Slings and meshes in the therapy of prolapse and urinary incontinence: Efficacy and side-effects

Extraction of the

Ph.D. Thesis

Zoltan Fekete, M.D.

University of Szeged
Faculty of General Medicine
Department of Obstetrics and Gynaecology

Supervisors:
Gábor Németh, M.D., Ph.D., Med. Habil.
University of Szeged
Faculty of General Medicine
Department of Obstetrics and Gynaecology
Zoltán Bajory, M.D., D.Sc.
University of Szeged
Faculty of General Medicine
Department of Urology

Director of Doctoral School of Clinical Medicine:
Lajos Kemény, M.D., D.Sc.
Director of Reproductive Health Programme:
György Bártfai, M.D., D.Sc.

University of Szeged
Faculty of General Medicine
Department of Obstetrics and Gynaecology
Albert Szent-Györgyi Medical Centre
Szeged, 2018

1. INTRODUCTION

The rapid development of technology and progress in the medical sciences have resulted in an amazing extension of life expectancy at the time of birth, so an aging population has presented the healthcare system with new challenges. Two main urogynaecological symptoms, such as stress urinary incontinence (SUI) and pelvic organ prolapse (POP), have been prevalent lately, and the cumulative risk of surgery for POP or SUI by the age of 80 years has been estimated at 11.1% [1].

1.1. Complications of urogynaecological operations

The potential complications of using transvaginal mesh are wide-ranging, from mild to seriously life-threatening. The most common complications, as reported in the US Food and Drug Administration (FDA) Public Health Notification, include mesh erosion at the site of vaginal incision, lower urinary tract infection, pelvic pain, dysuria, recurrence of prolapse or incontinence, de novo UUI, de novo SUI dyspareunia, and perforation of the bowel, and/or vessels during mesh insertion [2,3].

1. AIMS OF THE THESIS

- The aims of our series were to ascertain the feasibility of vaginal prosthesis operations following the FDA warnings.
- We examined an "oldy but goody" method for the of some of the most serious mesh-related complications, including VVF.
- We investigated the long-term utility of a newly developed anterior vaginal mesh method for the correction of POP–Q Stage 2–4 anterior vaginal prolapse.
- We designed a prospective randomized study for evaluating the effectiveness of an alternative operative method for reconstructing POP–Q 2–3 concomitant with genuine SUI.

2. HYPOTHESIS

Several incongruities can be found in the available literature on the effectiveness and side-effects of vaginal prosthesis operations. Therefore, a retrospective study was organized to ascertain the feasibility of vaginal prosthesis operations in our practice following the FDA warnings. We hypothesised that the long-term success rates for TVM operations on POP and SUI reconstruction with an acceptable frequency of side-effects are better than those found in the literature.

Vesicovaginal fistula (VVF) formation is an extremely rare but embarrassing complication of mesh methods [4,5]. A prospective short series study was organized to evaluate the utility of the Lehoczky's island flap [6] method in reconstructing the mesh-related bladder perforation and VVF. We assumed that the Lehoczky's island flap method is highly effective in reconstructing prosthesis-formed fistulas.

Mesh extrusions, dyspareunia or vaginal discharges are more frequent issues after vaginal prosthesis operations. Reviewing the literature, we have provided good evidence that the folding and contraction of the implanted meshes may cause pain, dyspareunia and the extrusion of the implants [7,8,]. For this purpose, a new concept involving an anchorless implant was developed.

We have hypothesised that our new anchoring technique and non-folding meshes result in better long-term results than other vaginal prosthesis methods.

The anti-SUI efficacy of the prosthetic placement is barely 72–83% [9-11]. Our previous study, where the anterior arms of the TVM were anchored by two stitches, resulted in greater anti-SUI efficacy (90%). We hypothesise that the original TVM operation may be followed by residual SUI since the strengthening of the back arms may result in a backward dislocation of the entire mesh.

3. MATERIALS AND METHODS

3.1. The experimental protocol in Study 1

In Study 1 we evaluated and compared the anti-POP effect, anti-stress incontinence (anti-SUI) efficacy, and the early (six weeks) and late (36 months) postoperative complication rates for the anterior vaginoplasty and the transvaginal mesh (TVM) operations.

