

# Pleated colposuspension: Our modification of Burch colposuspension

Vesna S. Antovska

Department of Urogynaecology and Pelvic Floor Disorders, University Clinic for Gynaecology and Obstetrics, Medical Faculty, Saint Cyril and Methodius University, Skopje, Republic of Macedonia, Europe

## ABSTRACT

**Introduction:** Burch colposuspension is a standard treatment for stress urinary incontinence. However, it is associated with recurrence and urinary retention. We describe a modification of this technique to overcome these problems and evaluate the results in comparison with the standard procedure.

**Materials and Methods:** A total of 145 patients with isolated stress urinary incontinence (SUI), underwent either our modified pleated colposuspension (PC;  $n = 97$ ) or standard Burch colposuspension (BC) ( $n = 48$ ). Description of PC: Three No. 0 non-absorbable sutures were placed in the side-to-side manner at the mid-urethral level with 0.5-1.0 cm distance between them using double bites and were passed through the Cooper's ligament. The patients were followed-up every 6 months for SUI and genital prolapse evaluation. Successful surgery was defined as (1) No self-reported SUI symptoms, (2) Negative Marshall's coughing test (MT), (3) No retreatment for SUI, (4) Absence of urodynamic SUI. In addition, failure was defined as the occurrence of urinary retention, use of catheter on 6-week visit, maximum flow rate  $< 15$  ml/s, flow time  $> 60$  s, or residual urine  $> 100$  ml. Data was compared using Student's paired test and Mantel-Haenzel's  $\chi^2$  test.  $P < 0.05$  was considered significant.

**Results:** The mean follow-up after surgery for PC was 102.4 months and for BC was 103.6 months. At last follow-up, data suggesting failure (Stress score  $\geq 7$ , urge score  $\geq 7$ , Pad test with weight  $> 15$  g/day and positive MT during lithotomic/upright position) were more frequent in BC group ( $P < 0.05$ ;  $P < 0.0$ ;  $P < 0.01$ ;  $P < 0.05$ ;  $P < 0.05$ , respectively). The incidence of recurrent SUI was 5.2% after PC and almost triple (14.6%) after BC. Residual urine  $> 100$  ml and weak stream were more frequent in the BC group ( $P < 0.05$ ;  $P < 0.01$ , respectively). Detrusor over-activity on urodynamic studies, Flow time  $> 60$  s, urethral pressure profilometry positive for obstruction had a higher incidence in BC group ( $P < 0.01$ ;  $P < 0.001$ ;  $P < 0.01$ , respectively).

**Conclusion:** Our modified pleated colposuspension showed improved outcomes when compared with standard Burch colposuspension.

**Key words:** Colposuspension, genital prolapse, urinary stress incontinence

## INTRODUCTION

Surgical options for stress urinary incontinence (SUI) include procedures such as the Marshall-Marchetti-Krantz procedure, Burch

colposuspension (BC) and pubovaginal sling procedures.<sup>[1]</sup> All these procedures achieve continence through tightening of the pubocervical fascia, elevation of the bladder neck (BN), increase of urethral resistance or functional urethral length. Post-operative urodynamics often show an increase in urethral pressure-transmission.<sup>[2]</sup> In healthy women, the maximum transmission-ratios are at the mid-urethra but after BC, these move to the proximal half of urethra.<sup>[3]</sup> We describe a modification of the standard Burch procedure and evaluated functional outcomes of our techniques in comparison with the standard procedure.

## MATERIALS AND METHODS

Between January 2002 and December 2006, women with isolated SUI without coexisting genital prolapse (GP) i.e., stage-0 according to pelvic organ prolapse quantification (POPQ),<sup>[4]</sup> requiring anti-SUI surgery were enrolled in an

For correspondence: Prof. Vesna S. Antovska,  
ul. K.Krsteovski-Platnik, 4-1000 Skopje, Republic of Macedonia,  
Europe. E-mail: vantovska@yahoo.com

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institutional ethics committee approved prospective study. Presence of incomplete emptying (residual urine >100 ml) and weak stream, (maximum flow rates <15 ml/s with voided volume >200 ml) were contraindications for surgery.

