Surgical Management of Pediatric Urolithiasis

M.M.Hosseini,M.D.

Shiraz University of Medical Sciences

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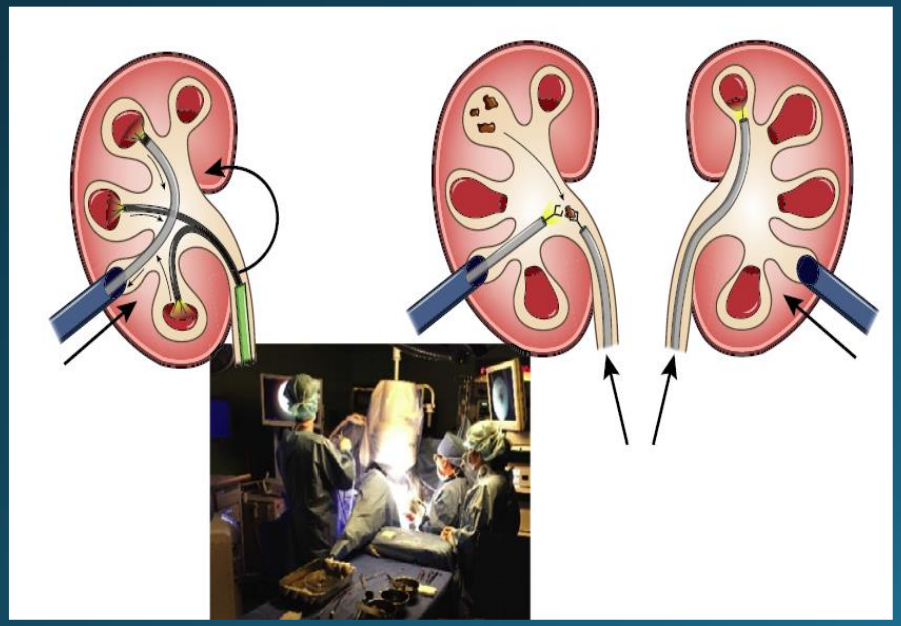


Surgical Management

- **Options for Surgical Management**
- Up to 60% of children with kidney or ureteral stones require surgery.
- URS, SWL, PCNL
- ***All of which require anesthesia and radiation exposure.***

- **Stone clearance ranging** :
- 70%–97% for PCNL,
- 85%–88% for URS,
- and 80%–83% for SWL.

- **choice of intervention** :
- size and location of the stone, patient anatomy, and patient (provider) preference

- **Radiation Risks Associated with Surgical Management**

- Exposed during diagnostic evaluation, operative treatment, and for surveillance after surgery.
- Cumulative radiation exposure
- Ultrasound for URS, SWL, and PCNL

- **Reduce radiation exposure:**
- Reduce fluoroscopy time, improve skin-to-image intensifier distance, and increase utilization of appropriate dose settings for children

- **Surgical Antibiotic Prophylaxis**

- In all patients undergoing URS or PCNL and for patients undergoing SWL who are at increased risk for infection.

- A urine culture should be obtained before all upper tract procedures

- Patients undergoing percutaneous procedures, patients with high-grade obstruction, or patients with an indwelling stent are at increased risk of urosepsis.

• ***Shock Wave Lithotripsy***

- A treatment option for upper tract calculi 15 mm or smaller
- Efficacy ranges from 68%–84%
- Stone clearance in children with a history of a urologic anomaly or urinary tract reconstruction is low.

Stone size

- Clearance is lower than PCNL for renal stones greater than 20 mm

Stone composition (cysteine/ ca-ph MH stones)

- **Stone location**
- Stone clearance for lower pole stones range from 56% to 61% with retreatment rates of 40%.

- **SWL failure**
- Mean stone burden, increased infundibular length, and an infundibulopelvic angle greater than 45 degrees.

- **Side effects**
- ***Hematuria*** and subcapsular or perirenal hematoma.
- Intermittent renal *colic*, emergency department visits for pain control, and ***steinstrasse*** and **hypertension**.

Ureteroscopy

- Stone clearance with this technique in children exceeds 85% with complication rates similar to the adult population.
- Routine "pre-stenting" before URS is not recommended.
- The complications of URS:
- ureteral injury, urinary tract infection, and bleeding.
- Serious complications (unrecognized ureteral injury, including mucosal flaps and tear, perforation, false passage, and partial to complete ureteral avulsion) are uncommon.
- Should a ureteral injury occur, the procedure should be aborted, and a ureteral stent should be placed.

