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the best selected abstracts of the
annual conference of the ***International Society for Pelviperineology (ISPP)***
and of the ***Israeli Society for Urogynecology and Pelvic Floor Medicine***
Tel-Aviv, Israel 21-24 September 2016
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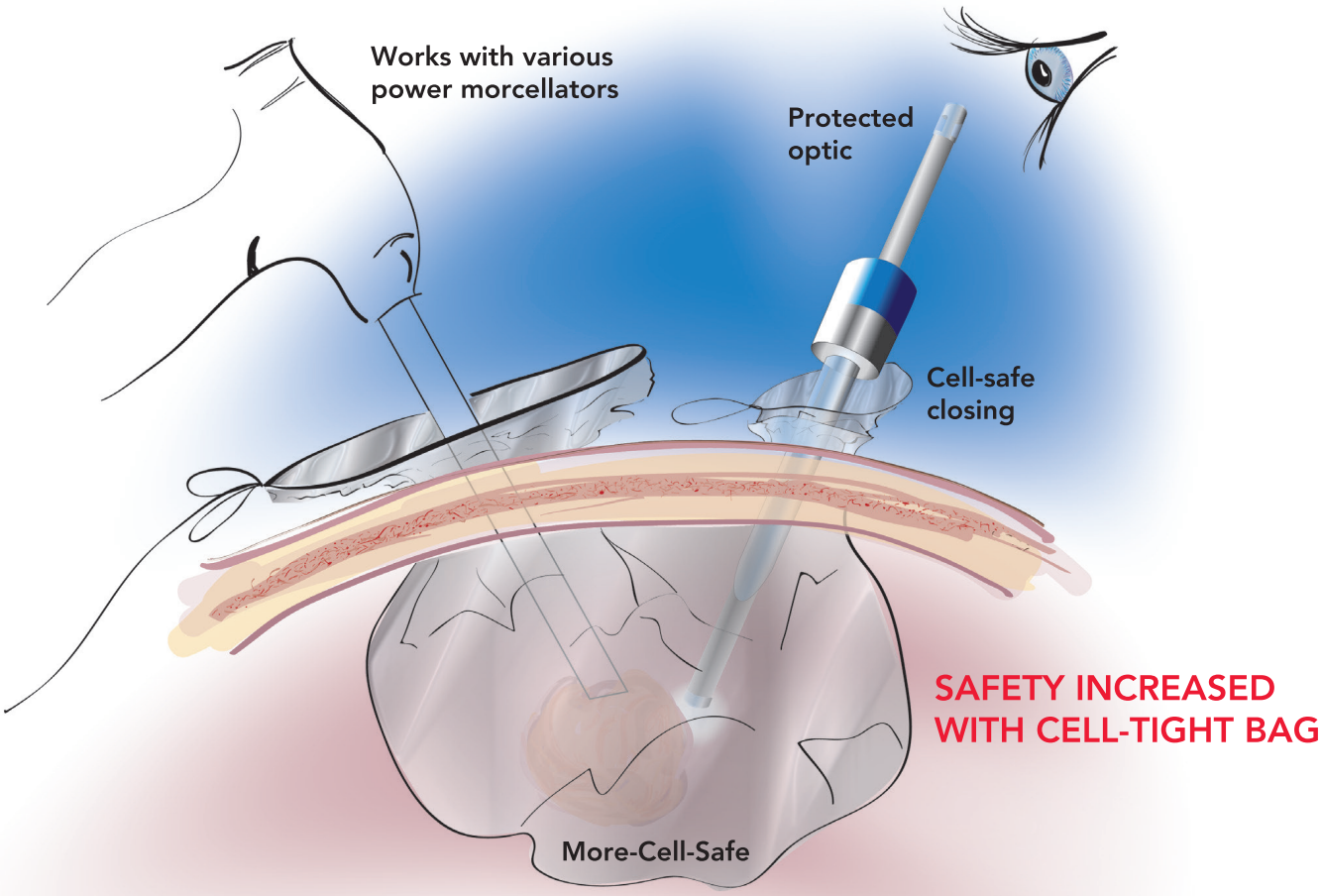

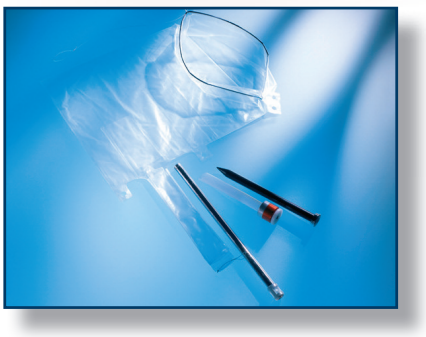

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The Israeli Society of Urogynecology and Pelvic Floor

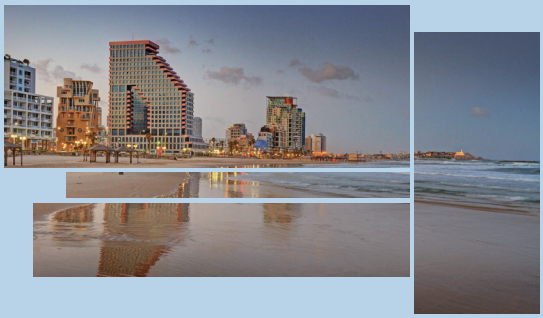
החברה הישראלית לאורוגינקולוגיה ורצפת האגן

THEME for 2016 CHRONIC PELVIC PAIN

2016 ISPP Annual conference

The 2016 International Society for Pelviperineology (ISPP) conference will be hosted in Tel-Aviv. The conference is combined with the annual meeting of the Israeli Society for Urogynecology and Pelvic Floor Medicine. The three days of the conference will include lectures, workshops, debates, and live surgery. It will include also research abstract presentations given mostly by residents. More than 60 abstracts were submitted. About 35% of them were international while 65% were from Israel. Due to time limitations, only 2/3 of the abstracts will be presented as oral presentations during the conference and reminder will be presented as E-Posters, available at the E-Poster area during exhibition hours. All abstracts were meticulously scored by the scientific committee and the twelve highest rating abstracts will compete in The Rami Langer Award for the Best Abstracts where three of them will receive awards. Abstract topics cover the full range of urogynecology and pelvic floor medicine; anatomy, physiology, symptomatology, diagnosis and management including surgery, outcomes and complications. Most of the abstracts are clinical studies, however some basic science studies were submitted as well. The highlights of some prominent abstracts are summarized here.

Abstract summary: ***Scientific Committee: Shimon Ginath, Benny Feiner, Adi Y Weintraub.***



Benhamou R. et al. (Israel): following pelvic-floor surgery, mainly with mesh, a high rate of women had recovery of sexual activity and relief of dyspareunia. De novo dyspareunia rates were very low.

Ben-Zvi M. et al. (Israel): expression of the enzyme Heparanase (heparin sulfate degrading endoglycosidase) is more common in connective tissue from the uterosacral ligaments of women with compared to those without uterine prolapse, suggesting a role in the pathophysiology of uterine prolapse.

Çalıskan E. et al. (Turkey), found a more effective educational program for obstetricians and gynecologists to adapt and apply urogynecological surgeries for anterior compartment defects that includes a three-day course of theoretical education combined with cadaver and hands on surgery courses compared to two-day course of theoretical education followed by watching live surgery session.

Chechneva M. et al. (Russia): performing palliative, suboptimal and anti-pathophysiologic surgeries, without consideration of the anatomical defects and connective tissue dysplasia (CTD) are the main factors for recurrent pelvic organ prolapse and/or urinary incontinence following surgical treatment.

Eisenberg VH. et al. (Israel): primiparous women with diastasis rectus abdominis, diagnosed by ultrasound, had a longer second stage of labor, and that these measurements correlated with a higher PFDI-20 score in the urinary symptoms portion (UDI).

Groutz A. et al. (Israel): surgically induced weight loss by laparoscopic sleeve gastrectomy was associated with a significant improvement of female urinary incontinence and related QOL. Improvement was documented in POP and colorectal-anal distress symptoms but not in female sexual dysfunction.

Hizkiyahu R. et al. (Israel): women with vaginal colonization with Candida albicans during pregnancy had increased risk of vaginal tears and obstetric perineal trauma compared to women with normal vaginal flora.

Khadzhievaa MK. et al. (Russia), found that Fibulin-5 (Fbln5) gene polymorphism was associated with pelvic organ prolapse in women.

Markovsky O. et al. (Germany), found that pain symptoms associated to cystocele and rectocele stage II-IV were improved following pelvic floor reconstruction surgery using Elevate meshes in the prospective multicenter PROPEL study.

Weintraub AY. et al. (Israel), found excellent anatomical and quality of life results in patients with advanced POP treated with a skeletonized mesh implant (Seratom). No mesh exposure was recorded within the first year after surgery.

Yaakobi T. et al. (Israel): low genital self-image was the main variable associated with sexual dysfunction in women with pelvic floor disorders. This variable was more important than self-reported pelvic disorder symptoms or type.

Zilberlicht A. et al. (Israel): overactive bladder symptoms in women may be aggravated by several somatic and psychological triggers which can be assessed by the SOPSETO questionnaire (34 statements` questionnaire regarding Somatic, Psychological and Sexual Triggers for OAB). Some triggers seemed to correlate well with UDI-6 and IIQ-7 scores, implying their close interaction and potential involvement in the pathophysiology of the OAB syndrome. These triggers may serve as potential targets for behavioral therapy of this disorder.

Original article

Partially absorbable versus non-absorbable mesh implants for trans-vaginal reconstruction reinforcement of advanced pelvic organ prolapse

RANEEN SAWAID, MENAHEM NEUMAN[1], JACOB BORNSTEIN[2]

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Abstract: *Objectives:* We aimed to compare the efficacy and safety of non-absorbable and partially absorbable meshes for the reinforcement of pelvic floor reconstruction. *Study design:* Patients with advanced pelvic floor prolapse were enrolled to this study and had either non-absorbable or partially absorbable mesh implants for reinforcement of pelvic floor reconstraction. Patients were evaluated at the end of the 1st post-operative months and interviewed at the study conclusion. *Results:* Of the 236 women enrolled to the study, 213 (90.2%) were available for evaluation. Nonabsorbable mesh implants were used in 109 women (51.1%) and partially absorbable mesh implants were used in 104 women (48.9%). Median follow-up for non-absorbable mesh patients was 4.6±1.0 years and for the partially absorbable mesh, 2.3±1.9 years. At the end of the first postoperative month, pain was the only subjective statistically significant parameter: 33.3% in the non-absorbable mesh group versus 10.7% in the partially absorbable mesh group ($p<0.002$). Similarly, the percentage of mesh felt at vaginal palpation was distinctly higher in the nonabsorbable mesh group than the partially absorbable mesh group (100% vs. 29%, respectively) ($p<0.04$). All other findings were similar with the 2 study groups. *Conclusions:* Partially absorbed mesh implant is safe and effective and has less early postoperative complications than the non-absorbable mesh implant with pelvic floor reconstruction reinforcements.

Keywords: Mesh; Pelvic organ prolapse.

INTRODUCTION

Pelvic organ prolapse (POP) is a common condition negatively affecting the quality of life of millions of women worldwide, with a lifetime prevalence of 30%.[1] Women with advanced symptomatic POP experience daily discomfort, as well body image dissatisfaction and impaired sexual function.[2] Treatment for POP requires significant health care resources,[3] with an ever-growing impact in parallel with the growing elderly population.[4,5]

According to recent studies, approximately one in ten women will undergo surgery for POP and/or incontinence during their lifetime.[6] The vagina is widely accepted as the natural orifice for POP reconstruction; hence, many favor the trans-vaginal route over the abdominal approach. Yet, POP repair surgeries have an unacceptably high failure rate with a 10-year reoperation rate of 17% reported by some[7] and 45%, reported by others.[8] This may be attributed to connective tissue weakness, related to genetic factors, reduced collagen content or increased collagen destruction.[9]

Given that POP is a herniation process, one must acknowledge the importance of replacing the weakened fascia that caused the defect with an implant to reinforce the reconstructive procedure. In an attempt to reduce these high failure rates, synthetic meshes were designed and implanted. They provided reinforcement and better support for vaginal surgical repair of prolapse. This led to a significant reduction in anatomical failure and reoperation rates.[10,11] However, mesh implantrelated complications ranged from mild issues of transient pain and small mesh erosions to severe adverse effects such as large vaginal mesh exposures or extrusions, perforations into the bladder or bowel, and chronic pain. Mild mesh complications can be managed conservatively, but bladder or bowel injuries, fistulae, abscess formation, and debilitating pain may require repeat surgery and are not always curable.[12]

One of the recent implant modifications aimed at reducing adverse effects is the partial absorbable mesh,[13,14] which is composed of a blend of monofilament, non-absorbable polypropylene and absorbable polyglecaprone. It reduces stiffness and increases elasticity after implantation.[15] Furthermore, the partial absorbable mesh provides easy handling and reduces implant mass. It is assumed that significant reduction of the implant mass may lead to reduction of the adverse effects and complications of the graft that are thought to be directly related to the mesh mass.

The purpose of this study was to compare the new partially absorbable mesh to the non-absorbable mesh at vaginal reconstructive surgery for POP.

METHODS

We conducted a retrospective, observational study utilizing data obtained from the medical records of women who had undergone reconstructive pelvic surgery for advanced and symptomatic posterior pelvic floor compartment prolapse, using trans-vaginal mesh implants, either nonabsorbable or partially absorbable, between the years 2008 to 2011. The study was approved by the local IRB committee (no. 50611).

All women that presented with symptomatic stage 3 posterior compartment prolapse, and thus had a mesh implant at increased risk for prolapse recurrence, who had been treated with a mesh implant, were included in the study. Risk factors for prolapse recurrence included previous POP reconstructive surgery and clinical assessment of supportive pelvic floor tissue. Exclusion criteria were previous vaginal mesh implantation, pelvic inflammatory disease, and chronic pelvic pain.

Prior to surgery, all patients completed a comprehensive questionnaire on symptoms of prolapse, urinary, bowel, and sexual malfunction. Preoperative evaluation included a detailed pelvic sitespecific vaginal examination at lithotomy position with a Sim's speculum during a maximal Valsalva maneuver and Pelvic Organ Prolapse Quantification (POP-Q) measurements and staging according to the standardized International Continence Society (ICS) scoring system.[16] Each compartment (anterior, apical and posterior) was separately evaluated for detection of defects in pelvic support.

During the years 2008 to 2009, patients underwent transvaginal mesh placement using the nonabsorbable Gynecare

Table 1. Patient characteristics of 236 women who underwent POP reconstruction with nonabsorbable or partially absorbable meshes.

P value	Partially absorbable mesh n=119	Non-absorbable mesh n=117	
0.161	59.4±11.2	61.6±11.8	Age, mean±SD
0.384	3.12±1.3	2.96±1.4	Parity, mean±SD
0.752	77.1%	79.5%	Menopause, %
0.212	93.3%	87.8%	Overactive bladder, %

Prolift kit system (Ethicon, Summerville, USA). From 2010 to 2011, the partially absorbable mesh Gynecare Prolift+M (Ethicon, Summerville, USA) was used. Both kits and operative techniques were identical, except for the difference in absorbance in the partial absorbable mesh.Anti-incontinence surgery was performed when indicated using sub-mid-ureteral synthetic tape, according to the surgeon's preference.

All patients were administered first generation Cephalosporin 1 g intravenously, half an hour before surgery. An iodine antiseptic wash was applied to the area prior to the onset of surgery. All procedures were performed under general anesthesia. The detailed surgical technique was as published before.[17]

At the end of the first postoperative month, all patients were asked to complete the same questionnaire they had been given before surgery, and patients were re-evaluated with site-specific vaginal pelvic examination. Postoperative pain was assessed with the visual analogue scale (0-10) where 10 indicate maximal pain.

In 2013, patients were interviewed by telephone for possible mesh-related complicationsand pelvic floor symptoms. The primary outcome measure was the mesh implant adverse effects, and the secondary outcome measure was the subjective cure rate, among the two patient groups.

One-hundred and ten patients were required in each of the two patient groups to detect a 20% increase for the postoperative pain rate, with 80% power and 95% confidence (0.05 significance).

Student's t-test was used for comparison of quantitative variables between groups. Chi-square test was used to compare qualitative variables. The Wilcoxon signed rank test was used to compare the POP-Q measurements before and after surgery. A p value of less than 0.05 was considered statistically significant.

RESULTS

Of the 236 women enrolled in this retrospective study, 117 (49.6%) underwent surgery using the nonabsorbable mesh implants during the years 2008-2009, and 119 women (50.4%) underwent surgery using the partially absorbable mesh implants, afterwards. One surgeon (NM) performed all surgical procedures. At the end of the first postoperative month, 213 women (90.2%) were available for evaluation, of whom, 109 (51.1%) had been implanted with the non-absorbable mesh and 104 (48.9%), with the partially absorbable mesh.

