Date: 4/12/18  Presenter Name: Karen Wakeman

Article Citation: Moore, CL et al. “Derivation and validation of a clinical prediction rule for uncomplicated ureteral stone - the STONE score: retrospective and prospective observational cohort studies

Country(ies):
US- Yale New Haven Hospital ED and community site

Funding Source(s): Agency for Healthcare Research and Quality

Purpose

Research Question(s):

Hypotheses:
patients with a high probability of ureteral stones would have a low probability of acutely important alternative findings

Study Purpose:
Incorporating a clinical decision tool into imaging decisions for suspected renal colic may decreased exposure to radiation and over-utilization of imaging

Methods

Study Design:
Retrospective observational derivation cohort, prospective observational validation cohort

Outcome(s) [or Dependent Variable]:
Prediction of kidney stone

Intervention [or Independent Variable]:
STONE score

Ethics Review: IRB Review  IACUC Review  Other:  None Stated

Research Setting: 1 urban hospital and 1 community site

Study Subjects:
Pts seen at Yale New Haven Hospital/Shoreline Medical Center

Inclusion Criteria: >18, undergoing “flank pain protocol” CT
**Exclusion Criteria:**
Lack of flank/back pain, h/o trauma, evidence of infection, active malignancy, known renal disease or previous urologic procedure

**Study Interventions:**
STONE score

**Study Groups:**
491 5/2012-1/2013 pts without exclusion criteria were enrolled

**Instruments/Measures Used:**
Literature review using keyword searches in PubMed and relevant citations through Web of Sciences
Lynx medical record used by EM clinicians

**Data Collection:**
Abstracted presence/absence of factors in standardized form in an electronic database
Blindly abstracted/categorized results of dictated CT reports
-kidney stone considered the source of pain if it was from the renal pelvis to the UVJ or signs of recently passed stone

**Data Analysis:**

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<th>A priori sample size calculation?</th>
<th>Yes</th>
<th>No</th>
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<td></td>
<td>inter-rater reliability of medical records 50 randomly selected records, A priori, any element with k&lt;0.6 was not eligible for inclusion</td>
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**Statistical analyses used:**
-multivariate logistic regression analysis
-misclassification rate (measures prediction of error) 0-1 (low score=fewer errors)
-AUC (0.5-1) higher score = better prediction
-Included all observations (Table 2) to provide the most accurate estimates of the coefficients (ORs) for the selected model/to derive an integer following similar methods to the Framingham study- assigned coefficients (ORs)
-While ORs could be used to estimate probability or events (stone)- sought to make a simpler scoring system
-To assess difference in accuracy between integer value and logistic regression analysis, calculated misclassification rate, AUC and weighted k for each
-Hosmer and Lemeshow test done to determine goodness of fit
-point system constructe-3 categories selected (low, moderate and high) based on estimated clinical utility for the probability of ureteral stone by point total for the category

For prospective cohort- patient’s receiving CT for suspected stone were enrolled (clinicians and enrolling staff blinded to elements of the STONE score

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<th>Adjustment for potential confounders?</th>
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Results

Study participants:
Of the 1040 (retrospective) 49.5% had a stone
- 2.9% had an acutely important alternative cause
- inter-rater reliability (k 0.75-0.80)

Brief answers to research questions [key findings]:
STONE score: male sex, acute onset of pain, non-back race, n/v, hematuria
- multivariate logistical regression model
  - misclass-0.23
  - AUC 0.86
  - STONE score
  - misclass- 0.23
  - AUC- 0.87
Agreement b/w risk estimates based on stone score and multivariate logistic regression model had k 0.87 indicating minimal loss of accuracy by assigning integer points to the factors

Derivation/validation
19.8% and 15.5% - low
49.6% and 46.8% moderate
30.6% and 37.7% high

- Prevalence of stone
  8.3% and 9.2% low
  51.6% and 51.3% moderate
  89.6% and 88.6% high

important alternative causes 2.9% and 3.7%
- 0.3% and 1.6% in high probability group

Clinical scoring system accurately predicts likelihood of ureteral stone
Can be helpful in determining which pts needs to undergo CT (may avoid in young pts - less likely to have other dz, more susceptible to radiation) & when to use reduced dose CT

Additional findings:
The group most likely to have stone was least likely to have other acute finding
Previous visits to the ED significantly associated with lower probability of stone

Limitations:
Gestalt not investigated, Derived and validated in same place
### Clinical Implications

**Applicable?** Yes  
**Feasible?** Yes  
**Clinically relevant?** Yes  

**Comments:**

### Level of evidence generated from this study

- [ ] Ia: evidence obtained from meta-analysis of randomized controlled trials  
- [ ] Ib: evidence obtained from at least one randomized controlled trial  
- [ ] IIa: evidence obtained from at least one well-designed, controlled study without randomization  
- [ ] IIb: evidence obtained from at least one other type of well-designed quasi-experimental study  
- [ ] III: evidence obtained from a well-designed, non-experimental study  
- [ ] IV: expert committee reports; expert opinion; case study; case report  

### Additional Comments/Discussion/Notes