Imaging urolithiasis, complications and interventional.

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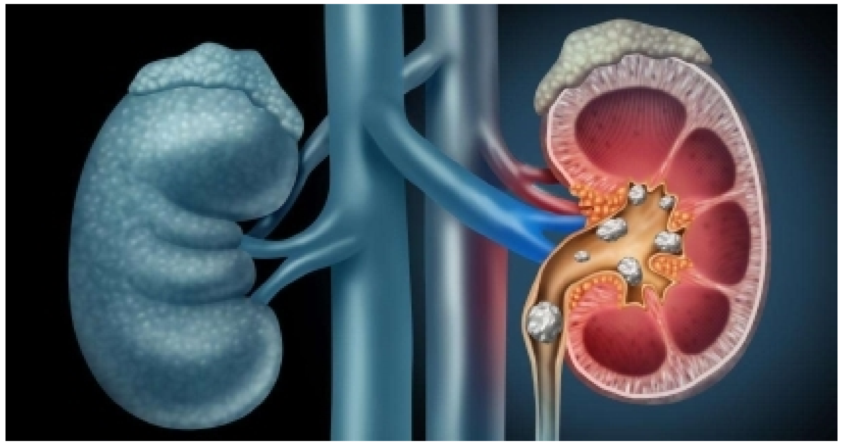
Conflict of interests

I DECLARE NO CONFLICT OF INTERESTS.

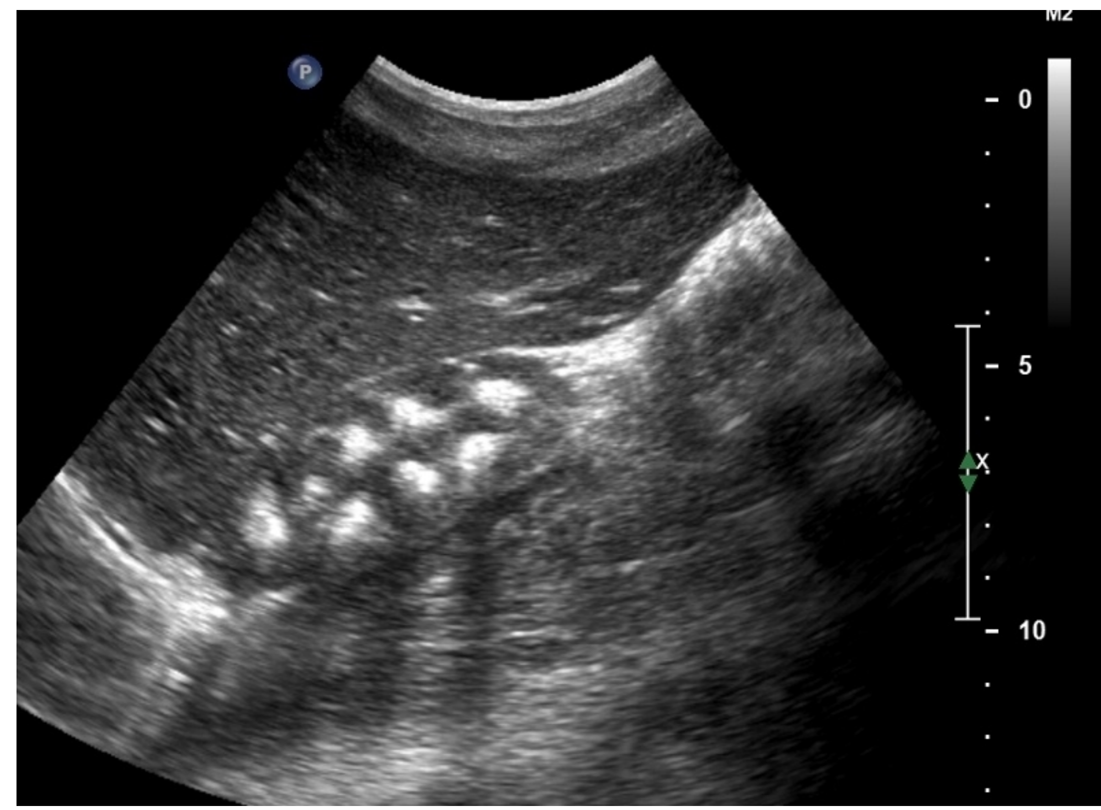
Nephrocalcinosis versus urolithiasis



NEPHROCALCINOSIS	UROLITHIASIS
Microcalcifications in the tubuli or interstitial tissue	Macroscopic calcifications in the collecting system
Asymptomatic, haematuria, UTI, hypertension	Flank pain, colicky pain, haematuria, UTI etc

MAY COEXIST!

Nephrocalcinosis



Urolithiasis in children

Increasing incidence over the last 25 years

Still uncommon compared to adults

Approx 80% metabolic

80-90% radiodense calcium stones

More often smaller stones

Higher recurrence rate compared to adults

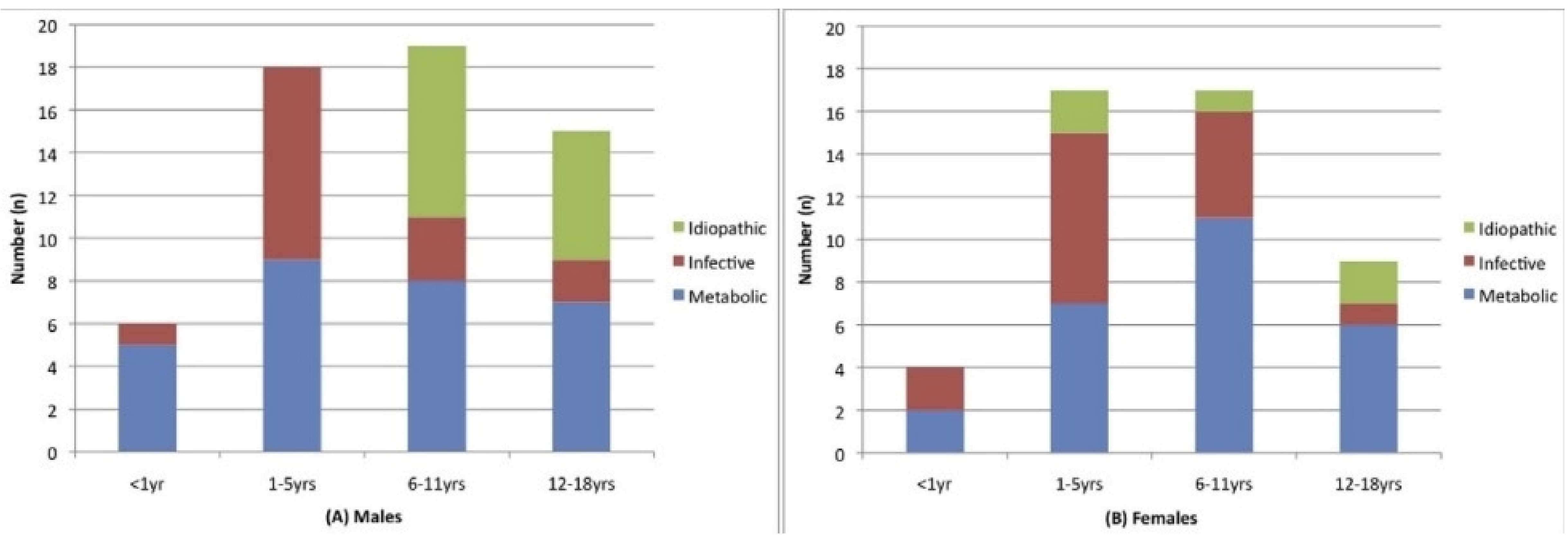
MIAF
- Metabolic
- Infection
- Anatomy
- Functional

Epidemiology

Mean annual rate: ~ 36 - 57 / 100 000 children in US population

vs ~ 138 - 200 / 100 000 in adult population

Etiological classification:



Robinson C, Shenoy M, Hennayake S. No stone unturned: The epidemiology and outcomes of paediatric urolithiasis in Manchester, United Kingdom. J Pediatr Urol. 2020;16(3):372.e1-372.e7.

Risk factors

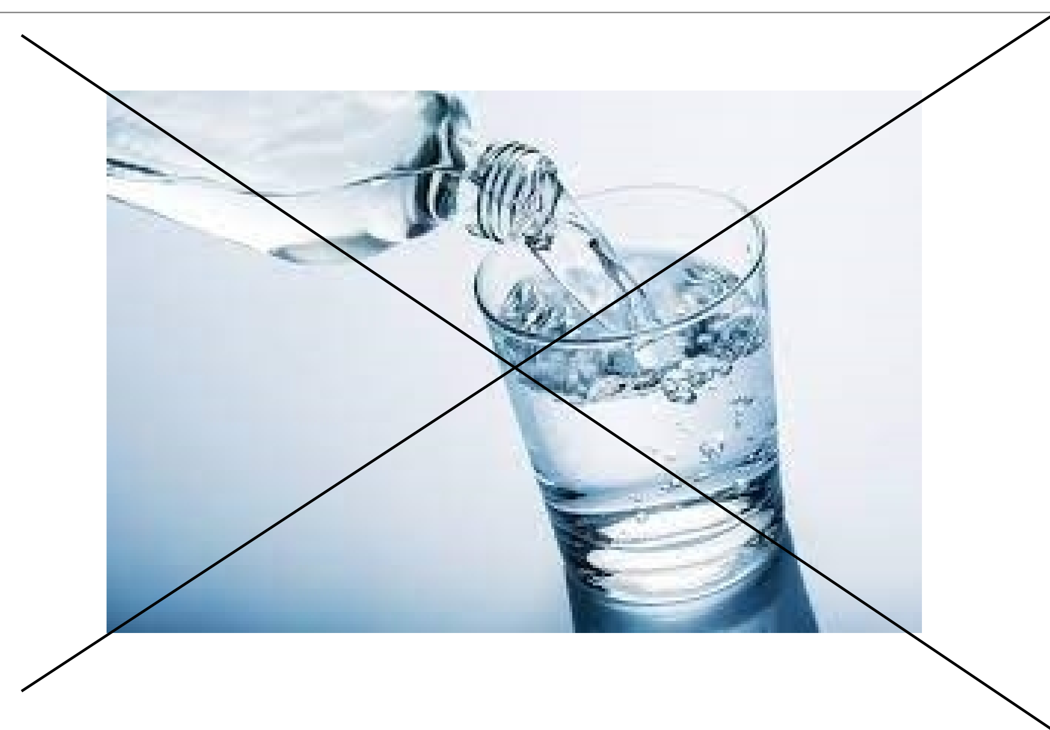
Underlying metabolic disorder (>50% of children!)