3.1.1. Material and methods

The retrospective cohort study comprised 120 women who presented for the correction of SUI in conjunction with symptomatic anterior compartment POP–Q 2–3 at the Departments of Urology and Obstetrics and Gynaecology at the University of Szeged, Hungary, between January 2013 and January 2014. Sixty patients had undergone Kelly–Stoeckel vaginoplasty and the other 60 cases had had TVM surgery. Both study groups were homogenized as much as possible according to age, parity, body mass index (BMI) and menopausal status. The symptomatic POP–Q Stage 2–3 anterior prolapse is defined as the maximum extent of the prolapsed anterior vaginal wall being within 1 cm above and 6 cm below the hymen [12,13]. Coexisting symptomatic SUI was determined with pad or cough tests.

3.1.2. Exclusion criteria

The exclusion criteria were as follows: a history of mesh use or anti-incontinence pelvic procedures, antidepressant therapy, pregnancy and cancer of the pelvic organs.

3.1.3. Efficacy criteria

The efficacy of the POP repair was taken as a significant (>1 cm) improvement at points Aa, Ba and C and total vaginal length (TVL) according to the POP–Q system (International Continence Society) during the follow-up [12,13]. Anti-incontinence efficacy was classified as no further SUI diagnosed by cough or pad test.

Early surgical complications were classified using the Clavien–Dindo (CD) classification system [14]. As concerns the long-term postoperative complications of the sling and mesh procedures, we determined the rejection rate, the presence of DNUS or urinary tract infection (UTI) and the need for reoperation.

3.1.4. The operative method used

All prosthesis operations were carried out with 100% polypropylene monofilament permanent meshes produced by Aspide® SURGIMESH® PROLAPSE (Aspide Médical, La Talaudière, France). The implanted vaginal prosthesis has pores which are 1.6 x 1.7 mm in size and is approved for anterior vaginal repair.

Traditional anterior colporrhaphy was augmented with Kelly's plication [15] in order to thicken the cervicopubic fascia which promotes the appropriate elevation of the bladder neck and closure of the urethra, enhancing the anti-incontinence effect.

3.1.5. Statistical analyses

The SPSS 17.0 program package was used to analyse the data. The non-parametric design of the continuous variables was verified with the Shapiro–Wilk test. Categorical and continuous variables were compared with the χ^2 test and Kruskal–Wallis test, respectively.

3.2. The experimental protocol in Study 2

A prospective short series study was organized to evaluate the utility of the Lehoczky's island flap method for reconstructing the mesh-related bladder perforation.

3.2.1. Material and methods

Women (mean age 62, n=3) with clear stress urinary incontinence underwent a TOT procedure using monofilament polypropylene tapes (Surgimesh sling 45x1cm VS112-KY, Aspide Médical, La Talaudière, France) at different hospitals who had urine leakage postoperatively and the postoperative examinations verified vesico-vaginal fistulas.

The flap closing method was effective if the patients involved at the three-month final follow-up self-reported no urine leakage and if all of them were free of fistulas, without any complaint of dyspareunia.

3.2.2. The operative method used

The vagina was exposed with a deep episiotomy, and the vaginal part of the fistula and the wide inflamed area were then excised. The opening of the fistula in the bladder was closed with absorbable interrupted sutures. The vaginal wall defects were covered with Lehoczky's skin flaps. The oval-shaped fatty-skin flaps were dissected from the area of the *genitofemoral* sulcus in all cases with a diameter of 3–4 cm on the same side as the fistula was located. The island flap was pulled into the vagina through a tunnel under the *bulbocavernous* muscle. The fatty part of the flap was situated between the vagina and the bladder, while the skin covered the vaginal defect as a patch and its edges were sutured to the wall of the vagina. The donor site of the flap was closed with interrupted sutures. The final follow-up was three months, when a cystoscopy and a bimanual examination were performed.

4

3.3. The experimental protocol in Study 3

The available international literature provides good evidence that the anchoring techniques used in the placement of vaginal implants are a major factor in the occurrence of complications: organ perforation involved in the anchoring technique, unbalanced scar formation at the anchoring points, tension, folding and contraction that can cause pain and/or dyspareunia [33, 34]. For this purpose, a new concept involving an anchorless implant was developed. The assumption was that an anchorless neo-pubocervical fascia would accurately mimic the physiological support system, therefore providing adequate support.

