


EAU Guidelines on Urolithiasis - 2017


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Prevalence , Aetiology, Classification

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- Prevalence rates 1-20%
 - >10% high standard of life countries – Sweden, Canada, USA
 - Classification of stones according to aetiology of stone formation, stone composition (mineralogy), stone size, stone location and X-ray characteristics
 - recurrence risk basically determined by the disease or disorder causing the stone formation

Aetiology classification

Table 3.1.1: Stones classified by aetiology*

Non-infection stones
Calcium oxalate
Calcium phosphate
Uric acid
Infection stones
Magnesium ammonium phosphate
Carbonate apatite
Ammonium urate
Genetic causes
Cystine
Xanthine
2,8-Dihydroxyadenine
Drug stones

**See Section 4.4.2*

Risk groups for stone formation

Table 3.1.3: High-risk stone formers [14-25]

General factors
Early onset of urolithiasis (especially children and teenagers)
Familial stone formation
Brushite-containing stones ($\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$)
Uric acid and urate-containing stones
Infection stones
Solitary kidney (the kidney itself does not particularly increase the risk of stone formation, but prevention of stone recurrence is of more importance)
Diseases associated with stone formation
Hyperparathyroidism
Metabolic syndrome
Nephrocalcinosis
Polycystic kidney disease (PKD)
Gastrointestinal diseases (i.e., jejunio-ileal bypass, intestinal resection, Crohn's disease, malabsorptive conditions, enteric hyperoxaluria after urinary diversion) and bariatric surgery [20]
Sarcoidosis
Spinal cord injury, neurogenic bladder
Genetically determined stone formation
Cystinuria (type A, B and AB)
Primary hyperoxaluria (PH)
Renal tubular acidosis (RTA) type I
2,8-Dihydroxyadeninuria
Xanthinuria
Lesch-Nyhan syndrome
Cystic fibrosis
Drug-induced stone formation (see Table 4.11)
Anatomical abnormalities associated with stone formation
Medullary sponge kidney (tubular ectasia)
Ureteropelvic junction (UPJ) obstruction
Calyceal diverticulum, calyceal cyst
Ureteral stricture
Vesico-uretero-renal reflux
Horseshoe kidney
Ureterocele
Environmental factors
Chronic lead exposure

Diagnostic Evaluation

- ▶ Ultrasound (US) should be used as the primary diagnostic imaging tool, although pain relief, or any other emergency measures should not be delayed by imaging assessments

Recommendation	LE	GR
With fever or solitary kidney, and when diagnosis is doubtful, immediate imaging is indicated.	4	A*

**Upgraded following panel consensus.*



Patients with acute flank pain/suspected ureteral stones

Recommendation	LE	GR
Following initial ultrasound assessment, use non-contrast-enhanced computed tomography to confirm stone diagnosis in patients with acute flank pain, as it is superior to intravenous urography.	1a	A

When stones are absent, the cause of abdominal pain should be identified.

Patients with renal stones

Recommendations	LE	GR
Perform a contrast study if stone removal is planned and the anatomy of the renal collecting system needs to be assessed.	3	A*
Use enhanced computed tomography in complex cases because it enables 3D reconstruction of the collecting system, as well as measurement of stone density and skin-to-stone distance. Intravenous urography may also be used.	2a	C

**Upgraded based on panel consensus.*

Basic laboratory analysis - emergency urolithiasis patients

Recommendations	GR
Urine	
Dipstick test of spot urine sample	A*
<ul style="list-style-type: none">• red cells• white cells• nitrite• approximate urine pH	A
Urine microscopy and/or culture	
Blood	
Serum blood sample	A*
<ul style="list-style-type: none">• creatinine• uric acid• (ionised) calcium• sodium• potassium	
Blood cell count	
<ul style="list-style-type: none">• C-reactive protein (CRP)	
Perform a coagulation test (partial thromboplastin time [PTT] and international normalised ratio [INR]) if intervention is likely or planned.	A*