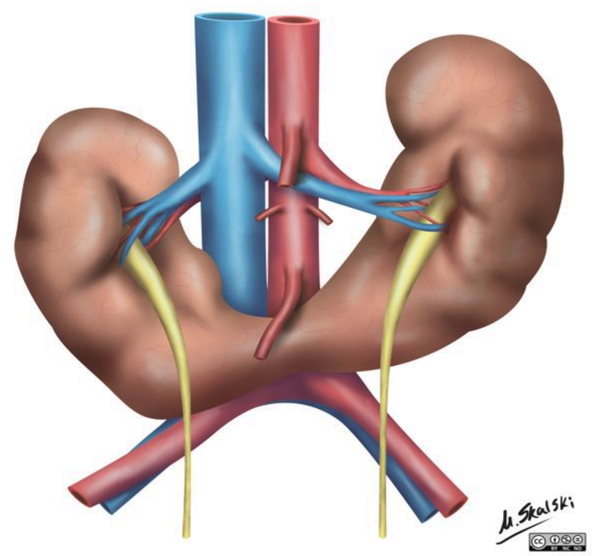
Low fluid intake

Urinary tract malformations

Urinary tract infections

Urinary tract diversions





Imaging urolithiasis

Ultrasound (US)
- **Always**
- Identifies most clinically relevant stones

Abdominal X-ray (KUB) Kidney Ureter Bladder
- **Sometimes**
- in combination with ultrasound

CT
- **Rarely**
- Only in indeterminate cases or when exact location and size required

What to assess?

- Presence
- Size
- Location
- Indirect signs (hydronephrosis)
- Complications

Ultrasound technique

Well hydrated

Supine and prone

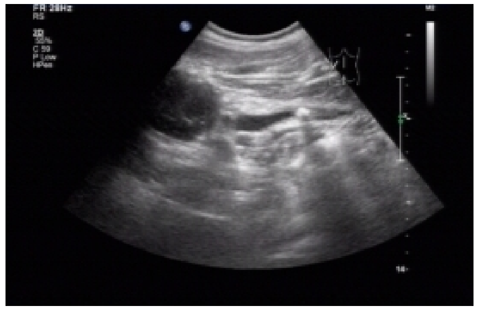
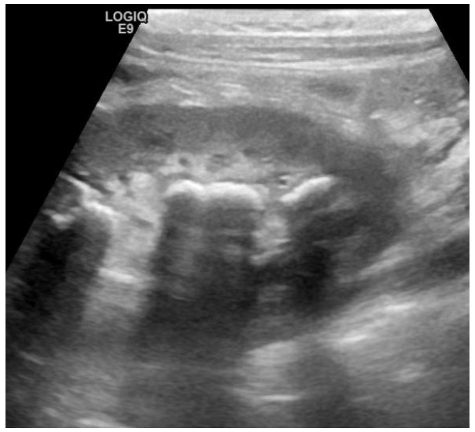
Include both curved and linear transducer

Ureteric jet

Doppler! Increased velocity to look for twinkling artifacts

Renal resistive index (RI) - elevation in RI may precede pelvicalyceal dilation

Ultrasound findings

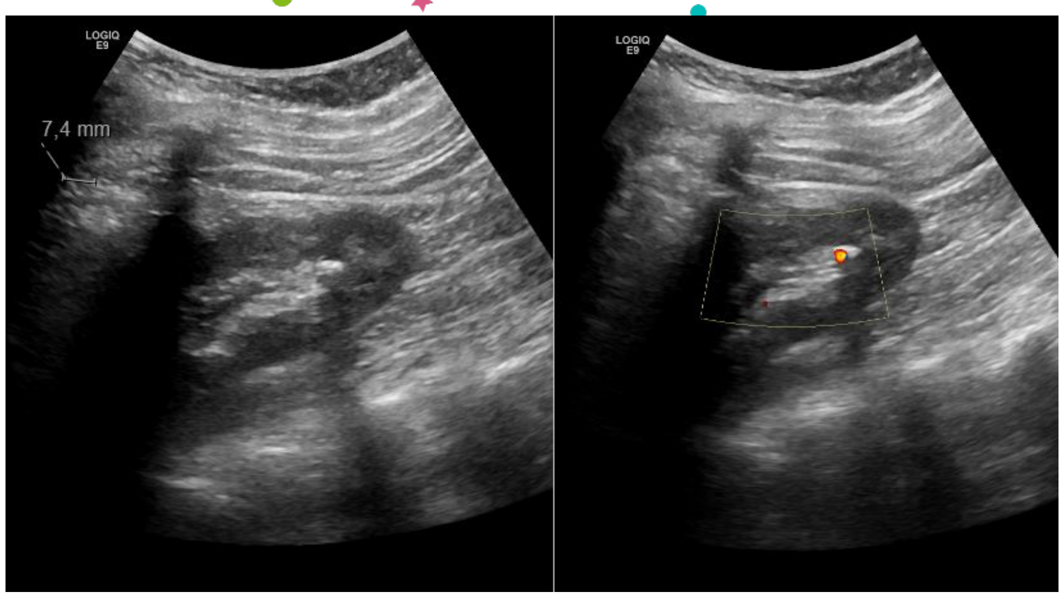
Echogenic foci

Often posterior shadowing

Calyces, pelviureteric junction, crossing vessels, bladder

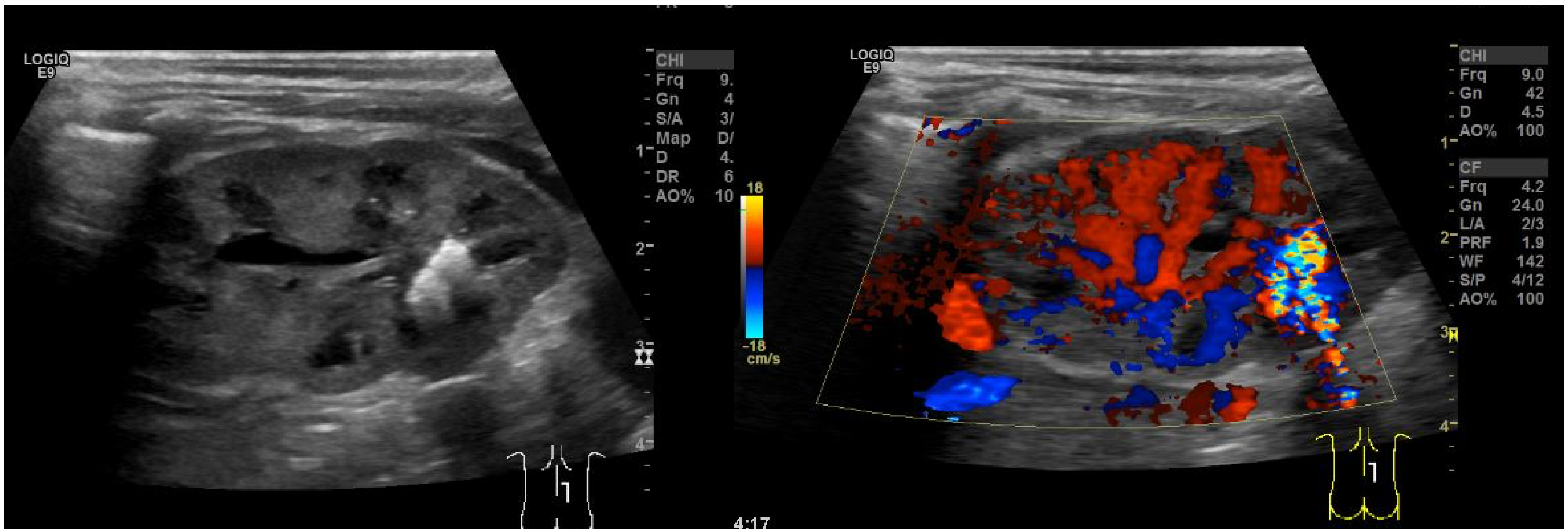
Twinkling artifacts!

Twinkling artifact



- Focus of alternating colors on Doppler signal behind a reflective object
- Appearance of turbulent blood flow
- More sensitive for detection of small stones than acoustic shadowing

