Urinary Stone Disease

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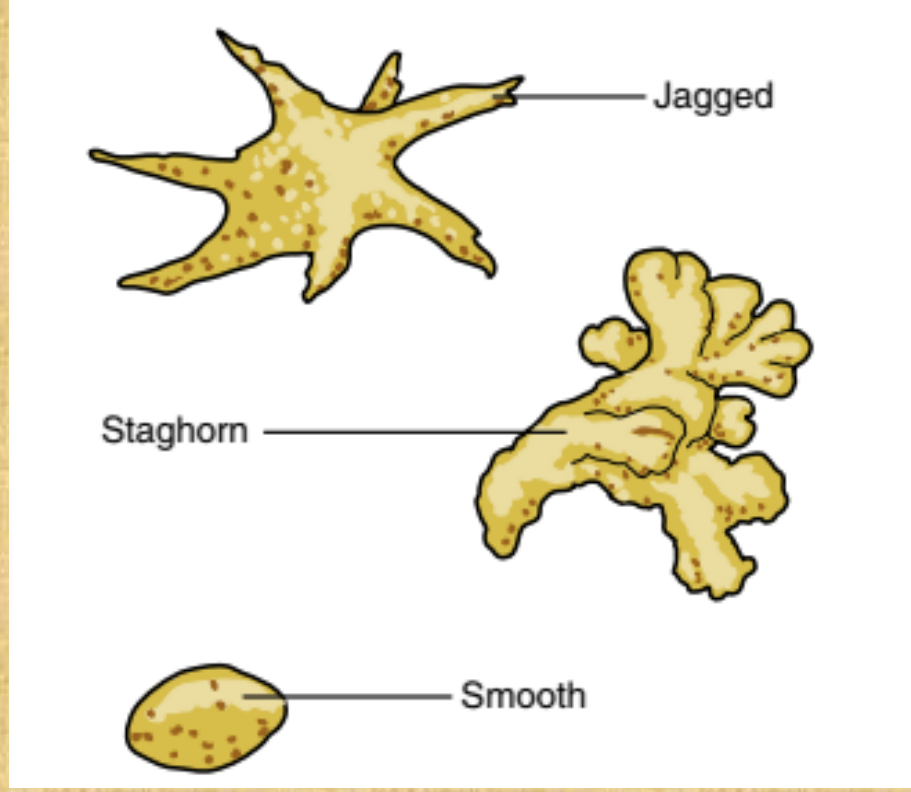
Introduction

- A renal calculus (kidney stone) is a solid deposit or deposits of minerals and salts. These deposits are called calculi and accumulate in the renal collecting system.

- Kidney stones are more common in white males living in warm climates and nearly 30% to 50% experience recurrence 5 to 10 years after initial treatment.

- Renal colic is an intense pain caused when a calculus or fragments of calculi partially or completely obstructs the calyces or renal pelvis.



- **Lithotomy** is removal of a calculus.
- **Lithotripsy** is fragmentation of a stone followed by removal.
- **Chemolysis** is dissolution with a chemical substance.

Lithotripsy

1. Ultrasonic Lithotripsy.
2. Electrohydraulic Lithotripsy
3. Laser Lithotripsy

Percutaneous Chemolysis

- **Hemiacidrin** may be instilled through a small nephrostomy tube to alkalinize cysteine and uric acid calculi and dissolve any debris that remains after other lithotomy procedures.

Introduction

- **Where we can find a stone:**

1. Kidney
2. Ureter
3. Bladder
4. Urethra
5. Prepuce

Kidney Stones

- **Kidney/Renal Stone Management**

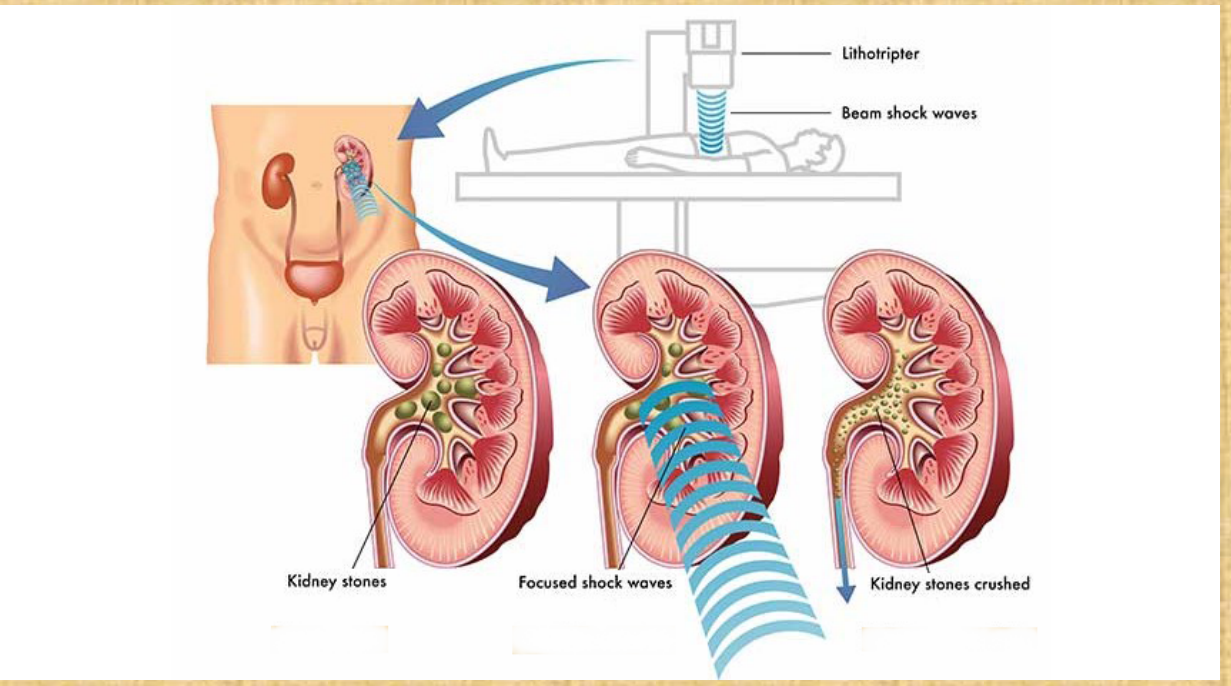
1. Conservative
2. Oral litholytic therapy
3. Extracorporeal shock wave lithotripsy (ESWL)
4. Retrograde Intrarenal Surgery (RIRS)
5. Percutaneous nephrolithotomy (PCNL)
6. Laparoscopy
7. Open Surgery

