Management of Complicated Urolithiasis

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Disclosures

- Retrophin - Speaker
Aims

• To discuss management of high-risk patients with complicated medical conditions
  • Anticoagulation
  • Pregnancy
  • Spinal cord injury/deformities

• Review surgical management with anatomic abnormalities
  • Horseshoe kidney
  • Calyceal diverticulum
  • Urinary diversion
  • Obese
  • Renal transplant
Anticoagulation

- Balance of risk of cardiovascular events against major bleeding
- Iatrogenic - Antiplatelets (AP) and Anticoagulants (AC)
  - Coronary artery disease
  - Bare metal stents
  - Drug eluting stents
  - Cardiac arrhythmias (i.e. A fib)
  - Valvular heart disease
  - DVT/PE
  - IVC filters
- Patient factors-
  - Hemophilia
  - Von Willebrand’s
  - Thrombocytopenia
  - Cirrhosis
Anticoagulation

- CAD, bare metal and drug-eluting cardiac stents
  - AP reduce risk of cardiac events and death
- Cardiac valves, Afib, DVT/PE
  - AC reduce risk of thromboembolic events
- Assess need for AP/AC
  - Estimate risk of systemic thrombotic event from cessation of AC/AP
  - Estimate surgical hemorrhagic risk from AC/AP therapy
  - Consider the urgency of a urologic procedure
Anticoagulation

- For those patients with risk factors
  - Low-dose aspirin can be continued in perioperative period without increased risk of major bleeding (RRR 80%; ARR 7.2%)
- For low-risk patient, AC/AP can be safely discontinued without an increased risk of bleeding complications
- Dual Antiplatelet Therapy should be continued for at least
  - 30 days after a bare metal stent
  - 12 months after a drug-eluting stent
  - 2 weeks after simple angioplasty
  - No elective surgery should be performed (only emergent)
  - High risk emergency surgery
    - Continue use of only aspirin alone
    - Discontinue clopidogrel (Plavix), prasugrel (Effient), or ticagrelor (Brilinta)
- After time frame, APs can be discontinued 7-10 days before surgery
  - Restart if the bleeding risk is acceptable
  - With normal dosing of clopidogrel, prasugrel, or ticagrelor, it may take up to 10 days to achieve an acceptable platelet inhibition
Anticoagulation

• Arterial or venous thromboembolism
• Major adverse cardiac and cerebrovascular events
  • Stroke
  • Pulmonary embolus
  • Major cardiac adverse events
  • Can be and usually are far more life altering than hemorrhage

• Afib patients- rate of ischemic stroke: 5% per year
  • Risk increases with age, DM, HTN, CHF, previous stroke/TIA
    • 1.5% for 50-59 years
    • 23.5% for 80-89 years

• Endovascular stents >> CABG
  • Drug eluting stents lower restenosis risk to <10%
    • Lower than bare metal
    • But the drugs delay arterial healing
    • → Prolonged need (12 months) for dual antiplatelet therapy (DAPT)
### Suggested AC perioperative management

<table>
<thead>
<tr>
<th>AC *</th>
<th>Time to Max Effect</th>
<th>Normal Renal Clearance</th>
<th>surgery bleeding risk</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warfarin (racemic)</td>
<td>5–7 Days for therapeutic INR</td>
<td>—</td>
<td>—</td>
<td>Circulating vitamin K dependent factors (II, VII, IX, X)</td>
</tr>
<tr>
<td>Unfractionated heparin</td>
<td>Immediate intravenous, within 6-hr subcutaneous</td>
<td>—</td>
<td>—</td>
<td>Renal clearance, effective reversal with protamine</td>
</tr>
<tr>
<td>LMWH</td>
<td>3–5 Hrs</td>
<td>—</td>
<td>—</td>
<td>Renal clearance, partial reversal with protamine</td>
</tr>
<tr>
<td>Fondaparinux</td>
<td>2 Hrs</td>
<td>—</td>
<td>—</td>
<td>Renal clearance, not reversed by protamine</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>1.25–3 Hrs</td>
<td>Last dose 2 days preop (skip 2 doses)</td>
<td>Last dose 3 days preop (skip 4 doses)</td>
<td>Nonreversible, 80% renal clearance</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>2–4 Hrs</td>
<td>Last dose 2 days preop (skip 1 dose)</td>
<td>Last dose 3 days preop (skip 2 doses)</td>
<td>Nonreversible, 66% renal clearance</td>
</tr>
<tr>
<td>Apixaban</td>
<td>1–3 Hrs</td>
<td>Last dose 2 days preop (skip 2 doses)</td>
<td>Last dose 3 days preop (skip 4 doses)</td>
<td>Nonreversible, 25% renal clearance</td>
</tr>
</tbody>
</table>

