

Renal stones

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44 year old woman

- Right sided flank pain for 2 days
- Fever to 39
- BP 100/60
- Reduced urine output

What next?

- Imaging – CT scan
- MSU
- EUC, FBC
- ABC....

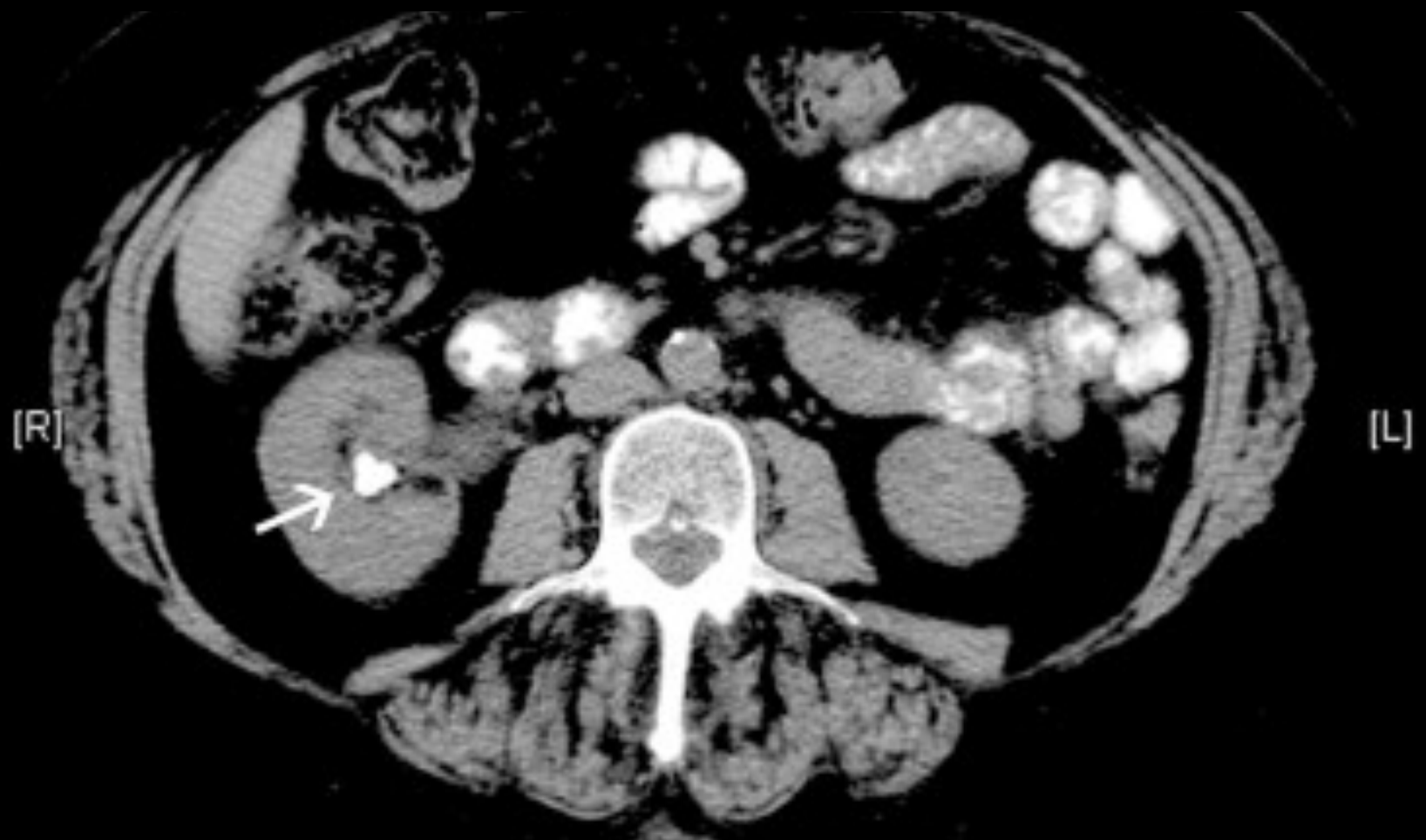
MSU

- Culture takes a while
- Blood >100
- Leukocytes >100
- Gram negative rods seen

Most likely cause

- E Coli
- What is the doubling time of E Coli?
 - 4 hours or so
- Time is of the essence

CT scan



Treatment

- ABC....
- Renal drainage
 - Stent if not too unwell
 - If unstable needs percutaneous nephrostomy
- Once sepsis settles fix stone

Presentation

- Loin to groin pain
- Sharp, shooting
- Likened to child birth
- Pain may settle with time or may be intermittent

epidemiology

- Prevalence 15% and increasing
- Peak incidence 40-60s
- Higher incidence in hot places
- Higher prevalence with high BMI

Why do stones form?

- Urine becomes supersaturated with stone forming salts
- Precipitation and crystal formation
- Crystals may anchor in the kidney and form stones

Define saturation

- The point at which no further added salt crystals will dissolve

Urine characteristics

- Supersaturated but stones do not always form
- Why?
- Inhibitors prevent stone formation (metastable)
- Dehydration or excessive salt excretion or urine stasis can lead to stone formation

Stone compositions

- Calcium oxalate 60%
- Calcium phosphate 15%
- Mixed oxalate & phosphate 20%
- Struvite 7%
- Uric acid 10%
- Cysteine 3%

inhibitors

- citrate
- inorganic pyrophosphate
- Tamm horsfall protein
- Nephrocalcin
- osteopontin

Most important factor

- Hydration
- Hydration
- Hydration

Metabolic stuff

- Ask a renal physician
 - Hypercalciuria
 - Hyperoxaluria
 - Hyperuricosuria
 - Hypocitraturia
 - Low pH
 - Renal tubular acidosis