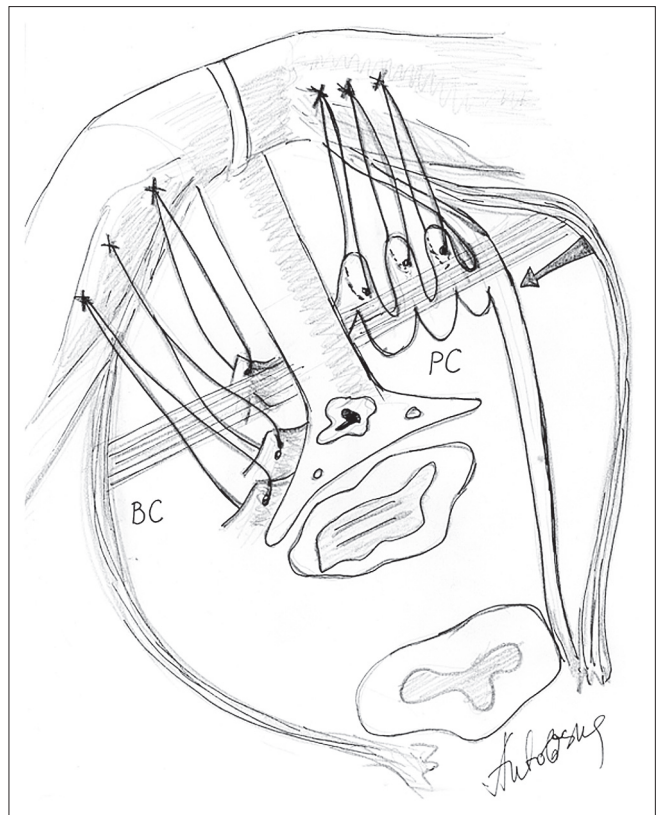
198 women with isolated SUI were screened for inclusion. Of these, 20 patients were excluded because they refused to participate, 14 patients had contraindications for anti-SUI surgery, and six patients had co-morbidities that prevented surgery. 13 patients did not return for follow-up and data for 145 patients was evaluated. This included 97 in the PC group and 48 in the BC group.

All patients underwent a complete evaluation for urinary incontinence and genital prolapse with (a) Structured questionnaire based on the International Continence Society recommendation;<sup>[5]</sup> (b) Marshall's coughing test (MT) in upright position (UP), lithotomy position (LP) and during cervix reposition maneuver (CRM) after bladder filling with 300 ml; (c) urodynamic studies including multichannel urethrocytometry, passive/dynamic urethral pressure profilometry (UPP), simple uroflowmetry, residual urine; (d) POPQ during rest position (RP) and Valsalva maneuver (VM) after complete emptying of bladder and rectum. All operations were performed by the author of the article.

### Surgical procedure

Description of the original BC<sup>[6]</sup> [Figure 1, left panel]: Once dissection lateral to the urethra is completed, the surgeon's non-dominant hand is placed in the vagina, palm facing upward, with the index and middle finger on each side of proximal urethra. The position of the urethra is determined by palpating the Foley catheter. The bladder is partially filled in order to define its lower margin. No midline dissection of the urethra is performed; thus, protecting its delicate musculature. Three 'No. 0', non-absorbable sutures are placed as far laterally in the anterior vaginal wall as is technically possible in the vertical manner: Distal sutures 2 cm-lateral to the proximal urethral third; middle one 2 cm-lateral to urethra-vesical junction (UVJ); proximal one 2 cm-lateral to the distal bladder. The sutures are placed bilaterally, using double bites through full vaginal thickness, excluding the epithelium, with the needle parallel to the urethra and finally passed through the pectineal Cooper's ligament. The sutures are tied while the surgeon elevates the vagina with the vaginal hand.

Description of our PC [Figure 1, right panel]: The bladder is completely emptied to protect its lower margin from damage during suture placement. Three 'No. 0' non-absorbable sutures (Ethibond; Ethicon, Inc., Somerville, NJ) are placed as close laterally in the anterior vaginal wall as is technically possible in horizontal (side-to-side) manner at level of the rich, thin-walled venous plexus, which creates a ring around the mid-urethra (1 cm below the urethro-vesical junction (UVJ)). The inner suture is placed just lateral to the urethral wall, and



**Figure 1:** Suture placement and mechanism of action of original Burch colposuspension (left side) and our pleated colposuspension (right side)

the other two at the same level, with 0.5-1.0 cm distance. The sutures are placed bilaterally, using double bites, through full vaginal thickness, excluding the epithelium, with the needle parallel to the urethra. This area is extremely vascular; thus, the needle must pass under the plexus. If venous bleeding occurs, the suture is immediately tied using the surgeon's right hand while the assistant lifts the free end of the suture. The sutures are placed through Cooper's ligament and tied lightly above it, without vaginal elevation. Excellent hemostasis, as well as continuous drainage of the space of Retzius helps prevent adhesion formation and aids urethral mobility, which is crucial for good post-operative results.

