

MORPHOLOGIC CHARACTERISTICS AND FUNCTIONAL CORRELATES OF TENSION FREE VAGINAL TAPE OBTURATOR (TVTO) PROCEDURE

Hypothesis / aims of study

Functional improvement or impairment subsequent to suburethral tape procedure seems to be secondary to the complex interaction between the urethra and suburethral tape (1). An effective interaction between the tape and urethra in response to the increased intra-abdominal pressure is possibly a crucial determinant of the surgical success. To assess the dynamic interaction between the tape and urethra, simply determining the resting and straining positions of a specific target at frozen images is inadequate. Real-time image technology of ultrasound with simultaneous imaging recording can provide the best way for this purpose (2).

Study design, materials and methods

This study was composed of two parts:

- 1) To explore the morphologic features and effects associated with TVTO procedure, whether dynamic or static, as well as the morphologic changes over time and to investigate the effects of concomitant pelvic surgeries on TVTO tape.
- 2) To explore the ultrasonographic characteristics relating to the functional improvement and impairment after TVTO procedure based on the observations in the part one study.

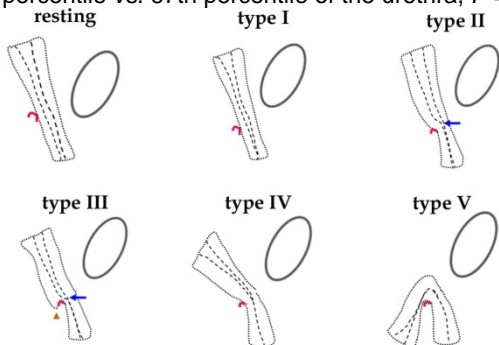
Results

The mean age and body mass index for the 98 women enrolled to this study were 54.7 ± 10.6 (range, 34 to 78) years and 24.9 ± 3.0 (range 16.9 to 32.0) kg/m^2 , respectively. Of the 98 women, 25 (25.5%) underwent TVTO procedure alone and 73 (74.5%) underwent TVTO procedure with concomitant pelvic surgery. Anterior colporrhaphy was performed in 48 subjects and 33 (68.7%) of them had Gynecare Gynemesh (Gynecare, Somerville, NJ, USA) enforcement. Nine of the 98 study subjects had positive stress test postoperatively. Twenty-two women (22.4%) had a positive response to the voiding dysfunction. Forty-two women (42.9%) had the symptoms of urgency or urge incontinence preoperatively. After operation, urge symptoms persisted in 9 patients (21.4%, 9/42) and improved in 33 patients (78.6%, 33/42). But, 3 patients had de novo urge symptoms postoperatively. Therefore, 12 (12.2%) of 98 subjects had postoperative urge symptoms.

PART ONE:

There was no significant difference in the resting and straining bladder neck positions except for the smaller straining bladder neck angles within 3 months of operation when compared with preoperative ultrasonographic data. There were significantly increasing trends in the resting bladder neck angle, straining bladder neck angle and resting tape angle as well as significantly decreasing trends in resting bladder neck distance and total urethral length with time. But, there were no significantly trends in proximal urethral length, urethral location, and the frequency of urethral encroachment. The vector of the TVTO tape was significantly correlated with the resting tape distance. The urethral descent during stress was classified into to five types (Figure 1).

At the first follow-up (within two weeks of operation), ultrasound cystourethrography did not reveal any morphologic differences between those with or without concomitant pelvic operations. There was a significant difference in the urethral location of TVTO tape between those with or without mesh enforcement (mean of 57th percentile vs. 67th percentile of the urethra, $P = 0.002$).



PART TWO:

Table 1. Multivariable analysis for surgical failure.

Ultrasonographic variables	Odds ratio	95% confidence interval		P
		Lower	Upper	
Resting bladder neck angle < 60°	1.938	0.285	13.175	0.498
Bladder neck funneling	8.270	1.996	34.261	0.004
Vertical descent	1.129	0.187	6.811	0.895
Resting tape angle < 165°	5.217	1.156	23.547	0.032
Resting tape distance > 16.5 mm	2.385	0.691	8.235	0.169
Urethral location < 50th percentile	6.016	1.433	25.253	0.014
Absence of urethral encroachment	16.631	1.871	147.852	0.012

Table 2. Multivariable analysis for postoperative voiding dysfunction.

Ultrasonographic variables	Odds ratio	95% confidence interval		P
		Lower	Upper	
Presence of urethral encroachment	2.863	1.300	6.304	0.009
Resting tape distance < 12.0 mm	3.008	1.445	6.265	0.003
Proximal urethral length > 29.0 mm	1.666	0.735	3.744	0.221
Urethral tape location below 70th percentile	0.944	0.364	2.446	0.906

Table 3. Morphologic differences between subjects with or without urge symptoms within 3 months of operation

Bladder neck funneling	Persistent urge symptoms	De novo urge symptoms	Improvement	P
Presence	10 (26.3%) ^a	8 (33.3%) ^b	9 (9%) ^c	0.003
Absence	28	16	91	

a-b, $P = 0.759$; a-c, $P = 0.018$; b-c, $P = 0.005$ by χ^2 test

Interpretation of results

Part one of this study demonstrates that the TVTO tape migrated distally with time, but remained at the same position relative to the urethra. TVTO procedure also had transient supportive effect of the bladder neck, but this effect reduced gradually over time. The effect of TVTO procedure was not affected by concomitant pelvic surgery. But, the tape position was displaced proximally by mesh enforcement anterior colporrhaphy. Part two of this study shows a proper action of TVTO procedure required a good affinity of the tape and urethra so that the dynamic interaction could create a transient pressure zone inside the urethra to resist urinary leakage during stress. Functional impairments after TVTO procedure were secondary to over or under activity of this mechanical interaction.

Concluding message

The pathophysiology of TVTO procedure is explainable by a biomechanical model. The dynamic interaction between the TVTO tape and urethra depends on the affinity of the tape and the type of urethral descent.

References

1. *Ultrasound Obstet Gynecol* 2006; **28**: 221–228.
2. *Scand J Urol Nephrol Suppl* 2001; (**207**): 94-99.

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HUMAN SUBJECTS: This study was approved by the IRB committees of Mackay Memorial Hospital and Cathay General Hospital and followed the Declaration of Helsinki Informed consent was obtained from the patients.