#172: Factors that favour the presence of detrusor overactivity in men undergoing adjustable trans obturator male system (ATOMS) implant for the treatment of postprostatectomy urinary incontinence

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Introduction

The main cause of post-prostatectomy urinary incontinence (PPI) is the injury to the sphincter mechanism leading to stress urinary incontinence (SUI). The treatment requires the repair of the sphincter injury by implantation of an artificial urinary sphincter or a male sling such as the ATOMS system (Figure 1).

However, incontinence associated to detrusor overactivity (DO) (Figure 2) may appear, leading to urge incontinence. In addition, DO is associated with other lower urinary tract symptoms (LUTS) such as urgency, frequency, or the so-called overactive bladder syndrome (OAB), which affect quality of life of these patients. Proper evaluation of factors that favour DO in patients after PPI treatment is crucial to predict postoperative outcomes.

Unfortunately, we cannot infer that the presence of these LUTS is due to DO because other lower urinary tract dysfunctions can give rise to these symptoms such as the persistence of SUI. Invasive urodynamics (UDS) is the only test to diagnose DO and other lower urinary tract dysfunctions.

Our **hypothesis** is that the presence of postoperative DO is related to the presence of other lower urinary disfunctions, both preoperatively and postoperatively. Consequently, the **objective** of this study is to assess which factors favour postoperative DO by evaluating preoperative and postoperative UDS data.

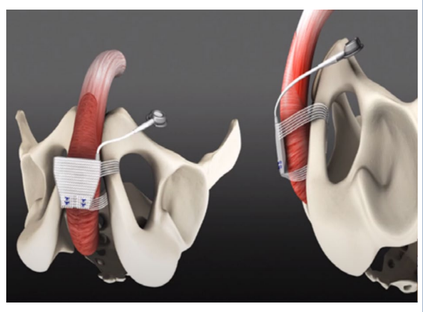

Figure 1. ATOMS system.

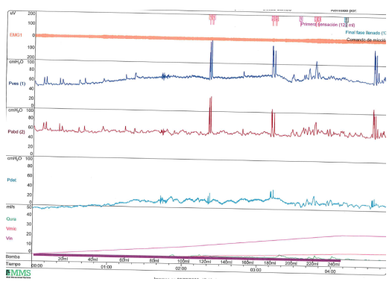

Figure 2. Detrusor overactivity.

Material and Methods

- ✓ A **prospective longitudinal study** was carried out between October 2020 and March 2021 in a cohort of patients with primary ATOMS implantation for persistent SUI after prostate surgery refractory to conservative options.
- ✓ **Inclusion criteria** were baseline urodynamic study before ATOMS implant, minimum 1-year follow-up after ATOMS surgery and signed informed consent.
  The **exclusion criteria** were the need to modify ATOMS system filling for urinary tract surgery after ATOMS adjustment and impossibility to perform urodynamic study for technical reasons.
- ✓ The urodynamic study made according to the specifications of the International Continence Society (ICS) and the protocols of Good Urodynamic Practices (GUP). The diagnostic of BOO was made when the URA value was equal to or greater than 29 cm H2O.
- ✓ The **sample size** was calculated according to Toia et al [1]. To find a preoperative DO percentage in continent patients of 27% and 55 % in incontinent patients after sling implantation to treat PPUI, an alpha error of 5% and a statistical power of 80%. This gave a minimum sample size of 54 patients.

Results

- ✓ A total of 84 cases were screened. Three patients died of another disease during follow-up, 19 patients did not give consent to undergo postoperative urodynamic study, 3 had urinary tract surgery performed after ATOMS implant (transurethral resection of bladder tumour in 2 patients and ureteroscopy in another), 2 patients had irregular urethra in which no urodynamic catheter could be inserted, and one was not able to urinate because of perineal contraction. Consequently, the final sample size was made up of 56 patients with a mean age of 70± 6,01 years.
- ✓ The relationship between preoperative clinical and urodynamic variables and postoperative detrusor overactivity is shown in Table 1.
  A significant direct relationship was observed between postoperative DO and detrusor pressure at maximum flow rate (P@Qmax), URA and Bladder contractility index (BCI) and a significative inverse relationship between postoperative DO and age.
- ✓ The relationship between postoperative clinical and urodynamic variables and postoperative detrusor overactivity are shown in Table 2.
  A significant direct relationship was observed between postoperative DO and number of ATOMS adjustment, Pmax, P@Qmax, BOOI and URA and a significative inverse relationship between cystometric capacity, bladder compliance and frequency of acontractile detrusor (absence in postoperative DO). The regression model showed that he only independent variables were age and postoperative URA.

Table 1. Comparison between preoperative and postoperative variables in the 56 patients.