3.3.1. Materials and methods

A prospective, multi-centre, international study was organized to evaluate the feasibility, safety and cure rate for POP surgery using the SRS implant. The patients involved (n=20) with at least POP–Q Stage 2 anterior compartment prolapse were recruited from the gynaecological clinics in each participating hospital (Ma'ayanei HaYeshua Hospital, Bnei Brak, Israel; Catholic University Gemelli Hospital, Rome, Italy; University of Szeged, Szeged, Hungary).

Exclusion criteria included: previous POP repair with mesh, age > 75 years, old POP–Q less than Stage 2 or asymptomatic POP.

Objective anatomical success was defined as POP–Q Stage 0 and 1 prolapse using the NIH criteria [40]. The Pelvic floor disability index (PFDI-20) is divided into three domains: Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6), Colorectal Anal Distress (CRAD-8) and Urinary Distress Inventory (UDI-8). Patients were followed at two weeks and two, six, twelve and 24 months after surgery. Objective and subjective primary end points were defined at 24 months.

3.3.2. The invented device

The device is composed of an ultra-light titanized polypropylene mesh ($16 \ g/m^2$) stretched and held in place by a U-shaped flexible frame made of a biocompatible implantable polymer (Figure 9). The SRS lateral arms have been designed to mimic the shape of the ATFP. The frame is composed of a solid but flexible material.

3.3.3. The surgical technique

The surgical technique involves performing an incision on the anterior vaginal wall and a central dissection of the bladder from the vagina. Dissection is then extended to the para-vesical space for direct bilateral palpation of the ischial spines. The implant is positioned in place with no tension, with the arms not flexed and the mesh fully stretched. The device is inserted between the bladder and the vaginal mucosa with the lateral arms following the anatomy of the ATFP. The connecting bridge is positioned under the pubic symphysis. No other anchoring techniques are used. The vaginal incision is closed with no tension.

3.3.4. Statistical analysis

Statistical analysis involved the Analysis of Variance (ANOVA) test, where the null hypothesis is that all subgroup means are equal. The results from the two-way ANOVA on changes in points Aa, Ba and C by subject and visit were analysed, looking at the p-values of the

term visit in the model to evaluate statistical significance. Pre- and post-surgery POP–Q measurements were calculated using a non-parametric Wilcoxon signed ranks test.

3.4. The experimental protocol in Study 4

Although the rate for concomitant SUI in patients with POP is as high as 63–80% [16], the effective treatment for coexisting SUI and POP is still debated. The anti-SUI efficacy of the prosthetic placement is barely 72–83% [34-36]; however, it is assumed that a combination of a synthetic mesh with the sling operation [26,27,41] will substantially increase the cure rate for concomitant SUI.

Therefore, the research group developed a modification to the transobturator four-arm TVM to increase its anti-incontinence effect. In the original TVM, the posterior part of the mesh is anchored to the anterior aspect of the cervix and the anterior arms are spread under the bladder neck with stabilizing sutures. We hypothesise that the original TVM operation can be followed by residual SUI since the strengthening of the back arms may result in a backward dislocation of the entire mesh. The posterior movement of the mesh allows the dorsal rotation of the urethra since the mid-urethra is not suspended. The proposed modification to the original surgical procedure includes the suture of the anterior part of the mesh to the mid-urethra to prevent the mesh sliding.

3.4.1. Material and methods

We designed a single-centre, prospective, double-blind (participant, investigator/surgeon, outcome assessor), randomized, controlled trial to evaluate the anti-SUI success rate for the modified TVM. The study is being conducted in accordance with the Declaration of Helsinki and has been approved by the local medical ethics committee at the University of Szeged under reference number 55/2016.

Patients will be recruited from the urogynaecology consultation at the Division of Urogynaecology, Department of Obstetrics and Gynaecology, University of Szeged, Hungary. All study participants will be provided an information sheet and a consent form describing the study in brief, so they can decide whether to participate in the study. This longitudinal study involving patients all successively scheduled for surgery for symptomatic prolapse POP–Q Grade 2 or 3 and coexisting SUI. The study will be conducted for an estimated maximum of 18 months.

