Retrograde Intrarenal Surgery (RIRS) for Large Renal Stones

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RIRS - Definition
RIRS = Retrograde Intrarenal Surgery
i.e., endoscopic surgery for management of pathology within the renal collecting system using a retrograde closed approach

Rationale for RIRS
Limitations of Success of SWL
SWL (stone free rate) decreases
• Stone Size: > 1.5 cm. — residual stones
• Stone Location: lower calyx
• Hardness / fragility: CaOMH, Cystine, Matrix
• Anatomical Alterations of UUT: stenosis below stone
• Physiological Alterations: immobile patient
• Patient Habitus: obesity, skeletal
• Medical: bleeding diathesis, unfit for anesthesia

What is the Role then for RIRS?
The “basic” Indications
• Solid stones < 1.5 cm, esp. known COMH, cystine SA,
• Lower calyx location
• Failed ESWL
  (solid stones < 1.5 cm. or < 50 fragments)
• Stones and caliceal diverticuli
• Radiolucent stones < 2.5 cm. (after medical dissolution)
• Concomitant ureteral and renal stones
  • (renal stone < 1.0 cm.)

What is the Role then for RIRS?
The “advanced” Indications
• Stones and nephrocalcinosis
• Stones and urinary diversion (conduit)
• RIRS assisted ESWL (stones up to 2.5 cm.)
• Staghorn stones (RIRS-SWL) using Holmium “debulking”
• Staghorn stones (when ESWL and PCNL not technically or medically feasible)

What is a “large” Renal Stone?
• Definition: > 2.0 cm Traditional Tx: PCNL
• Treatment goals?
  • Minimal invasiveness (ESWL < RIRS < PCNL < laparoscopy < open surgery)
  • Out-patient
  • Quick and uneventful recovery (no pain from stone passage or stent discomfort)
• Our task then: choose the right treatment modality for the right patient
When to choose RIRS for the “Large Stone”??

- Poor PCNL candidate
  - PCNL contraindication (bleeding disorder)
  - Morbid obesity
  - Compliance issues
- Patient preference
  - Less invasive
  - Out-patient procedure
  - But: more than one session, prolonged stenting

RIRS - Technique

Points of Technique:

- "Optical" dilation with 9.5 Fr. rigid ureteroscope allowing one-stage procedure
- Simultaneous use of RIRS and SWL
- Use of access sheath (2nd stage, big prostate, bleeding disorder)
- Use of 2nd irrigation thru 5 Fr angiocath

RIRS - Technique

- Instrumentation:
  - 9.5 Fr semirigid and 7.5 Fr. ureterorenoscopes (ACMI, Olympus, Storz): one-stage
  - Holmium Laser (Dornier, Lumenis, Storz):
    - fragments all stones, + vaporization, incision of strictures,
    - tumor coagulation/ablation, bleeding coagulation

Rigid Ureteroscopy: Step by Step

Step 1: Preparation

- Patient Selection
- Sterile urine (if at all possible)
- IV hydration
- IV peri-operative antibiotics
  - (e.g. Ampicillin + Gentamycin)
- KUB, general anesthesia (IV sedation)

Rigid Ureteroscopy

Step 2: Safe Access to the Ureter

- Cystoscopy
- Retrograde Pyelogram
  - (to assess course of ureter)
- Manipulation of safety wire into kidney
- Administration of diuretic
  - (Reduces risk of pyelorenal reflux and septic complications)

Access to the Upper Urinary Tract Technique (URS)

- Introduction of Ureteroscope into Ureter
  - alongside safety guide wire
  - over second (working guide wire)
  - empty bladder
  - if all else fails, consider dilation of ureteral orifice
RIRS: Access to the Upper Urinary Tract

- Dilation of ureteral orifice or higher ureteral segments rarely necessary when "optical dilation" with 9.5 Fr. rigid ureteroscope used

Passage of the Flexible Ureterorenoscope over Guidewire

- Ureterorenoscopy is performed passing an actively deflecting ureterorenoscope over guidewire which is removed once the ureteroscope advanced past the iliac vessels
- Irrigation fluid is begun and the instrument is advanced under direct vision to the area of interest.

RIRS-Access

- Straighten urethra and avoid kinking
  - Advance scope with thumb and index finger of left hand

RIRS: Points of Technique

- Low-pressure system
- Suction / irrigation
- Access sheath (optional)

Left hand:
- Straighten urethra
- Advance scope and direct tip

Right hand:
- Keep wire under slight tension
- Up/down flection

Right Hand Actions:
- Keep wire under slight tension
- Up/down flection after removal of guide-wire

Irrigation (gravity 60 cm)
- Suction
**Retrograde Intrarenal Surgery Equipment**

- Employ appropriate energy source
  - for stones: ultrasound, Lithoclast, EHL, Laser (Holmium)
  - for strictures: cold-knife, RF knife, Laser (Holmium)
  - for tumors: RF energy, Laser (Nd:YAG, Ho:YAG, Holmium)

