COMPLICATIONS WITH PERCUTANEOUS NEPHROLITHOTOMY

1. Incidence
2. Non-hemorrhagic Complications

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Risks of PCNL

- Chicago
- 11,721 patients
- National Inpatient Sample for 2002-2008
- Mortality rate 0.3% - Stable
- Transfusion rate – 5% - Increasing
  - Higher – small hospitals, elderly
- Chest tube - 1%
  - Higher – teaching hospitals, young (<30)
- Need for a chest tube or blood transfusion
  - 3-fold increase in length of stay and hospital charge.

AUA 2011(Abstract 1686)

Prevention: Pick the right patient

STONE SIZE >15MM

Anticoagulation Pleural on CT

Y Y N

PCNL URS SWL

Anticoagulation HU >1200 STSD >12 CM LP 10-15mm

READMISSION AND COMPLICATION RATES IN PATIENTS UNDERGOING PCNL, STRATIFIED BY CO-MORBID FACTORS
N. Ginzburg, D. Hoenig, A.A. Hakimi, A. Ovadia, D. Faleck
Albert Einstein / Montefiore – Bronx USA

- Diabetics
  - higher readmission rates (p<0.001)
  - more emergency room visits (p=0.017)
- BMI
  - Higher readmission rates (p=0.039).
**Percutaneous Nephrolithotomy (PCNL)**

4 of 1000 patients Die from PCNL

**WHY? Sepsis**

*J Urol 2013 Aug;190(2):558-64.*

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**SEPSIS after PCNL and URS**

- LIJ
- Preoperative predictors of sepsis after PCNL and URS
  - Bladder outlet obstruction (OR 6.4)
  - Positive pre-operative urine culture (OR 6.7)
  - Indwelling nephrostomy tube (OR 6.4).
- Treatment of a positive preoperative urine culture did not reduce the risk of sepsis, and cannot be considered a reliable preventative measure.

(Abstract 1548)

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**Stone / Pelvis Culture**

- 37% of pts – SIRS after PCNL
  - 4x higher risk if positive stone culture or positive pelvis aspirate
  - Bladder culture not predictive

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**MP25-14 ANTIMICROBIAL UTILIZATION PRIOR TO ENDOUROLOGICAL SURGERY FOR UROLITHIASIS: ENDOUROLOGICAL SOCIETY SURVEY RESULTS**

**MP38-05 THE MODERN ERA STRUVITE STONE: PATTERNS OF URINARY INFECTION AND COLONIZATION**

**Non-RCT – Ciprofloxacin 250 BID x 7 days**

RCT – Macrodantin 100mg BID x 7 days

% Of Pts


Antibiotic Options

• Follow the guidelines
• **Individualize approach**
  - 1 week for:
    • Recurrent UTIs
    • Indwelling catheters
    • Neurogenic Bladders
    • Pyuria
    • Struvite
  • Treat everyone with 1 week of antibiotics

Porcine Model of PCNL
E Coli Infusion

<table>
<thead>
<tr>
<th>Position</th>
<th>&quot;Mini&quot; arm 10F sheath (ID)</th>
<th>&quot;Standard&quot; arm 20F sheath (ID)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean intra-pelvic pressure (mmHg)</td>
<td>18.76 mmHg ± 5.52</td>
<td>13.56 mmHg ± 5.52</td>
<td>p=0.0001</td>
</tr>
<tr>
<td>Median time spent above 30mmHg (sec)</td>
<td>116.99 sec [95.62-135.53]</td>
<td>66.07 sec [32.64-103.09]</td>
<td>p=0.0152</td>
</tr>
</tbody>
</table>

Positive cultures:

- Kidney 10/10 10/10
- Spleen 10/10 6/10 p=0.0033
- Liver 9/10 3/10 p=0.0002
- Blood culture 3/10 0/10 p=0.0003

Positioning for PCNL?

**DOES IT SAVE TIME?**
**IS THERE LESS RISK OF COMPRESSION, LESS NEED FOR Padding?**
**IF THE PATIENT NEEDS REINTUBATION OR CPR...?**

no

Prone Split-Leg Position
The Effect of Prone-Flexed Positioning (PFP) on Airway Pressures During Percutaneous Nephrolithotomy (PCNL)
K Foell, M Ordan, T Alzahrani, AG Lantz, KT Pace, RJD 'A Honey
Division of Urology, St. Michael's Hospital, University of Toronto, Canada

- 63 patients
- All PAP < 40 cmH$_2$O
- No patients required repositioning for anesthetic or other reasons

Mean PAP (cmH$_2$O)

Access

- Align with the pathology
  - Avoids the need for aggressive torquing
- Anterior calyx may be more difficult to establish control
- Use stiff working wire
- Always use a safety wire

Courtesy Mitchell Humphreys

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Courtesy Mitchell Humphreys
Endoscopic vs. Fluoroscopic PCNL

Abort due to bleeding (%)

Endoscopic  Fluoroscopic

160 patients

Courtesy Mitchell Humphreys
At the end of PCNL – embedded stones… what now?

