

## Introduction

- Lower urinary tract symptoms (LUTS) are a collection of symptoms involving storage and voiding that affect quality of life.

- Prior studies have shown an association between LUTS and anatomic changes of the bladder and prostate
- Benign prostate enlargement (BPE) is weakly correlated with LUTS and not correlated with symptom severity.
- Prostate inflammation which contributes to collagen deposition and fibrosis are highly correlated with symptom severity.
- Metabolic syndrome, a collection of comorbidities that contribute to chronic, low-grade inflammation, leads to detrusor hypertrophy.

- **Aim:** To quantify functional and anatomic changes of the lower urinary tract in men without and with metabolic syndrome with MRI.

## Methods

- HIPAA-compliant, IRB-approved, single-center, retrospective study

- Population

- Consecutive men with prostate MRIs performed between 1/2017 and 5/2021 (n=439)

- Exclusion Criteria

- Clinically significant prostate cancer (n=222), prior prostate surgery/radiation (n=13), missing clinical data (n=43) and incomplete MRI (n=40)

- LUTS screening

- International Prostate Symptom Score (IPSS)

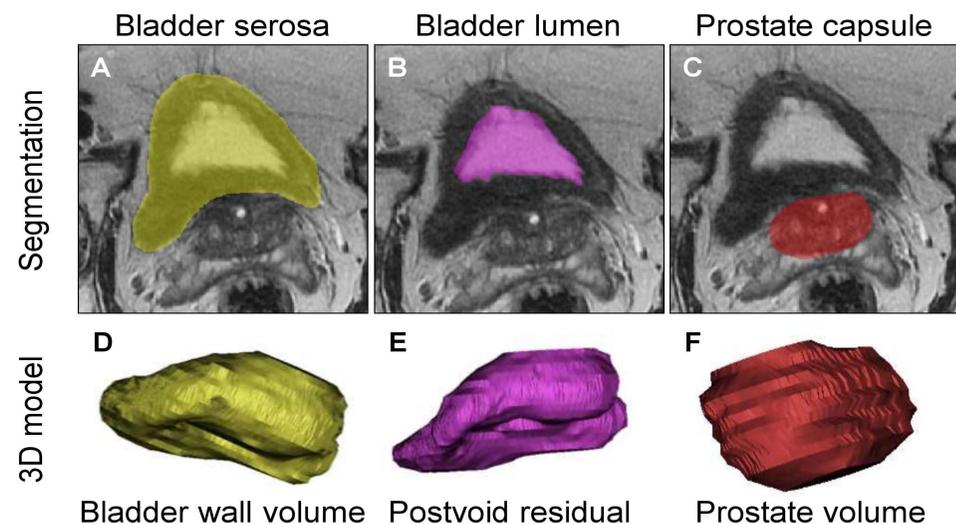
- Metabolic syndrome status

- Obtained from EMR
- Waist circumference not available
- *When the 4 remaining clinical criteria (hypertension, elevated fasting blood glucose, low HDL and high TAG) coexisted, the subject was considered to have metabolic syndrome*

## Methods

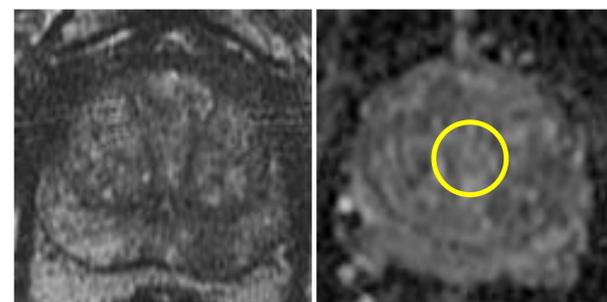
- **MRI analysis**

- The bladder serosa (A), mucosa (B) and prostate (C) were segmented to create 3D anatomic renderings.
- Bladder wall volume (BWV) post-void residual (PVR), and prostate volume (PV) were quantified from the 3D anatomic renderings. (**Figure 1**)



