

Urolithiasis

Urolithiasis is the presence of stones in the urinary tract - in the renal pelvis (*nephro-*), ureter (*uretero-*), bladder (*cysto-*) or urethra (urethrolithiasis) or stone-forming substances in the renal parenchyma (nephrocalcinosis), in our country is the most common calcium oxalate.

Pathogenesis

Crystallization and aggregation

The causes include:

- supersaturation of urine with stone-forming substances (Ca^{2+} +, urates, oxalate), supported by reduced diuresis,
- urinary incontinence (obstructive uropathy),
- changes in urine pH (incl. urea-degrading bacteria - Proteus, Pseudomonas, Klebsiella - struvite lithia),
- lack of inhibitors of crystallization and aggregation (citrate, pyrophosphates, Mg^{2+} +, glycoproteins),
- some drugs (sulfonamides, antacids).

Cystolithiasis occurs in chronic residual subvesical obstruction or neurogenic bladder.

Concretions are divided into:

- Contrast X-ray - Ca-oxalate, Ca-phosphate, struvite (MgNH_4PO_3), cystine,
- Non-contrasting X-ray - urate, xanthine.

Clinical symptoms

Urolithiasis can occur asymptotically (immobile stones).

Manifesting urolithiasis can be divided according to location into:

- nephrolithiasis - dull kidney pain (palpation, positive tapottement), ev. how many when blocking the drain,
- ureterolithiasis - renal colic with vegetative accompaniment, spread according to location (back, inner thigh),
- cystolithiasis - pain behind the buckle, polakisuria, urgency.

It is often manifested by hematuria and other complications - inflammation (pyelonephritis, cystitis).

Complications

Complications include obstruction - renal colic, hydronephrosis, infection to urosepsis, bleeding and renal insufficiency in bilateral disability.

Diagnostics

- Urine: sediment, chemically (incl. Cystine), pH, density, culture (negative with complete blockade).
- Biochemistry: Ca^{2+} +, phosphates, uricaemia, Astrup (exclusion of RTA - renal acidosis).
- Examination of concretion:
 - chemical,
 - mineralography - polarizing microscope, X-ray distraction,
 - imaging methods:
 - Ultrasound - identification of stones and dilatation of the urinary tract, so-called acoustic shadows can be seen
 - X-ray (native nephrogram, excretory urography), cystolithiasis cystography, cystoscopy,
 - spiral CT,
 - static renal function study (DMSA).
- Hypercalcaemia, hypercalciuria, hyperphosphaturia - suspected hyperparathyroidism.
- Urolithiasis with hypokalemia - suspected RTA - renal acidosis.
- Hypercalciuria - absorption type (\uparrow resorption of Ca^{2+} + from the intestine) and renal (\downarrow reverse resorption in the tubules).
- Hyperoxaluria - a disorder of intestinal fat resorption (chronic pancreatitis, obstructive jaundice).
- Hyperuricosuria - myeloproliferative diseases, disorders of purine metabolism, chemotherapy.
- Hypercystinuria - a congenital disorder of renal cystine transport.
- Hypocitration - chronic diarrhea, administration of thiazide diuretics.

Metabolic examination in urolithiasis

- Serum: urea, creatinine, uric acid, Na^{+} , K^{+} , Ca^{2+} +, Mg^{2+} +, Cl^{-} , phosphorus, glycemia, total protein, liver

- tests, cholesterol (LDL, HDL), triglycerides.
- Urine in 24 hours: volume, urine pH. Wastes in 24 hours: phosphorus, uric acid, creatinine, Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, oxalates, citrates, sulphates.
- Calculations: creatinine clearance, uric acid clearance, Ca²⁺ / creatinine ratios, Ca²⁺ / Mg²⁺.
- Proteinuria.
- Calcium-free diet followed by oral administration of 1000 mg eferv. calcium tablets

Differential diagnostics

- Pain - sudden abdominal event, biliary colic, gynecological disease.
- Hematuria - tumor, urinary tract infection, coagulopathy (warfarinization).
- Defect in the filling of the hollow system - urothelial tumor.

Treatment

- Acute renal colic:**
 - analgesics, antispasmodics, non-steroidal anti-inflammatory drugs (indomethacin National Office for Drug Control: indomethacin),
 - sufficient hydration,
 - supravesical urine derivation with signs of urinary tract infection or urosepsis.

- Chronic urolithiasis:**

- endoscopic methods,
- instrumentation - nephrostomy, ureteral probing with extraction or crushing of the stone, cystoscopy with extraction or crushing of the stone - extracorporeal shock wave lithotripsy,
- open surgery (in about 1%) - lithotomy (pyelo-, uretero-, cysto-), nephrotomy, nephrectomy,
- conservative treatment - symptomatic treatment of colic, metaphylaxis (prevention of recurrences).

- Concretion extraction** - forceps, Zeiss loop, Dormia basket.
- Concret crushing** - mechanically, ultrasound, electrohydraulic, laser, grinding.
 - Indication:

- X-ray contrast up to 2 cm made of soft material (weddellite), good anatomical conditions and outflow,
- stone over 2 cm, hard (whewellite, struvite, Ca-oxalate, urate), unfavorable anatomy and outflow (stenoses),
- Non-contrast X-ray (cannot be targeted by lithotripter), in the lower 2/3 of the ureter,
- minor asymptomatic nephrolithiasis, ureterolithiasis up to 4 mm - conservative treatment.

- Urine pH change:**
 - urate stones - alkalization of urine (sodium citrate, potassium citrate),
 - struvite stones - acidification of urine.

- Metaphylaxis:**

- non-specific - drinking and diet regime (↑ fluid intake, ↓ Ca²⁺ and salt intake, meat,...),
- specific - according to the composition of stones - most often citrates, in hyperuricaemia and urate lithiasis allopurinol.

Links

References

- KNIGHT, J, D G ASSIMOS a L EASTER, et al. Metabolism of fructose to oxalate and glycolate. *Horm Metab Res* [online]. 2010, vol. 42, no. 12, s. 868-73, dostupné také z <<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3139422/?tool=pubmed>>. ISSN 0018-5043 (print), 1439-4286.
- BARTONÍČKOVÁ, K. Urolitiáza. *Postgraduální medicína* [online]. 2006, roč. -, vol. 2, s. -, dostupné také z <<https://zdravi.euro.cz/clanek/postgradualni-medicina/urolitiaza-172263>>.