MANAGEMENT OF CHILDREN AND ADOLESCENTS WITH

KIDNEY AND URETERAL STONES

Dr. Behzad Lotfi

Pediatric Urologist

Medical Expulsion Therapy

Management options in pediatric patients with a ureteral stone:

1. **observation** with pain control
2. medical expulsion therapy (**MET**)
3. **surgery**

MET:

α-blockers

less commonly, calcium-channel blockers

Mechanism for MET: type **1a and 1d** α-receptors (distal one-third of the ureter and UVJ)

Spontaneous stone passage without MET is higher among **older patients** and **<5** mm and distal ureteral stones.

Medical Expulsion Therapy

- Tamsulosin was safe in children despite its off-label use

- **AUA: ureteral stones ≤10 mm should be offered "observation with or without**
  MET using alpha-blockers".

- The use of α-blockers is off-label and that the maximum duration of MET is unknown but should not exceed 6 weeks.

Surgical Management

- **Up to 60% of children with kidney or ureteral stones require surgery**.

- **As for adults: ureteroscopy (URS), ESWL, and PCNL**
- Open stone surgery such as nephrolithotomy is rarely used in the contemporary era.

Surgical Management

- AUA and Endourological Society Recommendations for the Surgical

Management of Urinary Stones for Pediatric Patients

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients with uncomplicated ureteral stones <10 mm, clinicians should offer **observation with or without medical expulsive therapy using α-blockers**.	Moderate: Net benefit or harm moderate	B: Moderate certainty

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
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 patients-pecific anatomy and body habitus.	Strong: Net benefit or harm substantial	B: Moderate certainty

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
Clinicians should obtain a **low-dose CT** scan on pediatric patients before performing PCNL.	Strong: Net benefit or harm substantial	C: Low certainty

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients with ureteral stones, clinicians **should not routinely place a stent before URS.**	Panel consensus	Expert opinion

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients with a total renal stone **burden ≤20 mm**, clinicians may offer **SWL or URS** as **first-line therapy**.	Moderate: Net benefit or harm moderate	C: Low certainty

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients with a total renal stone **burden >20 mm**, both **PCNL and SWL** are acceptable treatment options. If SWL is utilized, clinicians should place **DJ or nephrostomy tube**	Panel consensus	Expert opinion

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients, except in cases of coexisting anatomic abnormalities, clinicians **should not routinely perform** open/laparoscopic/robotic surgery for **upper tract stones.**	Panel consensus	Expert opinion

Surgical Management

RECOMMENDATION	STRENGTH OF RECOMMENDATION	LEVEL OF EVIDENCE
In pediatric patients with asymptomatic and nonobstructing renal stones, clinicians may utilize active **surveillance** with periodic ultrasonography.	Panel consensus	Expert opinion

Goals of Therapy

- **The choice of intervention:**
  - **Size**
  - **location of the stone**
  - **patient anatomy**
  - **patient (and provider) preference.**
  - patient comorbidities
  - composition of stone (if known)
  - equipment availability

Radiation

- Each patient received a median of one CT scan and three abdominal radiographs for the associated stone episode.

- A CT scan, PCNL, and 3 radiographs: 32 mSv.

- Current guidelines recommend a maximum dose of 50 mSv in a 12-month period, and an average of <20 mSv/year over a 5-year period.

Ancillary Procedures/Anesthesia

- **Children often need multiple anesthetics.**
- For URS, the smaller size of children's ureters often precludes direct access with a ureteroscope.
- **Active dilation** is not recommended in children, a **ureteral stent** may need to be placed.
- However, a "pre-stent" increases the number of anesthetics needed to remove the stone.
- Similarly, SWL often requires retreatment to clear the stone.

Surgical Antimicrobial Prophylaxis

- Antibiotic prophylaxis is indicated in **all patients undergoing URS or PCNL** and is indicated for patients undergoing SWL who are at increased risk for infection.
- For uncomplicated SWL and URS: cefazolin
- All children undergoing a **percutaneous** procedure or who have a **preexisting ureteral stent** or **nephrostomy** tube receive a fluoroquinolone or ampicillin/gentamicin.
- Antibiotics **should not be continued for greater than 24 hours**

Ureteroscopic Management of Upper Urinary Tract Calculi

- URS was not considered primary therapy for **upper tract stones** in children
  - ureteral ischemia
  - Perforation
  - Stricture
  - potential for development of VUR as a result of dilation of small-caliber ureteric orifices.