Post-operative care includes antibiotic prophylaxis and anticoagulation. The Foley-catheter is removed on the second post-operative day.

### Post-operative evaluation

Patients were followed-up every 6 months with SUI and GP evaluation. A successful outcome was defined according to the SISTEr trial<sup>[7]</sup> a priori as: (1) Negative pad test, i.e., an increase of less than 15 g in pad weight during a 24-h period; (2) no incontinence episodes on 3-day diary; (3) negative MT; (4) no self-reported urinary incontinence symptoms according to the Urinary Incontinence Score in the Diagnosis of Female Urinary Incontinence, according to Ishiko<sup>[8]</sup> (5) no retreatment for SUI; (6) absence of urodynamic stress incontinence.

**Table 1: Pre-operative/post-operative bladder neck position in patients with isolated SUI**

| POPQ columns                     | PC group (N=97) |            | BC group (N=48) |            | Difference among groups |                      |
|----------------------------------|-----------------|------------|-----------------|------------|-------------------------|----------------------|
|                                  | RP 1            | VM 2       | RP 3            | VM 4       | t <sub>1</sub> (1-3)    | t <sub>2</sub> (2-4) |
| Pre-operative values             |                 |            |                 |            |                         |                      |
| Aa                               | -1.56±0.31      | -0.79±0.33 | -1.58±0.32      | -0.81±0.31 | 0.04                    | 0.04                 |
| Ba                               | -1.56±0.31      | -0.79±0.33 | -1.58±0.32      | -0.81±0.31 | 0.04                    | 0.04                 |
| Post-operative at last follow-up |                 |            |                 |            |                         |                      |
| Aa                               | -3.11±0.34      | -2.36±0.31 | -4.38±0.33      | -4.10±0.33 | 2.73 <sup>†</sup>       | 3.85 <sup>‡</sup>    |
| Ba                               | -3.11±0.34      | -2.36±0.31 | -3.68±0.34      | -3.33±0.31 | 1.19                    | 3.85 <sup>‡</sup>    |

Student's paired test=\*P<0.05, †P<0.01, ‡P<0.001. Aa=A point located in the midline of the anterior vaginal wall 3 cm proximal to the external urethral meatus, Ba=The most distal position of any part of the upper anterior wall from the vaginal cuff to point Aa, PC=Pleated colposuspension, BC=Burch colposuspension, SUI=Stress urinary incontinence, POPQ=Pelvic organ prolapse quantification, RP=Rest position, VM=Valsalva maneuver

**Table 2: Recurrence of SUI with positive MT on the last follow-up in patients with isolated SUI**

| MT                    | Post-operative last follow-up |                     |                   |
|-----------------------|-------------------------------|---------------------|-------------------|
|                       | PC group (%) (N=97)           | BC group (%) (N=48) | χ <sup>2</sup>    |
| MT (+) in LP (total)  | 4/97 (4.1)                    | 6/48 (12.5)         | 5.13*             |
| MT (+) in CRM (total) | 4/97 (4.1)                    | 3/48 (6.3)          | 0.02              |
| MT (+) in UP (total)  | 4/97 (4.1)                    | 6/48 (12.5)         | 5.13*             |
| MT (+) in LP+CRM+UP   | 2/97 (2.1)                    | 1/48 (2.1)          | 0                 |
| MT (+) only in LP     | 0/97 (0.0)                    | 0/48 (0.0)          | 0                 |
| MT (+) only in UP     | 0/97 (0.0)                    | 0/48 (0.0)          | 0                 |
| MT (+) only in CRM    | 0/97 (0.0)                    | 0/48 (0.0)          | 0                 |
| MT (-) only in CRM    | 1/97 (2.1)                    | 4/48 (8.3)          | 7.54 <sup>†</sup> |

Mantel-Haenzel's χ<sup>2</sup> test with df of 1=\*P<0.05, †P<0.01, ‡P<0.001. MT=Marshall's coughing test, SUI=Stress urinary incontinence, PC=Pleated colposuspension, BC=Burch colposuspension, LP=Lithotomic position, CRM=Lithotomic position with cervix reposition maneuver, UP=Upright position

Because the voiding diary and pad test do not differentiate between urge incontinence and stress incontinence, the definition of success specific to stress incontinence was limited to no self-reported symptoms of SUI, a negative MT, no retreatment for SUI and the absence of urodynamic stress incontinence. The definition of success specific to urge incontinence was limited to the absence of urodynamic detrusor-overactivity incontinence.

