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Exceptional Case

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Renovascular acute renal failure precipitated by extracorporeal shock wave lithotripsy for pancreatic stones

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Abstract

Extracorporeal shock wave lithotripsy (ESWL) for pancreatic stones is considered a safe and efficient method to facilitate fragmentation and stone removal. We describe the case of a 73-year-old woman with a solitary functioning kidney who presented an acute-onset anuria and renovascular renal failure the day after ESWL. We speculate that vascular calcifications in the area targeted by shock waves played a critical role in renal artery obstruction in the present case.

Key words: acute kidney injury, pancreatitis, renal arterial thrombosis, vascular calcifications

Case report

A 73-year-old woman developed acute-onset anuria and renal failure the day after elective extracorporeal shock wave lithotripsy (ESWL) for a pancreatic stone. Her past medical history included chronic alcohol intake, complicated by pancreatitis and polyneuropathy, hypercholesterolaemia, hypertension, peripheral arterial disease, carotid endarterectomy and psoriasis. She had stopped alcohol intake 12 years earlier but was an active smoker (total of 50 pack-years). Three months before the current admission, she presented with an acute-on-chronic pancreatitis secondary to a 15-mm stone in the pancreatic duct; at that time, CT scan incidentally showed a severe atrophy of the right kidney, whereas the left kidney long axis was 11.4 cm (Figure 1A) . She was admitted to the gastroenterology ward for elective ESWL) followed by endoscopic retrograde sphincterotomy. On admission, she was taking olmesartan 40 mg od, amlodipine 10 mg od, pantoprazole 40 mg od and rosuvastatin 10 mg od; acetylsalicylic acid had been stopped 1 week before the procedure. Serum creatinine level at admission was 1.02 mg/dL [estimated glomerular filtration rate (eGFR) 53 mL/min/1.73 m^2 by MDRD]; other lab tests are shown in Table 1. The ESWL consisted of the administration of 3000 shock waves with a 120/min frequency and with a total energy of 125 J, followed by sphincterotomy, complete extraction of the stone with a balloon catheter and insertion of a pancreatic prosthesis. No medication was added. During the night after the procedure, the patient developed mild pain in the upper abdomen. The next day, the pain worsened and anuria was observed. On clinical examination, the temperature was

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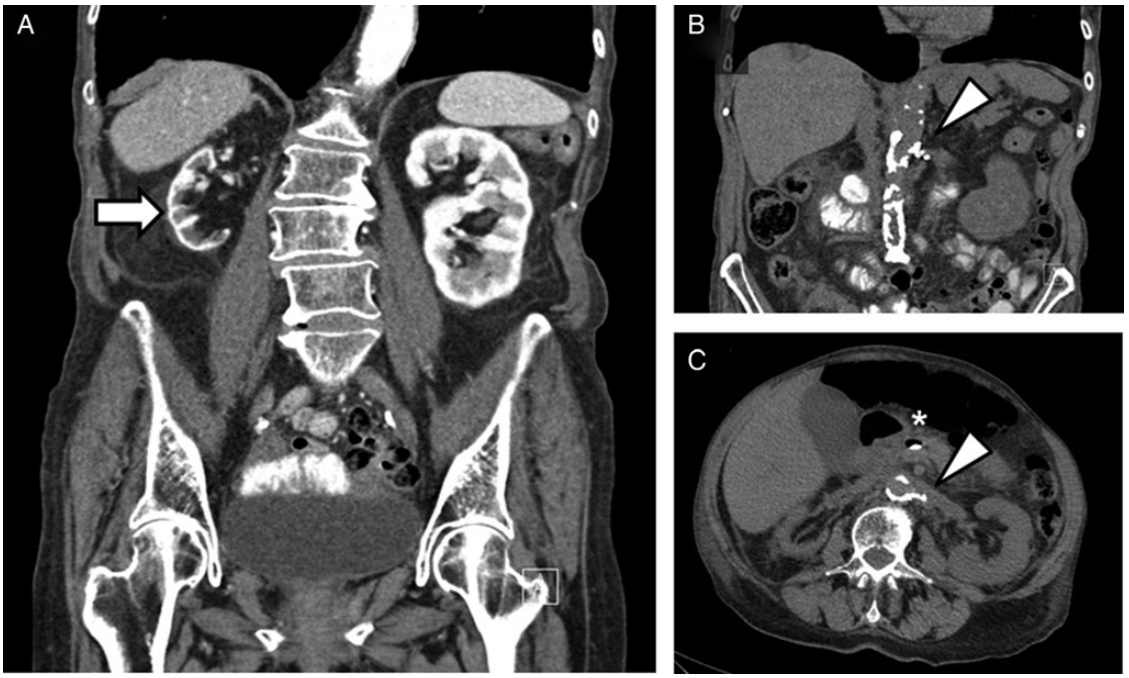