In 2013, of 153 women (64%) interviewed, the non-absorbable mesh was used in 78 women (50.9%), and the non-absorbable mesh, in 75 (49.1%) (Patient flow chart no. 1). The median followup for non-absorbable mesh patients was 4.6±1.0 years and for the partially absorbable mesh, 2.3±1.9 years.

The preoperative patient characteristics, symptoms, and POP-Q examination showed no statistical between-group differences. This was true also for the operative details and length of procedure (Tables 1,2). No major intra- or postoperative significant complication or long term severe morbidity was encountered in any group.

Early postoperative complications occurred in the non-absorbable and partially absorbable mesh groups as follows: pain level (4.35 vs. 4.50, according to VAS scale) urinary tract infections (2 vs. 1), vaginal mesh exposure (3 vs. 1) small pelvic hematoma (1 vs. 0), and bladder outlet obstruction (4 vs. 1), respectively. All these complications resolved spontaneously or with conservative measures and did not necessitate further operative steps. Postoperative bladder over-activity and defecation symptoms were similar in both groups.

The one-month postoperative vaginal examination for the assessment of pelvic floor different compartment prolapse using the POP-Q method showed no statistical differences between the two groups (Table 3).

The one subjective parameter statistically significantly different between the two patient groups was the pain level at the end of the first postoperative month: 33.3% of women in the non-absorbable mesh group still had postoperative pain compared to 10.7% of women in the partially absorbable mesh group ($p<0.002$). Similarly, the mesh could be felt at vaginal palpation distinctly higher in the non-absorbable mesh group than the partially absorbable mesh group, 100% vs. 29%, respectively ($p <0.04$) (Table 4).

Table 2. Preoperative POP-Q by independent t-tes.

P value	Partially absorbable mesh group	Non-absorbable mesh group	POP-Q points
0.502	1.94±1.997	2.02±1.124	Ba
1.620	2.99±1.632	4.25±1.058	Bp
1.856	2.87±2.676	4.14±1.706	C

All values are mean±SD.

Table 3. POP-Q at first postoperative month.

P value	Partially absorbable mesh group	Non-absorbable mesh group	POP-Q points*
0.481	-2.63±0.957	-2.7±0.462	Ba
0.295	-2.85±0.734	-2.74±0.699	Bp
0.332	-6.32±1.579	-6.14±1.098	C

All values are mean±SD.
*By independent t-test.

Table 4. Clinical findings after the first postoperative month measured by chi-square test.

P value	Partially absorbable mesh group	Non-absorbable mesh group	
0.002*	8 (10.7%)	20 (33.5%)	Pelvic pain, n (%)
0.04*	34 (29%)	117 (100%)	Palpable mesh, n (%)

DISCUSSION

The main findings of this study show that at the end of the first postoperative month, the patient's estimation of pelvic pain level was significantly less intense and mesh palpability at vaginal examination was significantly less

prominent in the partially absorbable patient group.These findings are probably attributed to the fact that a substantial fraction of the implant is removed by absorption and hence does not affect the pelvic soft tissue neither regarding pain generation nor regarding tactile sensation.

Pain reduction is crucial when considering mesh implantation. It is especially important in the sexually active patient who might experience dyspareunia after POP reconstruction.

We found no benefit among women who underwent vaginal reconstructive surgery with mesh implants for the posterior pelvic floor compartment, when the non-absorbable mesh was compared with the partially absorbable mesh regarding other intra- and post-operative adverse effects or pelvic floor dysfunction symptoms. The postoperative anatomical and subjective findings were similar as well.

Although the particular mesh used in the present study is no longer available, the principal benefits and drawbacks of the partially absorbed mesh implants are valuable and meaningful.

This study was limited by its nonrandomized nature. We felt that the partially absorbable meshes might cause less pelvic pain, thus implanting the non-absorbable once was not justified.

CONCLUSION

Partial mesh absorbability may offer significant reduction with postoperative implant-related pain with pelvic floor reconstruction reinforcements.

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Original article

Monofilament polypropylene mesh shrinkage in the posterior compartment surgery - its effect on anatomic and symptom success at 12 months follow up

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Abstract: Objective: In this prospective study we aimed to scrutinize to what extent synthetic meshes placed into the posterior vaginal compartment shrink in relation with urogenital symptoms. *Materials and methods:* This study was performed on 26 patients who had posterior vaginal repair with mesh. Symptom questioning and POP-Q assessment were done preoperatively. Mesh surface area was calculated intraoperatively and the mesh area was calculated at the postoperative 3rd, 6th and 12th months by means of perineal ultrasonography. *Results:* The mean area of the meshes placed into the posterior vaginal compartment was 29.6±5.8 cm^2 (min. 19.4-max. 40 cm^2) during the operation. The mean areas of the placed meshes were calculated to be 17.8±5.8 cm^2 (7.0-29.5 cm^2), 12.4±5.0 cm^2 (2.8-21.8 cm^2) and 8.3±4.8 cm^2 (3.7-21.5 cm^2) in the postoperative 3rd, 6th and 12th month follow ups, respectively. Repetitive mesh area measurements showed statistically significant decrease ($p<0.001$). There was significant healing in urogenital symptoms at the 12th postoperative months. The Pelvic Floor Impact Questionnaire –7 (PFIQ-7) summary scores were calculated to be 196.6 preoperatively and 82 postoperatively at 12th months respectively and the difference was statistically significant ($p=0.003$). *Conclusion:* Despite the fact that a decrease of 72% occurred in the mesh area at the end of one year follow up, the anatomic and symptomatic success at 12 months was excellent.

Key words: Mesh shrinkage; Posterior vaginal compartment defect; Urogenital symptoms.

INTRODUCTION

Pelvic organ prolapse (POP) is a common indication for operations which are being performed on women. Hence, 11% of women are operated due to POP and 30 % of the operated cases need a reoperation within 4 years after the first operation on the grounds of recurrence[1]. The high incidence of recurrence at conventional surgeries in the anterior and posterior vaginal compartments has led to 'mesh surgery'. As a matter of fact, the use of polypropylene mesh surgeries have increased exponentially since their introduction to the urogynecology field.

The most common complication of mesh application is 'erosion'. Mesh erosions have been a prime area of interest for researches and substantial amounts of data have been collected. Mesh shrinkage is another area of interest which is often neglected and has not been studied in detail. Our view is that the 'mesh surfacing' above the vaginal epithelium (erosion) is a fairly minor problem that can usually be dealt with by local excision, while mesh shrinkage has the potential for more serious complications such as chronic pain or fistula.

In this prospective study we aimed to investigate the extent of mesh shrinkage over a 12 month period using consecutive transperineal ultrasound measurements.

MATERIALS AND METHODS

This prospective study was carried out on in the urogynecology centre of Ankara Atatürk Training and Research Hospital between the dates of July 2009 and August 2010.

Thirty (30) patients who have had posterior vaginal compartment defect underwent posterior repair with mesh. Four (4) cases were lost at follow up. Patients who had anterior compartment defect, uncontrollable diabetes, previous pelvic surgery conventional or mesh surgery were not included in the study.

The patients were evaluated with a full clinical history, pelvic examination, pelvic ultrasound, and Turkish version of short form of Pelvic Floor Impact Questionnaire (PFIQ-7) to assess the severity of prolapse and its impact on the quality of life[2].

Pelvic organ prolapse quantification (POP-Q) staging system was used for quantifying the degree of posterior compartment prolapse. Surgical cure was defined as the leading edge of rectocoele/enterocoele being < –1 cm in relation to hymen (stage 1).

Symptoms of pelvic pain, pollacuria, urge incontinence, nocturia, faecal incontinence, difficulty in defecation and dyspareunia were assessed preoperatively and 12 months after the operation.

A rectangular mesh was placed in the posterior compartment during the surgery and the area of the mesh was calculated by multiplying the longest and shortest edges in centimeters (cm) during the operation. The area (cm^2) of the mesh that was applied has been calculated individually in order to eliminate the bias of same size. The area (cm^2) of meshes was calculated at 3rd, 6th and 12th month after the operations in the same patient consecutively at the follow up visits by means of two dimensional transperineal ultrasonography (TUS) with a transducer of 5mHz. Polypropylene mesh is seen as hyperechogenic structure on TUS and its longest and shortest edges can be determined at ultrasonography[3] (View 1a and 1b).

The association between symptomatology and mesh dimensions was recorded. The anatomic healing and changes in quality of life parameters were also investigated.

All the data were recorded using standard forms. One sample t-test, Wilcoxon Rank test and Friedman test were used in where appropriate. The comparison of the repetitive measurements of mesh areas was carried out by using the General Linear Model Repeated Measures test. If a difference was identified between the groups, Bonferroni correction test was applied to identify from which group the difference arose. For all comparisons, the p value <0.05 was considered statistically significant.

All operations were performed by the second author (Sivaslioglu AA), however the data from follow up visits were gathered by the first author (Catma TS).

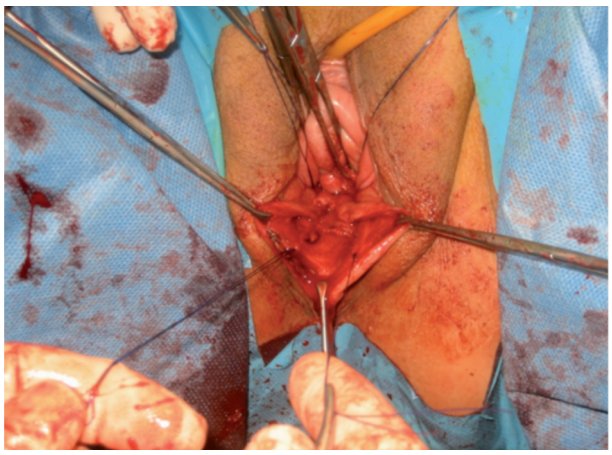


Figure 1A. – The 4-point-fixation of mesh: Upper two sutures come from the uterosacral ligaments and lower two sutures come from the either sides of perineal body.

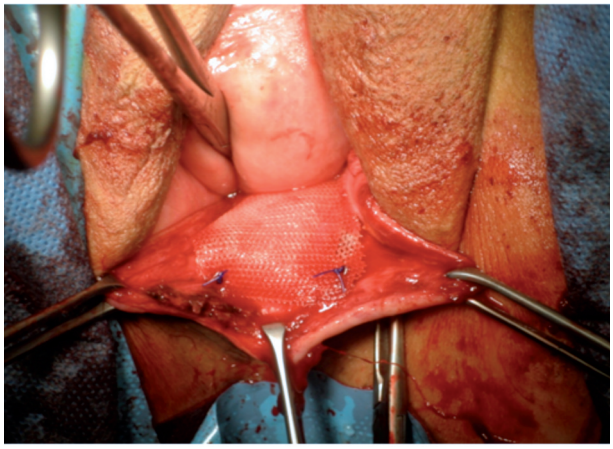


Figure 1B. – The perineal fixation of mesh.

TABLE 1. Demographic characteristics of the study group.

Age (mean)	45.5 ± 8.1 (31-60) years
Body Mass Index (kg/m2)	29.9 ± 3.4 (25-37.7)
Number of births given (median)	3 (min.1 - max.6)
Number of menopausal patients	12
Number of premenopausal patients	14

TABLE 2. Comparison of symptomatology between preoperative period and postoperative 12th months.

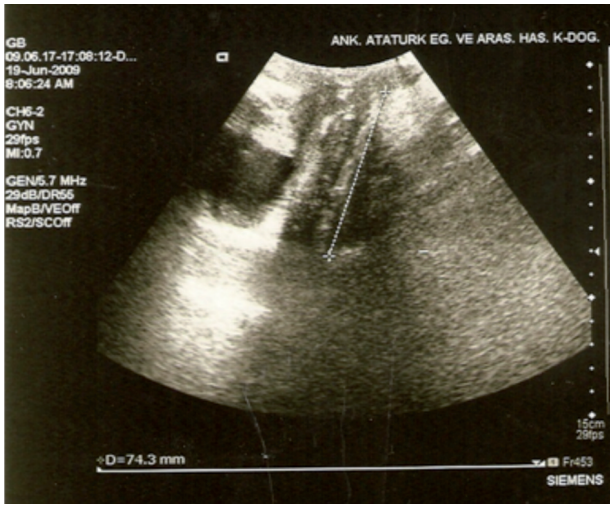
Symptoms	**Preoperative**	**Postoperative (12th month)**	**p value**
Pelvic pain	14 (53%)	5 (19%)	0.023
Pollacuria	16 (61%)	4 (7%)	0.004
Urge incontinence	19 (73%)	5 (19%)	0.035
Nocturia	13 (50%)	3 (11%)	0.041
Faecal incontinence	5 (19%)	–	
Difficulty in defacation	3 (11%)	–	
Dyspareunia	2 (7%)	–	

Informed consent was obtained from all patients for participation in the study and the local ethics committee of the hospital accepted the study.

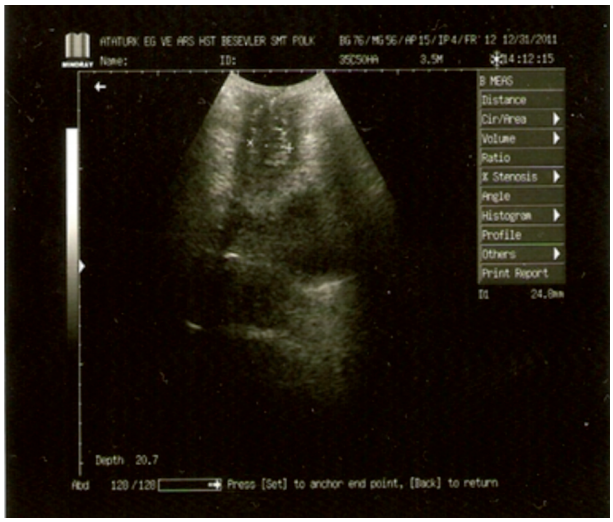
The Operation Technique

The cases were operated under spinal anaesthesia at the lithotomy position. A full thickness vertical incision extending from posterior vaginal fornix to the hymenal ring at the midline of the posterior vaginal wall was made. The vaginal wall flaps were dissected off the rectum so that the surgical plane was underneath the rectovaginal fascia (RVF). Both of the uterosacral ligaments were distinguished at the upper part of the surgical plane and a polyglactin 910 suture (Vicryl®), No 2 was placed at each ligament. The lower borders of the surgical plane were dissected off from the perineal membrane and polyglactin 910 sutures, No 2 were placed at lower left and lower right sides of vaginal flaps being aware of not to pass through the mucosa of vaginal walls. The polypropylene mesh at proper dimension to the surgical plane was spread out between the uterosacral ligaments and inside of the hymenal ring. The mesh was fixed at four points by means of polyglactin 910 sutures which were placed on certain points (Image 1a and 1b). After control of any bleeding, the incision was sutured with an absorbable polyglactin 910 (Vicryl®) No 1 suture material. In 5 cases, the upper border of the mesh was sutured to the posterior cervix.

The area (cm^2) was calculated by multiplying the lengths of the longest and short edges which were tailored according to the surgical plane of the patient during the operation.



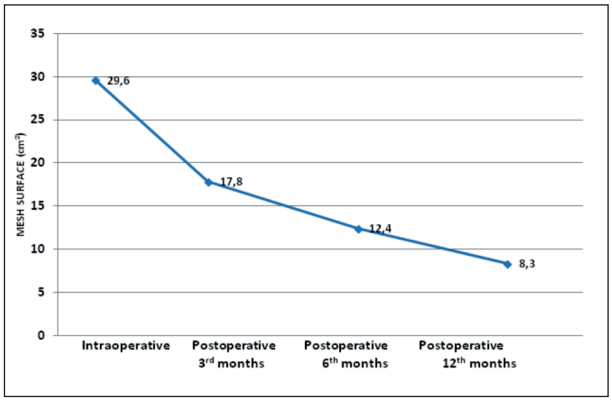
View 1A. – The measurement of the longest edge sagittaly by means of ultrasonography.



View 1B. – The measurement of the shortest length of the mesh horizontally by means of ultrasonography.

TABLE 3. The values of POP-Q points in the preoperative and postoperative 12 th months.

	Preoperative		Postoperative		
Point	**Median**	**Min; Max**	**Median**	**Min; Max**	**P Value**
Aa	0	-3; 3	-1	-3; 1	0.278
Ba	-0.5	-3; 2	-2	-3; 1	0.019
C	-4	-6; 2	-4	-6; 1	0.095
D	-5	-7; 1	-6	-7; -2	0.076
Ap	1	-3; 2	-1	-3; 0	< 0.001
Bp	1	-3; 3	-2	-3; 0	< 0.001
Pb	2.75	1.5; 4.5	2.25	1; 4.0	0.041
Gh	4	2; 7	4	3; 7	0.885
TVL	7	5; 10	8	7; 10	0.015



Graphic 1. – Time-weighted changes in the average area (cm^2) of the applied meshes into the posterior compartmen.

RESULTS

The total number of the patients that had been operated for the posterior compartment defect was 30. However 4 patients were lost to follow-up. Therefore, the study population was 26. The patient characteristics are given in Table 1.