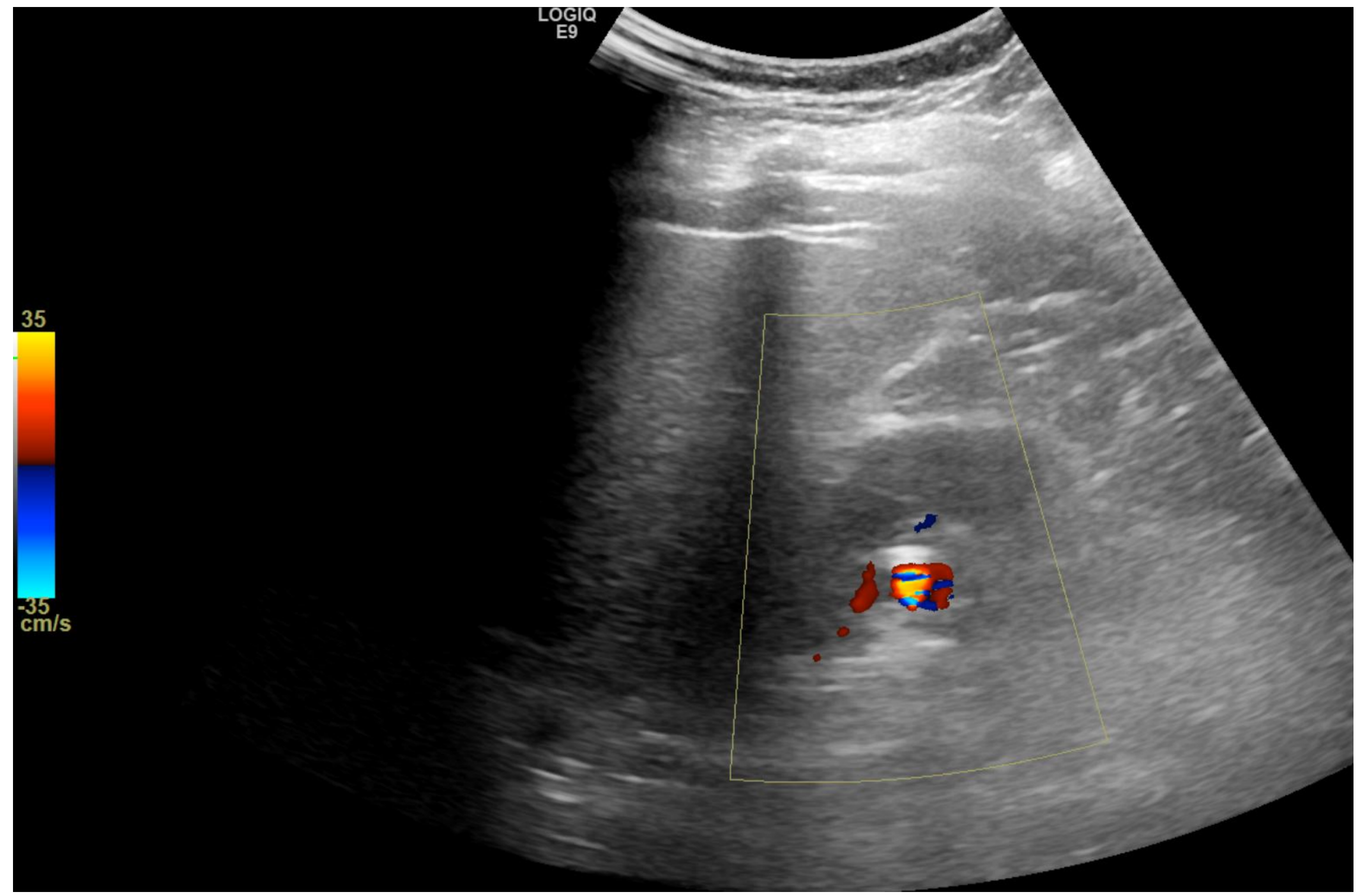
Twinkling artifact



Doppler increases the sensitivity and specificity for calculi

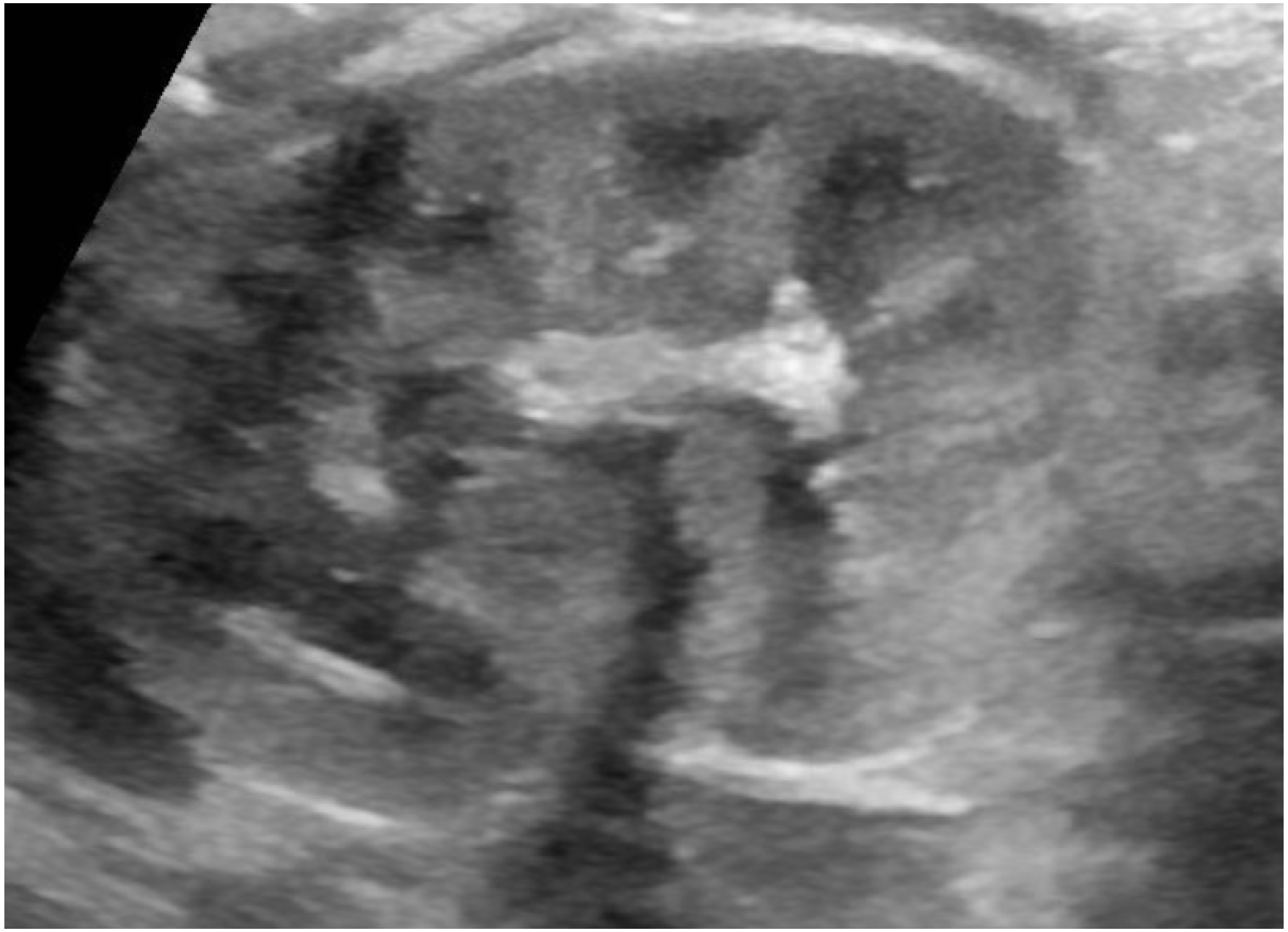
Twinkling artifact

Boy 14
Therapy refractory
JIA
Haematuria



Difficult to differentiate hilar fat from calculi, Twinkle artifact helps.
Stones confirmed by CT.

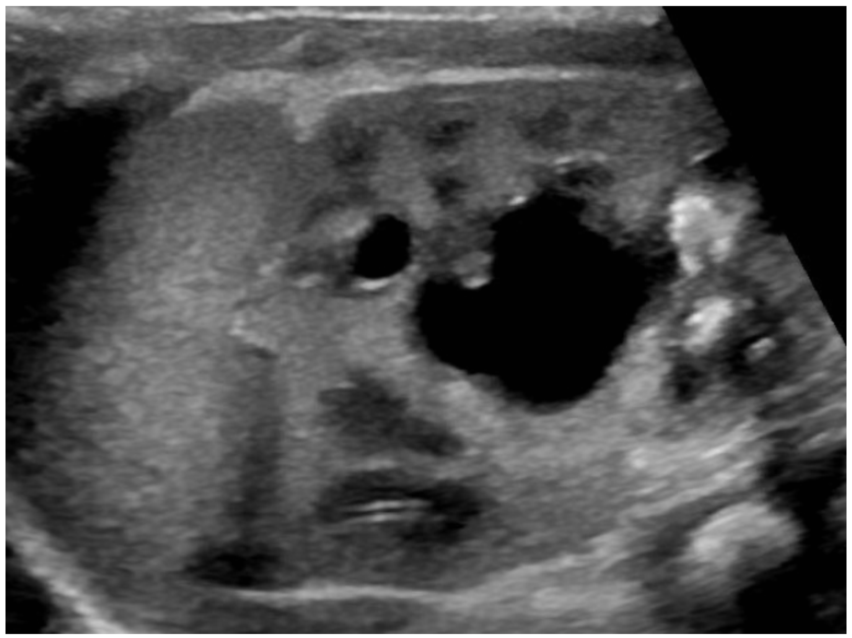
Drug induced urolithiasis (post diuretica)



