The Role Of Urinary Tract Obstruction In Occurrence Of Renal Failure
ALINA-GABRIELA PĂUNA
Department of Nephrology, "St. John" Emergency Hospital, Bucharest

ABSTRACT
Urinary lithiasis is a condition characterized by the formation of concretions or calculi inside the urinary tract, after precipitation of substances, which normally are dissolved in urine. Obstructive renal failure occurs because of urinary flow obstruction under a normal renal perfusion and the absence of renal parenchymal lesions. Usually, prompt correction of the cause lead to restoration of renal function. Were followed 75 patients with urinary tract obstruction and obstructive renal failure (38 men and 27 women) hospitalized in the Nephrology Clinic, “St. John” Emergency Hospital, Bucharest, in 2006–2009. Of these, 61 had ureteral obstruction and 14 had obstruction by compression or tumor invasion. The following tests were performed: simple renal radiography revealed radiopaque calculi in 12 cases; ultrasonography was performed in all patients and showed parenchymatous index reduced below 5 mm in eight patients and pyelocaliceal grade II–III expansion in 48 cases and grade IV–V in 25 cases. Doppler ultrasound: could not calculate the resistance index in the eight cases with parenchymatous index decreased (under 5 mm) and the 85/75 cases had resistance index (RI) >0.70. Only 23 of 61 patients had spontaneous kidney stone removed, in three patients with calculi between 0.8–1.5 cm located in upper ureteric was performed ESWL (extracorporeal shock wave lithotripsy) and 35 cases requiring calculus fragmentation by ureteroscopy procedure and mounting Cook probes.

KEY WORDS
urinary obstruction, chronic renal failure, Duplex Doppler ultrasonography, resistivity index

Introduction
Obstructive renal failure is a pathological entity, which leads rapidly to alter renal function, with rapid growth in circulation of catabolism products. Often renal insufficiency occurs in the kidney already affected (relapse lithiasis) with episodes of acute tubulointerstitial nephritis, amid major defects associated (neoplasm of the cervix uteri), being a direct consequence (tumor invasion or compression of ureteral orifices) or indirect (retroperitoneal fibrosis) or lower urinary tract obstruction (bladder outlet obstruction), the classic example being represented by prostate adenoma [10].

Diagnosis of urinary tract obstruction is based on demonstrating opposite increased resistance to flow along the urinary tract. Such increased resistance causes proximal expansion (obstructive uropathy) and side effects on kidney function (obstructive nephropathy) associated with damage of nephron and parenchymal atrophy (obstructive atrophy) [4].

Conventional ways of investigation are well known: simple renal scan, ultrasonography, intravenous urography, computed tomography (CT) scan, and magnetic resonance imaging make the diagnosis of obstruction especially by highlighting the consequences of anatomic obstruction, such as pyelocaliceal system expansion and the proximal ureter obstructive lesion.

Patients and Methods
During 2006–2009 were hospitalized in the Nephrology Clinic, “St. John” Emergency Hospital, Bucharest, 75 patients with urinary tract obstruction and obstructive renal failure (38 men and 27 women).

Of these:
• 61 had ureteral lithiasis obstruction:
  – obstructive ureteral calculi on single kidney surgery, functional or congenital (42 cases);
  – inclined calculi in pielocaliceal junction on single kidney (15 cases);
  – bilateral obstructive ureteral lithiasis (four cases);
• 14 patients with ureteral obstruction by compression or bilateral or unilateral ureteral tumor invasion on single kidney:
  – neoplasm of the cervix uteri (eight cases);
  – retroperitoneal fibrosis (three cases);
  – prostate adenocarcinoma (three cases);

Altered state of many patients hospitalized to emergency with anuria or oligoanuria, with severe electrolyte and biochemical disturbances, with blood creatinine values between 3.5–15 mg% and blood urea between 115–400 mg%, required close cooperation between Nephrology and Urology Clinics, both before and after the establishment of urological treatment and after urinary tract desobstruction.

In all cases were made: simple renal radiography, renal ultrasonography and duplex Doppler examination in determining the intrarenal resistivity index (RI) Doppler recording at the bladder urine bolus.
Simple renal radiography revealed radiopaque calculi existence on 12 cases. Real-time ultrasound assessed parenchymatous index and the degree of pielocaliceal expansion. This was classified into: absent (two cases) average (equivalent grade II / III) (48 cases) and severe (equivalent grade IV and V) (25 cases) [6, 7]. Resistivity index determinations were made by recording the Doppler signal at the cortical-medullary junction level of the kidney (arched arteries) and along the edge of medullary pyramids (interlobular arteries) [6]. Resistivity index was calculated as:

\[
RI = \frac{Systolic-diastolic \ flow}{Systolic \ flow}
\]

Resistivity index analysis was performed bilaterally. For obstruction was considered suggestive an RI>0.70. Therapy was represented by maintaining a convenient dieresis that will facilitate the removal of calculi, administration of spasmytic and analgesic drugs and extracorporeal shockwave lithotripsy techniques (ESWL) and ureteroscopy with calculi fragmentation in situ.

