MP24-15
SURFACE-TREATED PELLETHANE: COMPARATIVE QUANTIFICATION OF ENCRUSTATION IN ARTIFICIAL URINE SOLUTION

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INTRODUCTION AND OBJECTIVES: Pellethane is an aromatic polyether-based thermoplastic polyurethane noted for its strength, flexibility, and resistance to solvents. No studies have assessed the encrustation properties of Pellethane and surface-treated Pellethanes in urine. In an effort to identify a better material for ureteral stents, we sought to assess the stability in artificial urine (AU) (Ward′s Science®) of uncoated Pellethane and Pellethane surface-grafted with either 2-hydroxyethyl methacrylate (HEMA), a hydrogel, or tetraethylene glycol dimethyl ether (tetraglyme), both of which have the ability to resist protein adsorption.

METHODS: In a batch-flow AU model (Figure 1), Pellethane, HEMA-grafted Pellethane, and tetraglyme-grafted Pellethane, were tested against a commercially available hydrogel-coated latex urinary catheter (Bard®) and a hydrophilic polymer-coated polyurethane ureteral stent (Cook Medical®). Encrustation was quantified by the change in dry weight. Cylindrical samples of comparable mass were weighed prior to suspension in AU; 3-day, 7-day, and 30-day immersion trials were conducted. AU solution refresh was done on alternating days. Samples were dried for 48 hours in a fume hood prior to being weighed.

RESULTS: Pellethane products exhibited less mass increase than the commercially available catheter or stent (Table 1). At the conclusion of the 30-day trial, the mass changes were: catheter, +6.40%; stent, +8.63%; uncoated Pellethane, +0.58%; HEMA-grafted Pellethane, +0.07%; and tetraglyme-grafted Pellethane, -0.76%. The tetraglyme-coated Pellethane may have lost mass due to extraction of components from the tetraglyme coating in AUS.

CONCLUSIONS: Compared to commercially available urinary catheters and ureteral stents, Pellethane with and without surface-treatment with HEMA or tetraglyme reduces encrustation in an artificial urine model.

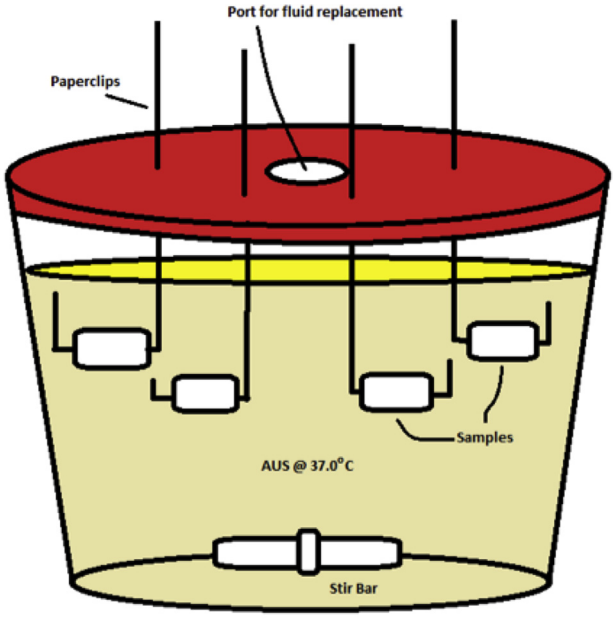

Figure 1: Batch flow model utilized for this study

	Trial		
	3-day	7-day	30-day
Catheter	2.78%	2.20%	6.40%
Stent	1.12%	6.91%	8.63%
Pellethane	0.35%	0.29%	0.58%
HEMA-Pellethane	0.21%	0.21%	0.07%
Tetraglyme-Pellethane	-0.28%	-0.98%	-0.76%

Table 1: Summary of 3-day, 7-day, and 30-day trials in artificial urine.

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MP24-16
THE ANALYSIS OF UROLITHIASIS INCIDENCE IN THE CONTRALATERAL KIDNEY OF UNINEPHRECTOMY PATIENTS

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INTRODUCTION AND OBJECTIVES: To analyze the incidence of urinary stone formation in the contralateral kidney of uninephrectomy patients.