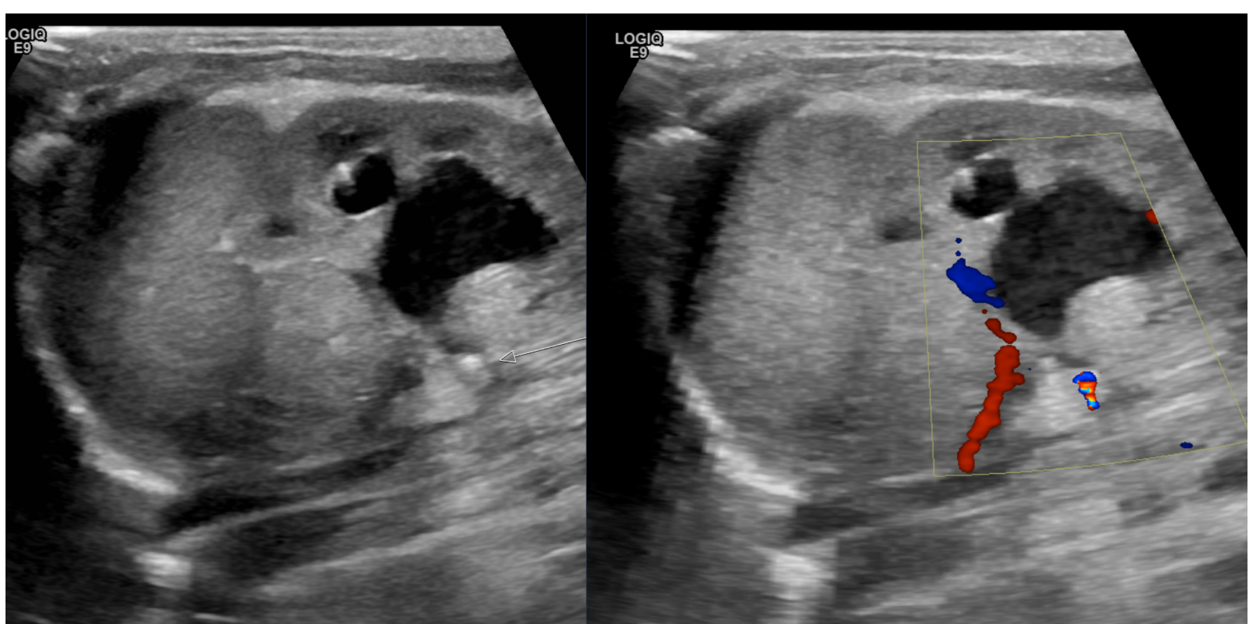
Ex premature boy
Born GA 26 w,
Now 35 W

Calcifications in the renal hilum

Urolithiasis post diuretica

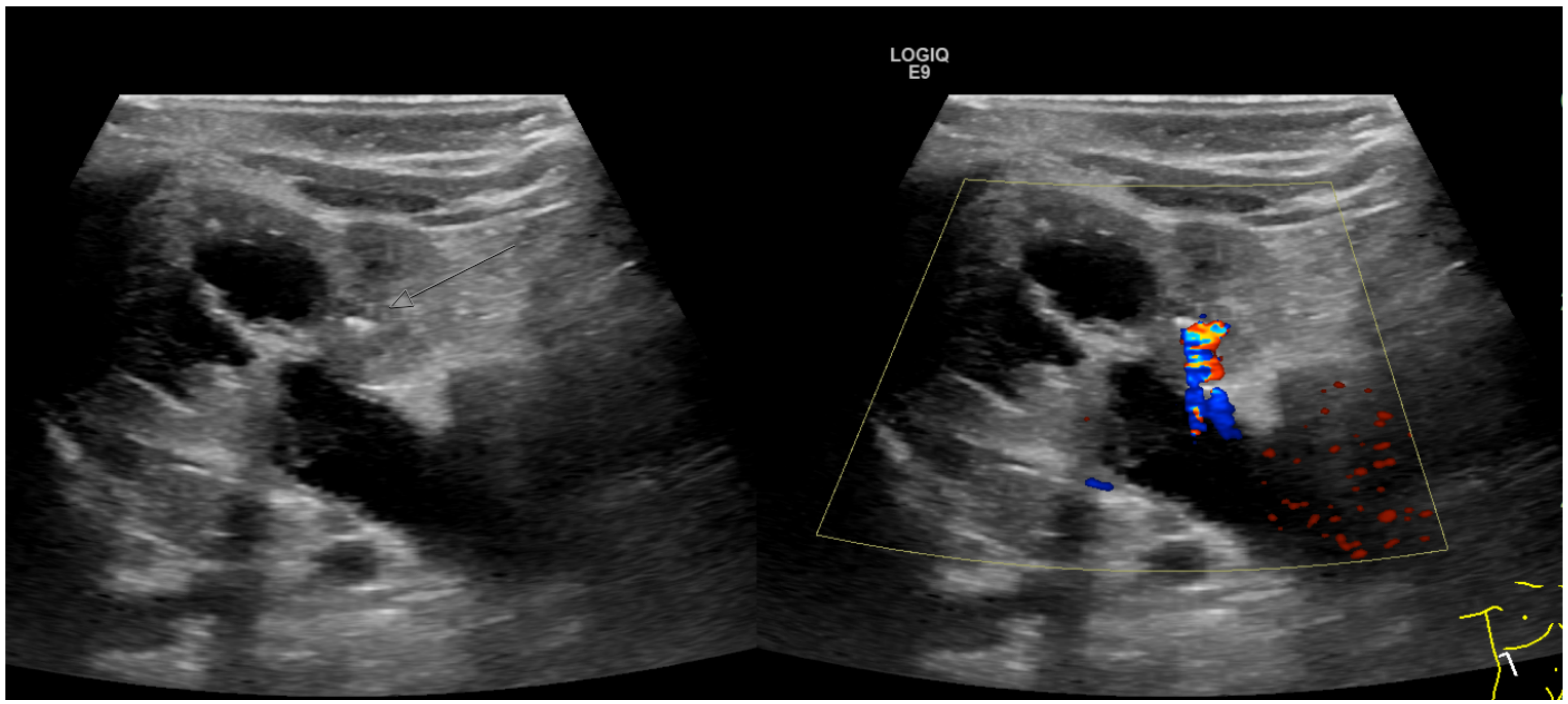


Ex premature boy
Born GA 26 w,
Now 40 W



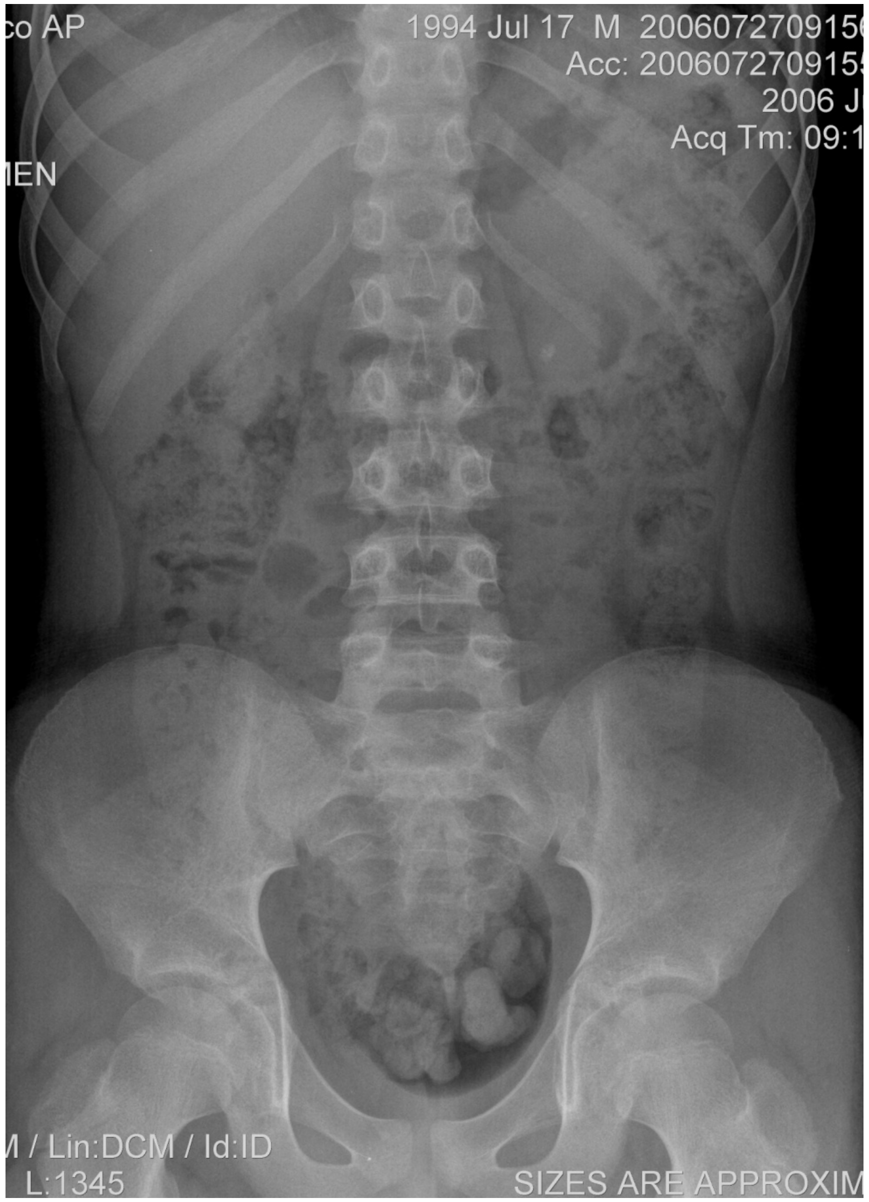
Follow-up showed large stone dissolved and now obstructive concrement in the renal pelvis.

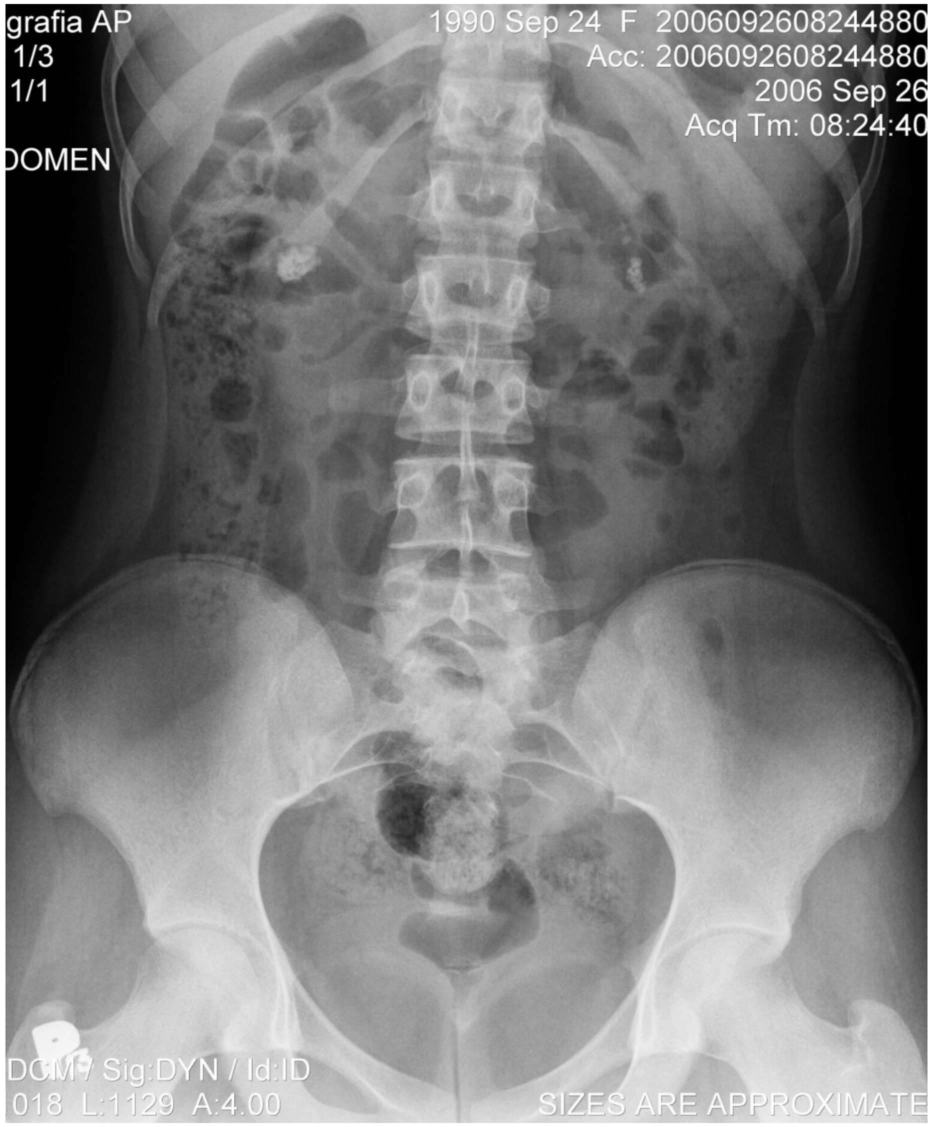
Urolithiasis, urethral valve syndrome



Ex premature boy
Born GA 26 w,
Now 40 W

Abdominal x-ray





CT

- Always after Ultrasound
- When negative ultrasound and clinically suspected calculi
- In complicated stones
- Before therapy
- Low dose protocol, no contrast needed

Table 1 Renal stone CT technique

Parameters	Siemens Force[a]	GE Optima 660[b]
• kV	• 150 a-tube/ 80 b-tube	• 80
• Reference mAs (Siemens)	• 60 a-tube/ 120 b-tube	• 40-190 mA
• Noise index (GE)	• CARE Dose 4D	• NI = 16
• Rotation time	• 0.5 s	• 0.5 s
• Acquisition	• 192 × 0.6 mm	• 40 × 0.6 mm
• Pitch	• 1.2	• 1.375
• Slice thickness	• 5 mm	• 5 mm
• Reconstruction method	• Iterative-ADMIRE (3) • Kernel - Br44	• Iterative-adaptive statistical iterative reconstruction (30%) • Kernel - standard