Evaluation of stone formers

- 1st or 2nd time stone formers
 - Calcium – if high check PTH
 - Serum uric acid
- 24 hour urine collection

Who should be evaluated

- Recurrent stone formers
- Family history
- Skeletal fractures
- Osteoporosis
- History of UTI with stones
- Solitary kidney
- Renal insufficiency
- Cysteine, uric acid or struvite stone

Classification of stones

- Radio opaque
 - calcium oxalate, calcium phosphate, mixed
- Partially radio opaque
 - Cysteine stones
 - Struvite stones (depending on calcium content)
- Radiolucent
 - Uric acid

Anatomic predispositions

- PUJ obstruction
- Horseshoe kidney
- Calyceal diverticulum
- Medullary sponge kidney

Pregnancy

- No more common than general population
- 2nd or 3rd trimester
- Physiological hydro in 90%
- Increased filtration but also increased citrate
- Placental vitamin D enhances hypercalciuria

Why are stones difficult in pregnancy?

- Limited use of radiation
- Sepsis more dangerous
- GA – risk of early labour
- Risk of stent encrustation and stent pain

Conservative treatment

- Produce 2L urine per day
- Dietary
 - moderate meat and salt intake
 - Increased risk with high protein low carb diets
 - Dietary calcium avoidance may increase stone formation

The boring stuff is over

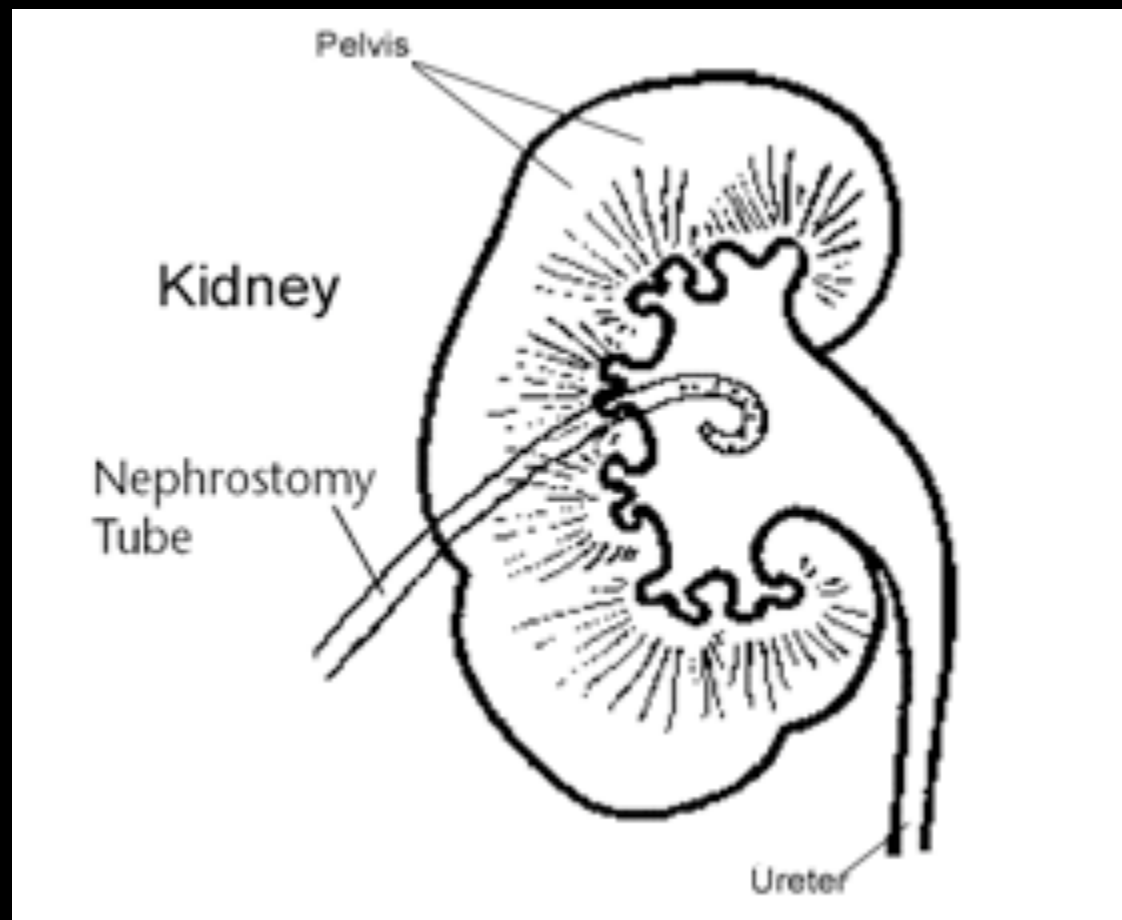
- Surgical treatments.....