	Preoperative	Postoperative	Significance
Pad number per day*	4.7± 1.95	0.5± 0.91	**0.000±**
Incontinence amount (mi/day) †	620 ± 377.2	40 ± 84.4	**0.000±**
Qmax in uroflowmetry (ml/s) †	13 ± 8.7	12 ±12.1	0.887
Voiding volume in uroflowmetry (ml) †	126 ±122.4	185 ±192.6	0.464
Postvoiding residual in uroflowmetry (ml) †	38 ±96.6	24 ± 52.0	0.729
Cystometric capacity (ml) †	276 ± 107.9	200 ± 102.0	**0.000**
Bladder compliance (ml/cm H2O) †	109 ±117.6º	85 ±97.7	0.252
DO*	30 (54%)	40 (71%)	0.127
Abdominal leak point pressure (cm H2O) †	75 ± 29.5	152 ± 73.9	0.009±
Pmax (cm H2O) †	29 ± 26.8	40 ± 28.2	0.012±
PQmax (cm H2O) †	21 ±20.5	28 ±21.6	0.095
BOOI (cm H2O) †	-7.1 ± 27.73	8.6 ± 29.70	**0.001±**
URA (cm H2O) †	11.9 ± 1305	17.7 ± 14.85	**0.004‡**
BCI (cm H2O) †	92.8 ± 46.98	74.7 ± 41.97	**0.020‡**
BOO*	5 (9%)	10 (18%)	**0.037±**
Detrusor underactivity*	33 (59%)	45 (80%)	0.170
Acontractile detrusor *	15 (27%)	9 (16%)	0.229

* Number (percentage). † Mean ± standard deviation. ‡ Significant Qmax. Maximum flow rate DO. Detrusor overactivity. Pmax ; maximum voiding detrusor pressure PQmax . detrusor pressure at Qmax BOOI. Bladder outlet obstruction index BOO. Bladder outlet obstruction

Table 2. Relationship between preoperative clinical and urodynamic variables and the presence of postoperative detrusor overactivity

	Postoperative DO	No postoperative DO	Significance
Radiotherapy history*	4 (10 %)	0 (0 %)	0.315
Age (years)†	69 ± 6.3	73 ± 4.4	**0.021‡**
Pad number per day*	5 ± 1.8	4 ± 2.1	0.054
Incontinence amount (mi/day) †	657 ± 403.0	512 ±275.7	0.255
Postvoiding residual in uroflowmetry (ml) †	38 ±96.6	24 ± 52.0	0.729
Qmax in uroflowmetry (ml/s) †	12 ±6.2	13 ±11.0	0.978
Voiding volume in uroflowmetry (ml) †	146 ±119.9	111 ±138.1	0.701
Postvoiding residual in uroflowmetry (ml) †	69 ±137.8	5 ±10.0	0.327
Cystometric capacity (ml) †	281 ±99.1	265 ±130.3	0.619
Bladder compliance (ml/cm H2O) †	107 ±119.3	113 ±116.8	0.847
DO*	24 (60%)	6 (37 %)	0.149
Abdominal leak point pressure (cm H2O) †	78 ±23.3	101 ±53.1	0.292
Pmax (cm H2O) †	33 ±28.1	18 ±20.3	0.056
PQmax (cm H2O) †	25 ± 20.1	13 ± 16.6	**0.041‡**
BOOI (cm H2O) †	-2,7 ± 30.00	-18.5 ± 17.23	0.057
URA (cm H2O) †	14.3 ±14.04	4.8 ± 5.70	**0.012‡**
BCI (cm H2O) †	93.9 ± 42.91	89.8 ± 56.09	**0.031‡**
BOO*	5 (12%)	0 (0%)	0.307
Detrusor underactivity*	24 (60%)	9 (56%)	1.00
Acontractile detrusor *	8 (20%)	7 (12 %)	0.097

* Number (percentage). † Mean ± standard deviation. ‡ Significant Qmax. Maximum flow rate DO. Detrusor overactivity. Pmax ; maximum voiding detrusor pressure PQmax . detrusor pressure at Qmax BOOI. Bladder outlet obstruction index BOO. Bladder outlet obstruction

Discussion

- ✓ The only clinically significant postoperative factor was the number of ATOMS adjustment, which was higher in patients with DO. This fact can be due to the higher level of incontinence caused by DO, as it has been proved in other studies [1]. This confirms the utility of urodynamic studies to determine which LUTD is the cause of LUTS.
- ✓ The relationship between higher URA value and DO can be explained by a reaction of the detrusor muscle to an increase of work due to the increase in bladder outlet resistance that translates into a muscular hyperreactivity as it can be seem in benign prostatic enlargement [2]. However, the difference with that phenomenon is that the URA values which trigger DO are below the values considered obstructive: the cut-off point of the ROC curve (10,5 cmH_2O) is much lower than the obstruction value (set at 29 cmH_2O).
- ✓ The second independent variable which influenced the presence of postoperative DO was the clinical variable age. However, this relationship I not the expected in the general population: patients with preoperative DO are younger that patients without DO. The explanation could be that detrusor contractility decreases with age. Therefore, younger patients have higher detrusor contractility that reacts more frequently to increased urethral resistance with overactivity than older patients with lower contractility. Yanagicuchi et al [3], have also observed in patients undergoing robot-assisted radical prostatectomy that patients who develop DO have a statistically higher detrusor power measured in Watt Factor than those who do not.

Conclusions

Postoperative DO in patients undergoing ATOMS implant for PPI treatment is related to the patient's age and the value of urethral resistance measured by the URA parameter.
These parameters are related to the reaction of detrusor muscle to the increase in postoperative urethral resistance.

References

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