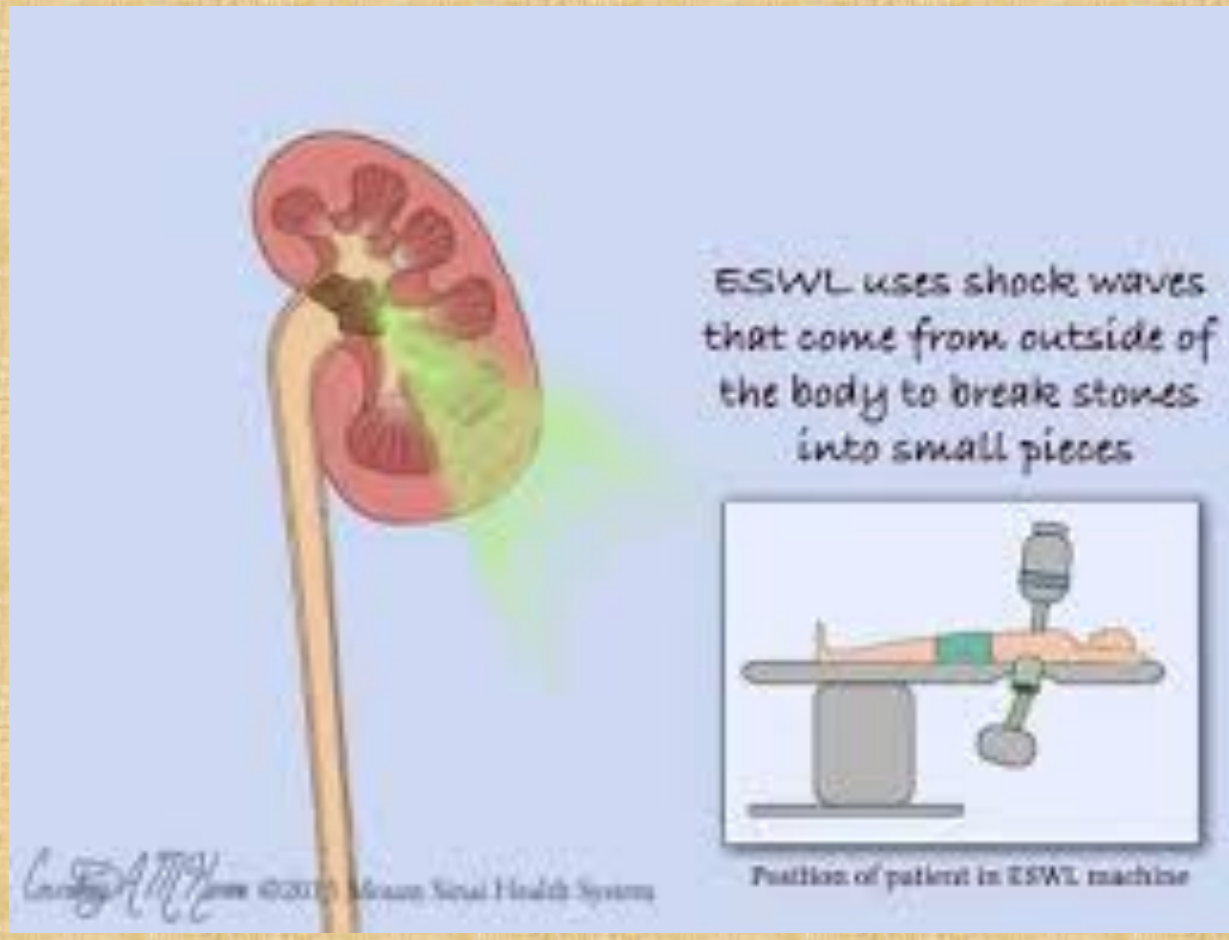
Oral litholytic therapy

Citrate potassium

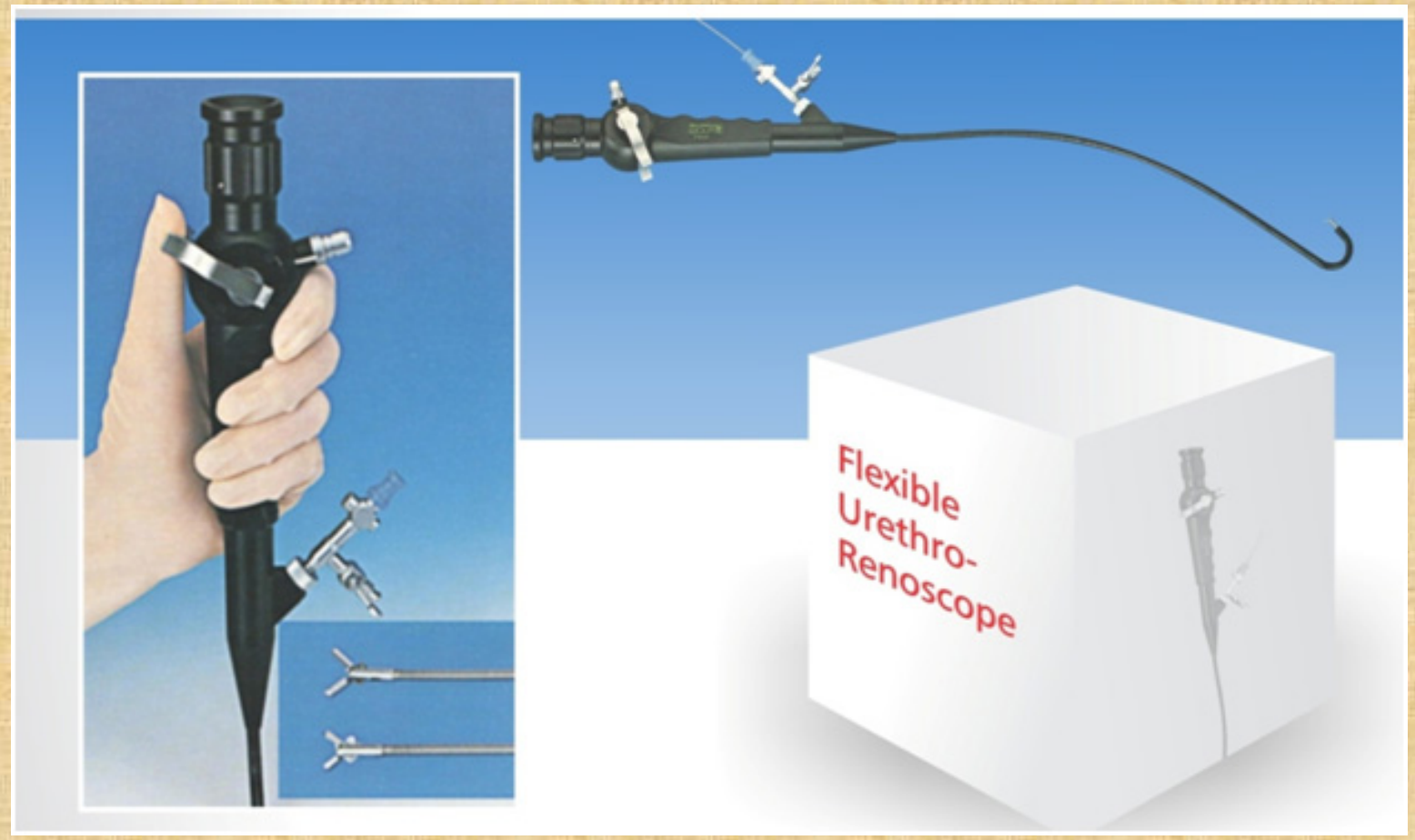
ESWL

ESWL

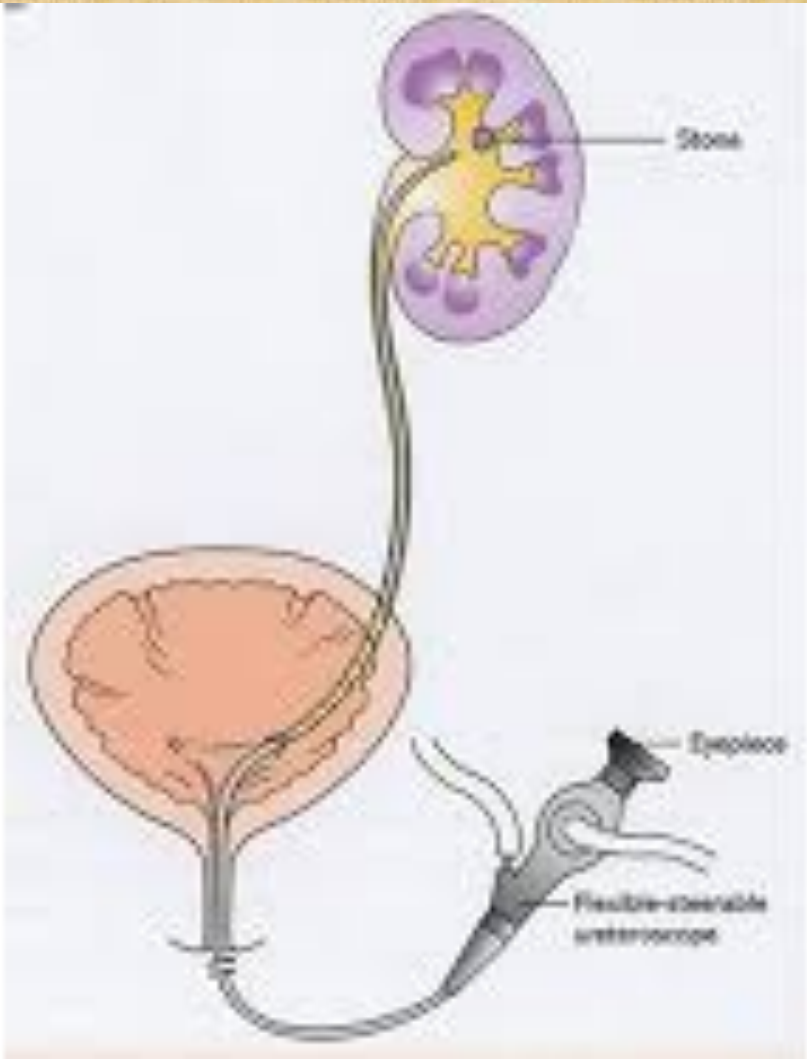

Lithotripter
Beam shock waves
Kidney stones
Focused shock waves
Kidney stones crushed


ESWL uses shock waves that come from outside of the body to break stones into small pieces
Position of patient in ESWL machine