PCNL

Stone clearances : 90%

Miniaturization of access sheaths and nephroscopes

- Both SWL and PCNL are options for children with renal stones greater than 20 mm.
- PCNL is technically challenging.
- ***CT before PCNL is recommended***.
- Any alteration in renal anatomy should also be considered.
- **The risks associated with PCNL**
- Bleeding , delayed renal hemorrhage , sepsis, pneumothorax, hemothorax, urothorax, incomplete stone clearance, and ***injuries to adjacent organs***.

- *UTI should be treated before PCNL.*
- *The indications for sandwich therapy are limited.*
- *Complication after PCNL (15% to 39%)*
- *1%–16% of these complications are major.*
- *Transfusion was associated with operative time, sheath & stone size.*
- *The most significant determinants affecting complication rates are operative time, sheath size, mid calyceal puncture, and partial staghorn formation.*

- ***PCNL has not been shown to cause loss of kidney function or scarring.***

- Should significant bleeding occur, the operation should be aborted, and either a Foley catheter or reentry catheter should be Placed.

- Should a renal pelvis injury occur, the operation should be stopped, and an
- antegrade ureteral stent should be placed, if feasible.

- Treatment of known complications of PCNL in children, including hydrothorax, colonic injury, and postoperative bleeding, is similar to adults.

Laparoscopic and Robotic-Assisted Pyelolithotomy

- These surgeries ***are not indicated*** for upper tract stones in pediatric patients with normal urinary tract anatomy.

- The primary exception to this is in children or adolescents with renal or ureteral stones and a *coexisting anatomic anomaly, such as ureteropelvic junction obstruction.*

Indication for active stone removal and selection of procedure Ureter:

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

- *The suspected stone composition might influence the choice of treatment modality.*

Indication for active kidney stone removal:

- *stone growth;*
- *stones in high-risk patients for stone formation;*
- *obstruction caused by stones;*
- *infection;*
- *symptomatic stones (e.g., pain, 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).*
- *The suspected stone composition influence the choice of treatment modality.*

AUA/Endourology Society Guideline

Treatment for pediatric patients with ureteral or renal stones:

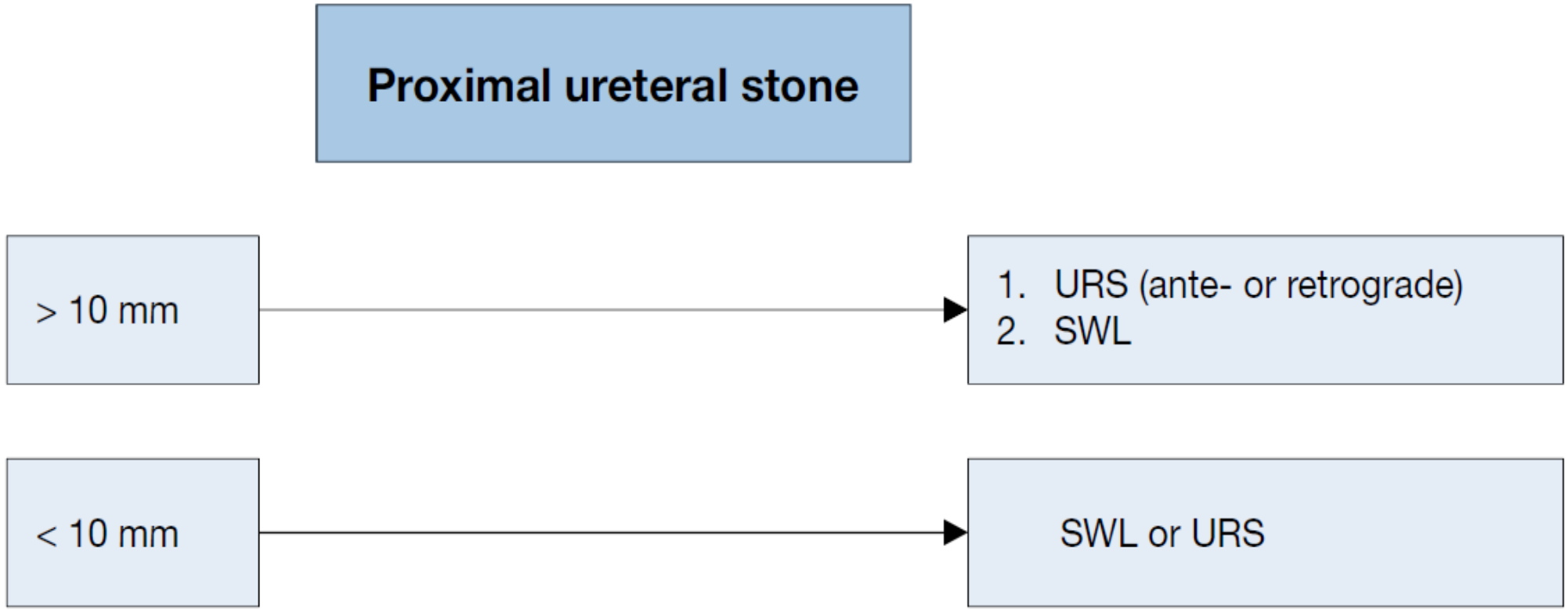
46. In pediatric patients with uncomplicated ureteral stones ≤10 mm, clinicians should offer observation with or without MET using α-blockers. (Index Patient 13) *Moderate Recommendation; Evidence Level Grade B*
47. Clinicians should offer URS or SWL for pediatric patients with ureteral stones who are unlikely to pass the stones or who failed observation and/or MET, based on patient-specific anatomy and body habitus. (Index Patient 13) *Strong Recommendation; Evidence Level Grade B*
48. Clinicians should obtain a low-dose CT scan on pediatric patients prior to performing PCNL. (Index Patient 13) *Strong Recommendation; Evidence Level Grade C*
49. In pediatric patients with ureteral stones, clinicians should not routinely place a stent prior to URS. (Index Patient 13) *Expert Opinion*
50. In pediatric patients with a total renal stone burden ≤20mm, clinicians may offer SWL or URS as first -line therapy. (Index Patient 14) *Moderate Recommendation; Evidence Level Grade C*
51. In pediatric patients with a total renal stone burden >20mm, both PCNL and SWL are acceptable treatment options. If SWL is utilized, clinicians should place an internalized ureteral stent or nephrostomy tube. (Index Patient 14) *Expert Opinion*
52. In pediatric patients, except in cases of coexisting anatomic abnormalities, clinicians should not routinely perform open/laparoscopic/robotic surgery for upper tract stones. (Index Patients 13, 14) *Expert Opinion*
53. In pediatric patients with asymptomatic and non-obstructing renal stones, clinicians may utilize active surveillance with periodic ultrasonography. (Index Patient 14) *Expert Opinion*