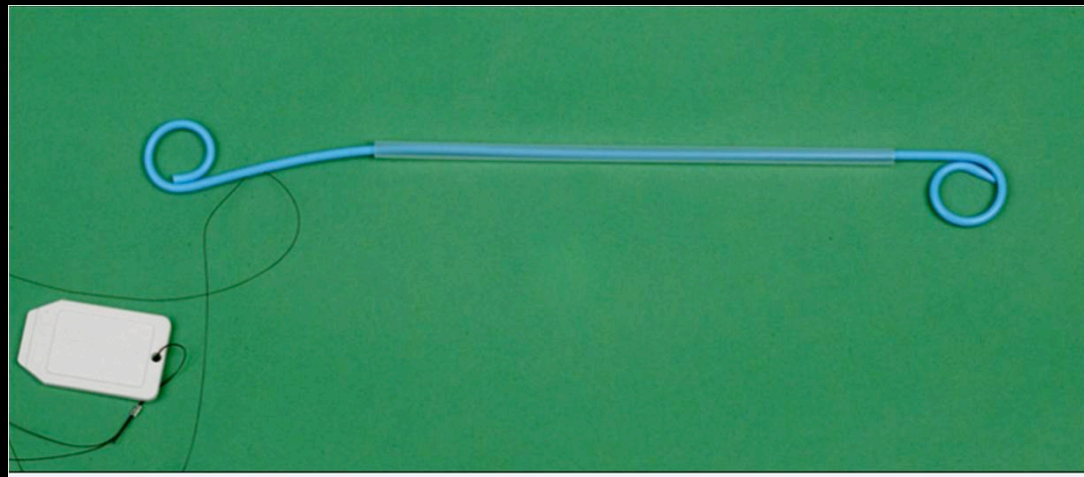
Treatment options

- Spontaneous passage
- Ureteroscopy and laser/lithoclast
- ESWL
- Dissolution therapy
- Stent
- PCNL

Indications for stent/nephrostomy

- Stone with
 - Fever
 - UTI
 - Single kidney
- Other factors (stent vs definitive treatment)
 - Access out of hours
 - Cost
 - Access to equipment





Nephrostomy vs stent

- Nephrostomy placed under local
- Good for unstable/sick patient
- We stay in bed – wake radiologist instead
- Uncomfortable for patient
- Needs to be converted to antegrade stent

Spontaneous passage

- Ok if no infection, two kidneys, no fever
- Stones up to 5mm have a 80% chance of being passed
- Increased chance if more distal
- Improved passage rate with flomaxtra
- Need to see with follow up imaging to ensure stone has passed

ESWL

- Localise stone with Xray or US
- Coupling device
- Energy onto stone
- May have obstruction with stone fragments
- Risk of perinephric haematoma

ESWL

- Stone clearance depends of passage of debris
- <10mm ~ 80% SFR
- >20mm ~ 50% SFR



ESWL

- Visualisation is difficult
 - Overlying bowel
 - Bariatrically challenged
- Non invasive
- Inexpensive
- Do crossword

dissolution

- Start on allopurinol and alkalinise urine with ural or polycitra K
- ESWL may break stone and increase surface area
- Follow up with ultrasound or CT

ureteroscopy

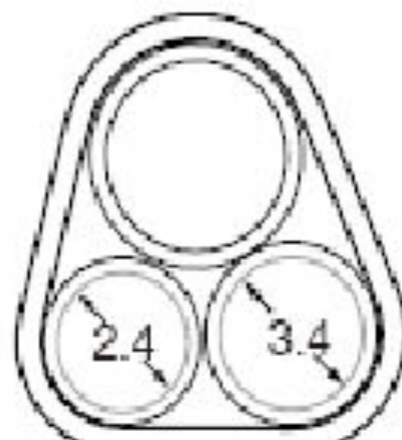
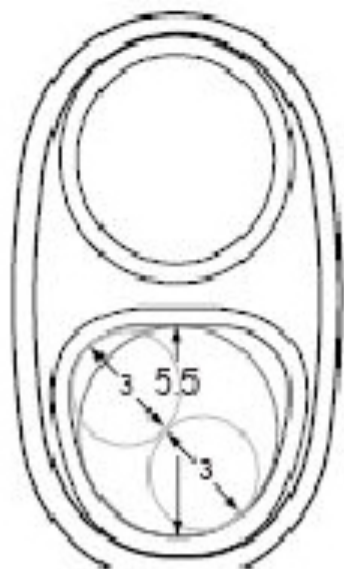
- Has taken over
- Rigid or flexible
- Vaporise stone
- High clearance rates
- Minimally invasive
- Lots of toys

“Laser”

- Usually holmium
- Flexible fibre goes up rigid or flexible scopes
- Different sizes

Modern rigid URS

- Fibre optic
- Tapered tip, 8 – 9F shaft diameter
- Working channels $>3F$
- Eye pieces are in line or off set