* AC regimen intensity depends on preoperative risk stratification.
† Aiming for mild to moderate (less than 12% to 25%) residual AC effect at surgery
‡ Aiming for no or minimal (less than 3% to 6%) residual anticoagulant effect at surgery.
Figure 2: Guide to APT in the perioperative period. Modified from Singla5

Urologic Procedure

- Urgent
  - Emergency
  - Very High Risk Period*
    - High Cardiac Risk
      - Y
      - N
        - High Risk Bleed
          - Y
          - N
          - Y
          - N
            - Immediate surgery
              - Risk stratify for AP postoperatively as with Urgent group
            - ASA or no APT
            - DPT or ASA
              - Delay Procedure
                - For Balloon angioplasty >14d
                - Bare metal stent >30d
                - Drug-eluting stent >365d

AP = Antiplatelet
DPT = Dual antiplatelet therapy
ASA = Aspirin
APT = Antiplatelet therapy
Y = Yes
N = No

If the surgical bleeding risk is low, the periprocedural recommendation would be to continue dual antiplatelet therapy or aspirin alone.
AUA Review Paper

- **SWL- NO** means to establish hemostasis
  - AC/APs must be discontinued or reversed (consider bridge)
  - Timing of cessation/reinstitution should include an assessment of the risks of thrombotic complications versus bleeding using a coordinated multidisciplinary plan with stratification according to risks
  - Advised cautious reinstiution due to report of massive hemorrhage 5 days post SWL

- **Ureteroscopy can be performed with continuing oral AC/AP therapy**
  - Correct those with correctable bleeding diathesis
  - Holmium laser is preferred lithotripsy
  - Consider staged approach for large renal stones
  - Care against guide wire or laser fiber trauama
AUA Review Paper

- **PCNL - very limited (~NO) means of hemostasis**
  - Oral AC/AP medications should be discontinued prior to
    - Bridged where deemed necessary
  - Timing of cessation/re-initiation should involve multidisciplinary decision plan with stratification according to risks
  - Most common: stop 10 days pre-operatively and resume 5 days post-operatively provided by CROES PCNL Global Study
  - Warfarin 5 days preop; LMWH bridge based on risk assessment
  - AC/AP associated with increased risk of postoperative bleeding
Pregnancy

- Urolithiasis is the #1 cause of non-obstetric acute admission during pregnancy
- Report incidence varies
  - 1/200 to 1/1500 pregnancies
- 75% are first time stone formers
- 87% presented in latter two trimesters

- High spontaneous passage (>50%) → initial observation
  - BUT… increased risk of pre-term premature rupture of membranes
  - 80% increased risk of preterm delivery (OR 1.8)

Pregnancy

- **US is 1\textsuperscript{st} line imaging in pregnancy**
  - Readily available
  - No ionizing radiation

- Highly user dependent
- Cannot reliably image the ureter
  - Must depend on secondary signs of obstruction (i.e. hydronephrosis)
  - Hydronephrosis can be physiologic

- Request assessment of ureteral jets
- Request renal resistive (RI) index: $(PSV-EDV)/PSV$
  - Vascular resistance increases with obstruction
  - Delta RI 0.06 suggests unilateral obstruction
    - Obstructed kidney: $0.69 (+/- 0.03)$
    - Unobstructed kidney: $0.63 (+/- 0.03)$

Pregnancy

- MRI/MRU
  - No ionized radiation
  - Provides detailed cross sectional imaging

- Stones typically not directly visible
  - Occasionally seen as hypointense filling defect on high resolution T2
  - May depend on secondary signs of obstruction (i.e. hydro)
  - Hydronephrosis can be physiologic
    - Physiologic hydro typically will only extend to pelvic brim
    - Double kink: hydroureter between pelvic brim and obstructing distal ureteral stone
Pregnancy

- ACOG Committee Opinion
  - Imaging without ionizing radiation should be considered when appropriate
  - Concern over effects of radiation should not preclude medically necessary diagnostic imaging
  - X-ray exposure <5 mSv not associated with increased fetal abnormalities or fetal loss

- Stone protocol CT = 10 mSv
- Low dose CT = 1-3 mSv
  - Can be used for clinically indeterminate pregnant patients
    - 25-50% do not have stones

ACOG Committee Opinion 299, Sept 2004
Pregnancy

- 51 pregnant patients underwent ureteroscopy
  - 7 negative ureteroscopies (14%)