Results and Discussion

Of the 75 patients with urinary tract obstruction and obstructive renal failure, 61 had ureteral lithiasis obstruction and 14 had ureteral obstruction by compression or tumor invasion. 21/75 patients were presented in emergency with anuria, with blood creatinine values between 11–15 mg% and blood urea between 290–400 mg%. From the analysis of risk factors for lithogenesis we mention the lack of fluid intake, urinary infection with urease producing pathogens (22 patients), congenital anatomic abnormalities (horseshoe kidney (one case) and polycystic kidney (six cases).

These abnormalities predispose to lithiasis because of urine stasis and recurrent urinary tract infections. Simple renal radiography revealed in 12 cases the existence of the radiopaque calculi at pieloureteral junction level (three cases) and the ureteral area level (nine cases). Renal ultrasound assessed parenchymatous index – decreased below 5 mm in eight patients. To them it was not possible to calculate the resistivity index. At the remaining 67 patients the RI was >0.70.

Dilatation was absent in two cases, average 48 cases and severe in 25 patients. At drug-treated patients only 23 of 61 were eliminated spontaneously the calculi (calciuli size between 4 mm and 6 mm), others require urologic intervention – extracorporeal shockwave lithotripsy (three cases) and calculus fragmentation by ureteroscopy procedure and mounting Cook probes (35 cases). Urea and creatinine values returned to normal only in 37 patients, at 30 cases decreased gradually while maintaining the values of 2.5–4 mg% for creatinine respectively 70–100 mg% for urea and at eight cases (five patients with cervical cancer and three patients with retroperitoneal fibrosis) values remained high requiring alternate methods of renal function.

Renal ultrasonography

Renal ultrasonography is the most valuable investigation, not invasive and has no contraindications. It is carried out in renal colic to reveal calculi, the presence or the absence of hydronephrosis and differential diagnosis with other disorders that may manifest by colic [1]. On ultrasound can show only stones over 0.5 cm in size. Ultrasound can be repeated to highlight the disappearance of hydronephrosis after spontaneous elimination of a calculus or the increase by calculus obstruction persistence.

Doppler ultrasounds

Doppler ultrasounds can objective efficient or inefficient drainage may indicate the time of filing or for therapeutic change. The limits of this method are related both to the technical performance of the device, the patient’s condition and experience of the echographist [5, 8]. In overweight patients, renal vascular objectivity may be difficult often leading to false positive results. In some cases, resistance index or ureteral flow cannot be objectified by Doppler examination because the patient’s general alterate condition and its lack of cooperation with the doctor. Because of disadvantages associated and disease severity, it cannot maintain apnea longer, for Doppler recording [9].

Simple renal radiography

Simple renal radiography is performed frequently in renal colic to reveal a radiopaque calculus at the reno-uretero-bladder area level. The results are often non-interpretable due to difficulty in preparing patient in colic and a degree of ileus associated to renal colic leading to the gas mask in the kidney area and the ureters trajectory.

Intravenous urography

Intravenous urography is not made during nephritic colic or hematuria. Urography confirmed the existence of radiopaque calculi, highlighting the radio transparent calculi; may reveal a possible favoring cause of lithogenesis (congenital hydronephrosis, horseshoe kidney, extrinsic obstruction of the ureter). Functional status of the kidney is reflected by the secretion contrast substance.
Kidney size can be increased in hydronephrosis or pionephrosis [1–3]. Intravenous urography is not indicated as a first intention investigation in lithiasis, preferring the simple renal ultrasonography and radiography.

**Scintigram and isotopic nephrogram**

Scintigram and isotopic nephrogram provide information on glomerular filtration rate, renal blood flow and anatomical structures. Classic nephrogram and its furosemide version give a characteristic appearance of accumulation and elimination of the radionuclide of urinary tract in the presence of obstruction. The method is quite irradiated for the patient, which is why scintigram is not used in the diagnosis of obstructive uropathy.

**CT scan**

CT scan finds utility in lithiasis for positive and differential diagnosis of infectious complications (renal abscess). The change of resistance index after removal of obstruction: Platt and collaborators have observed resistance index decreased to 90% of patients within 2–9 days after resolution of obstruction [7]. Most authors have described resistance index decreased below 0.70 measured up to three months postoperatively. Reversible resistivity index after obstruction resolution may vary depending on patient age, type and duration of obstruction, being closely related to vascular and parenchymal kidney damage [7, 9].

**Conclusions**

Renal obstruction with other pathological conditions that alter vascular resistance produces changes in the Doppler waveform by increasing the resistivity index. Most authors accept the value of 0.70 as the normal upper limit for adults. Doppler ultrasound and in particular the resistivity index can be important elements of monitoring dilation system renal collecting due to obstruction. Duplex Doppler ultrasound tends to impose itself as a valuable investigative tool and tracking efficiency urinary drainage tract. Due to the complexity of cases, electrolyte and metabolic changes, for correct diagnosis and effective type of patients with obstructive renal failure requires a close collaboration between nephrologist and urologist.

**References**


**Correspondence Adress:** Alina-Gabriela Pâuna, MD, Nephrology Specialist, PhD, Department of Nephrology, “St. John” Emergency Hospital, 13 Vitan–Bârziști Highroad, Sector 4, 042122 Bucharest, Romania; Phone +4021–334 50 75, Fax +4021–334 59 70, e-mail: alina.pauana76@yahoo.co.uk