal of International Medical Research

48(6) 1–5

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DOI: 10.1177/0300060520931608

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Xin Wang*, Bowen Zhang*, Yunfeng Zhu and Hongwei Ge 

Abstract

Extracorporeal shockwave lithotripsy (ESWL) is a common and effective treatment method for most renal and upper ureteral calculi. Aortic rupture after ESWL is an extremely rare complication. Seven cases of aortic rupture have been reported to date, and only one case involved the rupture of a calcified abdominal aorta. We herein describe a Chinese patient who was hospitalized for rupture of the abdominal aorta 5 days after ESWL for right ureteral calculi. The patient was transferred to the Department of Vascular Surgery and underwent emergency endovascular aortic repair. The patient's recovery was unremarkable. One week after the operation, enhanced computed tomography showed that the size of the hematoma around the periaortic area was constant, and repeat enhanced computed tomography 1 month later showed that the hematoma had been significantly absorbed. ESWL may cause rupture of a heavily calcified abdominal aorta. We suggest that all patients with atherosclerosis being considered for ESWL should be evaluated by imaging examinations both preoperatively and during follow-up.

Keywords

Aortic rupture, extracorporeal shockwave lithotripsy, endovascular aortic repair, calcified abdominal aorta, calculi, computed tomography

Date received: 17 December 2019; accepted: 13 May 2020

*These authors contributed equally to this work and should be considered co-first authors.

Corresponding author:

Hongwei Ge, Department of Vascular Surgery, The Third Affiliated Hospital of Soochow University, 185 Juqian Street, Changzhou, Jiangsu 213000, China.

Email: ghw7575@163.com

Department of Vascular Surgery, The Third Affiliated Hospital of Soochow University, Changzhou, China



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Introduction

Extracorporeal shockwave lithotripsy (ESWL) is a common and effective method to treat most renal and upper ureteral calculi. With the wide availability of this technique, some complications involving the kidneys and surrounding tissues are being increasingly recognized. We herein report a Chinese patient who was admitted with a ruptured abdominal aorta 5 days after ESWL for treatment of right ureteral calculi.

Case report

A 77-year-old man with right renal calculi measuring 1.0×0.8 cm underwent primary ESWL with satisfactory efficacy. Follow-up renal ultrasound showed no remaining calculi. Although he felt pain in the abdomen at the time of ESWL, he paid little attention to it. Five days later, his abdominal pain had worsened and he was admitted to the emergency department. Physical examination showed significant tenderness of the abdomen and high blood pressure of 176/105 mmHg. Enhanced computed tomography (CT) revealed a contained rupture of the abdominal aorta with a retroperitoneal hematoma (33×25 mm) around the periaortic area. More remarkably, a disruptive calcified plaque was found at the level between the third and fourth lumbar vertebrae (Figure 1). The patient reported that his medical history included smoking, hypertension, and diabetes. Liver function, renal function, lipid and blood parameters, and other routine laboratory examination findings were within the reference range.

Preoperative CT angiography demonstrated normal morphology of the abdominal aorta, renal artery, and superior mesenteric artery. Based on the patient's history and CT results, we suspected rupture of the abdominal aorta after ESWL. We identified the contained rupture, which

was essentially a pseudoaneurysm of the abdominal aorta. The size of the hematoma was 33×25 mm (Figure 2(a)). Considering the risk of mortality associated with a ruptured abdominal aorta, we performed endovascular aortic repair. Preoperative preparation included strict bed rest and control of the blood pressure to less than 130/80 mmHg. The surgery was performed in the digital subtraction angiography room under general anesthesia. Open femoral exposure was performed, and a pigtail catheter was inserted to the aorta. Aortic angiography showed the location of the aortic lesions. However, no extravasation of contrast agent was found in the abdominal aorta, possibly because of a minor intimal tear.

Through the right common femoral artery, a 26-26-80-mm Ankura stent graft (Lifetech Scientific Ltd., Shenzhen, China) was placed with its proximal end immediately below the renal arteries. The stent graft was deployed successfully, and the abdominal aortic area between the third and fourth lumbar vertebrae was completely covered (Figure 2(b)). The patient had an uneventful recovery with effective blood pressure control and infection prevention measures during postoperative follow-up. One week after the operation, enhanced CT revealed that the size of the hematoma around the periaortic area had remained constant, and repeat enhanced CT 1 month later showed that the hematoma had been significantly absorbed (Figure 3).

