Combined Extracorporeal Shock Wave Lithotripsy and Percutaneous Alkalinization in Uric Acid Calculi

H. Hendrik Vandeursen
G. Geert Pittomvils
L. Baert

Department of Urology, University Hospital St. Pieter, Department of Didactical Physics, Catholic University of Leuven, Belgium

Key Words
Uric acid calculi
Obstruction
Extracorporeal shock wave lithotripsy
Percutaneous alkalinization

Abstract
The combination of percutaneous alkaline irrigation and lithotripsy was performed in 5 cases of uric acid calculi obstructing the ureter. Shock wave lithotripsy accelerates the dissolution of uric acid stones.

A 56 year-old man was admitted in the emergency department with severe left renal colicky pain. Plain X-ray showed no specific radioopaque densities but sonography revealed extreme hydronephrosis with a sonoreflection measuring 10 mm in diameter at the ureteropelvic junction. Persisting acid urinary pH suggested an uric acid stone. The severe hydronephrosis necessitated a percutaneous nephrostomy. ESWL was performed with nephrostomography, and subsequent alkalinization was started with a continuous sodium bicarbonate (1/6 M) irrigation through the nephrostomy. Four thousand shock waves at 17.8 kV were delivered and control nephrostomy revealed dye passage immediately after the treatment and complete evacuation was confirmed at X-ray nephrostomographic control within 48 h. X-ray diffraction of the evacuated fragments confirmed the uric acid composition.

An 82-year-old man was hospitalized in anuria. Clinical examination revealed prostatic hypertrophy and bilateral lumbal tenderness. Bilateral hydroureteronephrosis was found at sonography and because of the anuria bilateral nephrostomy was inserted: bilaterally an obstructing radiolucent stone, measuring 10 and 12 mm in diameter, in the sacroiliac ureter was found on nephrostomography. ESWL was performed on both localizations during nephrostomography with continuous alkalinization (sodium bicarbonate 1/6 M) through the nephrostomy: 2,000 shock waves averaging 18.1 kV were focussed on both calculi separately. Dye passage was noted after the session; nephrostomography was controlled after 2 days with complete evacuation bilaterally. X-ray diffraction of the stone fragments confirmed the uric acid composition.

A 40-year-old man presented with right colicky pain. Plain X-ray showed no radioopacity, but sonography demonstrated hydroureteronephrosis with a sonoreflection measuring 12 mm in the
right proximal ureter. A percutaneous nephrostomy was inserted, and ESWL was performed with nephrostomographic localization: 3,400 shock waves ranging from 17.8 to 18.1 kV were administered. Due
Introduction

Intense alkalinization can dissolve uric acid calculi [1]. The combination with extracorporeal shock wave lithotripsy (ESWL), especially in obstructive calculi, accelerates the dissolution by increasing the contact surface for the dissolving alkalinizing agents [2]. This allows a noninvasive and anesthesia-free treatment with quick relief of the urinary tract obstruction. Using an ESWL device with a fluoroscopic imaging system makes an adjuvant dye opacification necessary in case of radiolucent calculi. In these cases, we prefer to insert a percutaneous nephrostomy to accurately localize the stone and to simultaneously start intense alkalinization through the nephrostomy in suspected uric acid calculi.

Materials and Methods

ESWL was started in our department in June 1987 with a second-generation lithotriptor (Lithostar Siemens, Erlangen, FRG). Within 24 months, 5,000 procedures were performed. The total maximal amount of shock waves delivered per session is 4,000, while the kilovoltage ranges from 16 to 19 kV. A fluoroscopic imaging system allows a three-dimensional stone detection. The treatment can be performed as an outpatient procedure as no anesthesia is required. Hospitalization is reserved for infected calculi to administer parenteral antibiotic therapy during and after the session to minimize the risk of infection during stone disintegration [3].

A 55-year-old man presented with persisting flank pain. Plain X-ray remained negative but sonography revealed severe hydronephrosis, and an obstructive pelvic and proximal ureteric calculus. The maximal diameter was 11 and 8 mm, respectively. A nephrostomy was inserted because of the extreme obstruction. Urinary pH persisting at 5 and the radiolucent aspect suggested uric acid stone composition. ESWL was performed in two sessions on both locations within 3 days: 3,400 shock waves at 18.1 kV on the ureteric location and 4,000 shock waves at 18.1 kV on the pelvic stone were administered during nephrostomographic dye opacification. Percutaneous alkalinization with sodium bicarbonate 1/6 M was started during ESWL and continued for 5 more days after the second litho-tripsy. Nephrostomography confirmed a complete relief of obstruction. X-ray diffraction of the stone fragments confirmed the uric acid stone composition.

Discussion

Nonobstructing uric acid calculi may be treated pharmacologically, as complete dissolution can be expected [4]: increase of the urine volume, reduction in urinary uric acid levels, and maintenance of an alkaline urine. Problems arise in obstructive uric acid calculi where long-standing medical dissolution can hardly be performed, while the high recurrence rate due to the underlying metabolic disorders requires an noninvasive management. The combination of ESWL with simultaneous alkalinization increases the contact surface for dissolving alkalinization,
accelerating the dissolution of the uric acid calculi. Inserting a nephrostomy offers the supplementary advantage not only of immediate relief from obstruction, but intense alkalinization can be started during the ESWL. Evacuation can be assessed on nephrostomographic controls. Using a second-generation lithotriptor allows an anesthesia-free treatment, while the percutaneous nephrostomy can be performed under local infiltration.

Regarding microhardness studies of renal calculi, the uric acid composition ranged hardness values between the extreme hard calcium oxalate monohydrate and di-hydrate mixes and the softer magnesium ammonium phosphate hexahydrate and carbonate apatite and/or di-hydrate calculi [5].

References