Combination of shear wave elastography and Duplex Doppler sonography for investigating acontractile bladder and detrusor underactivity in women

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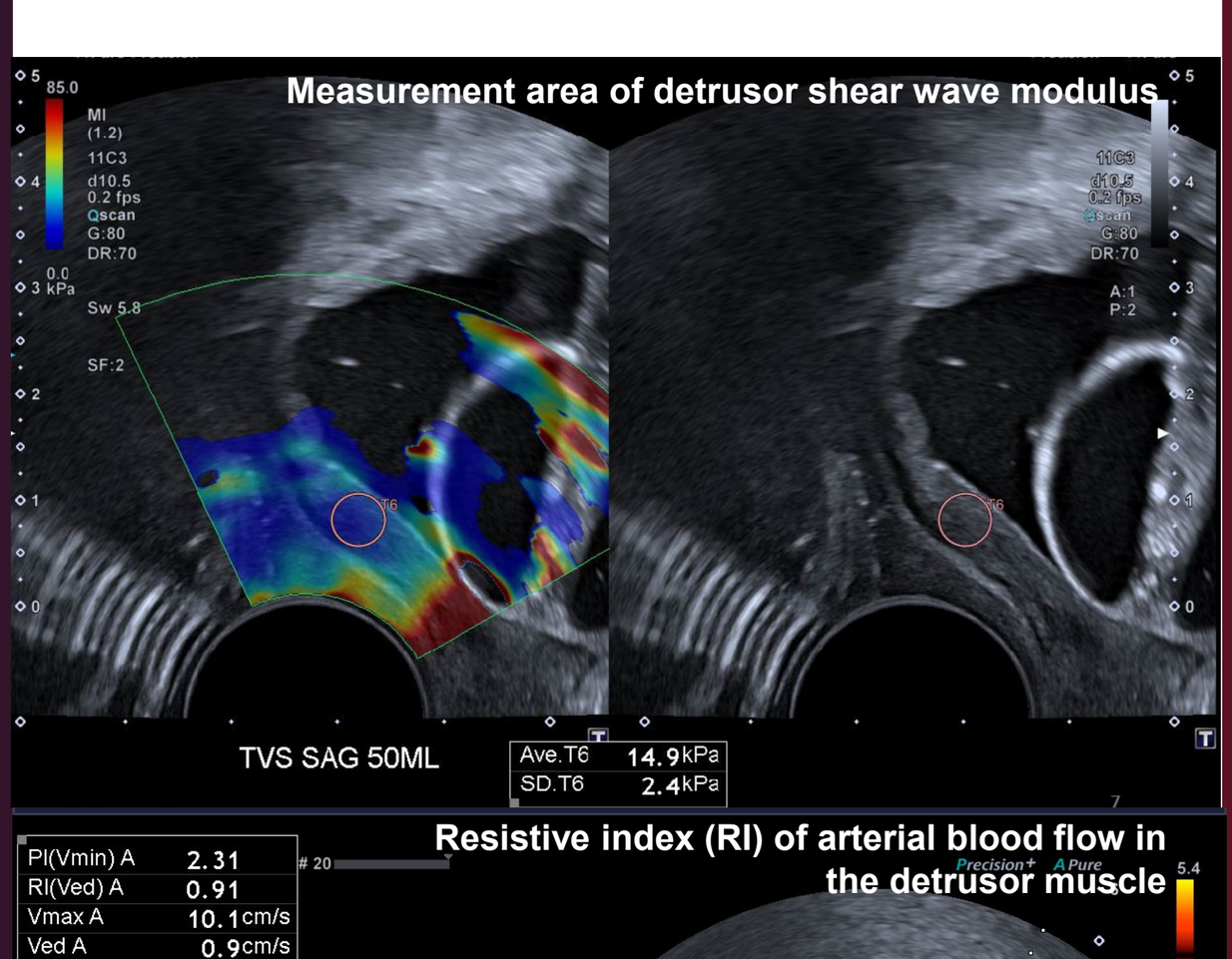
Introduction