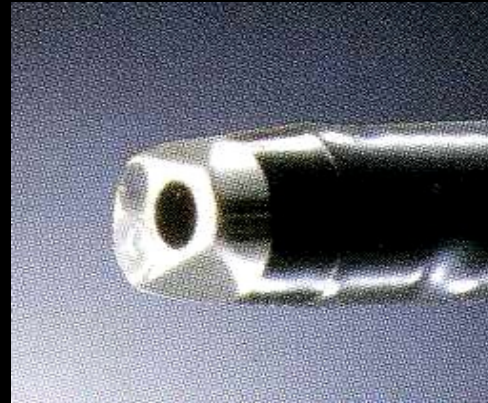




- 7 to 9F diameter
- 3.6F working channel



URF-P5



URF-P3

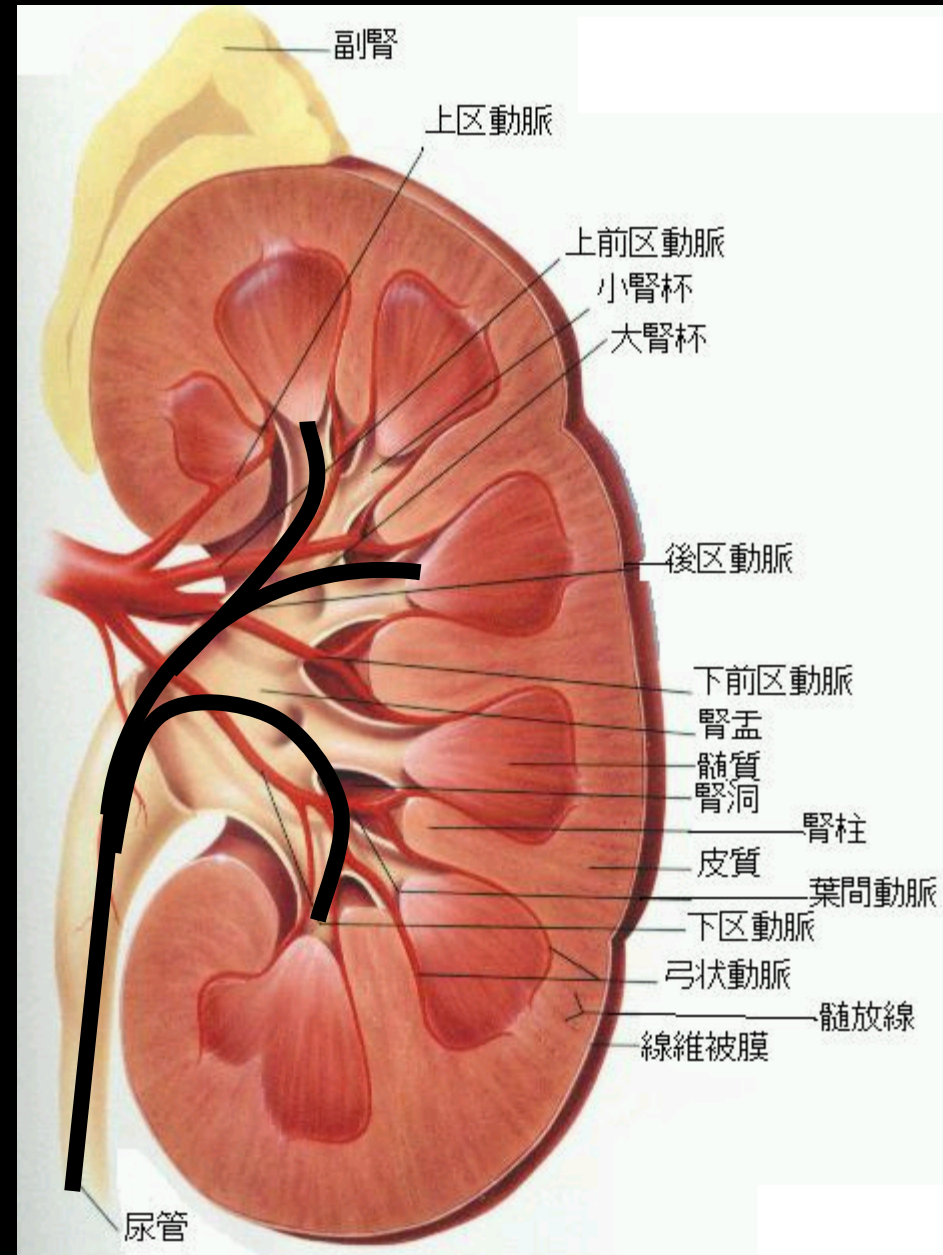


Asymmetric design applied

- ◆ Angle Down: $180^\circ \Rightarrow 275^\circ$
- ◆ Easier approach to the lower pole calices.

UP: 180°

**DOWN:
 275°**



New technology – digital chips

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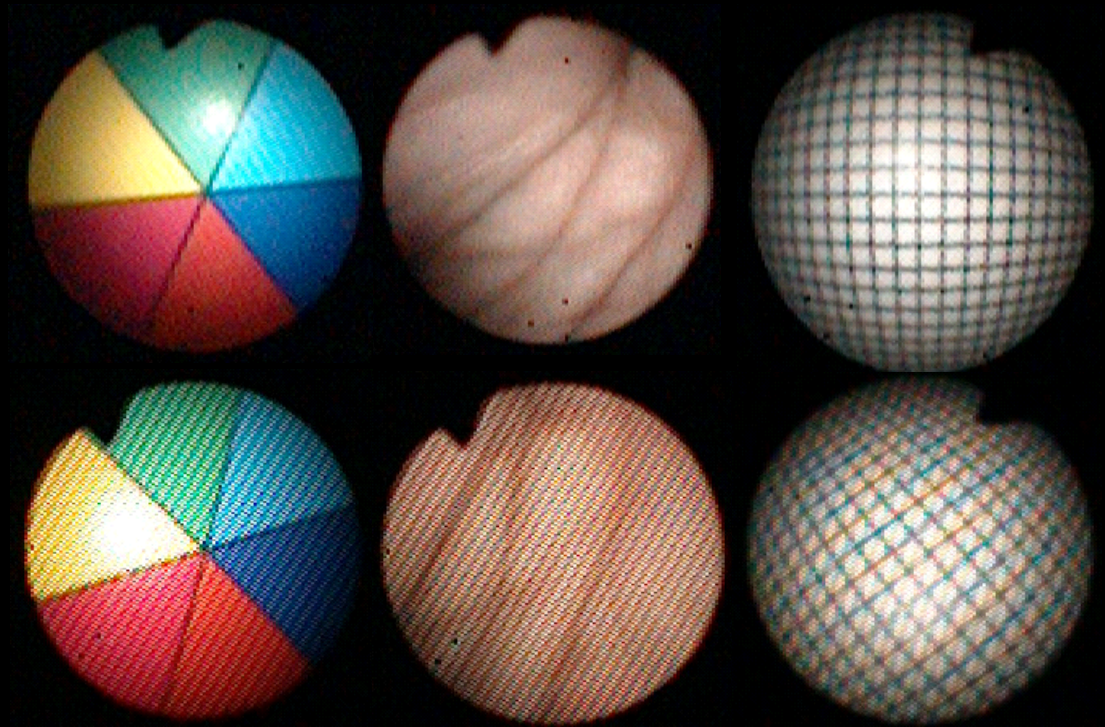


"You just keep going and going?"