In terms of symptomatology, the dominant complaint was urge incontinence. However, at the 12th postoperative months we noticed that there were significant healing in all the symptoms which were questioned (Table 2).

Mesh erosion was not seen in any of the cases. The anatomic cure was 100% at the 12th month postoperatively. POP-Q values of the cases in the preoperative and postoperative 12th month are given in the Table 3. Statistically significant differences were noticed between the preoperative and postoperative values of Ba, Bp, Pb and TVL (Table 3).

The mean area of the meshes placed into the posterior vaginal compartment was 29.6 ±5.8 cm^2 (min. 19.4-max. 40 cm^2) during the operation. The mean areas of the placed meshes were calculated to be 17.8±5.8 cm^2 (7.0-29.5 cm^2), 12.4±5.0 cm^2 (2.8-21.8 cm^2) and 8.3±4.8 cm^2 (3.7-21.5 cm^2) in the postoperative 3rd , 6th and 12th month follow ups, respectively (Graph 1).

Repetitive mesh area measurements showed statistically significant decrease ($p < 0.001$).

Bonferonni test detected that the maximum decrease in mesh area was at the 3rd month after the operation (intraoperative 29.6±5.8 cm^2 versus postoperative 3rd month 17.8±5.8 cm^2, $p<0.001$). The decrease in the mesh area has continued to decrease significantly in the repetitive measurements as well (17.8±5.8 cm^2 to 12.4±5.0 cm^2, $p<0.001$ between 3rd and 6th months, (12.4±5.0 cm^2 to 8.3±4.8 cm^2, $p<0.001$ between 6th and 12th months).

On the other hand, the PFIQ-7 summary scores were calculated to be 196.6 and 82, preoperative and postoperative 12th months, respectively and the difference was statistically significant (p=0.003).

DISCUSSION

Conventional native tissue posterior compartment defect repairs have a high recurrence rate, anywhere between 18-24% in the short term[4]. There are two handicaps to conventional plication methods: firstly, the repair of the fascia which is already weak is unlikely to be a reliably strong support, because all that happens is that a weak tissue is approximated to another weak tissue. Secondly, it was observed during histological examinations that samples taken during colporrhaphy which was supposed to be fascia, in fact turned out to be a part of the vaginal wall, or an artefact of the surgical dissection[5].

Although mesh usage is controversial in the posterior compartment, de Tayrac, *et al*. reported high rates of anatomical and functional healing after polypropylene mesh surgery for rectocele in a period of 23 months monitoring, 92% and 88%, respectively[6]. In our study, we found the anatomic success to be 100%. In addition, the rates of healing in the pelvic pain, pollakisuria, urge incontinence and nocturia symptoms were 64, 75, 74 and 77%, respectively at the end of 1 year follow up.

Mesh complications are the most important risk in mesh surgery. It has been accepted that the shrinking of mesh is an eventual cause of mesh complications such as mesh erosion and recurrence[7]. In our study, the 'shrinkage of mesh' was observed in all cases but no mesh erosion was seen. The issue of mesh shrinkage was proposed for the first time by Amid, et al. in 1997[8]. Mesh shrinkage is a fact. Tunn, et al. compared the dimension of the implanted mesh with the length of mesh which was specified during the ultrasonographical evaluation in the 6th week after the operation and they detected a 60% decrease in the mesh dimension in the posterior compartment[9]. We found a 72% shrinkage at the mesh area (29.6 versus 8.3cm^2) after 1 year follow up.

There are many obscurities and theories as regard to the etiology of mesh shrinkage. Garcia-Urena, *et al*. claimed that the shrinking was a result of the physical response of inflammation that occurred against the mesh[10]. Gonzalez, *et al*. defended the argument that insufficient invasion of tissue on the mesh was the cause of mesh shrinkage[11]. Another explanation is that scar tissue collagen fibres become oriented primarily along lines of tension to create rigidity and shrinkage; furthermore scar tissue collagen becomes more brittle and shrinks further as the patient ages[12]. On this basis, further shrinkage could be expected over the years subsequent to the mesh implantation.

Velemir, *et al*. reported that a relation had existed between the degree of shrinkage and pelvic organ prolapsed recurrence[13]. In that study where 125 cases were involved, repairs in the anterior and/or posterior compartments were performed. The cases were evaluated at least one year after the operation in the clinic and under ultrasonography and it was observed that bladder or a part of rectum (particularly the distal part) lost the support of mesh when a significant mesh shrinkage took place. They also claimed that recurrence occurs from these areas which are not covered with mesh. In our study we did not encounter any defect at the posterior compartment even after the mesh shrinkage.

Nevertheless Svabik, *et al*. indicated that the shrinkage can not be evaluated by examining the mesh dimension only once in the post-operative period and they affirmed that a significant shrinkage would take place in the mesh dimen-

sion if the mesh could not be spread out sufficiently or if a folding occurred during the implantation[14]. In their study, they stressed that the mesh dimension had decreased by 38% in the 4th postoperative day in comparison to its dimension during the operation. In their opinion that was due to the folding of mesh occurred during the operation[13]. In our study, the mesh shrinkage rate was 40% after 3 months, 59% after 6 months and 72% at the end of first year. We think that the decrease in the mesh dimension is the result of mechanical shrinkage rather than folding of mesh during placement.

In addition, the PFIQ-7 summary scores showed that the mesh surgery at the posterior compartment had a positive impact on the quality of life patients. The PFIQ-7 summary score dropped to 82 at the postoperative 12 months from 196.6 preoperatively. The difference was statistically significant (p=0.003).

Interestingly, although a statistically significant decrease has been observed in the mesh area; the effect of mesh shrinkage regarding symptomatology was not prominent. Moreover, the rates of pelvic pain, pollacuria, urge incontinence and nocturia diminished significantly.

In conclusion, despite the fact that a decrease of 72% occurred in the mesh area at the end of one year follow up, the anatomic and symptomatic success at 12 months has been excellent. However, given that collagen cross bonds further and becomes more brittle with age, long term studies extending over some years will be required to assess clinical and anatomical sequelae, if any.

Conflicts The authors have no commercial interest in the polypropylene material that was used for the prolapse surgery (Sofradim Parietene®, a monofilament and polypropylene mesh).

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Review

A review of the Integral Theory of Pelvic Organ Prolapse and proposed concept of repair: Part 1 - Structural components and damage

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Abstract: *Aim:* To explain the structural basis of the Integral Theory, how pelvic organ support requires 5 competent ligaments, uterosacral (USL), cardinal (CL) arcus tendineus fascia pelvis (ATFP), pubourethral (PUL) and perineal body (PB) and how damage to these ligaments may cause pelvic organ prolapse 'POP' (cystocele, uterine prolapse, rectocele), bowel, bladder and pain symptoms. *Biomechanics:* The ligaments attach the organs to the skeleton from above. Pelvic muscles stretch them from below. Ligaments are strong and relatively inelastic, breaking strain 300 mg/mm^2; vagina is weak and elastic 60 mg/mm^2. *Pathogenesis:* Dislocation/stretching of vagina and CL from the cervix are principal causes of cystocele; stretching of USL &CL cause uterine prolapse. Dislocation/stretching of vagina from USL and PB may cause rectocele as may separation of the PB bodies. *Conclusions:* The pelvis functions like a suspension bridge. Organ support is derived by adequately tensioned ligaments from above and muscle contraction from below. If the ligaments are damaged they need to be reinforced in the position and along the axis of the natural ligament. Shortening and strengthening the ligaments also restores the directional muscle forces which contract against these ligaments to restore organ support from below.

Keywords: POP; Ligaments; Pelvic muscles; ATFP; Cardinal ligament; Uterosacral; Perineal body.

INTRODUCTION

This is the first of four related papers seeking to review and precis a proposed concept of repair of pelvic organ prolapse and the Integral Theory System on which it is based.

The Integral Theory[1], states pelvic organ prolapse and bladder and bowel dysfunction and some types of pelvic pain, mainly derive, for different reasons, from laxity in the vagina or its supporting ligaments, a result of altered collagen/elastin.

The aim of Part 1 is to explain the anatomical basis of the Integral Theory, how 5 competent ligaments, uterosacral (USL) cardinal (CL) arcus tendineus fascia pelvis (ATFP) pubourethral (PUL) and perineal body (PB) are key to organ support and how laxity in these structures may cause pelvic organ prolapse 'POP' and symptoms.

THE BIOMECHANICS OF PELVIC ORGAN PROLAPSE (POP) SURGERY

The following are important aspects of the Integral Theory[1,2].The ligaments attach the organs, vagina, bladder, rectum to the skeleton from above (Figures 1, 2). The pelvic muscles stretch them from below (Figure 3). The ligaments are strong and inelastic. They provide the principal strength for organ suspension. Because the organs and the vagina need to expand and contract, they contain significant quantities of elastin, but have far less structural strength. Estimated breaking strain of ligaments is approximately 300 mg/mm^2 and vagina approximately 60 mg/mm^2, Yamada 1973[3]. Collagen I provides structural strength and elastin stretchability. Both weaken with age, especially after the menopause. Elasticity of the vagina is fundamental to its function during organ closure, evacuation, intercourse and it is a low energy mechanism for closure of the urethra.

From these simple biomechanics, two surgical principles follow which need to be observed during pelvic reconstruction.

1. It is the ligaments which provide suspensory strength, so they must be reinforced in any surgical reconstruction, along the length of the ligament and in its anatomical axis.

2. The vagina has little structural strength. It functions as an elastic organ. Its elasticity must be preserved. Vaginal excision will only add less elastic scar tissue and reduce the quantity of collagen and elastin available for normal vaginal function.

SURGICAL ANATOMY OF PELVIC ORGAN PROLAPSE

The ligaments. The organs are suspended to the pelvic side wall skeleton by 5 main ligaments, uterosacral (USL) cardinal (CL) arcus tendineus fascia pelvis (ATFP) pubourethral (PUL) from above, Fig1 and perineal body (PB) from below (Figure 2)[4]. The ligaments and the structural layer of vagina known as pubocervical (PCF) and rectovaginal (RVF) fascia are composed of collagen, elastin, smooth muscle, blood vessels and nerves, so they are contractile (1).

Ligaments attach the organs to the skeleton. *ATFP ligaments* attach to the pubic symphysis just above PUL, to

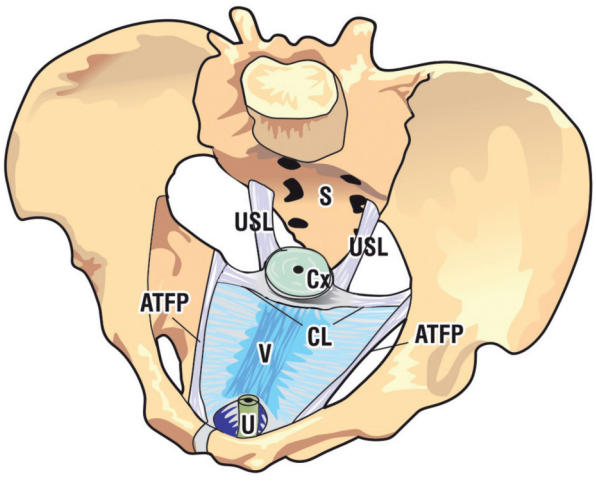

Figure 1. – Anterior vaginal attachments to skeleton. The vagina is suspended like a trampoline membrane between the Arcus Tendineus Fascia Pelvis (ATFP) ligaments laterally, proximally to the anterior part of the cervical ring (CX) and cardinal ligament (CL) and distally to the lower half of urethra (U) via the pubourethral ligament which inserts into the middle part of the urethra. S=sacrum.

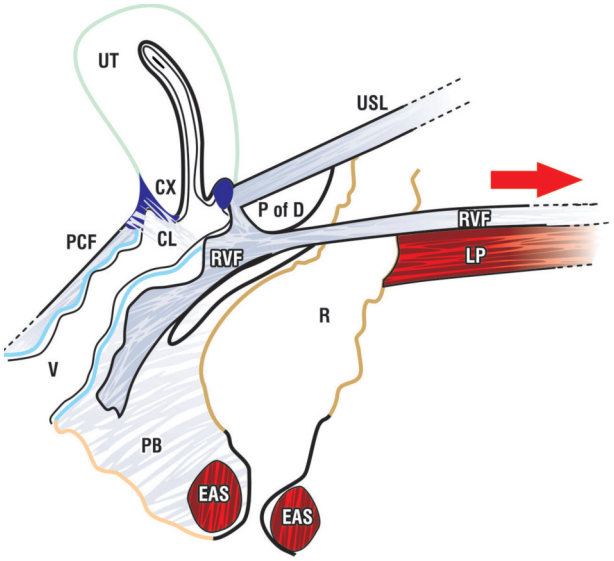

Figure 2. – The uterosacral ligaments (USL) attach uterus to sacrum, to the lateral rectal walls, cervical ring (CX), cardinal ligament (CL), fascial layer of posterior vaginal wall (rectovaginal fascia 'RVF') and perineal body (PB) in its distal 50%. Note the organ space between posterior vaginal wall and rectum. It needs to be preserved to allow independent movement of vagina over rectum especially during intercourse and defaecation.

the paracolpium of the lateral vaginal walls and to the ischial spines (Figure 1).

Cardinal ligaments attach to lateral side wall of the skeleton, anterior cervical ring, the pubocervical fascial layer of anterior vaginal as it attaches to the cervical ring, lateral border of cervix and USL (Figure 1).

Uterosacral ligaments attach to sacrum, rectal walls laterally and cervix anteriorly (Figure 1).

Perineal body (PB) attaches to distal rectum, distal vagina and to the descending ramus via the deep transversus perineus ligament (Figure 3).

Pubourethral ligaments attach to the mid urethra, anterior portion of pubococcygeus muscle (pubovaginalis muscle) and to the lower border of the pubic symphysis; Figure 4.

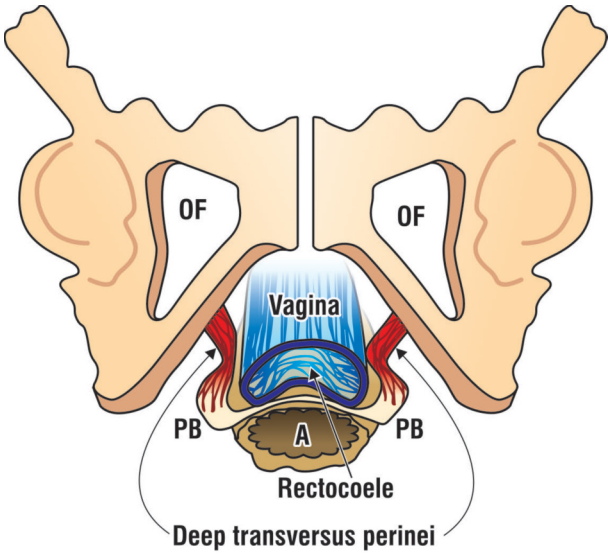

Figure 3. – Ligament attachment of perineal bodies (PB) behind descending ramus. The PBs have been separated during childbirth, causing stretching of the central tendon (not shown) allowing the rectum to protrude into the vagina as a rectocele. Note attachment of PBs to the descending ramus by the deep transverse perinei ligaments.

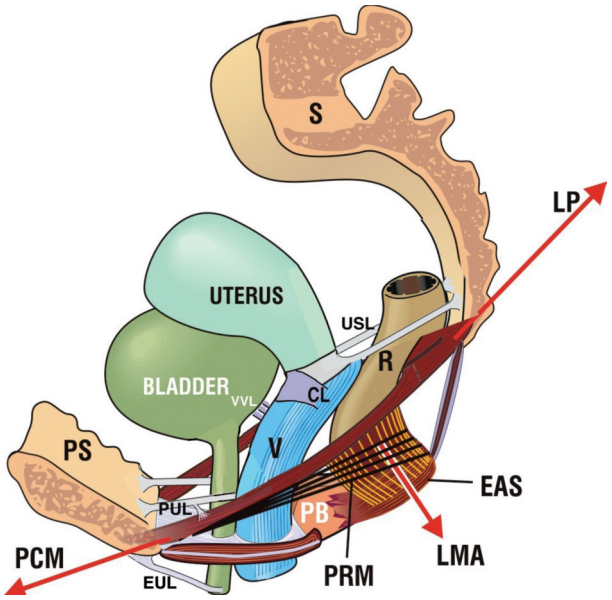

Figure 4. – The principal muscles and ligaments of the pelvic floor.
The 3 directional muscle forces (arrows) contract against PUL anteriorly and (CL/USL) posteriorly.
Forward contracting m.pubococcygeus (PCM); m.puborectalis (PRM).
Backward contracting m. levator plate (LP); conjoint longitudinal muscle (LMA). Ligament labelling as in fig1. LP inserts into the posterior wall of rectum; LMA connects LP to the external anal sphincter and contracts downwards.

External urethral ligament (EUL) attaches the external meatus to the anterior surface of the pubic bones. It is a 6th ligament, not directly relevant to POP causation, but important for urethral sealing (Figure 4).