Upper pole access
- Access below the 12 rib rarely results in plural injury (<5%)
- CT study of pts:¹
  - Supra-11th rib
    - Right 86%; Left 79%
  - Supra-12th rib
    - Right 29%; Left 14%
- Clinical series for supracostal approaches 3.3-15.3%²³


Injury to Pleural cavity
- Pneumothorax, hemothorax, urothorax, hydrothorax.
- Distal ureteral obstruction
- Tubeless for high puncture
- Routine use of fluoro of chest
- Chest x-ray more sensitive
- Most conservatively managed
- Aspirate at end of case
- Rarely requires chest tube
Special considerations

- Hemothorax – has HB dropped?
- Infected urine – progress to empyema
- Delay in drainage may lead to need for a Video-assisted thoracoscopic surgery (VATS)

Case Presentation

- 32 year old female POD#1 from left PCNL for staghorn calculus
- Left upper pole percutaneous access supra 12
- Feels well other than some pleuritic chest pain with inspiration, no SOB
- Hct 37 from preop 41
- Routine non-contrast CT scan ordered to evaluate for residual stone
No perinephric hematoma. No residual stone.

What do you do now?

a. Remove nephrostomy tube and send patient home
b. Send patient to Interventional radiology for embolization
c. Consult General Surgery for urgent splenectomy
d. Bed rest, serial Hct, leave nephrostomy tube in place for 2 weeks

Misplaced nephrostomy tube

Cause
• Transhepatic
  – Upper pole or supra-11th rib punctures
  – Hepatomegaly
• Transplenic
  – Upper pole or supra-11th rib punctures
  – Splenomegaly
• Transcolonic
  – Retrorenal colon (0.6% pts)
  – Congenital renal anomalies: horseshoe, ectopia, fusion anomalies
  – Prior gastrointestinal surgery
  – Chronic constipation, neurogenic bowel
  – Musculoskeletal anomalies
  – Anterior calyceal access

PREVENTION
TUBELESS!!

Splenic injury

Treatment
• Hemodynamic instability/massive bleeding
  – Surgical exploration and splenectomy
• Stable, minor bleeding
  – Prolonged immobilization
  – Have IR and/or vascular on stand by at time of nephrostomy tube removal

Hepatic injury

• Usually diagnosed on postoperative CT imaging
• Most hepatic injuries can be managed conservatively
• Transhepatic PCNL has even been reported to be safe when necessary

Colon Injury

• Colon <1%
  – Retrorenal 0.6%
• Left 2X more common than right
• More common with lower pole access
• Most extraperitoneal
Colonic injury

- Conservative management if no signs of peritonitis
  - Place double J stent
  - Pull nephrostomy tube back into colon
  - Foley in bladder
  - Broad spectrum antibiotic
  - Low residue diet
  - After 7 days, retrograde pyelogram or CTU and/or BE to rule out persistent fistula
- Peritonitis, sepsis, failed conservative management
  - Open surgical exploration and repair

Misplaced nephrostomy tube

- Prevention
  - Cross sectional imaging with CT scan prior to PCNL
  - Ultrasound and/or CT guidance for percutaneous access may be necessary in some cases
  - Postoperative CT imaging should be considered
  - Fluoroscopy over the chest or CXR in cases of upper pole/supracostal percutaneous access

Air embolism

- Extremely rare
  - Vascular injury is a precondition
  - Associated with air pyelography
- Results in hypoxia, hypercapnia, depressed cardiac output, mill-wheel cardiac murmur, widened QRS complex
- Rapid ventilation with 100% O2
- Left lateral decubitus position
  - Head down, right side up
- Central venous line to aspirate the air
Obstruction

- Infundibular stenosis <2%
  - Risks: prolonged op time, large stone burden, multiple procedures, extended drainage
- Stricture <1%
  - Proximal ureter and UPJ
  - Inflammation 2° to impacted stone
  - Lithotripsy trauma (thermal injury)
- Usually occur first year after treatment, can present asymptomatically

Conclusion

- Preparation to avoid complications
- High index of suspicion for prompt identification
- Immediate management to avoid morbidity
- Avoid excessive torque
  - Use flexible instruments
- Most can be conservatively managed