**Upgraded based on panel consensus.*

Only patients at high risk for stone recurrence should undergo a more specific analytical programme

Stone analysis

Recommendations	LE	GR
Perform stone analysis in first-time formers using a valid procedure (X-ray diffraction or infrared spectroscopy).	2	A
Repeat stone analysis in patients: <ul style="list-style-type: none">• presenting with recurrent stones despite drug therapy;• with early recurrence after complete stone clearance;• with late recurrence after a long stone-free period because stone composition may change.	2	B

Disease Management

Renal colic

Recommendations

Provide immediate pain relief in acute stone episodes.

GR

A

Whenever possible, offer a non-steroidal anti-inflammatory as the first drug of choice. e.g. metamizol (dipyrone); alternatively, depending on cardio-vascular risk factors, diclofenac*, indomethacin or ibuprofen**.

A

Offer hydromorphone, pentazocine or tramadol as a second choice.

C

Summary of evidence

Administration of daily α -blockers seems to reduce colic episodes, although controversy remains in the published literature.

LE

1b

For symptomatic ureteral stones, urgent stone removal as first-line treatment is a feasible option in selected cases (see text).

1b



Sepsis/anuria

Recommendations	LE	GR
Urgently decompress the collecting system in case of sepsis with obstructing stones, using percutaneous drainage or ureteral stenting.	1b	A
Delay definitive treatment of the stone until sepsis is resolved.	1b	A

Renal stones - Conservative treatment (Observation)

Recommendations	GR
Follow-up periodically in cases where renal stones are not treated (initially after six months and then yearly, evaluating symptoms and stone status [either by ultrasound, kidney-ureter-bladder radiography or computed tomography]).	A*
Offer active treatment for renal stones in case of stone growth, <i>de novo</i> obstruction, associated infection, and acute and/or chronic pain.	C
Assess comorbidity, stone composition if possible, and patient preference when making treatment decisions.	C

**Upgraded based on panel consensus.*

Renal stones - Conservative treatment (Oral chemolysis)

- Stones composed of uric acid
- based on alkalinisation of urine by application of alkaline citrate or sodium bicarbonate

Recommendations	GR
Inform the patient how to modify the dosage of alkalinising medication according to urine pH, which is a direct consequence of such medication.	A
Inform the patient how to monitor urine pH by dipstick three times a day (at regular intervals). Morning urine must be included.	A
Carefully monitor radiolucent stones during/after therapy.	A*
Inform the patient of the significance of compliance.	A

**Upgraded based on panel consensus.*



Kidney stones – indications of active removal

3.4.2.2 *Indication for active stone removal of renal stones [240]*

- stone growth;
- stones in high-risk patients for stone formation;
- obstruction caused by stones;
- infection;
- symptomatic stones (e.g., pain or haematuria);
- stones > 15 mm;
- stones < 15 mm if observation is not the option of choice.
- patient preference;
- comorbidity;
- social situation of the patient (e.g., profession or travelling);
- choice of treatment.



Shock wave lithotripsy

- Contraindications
 - 1) pregnancy, due to the potential effects on the foetus
 - 2) bleeding diatheses, which should be compensated for at least 24 hours before and 48 hours after treatment
 - 3) uncontrolled UTIs
 - 4) severe skeletal malformations and severe obesity, which prevent targeting of the stone
 - 5) arterial aneurysm in the vicinity of the stone
 - 6) anatomical obstruction distal to the stone.

Shock wave lithotripsy

Summary of evidence

Stepwise power ramping prevents renal injury.

Clinical experience has shown that repeat sessions are feasible (within one day for ureteral stones).

Optimal shock wave frequency is 1.0 to 1.5Hz.

LE

1b

4

1a

Recommendation

Ensure correct use of the coupling agent because this is crucial for effective shock wave transportation.