Vagina. The vagina is a weak elastic membrane with little structural strength. It is attached to the cervix and side wall skeleton via its ligamentous and muscular attachments. The vagina has a squamous epithelial layer and attached below, a 'fascial' layer. This layer is known as the 'PCF' (pubocervical fascia) for the anterior vaginal wall and 'RVF' (rectovaginal fascia) for the posterior vaginal wall. Both structures contain smooth muscle, collagen, elastin, nerves and blood vessels[1].

Anterior vaginal wall. The fascial layer (pubocervical fascia 'PCF') attaches proximally to the anterior cervical ring and cardinal ligaments, laterally to ATFP and distally to the pubococcygeus muscle ('pubovaginalis') distal urethra and external urethral ligament (Figure 1).

Posterior vaginal wall. The fascial layer (rectovaginal fascia 'RVF') attaches to uterosacral ligaments, posterior cervical ring, ATFP laterally via the paracolpium, and distally, to perineal body and rectum (Figure 2).

Consequential anatomical relationship of the rectum (Figures 2-4). The USL attaches to the lateral walls of rectum and suspends it to the skeleton (sacrum); levator plate (LP) inserts into the posterior rectal wall. Rectovaginal fascia 'RVF' attaches to levator plate 'LP', perineal body 'PB' and cervix. LP contracts backwards to tension the uterus, the USLs, perineal body and posterior wall of the rectum. Anything which loosens USL will create a cascade of symptoms from the functions dependent on the USL muscle/ligament relationships. These are summarized in the pictorial algorithm (see Parts 3 & 4).

Organ spaces. Organ spaces (Figure 2) are essential to allow free movement of bladder over vagina and vagina over rectum. Especially vulnerable is the rectovaginal

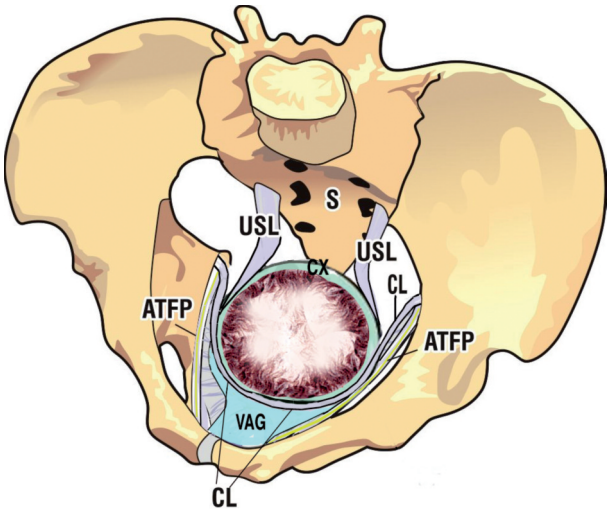

Figure 5. – Ligament damage at childbirth. View from above at 10cm dilatation of the cervix. The maximal strain of the 10cm dilatation is on the cervical ring attachments of vaginal 'fascia', uterosacral ligaments (USL) and cardina1(CL) ligaments and attachment of paracolpium of vagina laterally to ATFP. Extension or tearing of these attachments may cause apical prolapse, cystocele anteriorly, rectocele and enterocele posteriorly. The perineal body may be damaged and separated to cause low rectocele (perineocele) as the head exits the birth canal.

space. If the rectum and vagina are glued together via interposition of a mesh or surgical scarring, this may prevent natural stretching during intercourse in some individuals and dyspareunia and/or evacuatory dysfunction/incontinence may result. The basic cause of the pain is the stretching of the viscerally innervated vagina; pain in a visceral organ is caused by distension.

Muscles. There are 4 directional pelvic muscles, two forward acting, pubococcygeus muscle (PCM), puborectalis muscle (PRM) and two backward, levator plate (LP) and conjoint longitudinal muscle of the anus (LMA) (Figure 4). They also support the organs from below. They contract or relax selectively to close the urethral or anal tubes (continence), open them (evacuation) or support the bladder and rectal stretch receptors to control the micturition and defecation reflexes.

Muscles contract against suspensory ligaments. With reference to Figure 4, only the PRM does not contract against any ligaments. It contracts against the pubic symphysis; the pubovaginalis portion of PCM contracts forwards against the pubourethral ligament (PUL); LP contracts backwards against PUL; LP and LMA contract backwards and downwards against the cardinal/uterosacral ligament complex (CL/USL).

If a ligament is loose, the muscle lengthens and loses contractile force, Gordon's Law[5]. All functions of that muscle, *including organ support*, will be compromised, as a striated muscle must have a firm insertion point to function optimally.

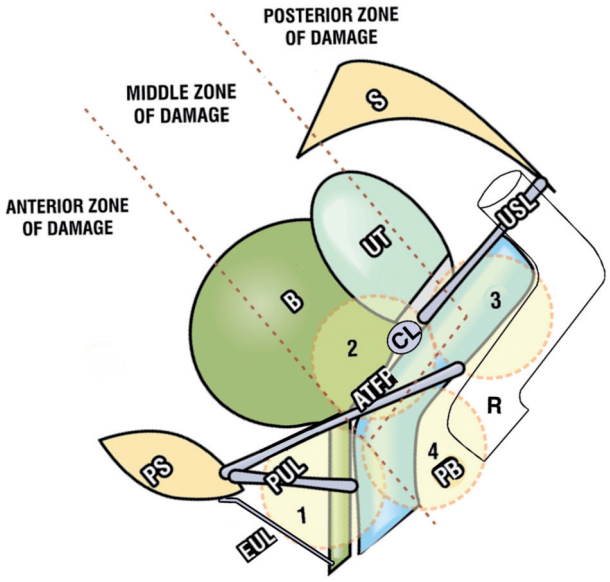

Figure 6. – Ligament damage at childbirth, schematic sagittal view
As the head descends down the birth canal, circles 1-4, it may stretch or tear the ligaments or fascial attachments of the vagina.
Circle 2. *Cystocele*. Defects: ATFP, CL, pubocervical fascia (PCF).
Circle 3. *Uterine prolapse, high rectocele, enterocele, anterior rectal wall intussusception* Defects: USL, rectovaginal fascia (RVF).
Circle 4 *Middle and low rectocele* Defects: PB, rectovaginal fascia (RVF).
Circle 1 *Stress urinary incontinence* Defects: PUL, EUL, distal vagina.

PATHOGENESIS OF POP

Causation of pelvic organ prolapse is by stretching of the suspensory ligaments, and/or distension or tearing of vaginal fascia (Fig. 5 and 6). The resulting affect is lack of support leading to prolapse, and lack of tension in the organs leading to failure of muscular control and dysfunction.

CONCLUSIONS

The pelvis functions like a suspension bridge. Strength is derived by tensioning the cables (ligaments). If these are damaged they need to be reinforced and strengthened along their natural anatomical axis. Shortening and strengthening the ligaments also restores the directional muscle forces which contract against these ligaments to restore organ support from below and restore function.

CONFLICTS

There are no financial conflicts.

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Original article

A prospective comparative urinary incontinence study between nulliparous female basketball athletes and non-athletes indicates a key role for health professionals in prevention

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Abstract: *Background* The body of a female basketball player undergoes considerable physical effort, since the rigid surface of the basketball court does not absorb the impact. *Aim of the study:* This study aims at estimating the real prevalence of symptoms associated with urinary incontinence (UI) in nulliparous female basketball players in comparison to nulliparous non athletes. *Materials and methods:* Through anonymous surveys and voiding diaries, distributed to 60 female non-athlete and 60 female basketball players, we examined the symptoms related to pelvic floor weakness and urinary incontinence. The participating athletes were asked whether they would agree to undergo a pubococcygeus (PC) muscle test at the Pelvic Floor Rehabilitation Unit of Azienda Ospedaliera di Parma (Italy). Eight of them accepted. *Results:* the percentage of symptomatic subjects amounted to 50% among athletes and 30% among non-athletes. Analyzing the responses of the asymptomatic athletes, we found that 90% of them do physical preparation and 66.6% of them lift weights more than once a week. The responses also showed that 73.3% of the participants were unaware of the pelvic floor functions. The PC muscle tests on the eight volunteers revealed a severe weakness of the analyzed musculature, with antagonistic muscle action, in half of the women who underwent the tests. *Conclusions:* The results highlight the fact that this group of fit professional women were unaware of their anatomy and unable to voluntarily strengthen the perineal muscles. In a female athlete, complementing general training with strengthening exercise for the perineal muscles is of crucial importance. An integrated role of an empathic professional with the necessary expertise in this field is emphasized.

Keywords: Urinary incontinence; Basketball players; Symptoms; Prevention.

INTRODUCTION

In his famous 1889 paper *Studies of the levator ani muscle,* Dickinson observed that "*There is no considerable muscle in the body whose form and function are more difficult to understand than those of the levator ani, and about which such nebulous impressions prevail*".[1]

In recent years, numerous studies have focused on the prevalence of urinary problems in athletes and the correlation that these dysfunctions have with specific sports. It has been proven that female athletes are often affected by dysfunction of the urogenital apparatus. In his study *Urinary Incontinence in elite female athletes and dancers,* Thyssen discovered that "the activity most likely to provoke leakage was jumping. Sixty per cent (91/151) occasionally wore pads or panty shields because of urine loss. Urinary leakage is common among elite athletes and dancers, particularly during training, but also during daily life activities".[2] Di Benedetto conducted an epidemiologic investigation on the incidence of urinary incontinence in female volleyball players. He concluded that "frequently raised intra-abdominal pressure, especially intense pressure like the one which characterizes sport training, is likely to damage the myofascial pelvic system".[3] He examined 217 athletes, using a focused questionnaire. The highest prevalence of urinary dysfunction and genital problems was detected in the group of volleyball players.

Basketball players are often subjected to two hours of training up to four times a week, plus games during the weekend. This athletic training often consists of long distance running, sprinting, lunges, jumps and weightlifting; all high impact activities for the pelvic floor.

In this study, the quantity and range of symptoms related to perineum weakness and urinary incontinence in a group of nulliparous basketball player have been determined through an anonymous focused questionnaire and a micturition diary. A second group of nulliparous non-athlete young women has also been asked to complete an equivalent questionnaire and micturition diary. Results have then been compared and assessed.

Basketball players, especially if over 18 years of age, showed a great interest in the subject, but they were also very embarrassed when asked to talk about it and to answer questions about any specific symptomatology. We detected a general sense of resignation toward the problem and some athletes also believed that what they were experiencing was normal, despite the evidence of anomalous symptoms. All female basketball players involved in the study were invited to undergo a Pubocoggygeus test (PC test). Only 8 players accepted, proving once again how people were intimidated by the subject.

The aim of this study is to compare the incidence of urinary incontinence between a group of nulliparous basketball players and a second group of non-athlete young women.

MATERIALS AND METHODS

A focused questionnaire (Fig. 1) has been created with the aim of detecting urinary incontinence or other perineal dysfunctions in the sample of women interviewed. The questionnaire was anonymous and integrated with a micturition diary and an explanatory leaflet about the study. The questionnaire was identical for the non-athletes and for the basketball players, but the latters also had to answer additional questions about their physical activity. All questions were easy to understand and they were aimed at detecting the incidence, the typology and severity of the pathology. The micturition diary is a fact sheet covering three days and recording all sensations, fluids intake and urination events of the participant. All the basketball players examined had a minimum of two hours training four times a week. Considering the complexity and the lack of knowledge of the issues covered by the study, the researcher (F.R.) explained its aim to all the young women involved and personally delivered the questionnaire and micturition diary to the participants. All athletes were also invited to undergo a Pubocoggygeus test (PC test) carried

Reeducation of the Pelvic Floor at Parma Hospital. out by the researcher at the Clinic for the for the Reeducation of the Pelvic Floor at Parma Hospital.

RESULTS

The study involved 120 nulliparous young women: 60 athletes and 60 non-athletes with an average age of 19.6 years. Symptoms of incontinence were detected in 50% of the athletes and 30% of the non-athletes (see Table 1a and 1b for statistical significance). This difference has a 5% statistical significance ($p<0.05$, $p=0.04$ using Fisher's exact test and the chi-square test with Yates correction). Confounding variables were eliminated so the difference between the two groups was clearly visible. In the group of athletes, 50% had symptoms of urinary incontinence and 50% were asymptomatic. In the non-athletes only 30% of the group were symptomatic. In both athletes and non-athletes, urgency in 80% of daily micturitions was a recurrent symptom.

An overall analysis of the different lifestyles (see details in Tables 2, 3) revealed this picture:

• Non athletes: 25% habitual smokers, 71.6% drinking more than one coffee every day, 65% drinking more than one cup of tea every day, 33.3% constipated, 6.6% on medications, 25% using energy drinks or supplements

• Athletes: 16.6% habitual smokers, 51.6% drinking more than one coffee every day, 41.6% drinking more than one cup of tea, 13.3% constipated, 5% on medications, 18.3% using energy drinks or supplements.

1. *Basketball players group*

The questionnaires and micturition diaries revealed that 50% of the athletes (30 women from a total of 60) had urinary problems (urinary stress incontinence, urgency and signs of hyperactive bladder).

Symptomatic athletes: 93.3% of the 30 young women were of Italian nationality, 73.3% were not aware of the function or importance of the pelvic floor and only 23% were habitual smokers. None of them was drinking alcohol regularly, 63.3% were drinking more than one coffee every day and 50% more than one cup of tea every day. 26.6% coughed or sneezed frequently and 16.6% suffered from seasonal allergies. 20% were constipated and none of them had diabetes or had pelvic surgery.

Table 1A. Data analysis.

	with symptoms	without symptoms	total number
athletes	30	30	60
non-athletes	18	42	60
	48	72	120

Table 1B. Data statistical significance.

Test	Value	One tailed p-value	Two tailed p-value
Chi-square	5	0.01267	0.02535
Yates's correction of Chi-square	4.201	0.02020	0.04039
Mantel-Haenszel Chi-square	4.958	0.01298	0.02597
Fisher's exact		0.01994	0.03988
Mid-p value		0.1372	0.02744

Table 2. Non-athletes lifestyle

	Symptomatic non-athletes (%)	Asymptomatic non-athletes (%)
Habitual smoker	27.7	23.8
Habitual alcohol drinker	0	0
More than one coffee per day	83.3	66.6
More than one cup of tea per day	66.6	64.3
Constipated	45.2	5.5
On medications	5.5	7.1
Using energy drinks	27.7	23.8

Table 3. Athletes lifestyle

	Symptomatic athletes (%)	Asymptomatic non-athletes (%)
Habitual smoker	23	10
Habitual alcohol drinker	0	0
More than one coffee per day	63.3	40
More than one cup of tea per day	50	33.3
Constipated	20	6.6
On medications	6.6	3.3
Using energy drinks	36.6	0

Only 6.6% were on medications: antiepileptic drugs and Levothyroxine Sodium. 36.6% were using energy drinks. 13.3% had family members affected by urinary incontinence. Only 10% wore orthotics.

During basketball trainings, 66.6% of the athletes were using weights more than once a week, 90% were mainly doing squats (with or without barbell), race walks, sprints, long distance runs, runs requiring several changes of speed and jumps.

On average the athletes had been playing basketball for 10.6 years at the time of the interview. They drank 0.7 litres of water during each training. 26.6% of the athletes trained on synthetic gym floors installed over concrete and the remaining 73.4% on hardwood gym flooring. 23.3% of the athletes had previous fractures of the lower limbs. Both symptomatic and asymptomatic players did the same training. 16.6% of the young women had no previous sexual intercourse and 6.6% of the women that had previous intercourses reported dyspareunia (painful sexual intercourse). 20% of the athletes wore panty-liners between menstrual periods.

With regards to hydration: 50% of the athletes had drinks at intervals of at least 3 hours, 6.6% drank less than 5 glasses of water a day, 3.3% drank more than 2 litres of water per day and 10% had a drink before going to bed. 66.6 % (20 over 30 women) urinated more than 7 times every day and 66.6% had involuntary loss of urine when running, under stress, sleeping, if cold, sneezing or just because unable to hold it.

86.6% of the symptomatic athletes (26 over the total of 30 women) said that 80% of the daily micturition was associated with urgency.

2. *Non-athletes group*

The questionnaires and micturition diaries revealed that 30% of the non-athlete young women (18 over a total of

TABLE 4. Symptomatic athletes and symptomatic non-athletes discomfort during intercourse

	Symptomatic athletes (%)	Asymptomatic non-athletes (%)
Discomfort during intercourse	16.6 (5 over 30)	16.6 (3 over 18)

TABLE 5. Symptomatic athletes and symptomatic non-athletes with family members suffering of urinary incontinence

	Symptomatic athletes (2) with family history (%)	Symptomatic non-athletes (5) with family history (%)
Habitual smoker	20	50
Habitual alcohol drinker	0	0
More than one coffee per day	60	100
More than one cup of tea per day	40	100
Constipated	20	0
On medications	20	0
Using energy drinks	20	50

60) had urinary problems (urinary stress incontinence, urgency and signs of hyperactive bladder).