**Universal Urology Energy Source: Holmium Laser**

**RIRS with Holmium Laser**

- Energy settings:
  - Stone: 0.6 - 1.0 J @ 10 - 5 Hz
  - Stricture: 1.0 J @ 15 Hz = 15 W
  - Tumor: 1.0 J @ 10-20 Hz
  - Bleeding: 1.0 J @ 10 Hz

**RIRS for Managing the Large Stone**

- RIRS assisted ESWL (stones up to 2.5 cm.)
- Staghorn stones (RIRS-SWL) using Holmium “debulking” + simultaneous SWL
- Large / Staghorn stones: RIRS - monotherapy
  (when ESWL and PCNL not technically or medically feasible; e.g. coagulopathy, skeletal abnl)

**Managing the Large Stone**

- 2.5 cm stone
- Pt. with coagulopathy
  - (Liver Txp failure, awaiting new liver)
- How to treat?

**Managing the Large Stone: Using the rigid scope**

- Holmium Vaporization: Stone “debulking”
  Safe use of direct-contact energy

**Managing the Large Stone: + complicating factor: coagulopathy!**
Managing the Large Stone: and the flexible scope

Lower calyx component:
200 micron fiber (10 - 5 W)
+ basketing of gravel
+ use of access sheath

Managing the Large Stone: + complicating factor: coagulopathy!
- The solution is RIRS
  - Minimal invasive, direct – contact fragmentation with low risk of bleeding
  - Use of the rigid and flexible scope
  - Use of access sheath to reduce bleeding risk and allow for expeditious removal of gravel
  - Remove most gravel actively
  - Leave stent for short period of time

Managing the Large Stone: Using multiple modalities

- Indication:
  - 2.0 cm lower calyx (s/p failed SWL)
- Techniques:
  - “optical dilation” (9.5 + 7.5 Fr.)
  - 200 micron fiber
  - “relocation techniques”
  - Combination RIRS-SWL

RIRS assisted SWL

Rationale
- RIRS allows real-time endoscopic monitoring of SWL fragmentation and determination of endpoint of treatment:
  - also accelerates fragmentation: Holmium / EHL co-fragmentation
  - to remove fragments during SWL
  - localization of poorly opacified stones for SWL
  - to correct anatomical problems of stone egress

Advanced Endourology
RIRS assisted SWL

1. Complete vaporization and fragmentation
2. Active removal of gravel
No / Minimal residual
Minimally invasive
RIRS assisted SWL

**Equipment**
- Multipurpose Lithotriptor (MFL 5000, Storz Modulith, Dornier)
- Simultaneous use of SWL and RIRS
- Flexible Ureterorenoscopes
  - 10.4, 8.5, and 7.5 Fr.; ACMI, Olympus, Storz, Wolf
- Holmium Laser (Dornier, Lumenis, Storz)
- EHL Calciuret (Karl Storz)
- Accessories: Basket, Access sheath, Grasper (Cook, Microvasive)

**INDICATIONS**
- Failed SWL, secondary to:
  - Size (larger than RIRS-monotherapy)
  - Stone Composition (direct visual feedback)
  - Anatomic Variances (stenosis, can repair)
- Stones and intrarenal stenosis amenable to RIRS repair (in upper pole / mid renal)
  - Infundibular Stenosis
  - Diverticulum

**The “Large” Stone**
- RIRS assisted ESWL
  - Stones up to 2.5 cm., routine alternative
  - Lower pole (when difficult RIRS access)
  - Even larger stones --- usually PCNL
- Staghorn stones (RIRS-SWL) using RIRS Holmium “debulking” (up to 25 Watts)

RIRS assisted SWL

**Staghorn Stone**

**Points of Technique:**

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<tr>
<th>Technique</th>
<th>Description</th>
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<td>RIRS</td>
<td>AKs, diuretics, low pressure conditions (gravity inflow through 5 Fr. Angiocath, suction outflow through workchannel access sheath)</td>
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<td>ESWL</td>
<td>Start peripheral to central 60 Hz repetition rate (improve efficiency) increasing energy levels (reduce SE)</td>
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**Staghorn Stone**

| RIRS – Holmium debulking of renal pelvis upper pole |
| Simultaneous SWL of lower calyceal group mid calyceal group |

RIRS for Renal Stone
Extracorporeal Shockwave Lithotripsy

RIRS assisted SWL
Improving Results for Large Stones

• Determines precise endpoint of fragmentation and eliminates empirical “extra shocks for the road”
• Allows for co-fragmentation/vaporization and active stone removal
• Allows for repair of anatomical variants

RIRS assisted SWL (MFL 5000)
RESULTS (1995-1996)

• TOTALS (All Indications)
  - 45 patients
  - Ave stone 21.4 mm
  - Co-fragmentation:
    • Holmium 53%
    • EHL 46%
  - Basket 95%
  - Ave treatment time 115 min
  - Stone free rate 84.4%

Retrograde Intrarenal Surgery
Conclusions

• In the management of stones RIRS has replaced SWL and PCNL as first choice for a number of indications
RIRS is a routine procedure
with a wide range of indications including management of the select “large renal stone”
• Safe, efficacious, out-patient, reproducible
RIRS – Endourology
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