- **MRI analysis**

- 200mm<sup>3</sup> region-of-interest (ROI) was placed around the prostatic urethra, at the level of the verumontanum, on b800 Apparent Diffusion Coefficient (ADC) map using the T2-weighted MRI for anatomic reference. (**Figure 2**)
- *ADC is a quantitative measure of cellular density (higher cellularity = lower ADC). Clinically significant prostate cancer has an ADC of 800.*



- **Statistical Analysis**

- IPSS stratified into 3 categories: Mild (0-7), Moderate (8-19), Severe (20+)
- Prostategaly defined as PV > 40 cc
- Wilcoxon rank sum, Chi-square and Fisher's exact tests used to explore differences in anatomic (BWV, PVR, PV) and functional (ADC) metrics across symptom severity in men without and with metabolic syndrome

## Results

- **Study population**

- 147 men [median age 66.5 years (IQR: 62-71) and median BMI of 28.8 (IQR: 27.0-31.9)]
- 56% (82/147) men had prostategaly
  - 16% with PV > 80 cc
- 67% (98/147) had metabolic syndrome
- 55% (81/147), 39% (57/147) and 6% (10/147) had mild, moderate and severe LUTS

- **Study population stratified by metabolic syndrome status**

- Men with metabolic syndrome had higher BMI (27.8 vs 29.6, p=0.002) but similar age, anatomic and functional metrics and symptoms.

- **Study population stratified by prostate volume**

- Men with prostategaly were more symptomatic (IPSS 5 vs 8, p=0.02), had higher BWV (44 mL<sup>3</sup> vs 48 mL<sup>3</sup>, p=0.005), PVR (35 cc vs 53 cc, p=0.05) and periurethral ADC (x vs y, p=0.01).
- Men without and with prostategaly were similar in age and had similar BMI and metabolic syndrome status.

- **Study population stratified by lower urinary tract symptoms**

		MILD	MODERATE	SEVERE	P-VALUE
<b>AGE</b>	years	66 (62-71)	67 (64-70)	66 (61.2-70)	0.81
<b>BMI</b>		29.4 (27.3-32)	28.2 (27.1-31.4)	28.1 (23.4-30)	0.23
<b>QOL</b>	<=2	52 (100%)	19 (57.6%)	0 (0%)	<0.001
	>2	0 (0%)	14 (42.4%)	4 (100%)	
<b>PVR</b>	mL	37.1 (19.6-72.7)	49.7 (18.6-71.8)	74.8 (42.7,120.5)	0.13
<b>BWV</b>	cm <sup>3</sup>	44.2 (36.3-49.9)	45.4 (37.7-52.7)	63.1 (53.2,86.9)	<0.001
<b>PV</b>	cm <sup>3</sup>	38.3 (31.7-51.9)	47.6( 35.2-67.8)	57 (47.5,99.6)	0.01
<b>ADC</b>		1355.5 (1294-1419)	1376 (1301-1455)	1438 (1343-1479)	0.12
<b>METS</b>	No	27 (33.8%)	18 (31.6%)	4 (40%)	0.85
	Yes	53 (66.2%)	39 (68.4%)	6( 60%)	

Abbreviations: QOL (quality of life) and METS (metabolic syndrome)

## Conclusions

- Men with BPE are more symptomatic, have MRI evidence of anatomic and functional changes of the lower urinary tract.

- Higher periurethral ADC may relate to fibrosis (collagen).
- Men with worse LUTS have higher BWV and PV and trend toward higher PVR.
- The effect of metabolic syndrome on LUTS, anatomy and function is unclear.
- Weaknesses: Retrospective design, lack of waist circumference measurement

## Acknowledgements

NIH (U54 DK104310)  
SAR (Mortan A. Bosniak Research Award)  
University of Wisconsin-Madison (Shapiro Summer Research Program and Department of Radiology)