Fig. 1. CT-scan findings. (**A**) Severe atrophy of the right kidney (arrow) incidentally found on the CT scan (coronal sections; with iodine contrast media) performed 3 months before current admission. (**B** and **C**) Extensive calcifications of the aorta and the ostium of the left renal artery (arrowhead) on the CT scan performed after ESWL (transversal sections). The pancreatic prosthesis (asterisk) is located in front of the ostium of the left renal artery.

Table 1. Lab test analysis

	Normal range	Day 0 ESWL	Day 2	Day 10 PTA	Day 20	Month 1	Month 12
Serum creatinine (mg/dL)	0.6–1.3	1.02	7.32	5.67	4.83	3.38	3
Serum urea (mg/dL)	15–50	37	127	103	158	130	96
ALT (IU/L)	<50	19	55	47	16	24	17
AST (IU/L)	<50	7	80	38	10	11	8
LDH (IU/L)	<248	159	742	320	256	238	188
Total bilirubin (mg/dL)	0.3–1.2	0.3	0.4	0.3	0.5	0.5	0.1
Lipase (IU/L)	<67	24	43	26	14	ND	18

ESWL, extracorporeal shock wave lithotripsy; PTA, percutaneous transluminal angioplasty; ALT, alanine aminotransferase; AST, aspartate aminotransferase; LDH, lactate dehydrogenase.

36.1°C, heat rate 88 bpm and blood pressure 180/90 mmHg; palpation of the epigastric area was tender, with no sign of peritoneal irritation. Lab tests showed an acute renal failure (serum creatinine level 7.32 mg/dL); other results showed a C-reactive protein level at 28.8 mg/dL, white blood cell count of 17750/μL, neutrophilic (88%), increased levels of lactate dehydrogenase (742 IU/L; N < 248), aspartate aminotransferase (55 IU/L; N < 50) and alanine aminotranferase (80 IU/L; N < 50); the levels of alkaline phosphatase, γGT and pancreatic lipase were normal. No urine sample was available because of total anuria. CT scan without iodine contrast media ruled out acute pancreatitis, bowel perforation and ureterohydronephrosis but showed severe and diffuse aortic calcifications involving the ostium of the left renal artery (Figure 1B and C). Haemodialysis had to be initiated because of fluid overload in the face of anuria.

Anuric acute renal failure in the absence of urinary tract obstruction, in a patient with extended vascular calcifications and a solitary functioning kidney, was highly suggestive of renovascular acute renal failure. Doppler ultrasonography indeed showed a dramatically reduced renal arterial flow. Potential renal viability was suggested by retrospective analysis of the CT scan performed 1 month earlier, with a normal perfusion of the left kidney thanks to collateral vascularization, despite chronic, calcified, ostial stenosis of the left renal artery.