METHODS: 1048 patients,including 596 males and 452 females, who underwent uninephrectomy from June 2010 to June 2016 at the age of 16-87 years old with average of 58.7 years old,were followed up for 0.5-6.0 years, averaged of 3.2 years.532 patients combined with components of metabolic syndrome and 213 patients with metabolic syndrome.164 patients had a history of urolithiasis. The incidence of urinary stone formation in the contralateral kidney after uninephrectomy was recorded and analyzed. The urolithiasis incidences in different gender,age,comorbidity and history of urolithiasis patients after uninephrectomy were compared.

RESULTS: Eighty nine patients suffered from urinary stones in the contralateral kidney after uninephrectomy. The incidence of urinary stone formation in the contralateral kidney of uninephrectomy patients was 8.5%(89/1048), higher than in general population of China, which was 1%~5%. The urolithiasis incidence was 9.1%(54/596)in male patients after uninephrectomy and 7.7%(35/452)in female patients. The incidence of urinary stone formation was 8.6%(3/35)in patients aged under 30 years old,12.5%(34/272)in patients aged 30-49 years old,7.3%(37/504)in patients aged 50 to 69 years old,6.3%(15/237)in patients aged 70 years old and over. The incidence of urinary stone formation was 12.2%(65/532)in patients with components of metabolic syndrome after uninephrectomy and 19.7%(42/213)in patients with metabolic syndrome, while the incidence was 4.7%(24/516)in patients without components of metabolic syndrome. In patients with history of urolithiasis, the incidence was up to 30.5%(50/164)after uninephrectomy, while 4.4%(39/884)in patients without history of urolithiasis.

CONCLUSIONS: The incidence of urinary stone formation in the contralateral kidney of uninephrectomy patients was higher, especially in patients with metabolic syndrome or urolithiasis history. Uninephrectomy patients are more vulnerable to urolithiasis.

Source of Funding: none

MP24-17
SALIVARY AND KIDNEY STONES: INSIGHTS INTO PATHOLOGIC BIOMINERALIZATION

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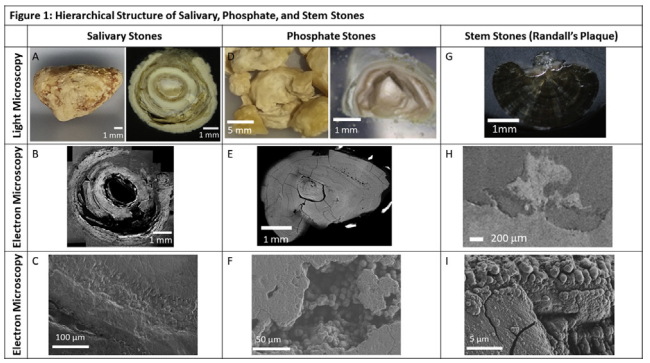
INTRODUCTION AND OBJECTIVES: Salivary stones affect 1-2 percent of individuals in the United States and are typically composed of calcium apatite, similar to Randall′s plaque and phosphate renal

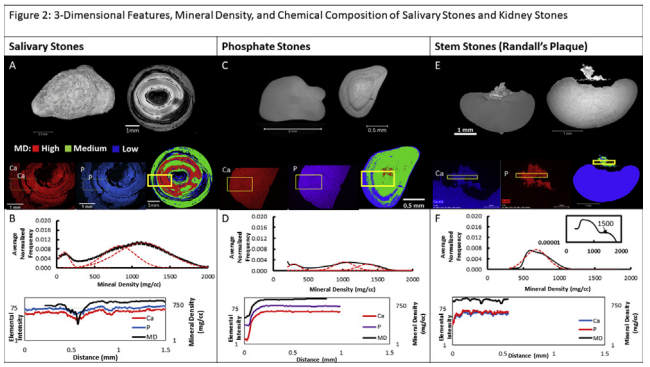
calculi. We seek to correlate ultrastructural features, mineral density profiles, and energy dispersive X-ray (EDX) spectroscopy maps between sialoliths, Randall's plaque (in the form of phosphate stems on oxalate stones), and phosphate renal calculi.

METHODS: After obtaining institutional approval, intact submandibular salivary stones (n=5), calcium phosphate kidney stones (n=5), and calcium oxalate stones with an identifiable stem (n=5) were compared using light and scanning electron microscopy techniques (SEM), and X-ray micro-computed tomography (Micro-XCT) techniques. EDX maps and ultrastructural features were correlated to mineral density profiles for all stones.