Symptomatic non-athletes: 100% of the 18 symptomatic young women were of Italian nationality, 22.2% were not aware of the meaning or importance of the pelvic floor and 27.7% were habitual smokers. None of them was drinking alcohol regularly, 83.3% were drinking more than one coffee every day and 66.6% more than one cup of tea every day. Only 16.6% coughed or sneezed frequently and the same percentage suffered of seasonal allergies. 55.5% were constipated and none of them had diabetes or previous pelvic surgery. Only 5.5% were on medications: contraceptive pill.

27.7% were using energy drinks. 5.5% had family members affected by urinary incontinence and 11.1% wore orthotics. All of the women had previous sexual intercourses and 16.6% of them reported dyspareunia. 5.5% of the group wore panty-liners between periods.

With regards to hydration: 38.8% of the athletes had drinks at intervals of at least 3 hours, no one drank less than 5 cups or more than 2 l of water a day and 44.4% had a drink before going to bed.

88.8% (16 over 18) urinated more than 7 times every day and 66.6% had involuntary loss of urine especially after sexual intercourse, under stress, laughing, if cold or when sneezing or coughing.

83.3% of the symptomatic athletes (15 over a total of 18) said that 80% of the daily micturition was associated with urgency.

The anonymous questionnaire was not enough to properly cover the problem of dyspareunia because the PC test actually revealed a higher percentage of athletes affected by it. The questionnaire revealed that the percentage of painful intercourses is the same in both symptomatic athletes and symptomatic non-athletes (see Table 4), regardless of the incidence of continence problems.

16.6% (5 over 30) of the symptomatic athletes and 11.1% (2 over 18) of the symptomatic non-athletes had family members affected by urinary incontinence. Table 5 shows the lifestyle of the young women with family history of incontinence.

3. *PC test results*

Only 8 athletes volunteered for the PC test. The average ano-vulvar distance was 1.3 cm. None of these athletes showed vulvar tearing. 37.5% of the young women had no inner thighs or anal reflexes. The stress test (coughing) resulted negative in all of the girls. The mean in the PC phasic test is 3.1, in the PC tonic test is 1.6 and in the PC endurance test is 1.2.

50% of the athletes showed muscle synergies, 50% had reflexive antagonism and 20% reacted with the opposite action to the command (pushing instead of contracting). 10% of the sample had other perineal problems like hemorrhoids. 62.5% had discomfort during intercourse and 20% lamented a frequent urinal urgency.

In the final self-evaluation question, regarding micturition personal satisfaction, the average score was 7.5, in a scale from 1 to 10.

DISCUSSION

This study shows that the prevalence of urogenital disorders is higher in the basketball players' group, compared to the non-athlete young women.

The study started with the same number of female athletes and non-athletes. 50% of the athletes and only 30% of the non-athletes revealed symptoms. Micturition habits, involuntary loss of urine and urgency were very similar between the two groups. Furthermore, a significant difference was detected between the symptomatic athletes that wore panty-liners between periods (66.6%) and the symptomatic non-athletes (5.5%). This corroborates the idea that high impact sports (like basketball) are conducive to early symptoms of stress urinary incontinence.

Because 90% of the symptomatic athletes did athletics training and 66.6% did weightlifting more than once a week, the question arises "Do these and other exercises damage the muscles and ligaments involved in continence control, or is the urine loss reported merely a result of the higher intraabdominal pressure generated by the exercises?" Our study was not able to answer that question. However, our other major finding, that 73.3% of this group did not know what the pelvic floor was or what function had in the body renders this question irrelevant. The athlete group, indeed both groups, would clearly benefit from a better education on the subject of pelvic floor exercises, leading to urinary incontinence prevention.

The PPC test results, though limited, confirmed this view. We objectively discovered an evident weakness and hypotonia of the studied muscles, for instance, presence of muscular reflexive antagonism in half of the girls and of muscular lack of control on command (pushing when asked of pulling) in some of the athletes. This proves once again the inadequate knowledge of human anatomy and the inability of using the perineal muscles. Another concern was that several symptomatic athletes declared a feeling of resignation regarding some of their discomforts.

CONCLUSIONS

Though the causes of urinary incontinence in young nulliparous women are still not completely clear, based on our findings, we are able to draw the following conclusions.

1. A program of education on how to feel and control pelvic muscles even without seeing them would be highly beneficial. Proprioception plays a fundamental role in the complex movement mechanism.

2. A focused strengthening of the perineal muscles (perineal care programs) as an integral part of the training in female athletes is absolutely essential.

3. An empathetic professional figure is required to effect 1&2 above, as self- awareness, transfer of knowledge and self-motivation will all be important keys in the ongoing prevention and treatment of incontinence in the individual athlete.

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Comment

Despite the recent Olympics in Rio, urine loss in female sports has somehow escaped the consciousness of urogynecologists such as myself.

This is an important paper as it potentially opens up a Pandora's Box concerning the effect of sport on urinary incontinence.

I was amazed to discover a 50% incidence of incontinence in female basketball players, basket ball not being as stressful on the female bladder as say, weightlifting.

Many of us have seen the famous video of a female weightlifter squirting urine as she completes the Clean part of the Clean and Jerk.

From a mechanical perspective, the short urethra and the upright stance unfortunately predispose to urinary incontinence, at least when compared to four footed animals.

The authors I think prove quite conclusively that a special pelvic floor training programme for female athletes is necessary and, in my view, should be part of every training session for female athletes. I hope that there will be more papers such as this, specific for other sports and especially long-term effects of sport on the genitourinary system over time.

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Original article

Laparoscopic assisted vaginal hysterectomy. Reconsidering the indications

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Abstract: *Background and objectives:* Laparoscopic assistance was introduced at the end of the 1980s with the purpose of enlarging the indications of vaginal hysterectomy and reducing the indications of abdominal hysterectomy. The purpose of the study is to reconsider the indications for laparoscopic assistance. *Methods:* In the period 2005-2013 1516 vaginal hysterectomies (VH) were performed on unprolapsed uteri by the same surgical team. Of these, a total of 279 (18.4%) cases received laparoscopic assistance (ALVH). *Results:* The main indications for assisting laparoscopic vaginal hysterectomies were facilitating difficult hysterectomies in 85.6% of cases and solving associated pelvic pathology in 15.4% of cases. Comparative results and specific complications of the two variants of vaginal hysterectomy are presented. *Interpretation and conclusions:* ALVH should not replace VH. ALVH is required in difficult cases or when other pelvic gynecological pathology must be solved simultaneously.

Key words: Laparoscopic assistance; Vaginal hysterectomy.

INTRODUCTION

Hysterectomy is one of the most common gynecological operations and is practised on abdominal, open, laparoscopic or vaginal route. A study completed in 2009 showed that the distribution of hysterectomies according to the approach path was 56% for abdominal hysterectomies, 20% for laparoscopic (ALVH), 19% for vaginal hysterectomies (VH) and 5% for the robotic ones. [1] Even so, in our experience, patients prefer vaginal hysterectomy because of simplicity, cost effectiveness and the lack of any scarring of the abdominal wall. [2]

ACOG recommendation on the approach of hysterectomy states that ... *"vaginal hysterectomy is the first choice every time is possible."* [3] In reality, the decision rests solely with the surgeon that adapts to the specifics of the patient and his own abilities.

Vaginal hysterectomy has limitations related to accessibility, the size of the uterus or pelvic pathology associated. [4, 5] Laparoscopic assistance was introduced in practice in the late 1980s [6] [7] from the need to broaden the indications for vaginal hysterectomy and to limit the indications of abdominal hysterectomy. Laparoscopic assisted vaginal hysterectomy (ALVH) has recognized indications the uterine size over 12 weeks, endometriosis and concomitant adnexal pathology.[8] The main disadvantages of ALVH compared with VH concern increased operating time and bleeding and not least, cost. [9]

The low percentage of vaginal hysterectomy is not due to contraindications of the vaginal route but technical barriers that arise in the minds of surgeons on inadequate availability, reduced visibility and hemostasis safety even after a sufficient prior experience.

Choosing the right path of hysterectomy is dependent on mental attitude and dexterity of the surgeon in order to give the patient the safest and cheapest alternative.

Indications for ALVH otherwise are seen from the perspective of a surgeon who has performed over 3000 vaginal hysterectomies without laparoscopic assistance with a conversion rate of 0.6% to laparotomy, which is why we initiated this study aiming to highlight the real indication of laparoscopic assistance as well as specific complications ALVH.

MATERIAL AND METHODS

In the period 2005-2013 a number of 1516 vaginal hysterectomy were made on unprolapsed uterus by the same surgical team in private practice. Of these, a total of 279 (18.4%) cases received laparoscopic assistance.

All cases were diagnosed clinically and confirmed by transvaginal ultrasound or magnetic resonance imaging. Cervical cytology and histopathological exam of endometrium were practised in all cases. By ultrasound examination the uterine weight was estimated using the generally accepted formula (L x W x 0.52) [10, 11] Estimating the uterine weight allows also to appreciate by subtraction the real blood loss given that 40% of the calculated weight of the uterus is represented by the blood stuck in the myometrium which cannot be recovered.

Technique

Laparoscopic assistance (ALVH) had two operative times in cases with primary assistance before and after the VH time, or one time when it was necessary to control posthysterectomy hemostasis.

Laparoscopic assisting was performed under general anesthesia with the patient supine. We did not use the uterine manipulator. Port of vision was located transumbilically from Hassan, from Dargent's technique [12]. In the case of uteri weighing more than 16 weeks the vision port was moved supraumbilically under visual control. Two of the working ports were located symmetrically at 3-4 cm medial towards the anterior-superior iliac spines and suprasymphysary on the midline.

Initial laparoscopic time included exploration of the entire abdominal cavity, adhesion removal, or treatment of associated pelvic pathology and laparoscopic assistance of vaginal hysterectomy type LH 1-2 according to AAGL classification. [13]

Vaginal time included approaching the uterus by anterior and posterior colpoceliotomy by standard technique or technical variations imposed by the anatomical situation. Disconnecting the uterus by clamping, sectioning and ligating the inferior uterine pedicle (uterosacral and vesicouterine ligaments) and uterine artery pedicle allowed the extraction of the uterus by various maneuvers (without tip-

ping by simple release, hemi section, coring or morcellation depending on its size).

Final laparoscopic time consisted generally in controlling hemostasis or realizing an adnexectomy that failed vaginally.

RESULTS

Of the total number of cases 1237 (81.5%) were operated by simple vaginal total hysterectomy. Laparoscopic assistance was considered necessary in 18.4% of cases.

The average age of the patients was 43.6 (28-61) years. 4.2% were nulliparous patients. Patients with a body mass index (BMI) of 20-24 were represented in equal proportions with the 25 -30 index. Among previous interventions, caesarean section accounted for 26.7% of all cases. Of these 60.8% had a single caesarean and 38.6% two previous caesarean sections. History of gynecological operations (myomectomies, adnexectomies, cystectomies, peritonitis, etc.) represented 13.5% of total cases. The characteristics of the group are listed in Table I.

TABLE 1. Characteristics of the group (n=1516)
• * Total vaginal hysterectomy
• ** Laparoscopic assisted vaginal hysterectomy.

Age	43,6 (28-61) years	
Parity	years	
Nulliparous	2(±1)	
BMI	65	4.2%
<20		
20-24	48	3.1%
25-30	689	45.4%
>30	727	47.9%
Previous operations	52	3.4%
Without		
Caesarean section	904	59.6%
1	406	26.7%
2	247	60.8%
>2	157	38.6%
Myomectomies	2	0.1%
Adnexectomies	12	0.7%
Other interventions	149	9.7%
VH*	45	2.7%
ALVH**	1237	81.5%
	279	18.4%

Medical indications for total hysterectomy performed with or without laparoscopic assistance were dominated by symptomatic myoma in similar proportions for the VH and ALVH, respectively 57.3% vs. 58.9%. Table II. In all cases with normal sized uterus whether there was a history of medical pathology ornot, we used VH. In all cases of deep ovarian or pelvic endometriosis or previous pelvic interventions, laparoscopic assistance was indicated.

TABLE 2. Medical indications of total hysterectomy.

	VH %	LAVH%
Symptomatic myomas	58.9	57.3
Abnormal uterine bleeding (with reduced size uterus)	17.4	0
Chronic pelvic pain	4.2	1.8
Complex endometrial hyperplasia	14.2	0
CIN III/CIS	2.6	0
Endometriosis	0	11.1
Previous pelvic interventions	9.8*	21.1

Along with hysterectomy interventions for stress urinary incontinence or prolapse of the vaginal walls were applied to 356 cases (23.4%). In over 80% of times these interventions were practiced simultaneously with VH. Table III.

TABLE 3. Simultaneous interventions.

	Number of Interventions	VH (no/perc)	ALVH (no/perc)
Stress urinary incontinence	243	211 (83.6)	32 (13.1)
Cystocele	187	162 (86.6)	25 (13.3)
Rectocele	64	51 (79.6)	13 (20.3)
Perineal plasty	72	59 (81.9)	13 (18.5)

Weight of the uteri extracted by the two versions of vaginal hysterectomy was significantly in favor of the VH for the uteri under 12 weeks of pregnancy size unlike the larger than 16 weeks sized uteri that were removed by VH. Table IV.

TABLE 4. Weight of the uterus.

Week of pregnancy	VH%	ALVH %
<12 weeks	61.3	52.4
12-16 weeks	34	32.2
16-18 weeks	13.4	2.9

Operative time, blood loss and costs are significantly higher for ALVH. Operative time was considered effective working time from initiation of anesthesia. All patients with VH were operated under spinal anesthesia as opposed to those with laparoscopic assistance operated under general anesthesia. Postoperative pain was assessed by visual analogue scale (VAS), without finding any significant differences between the two types of hysterectomy. Table V.

TABLE 5. Parameter comparison VH vs HVAL.

	VH	HVAL	p
Operative time	37 min (10-70)	79 min (60-120)	.005
Blood loss	237±125	342±200	.005
Postoperative pain (VAS)	6	5	NS
Hospitalization	1.5 (12-36 ore)	2 (24-48 ore)	NS
Cost	6500 RON	7800 RON	S

Perioperative complications were represented by inadvertent bladder wounds, bleeding and urinary infections. We have not had a case of conversion to abdominal hysterectomy. Overall percentage of complications was 5.4% for VH opposed to 12.1% for assisted hysterectomy laparoscopic. Table VI.

Bladder wounds were significantly more frequent for vaginal hysterectomy 0.9% as opposed to laparoscopic assisted hysterectomy where the rate was three times lower 0.3%. All bladder wounds were recognized and intraoperative double layer suture with resorbable monofilament (PDS 3/0). Recognition of bladder wound was made by extravasation of methylene blue solution introduced at the beginning of the surgical operation in all cases when a difficult decollation of the bladder was suspected (multiple caesarean section, myomectomy history, etc.).

Hemorrhagic complications were defined as intraoperative bleeding or postoperative within 24 hours. In assessing intraoperative blood loss we excluded the quantity of blood stored in the uterine mass. Intraoperative bleeding was defined as a blood loss volume greater than 500 ml over this amount.

Intraoperative bleeding was nearly 10 times more common for ALVH compared to VH. Hemorrhage always oc-

curred after removing the uterus during vaginal operative time regardless of its size. Most frequently bleeding occurred after skid of the ligation of one of the uterine arteries in case of VH for large uteri and uterine artery avulsion ALVH regardless of the size of uterus.

TABLE 6. Operative complications.

Complications	VH n=1237	ALVH n=279
Bladder wounds	12 (0.9%)	1 (0.3%)
Hemorrhage		
• Intraoperative	11 (0.8%)	29 (10.3%)
• Postoperative	3 (0.2%)	0
Urinary infections	22 (1.7%)	4 (1.4%)

Hemostasis control was made exclusively via the vaginal route for VH and combined laparoscopic and vaginal for ALVH. Blood transfusion was necessary in one case.

Postoperative bleeding was present in 3 cases (0.2%) of the VH for uteri weight between 12-16 weeks of pregnancy and reintervention was made in the first 8-12 hours after the initial operation. Signs of hemodynamic instability occurred after 6-8 hours and the decision for reintervention was dictated by them and the decreasing of hemoglobin by 2-3 units. In these cases the vaginal stump was opened, the patient was placed in the Fowler position, blood clots were evicted, after which control of hemostasis was done laparoscopically.

We had no case of conversion to abdominal laparotomy for technical difficulties or intra or post operatory bleeding during hysterectomy.

Second generation cephalosporins were administered in a single dose 30 minutes preoperative. We had no case of septic complications or vaginal stump dehiscence.

Urinary infection was present in equal proportions for both variants of vaginal hysterectomy.

Duration of hospitalization was significantly reduced for cases operated by VH (12-24 hours) than with laparoscopic assistance (24-48 hours). Resumption of work has been done in the first week after surgery for both variants of vaginal hysterectomy.