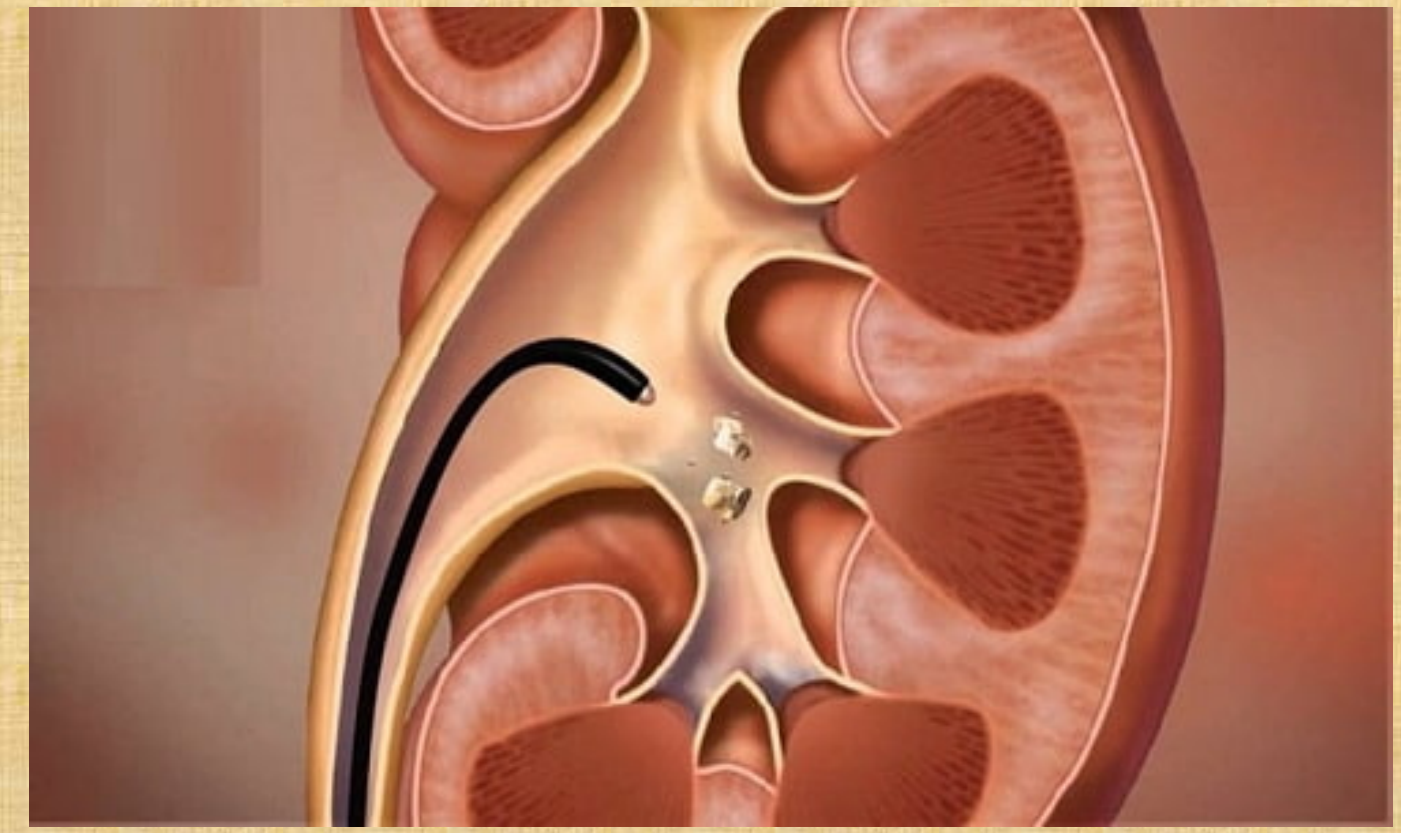
RIRS

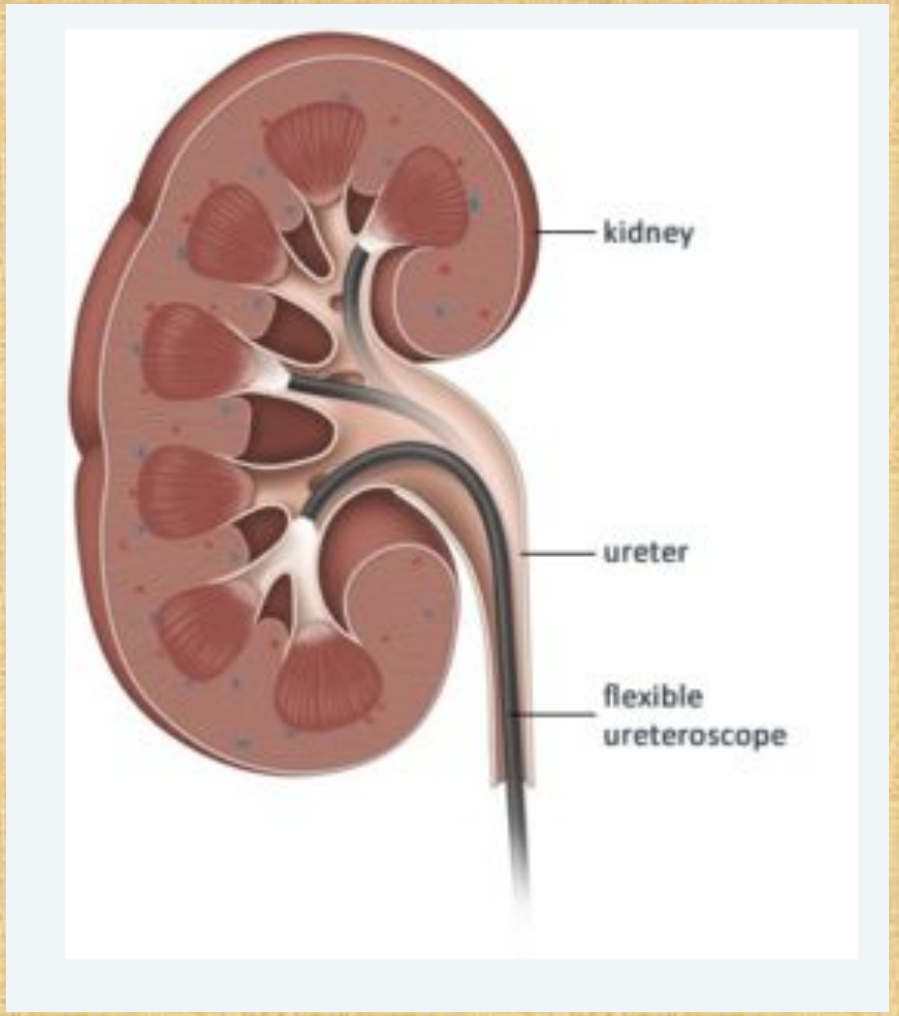


RIRS

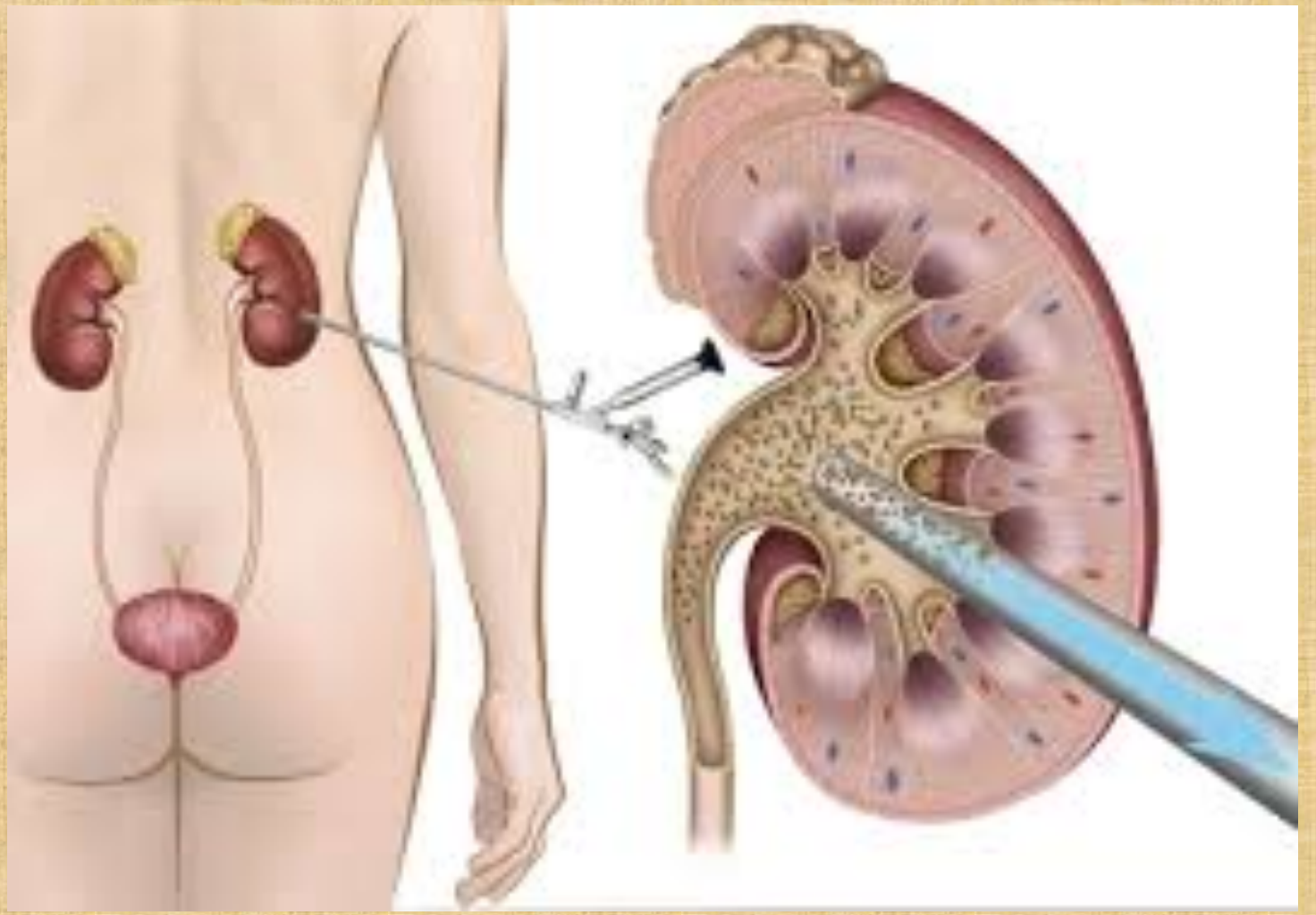


RIRS





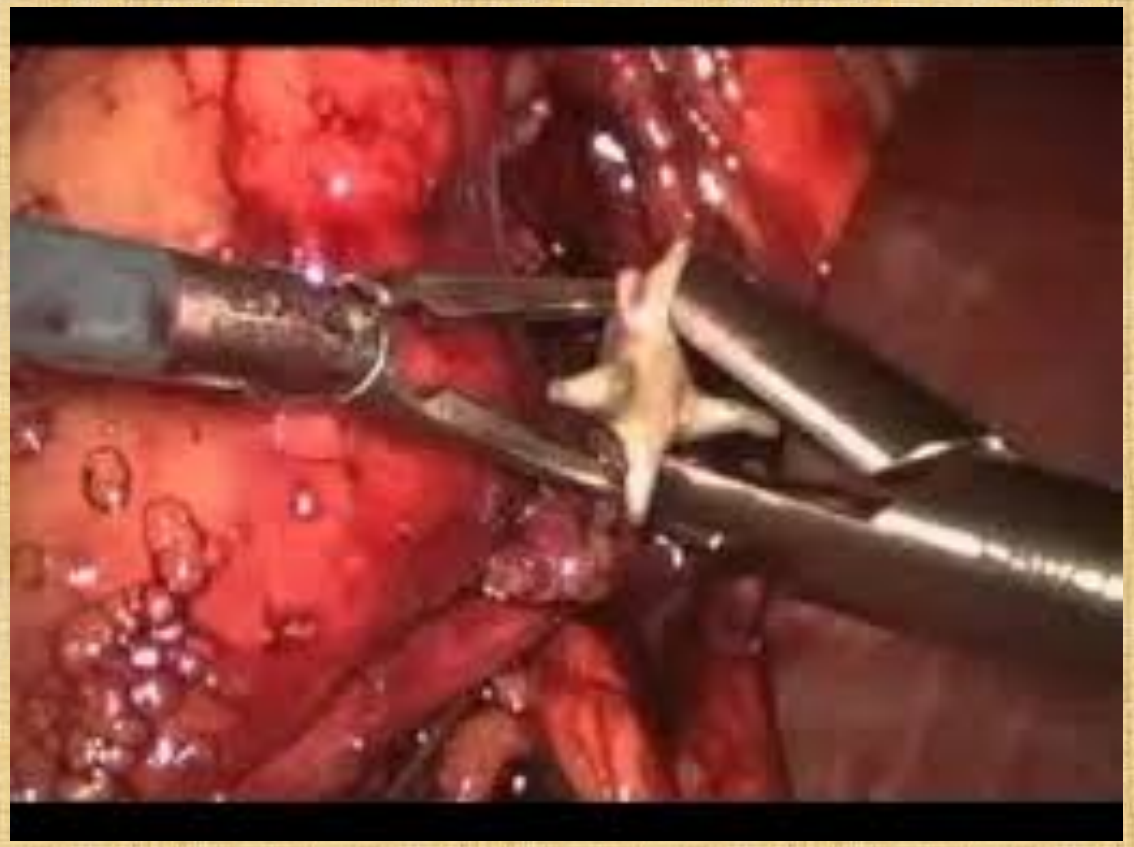
PCNL



PCNL

PCNL

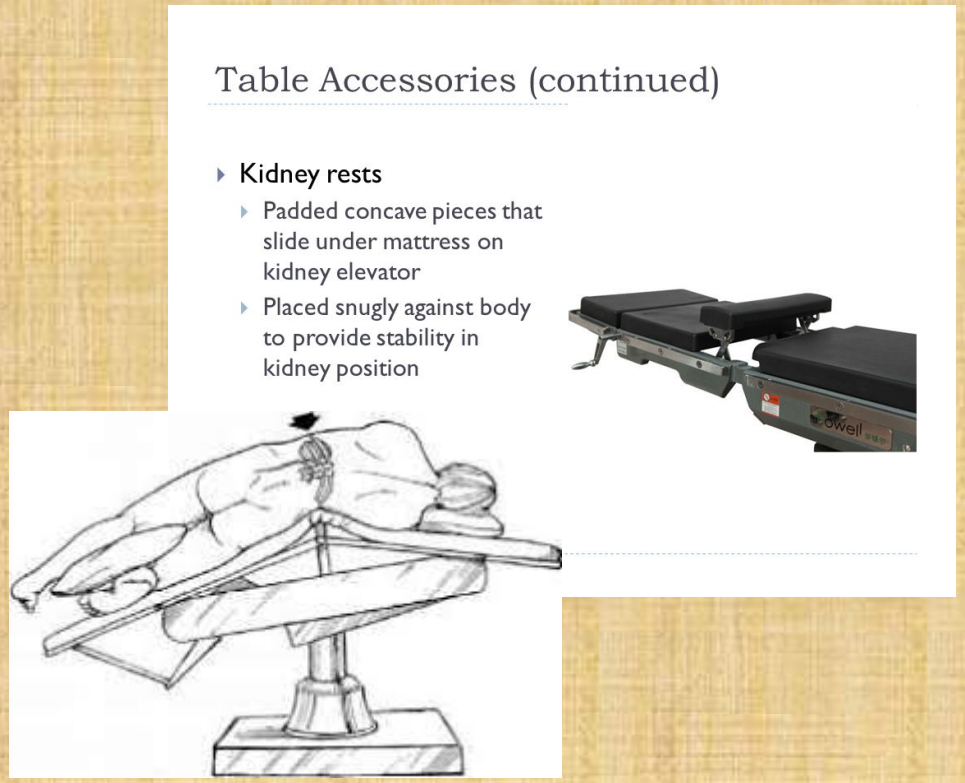
Laparoscopy



Open Surgery

Pyelolithotomy/Nephrolithotomy

- **Equipment, Instruments, and Supplies Unique to Procedure**