Left renal artery revascularization was therefore attempted, but femoral catheterization was unsuccessful because of complete iliac artery occlusion. Angio-magnetic resonance imaging confirmed this occlusion and demonstrated a 10-mm-ostial subocclusion of the left renal artery with severe renal hypoperfusion (Figure 2A); upper limb arteries were suitable for catheterization. A second attempt through brachial catheterization (delayed because of pulmonary oedema requiring daily haemodialysis) allowed successful blood flow restoration after percutaneous angioplasty and stenting of the left renal artery (Figure 2B). The day after angioplasty, the patient resumed diuresis after prolonged total anuria, and haemodialysis was withdrawn a few days later. Serum creatinine level fell to around 3 mg/dL (eGFR of 15 mL/min/1.73 m^2) and stabilized (Figure 3).

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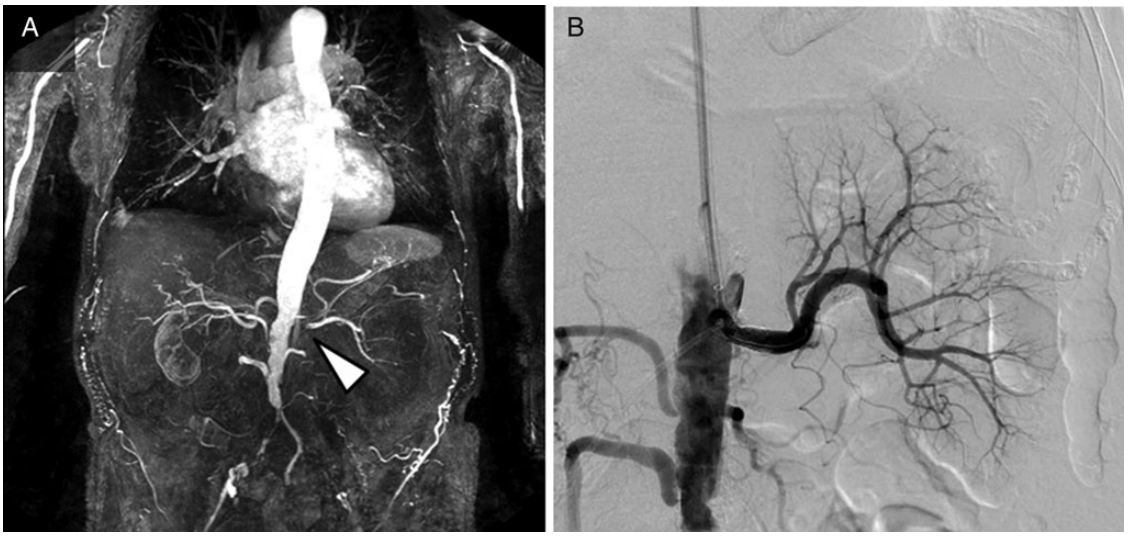

Fig. 2. Angiographies of the left renal artery before and after percutaneous luminal angioplasty. (**A**) Angio-MRI showing the absence of vascularization of the left kidney secondary to an ostial occlusion of the left renal artery (arrowhead). Collateral vascularization suggests chronic blood flow limitation due to atherosclerotic disease. The distal aorta is completely occluded. Haemodialysis was performed immediately after the procedure and on the day after to limit the risk of nephrogenic systemic fibrosis. (**B**) Arteriography after percutaneous angioplasty of the left renal artery with successful blood flow restoration.

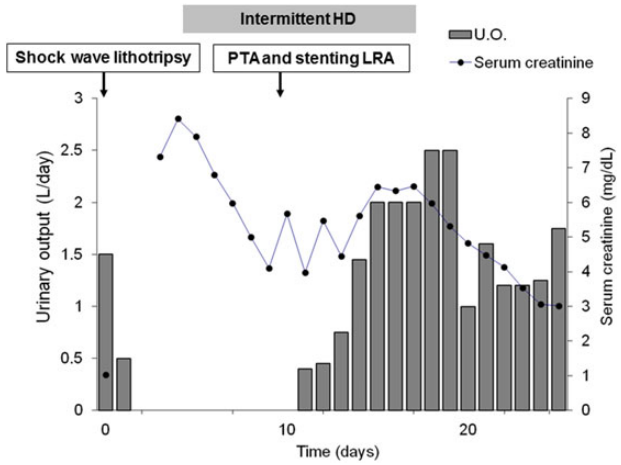

Fig. 3. Evolution of renal function over time. Bars show daily urine output; points and lines serum creatinine levels. HD, haemodialysis; PTA, percutaneous transluminal angioplasty; LRA, left renal artery; UO, urinary output.