Costs were significantly lower for VH compared to the cases operated with laparoscopic assistance.

DISCUSSION

Laparoscopic assisted vaginal hysterectomy was introduced by the authors in 2005, after over 20 years of experience with over 3,000 vaginal hysterectomies. When laparoscopic assistance was introduced over 85% of hysterectomies were performed vaginally with about a 8.6% rate of complications and laparocoversion of 0.6%. [14]

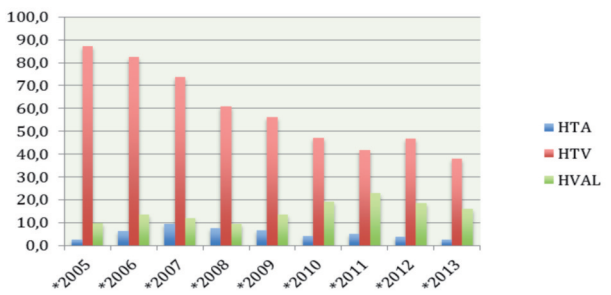

Figure 1. – Percentage distribution of types of hysterectomies practiced
HTA = abdominal hysterectomy; VH= vaginal hysterectomy; HVAL = laparoscopic assisted hysterectomy.

During the first trial period we noticed a decrease in abdominal hysterectomies in favor of vaginal while at the end of th period LAVH lead to significant decrease in abdominal (HTA) and vaginal (VH) hysterectomy. Figure 1.

In our study, laparoscopic assistance was indicated in two situations: to limit the risk of intraoperative complications and surgical effort, due to a difficult vaginal hysterectomy, in 236 cases (85.6%), or in order to simultaneously treat associated pelvic pathology in 43 cases (15.4%). Uncertain haemostasis during VH which was necessary in 9 cases (2.1%) remains the most justified indication for laparoscopic assistance.

TABLE 7. Indication of HVAL.

Patient safety/Surgical comfort 236 cases (85.6%)		
• Size, shape and mobility of the uterus		
• Known or not previous interventions		
o Adnexal pathology	167	56.7%
o Peritonitis	69	21%
o Other		
• Uncertain hemostasis	9	2.1%
Necessity to treat a pelvic associated pathology 43 cases (15.4%)		
• Pelvic endometriosis	5	1.7%
• Adnexal pathology or suspicion of difficult anexectomy	30	10.7%
• Other	8	2.8%

A systematic study conducted in 2009 only on randomized controlled batches concluded that VH should be the first option compared to abdominal hysterectomy and when this is not possible laparoscopic hysterectomy or laparoscopic assisted vaginal hysterectomy (ALVH) can replace HA. [1]

Under these conditions VH on unprolapsed uterus must become an operation that can be practised by any experienced gynecologist surgeon in the base of fulfillment of minimum conditions related to the availability of vaginal route and anatomic characteristics of size, shape and mobility of the uterus. Most contraindications of VH can be overcome by experience. A study conducted on a sample of 280 cases showed that large uterus, nulliparity, previous cesarean operations or previous laparotomies do not constitute a contraindication for vaginal hysterectomy. [15] This implies a selection of cases so that vaginal hysterectomies with high difficulty level should be addressed to experts or require laparoscopic assistance.

S. Sheth, one of the most experienced surgeons in vaginal hysterectomy states that uteri with sizes up to 12 weeks of pregnancy can be extracted exclusive vaginally and the bigger than 16-18 weeks ones require laparoscopic assisting (HVAL). For uteri larger than 18 weeks abdominal hysterectomy is the best solution. [16] Surgeons trained in vaginal hysterectomy easily exceed the size limit considered safe [17] without subjecting the patient to unnecessary risks but at the cost of a particular surgical effort, but with the satisfaction of a simple evolution, without risk of complications for the patient.

In our view large uteri can be extracted in good condition by VH with a much more reduced intraoperative bleeding compared to same uteri size extracted with laparoscopic assistance.

For the pre-surgical assessment of VH, the key elements are assessing the size and mobility of the uterus. Appreciating the size of the uterus by fundal height is not sufficient; so that the ultrasound is required in particular in case of globular uteri which typically have equal size in all three diameters. [18] In these cases disconnecting the arte-

rial pedicles is difficult and sometimes vaginal hysterectomy fails. [19] Uterine mobility can only be assessed with an anesthetized patient with pelvic muscles relaxed and is a skill that is learned over time. "A mobile uterus is a normal uterus, an immobile uterus has a problem." [16]

Based on our wide experience, we have preferred that large uteri over 16 to 18 weeks should be extracted by VH for the following reasons:

Bleeding is much reduced for VH compared to VHAL [20]. Factors that make bleeding less for VH are:

• Vascular disconnecting of the main vascular pedicle at the onset of surgery

• Continuous caudal traction on the uterus that produces:

Tensioning the superior vascular pedicle and reducing the blood flow

Accommodating a large uterus into the pelvis as it is extracted (progressive tourniquet)

• The risk of uterine artery avulsion which can produce heavy bleeding difficult to control is virtually nonexistent. [21]

The laparoscopic approach is especially difficult for uteri with large transverse diameter.

American College of Obstetricians and Gynecologists (ACOG) recommends assisting laparoscopic vaginal hysterectomy in the following situations: lysis of adhesions, pelvic endometriosis treatment, difficult anexectomy, fibroids that make VH difficult or necessity to explore the abdomen and pelvis. [22]

In our opinion, the problem of laparoscopic assistance is a preferred option for uteri (12-16 weeks) with or without pelvic or adnexal associated, especially for surgeons with limited experience in vaginal hysterectomy for reasons of patient safety, or for experienced surgeons who want to reduce surgical effort by a long elegant and safe operator time.

Previous experience has allowed us to treat by vaginal hysterectomy, cases that in the study group we assisted laparoscopically with a similar rate of intraoperative complications.

Particular surgical effort, uncertainty over what remained in the pelvis after vaginal hysterectomy in cases with associated pelvic pathology or postoperative hemorrhage were the arguments that led us to introduce laparoscopic assistance as a safety feature for the cases we have considered potential complicated, or which have further complicated.

LAVH offers as a main advantage, preparing the uterus to be removed vaginally without the tilting maneuver, but also brings a disadvantage that generates a specific type of complication - uterine artery avulsion, which we found in 8 of the 29 cases of intraoperative bleeding. For this reason we introduced the uterine artery coagulation and cutting technique originally by Kohler [23] for large uteri. Uterine artery avulsion occurs due to traction exerted on the uterus following section of the inferior pedicle. The uterus remains anchored only by the uterine artery pedicle which detaches from the parametrium.

When planning a vaginal hysterectomy, the surgeon must address the associated pelvic static disorders that can be treated simultaneously. In our study group we treated concomitantly 566 complementary interventions for pelviperineal restoration of which 39% were achieved during simple vaginal hysterectomy and 37% during laparoscopic assisted hysterectomy.

Operating time is dependent on factors related to the experience of the surgeon, the size of the uterus and the patient's body mass index. Estimated operating time in this study is lower than the data in literature showing 37 min for VH and 79 min for LAVH [24] and we consider that the main factor was the experience of the same surgical team.

Some authors consider that uteri greater than 500g cannot be treated by vaginal hysterectomy and recommended laparoscopic assistance. [25] We believe that the indication of laparoscopic assistance in these cases applies to globally enlarged uteri by adenomyosis or associated adnexal pathology. A large uterus with multiple fibroid nodules can be removed more easily than exclusively by the vaginal route than a similar sized globally enlarged uterus. [24]

Peri and post-operative complications are more reduced for VH compared to LAVH. [5, 26] In our study they have been less than the rate cited in the literature. The percentage of bladder wounds accounted for 0.3% of the total HVAL number compared to 1.29 %. [27]

Laparoscopic assistance offers the chance to facilitate a difficult vaginal hysterectomy. The need to "assist laparoscopically" a vaginal hysterectomy without unnecessarily prolonging the intervention and submit the patient to unnecessary risks is the main problem that arises in this kind of intervention. Alan Johns says ... "*never add the risks of laparoscopy to another surgical procedure unless you are sure the benefits of the endoscopic procedure outweigh the risks*." The answer to the question, "vaginal or laparoscopic surgery" is "both": the vaginalist and the laparoscopist can coexist in the same person and the appropriate mode is used according to what is best and safest for he patient.

CONCLUSIONS

Laparoscopic assisted LAVH is required in difficult cases or when a pelvic gynecological pathology must be solved simultaneously. The uterus greater than 12 weeks is not an indication of laparoscopic assistance. Laparoscopic assisted vaginal hysterectomy prevents the complications of difficult VH and is an element of patient safety.

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Original article

Prevalence and types of anal hpv in infertile patients with semen infection

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Abstract: Introduction. HPV infection is a very common sexually transmitted disease. Studies regarding anal infection in men, typically focus on HIV-immunosuppressed subjects or men who have sex with men. *Objective*. To evaluate the prevalence of anal HPV in infertile patients with infected semen and to detect the genotype concordance and most prevalent types at both sites. *Methods*. In 118 infertile patients with positive FISH analysis for HPV on semen, sperm parameters were compared with those of 172 infertile noninfected men serving as control group for semen analysis. In the former group, detection and genotyping of HPV infection was performed by INNO-LiPA assay in semen and anal brushes. *Results*. Sperm parameters from infected males showed significantly reduced motility and increased anti-sperm antibodies compared with controls (P<0.001 and P<0.01). HPV DNA detection and typing in semen showed HPV-16 as the most prevalent genotype (24.6%). Anal brushing tested positive 47 subjects (39.8%) showing high concordance with seminal HPV types. In this group, 7 patients (14.9%) had anal warts and 23.4% had a coinfection by more HPV types. Most prevalent HPV type observed in patients with anal infection was HPV-6 (24.4%). *Conclusions*. This study demonstrates for the first time that HPV semen infection may represent a risk factor for anal HPV even in heterosexual asymptomatic men. Because the strong associacion between anal cancer, anal warts and HPV infection, we suggest testing the anal site of patients with semen infection and to counsel them in order to prevent warts and cancer development.

Key words: Anal HPV; Heterosexual males; HPV Semen infection; Male infertility; Sexual transmitted disease.

INTRODUCTION

Human Papillomavirus (HPV) is the most common sexual transmitted disease (STD) worldwide. HPV are small non-enveloped DNA viruses able to infect mucosal and cutaneous membranes of the anogenital region, upper aerodigestive tract, and other head and neck mucosal regions[1]. This infection is mainly asymptomatic and transient[2], however it may persist and give rise to various lesions such as warts[3], low grade squamous intraepithelial lesion (LSIL), high grade squamous intraepithelial lesion (HSIL), and invasive cancers[4,5] depending on low or high risk (LR or HR) type of HPV infection. This infection has been largely investigated in women and it is estimated that about 10% of women worldwide with normal cytological screening, tested positive for cervical HPV[6]. Moreover, HR HPV type's infection represents a well known cause of invasive cervical cancer, which is the second most common cancer among women[7]. Despite HPV prevalence results higher in females, recently HPV has been taken into account for men's health and at present, there is a growing interest in further understanding the relationship between HPV infection and disease in men, including the development of genital warts, penile cancer, anorectal cancer and oropharingeal cancer[8]. Recently, new insights on human reproduction suggested a major role for HPV even in male infertility[9-12]. The reported prevalence of genital HPV DNA in men has a wide range, from 1.3% to 72.9% with most studies showing ≥20%[13,14]. Recently, it has been reported that HPV can be found not only along the whole male genital tract but even in semen[15]. Interestingly, the presence of HPV DNA at this site has been demonstrated to be associated with an impairment of sperm motility and presence of anti-sperm antibodies[16,17]. In the last years, it has been observed a steady increase of this sexual transmitted disease (STD) and it is currently the most common STD seen by colorectal surgeons for anal lesions, with a million new cases seen every year[18]. It is known that about one-third of sexually active young women have a detectable HPV infection on anal smear, with a higher prevalence among those who reported anal intercourse[19]. In men, who have sex with men (MSM) the reported prevalence of anal HPV is about 57 percent, with HPV-16 being the most common type[20]. In heterosexual men, the prevalence of anal HPV is about 12 percent[21,22] and known risk factors are a lifetime number of ≥ 10 female sex partners, a primary sexual relationship <1 year in duration, and a prior hepatitis B diagnosis[21]. While for women the presence of cervical HPV remains a major risk factor for anal HPV, even in the absence of anal intercourse[19,23,24], in heterosexual men the relation between HPV semen infection and anal HPV is still not fully understood. To evaluate this aspect, in the present study we tested for anal HPV, 118 consecutive subjects who had semen infection during the dignostic workup for infertility.

METHODS AND MAIN OUTCOME MEASURERS

Patients

Written informed consent was obtained from all patients, and the study protocol was approved by the local ethics committee, Protocol Number 2331P. Inclusion criteria: heterosexual infertile men that were tested positive for semen HPV at Fluorescent in situ hybridization (FISH) on the ejaculated semen for the detection of HPV-DNA sequences in the spermatozoa and exfoliated cells during the dignostic workup for infertility. Exclusion criteria: HCV, HBV, HIV infection, previous knowledge of HPV infection or previous HPV vaccination. We included in the study 118 consecutive infected patients. A medical history including smoking, sexual behavior and previous circumcision (in males) was obtained from each patient. At enrolment, all subjects were tested for semen analysis, detection of HPV DNA and typing on semen and anal brushing and were evaluated to detect the presence of anal warts. Sperm parameters were compared with an age matched group of 172 noninfected infertile men.

FISH for HPV on semen

As previously reported[25], glass slides containing at least $2x10^6$ adhered sperm were fixed in a methanol-acetic acid solution for at least 1 hour at −20°C. To permeabilize, samples were digested with pepsin diluted 1:25,000 in prewarmed 0.01 mol/L-1 HCl for 10 minutes at 37°C. Permeabilization of the specimens was stopped with 3- to 5-minute washes in PBS 1x;

then samples were dehydrated in 70%, 80%, and absolute ethanol for 2 minutes and finally air-dried. Samples were then overlaid with 20 mL of hybridization solution (Pan Path) containing biotin-labeled HPV DNA probe (a mix of total genomes containing the conserved HPV region). Each slide was covered with a glass coverslip, and the edges were sealed with nail polish to prevent loss of the mixture during denaturation and hybridization. After a simultaneous denaturation of cellular target DNA and HPV DNA probe on a heating block for 5 minutes at 95°C, hybridization was performed by incubating the samples at 37°C overnight in a humidified chamber. Thereafter the coverslips were carefully removed, and the slides were washed in PBS 1× for 10 minutes. After 15 minutes' incubation at 37°C with the differentiation reagent (Pan Path), the slides were washed three times in PBS 1x. The biotin-labeled HPV probe was detected by incubation with 1:200 streptavidin Texas Red (Vector Laboratories) for 40 minutes at room temperature. After detection the slides were washed twice in PBS 1x/0.01% Triton and thentwice in PBS 1x and mounted with a solution containing DAPI and anti-fade (BioBlue; BioView). Samples were analyzed using a fluorescence microscope (Nikon ViCo video confocal microscope) equipped with a triple band-pass filter set (FITC, TRITC, DAPI). For each slide at least 200 spermatozoa and 200 exfoliated cells were analyzed. Evaluation of nuclear hybridization signals was performed by three investigators. When nuclei were completely and homogeneously stained and multiple small spots or single large signals were present, the sperm cells were classified as positive. The method was tested on control slides containing CaSki cells, a human cervical carcinoma cell line with stably integrated and transcriptionally active HPV genomes that served as a control for the specific probe. Cells smeared on salinated glass slides were fixed with 4% paraformaldehyde in PBS for 10 minutes. After fixation, cells were subjected to 3- to 5-minute washes in PBS 1x and then dehydrated with 5-minute ethanol washes (30%, 60%, and 95%). Cell smears were then air-dried and stored at 4°C until use.

Semen Analysis

Semen samples were obtained by masturbation after 3 days of sexual abstinence. After liquefaction at room temperature, semen volume, pH, sperm concentration, viability, motility, and normal morphology were determined according to World Health Organization guidelines for semen analysis[26]. In each sample we performed also the spermMar test to sperm antibodies detection. Sperm antibodies were detected using the spermMar Test kit for IgG and IgA (FertiPro N. V., Sint-Martens-Latem, Belgium). Semen samples were treated according to the kit protocol. The test was considered positive when spermatozoa were partially or totally covered by latex particles. The reactivity of the test was confirmed by the next formation of growing agglutinates of latex particles themselves.

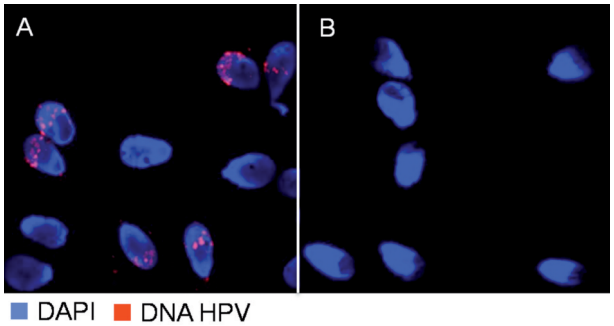

Figure 1. – Examples of FISH analysis for HPV performed in semen samples of infertile patients. A) Infected and B) non-infected semen sample. Red staining indicates the presence of HPV DNA.