For female patients with lower urinary tract symptoms, urodynamic studies provide limited information for evaluating bladder function as a predictor of successful trial without catheter (TWOC). Early removal of the Foley catheter could reduce catheter-related complications, such as urinary tract infections. This study aimed to measure the posterior wall of the urinary bladder by transvaginal ultrasonography, investigating blood flow, thickness, and stiffness (measured by shear wave velocity, SWE) of detrusor muscle, in women with acute or chronic urinary retention under different degrees of bladder filling, for investigating the different biochemical characteristics of the urinary bladder.

Study design, materials and methods

During the period from October of 2019 to March of 2022, 16 women with chronic urinary retention, with first episode of acute urinary retention, without Foley catheter. Transvaginal ultrasound were performed by using an ultrasound machine (Aplio i-Series A800, Canon Medical System) with a transcavitary curvilinear probe (3 to 11 mHz) equipped with SWE. We measured the bladder wall blood circulation (Resistive Index, RI), using Duplex Doppler ultrasound. Detrusor wall thickness (DWT) and SWE of posterior bladder wall were acquired sequentially starting from empty bladder, different degrees of bladder filling (50ml, 100ml, 150ml, 200ml), and once again empty bladder.



Results

The mean age was 70.4±9.1 years old for patients with AcB/DU, 69.0±10.9 years old for patients with detrusor normoreflexia. DWT decreases during the bladder filling, and no statistical difference was found between AcB/DU and normoreflexia. Patients with AcB/DU showed significantly greater resistive index (RI) at empty bladder. In AcB/DU, the mean shear wave modulus was higher than those with detrusor normoreflexia under distended bladder (at 100cc, 150cc and 200cc). The AcB/DU group also showed positive correlation between increased mean shear wave modulus and increased DWT at initial empty bladder (r=0.500, p=0.015), 150cc (r=0.716, p =0.001), 200cc (r=0.737, p =0.000) and second-time empty bladder (after distention) (r=0.397, p=0.033). We also observed, although not statistically significant, a trend of negative correlation between DWT and stiffness in women with detrusor normoreflexia under distended bladder (at 150cc, r= - 0.196, p=0.466; at 200cc, r= -0.181, p=0.472).

		AcB/DU	Normoreflexia	*p*
Age	(mean± SD)	70.40± 9.10	69.00± 10.90	0.475
RI	(mean± SD)	0.75±0.04	0.61±0.03	< 0.001
Detrusor wall thickness	(mm, mean± SD)			
	0cc	5.07± 1.26	4.02± 0.76	0.514
	50cc	4.61± 0.81	3.58± 0.98	0.388
	100cc	3.99± 0.67	3.63± 1.11	0.349
	150cc	4.05± 0.79	3.38± 0.71	0.098
	200cc	3.77± 0.81	3.17± 0.67	0.753
	2nd empty	5.70± 1.05	4.07± 1.45	0.558
Shear wave modulus	(kPa, mean± SD)			
	0cc	21.81± 7.05	16.12± 4.26	0.381
	50cc	31.33± 16.53	18.22± 7.75	0.200
	100cc	54.11± 37.27	17.81± 6.24	0.023
	150cc	55.37± 37.54	19.65± 6.51	0.054
	200cc	65.95± 40.56	24.15± 7.71	0.000
	2nd empty	27.47± 23.01	14.68± 2.69	0.066

Conclusions

AcB/DU women had poor blood flow and a significant increase in detrusor stiffness under bladder distention. Even under thinner detrusor, there is a positive correlation between DWT and stiffness in women with AcB/DU. This finding may be explained by fibrotic changes of detrusor muscle that resulted in AcB/DU. In summary, shear wave elastography is a feasible and reliable tool for predicting AcB/DU. The image findings could well explain the bladder function as a predictor of successful trial without catheter (TWOC).

References

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COI Disclosure Information

We have no Conflict of Interest to disclose regarding this presentation

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