LE

2a

GR

B

Recommendation

Maintain careful fluoroscopic and/or ultrasonographic monitoring during shock wave lithotripsy.

LE

3

GR

A*

**Upgraded based on panel consensus.*

Recommendation

Use proper analgesia because it improves treatment results by limiting pain-induced movements and excessive respiratory excursions.

LE

4

GR

C

SWL - Complications

Table 3.4.1: Shock wave lithotripsy-related complications [120, 175-188]

Complications			%	Ref.
Related to stone fragments	Steinstrasse		4 - 7	[120, 175, 176]
	Regrowth of residual fragments		21 - 59	[177, 178]
	Renal colic		2 - 4	[179]
Infectious	Bacteriuria in non-infection stones		7.7 - 23	[177, 180]
	Sepsis		1 - 2.7	[177, 180]
Tissue effect	Renal	Haematoma, symptomatic	< 1	[181]
		Haematoma, asymptomatic	4 - 19	[181]
	Cardiovascular	Dysrhythmia	11 - 59	[177, 182]
		Morbid cardiac events	Case reports	[177, 182]
	Gastrointestinal	Bowel perforation	Case reports	[183-185]
		Liver, spleen haematoma	Case reports	[15-188]



Percutaneous nephrolithotomy (PNL)

standard procedure for large renal calculi

- Contraindications

1. untreated UTI
2. tumour in the presumptive access tract area
3. potential malignant kidney tumour
4. pregnancy

Percutaneous nephrolithotomy (PNL)

Recommendation

Use ultrasonic, ballistic and holmium: yttrium-aluminium-garnet devices for intracorporeal lithotripsy during percutaneous nephrolithotomy.

GR

A*

**Upgraded based on panel consensus.*

Recommendation

Perform pre-procedural imaging, including contrast medium where possible or retrograde study when starting the procedure, to assess stone comprehensiveness and anatomy of the collecting system to ensure safe access to the renal stone.

GR

A*

**Upgraded based on panel consensus.*

Recommendation

In uncomplicated cases, perform a tubeless (without nephrostomy tube) or totally tubeless (without nephrostomy tube and ureteral stent) percutaneous nephrolithotomy procedure as it is a safe alternative.

LE

1b

GR

A

Percutaneous nephrolithotomy (PNL)

Table 3.4.2: Complications following percutaneous nephrolithotomy [216]

Complications	Trans-fusion	Embolisation	Urinoma	Fever	Sepsis	Thoracic complication	Organ injury	Death	LE
(Range)	(0-20%)	(0-1.5%)	(0-1%)	(0-32.1%)	(0.3-1.1%)	(0-11.6%)	(0-1.7%)	(0-0.3%)	1a
N = 11,929	7%	0.4%	0.2%	10.8%	0.5%	1.5%	0.4%	0.05%	

Ureterorenoscopy for renal stones

Recommendation

Use flexible ureterorenoscopy in case percutaneous nephrolithotomy or shock wave lithotripsy are not an option (even for stones > 2 cm). However, in that case there is a higher risk that a follow-up procedure and placement of a ureteral stent may be needed. In complex stone cases, use open or laparoscopic approaches as possible alternatives.

GR

B

Recommendations

Offer laparoscopic or open surgical stone removal in rare cases in which shock wave lithotripsy, (flexible) ureterorenoscopy and percutaneous nephrolithotomy fail, or are unlikely to be successful.

When expertise is available, perform surgery laparoscopically before proceeding to open surgery, especially when the stone mass is centrally located.

LE

3

GR

C

3

C

Ureteral stones - Conservative treatment/observation


Recommendations	LE	GR
In patients with newly diagnosed small* ureteral stones, if active stone removal is not indicated, observe patient initially along with periodic evaluation.	1a	A
Offer patients appropriate medication to facilitate stone passage during observation.		