Voiding dysfunction was defined by the need for surgical revision to facilitate bladder emptying or the use of any type of catheter after the 6-week visit as well as the presence of urodynamic signs of urine retention, such as: Maximum flow rate <15 ml/s, flow time >60 s and residual urine >100 ml. Patients who answered that they were either completely or mostly satisfied were classified as being satisfied with the outcome.

## RESULTS

The two groups were similar in baseline demographic data. There were no differences in operation time, estimated blood

loss, and post-operative complications between the groups. There were no serious adverse events such as ureteral injury, urethrovaginal or vesicovaginal fistulae, incidental vaginotomy or cystotomy, erosion of suture into the bladder, or voiding dysfunction leading to surgical revision in either group.

The mean duration of follow-up for PC group was 102.4 months and for BC group was 103.6 months. At last follow-up, two anatomical landmarks of POPQ,<sup>[4]</sup> which identify the position of the anterior vaginal wall during maximal effort (point Aa, reflecting BN and point Ba, reflecting the upper part of the anterior vaginal wall) were in higher position in the BC group, suggesting greater BN elevation [Table 1].

Table 2 compared outcomes between the two groups in terms of the Marshall's coughing test in various positions. Higher incidence of positive MT in the lithotomy and upright positions in the BC group at the last follow-up were significant, suggesting poorer outcomes in this group (P < 0.05; P < 0.05, respectively). Questionnaire based functional symptoms and clinical evaluation suggesting poorer outcomes (stress score ≥7 and urge score ≥7) were more frequent in the BC group, (P < 0.05; P < 0.01, respectively) while data in favor of higher cure rate (no incontinence episodes on 3-day diary) was more frequent in PC group (P < 0.05). Urge symptoms such as frequency, urgency, hesitancy, and nocturia were more frequent in BC group (P < 0.01; P < 0.01; P < 0.01; P < 0.05, respectively).

Clinical signs of recurrent SUI such as the pad test with weight > 15 g/day and positive MT during LP and UP, i.e., genuine SUI were more frequent in BC group (P < 0.01; P < 0.05; P < 0.05, respectively). The incidence of recurrent SUI after PC was 5.2% but it was almost three times higher (14.6%) after BC. On the Q-tip test, resting angle was significantly greater in PC group (P < 0.05) but was still lower than 30 degrees, as a sign of satisfactory urinary continence [Table 3].

On urodynamic studies, we found a higher incidence of detrusor overactivity, flow time >60 s and positive default

transmission on dUPP as a sign of recurrent SUI ( $P < 0.01$ ;  $P < 0.001$ ;  $P < 0.01$ , respectively) in the BC group. Clinical signs of urine retention such as incomplete emptying (residual urine  $>100$  ml) and weak stream were more frequent in BC group ( $P < 0.05$ ;  $P < 0.01$ , respectively) [Table 4].

## DISCUSSION

Riccetto *et al.*,<sup>[9]</sup> suggested that the principal ligaments of the pelvic floor that interact with the muscles

during Valsalva maneuver are: (1) Pubo-urethral ligaments (PUL), which originate from the lower border of pubis, pass downward and insert into the arcus tendineus fascae pelvis (ATFP) on the level of mid-urethra; (2) urethro-pelvic ligaments (UPL), which originate bilaterally from the above mentioned insertion of PUL into ATFP and fuse behind the mid-urethra; (3) utero-sacral ligaments, which originate from the sacrum, pass forward and insert into the vaginal Halban's fascia, making a fascial ring around the uterine cervix. The region between the mid-urethra and urethra-vesical