- Same as for nephrectomy



- **Preoperative Preparation**
- Position: Lateral with kidney rests
- Anesthesia: General
- Skin prep: Axilla to mid-thigh
- Draping: Transverse drape

• Practical Considerations

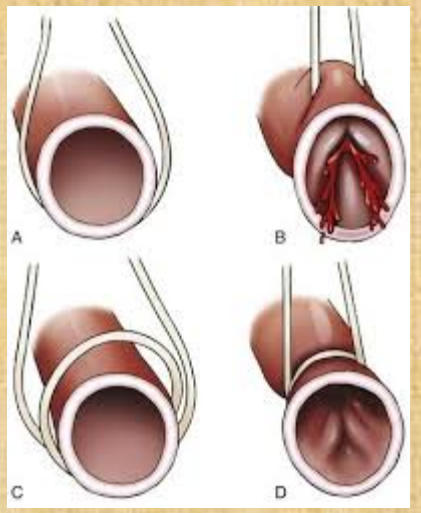
- The **position** of the patient is lateral if the stone is within the renal pelvis or located in the upper part of the ureter.
- X-rays should be in the OR.

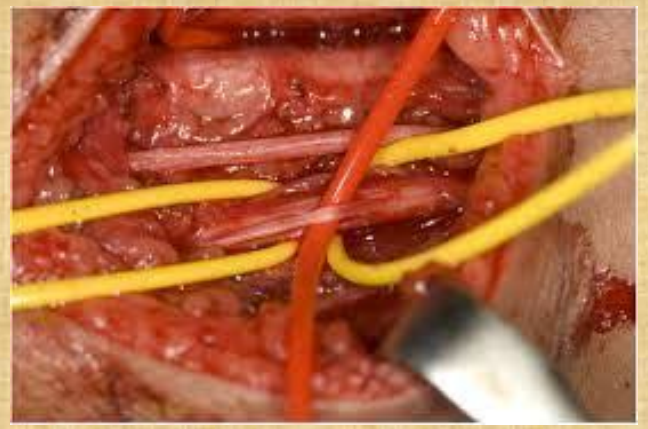
- **Surgical Procedure**

Rib resector

- Using the #10 knife blade, the surgeon makes a flank incision.
- The surgeon may have to remove the 12th rib with the rib resector in order to fully visualize the renal pelvis.