- 23% negative URS after US alone

- Conclusion - consider low dose CT to obviate unnecessary intervention

<table>
<thead>
<tr>
<th>Modality (n)</th>
<th>False Positive</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low dose CT (24)</td>
<td>1</td>
<td>96%</td>
</tr>
<tr>
<td>US (22)</td>
<td>5</td>
<td>77%</td>
</tr>
<tr>
<td>MRU (5)</td>
<td>1</td>
<td>80%</td>
</tr>
</tbody>
</table>

Pregnancy

- ACOG Committee Opinion
  - Pregnant women should not be denied indicated surgery
    - Elective surgery should be postponed until postpartum
    - Nonurgent surgery should be performed in second trimester
  - Fetal heart monitoring and neonatal, pediatric and obstetric services should be available
  - If fetus nonviable, obtain fetal heart monitoring before and after
  - If viable, simultaneous contraction monitoring should be performed with fetal heart monitoring before and after
    - Can also be used intraop if feasible, OB available, surgery can be concluded prn

Pregnancy

• Temporizing measures- both a/w higher encrustation
  • Stent placement- consider US guidance
  • NT

• Definitive Stone Surgery
  • Uncontrolled pain, nausea, fever, renal impairment, failure to pass
  • Re-admission not necessarily criterion for intervention

• SWL and PCNL strictly contraindicated
• URS can obviate need for serial stents (4-10% complications)
  • More cost effective
  • Second trimester is preferred due to risk of preterm labor in 3rd
Spinal Cord

- Increased incidence of stones
  - SCI
    - 7-20% within 10 years of SCI
    - 34% within 30 years
  - Spinal muscular deformities
    - ~16x more likely to have stones
- Bacteruria more common
  - Polymicrobial, multi-drug resistance common
- Autonomic dysreflexia (T6 and above)
- Positioning challenges
  - May limit retrograde surgery
  - Block fluoroscopic imaging
Spinal Cord

- SWL, URS, PCNL ALL associated with:
  - Lower stone free rates
  - Increased LOS
  - Increased postop infectious complications
Horseshoe Kidney

- 1 in 400 individuals
- Isthmus prevents ascent resulting in a caudal and malrotated kidney
- Stones may form in up to 60%
- Flexible ureteroscopy/SWL associated with lower stone free rates
- Configuration of UPJ/calyses
  - UPJ higher
- Access upper pole
  - US guided; consider CT guided
Calyceal diverticulum

- 2/3 are upper pole
- 2/3 are posterior
- 50% have stones
- Treat only if symptomatic
  - May be vague pain
Calyceal diverticulum

- SWL
  - Poor stone free rates due to stasis
  - Improved symptoms more often
- URS
  - Consider for anterior or medial calyx
  - Lower pole difficult
  - May need to incise neck
- Percutaneous
  - Superior stone-free rates 87-100%
  - Relief of symptoms 90%
  - Obliteration of cavity 76-100%

Krambeck AE et al. J Endourol, 23(10), 1723-9, 2009
Calyceal diverticulum

- Laparoscopic/Robotic
  - Consider when other options not possible
  - Ideal for anterior calyx
  - Excellent stone free rates
Obesity and PCNL

- 3709 patients from 96 centers stratified by BMI
- Obesity associated with
  - Longer operative duration
  - Higher retreatment rate
  - Inferior stone free rates
- NO difference
  - Transfusion rates
  - Length of hospital stay
  - Complication rates

Fuller A et al. J Urol 188; 168-44, 2012
Urinary diversion

- Associated with increased risk of urolithiasis
  - 11% will develop a stone within 3 years of diversion

- Multifactorial
  - Chronic UTI
  - Urinary stasis
  - Foreign bodies
  - Hyperchloremic metabolic acidosis
    - Chronic acid load
      - Absorption of ammonium from urine
Urinary diversion

- Lower SWL/URS success rates
  - Narrowing/striction of ureterointestinal anastomosis
  - Failure to ID ureterointestinal anastomosis
  - Tortuosity
  - Angulation

- Higher risk of sepsis
- Antibiotics and access sheath

Urinary diversion

- Urinary diversion associated with
  - Higher likelihood of radiologist access (40% vs 0%)
  - Increased need for second look nephroscopy (36% vs 16%)
  - Struvite stone composition (80% vs 12.5%)
  - Higher risk of post-operative sepsis (8% vs 0%)

- No significant difference seen
  - Stone free rates
  - Complications
  - Transfusion rates
  - Length of hospital stay

Renal Transplant

- Up to 3% of transplants develop stones
- Risk secondary to metabolic abnormalities, foreign body, papillary necrosis, recurrent UTI
- Presentation: ARF, hematuria, UTI
  - Not pain
- SWL can be performed but often prone
  - May require multiple sessions
- URS successful if access possible
  - Antero-lateral insertion
- PCNL
  - US access but may require CT guided access
References