Pediatr Radiol (2017) 47:5–16

REVIEW

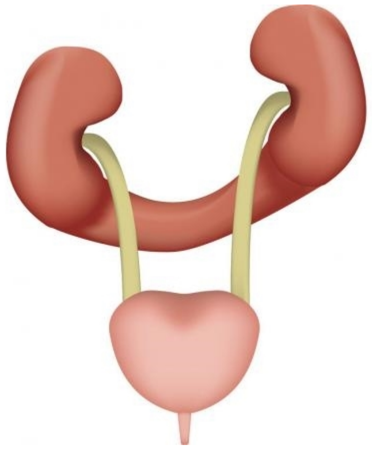
Imaging in the diagnosis of pediatric urolithiasis

Gabrielle C. Colleran[1] · Michael J. Callahan[1] · Harriet J. Paltiel[1] · Caleb P. Nelson[2] · Bartley G. Cilento Jr.[2] · Michelle A. Baum[3] · Jeanne S. Chow[1]

Drug induced urolithiasis (post diuretica)

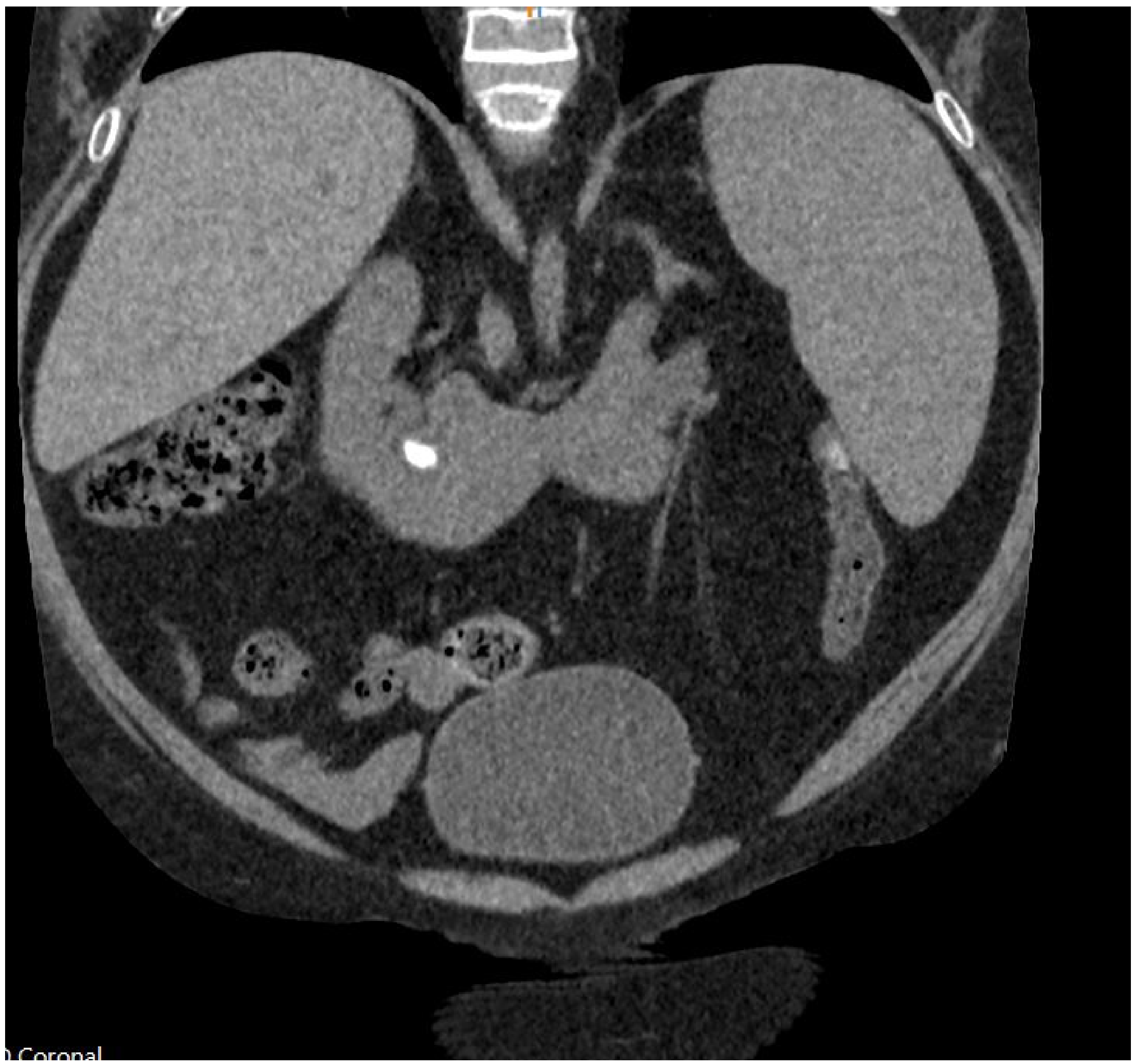
Ex premature boy
Born GA 26 w,
Now 40 W

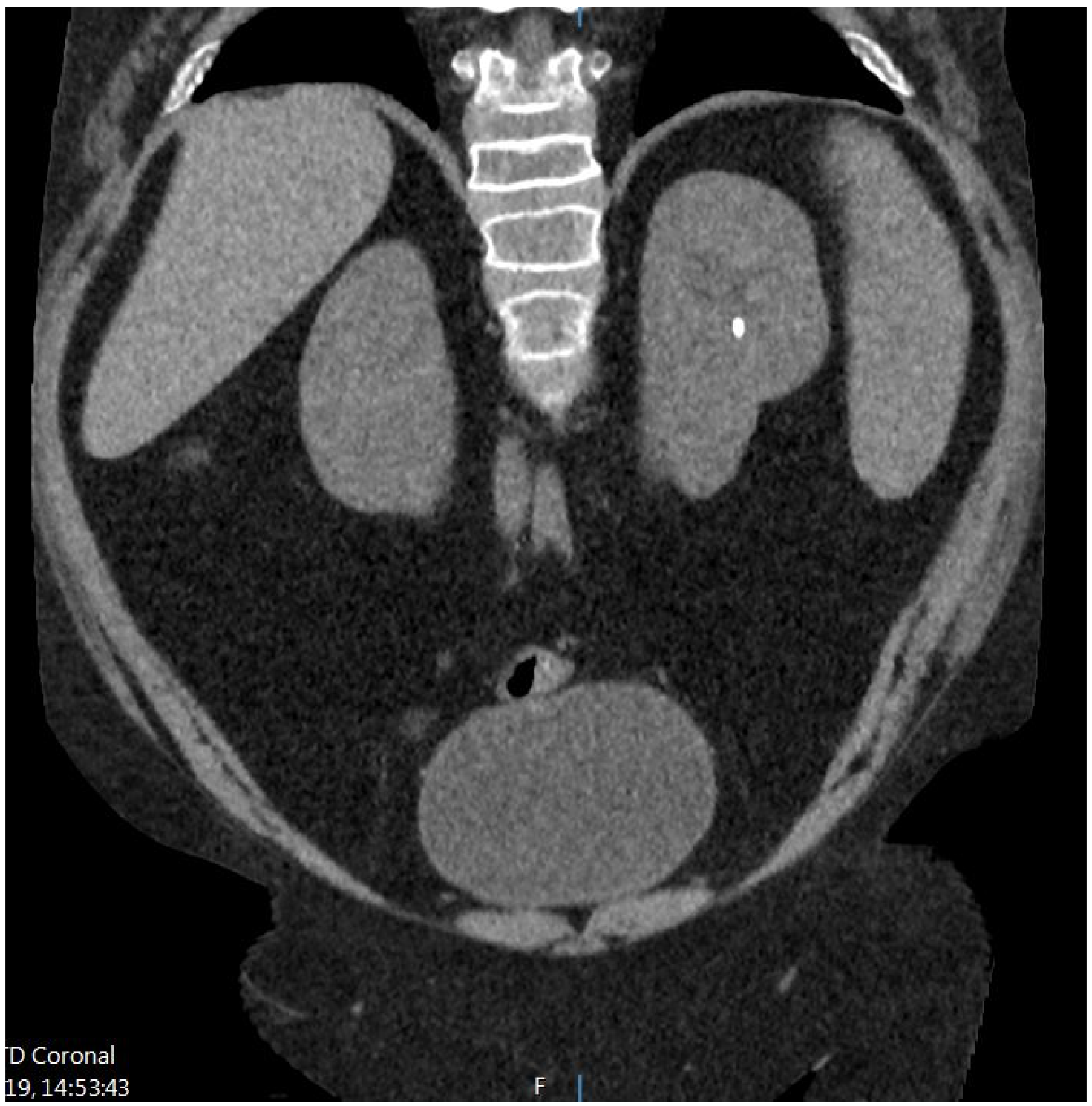
CT performed post nephrostomy and pre stone removal



CT

Boy 14
Horshoe kidney
Haematuria

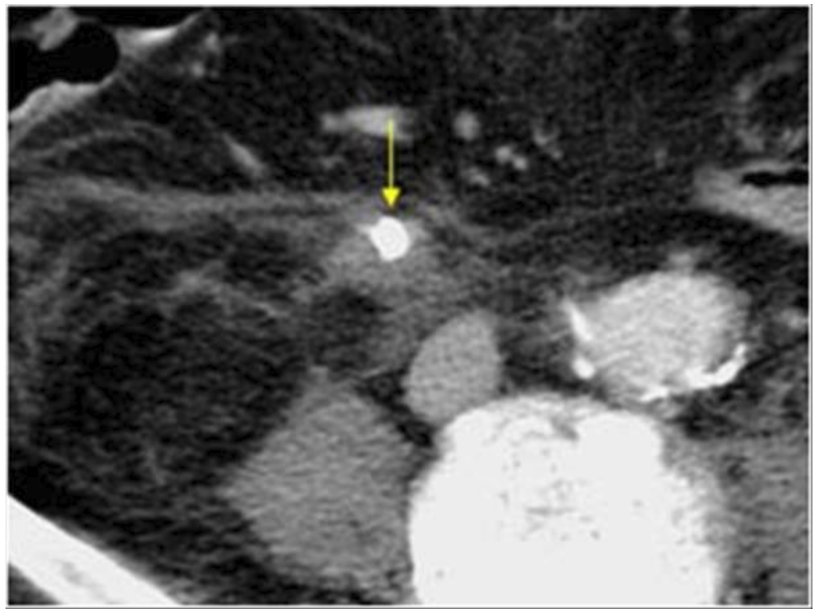


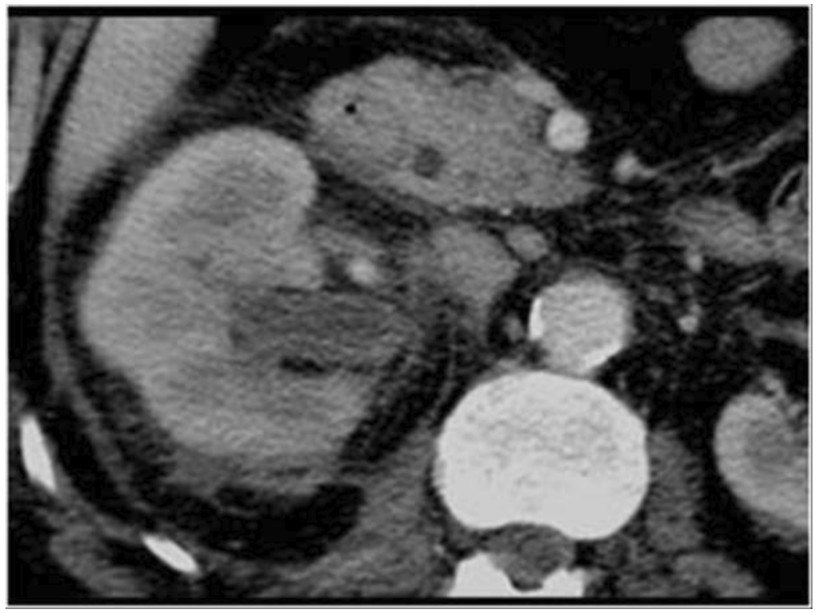


Complications of urolithiasis

- Spontaneous rupture of renal pelvis - formation of urinoma
- Recurrent urinary tract infections
- Hydroureter / hydronephrosis
- Progressive renal parenchymal damage