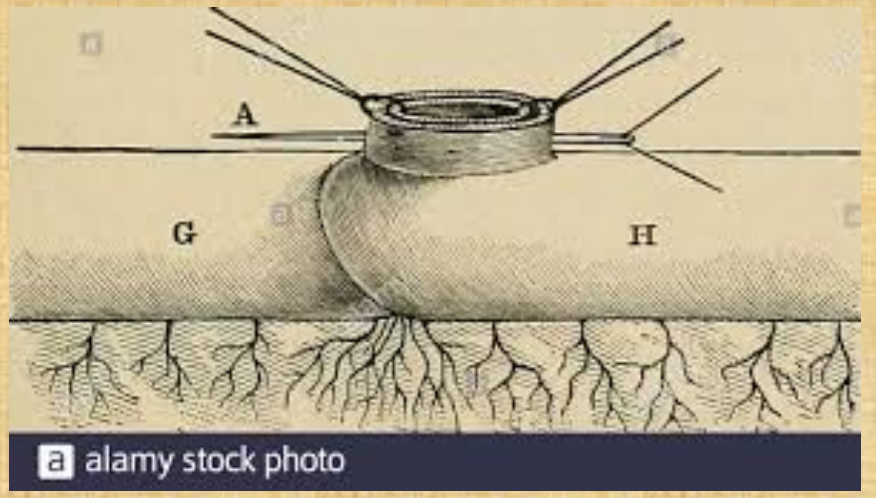
- Vessels loops are placed around the distal ureter as close to the renal pelvis as possible and clamped to occlude the ureter.





- With the help of the X-ray studies to view the location of the stone, the surgeon incises the renal pelvis over the stone using a #15 knife blade on a #7 knife handle.
- Two traction sutures are placed lateral and medial to hold the two flaps of the incision open.

#7 knife handle



Traction sutures
(example)

- The surgeon uses the stone forceps to grasp and remove the stone.
- The renal pelvis is thoroughly irrigated and inspected for additional small stones that may not have appeared on the X-rays.

Stone forceps

- The incision is closed with a 4-0 or 5-0 absorbable suture using interrupted technique.

- A closed wound drainage system is placed with the tube laterally exteriorized.

- Surgical wound is closed in layers as described for a nephrectomy.

- Additional 4*4 dressings should be placed to reinforce the dressing. Urinary leakage can be expected for up to 5 postoperative days.

Ureteral Stones

- **Ureteral Stone Management**

1. Conservative
2. ~~Oral litholytic therapy~~
3. Extracorporeal shock wave lithotripsy (ESWL)
4. Trans ureteral lithotripsy (TUL)/ Ureteroscopy (URS)
5. Percutaneous nephrolithotomy (PCNL)
6. Laparoscopy
7. Open Surgery

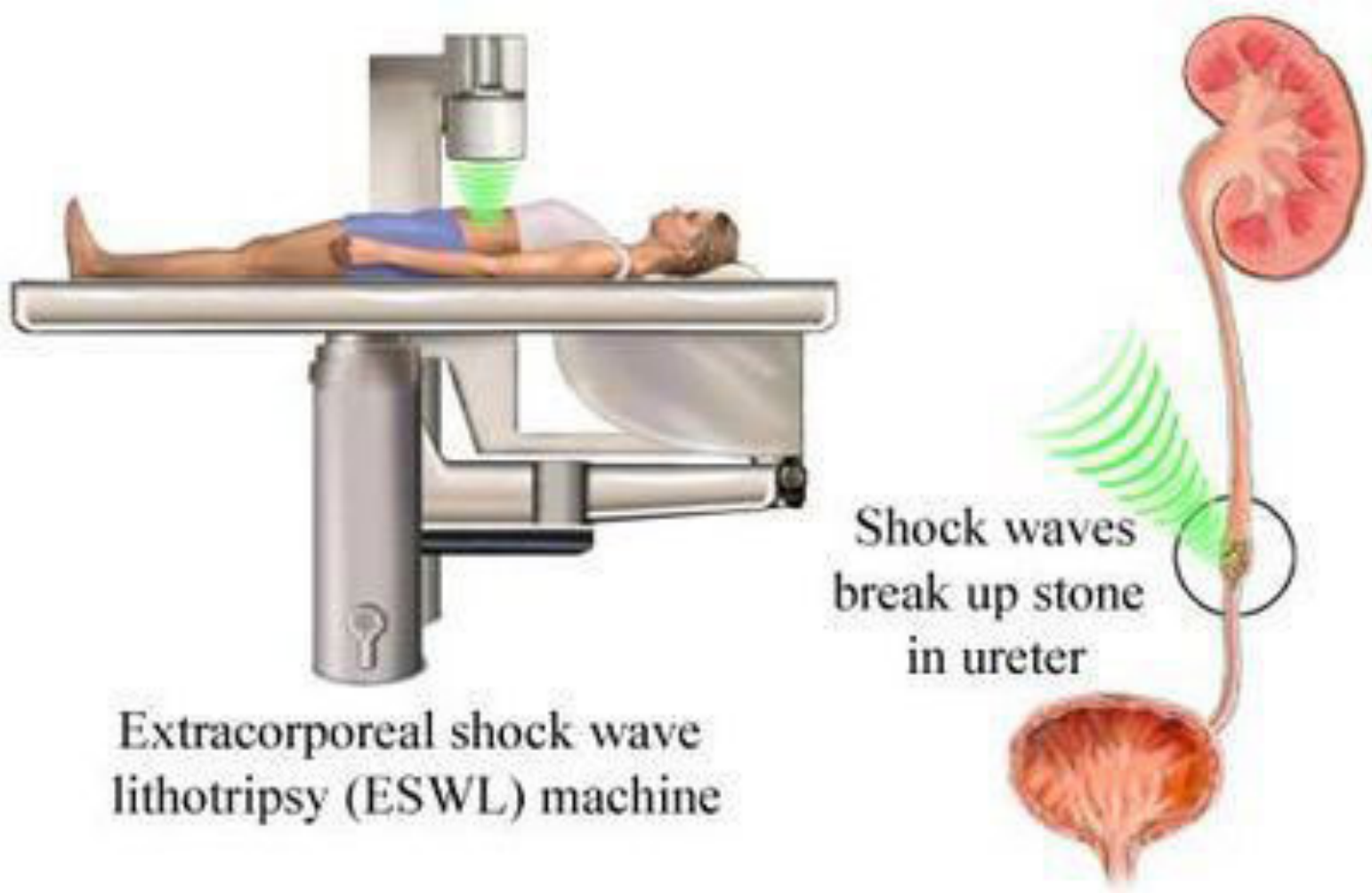
Conservative

- Medical expulsive therapy with alpha-receptor antagonists potentially shortens the duration and increases the likelihood of spontaneous stone passage.
- Consideration should be given to offering it to patients with distal ureteral stones less than 10mm in size.

- **Spontaneous passage** of stones less than 5 mm in size in the distal ureter have a >90% chance of spontaneous passage within 40 days and are appropriate for an attempt at conservative management provided there are no infectious symptoms, intolerable patient symptoms or a threat to renal function.
- Stones above 5 mm in diameter are less likely to pass spontaneously and patients should be counselled about treatment options.