**Table 3: Post-operative functional symptoms based on the urinary incontinence symptoms score of Ishiko *et al.*<sup>[9]</sup> and clinical evaluation**

| Variable  | Pleated colposuspension (N=97) | Burch colposuspension (N=48) | t/ $\chi^2$ P value |
|---|--------------------------------|------------------------------|---------------------|
| Urinary-incontinence symptoms score <sup>[9]</sup>        |                                |                              |                     |
| Stress score $\square$ 7                                  | 1/97 (1.03)                    | 4/48 (8.33)                  | 7.54*               |
| Urge score $\square$ 7                                    | 5/97 (5.15)                    | 8/48 (16.67)                 | 6.69 <sup>†</sup>   |
| Urge symptoms   |                                |                              |                     |
| Frequency   | 4/97 (4.12)                    | 8/48 (16.67)                 | 8.37 <sup>†</sup>   |
| Urgency   | 5/97 (5.15)                    | 8/48 (16.67)                 | 6.69 <sup>†</sup>   |
| Hesitancy   | 5/97 (5.15)                    | 9/48 (18.75)                 | 8.41 <sup>†</sup>   |
| Nocturia  | 4/97 (4.19)                    | 7/48 (14.68)                 | 6.58*               |
| Clinical signs for SUI                                    |                                |                              |                     |
| No incontinence episode on 3-day diary                    | 92/97 (94.84)                  | 40/48 (83.33)                | 3.90*               |
| Pad test: Weight $>15$ g/day                              | 5/97 (5.15)                    | 9/48 (18.75)                 | 8.41 <sup>†</sup>   |
| Q-tip test: Resting angle                                 | 23.2 $\pm$ 4.1                 | 10.6 $\pm$ 3.2               | 2.42*               |
| Q-tip test: Straining angle                               | 28.4 $\pm$ 5.3                 | 18.9 $\pm$ 4.5               | 1.37                |
| Q-tip test difference between resting and straining angle | 6.2 $\pm$ 2.1                  | 8.5 $\pm$ 3.3                | 0.66                |
| Positive Marshall's coughing test                         | 5/97 (5.15)                    | 7/48 (14.68)                 | 5.08*               |
| During lithotomic/upright position                        | 1/97 (1.03)                    | 4/48 (8.33)                  | 7.54*               |
| Only during cervix reposition                             | 4/97 (4.12)                    | 3/48 (6.25)                  | 0.02                |

Student's paired test=\* $P < 0.05$ , <sup>†</sup> $P < 0.01$ , <sup>‡</sup> $P < 0.001$ . Mantel-Haenzel's  $\chi^2$  test with df of 1=\* $P < 0.05$ , <sup>†</sup> $P < 0.01$ , <sup>‡</sup> $P < 0.001$ . SUI = Stress urinary incontinence