Patient with a duplex kidney with a calculus in the upper pole ureter causing pyelonephritis





48 TURKISH JOURNAL OF UROLOGY Turk J Urol 2016; 42(1): 48-50 • DOI: 10.5152/tud.2015.94467
PEDIATRIC UROLOGY
Case Report

Unusual complication of a urinary stone in a child: spontaneous rupture of the renal pelvis with the migration of calculus into the retroperitoneum

Hakan Taşkınlar, Doğakan Yiğit, Dinçer Avlan, Ali Naycı

Rare complications

18-month-old female with fever vomiting abdominal pain

→

US
- adrenal Tu susp

→

CT
- complex cystic mass
- contrast extravasation
- 10 mm stone formation inside

→

Perirenal urinoma - 4 weeks drainage

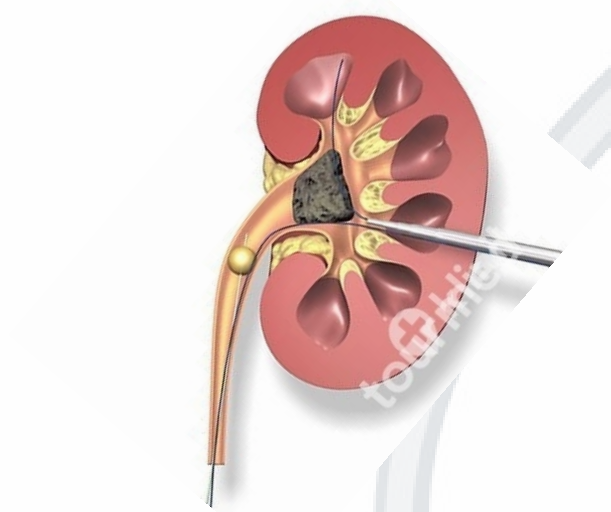
Interventional treatment

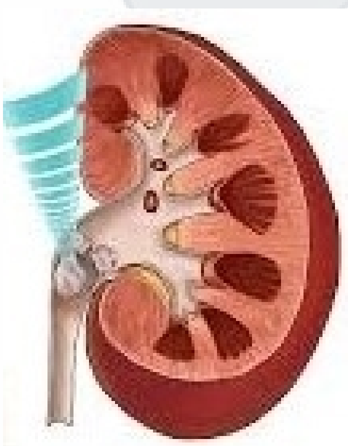
Percutaneous nephrolithotomy / nephrolithotripsy (PCNL)

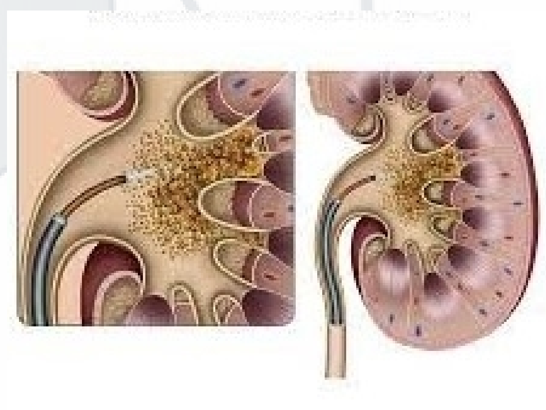
Extracorporeal shockwave lithotripsy (ESWL)

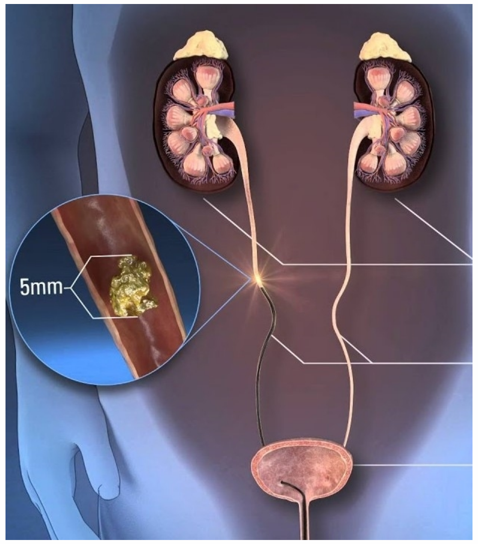
Retrograde intrarenal surgery (RIRS)

Ureteroscopy (URS)





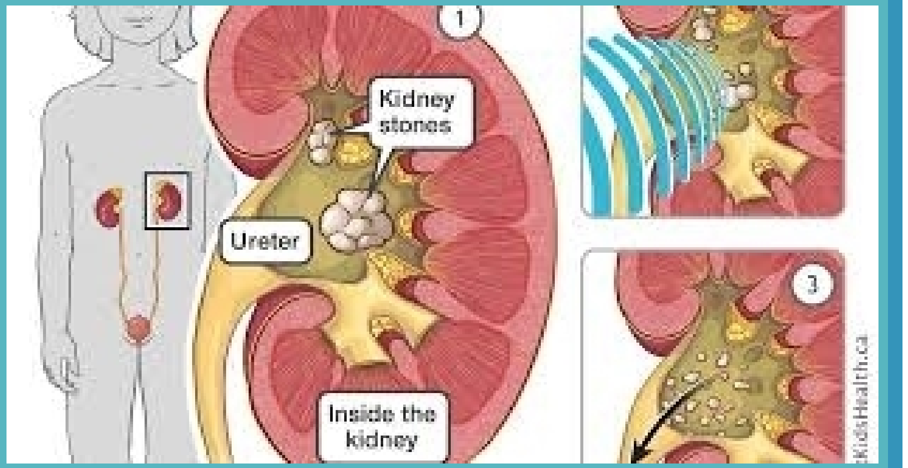




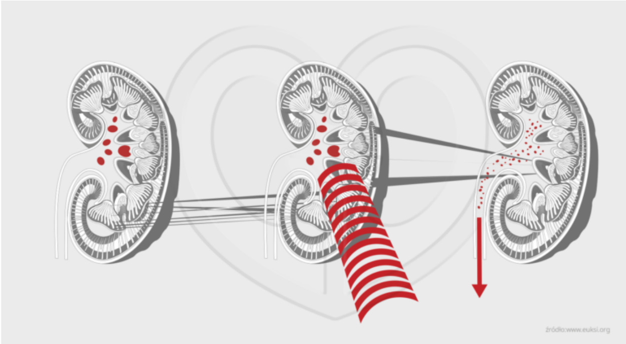
Choice of method

- Localisation of the calculi
- Size of the calculi
- Presence of anatomical variations
- Presence and intensity of clinical symptoms

ESWL Extracorporeal Schock Wave Lithotrypsy



- The least invasive of the methods
- Recommended in children due to its higher effectiveness than in adults
- Less amount of subcutaneous tissue
- Greater flexibility of the ureters