~~Oral litholytic therapy~~

ESWL



Extracorporeal shock wave lithotripsy (ESWL) machine

TUL / URS

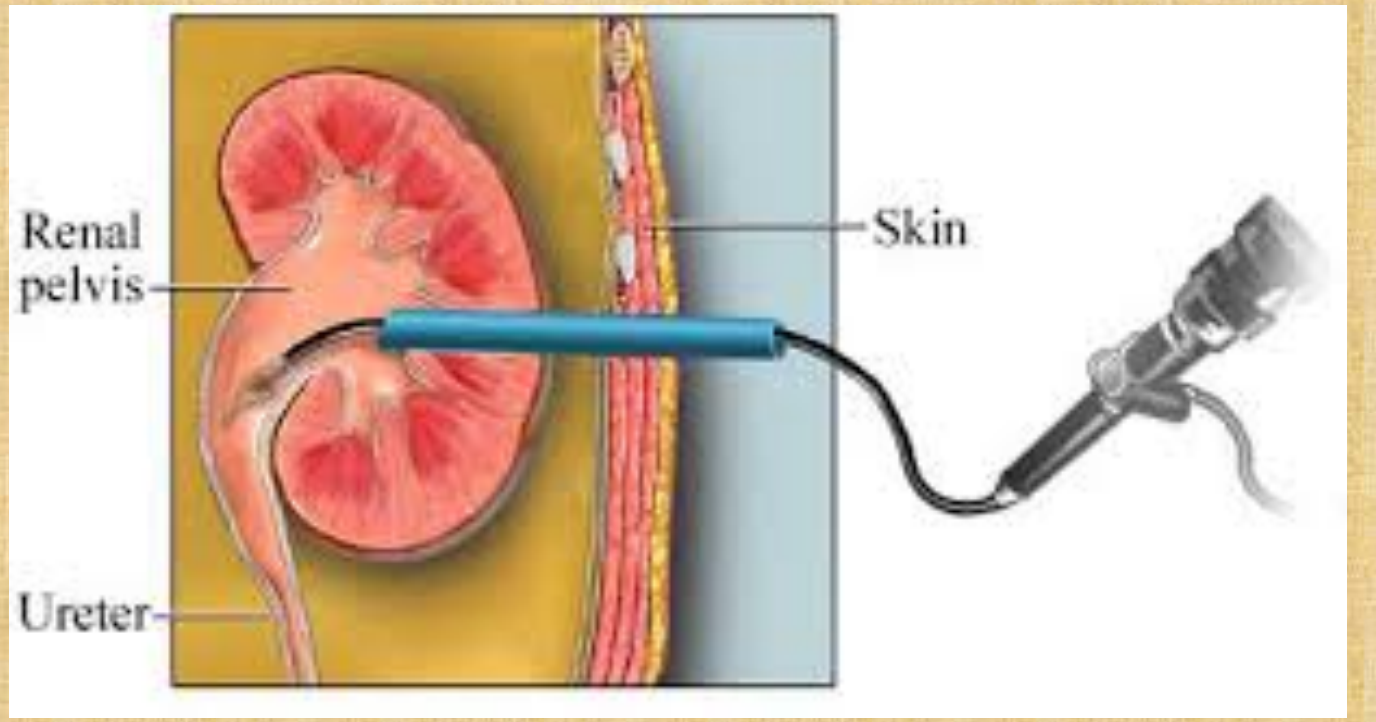
Ureteroscopy

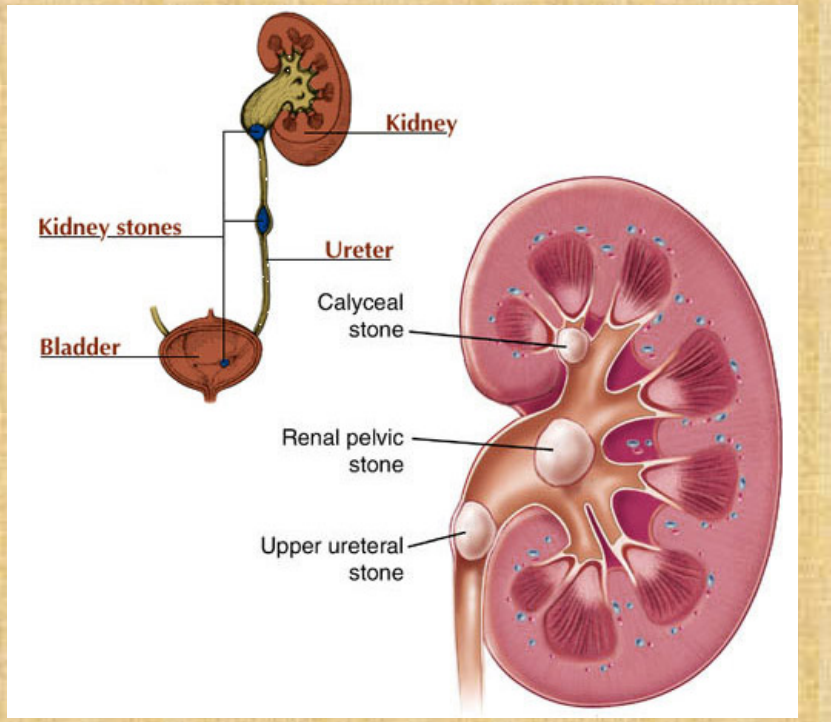
Equipment, Instruments, and Supplies Unique to Procedure

- Ureteroscope
- Urethral dilators
- Lithotrite
- Basket stone forceps
- Holmium laser
- Foley catheter with drainage bag
- JJ ureteral stents (various sizes)
- Light source and cable
- Irrigation fluid
- Irrigation inflow and outflow tubings
- KY jelly
- Stopcock
- ESU and cautery cord
- Minor procedure back table pack
- 4*4 radiopaque sponges

PCNL

- Some proximal large ureteral stones can be managed by PCNL





Open Surgery

Ureterolithotomy

- Operative Procedure
- After exposure of the ureter, the stone may be kept stationary with Babcock clamps or vessel loops applied above and below it.
- With a #15 blade, the surgeon makes an incision in the ureter directly over the stone, which may be easily removed with Randall stone forceps.

- A 10F catheter is passed proximally up and distally down the ureter while irrigating with saline to check for ureteral patency and to dislodge any remaining stone fragments.
- The surgeon closes the ureter with 4-0 or 5-0 absorbable sutures. All stones should be placed in dry receptacles and sent to the chemistry laboratory for analysis.

Bladder Stones

- Calculi usually can be removed from the bladder through the urethra. Crushing a urinary calculus in the bladder is referred to as **litholapaxy or lithotrity**. If a litholapaxy is unsuccessful or contraindicated, the removal of a calculus by incision into the bladder may be necessary; this surgical procedure is a **cystolithotomy**.

Bladder Stones

- Because a bladder stone is in itself a sign of an underlying problem, both removal of the stone and treatment of the underlying abnormality are nearly always indicated.
- Management of the underlying cause of stone formation (eg, bladder outlet obstruction, infections, foreign body, or diet) is integral to prevention of recurrence.
- The only contraindication to bladder stone removal would be existence of the stone in a medically unstable or near-terminal asymptomatic patient.

- **Bladder Stones:**

1. Conservative
2. Litholysis
3. ESWL
4. Transurethral cystolitholapaxy
5. Percutaneous suprapubic cystolitholapaxy (PCCL)
6. Laparoscopic
7. Open suprapubic cystotomy

Conservative

- **Asymptomatic migratory** bladder stones in adults may be left untreated, especially if stones are small.