**Table 4: Post-operative urodynamic studies and adverse events**

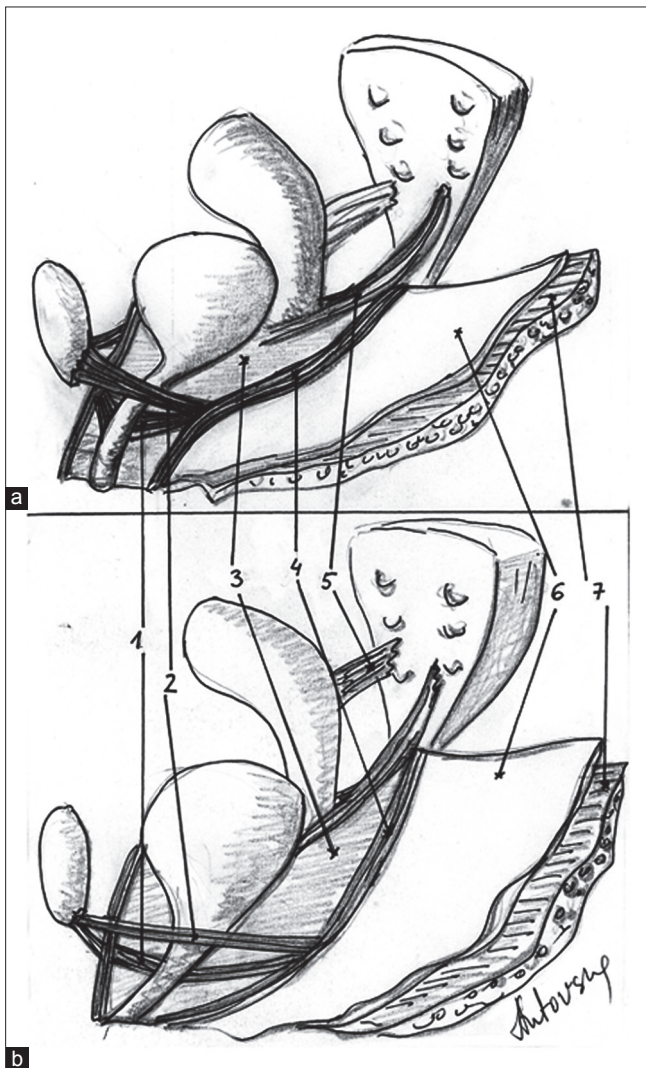
| Variable  | Pleated colposuspension (N=97) | Burch colposuspension (N=48) | t/ $\chi^2$ P value |
|---|--------------------------------|------------------------------|---------------------|
| Urodynamic studies                                      |                                |                              |                     |
| Cystometry-detrusor overactivity                        | 2/97 (2.06)                    | 6/48 (12.50)                 | 8.82 <sup>†</sup>   |
| Uroflowmetry  |                                |                              |                     |
| Maximum flow rate $<15$ ml/s                            | 3/97 (3.09)                    | 8/48 (16.67)                 | 3.11                |
| Flow time $>60$ s                                       | 2/97 (2.06)                    | 9/48 (18.75)                 | 15.18 <sup>‡</sup>  |
| dUPP (default transmission)                             |                                |                              |                     |
| Stress incontinence:<br>Yes $\rightarrow$ (+) dUPP      | 3/97 (3.09)                    | 7/48 (14.68)                 | 8.47 <sup>†</sup>   |
| Stress incontinence:<br>No $\rightarrow$ (-) dUPP       | 94/97 (96.91)                  | 41/48 (85.42)                | 4.91*               |
| Valsalva leak point pressure $<60$ cm H <sub>2</sub> O  | 3/97 (3.09)                    | 7/48 (14.68)                 | 8.47 <sup>†</sup>   |
| Urethral profile pressure UPP max (cm H <sub>2</sub> O) | 89.33 $\pm$ 10.6               | 70.19 $\pm$ 11.22            | 1.62                |
| Adverse events  |                                |                              |                     |
| Incomplete emptying (residual urine $>100$ ml)          | 3/97 (3.09)                    | 6/48 (12.50)                 | 6.60*               |
| Weak stream   | 3/97 (3.09)                    | 7/48 (14.68)                 | 8.47 <sup>†</sup>   |

Student's paired test=\* $P < 0.05$ , <sup>†</sup> $P < 0.01$ , <sup>‡</sup> $P < 0.001$ . Mantel-Haenzel's  $\chi^2$  test with df of 1=\* $P < 0.05$ , <sup>†</sup> $P < 0.01$ , <sup>‡</sup> $P < 0.001$ . UPP=Urethral profile pressure



junction, so-called zone of elasticity, plays a crucial role in the urination-continence mechanism. The Figure 2 represents the position of the above mentioned ligaments when they are intact [Figure 2a] and when they are weakened with the presence of SUI [Figure 2b]. In SUI, their direction is changed, i.e., they are more horizontally positioned. The final result is a descent of mid-urethra.

We would like use the analogy of a bow and arrow to describe our hypothesis. The urethro-pelvic ligaments are the back-end of the arrow, the ATFP is the bow-string and the arcus tendineus muscoli levatoris ani (ATMLA) with its aponeurosis, pelvic superior fascia (PSF), attached to the obturator fascia (OF), together act as the bow [Figure 3]. During continence, contraction of the UPL stretches the ATFP with a consequent opposite pull by the ATMLA/PSF/OF.