Discussion

We report an unusual case of partly reversible renovascular acute renal failure triggered by ESWL performed for chronic pancreatitis. ESWL has been recommended to facilitate fragmentation and stone removal, in combination with sphincterotomy of the pancreatic duct and insertion of a stent. This technique was shown to be safe and particularly successful in patients with a single stone [1], as in our patient. The technique follows physical laws of acoustics and is based on the principle that an abrupt change in acoustical impedance—normally at its focus point, the stone—liberates short-term high-energy mechanical stresses and tear-and-shear forces which eventually lead to disintegration of the stone [2].

ESWL for pancreatic stones is usually safe, with a low (~5%) overall complication rate. Major complications mainly include post-ESWL pancreatitis, bleeding, infection and perforation [3]. ESWL for renal stones has been occasionally associated with vascular damage, both in experimental models and in patients [4–9]. Localized dissection of the aorta or abdominal aortic rupture has been reported, especially in patients with calcified vessels [10, 11]. It has been suggested that the calcified wall might act as an acoustic interface leading to plaque fragmentation and rupture [10].

In our patient with a solitary functioning kidney, ESWL for pancreatic stone clearly precipitated acute renal failure, and its renovascular nature was definitively confirmed by successful renal revascularization [12] and spectacular resolution of anuria. We speculate that the presence of extensive vascular calcifications in the area targeted by shock waves offered an unexpected change in acoustic bioimpedance, thereby contributing to plaque rupture and renal artery obstruction. However, alcohol and tobacco consumption represents the main aetiology of chronic pancreatitis, and aortic calcifications surrounding the targeted pancreatic area are therefore not infrequent in patients requiring ESWL. Importantly, even in patients with aortic calcifications, ESWL remains the standard of care and should not be contraindicated. Very few other treatment options can be proposed to patients with a large obstructive stone in the main pancreatic duct. Surgery may be an alternative but is usually reserved for failures of endotherapy, since it is associated with a higher morbidity. Endotherapy without ESWL is not considered a valid option anymore in most recent guidelines on the management of chronic pancreatitis with obvious obstruction [13]. Mechanical lithotripsy of pancreatic stones usually fails due to the hardness of the calcified stones and is associated with a high risk of breakage of the Dormia baskets used for mechanical lithotripsy. In chronic pancreatitis with radiopaque stones of ≥5 mm obstructing the main pancreatic duct, ESWL alone is even recommended as the first-line procedure in expert centres [13]. During pancreatic ESWL in patients with extensive vascular calcifications, we would recommend limiting the shocks number (maximum 5000), the intensity of shock waves or the shock wave frequency (<100/min), to prevent vessel damage.

In addition, we cannot formally rule out any contributive role of aspirin withdrawal—a practice that is routinely

recommended before ESWL. Indeed, in patients with a history of cardiovascular or cerebrovascular disease, pre-operative withdrawal of low-dose acetylsalicylic acid has been associated with an increased risk of peri-operative myocardial infarction [14]. In patients at high vascular risk, our recommendation would be to avoid withdrawal of antiplatelet agents such as aspirin, as now recommended for other minimally invasive procedures, since ESWL for pancreatic stones carries a low risk of bleeding [3].

Altogether, the renovascular nature of acute renal failure was clearly demonstrated in this case, and we speculate that ESWL triggered renal artery obstruction because of surrounding extensive vascular calcifications. Future epidemiological studies are required to assess the actual risk of renal failure after ESWL. In the meantime, caution is warranted in patients with severe vascular calcifications that are potentially eligible for ESWL.

Conflict of interest statement

None declared.

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