Medical expulsive therapy

Recommendations	LE	GR
Select patients for an attempt at spontaneous passage or medical expulsive therapy (MET), based on well-controlled pain, no clinical evidence of sepsis, and adequate renal functional reserve.	4	C
Offer α -blockers as MET as one of the treatment options, in particular for (distal) ureteral stones > 5 mm.	1a	A
Counsel patients regarding the controversies in the literature, attendant risks of MET, including associated drug side effects. Inform the patient that α -blockers as MET are administered off-label ^{†**} .	1b	A*
Follow-up patients in short intervals to monitor stone position and assess for hydronephrosis.	4	A*



Ureteral stones – indications of active removal

- stones with a low likelihood of spontaneous passage
 - persistent pain despite adequate analgesic medication
 - persistent obstruction
 - renal insufficiency (renal failure, bilateral obstruction, or single kidney).
- 

Ureteral stones - URS

- URS can be performed in all patients without any specific contraindications

Recommendations	LE	GR
Do not perform stone extraction using a basket without endoscopic visualisation of the stone (blind basketing).	4	A*
Use holmium: yttrium-aluminium-garnet laser lithotripsy for flexible ureterorenoscopy.	3	B

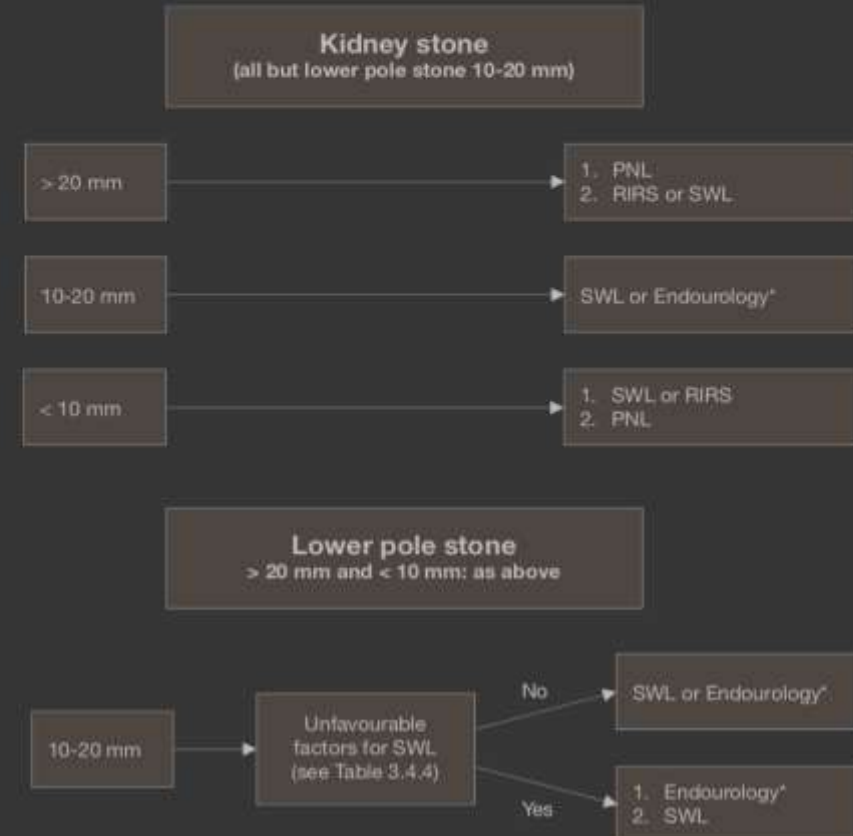
**Upgraded following panel consensus.*

Kidney stones

3.4.2.3.3 Recommendations for the selection of procedures for active removal of renal stones

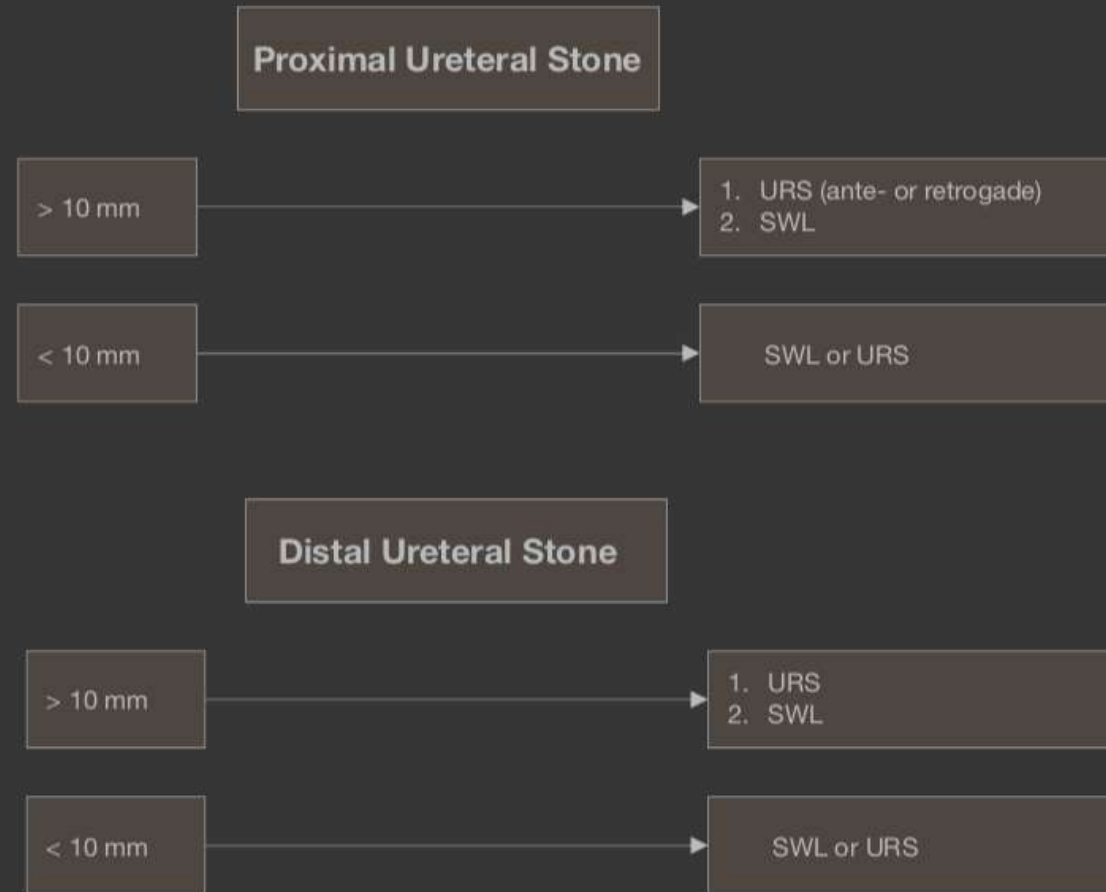
Recommendations	GR
Offer shock wave lithotripsy (SWL) and endourology (percutaneous nephrolithotomy [PNL], retrograde renal surgery [RIRS]) as treatment options for stones < 2 cm within the renal pelvis and upper or middle calices.	B
Perform PNL as first-line treatment of larger stones > 2 cm.	B
In case PNL is not an option, treat larger stones (> 2 cm) with flexible ureterorenoscopy or SWL. However, in such instances there is a higher risk that a follow-up procedure and placement of a ureteral stent may be needed.	B
For the lower pole, perform PNL or RIRS, even for stones > 1 cm, as the efficacy of SWL is limited (depending on favourable and unfavourable factors for SWL).	B

Figure 3.4.1: Treatment algorithm for renal calculi



Ureteral stones

Figure 3.4.2: Treatment algorithm for ureteral calculi (if indicated for active stone removal) (GR: A*)





Ευχαριστώ