The symptomatic POP–Q Stage 2–3 (determined by the gynaecological examination using the International Continence Society quantification system) [18] anterior vaginal wall prolapse is defined as the maximum extent of the prolapsed anterior and middle compartments being within 1 cm above and 6 cm below the hymen [20,38].

In all cases, SUI will be visualized after a complete physical examination is performed (confirmed by pad test/Bonney test/two dimensional (2-D) introital sonography and urodynamic examination).

3.4.2. Inclusion criteria

Female adults aged over 40 with coexisting pelvic floor defects will be recruited, at least one year following delivery, irrespective of parity and pre- or postmenopausal state, medically and physically fit for the measurement and therapeutic surgeries, and, in the case of systemic or local oestrogen treatment, stable for the past three months prior to inclusion. The patients will be randomized to one of the study groups using a computer-generated list.

3.4.3. Exclusion criteria

Exclusion criteria are urge; mixed incontinence; prolapse < Grade 2 or > Grade 3 POP–Q; apical or posterior compartment prolapse; dysuria (bladder tumour and/or neurogenic urinary bladder damage); a history of mesh use or anti-incontinence pelvic procedures; pregnancy (urine test); lactation period not yet finished; current urinary tract or vaginal infection; menstruation on the day of examination; contraindications for measurements or interventions, for example, acute inflammatory or infectious disease, tumour or fracture; de novo systemic or local oestrogen treatment (<3 months); de novo drug treatment with anticholinergics or other active substances for bladder-related disorders (tricyclic antidepressants and selective serotonin reuptake inhibitors); and cancer of the pelvic organs.

3.4.4. Operative method

All operations will be carried out using 100% polypropylene monofilament meshes produced by Aspide® SURGIMESH® PROLAPSE (Aspide Médical, La Talaudière, France). The anterior vaginal wall will be incised longitudinally throughout its thickness from the 1.5 cm below the urethral meatus (where the mid-urethra is located) to the cervix. The thickness of the dissection, the location of the vaginal incision, the placement of the mesh and the closure of the incision will vary only minimally, and the length of the incision is intended to be 6–7 cm. All the operations will be performed by two experienced senior surgeons who are subspecialists in urogynaecology. The posterior part of the mesh will be anchored to the anterior side of the cervix using two Prolene® 2-0 sutures (Ethicon, Issy-les-Moulineaux, France).

The mesh will then be spread by securing its anterior parts beneath the mid-urethra using two Vicryl 2-0® absorbable sutures (Ethicon, Issy-les-Moulineaux, France)

A urinary catheter will be removed on the morning of the postoperative day. A vaginal gauze pack (gauze soaked in Betadine iodine) will be placed for 12h.

3.4.5. Efficacy criteria

The follow-up period of the study will be 36 months. The primary outcome measures will be a significant improvement in POP repair and objective cure of SUI following surgery. The efficacy of POP repair will be understood as a significant (>3 cm) improvement during follow-up at points Aa, Ba, C and D using the POP–Q system (International Continence Society) [20,38]. Anti-incontinence efficacy is classified as no further SUI, as diagnosed by cough tests and urodynamic examinations. The secondary measurement outcome will comprise the intraoperative findings and postoperative factors. As concerns the long-term postoperative complications of the mesh procedures, we will determine the extrusion rate, the presence of DNUS or UTI, and the need for reoperation.

The subjective cure for prolapse and incontinence will be measured with a significant enhancement of the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) and PFDI-20 scores. The PISQ-12 and PFDI-20 have been validated to assess the impact of SUI symptoms on quality of life and sexuality and relate well to the prolapse symptoms.

3.4.6. Data collection

Baseline (before the intervention phase) and follow-up measurements (of primary, secondary and tertiary outcomes) after six weeks to three years will be performed at the Division of Urogynaecology, Department of Obstetrics and Gynaecology, University of Szeged, Hungary, by experienced urogynaecologists, who will be blinded to group allocation of participants and who will not operate on the patients

3.4.7. Statistical analyses

All statistical analyses will be conducted using SPSS software version 22 (IBM, Armonk, NY, USA). All tests will be two-sided, and significance will be set at $p<0.05$. Efficacy measurements will be adjusted by intention-to-treat analysis. Missing values will be replaced using the last observation carried forward (LOCF) method. No subgroup analyses are planned. Standard deviations, 95% confidence intervals and median will be used for the descriptive analyses. Regarding the primary and secondary outcome analysis, the Chi-square test or Fisher's exact test will be employed to identify any objective outcome differences among groups.