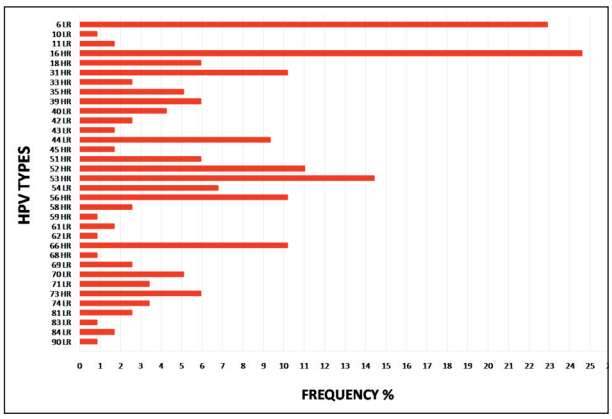

Figure 2. – Prevalence of high-risk (HR) and low-risk (LR) HPV types in semen samples of infertile men.

On the other hand freely moving spermatozoa uncovered by latex particles were considered as negative. A semen aliqot of 0.5 mL was used to perform HpV detection and typing.

Detection of HPV DNA and typing

A sample of exfoliated cells was obtained by a wide brushing of the anal region, using a standard-sized, COPAN ESwab™. Swabs were placed in phosphate-buffered saline, squeezed and rotated against the side of collection tube to release as much liquid as possible. Detection and typing of HPV on semen was performed using a 0.5 mL aliquot of whole semen. HPV DNA detection and typing was performed by using the INNO-LiPA HPV Genotyping Extra assay (Innogenetics, Ghent, Belgium) according to the manufacturers' protocol. For the INNO-LiPA test, total DNA was isolated from 200 µL of the other STM sample aliquot by using Qiagen DNA purification reagents on a Qiagen 3604 BioRobot (Qiagen) and eluted in 100 µl of water. Each DNA extraction run contained blank negative controls and positive controls to monitor the DNA isolation procedure. Five microliters of the DNA solution was used for PCR amplification using the INNO-LiPA HPV Genotyping Extra assay reagents. Biotinylated PCR products were genotyped by hybridization to HPV type-specific oligonucleotide probes bound to nitrocellulose membrane and detected by colorimetric reaction using an Auto-LiPA48 instrument in accordance with the manufacturer's recommendations. After colour development, strips were scanned and evaluated by the Line Reader and Analysis Software (Innogenetics) to determine HPV genotype/s. All results were confirmed by visual inspection. A sample was considered positive if at least one of the defined type-specific banding patterns or one of the HPV control lines were positive. Patients tested positive for anal HPV were invited to undego to colposcopy of the anal region.

Statistical analysis

The results are expressed as mean + SD and categorical variables are expressed as a percentage.

Comparisons between groups were performed with unpaired Student's t-tests after acceptance of normality with the Kolmogorov-Smirnov test and by the chi-square test for categorical data.

Probability (p) values of <.05 were considered statistically significant.

RESULTS

In this study, 118 infertile males (mean age 33.3+5.5) tested positive at FISH for HPV on semen during the dignostic workup for infertility, were further evaluated for anal infec-

TABLE 1. – Sperm parameters of infertile patients with HPV infected semen are compared with a group of noninfected infertile men. *P < 0.01 vs non-infected patients; **P < 0.001 vs non-infected patients.

Patients	Semen Volume (mL)	Sperm Concentration (mill/mL)	Sperm Count (mill/tot)	Motility (a+b) (%)	Normal Morphology (%)	Sperm Viability (%)	Sperm Antibodies n. (%)
HPV-infected Infertile patients n=118	2.4+1.4	55.7+49.1	143.8+131.9	21.7+15.6**	13.7+12.6	66.7+31.2	38 (32.2) *
Noninfected Infertile patients n=172	2.7+1.5	52.2+50.3	131.9+128.4	34.3+14.9	14.8+13.7	66.1+27.3	18 (10.5)

tion. All patients referred no symptom both at penile and anal level. Figure 1 shows examples of FISH analysis for HPV performed in semen samples of infected (A) and noninfected (B) infertile patients. In table 1 are reported sperm parameters observed in infected patients and in a group of age matched noninfected infertile subjects (mean age 34.6+4.7). Seminal volume, pH (data not shown), sperm concentration, sperm count, normal morphology, and viability were not different in HPV-infected and in noninfected infertile patients. A significant reduction of mean progressive sperm motility and a higher prevalence of antisperm antibodies was found in semen samples of infected patients compared with noninfected ones (respectively P<0.001 and P<0.01).

Patients with positive FISH for HPV at sperm level, underwent to DNA viral detection and typing in semen. This analysis allowed us to identify the following HR: HPV-16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73 and the following LR HPV genotypes: HPV-6, 10, 11, 40, 42, 43, 44, 54, 61, 62, 69, 70, 71, 74, 81, 83, 84 and 90. Coinfection by more HPV types (from two up to five types) was present in 54 patients (45.7%). The prevalence of each HPV type in semen is shown in figure 2. HPV-16 was the most observed infection (24.6%), followed by HPV-6 (22.6%). Other types, both those present in the quadrivalent vaccine and those types against which it offers a cross-protection (27), showed the following prevalence: HPV-11 1.7%, HPV-18 5.9%, HPV-31 10.2%, HPV-33 2,5%, HPV-45 1.7%, HPV 52 11.0% and HPV 58 2.5%). In these patients, the anal brushing for the detection of HPV DNA and typing tested positive 47 subjects (39.8%). Among these, 3 patients (6.4%) had anal warts at first examination and 4 more subjects (8.5%) showed anal warts at colposcopy. No dysplastic lesions were found. Most prevalent HPV types observed at anal site were: HPV-6, 16, 53, 56, 66, 44, 52 and 31 (respectively, 24.4, 18.6, 20.3, 17.7, 16.5, 10.1, 9.3 and 8.4% frequency). Coinfection by more HPV types was present in 23.4% of these subjects. Finally, we found a high concordance between HPV types observed in semen and those detected at anal brushing.

DISCUSSION

Clinically, HPV infection of the anal region can present as benign warts, dysplastic lesions or as a combination of both. Symptoms are frequently associated with the perception of a raised anal lesion, anal pruritis, bleeding and pain. In case of malignant forms, the disease shows growing lesions that tend to invade locally with possible formation of abscesses and fistulas and progression into carcinoma. Recently, several papers have established a causal relationship between HPV anal infection and the development of cancer at this site, even showing that 88% of these cancers are attributable to HPV[28]. However, in most cases HPV anal infection is represented by a silent infection and affected subjects are asymptomatic.

It is well known that HPV can be easily transmitted between sexual partners, mainly due to multiple transmission events that can occur between a couple[29]. It has been demonstrated that eighty-six percent of asymptomatic men whose sexual partners presented HPV infection, had positive HPV DNA detection by PCR at any genital site[30]. Although the role of males in the transmission of this virus to women seems clear, the prevalence of infection in the anal region of infertile men and associated risk factors have not been fully investigated. The presence of anal HPV infection has been usually related to the immunosuppression secondary to HIV infection and associated to MSM with a history of anal-receptive intercourse[31]. Up to now, no studies have considered the presence of HPV in semen as a risk factor for anal infection.

In the present study, infertile men with HPV semen infection were evaluated to test the prevalence of HPV at anal site. In particular, sampling the anal region enabled HPV detection in almost 40% of infertiles with infected semen, and high concordance of HPV types was observed at both sites. Recent studies reported that HPV infection can be found in about 12% of heterosexual men and in 50% of HIV-negative MSM having any type of anal HPV infection[28]. Considering these data, our results demonstrated a very high prevalence of anal HPV detection among infertile men with semen infection. As previously reported these patients had impaired sperm parameters[16,17], showing significantly reduced sperm motility and icreased prevalence of anti-sperm antibodyes. In semen, the most prevalent types were HPV-16 and HPV-6, with a prevalence of 24 and 22% respectively. At anal site, HPV-6 was the most prevalent (24.4%) followed by HPV-16 (18.6%). Anal coinfection by more HPV types was less frequent that in semen (23.4 versus 45.7%). Interestingly, three high risk (HPV 53, HPV 56, HPV 66) and one low risk type (HPV 44) against which the quadrivalent vaccine does not offer a cross-protection, were highly represented at anal brushing. Among patients with anal infection, about 15% showed warts at inspection or colposcopy.

CONCLUSIONS

Because the strong associacion and type concordance between seminal and anal HPV infection observed in our infertile patients, semen infection should be considered as a risk factor for anal HPV even in heterosexual asymptomatic men. Our data suggest that HPV could be spread from semen to anal region possibly during the personal care of genital area after sexual intercouse. Despite the lack of effective therapies for HPV infection, good reasons to screen anal HPV in in these patients are: i) high relation between HPV anal persistence and cancer at this site; ii) high incidence of anal warts that frequently lead to psychosexual consequences in affected patients[32]; iii) high prevalence of anal HPV types (both

HR and LR), against which quarivalent vaccine does not offer protection; iv) anal infection is considered an anatomic site that could act as viral reservoirs able to sustain the persistence of HPV infection[33]; v) possible transmission of the infection to the the female partner.

Although more and larger studies are needed to confirm our findings and to assess possible side effects of HPV anal persistence in these subjects, we suggest testing the anal site of patients with semen infection and to counsel them in order to prevent warts and cancer development.

Conflict of interest.

None to declare.

Autorship

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Original article

A feedback control system explains clinical and urodynamic bladder instability in the female

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Abstract: There are two reflex control mechanisms of the bladder, opening (micturition) and closure (continence). These reflexes concern, in particular, urge incontinence. Both of these reflexes are controlled by CNS feedback systems. Afferent signals from stretch receptors are conveyed to the brain. These are processed. Depending on circumstances, the brain sends out efferent signals to activate directional muscle forces to retain or expel the urine. These forces act against suspensory ligaments. If the ligaments are loose, the muscle forces weaken, so both modalities, closure (continence) and micturition opening (evacuation) may become dysfunctional to cause the appropriate symptoms. All bladder symptoms reflect inability to close (incontinence) or open (evacuation difficulties) or the afferent signals themselves (urgency). In this context, 'Overactive bladder' (OAB) symptoms (urge, frequency, nocturia) and 'Detrusor Overactivity' (DO) are consistent with a prematurely activated, but normal micturition reflex. The wave pattern characteristic of DO is a function of the two partly activated control mechanisms struggling for dominance, with the time delay expressed as a wave pattern. When the micturition finally dominates, the detrusor spasms and expels the urine.

Keywords: Micturition; Feedback; OAB; DO; Urge; Nocturia.

INTRODUCTION

In the International Continence Society's (ICS) paradigm, the definitions 'OAB' (overactive bladder syndrome) and DO (detrusor overactivity) imply etiology from the bladder itself.[1] Another view is that of the Integral Theory, a connective tissue paradigm, which states that urge symptoms are mainly caused by laxity in the vagina or its suspensory ligaments, a result of altered collagen/elastin.[2] Consistent with this concept, the unstable bladder in both its symptomatic and urodynamic manifestations is considered to be a prematurely activated, but normal micturition reflex;[3, 4] the etiology is not in the bladder itself, but in the structures giving mechanical support to the stretch receptors. If this is correct, such symptoms are potentially curable surgically.

An anatomical basis for bladder control and urodynamics in the female

The main purpose of this paper is to discuss an anatomical basis for urge incontinence, definitions such as 'Overactive bladder' (OAB) 'Detrusor Overactivity' (DO)[1] and to explain the mechanical process which leads to these definitions.

Closed (retention or continence) mode in the normal patient is described in figure 1. It is widely accepted that bladder has only two stable modes, closed (retention) and open (evacuation). Except when there is a need to evacuate urine, the dominant bladder mode is the closed (continence) mode ('C' red lines). The 'closed' mode has central and peripheral components. The central component activates the inhibitory centres which are found throughout the CNS. These centres act much like a trapdoor, blocking the afferent impulses which originate from peripheral stretch receptors in the urothelium'N'. The peripheral components activate the three directional vectors PCM, LP, LMA, fig 1to stretch the vaginal membrane to provide underlying support to the stretch receptors 'N'. This reduces the afferents to the cortex (broken green lines).

"Open" (micturition) mode in the normal patient. When the bladder fills, the micturition reflex is activated: in figure 2 the bladder/urethra are in the 'open' position, the closed mode 'C' (red broken lines) has been overcome by the open mode 'O' (green unbroken lines). Afferent impulses 'O' activate the cascade of events for micturition: de-activation of the inhibitory centre so it opens to afferents from the stretch receptors 'N'; inhibition of the peripheral closure reflex 'C' (broken red lines); relaxation of m. pubococcygeus (PCM) releases the tension on the vaginal membrane which supports 'N' ; 'N' now fires off more afferent impulses; LP (levator plate) and LMA (conjoint longitudinal muscle of the anus) contract to open out the posterior urethral wall, exponentially reducing the frictional resistance to flow (Poiseuille's Law); the flow of urine further stimulates receptors in the proximal urethra to accelerate the opening reflex even further.

Unstable mode- how loose ligaments may cause urge symptoms

It is well accepted that loose pubourethral ligaments (PUL) are the prime cause of urinary stress incontinence. Though 50% of urge symptoms are also cured with a

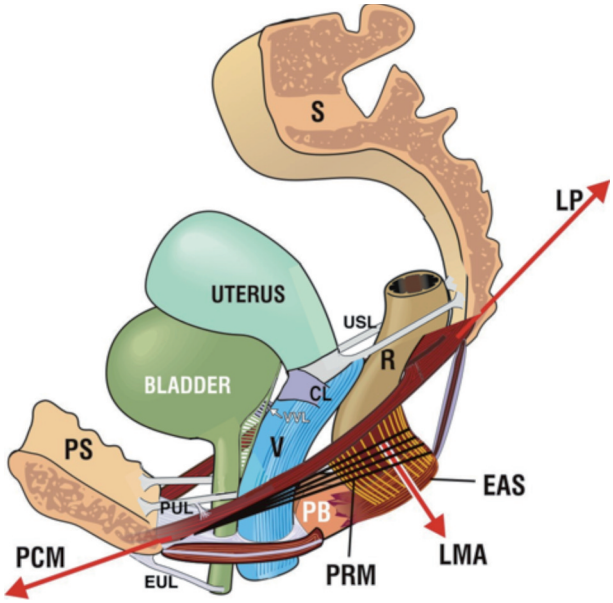

Figure 1. – **'Closed' (continence) mode in the normal patient.** The closure reflex 'C' (shown in red) dominates the opening (micturition) reflex 'O' (broken green lines). The cortex stimulates inhibitory centres throughout the CNS which act like trapdoors. **Closure.** The 'trapdoor' closes, PCM, LP/LMA contract to close the urethra and to stretch the vagina to support 'N', thereby diminishing the number of afferent impulses (broken green lines).

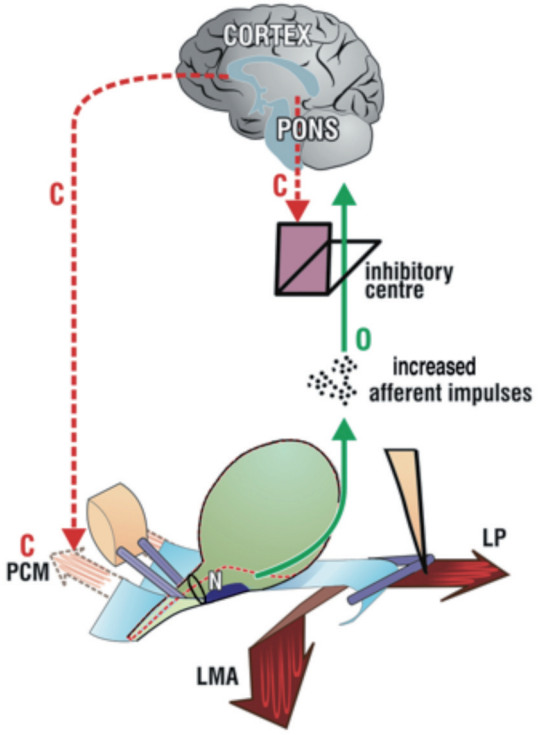

Figure 2. – **"Open" (micturition) mode in the normal patient.** Bladder/urethra are in the 'open' position. 'O' = afferent impulses; N= bladder stretch receptors. C= closure reflex 'C' (broken red lines); PCM = pubococcygeus muscle, LMA = longitudinal muscle of the anus, LP = levator plate. The closed mode 'C' (red broken lines) has been overcome by the open mode 'O' (green unbroken lines).

midurethral sling, not so well accepted is the explanation for this: failure of PUL to sufficiently support the anterior part of the vagina, so that the stretch receptors 'N' (Fig. 3), fire off prematurely. The same rationale is used to explain why loose uterosacral ligaments (USL) are also an important cause of urgency (Fig. 3).