RESULTS: Sialoliths and phosphate kidney stones visualized by light microscopy and micro-XCT demonstrated a layer-by-layer apposition (Figure 1, A, D, G). EDX confirmed a predominant composition of calcium and phosphorus for stone stems, sialoliths, and phosphate stones (Figure 2, A, C, E). Mineral density profiles were trimodal (low, medium and high) for all stone types (Figure 2, upper B, D, F) and ultrastructural features were similar across stone types at each density region: plate-like formations observed in lower mineral density zones, spherulitic particles of medium mineral density, and packed spheres of higher mineral density. Patterns of elemental Ca and P intensities by EDX correlated with mineral density profiles (Figure 2, lower B, D, F).

CONCLUSIONS: Calcium phosphate dispersion in urine and saliva appears to follow a common hierarchical archetype resulting in either nephroliths or sialoliths: spherulitic particles agglomerating into stratified structures. These pathologic biominerals varied in density but had similar elemental composition (Ca and P) indicating that the mechanistic process for biomineralization could be similar between these disparate secretory (salivary) and excretory (kidney) systems.





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MP24-18

ARCHITECTURE GUIDED FLUID PROPULSION IN A SIMULATED NEPHRON

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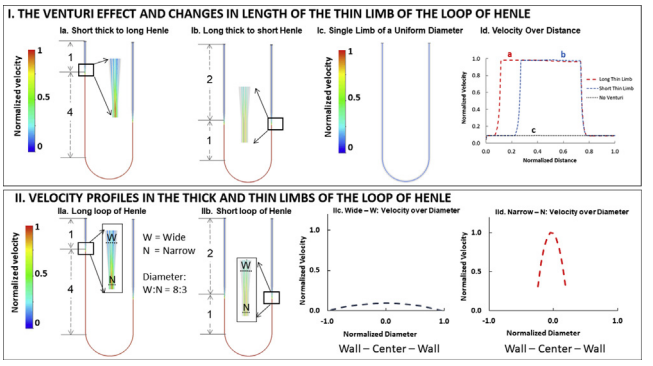
INTRODUCTION AND OBJECTIVES: Computational Fluid Dynamics has long been used to solve problems of fluid velocity, shear, and strain in biologic systems. The objective of this study is to underscore the unique architectural features of the renal papilla including the Venturi effect as it pertains to the thick and thin segments of the loop of Henle, and the effect that the length of the thin loop of Henle has on fluid flow.

METHODS: Using computer aided design software (ANSYS SpaceClaim 18.2), three nephrons were designed based on published dimensions (Fig I). The effect of thin limb length was assessed by comparing a descending limb with a length ratio of 1:4, from thick to thin (Fig. Ia) to a nephron with a limb-length ratio 2:1 (Fig. Ib). The diameter ratio from thick to thin was 8:3. The effect of narrowing was assessed in a nephron with no thin limb (Fig. Ic). ANSYS Fluent 18.2 was used to simulate flow and velocity profiles.

RESULTS: The presence of a thick to thin limb transition in a nephron results in an increase in particle velocity by over ten-fold within the thin limb (Fig. Ia, Ib, Id lines a & b), compared to a nephron without a thin limb (Fig. Ic, Id line c). Regardless of the diameter, particle velocity at the center of the nephron was more than at the wall of the nephron (Fig IIc, IId). The position of the transition from descending thick to thin limbs did not significantly change the pattern of fluid flow, except that it delayed the increase in fluid velocity (Fig Id a vs. b).

CONCLUSIONS: The form and function of the nephron are intimately linked. A longer thin limb, relative to the thick limbs, decreases the amount of time a particle will spend in transit. Consistent with laminar flow, particles at the tubule wall are significantly slower compared to particles at the center of a tubule cross-section. Variations in nephron diameter, particularly at the junction of thin and thick limbs of the loop of Henle, may alter flow dynamics in the human papilla. The Venturi effect caused as the thick descending limb joins the thin limb is a critical architectural component that enhances fluid transit within nephrons regardless of the length of the thin limb of the loop of Henle. These findings are likely relevant from a microfluidics perspective to pathologic processes that result in particulate deposition, resulting in mineralization within the proximal papilla, and provide insight into the study of Randall's plaque formation.



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MP24-19

ENTERAL NUTRITION FORMULAS WITH HIGHER OXALATE CONTENT MAY CONTRIBUTE TO HIGHER OXALATE ABSORPTION AND URINARY EXCRETION IN PATIENTS REQUIRING NUTRITION SUPPORT

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