The Risk of Post-Operative Sepsis in Patients Undergoing Interventions for Upper Urinary Tract Stones: A Study from the American College of Surgeons National Surgical Quality Improvement Database

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INTRODUCTION

- Urinary stone disease is a highly prevalent condition worldwide with a rising incidence
- Multiple safe and effective treatment strategies exist for patients requiring intervention including ureteroscopy (URS) and percutaneous nephrolithotomy (PCNL)
- However, the increasing medical complexity of patients requiring surgical stone treatment has led to concerns regarding an increased rate of post-operative complications
- The development of sepsis following stone surgery is a leading cause of morbidity and mortality
- While several factors have previously been identified to increase the risk of sepsis, it remains difficult to effectively predict and prevent the development of post-operative sepsis
- We aimed to explore the incidence of sepsis following both URS and PCNL over time, and identify predictive patient and procedural factors associated with sepsis which may be utilized as future preventative strategies

METHODS

- The American College of Surgeons (ACS) National Surgical Quality Improvement Database (NSQIP) is a voluntary, multi-institutional, validated program to measure 30-day, risk-adjusted surgical outcomes, and was used to identify patients undergoing URS and PCNL procedures between 2006-2017
- Sepsis was defined as the presence of clinical or laboratory evidence of an infectious source and two or more system inflammatory response (SIRS) criteria including:
  - Tachycardia >90 beats per minute
  - Tachypnea >20 breaths per minute
  - Temperature >38º or <36º
  - Leukocytosis >12,000 cells/mm^3, leukopenia <4000 cells/mm^3 or bandemia >10% total leukocytes count
  - Anion-gap acidosis >12
- Chi-squared test was used to evaluate changes in post-operative sepsis rates over time, and multivariate logistic regression analysis was performed to identify potential factors for the development of sepsis

RESULTS

- 1517 patients were identified who underwent:
  - 369 PCNL procedures
  - 1148 URS procedures
- Overall rate of sepsis (Figure 1):
  - 2.7% for patients undergoing PCNL
  - 1.0% for patients undergoing URS
  - Trend towards increase rate of sepsis over time in the URS cohort (p=0.05)

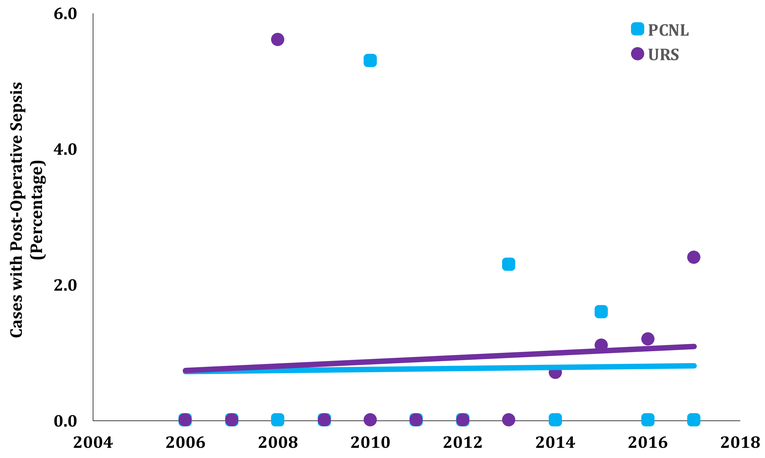

Figure 1: Percentage rate of post-operative sepsis from 2006 to 2017 for ureteroscopy and percutaneous nephrolithotomy

- Factors associated with the overall occurrence of sepsis (Table 1):
  - Higher American Society of Anesthesiologists (ASA) score
  - Active smoking status
  - Dialysis
- Characteristics associated with sepsis following URS only (Table 1):
  - History of a bleeding disorder
  - Congestive heart failure
  - Greater number of days from hospital admission to surgery

Patient Characteristics	Ureteroscopy		Percutaneous Nephrolithotomy	
	Odds Ratio (95% CI)	p-Value	Odds Ratio (95% CI)	p-Value
Age	1.02 (0.96-1.08)	0.538	1.06 (0.91-1.11)	0.917
BMI	1.03 (0.95-1.11)	0.412	1.21 (1.01-1.45)	0.298
Gender	0.99 (0.99-1.01)	0.612	1.16 (0.97-1.39)	0.403
ASA Classification	**1.12 (1.01-1.25)**	**0.027**	**1.30 (1.13-1.49)**	**0.036**
Comorbidities				
Smoker	**1.35 (1.21-1.51)**	**0.008**	**1.73 (1.34-2.18)**	**0.015**
Diabetes Mellitus	0.90 (0.83-0.99)	0.286	0.77 (0.65-0.91)	0.120
Chronic Obstructive Pulmonary Disease	1.11 (0.90-1.36)	0.966	0.59 (0.36-0.96)	0.285
Congestive Heart Failure	**1.58 (1.19-2.12)**	**0.019**	0.85 (0.41-1.76)	0.832
Dialysis	**3.66 (1.99-6.74)**	**<0.001**	**2.79 (1.69-2.97)**	**0.021**
Chronic Steroid Treatment	0.98 (0.96-1.01)	0.418	0.88 (0.53-1.44)	0.808
Bleeding Disorder	**1.5 (1.20-1.90)**	**0.003**	0.85 (0.50-1.46)	0.772
Pre-Operative Serum Biochemistry				
Creatinine	0.98 (0.98-1.00)	0.617	0.95 (0.87-1.04)	0.387
Platelet Count	0.99 (0.99-1.00)	0.831	0.91 (0.87-0.96)	0.876
INR	1.01(1.00-1.02)	0.913	1.05 (0.96-1.15)	0.358
Albumin	1.11 (1.04-1.17)	0.058	1.11 (1.00-1.22)	0.50
Operative Characteristics				
Outpatient Procedure	0.88 (0.79-0.97)	0.188	1.04 (1.02-1.06)	0.872
Elective Procedure	0.45 (0.41-0.50)	0.136	0.86 (0.73-1.02)	0.373
Days from Hospital Admission to OR	**1.23 (1.15-2.48)**	**0.006**	1.02 (0.98-1.06)	0.453
Operative Time	1.04 (1.02-1.06)	0.597	0.98 (0.73-1.3)	0.756

Table 1: Multi-variate analysis of pre-operative and procedural variables associated with post-operative sepsis stratified by procedure type

CONCLUSIONS

- Overall incidence of post-operative sepsis following URS and PCNL remains low
- There is a trend towards increasing rates of sepsis among patients undergoing URS
- This may be related to increasing medical complexity of patients or colonization with hospital acquired organisms
- Several characteristics were associated with the development of sepsis following both URS and PCNL including higher ASA score, smoking, and renal failure requiring dialysis
- Further investigation is required to determine the reason(s) for the trend of increasing sepsis and to develop reliable predictive models to help mitigate the risk of post-operative sepsis