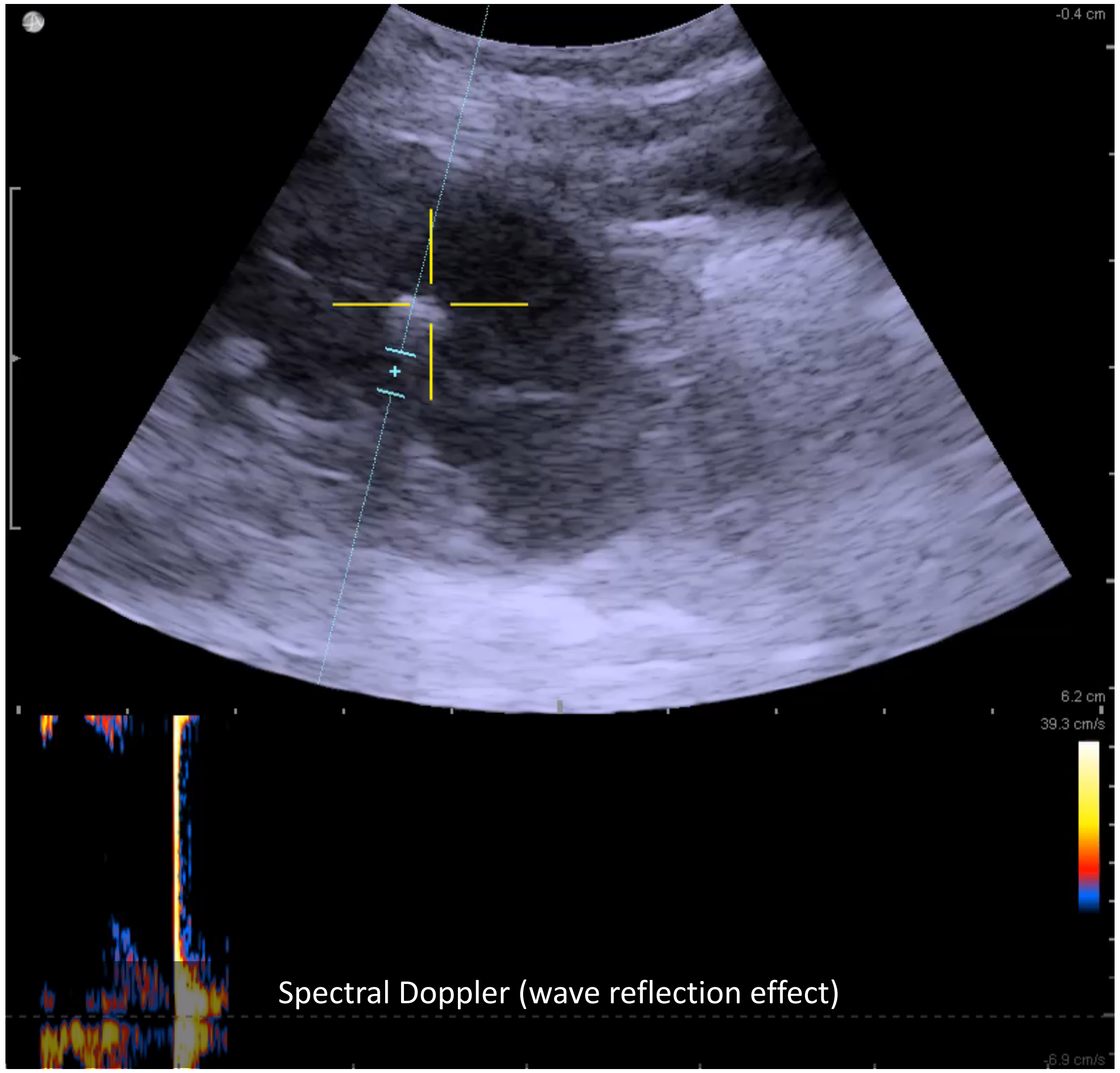
ESWL technique

An electrode placed in an aquatic environment generating a wave

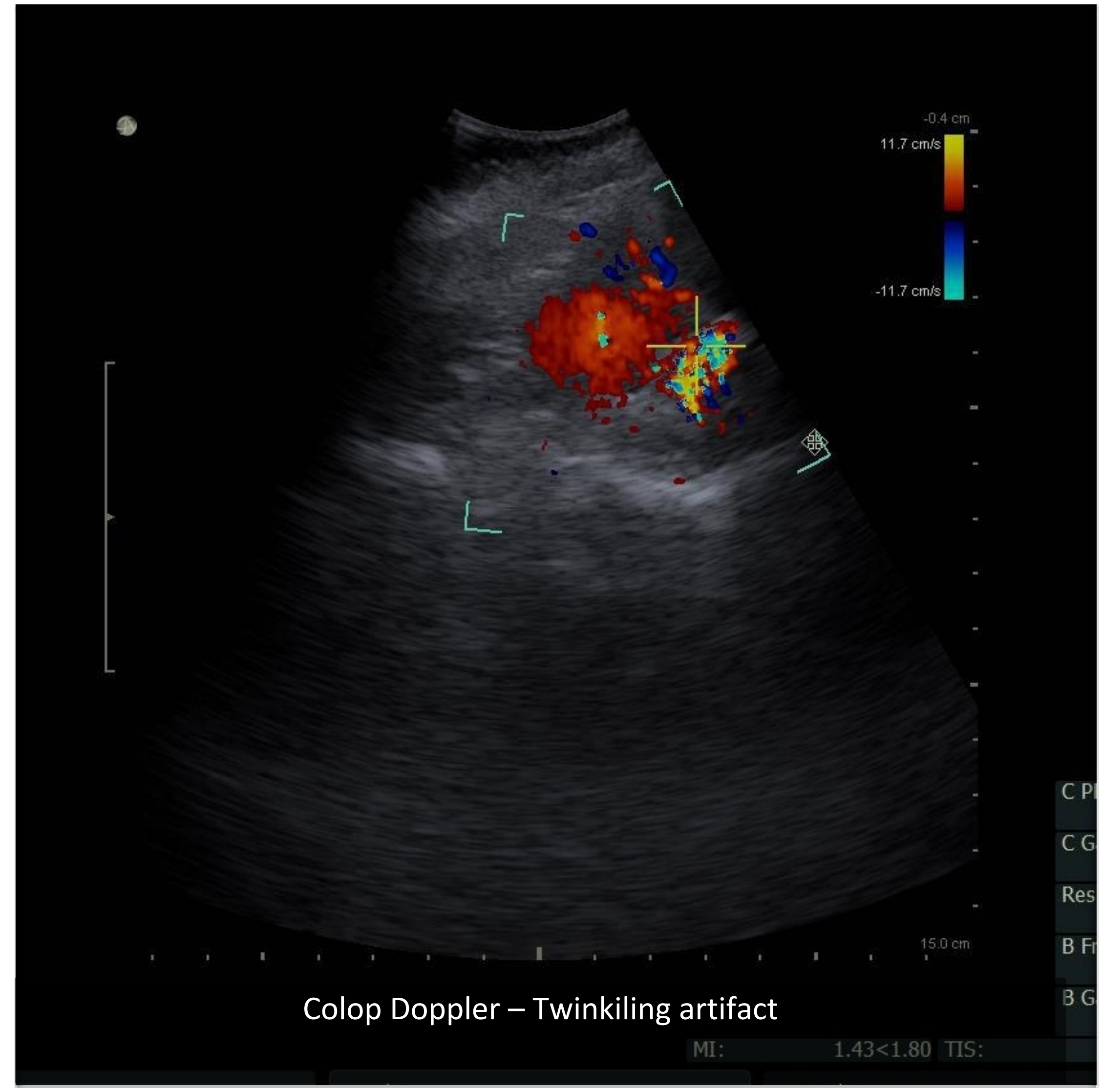
The wave passes through the patient's tissues

The focus of the wave is located on the deposit (X-ray / US) that is being crushed

Fine deposits evacuate through the urinary tract



Spectral Doppler (wave reflection effect)

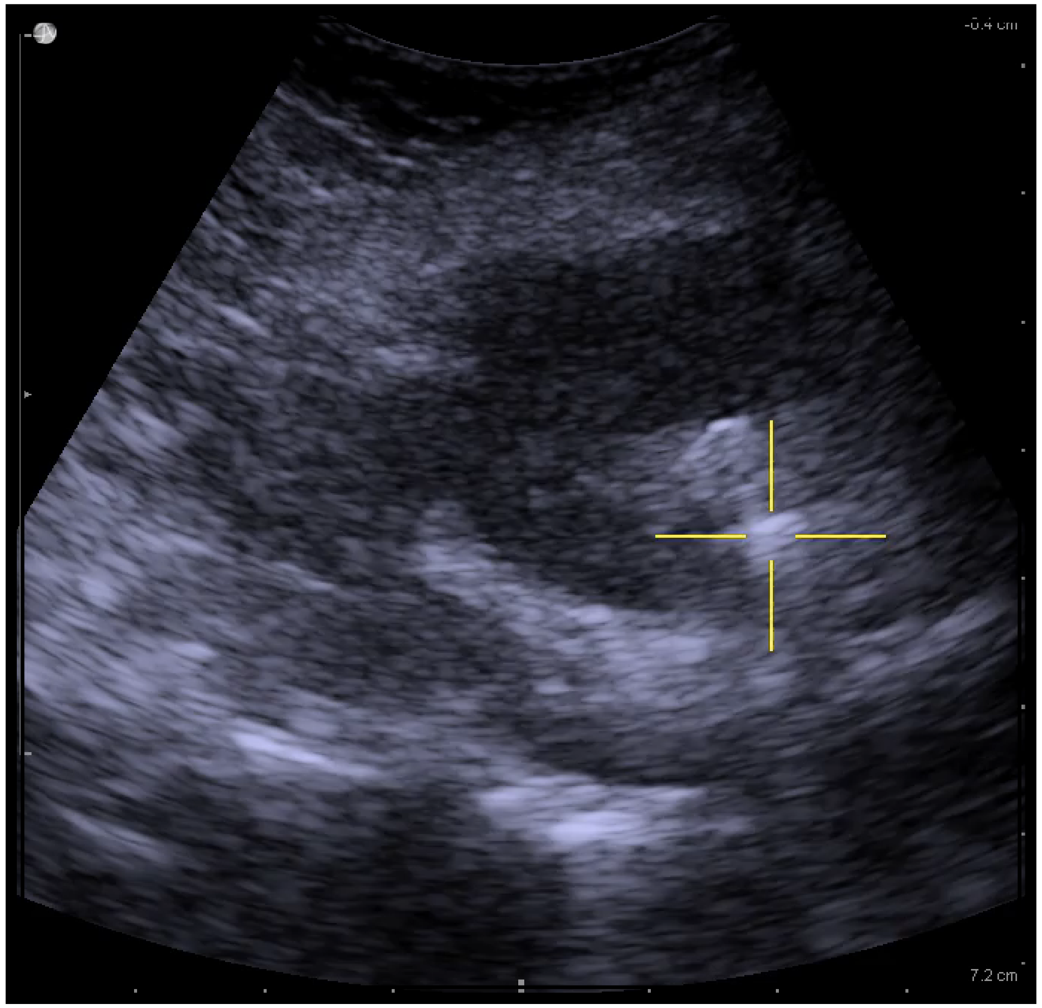


Colop Doppler – Twinkiling artifact

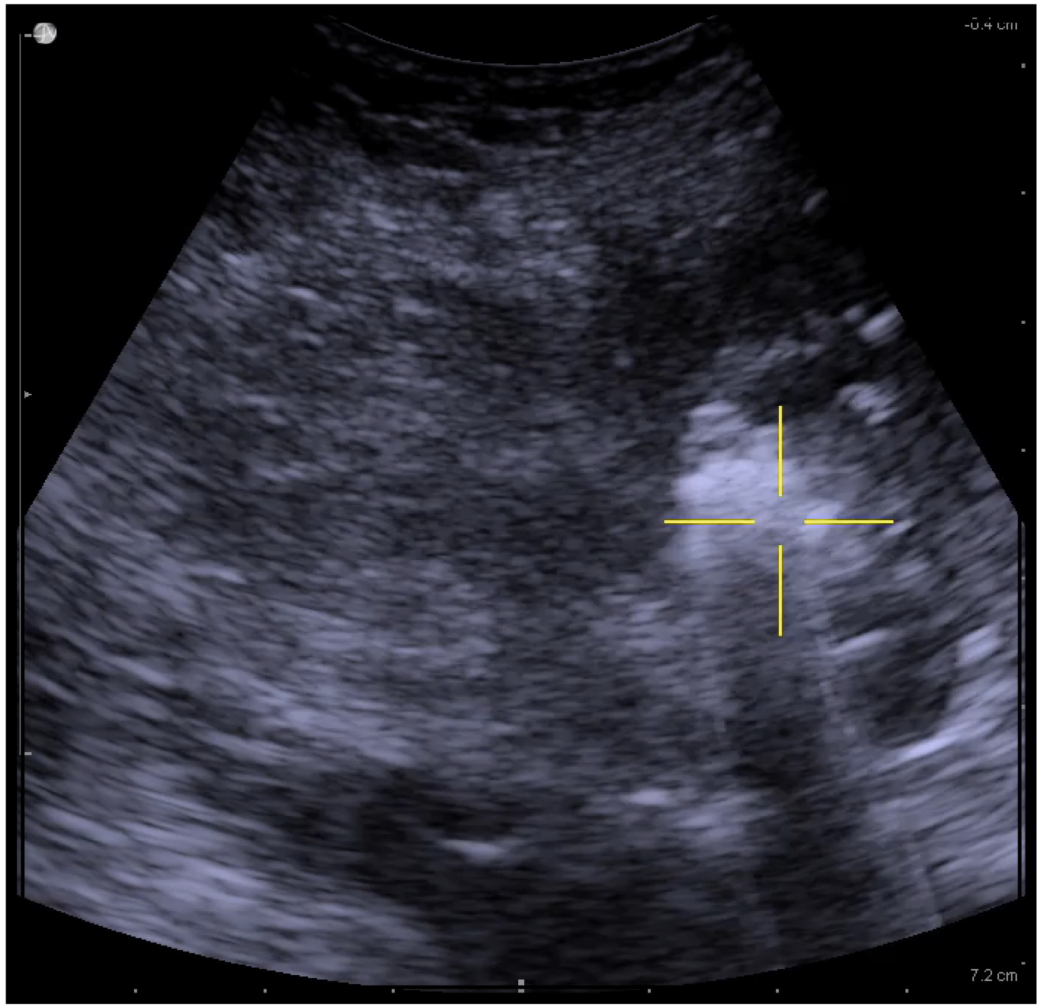
ESWL procedure

ESWL procedure

BEGINNING



END



Ultrasound guidance of ESWL

Recommended in children

Avoidance of X-rays

Location of non-shading deposits

Constant monitoring of the deposit location

Assessment of possible kidney damage

Assessment of the effectiveness of the treatment

Complications of interventional treatment

‚Steinstrasse' (stone street)