The patient was treated at our hospital from March 2012 to May 2016. During follow-up, he remained asymptomatic until he died of myocardial infarction at the age of 81 years.

Discussion

ESWL has become the treatment of choice for nonsurgical management of most renal and upper ureteral calculi, especially for

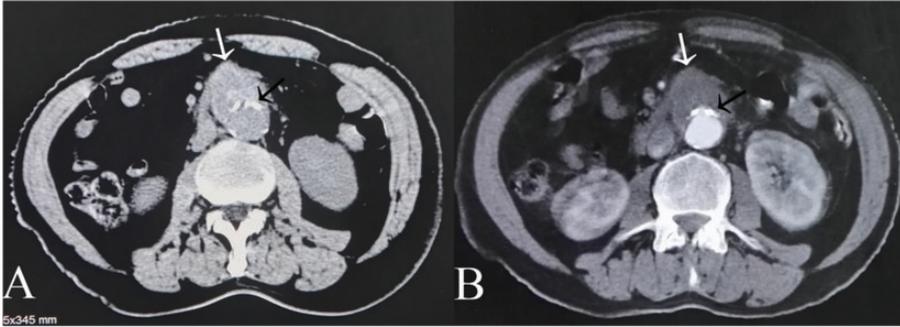


Figure 1. Preoperative computed tomography revealed a disruptive calcified plaque (black arrows) and a retroperitoneal hematoma (33 × 25 mm) (white arrows). (a) Computed tomography scan. (b) Enhanced computed tomography scan.

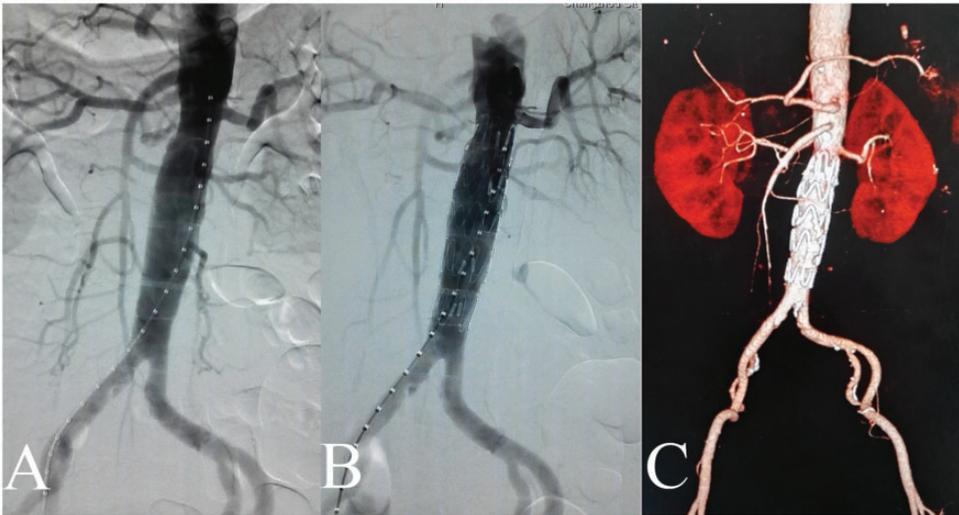


Figure 2. Endovascular aortic repair was performed. (a) Preoperative angiography showed no extravasation of contrast agent. (b) Postoperative angiography. (c) Postoperative three-dimensional computed tomography reconstruction.

stones of <math><2\text{ cm}</math>. ¹ ESWL generates an external high-energy shockwave that causes stone fragmentation, but the surrounding tissue is also subjected to this energy. Reported adverse effects associated with ESWL include renal rupture and subcapsular hematoma, hepatic parenchyma damage, iliac vein thrombosis, and abdominal aortic aneurysm rupture. ^{2,3} After an

extensive search, we found only seven published cases of aortic rupture associated with ESWL to date, and only one of these cases involved rupture of a calcified abdominal aorta. ⁴