Asian Guideline:ESWL

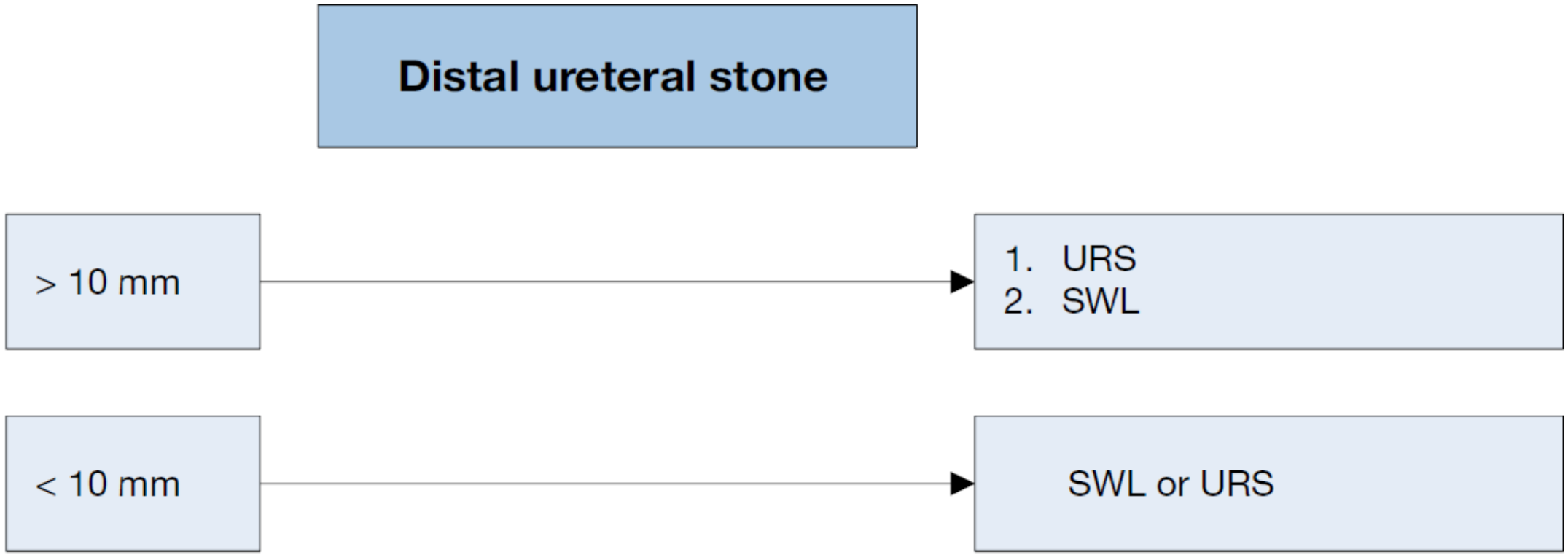
- SWL is an option for most renal stones, it is contraindicated for patients that have abnormal renal anatomy, such as caliceal diverticulum,..(LE:5, GR:A).
- renal stones <20 mm, SWL is the firstline treatment for patients (LE:3, GR:A).
- For stones >20 mm or for stones presenting less favorable factors, such as high mean stone density or located in calices with poor anatomy, the treatment outcome will be less favorable. Therefore, the pros and cons of each treatment modality should be discussed in detail with the patient before a joint decision on treatment plan can then be taken (LE:5, GR:B).
- ***SWL is highly effective in pediatric cases due to its noninvasive nature and higher SFRs compared with adults (LE:2, GR:B).***