UTI

Hematoma

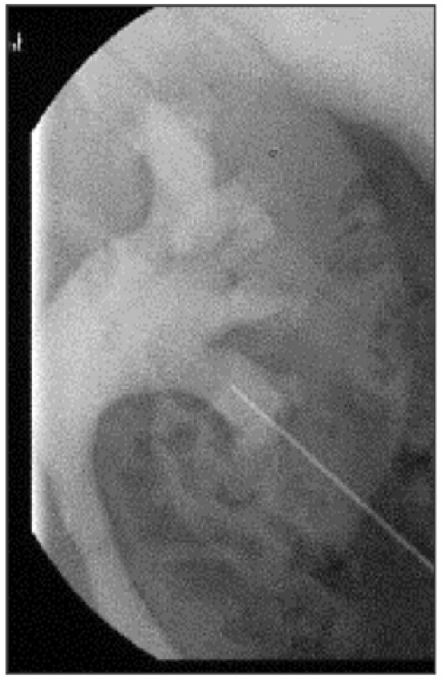
Kidney damage

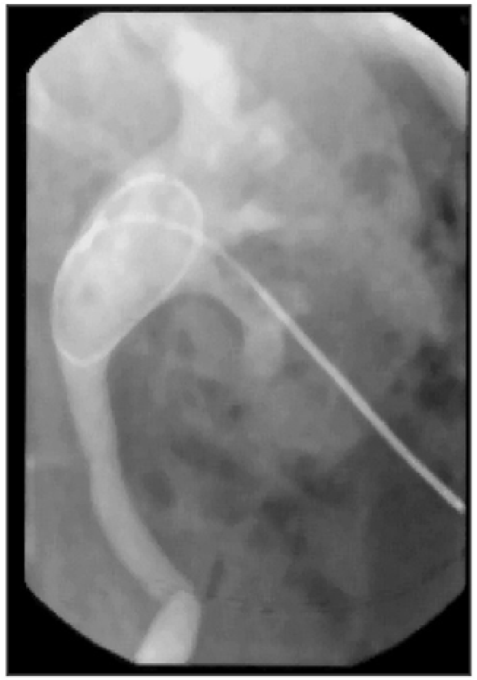
Urinoma

Hematuria

Ureteral stenosis

Interventions due to complications





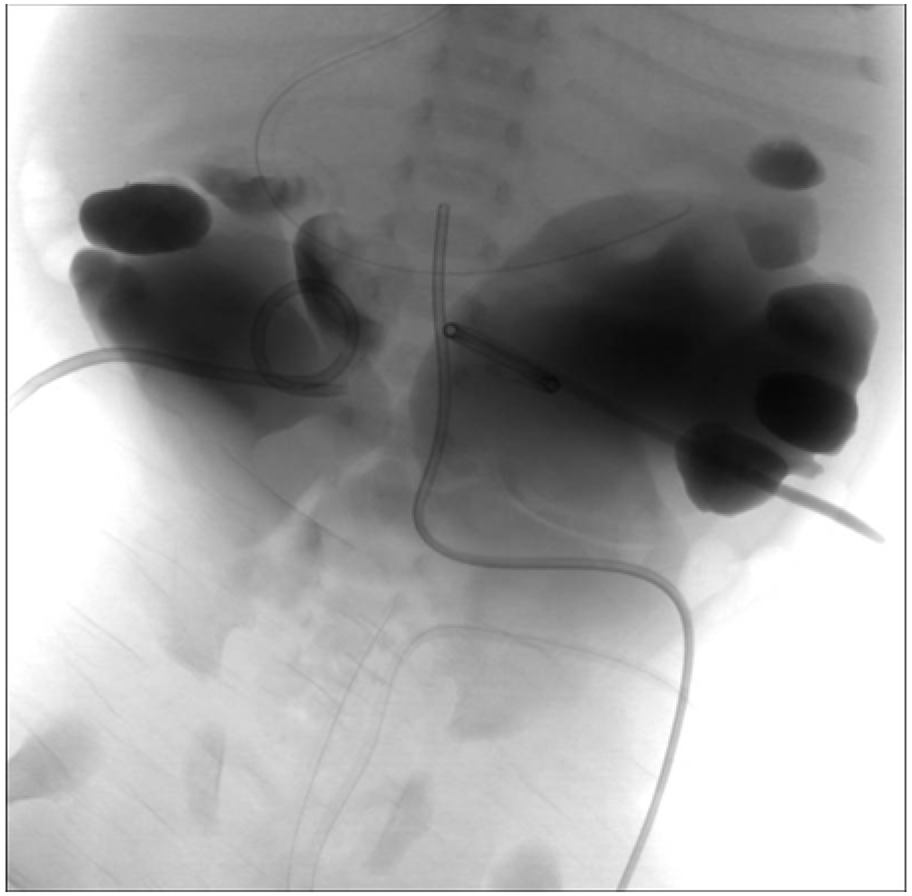
Puncture under US of the lower calyx

guide wire insertion, dilatation of the tract and positioning of the drain into the pelvis or

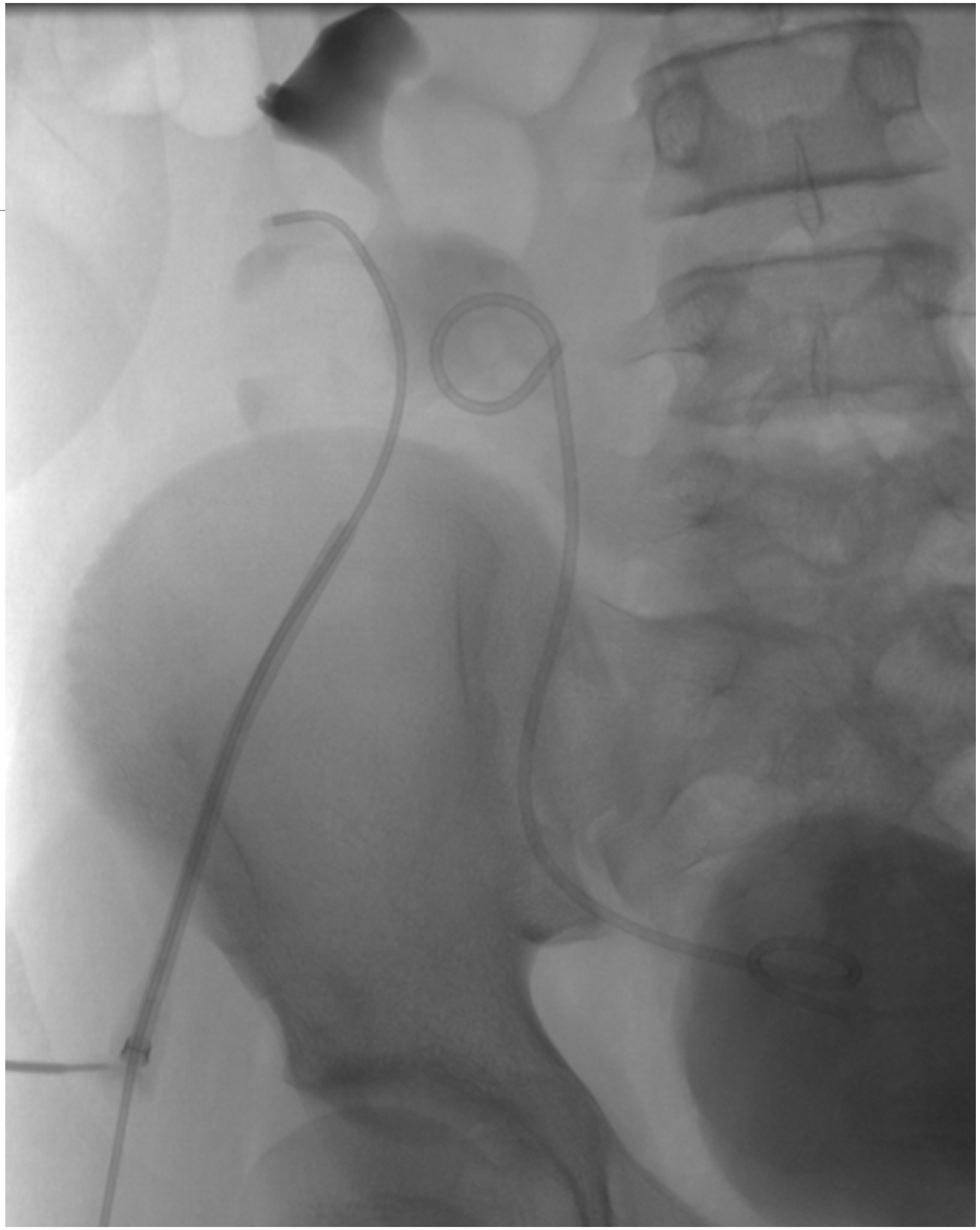
one step procedure with the drain already mounted on a needle

Double nephrostomy
for bilateral stenosis post ureteral
reimplantation.

Emergency for acute renal failure double nephrostomy in a neonate for severe congenital stenotic megaureters.



Renal graft, double J
for long stenosis
of the ureter.



Conclusions

Most clinically significant stones are seen on ultrasound

CT only in selected cases

Close collaboration with clinicians!

Special thanks

- Lil-Sofie Ording Müller, Oslo
- Philipe Petit, Marseille
- Ewa Wajszczuk, Warszawa
- Piotr Kwaśniewicz, Warszawa