In the present case, the examinations before ESWL did not reveal the abdominal aortic rupture; we presume that injury of the normal calcified abdominal aorta had

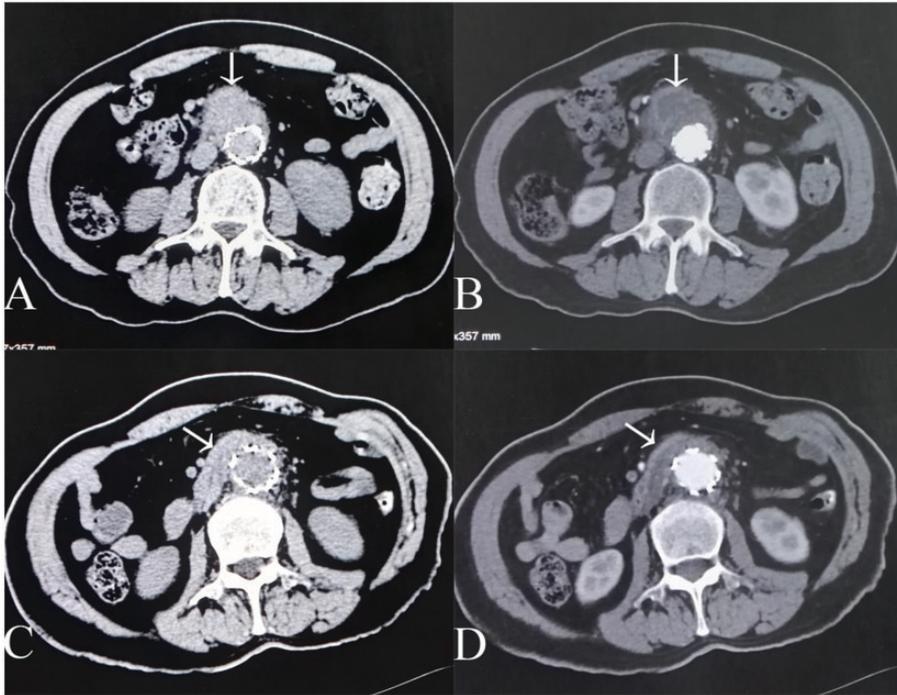


Figure 3. Postoperative computed tomography. (a, b) One week. (c, d) One month.

occurred at the time of ESWL. During ESWL, the high-energy shockwave targets the renal calculi and also acts on the arterial calcific plaque as an acoustic interface. The cumulative shockwave effect can cause fragmentation of calcified plaques. Venous and cellular injuries have also been identified in animals, and human studies suggest that abdominal arterial injury can occur when exposed to shockwaves.^{5,6} These factors in combination with hypertension ultimately result in abdominal aortic rupture.

Among all of these factors, fragmentation of calcified plaques by ESWL likely plays a critical role. However, arterial calcific plaques are associated with atherosclerosis. With the changes in the Chinese lifestyle and diet, the incidence of atherosclerosis has shown an upward trend. Because of the potential risk of aortic rupture, CT should be part of the investigation

of patients with atherosclerosis, and a vascular surgeon should be available in an emergency when CT reveals heavily calcific plaques of the abdominal aorta before ESWL.

In previous reports, abdominal aortic rupture occurred hours to even months after ESWL,⁴ suggesting that long-term follow-up under careful monitoring is mandatory in all patients with a calcified abdominal aorta. Any onset of new pain or symptoms during the procedure in patients with comorbid factors such as a calcified aorta requires further investigation.

Conclusion

ESWL may cause an abdominal aortic rupture, especially for patients with a heavily calcified aortic wall. We suggest that all

patients with atherosclerosis being considered for ESWL undergo imaging examinations both preoperatively and during follow-up. Because of the current lack of literature related to this condition, our recommendation must be further evaluated in future studies.

Acknowledgement

The authors thank all the people who helped during the writing of this paper.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Ethics approval

This article was approved by the Ethics Committee at the Third Affiliated Hospital of Soochow University. Written consent was obtained from the patient to publish the details of this case.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID iD

Hongwei Ge  <https://orcid.org/0000-0001-8683-6770>

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