Fibre bundles are clad with 2nd layer of glass – improved durability & picture

URF-P5 image

With moiré
reduction filter.



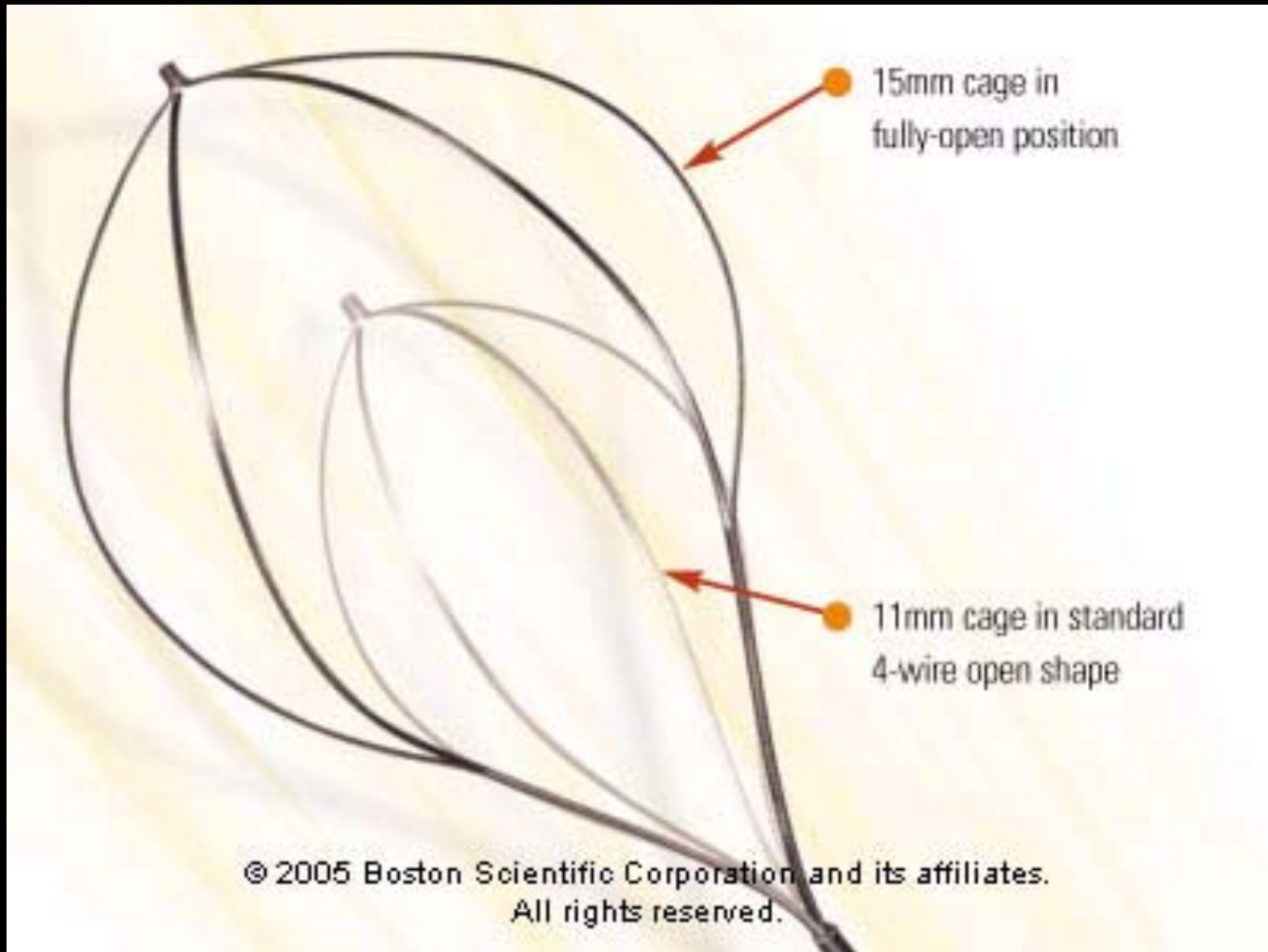
URF-P3 image

Moiré is seen in
the view.