EAU Guideline

Figure 1: Treatment algorithm for ureteral stones (If active stone removal is indicated) (Strength rating: Strong)



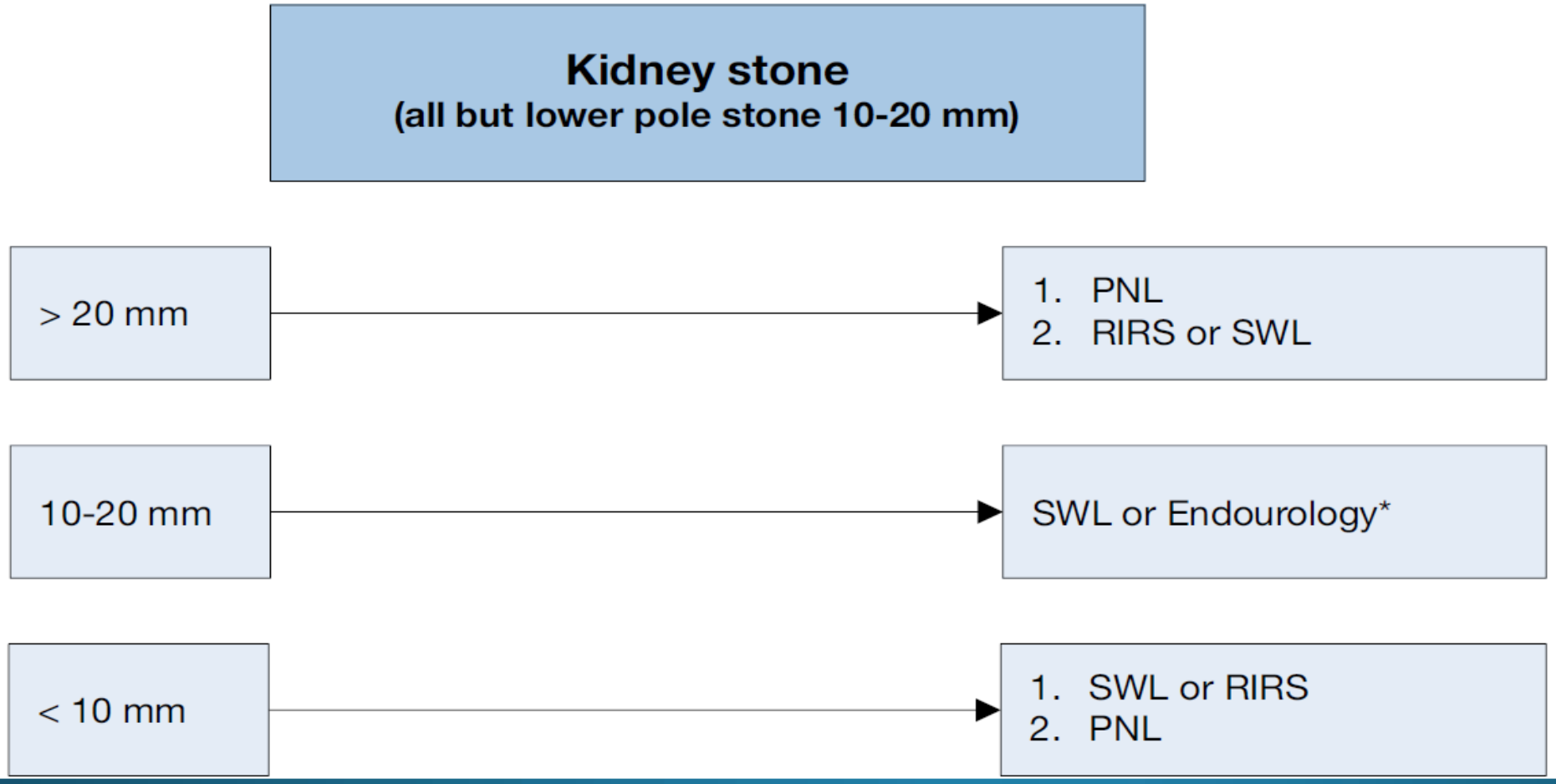
EAU Guideline



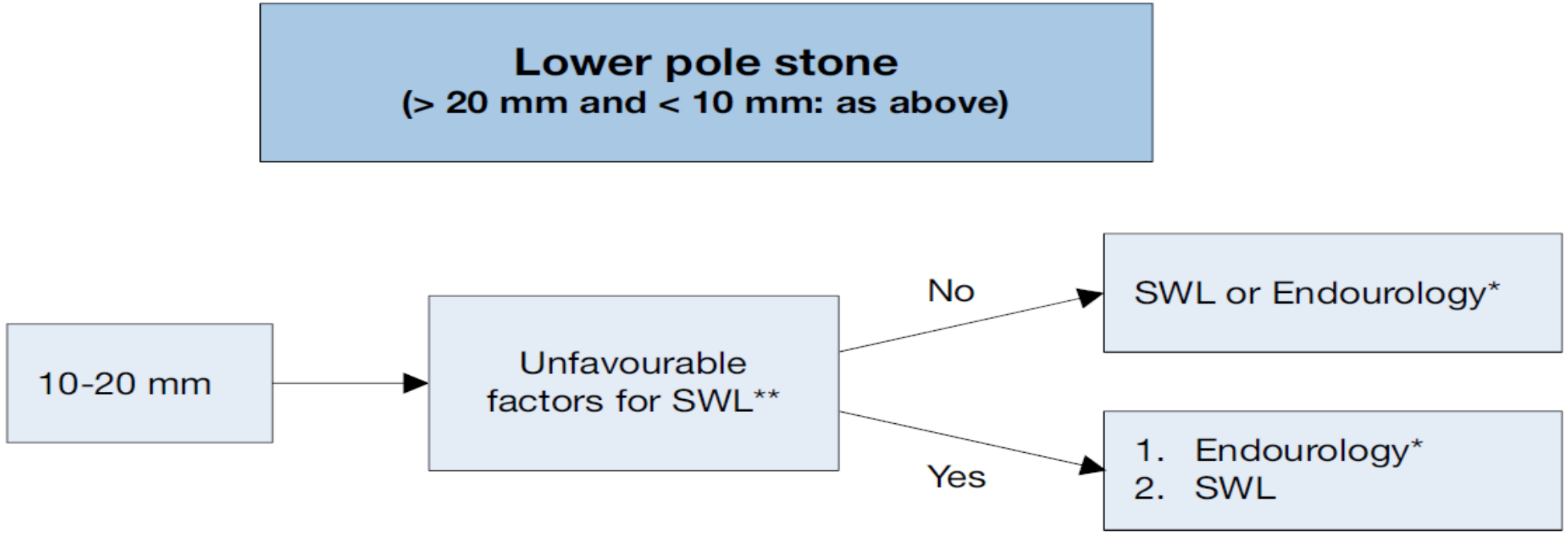
SWL = shock wave lithotripsy; URS = ureteroscopy.

EAU Guideline

Figure 2: Treatment algorithm for renal stones (if active treatment is indicated) (Strength rating: Strong)



EAU Guideline



** The term 'endourology' encompasses all PNL and URS interventions.*

*** See chapter 3.4.5. of full Urolithiasis guideline.*

PNL = percutaneous nephrolithotomy; RIRS = retrograde renal surgery; SWL = shock wave lithotripsy; URS = ureteroscopy.

خیام

یک چند به کودکی به استاد شدیم

In childhood we strove to go to school

یک چند ز استادی خود شاد شدیم

Our turn to teach, joyous as a rule

پایان سخن شنو که ما را چه رسید

The end of the story is sad and cruel

از خاک در آمدیم و بر باد شدیم

From dust we came, and gone with winds cool