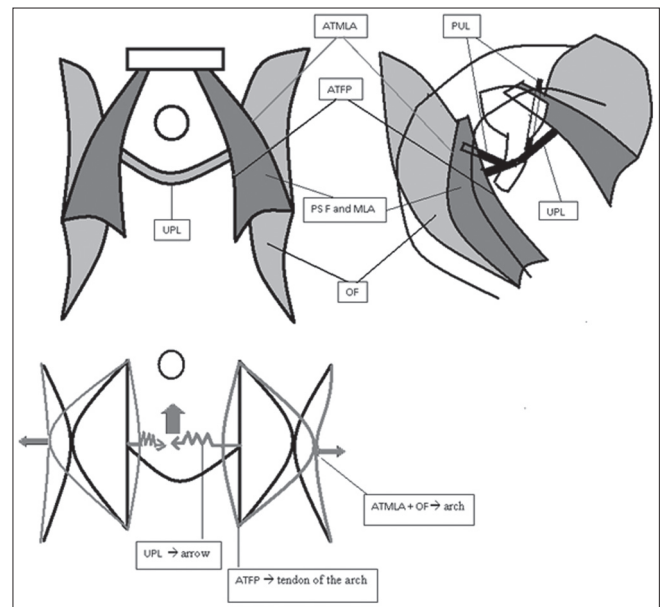


**Figure 2:** Position of the pelvic floor ligaments when: (a) they are intact. (b) they are weakened and stress incontinence is present. (1) Urethro-pelvic ligament; (2) Pubo-urethral ligament; (3) Halban's vaginal fascia; (4) Arcus tendineus fasciae pelvis; (5) uterosacral ligament; (6) Pelvic superior fascia; (7) Musculus levator ani

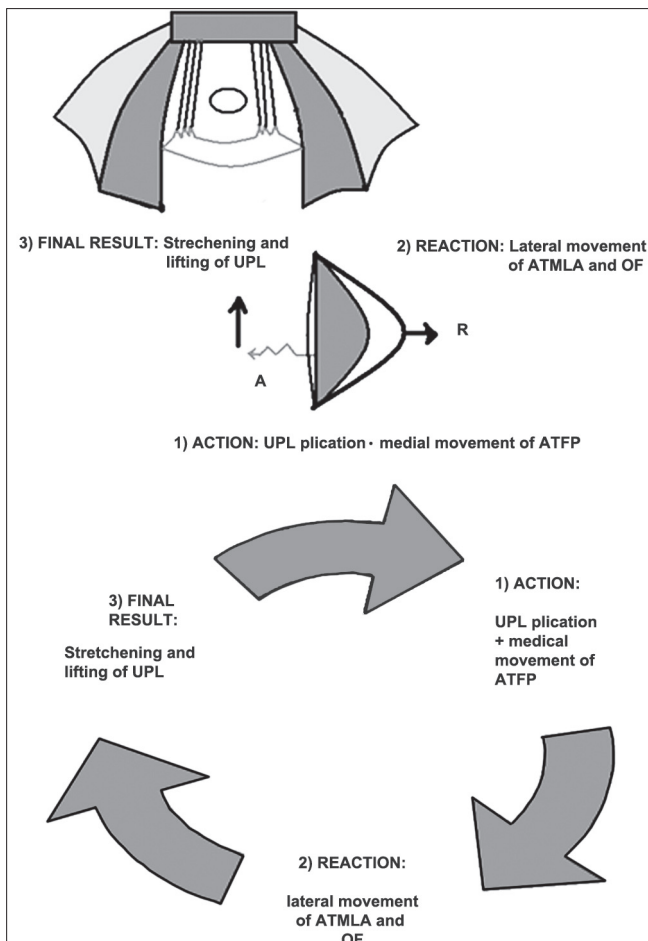
Our new PC tends to imitate this natural mechanism [Figure 4]. Due to the pleating, the UPL gets shortened and straightened. This creates the first vector force, akin to an arrow being pulled on a bow. This force pulls the ATFP in its central part, corresponding to the mid-urethra. This stretch is transmitted to the ATMLA/PSF/OF complex where, as a reaction, it initiates the second vector force from the tissues. The latter anatomic structures are very strong and the final result of these forces is traction, stretching and lifting of UPL causing creation of a strong, non-permanent sub-urethral support. This sub-urethral support is composed of both Cooper's ligaments, three non-absorbable sutures and the central part of UPL. The non-absorbable sutures replace the weakened PUL in cases with SUI. This sub-urethral support is stretched and fixed supero-laterally by the bilateral reaction-vector force of the ATMLA/PSF/OF.

Our technique also proved very effective in preventing urge incontinence, which can be explained by the integral theory of continence by Petros and Woodman.<sup>[10]</sup> According to them, urge incontinence is a neurogenic symptom, which can occur even with minimal prolapse. Like a trampoline, the muscle forces stretch the vaginal membrane against the ligaments (springs). A lax membrane, or even one loose ligament, which prevents its tightening, may cause the micturition-stretch receptors to fire prematurely and this is perceptible by the cortex as urgency. Our procedure annuls the laxity of UPL and stretches the ATFP which has the richest supply of micturition-stretch receptors.

