## PD14-03

### DEVELOPMENT OF PREDICTION MODELS OF SPONTANEOUS URETERAL STONE PASSAGE THROUGH MACHINE LEARNING: COMPARISON WITH CONVENTIONAL STATISTICAL ANALYSIS

Joon Kim*, Hyun Kyu Ahn, Kyo Chul Koo, Byung Ha Chung, Kwang Suk Lee, Seoul, Korea, Republic of

**INTRODUCTION AND OBJECTIVE:** Indications for management of ureteral stones are unclear, and clinician determines whether to wait for spontaneous ureteral stone passage (SSP) or perform active treatment, especially in well-controlled patients to avoid unwanted complications. Therefore, suggesting the possibility of SSP would help to make a clinical decision regarding ureteral stones. Therefore, we aimed to develop a prediction model of SSP using machine learning and logistic regression and to compare the performance of the two models.

**METHODS:** Patients diagnosed with unilateral ureteral stones at our emergency department between August 2014 and September 2018 were included and underwent non-contrast-enhanced computed tomography at 4 weeks from the first stone episode. Predictors of SSP were applied to build and validate the prediction model using multilayer perceptron (MLP) with the Keras framework.

**RESULTS:** Of 833 patients, SSP was observed in 606 (72.7%). The performance of the models was good, especially in identifying SSP for 5–10 mm ureteral stones without definite treatment guidelines. To further improve the performance of these models, future studies should focus on using machine learning techniques in image analysis.

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### Table 1. Comparison of demographics and outcomes among patients treated initially with medical expulsive therapy (MET), ureteral stent placement with delayed ureteroscopy (stone removal), or primary URS.

| MET | Ureteral Stent with Delayed URS | Primary URS | p-value |
|-----|-------------------------------|-------------|--------|
| **Total Number (%) of Patients** | | | |
| 77 (53.5) | 39 (27.1) | 29 (19.4) | - |
| **Median (IQR) Age in Years** | | | |
| 44 (54-57) | 54 (41-69) | 48 (34-63) | 0.037 |
| **Female Sex, n (%)** | | | |
| 39 (50.6) | 23 (59.0) | 12 (42.9) | 0.42 |
| **Laterality, n (%)** | | | |
| Bilateral | | | |
| 0 (0) | 1 (2.6) | 3 (10.7) | 0.042 |
| Left | 41 (53.2) | 19 (48.7) | 16 (57.1) |
| Right | 36 (46.8) | 19 (48.7) | 9 (32.1) |
| **Spontaneous Stone Passage, n (%)** | | | |
| 52 (41.6) | - | - | - |
| **Median (IQR) Days between Diagnosis and Stent Placement** | | | |
| 1.0 (1.0-1.0) | 0.0 (0.0-0.0) | - | 0.008 |
| **Median (IQR) Days between Diagnosis and URS** | | | |
| 18.0 (6.5-23.5) | 20.0 (13.0-29.0) | 10.0 (0.0-4.0) | <0.001 |
| **Receipt of Any Narcotic Prescription, n (%)** | | | |
| 46 (59.7) | 10 (25.6) | 10 (33.3) | 0.001 |
| **Total Morphine Equivalents Received in Milligrams** | | | |
| 120 (60-204) | 128 (71-251) | 110 (75-158) | 0.792 |

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## PD14-04

### DEVELOPMENT OF A RISK CALCULATOR TO PREDICT SPONTANEOUS STONE PASSAGE IN PATIENTS WITH ACUTE URETERIC COLIC

Chuanyu Gao*, London, United Kingdom; Max Peters, Utrecht, Netherlands; Keerthanaa Jayaraajan, London, United Kingdom; Todd Manning, Heidelberg, Victoria, Australia; Sophia Cashman, Arjun Nambiar, London, United Kingdom; Marcus Cumberbatch, Sheffield, United Kingdom; Ben Lamb, Anthony Peacock, London, United Kingdom; Marieke J. Van Son, Peter S. N. van Rossum, Utrecht, Netherlands; Robert Pickard, Newcastle, United Kingdom; Paul Erotocritou, Daron Smith, Taimur Shah, Veeru Kasivisvanathan, British Urology Researchers In Surgical Training MIMIC Study Group, London, United Kingdom

**INTRODUCTION AND OBJECTIVE:** Renal colic is a common urological problem with a lifetime incidence of approximately 8-19% in males and 3-5% in females. The MIMIC Study was a 4171 patient cohort study assessing clinical outcomes in patients admitted to hospital with renal colic and a CT-confirmed obstructing ureteric calculus. One of the aims of the study was to establish what the most important predictors of spontaneous stone passage (SSP) were. In this report, we present a risk calculator developed from the MIMIC study data that can be used by clinicians when a patient is admitted with ureteric colic.

**METHODS:** Using the MIMIC Study results, the influence of hydronephrosis, hydroureter, perinephric stranding, temperature, stone size and stone position on computed tomography on SSP were assessed. Multiple imputation was used for missing data. Logistic regression was used to obtain the set of variables with the highest predictive ability for SSP and the corrected β-coefficients after internal validation was used to create a nomogram. The nomogram was externally validated in a subset of patients from 2016-2017.

**RESULTS:** An online risk calculator was created which informs clinicians and patients of the chances of SSP based on patient's presenting features. In total, 2518 patients discharged with initial conservative management were included in the modelling process, of which 1874 had SSP (74.4%). Mean age was 47 (±14.7) and 1892 were male (75.3%). The most important predictive factors for spontaneous stone passage were stone size (p<0.0001), stone position (p<0.0001) and neutrophil count (p=0.06). The model was developed and internally validated in a subset of patients from 2009-2015 (n=1728) with an apparent C-statistic of the uncorrected model of 0.77 indicating good discrimination and externally validated on a subset of patients from 2016 and 2017 (n=789) confirming that the model was sensitive to temporal trends. A Nomogram representing the findings is presented in Figure 1 and can determine a probability of spontaneous stone passage ranging from 20% to 95%.

**CONCLUSIONS:** In this report, we present a risk calculator developed from the MIMIC study that can aid clinical decision-making by determining an individual patient's risk of spontaneous stone passage when admitted with ureteric colic.

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