The afferent impulses from the stretch receptors are perceived by the cortex as urge symptoms. At a critical point, the micturition reflex is activated. Whether or not there is urine loss depends on how well the closure mode can control the micturition reflex.

The concept that urge symptoms are potentially curable surgically by repairing the suspensory ligaments was directly tested in a prospective urodynamically controlled observational study published in IUJ in 1997:[5] midurethral and apical slings were inserted into 85 patients.

It was found that reinforcement of PUL and USL with midurethral and posterior slings gave a high cure rate for urgency and nocturia. Many of the patients had only 1st degree prolapse. Assessment was with a symptom-based questionnaire, pre and post-operative urodynamics and 24 hour pad tests. At (mean) 21-month follow-up cure rates were: stress incontinence 88% (n = 85), frequency 85% (n = 42), nocturia 80% (n = 30), urge incontinence 86% (n = 74), emptying symptoms 50% (n = 65)[5].

Urodynamically diagnosed detrusor instability 'DI' (now called 'DO") was present in 36/85 patients preoperatively (42%) and in 13/61 postoperatively (21%). Of these 13 patients 12 had no incontinence symptoms whatsoever. Of the 5 operative failures who were tested postoperatively, 4 had a stable detrusor, i.e. DI was neither predictive of nor associated with surgical failure in this study.

A simple proof. Examine a patient who has urge symptoms with a full bladder. Very gently support the bladder base area of the vagina digitally. The urge symptoms frequently diminish, immediately. Excessive pressure will worsen the urge. Both maneouvres demonstrate the presence of stretch receptors.

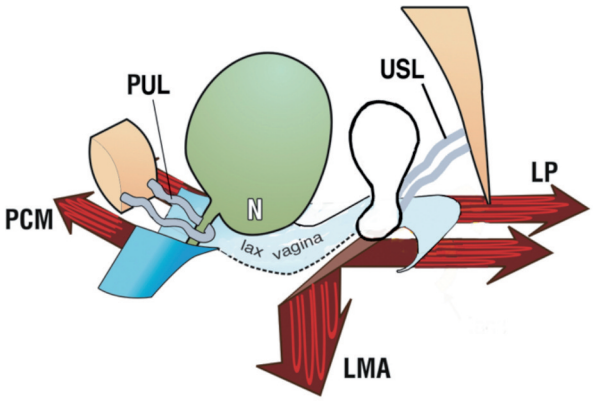

Figure 3. – How loose ligaments may cause lack of support for the bladder base stretch receptors 'N' even with minor vaginal prolapse. *Vector forces* PCM (m.pubococcygeus); LP (levator plate); LMA (conjoint longitudinal muscle of the anus) lose muscle force if the ligaments against which they contract (USL, PUL) are loose. N=bladder base stretch receptors. PUL=pubourethral ligament; USL= uterosacral ligament.

'Detrusor Overactivity' (DO). This is a urodynamic diagnosis. The 2002 ICS Standardization Report describes two types of detrusor overactivity 'Phasic', characterized by a characteristic wave form and 'Terminal', a single involuntary detrusor contraction occurring at cystometric capacity which cannot be suppressed and results in bladder emptying (voiding).

An anatomical explanation for the unstable bladder ('OAB', 'DO').

The trampoline analogy. Figure 4 transforms the bladder control system into the analogy of the trampoline; oppositely- acting vector forces are required for the vaginal membrane to be stretched sufficiently so as to support the bladder base stretch receptors 'N'. Like a trampoline, any loose spring (ligament) will not allow the vectors to stretch the vagina; 'N' becomes unsupported and fires off afferent impulses. These are perceived by the cortex as urgency symptoms. The ICS describes such symptoms 'overactive bladder' (OAB) symptoms.

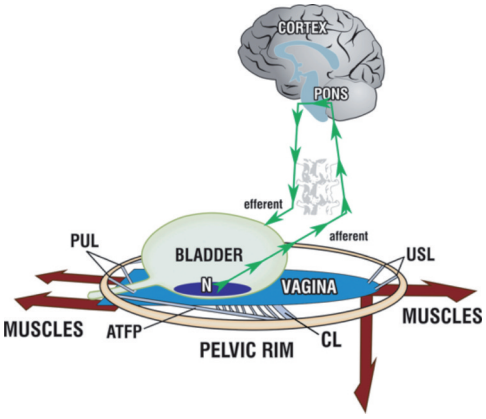

Figure 4. – Trampoline analogy- function: how the muscle forces control peripheral neurological function. Like a trampoline, laxity in even one suspensory ligament, PUL, ATFP, CL or USL, may prevent the muscle forces (arrows) from tensioning the vaginal membrane. The stretch receptors 'N' cannot be supported, and fire off prematurely. The cortex perceives the afferent impulses as urge symptoms.

Unstable mode - the mechanics of phasic patterns of DO. With reference to figures 1& 2, if the suspensory ligaments are loose, the micturition reflex ("open mode") cannot be so well controlled and it may be partly activated, causing the detrusor to contract. Data from a previous study indicated that a low compliance pattern seen during urodynamic testing was consistent with a partially activated, but controlled micturition reflex.[6]

An anatomical explanation for the phasic pattern in DO (Fig. 5). The phasic DO pattern is consistent with a struggle between the two partially activated feedback systems, closed 'C' (continence) and open 'O' (micturition).The transducer inside the bladder will record the pressure of the detrusor contracting against the urethra, higher for 'C', lower for 'O'. The time delay in switching from closed to open mode results in a phasic pattern. The phasic pattern can occur in patients with urge incontinence or in a normal woman with no history of incontinence, but 'hanging on' with a full bladder.

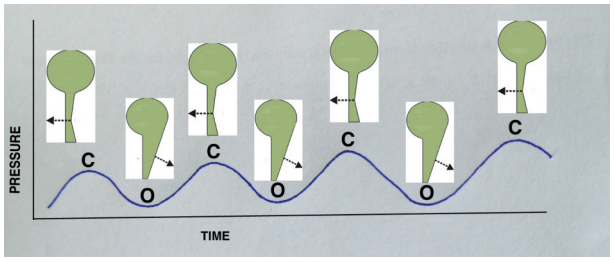

Figure 5. – Phasic pattern in DO is indicative of a struggle between the two feedback systems closing the urethra 'C' (continence) and opening it 'O' (micturition). At 'O' the micturition reflex is partly activated, the vectors (backward arrows) partly open the urethra and the detrusor pressure falls. At 'C' the vectors (forward arrows) partly close the urethra, thereby increasing the resistance to detrusor contraction. The detrusor pressure increases. The time delay in switching from 'C' mode to 'O' mode results in a phasic pattern.

Unstable mode- bladder empties 'Terminal DO'. The ICS describes Terminal DO as a single involuntary detrusor contraction occurring at cystometric capacity which cannot be suppressed. With reference to figure 2, at a critical point, LP/LMA have opened out the urethra. Because smooth muscle works by direct transmission of the muscle fibres to each other,[7] so the detrusor muscle spasms and smooth muscle fibres shorten around the urine as it is expelled. These events, detrusor spasm during emptying, are evident on simple observation of a video xray.

Nocturia increases linearly with age, occurring in more than 50% of women ≥80 years old.[8] Nocturia has a major effect on quality of life,[9] costs the community up to 62 billion dollars p.a.[10] Followers of traditional views state that there is no effective treatment to date. However, data from four different operations which suspend a prolapsed posterior vaginal fornix[5, 11-19] all show high rates of cure for nocturia, up to 85%. A hypothesized pathogenesis, apical prolapse, is detailed in figure 6. This can be tested by insertion of a large vaginal tampon into the posterior fornix of the vagina.[20] Depending on the size of the vagina, a 2nd tampon may be required. This works by supporting the bladder base, preventing the stretch receptors from firing off.

CONCLUSIONS

The ICS definitions and clinical descriptions of 'DO' and 'OAB' are consistent with the unstable bladder being a premature activation of an otherwise normal micturition reflex,

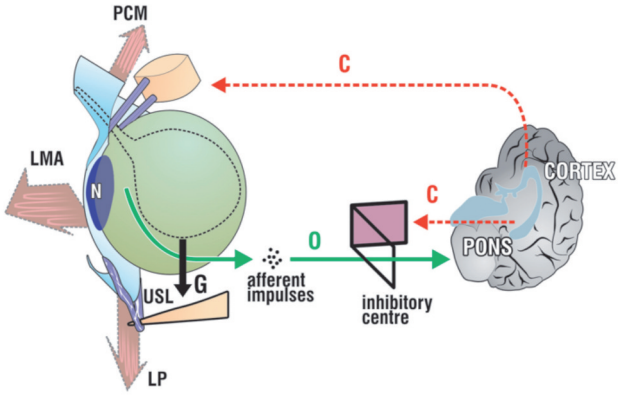

Figure 6. – Proposed mechanical origin of nocturia- patient asleep. Pelvic muscles (arrows) are relaxed. As the bladder (broken outline) fills, it is distended downwards by gravity G. If the uterosacral ligaments (USL) are weak it continues to descend until the stretch receptors 'N' are stimulated, activating the micturition reflex once the closure reflex 'C' has been overcome.

in turn caused by lax suspensory ligaments[3]. Alleviation of urge by digitally supporting the vagina below bladder base,[6] by digital pressure at midurethra[21], by gentle insertion of a speculum into the posterior fornix or support of bladder base,[22] are all simple proofs of the concept that the origin of urgency is failure of the vaginal membrane to support the bladder base stretch receptors. Such direct anatomical proofs validate published data, that urge incontinence symptoms, frequency and nocturia, collectively termed 'OAB symptoms' are potentially curable surgically.[11-20]

CONFLICTS

None.

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Original Article

Effect of hysterectomy on Pelvic Floor Disorders

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Abstract: Aims. This study was designed to assess the effect of subtotal abdominal hysterectomy on pelvic floor disorders and anorectal function. *Methods:* Forty-seven women awaiting subtotal abdominal hysterectomy were included in this cross-sectional study by a non-probability convenience sampling method. Their anorectal function was assessed by a questionnaire and anorectal manometry before and 6 months after hysterectomy. *Results:* Our subjects did not frequently have defecation problems and results of baseline manometric study were in coordination with the clinical feature. In the current study, increased number of parities, BMI and age were not significantly correlated with manometry values. At follow up, all patients were well and none of them had any defecation disorder or complication, so only 3 of them accepted to undergo the follow up manometry. *Conclusions:* This study reports the manometric results of 47 healthy Iranian women, so provides a basic manometric data of Iranian women. This research detected no defecation disorder or manometric abnormality associated with subtotal abdominal hysterectomy, so this study suggests that this operation is an appropriate alternative to total abdominal hysterectomy which can cause more complications.

Keywords: Hysterectomy; Pelvic Floor Disorder; Manometry.

INTRODUCTION

Fecal continence is a result of complex integration between the anal sphincter, pelvic floor, rectal perception, and rectal compliance.[1, 2] Tests of anorectal function are means of clinical examination and very useful to diagnose anorectal disorders. Anorectal manometry is a noninvasive test for objective evaluation, diagnosis, and treatment of disorders of the anorectum and is one of the most-important methods for evaluation of continence and to diagnose functional disorders of defecation.[1-7]

Studies suggest that abdominal hysterectomy affects anorectal function and some adverse effects are reported on colonic motility but the exact effects are incompletely understood.[8-11] It is not clear that patients awaiting hysterectomy already have a kind of pelvic floor failure or it is related to obstetric risk factors, so this study was designed to evaluate both basic manometric data of Iranian women and also the effect of subtotal abdominal hysterectomy on pelvic floor disorders and anorectal function.

MATERIALS AND METHODS

This cross-sectional study aimed to measure parameters of anorectal function before and after subtotal abdominal hysterectomy.

During 2008-2009, forty-seven subjects were included in this cross-sectional study by a non-probability convenience sampling method. Their anorectal function was assessed by a questionnaire and anorectal manometry before and 6 months after hysterectomy. The questionnaire included variables such as age, occupation, weight and height, parity, type of deliveries, history of constipation (less than 3 defecations per week), gas or fecal incontinence, difficult defecation or urgency, history of bloody stool and laxative or drug consumption. The history of defecation disorders considered positive only if the patient experienced it always or most of the time. Patients with inflammatory bowel disease, abdominal/anorectal surgery or history of radiotherapy were excluded.

Twenty-six patients were evaluated in a remedial hospital using a portable water-perfused manometer and the other 21 patients were selected from an educational center and were evaluated with a solid-state manometer.

For the patients who did not accept to undergo follow up manometric examination, questionnaire was completed via a phone call.

Statistical analysis: Data are presented as mean (SD) for continuous variables and count (percentage) for categorical variables. The chi-square test for testing the significance of difference of proportions and two-tailed independent sample T-test and one-way analysis of variance (ANOVA) for testing the significance of the difference of means were used. Correlation of anorectal pressures with age, BMI and number of deliveries was calculated using Pearson's correlation equations. Statistical significance was accepted at p value < 0.05. Statistical analysis was done by SPSS® for windows version 16.

RESULTS

Forty-seven subjects were included in the study with the mean age of 48.47 (7.70) years and mean body mass index

Table 1. History of defecation disorders in the 47 patients.

	(n = 47)
Painful defecation	18 (39.1%)
Gas incontinence	10 (21.7%)
Watery stool incontinence	8 (17%)
Digital assistance during defecation	12 (25.5%)
Urgency for defecation	20 (42.6%)
Leakage of stool	6 (12.8%)
Constipation	7 (14.9%)

Table 2. Results of anorectal manometry.

	(n = 47)
Rest profile:	
Anal sphincter length	4.29 (0.58)
Distance from Verge to Maximum pressure (cm)	2.14 (0.72)
Pressure over high pressure zone (mmHg)	15.8723 (8.37)
Maximum Pressure (mmHg)	86.68 (43.00)
Peak Pressure (mmHg)	43.84 (18.13)
Asymmetry	23.73 (15.83)
Squeeze profile:	
Distance from Verge to Maximum pressure (cm)	2.65 (2.59)
Maximum pressure (mmHg)	114.54 (60.05)
Average peak pressure (mmHg)	65.65 (33.69)
Asymmetry	29.34 (29.34)

(BMI) of 30.07 (6.45) kg/m^2. Most subjects were housekeepers (87.2%) and mostly (73.9%) undergraduate. Mean parity number was 3.51 (1.82), with mean 3.30 (1.88) normal deliveries and mean 0.21 (0.46) number of cesarean sections. No patient suffered constipation.

As shown in Table 1, our subjects did not frequently have defecation problems and results of baseline manometric study were in coordination with the clinical feature (Table 2). In the current study, increased number of parities, type of delivery (vaginal or caesarian section), BMI and age were not significantly correlated with manometry values ($p > 0.05$).

At follow up, all patients were well and none of them had any defecation disorder or complication or any changes in comparison to the preoperative condition, so only 3 of them accepted to undergo follow up manometry (postoperative) whose manometric results had also no change ($p > 0.05$).

DISCUSSION AND CONCLUSIONS

This study was designed to evaluate the effect of subtotal abdominal hysterectomy on anorectal function. Patients were studied before by a questionnaire and anorectal manometry and were followed 6 months later. At follow up, questionnaire was completed on a phone call and all patients were asked to come for manometric examination. None of the patient had any new defecation problem or any changes in anorectal function, so most of them refused to undergo follow up anorectal manometry.

In contrast to previous studies which reported adverse effects of total abdominal hysterectomy on anorectal function [8, 12] and quality of life,[13] our subjects who were awaiting hysterectomy had no physiological and manometric abnormalities on behalf of pelvic floor disorder.

Although bowel complaints are common after radical hysterectomy, the effects of this surgery are pooly understood on anorectal function[11] and some studies suggested a possible link between fecal incontinence and abdominal hysterectomy.[10] The present study detected no defecation disorder or manometric abnormality associated with subtotal abdominal hysterectomy, so this study also suggests that this operation is an appropriate alternative to total abdominal hysterectomy which can cause more complications.[8-11, 14] Also in this study no difference was present between subjects according to the type and number of previous deliveries, which shows Hat vaginal deliveries or caesarian sections have had no effect on anorectal function in this group of women.

As the population in the present research was a sample of healthy women with no underlying defecation disorders, the manometric results can be mentioned as baseline manometric values in our sommunity.

The study had some limitations such as the difference of manometer in two hospitals. Although the exam was prformed by the same professional colorectal surgeon in both hospitals and according to the other studies with portable manometer, this factor should have caused no bias in the current evaluation. Another problem was that most of our patients refused to undergo postoperative manometry, and we could not force them to do it regarding ethical points.

The same as the review study,[15] this research also recommends randomized controlled trials to evaluate the effects of hysterectomy on pelvic floor function.

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DISCLOSURE STATEMENTS

The Authors declare that there was no conflict of interest, informed patient consent was obtained, and the study was approved by the local ethical committee

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