This theory also explains the effectiveness of our procedure in preventing urine retention.<sup>[10]</sup> The pubococcygeal muscles



**Figure 3:** Transversal and horizontal view of the proposed mechanism of action UPL: Urethro-pelvic ligament; PUL: Pubo-urethral ligament; ATFP: Arcus tendineus fasciae pelvis; ATMLA: Arcus tendineus muscoli levatoris ani; PSF: Pelvic superior fascia; LAM: Levator ani muscle; OF: Obturator fascia



**Figure 4:** Mechanism of action of our pleated colposuspension

pull backwards to stretch the proximal vagina and open the posterior urethral wall. This fires the micturition reflex, contraction of the bladder and voiding. The muscle requires a firm insertion point to function optimally. If the ligaments are lax, it cannot open the bladder neck, resulting in urinary retention. Our procedure annuls the ligament laxity and prevents urine retention.

The main differences between our technique and the original procedure are: (1) The sutures are placed in side-to-side manner, instead of the vertically; (2) they are placed at the mid-urethra level, instead of the bladder neck; (3) the inner suture is placed just lateral to the urethral wall instead of as far laterally as is technically possible; (4) the bladder is completely empty to prevent injury to the bladder instead of being partially filled to aid identification of the lower bladder margin; (5) a wide vaginal dissection in the midline over the urethra and UVJ is performed in order to obtain good access to the mid-urethra and provide its satisfactory mobility, instead of no dissection; thus, protecting the delicate urethral musculature from surgical trauma; (6) the sutures are tied without any elevation of the vagina, and (7) meticulous hemostasis and continuous drainage of the space of Retzius to prevent fibrosis and

scarring of periurethral and vaginal tissues over OF ). We believe that satisfactory urethral mobility is crucial for achievement of post-operative continence and avoiding urine retention. According to the Lazarevski's Theory,<sup>[11]</sup> the non-permanent sub-urethral support should be active only during the maximal effort and for this to occur, the principal requirement is a mobile urethra.

We compared our results with those of other authors. Bai *et al.*<sup>[12]</sup> found 8.6% recurrence of SUI after BC on the 1-year follow-up while Brubaker *et al.*<sup>[13]</sup> found this to be 32.0% with 32.0% urgency symptoms on 2-years follow-up after BC in a series of 302 patients. Lapitan *et al.*,<sup>[14]</sup> reported that within the first year after BC, the overall continence rate is 85% to 90%, but after 5 years, it drops to approximately 70%. Hong *et al.*,<sup>[15]</sup> reported 72% cure rate at the last follow-up after a mean 52 months. We noticed 94.8% cure rate after PC (mean 102.4 mo) and 85.4% after BC (mean 103.6 mo).

Regarding the voiding dysfunction, we found much lower incidence of poor stream and incomplete emptying after PC. Natale *et al.*,<sup>[16]</sup> noted persistent voiding dysfunction in 5-20% patients after the Marshall-Marchetti-Kranz procedure, 4-22% after BC and 5-7% after needle suspension. Kjølhede,<sup>[17]</sup> in his 14-year follow-up study of 190 BC procedures, found 28% recurrence, 17% urge incontinence and 42% mixed incontinence. Moon *et al.*,<sup>[18]</sup> in their study of 49 BC and 60 Trans-obturator tape combined with abdominal sacro-colpopexy, found 69.7% cure rate, 53.1% urinary retention, 18.4% de novo urgency and 18.4 recurrent SUI in the BC group.

The high recurrence rate after BC could be because only its distal suture results in shortening of UPL while the other two make only a slight side-to-side Halban's fascia plication with no effect on SUI. On the other hand, the great vaginal elevation after BC can result in urethral stenosis and urine retention.

## CONCLUSION

Our modified pleated colposuspension showed improved outcomes when compared with standard Burch colposuspension. This operation tends to imitate the natural mechanism of continence during the maximal effort, when the contraction of the UPL stretches the ATFP with a consequent opposite pull by the ATMLA/PSF/OF complex. Due to the pleating, the UPL gets shortened and straightened, and creates a strong, non-permanent sub-urethral support, which is stretched and fixed supero-laterally by the bilateral reaction-vector force of the ATMLA/PSF/OF complex.

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