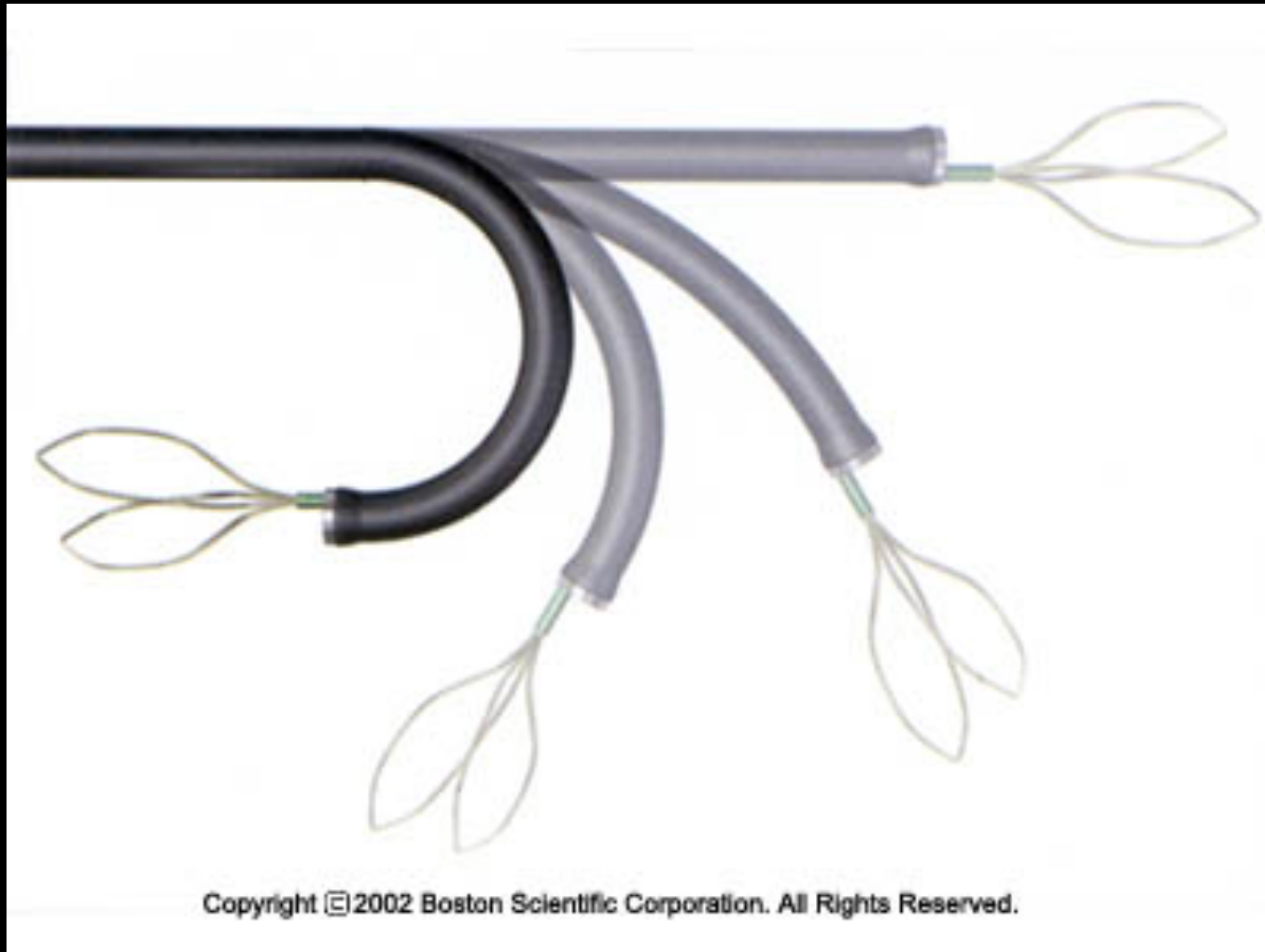
Durability

- User skill/ experience
- Damage to working channels
 - 3F baskets/forceps – slight damage at 120 deg deflection
 - 200m holmium fibre damaged inner surface at 60 deg deflection
- Ensure scope is straight before inserting fibre

