Irreversible Acute Renal Failure after Extracorporeal Shock-Wave Lithotripsy

R.	Rafael	Díaz-Tejeiro ^a
E.G.	Eugenio García	Díaz ^a
G.	Gonzalo	Fernández ^a
E.	Eduardo	González ^a
M.A.	María Antonia	García ^a
F.	Francisco	Ahijado ^a
E.	Emilio	Gómez ^a
T.	Tomás	Sierra ^a
A.	Agustin	Iglesias ^b

^aDepartment of Nephrology, Hospital Virgen de la Salud; ^bDepartment of Urology, Hospital Provincial, Toledo, Spain

Rafael Díaz-Tejeiro, Department of Nephrology, Hospital Virgen de la Salud, E-45004 Toledo (Spain)

Dear Sir,

Extracorporeal shock-wave lithotripsy (ESWL) was introduced clinically in February 1980 by Chaussy et al. [1], and it has been in clinical use for 11 years having replaced other treatment techniques for the majority of surgical calculi in the upper urinary tract. Since that time, approximately 2 million patients around the world have been successfully treated by this technique. Patient acceptance and clinical adoption of ESWL has been facilitated by the perception that ESWL does not cause severe acute or lasting side effects [2]. Most complications are related to obstruction from stone fragments lodged within the ureter with accompanying colic and/or infection and subcapsular or perirenal hematoma [3].

We report the case of a patient with a single functioning kidney who was treated with ESWL developing irreversible acute renal failure.

A 54-year-old woman was admitted to the hospital with severe renal failure (Cr = 751 $\mu\text{mol/l}$; 8.5 mg/dl). Diagnostic evaluation with ultrasound scan revealed bilateral obstructive staghorn calculi. Nephrostomy was performed in the left kidney because the right kidney showed no renal cortex. Renal function recovered to a Cr value of 132 $\mu\text{mol/l}$ (1.5 mg/dl), and pyelolithotomy was performed. Two months later, ESWL was initiated to treat the remaining calculi. A total of 5,000 shock waves with the clinical power setting of 10 (on the scale of 1-10) was administered with the Wolf Piezolith 2500 lithotripter. No ureteral stents were used. Following monitoring in the recovery room for 2 h, the patient was discharged from the hospital with the prescription of ciprofloxacin orally twice a day for 10 days. Six hours after postoperative procedure, she developed gross hematuria for 2 days. Two days later chemistry studies showed a rise in serum Cr to 398 $\mu\text{mol/l}$ (4.5 mg/dl). Physical examination was normal. Blood pressure and body temperature were always in the normal range. Scan ultrasound revealed loss of corticomedullary demarcation and hypoechogenic parenchyma. Slight

ureterohydronephrosis was delimited. No in-trarenal, subcapsular and perirenal hematoma was observed. A duplex Doppler scan showed permeability of the renal vasculature. Blood and urine cultures were negative. Nephrostomy catheter was placed, however, no recovery of the renal function was observed. One month later, the renal histology showed extensive fibrosis and diffuse atrophy of the tubules besides microscopic nephrocalcinosis and glomerular obsolescence. The renal function deteriorated to end-stage renal failure, and the patient was included in a hemodialysis program.

The complications of ESWL are related to the administration of shock waves and those resulting from fragmentation and the passage of particles to the ureter [4]. The former com-

plications included acute renal damage. Recent clinical and experimental reports show that ESWL cause acute renal effects in the majority of treated kidneys [5-8]. These effects induced by ESWL appear to be dependent on a number of factors, including the type of lithotripter used, shock wave generator power, focal size of the shock wave, total energy delivered, number of shock waves and prelithotripsy renal function [7]. Our patient was treated with piezoelectric lithotripter. This machine is associated with less tissue damage than other types of lithotripters. The number of the shock waves and the energy delivered were the usual.

ESWL-induced acute renal damage may affect the nephron, microvasculature and the surrounding interstitium (hemorrhage, edema and acute tubular necrosis). This form of renal trauma is associated with an immediate decrease in the renal function of the treated kidney, and occasionally may be permanent [9]. The decrease in renal clearance in a kidney resulting from renal trauma caused by ESWL can probably be compensated by an increased function of a healthy untreated kidney. For this reason, the measurement of total renal clearance may not detect the presence of an adverse effect of ESWL on a treated kidney unless the untreated kidney is unable to respond. The case here presented may be an example of this. The patient developed acute renal failure in the absence of sepsis, vascular damage, obstruction and nephrotoxic drugs. The pathogenic factor of acute illness would be intraparenchymal edema and/or hemorrhage and subsequent fibrosis. Sonographic changes and renal histology are compatible with this hypothesis.

Although ESWL is a safe mode of stone treatment when used judiciously in the vast majority of cases, acute renal failure can occur in a patients with only 1 functioning kidney and/or previous chronic renal failure in spite of using the less traumatic lithotripter and normal number of shock waves. In these patients, the renal function should be monitored closely postoperatively.

References

Chaussy C, Schmiedt E, Jocham D, Brendel W, Forssmann B, Walther V: First clinical experience with extracorporeally induced destruction of kidney stones by shock waves. *J Urol* 1982; 127:417-420.

Chaussy C: Extracorporeal shock wave lithotripsy: New aspect in the treatment of kidney stone disease. Basel, Karger, 1982.

Dretler SP: Extracorporeal shock-wave lithotripsy; in Rons NS (ed): *Stone Disease: Diagnosis and Management*. Orlando, Grune&Stratton, 1987, pp 289-310.

Roth RA, Beckmann CF: Complications of extracorporeal shock-wave lithotripsy and percutaneous nephrolithotomy. *Urol Clin North Am* 1988;15:155-159.

Evan AP, Willis LR Connors B, Reed G, McAteer JA, Lingeman JE: Shock-wave-lithotripsy-induced renal injury. Am J Kidney Dis 1991; 17:445-450.

Morris JS, Husmann DA, Wilson WT, Denstedt J, Fulgham PF, Dayman RV, Preminger GM: A comparison of renal damage induced by varying modes of shock wave generation. J Urol 1991; 145:864-867.

Morris JS, Husmann DA, Wilson WT, Preminger GM: Temporal effects of shock wave lithotripsy. J Urol 1991;145:881-883.

Lingeman JE, Woods J, Toth PD, Evan AP, McAteer JA: The role of lithotripsy and its side effects. J Urol 1989;141:793-797.

Williams CM, Kaude JV, Newman RC, Peterson JC, Thomas WC: Extracorporeal shock-wave lithotripsy: Long-term complications. Am J Roentgenol 1988;150:311-315.

Editor's Note

We are saddened to hear of the recent death of Professor J. F. Maher, Bethesda, Md. His work on the editorial board was much appreciated. He will be sorely missed by the nephrological community throughout the world.