- Children **<6 years** of age had **lower success** and **higher complications**

Ureteroscopic Management of Upper Urinary Tract Calculi

- Pediatric ureters may require a period of **stenting** before definitive **URS** treatment.

- **Approximately 25% of children undergoing URS required staged procedures.**

- **AUA do not recommend routine “prestenting” before URS**

Ureteroscopic Technique in Children

- Irrigating fluid should be isotonic and body temperature

- **The decision to place a ureteral stent postoperatively:**
  - **duration of the procedure**
  - **the number of passes with the ureteroscope**
  - **the degree of visible ureteral trauma or edema**

- The stent is removed under brief anesthesia after 7 days.

Limitations and Complications

- **The complications of URS:**
  - **ureteral injury**
  - **UTI**
  - **bleeding.**

- Serious complications (greater than Clavien3) are uncommon.
  - mucosal flaps and tears
  - Perforation
  - false passage
  - partial to complete ureteral avulsion

SHOCK WAVE LITHOTRIPSY

- SWL may be more effective in children

- **Along with URS, SWL is a treatment option for upper tract calculi 15 mm or smaller in children.**
- **For upper tract calculi, SWL efficacy ranges from 68% to 84%**

- stone clearance of 80% at 3 months.

- 91% stone clearance for mean stone diameter less than 10 mm versus 75% stone clearance for stone size greater than 10 mm.

SHOCK WAVE LITHOTRIPSY

- **For renal stones > 20 mm, clearance is lower for SWL than PCNL and requires multiple treatments**.

- AUA: Ureteral stent to decrease the risk for major complications for pediatric patients who undergo SWL for stones > 20 mm

- It is the authors' practice not to perform SWL for stones greater than 15 mm in pediatric patients.

SHOCK WAVE LITHOTRIPSY

- SWL failure:
  - increased mean stone burden
  - increased infundibular length
  - Infundibulo-pelvic angle greater than 45 degrees.

- CT is not necessary before SWL

- Stone attenuation less than 1000 HU was associated with treatment success in children.

Shock Wave Lithotripsy Technique in Children

- SWL is typically performed **under general anesthesia**
- Bowel preparation is seldom used to avoid dehydration and electrolyte imbalance
- The AUA recommended placement of a ureteral stent or nephrostomy for SWL for stones greater than 20 mm.
- **additional relative indications include:**
  - **Solitary kidneys**
  - **Obstruction**
  - **Abnormal anatomy.**

Limitations and Concerns

- Stone clearance after single SWL treatment is low.
- Children are subjected to multiple treatments requiring general anesthesia.
- **SWL was associated with 40% increased risk for incident hypertension in adults**.

PERCUTANEOUS NEPHROLITHOTOMY

- **PCNL is considered first-line therapy for renal stones greater than 20 mm in children**
- **stone clearances: 90%**.
- PCNL has replaced open surgery as the treatment of choice for large stone burdens in all children.

PERCUTANEOUS NEPHROLITHOTOMY

- **Adult-sized PCNL** for pediatric patients reported **high stone clearance** demonstrated that the risk for **bleeding** increases with access tract size. (relative size 72 Fr).

- Mini- and micro-PCNL have become increasingly common for large renal stones for both children and adults.
- Mini-PCNL < 20 to 24 Fr
- micro-PCNL < 10 Fr.

- The indications for PCNL in children are expected to continue to increase
- For children with renal stones greater than 20 mm, we recommend PCNL

Percutaneous Nephrolithotomy Planning for Pediatric Patients

- The risks associated with PCNL:
  - bleeding requiring transfusion
  - delayed renal hemorrhage requiring angioembolization
  - Sepsis
  - Pneumothorax
  - Hemothorax
  - Urothorax
  - incomplete stone clearance
  - injuries to adjacent organs.

Percutaneous Nephrolithotomy Complications

- Complication: 15% to 39%.
- most of them are minor
- Blood transfusion is consistently <10%.
- Complications:
  - postoperative fever (30%)
  - need for transfusion (24%).

- **Transfusion was associated with operative time, sheath size, and stone burden**

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

PERCUTANEOUS NEPHROLITHOTOMY

- Significant bleeding
  - insert a Foley catheter or re-entry in the collecting system through the nephrostomy tract

- Renal pelvis injury
  - the operation should be stopped and an antegrade ureteral stent should be placed, if feasible.

- **Treatment of known complications of PCNL in children is similar to adults**.


Karnaval.ir