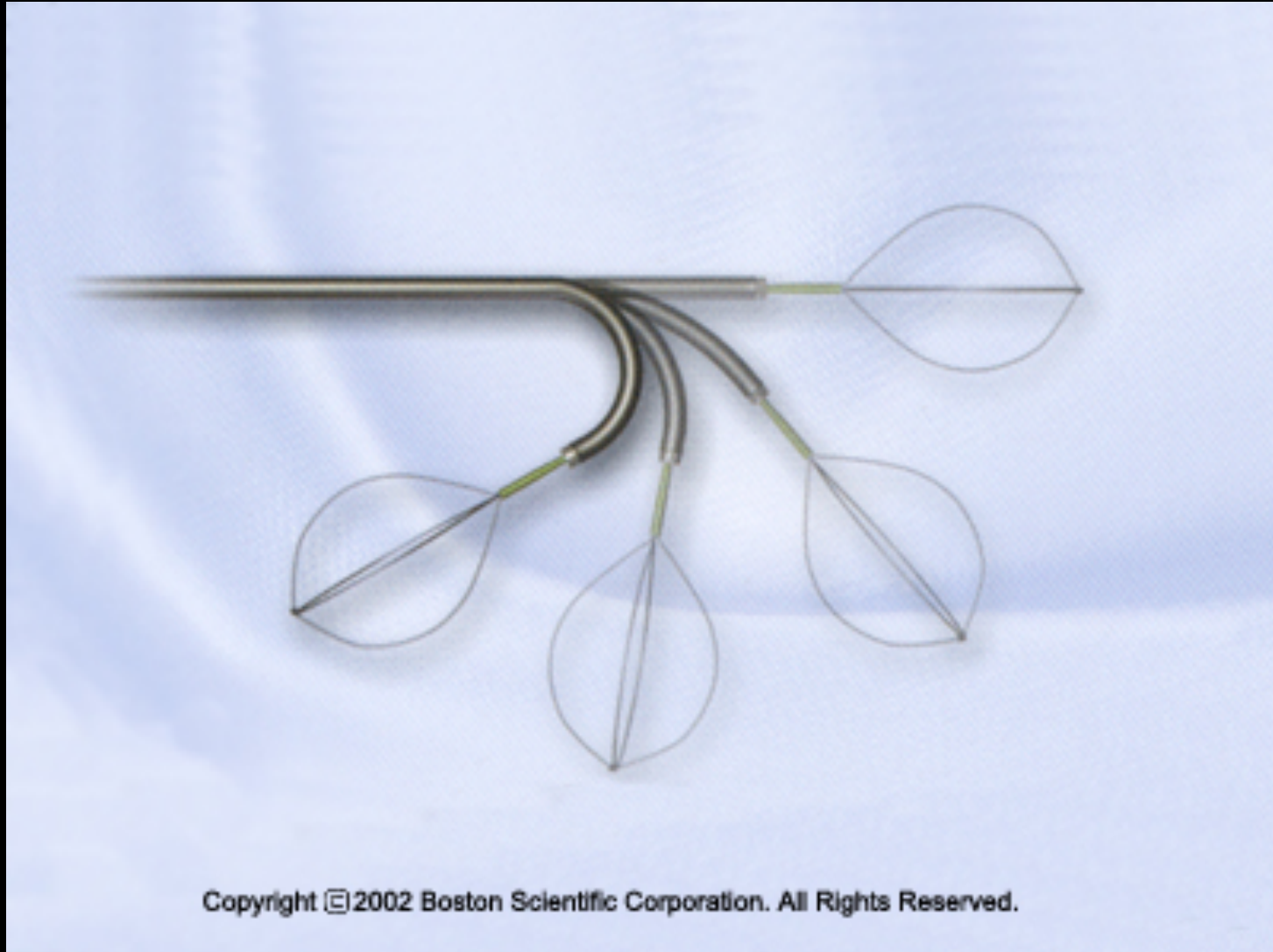
Escape – Boston Scientific



Grasper – Boston Scientific



Zero tip 1.9F – Boston Scientific

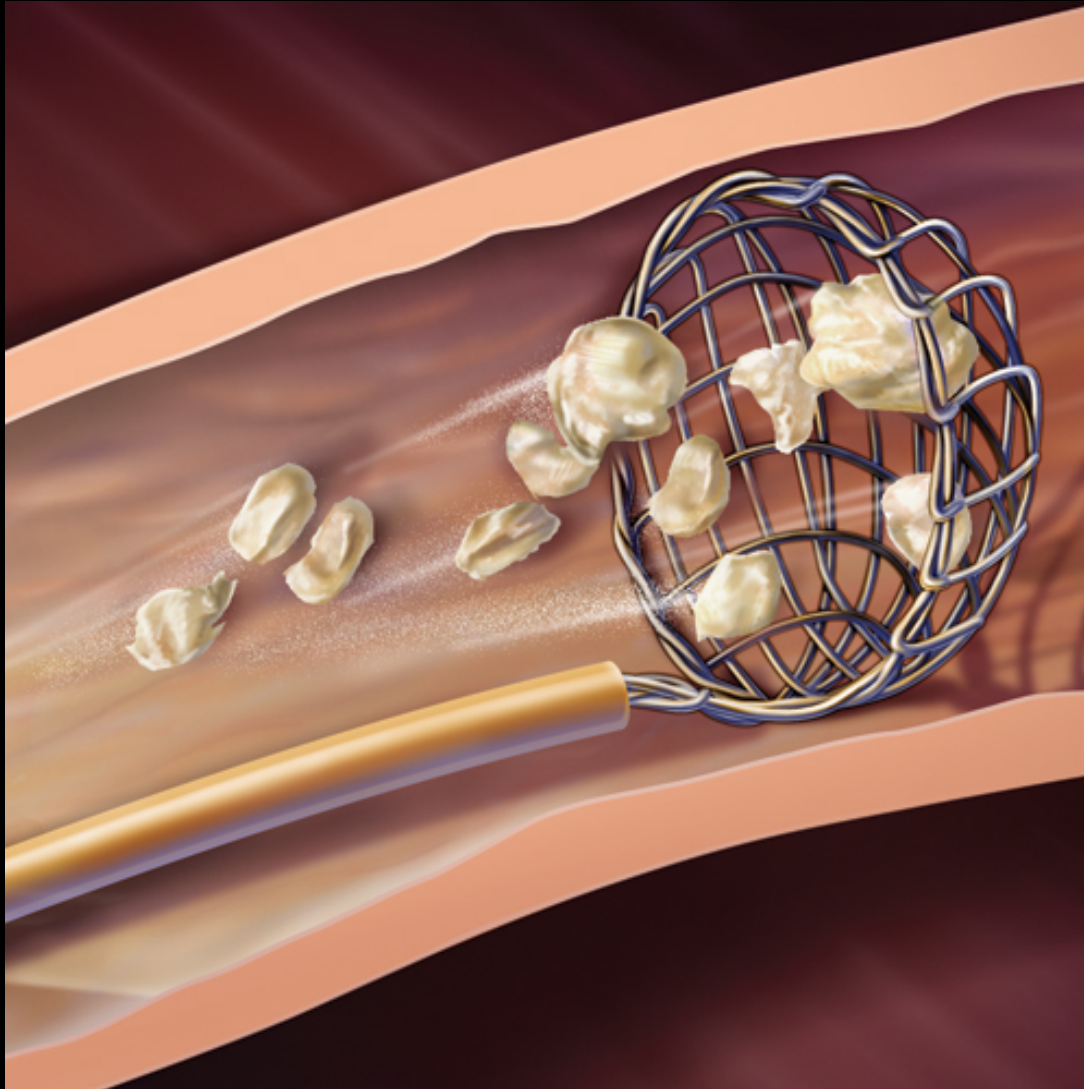


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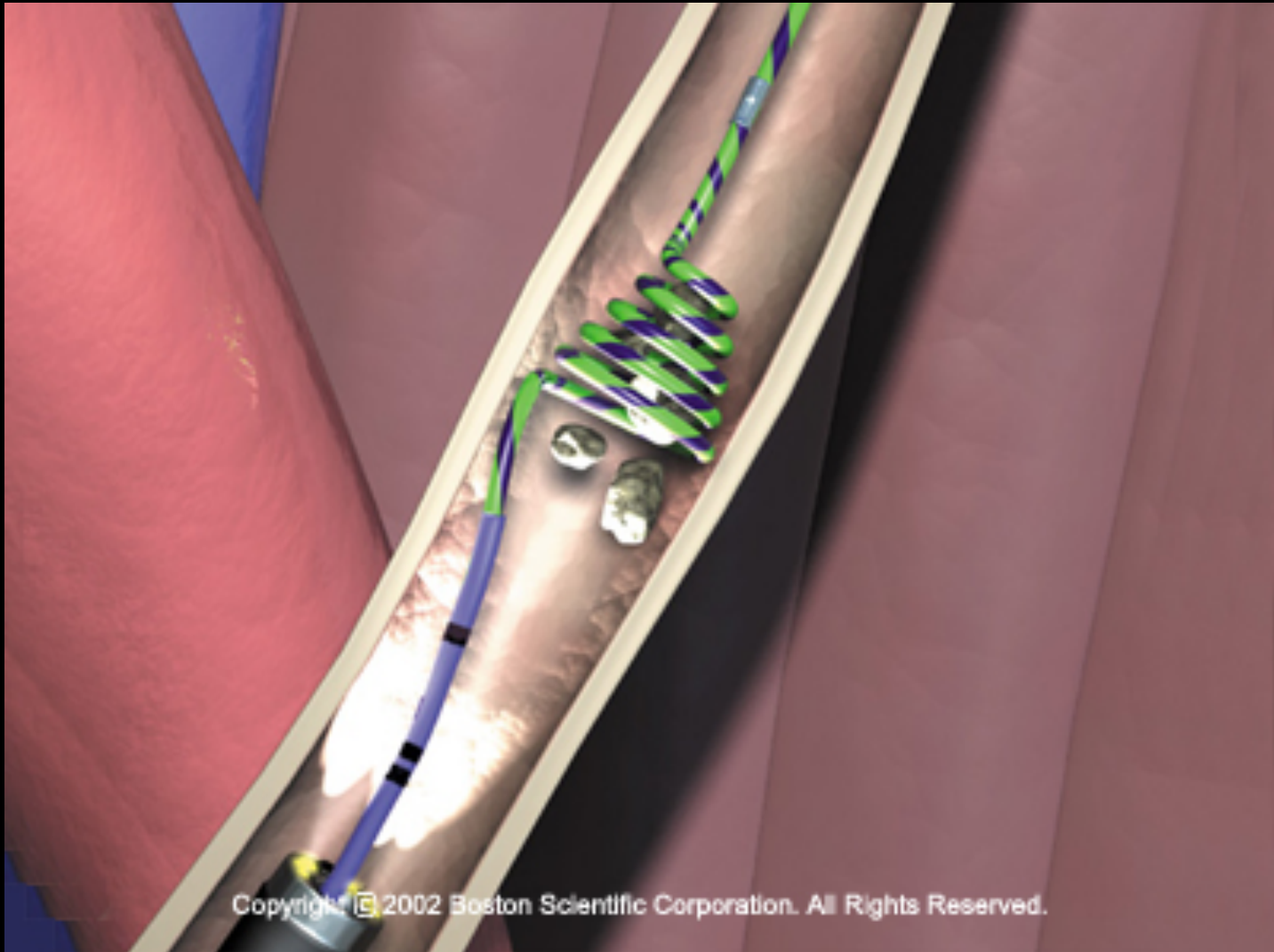
Cook – helical basket



Cook – Stone trap



Stone cone – Boston Scientific

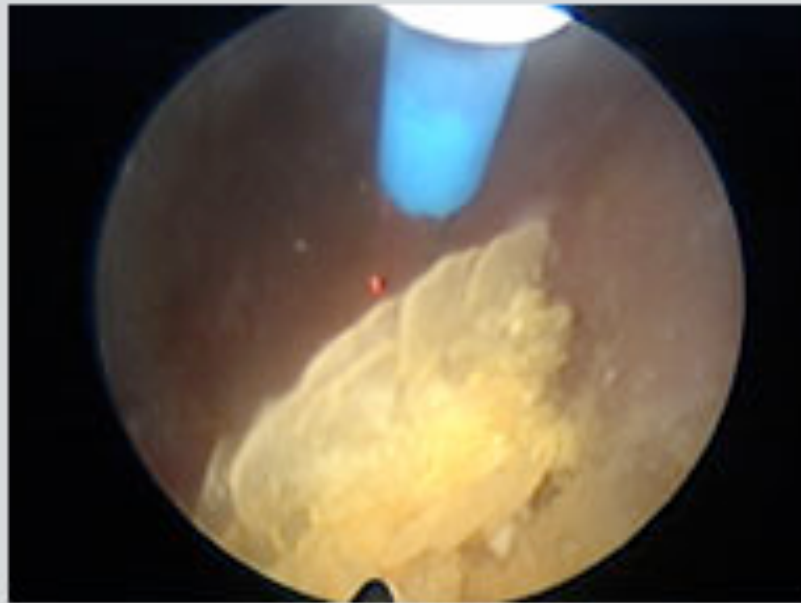


Ureteric access sheaths – better irrigation, fragment removal



Wires –urowire, sensor wire





Laser fiber introduced through the cystoscope in the bladder of a female Bichon Frise for lithotripsy of recurrent calcium oxalate calculi.



PCNL

- Reserved for larger stones
- staghorns



PCNL

- Puncture kidney and insert wire
- Dilate tract with nephromax and insert sheath
- Nephroscope and lithoclast master
- High stone clearance rates

nephromax