Litholysis

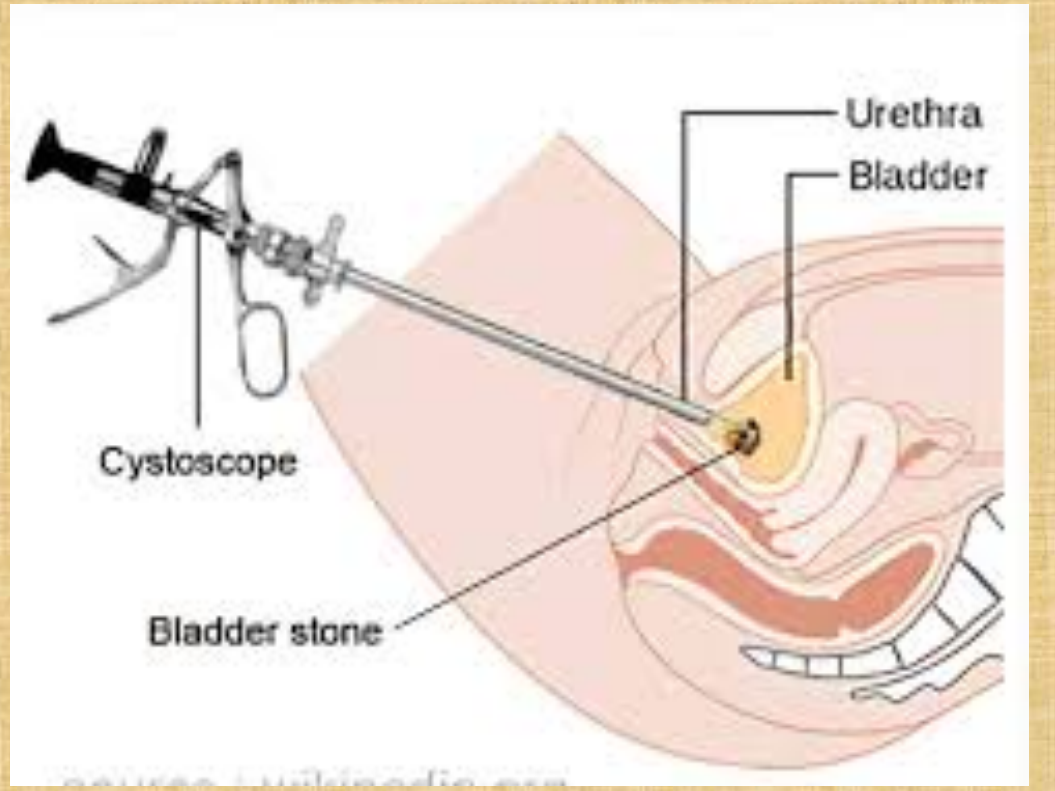
- Stones composed of **uric acid or struvite** can be dissolved by chemolysis.

ESWL

- Unlike renal and most ureteral calculi, bladder calculi have not been effectively treated with electrohydraulic shock-wave lithotripsy.

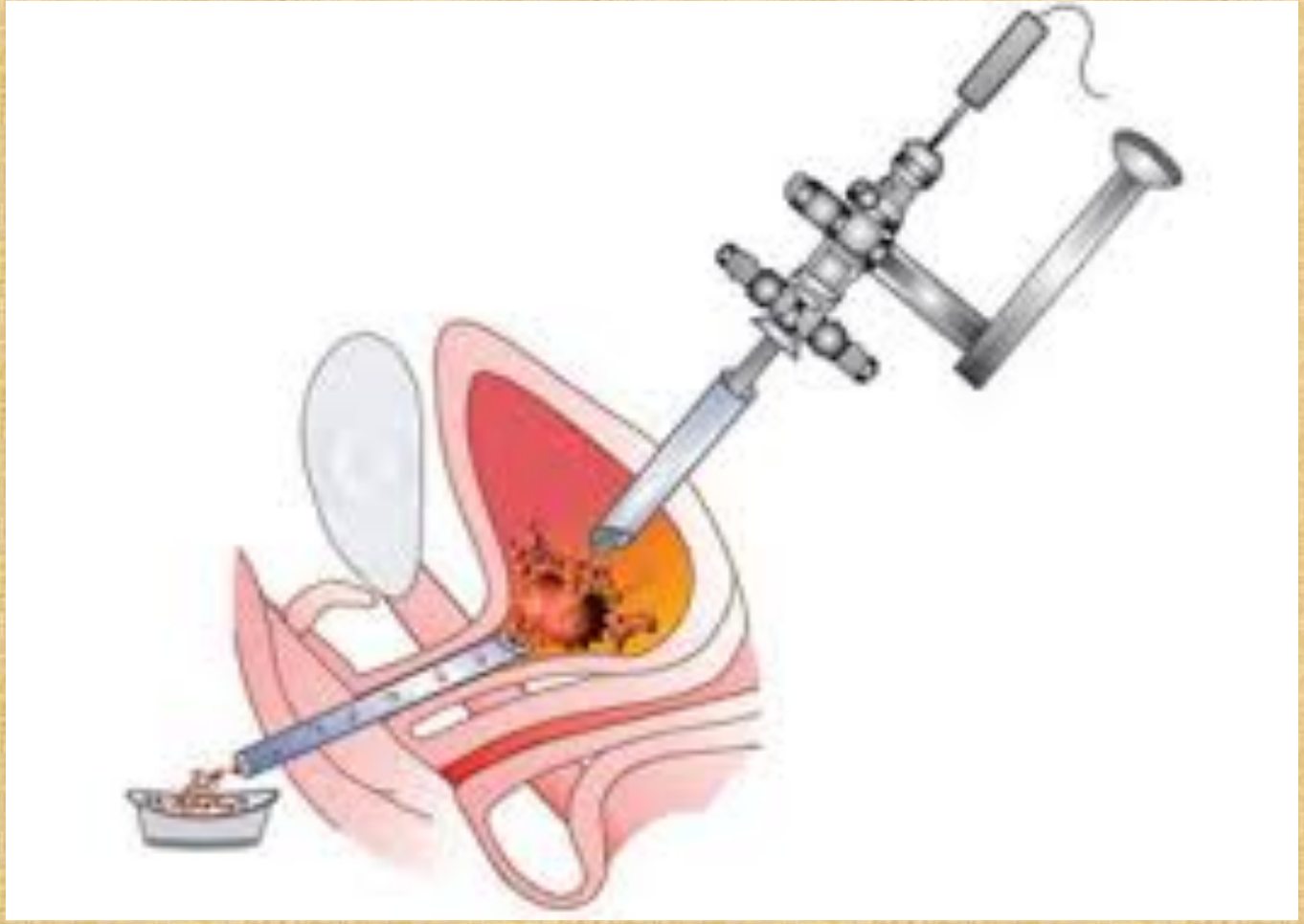
Transurethral cystolitholapaxy

- In general, most vesical calculi procedures are performed via endoscopy.




BA

PCCL



Open suprapubic cystotomy

- This approach can be used with larger and harder stones and in cases where open prostatectomy or bladder diverticulectomy is indicated.

Urethral Stones

- Urethral calculi are almost exclusively a male pathology. Either they come from the bladder and are stopped in their migration because they are too large for the caliber of a normal urethra, or they are a result of urinary stasis above a urethral stricture or within a urethrocele. In both cases, they are usually revealed by infection, pain during micturition, or acute urinary retention.

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