4. RESULTS

4.1. Comparison of the effectiveness of vaginal prosthesis and colporrhaphy operations

The main results of our study were the following. The TVM significantly improved the prolapse status (POP–Q of Aa ($p<0.001$), Ba ($p<0.001$) and C ($p<0.001$)) compared to that of anterior colporrhaphy, while the total vaginal length was significantly shortened ($p<0.001$)

The recurrence of anterior compartment POP (36.5%, $p<0.001$) and SUI (45%, $p<0.001$) or reoperation due to recurrence of SUI (8.3%, $p=0.007$) and POP (26.7%, $p<0.001$) during the 36-month follow-up period was typical of the anterior *colporrhaphy* patients. Prolapse repair was achieved in a significantly higher proportion of the patients who underwent TVM compared to their anterior *colporrhaphy* counterparts (91.7% vs 63.3%, $p<0.001$). Urinary tract infection was not more prevalent after the prosthesis operations than after anterior colporrhaphy. DNUS was found not significantly more often in the prosthesis than in the *colporrhaphy* group ($p=0.006$). The extrusion rate was 8.33% in the TVM group. The overall reoperation rate was remarkably lower in the TVM group than in the colporrhaphy group (16.7% vs. 35%).

The operation took longer in the TVM group as compared with the anterior *colporrhaphy* ($p=0.02$). The estimated blood loss (83.1ml vs 75.3ml) during the operation and the number of early reoperations were approximately the same in both groups ($p=0.71$, $p=0.31$ and $p=0.75$). The occurrence of bladder injury and the need for immediate postoperative blood transfusion were negligible in both the study groups.

Total complication rates of 33.3% in the TVM group and 25% in the colporrhaphy group were noted with non-significant differences (p=0.4). CD 1 complications predominantly occurred in the group of women operated on with prostheses, while anterior colporrhaphy operations were followed mostly by CD 2 .

4.2. Effectiveness of Lehoczky's island flap method in reconstructing the mesh-related bladder perforation

Among the operated patients at the third week of follow-up, no vesicovaginal fistulas were found by cystoscopy, and bimanual examinations demonstrated that Lehoczky's island flap healed *per primam* in our short-term series involving Lehoczky's island flap.

At the three-month final follow-up, patients self-reported no urine leakage, and all of them were free of fistulas and *dyspareunia*.

4.3. Feasibility of the Self-Retaining Support Implant in the POP–Q Stage 2–4 reconstruction

Twenty women were recruited for the SRS study. The mean age of the patients enrolled was 61.9 years, and the mean number for previous parity was four. The participants were slightly overweight (BMI: 28.13), and the vast majority of them had no anamnestic hysterectomy or *prolapse surgery.* Preoperative mean POP–Q measurements were Aa=1.40 (-1 to 3) cm, Ba=2.3 (-1 to 6) cm and C=0.4 (-7 to 6) cm. Nineteen (95%) patients suffered from both an anterior and an apical compartment prolapse, while one (5%) patient only had an anterior prolapse.

The anatomical outcome at the two-year follow-up. Seventeen (84.2%) patients had a Stage 0 prolapse, and three patients (15.8%) had a Stage 1 prolapse. At the 24-month follow-up, significant anatomical changes were found at points Aa (1.4 to -2.9cm), Ba (2.3 to -2.8cm) and C (0.4 to -7cm). No cases of mesh erosion or chronic pelvic pain were documented at follow-up .

Surgical time for the SRS implantation averaged 31.2 (21–50) min. Estimated total surgical blood loss averaged 205 (150–500) ml. Estimated blood loss for patients who underwent the implant-only procedure averaged 165 ml. No intra-operative complications were observed.

As for the subjective outcome, PFDI-20 scores showed significant improvement of both prolapse and urinary domains as well as improvement in total scores. No deterioration was noted in the colorectal or the incontinence domains of the questionnaire.

Considering a standard MID of 15 points per domain and 45 points in total PFDI scores, results showed a significant improvement in the prolapse domain, incontinence domain and total PFDI-20 scores. Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6) (POP domain) showed a decrease of 41.94 points (p<0.0001) at follow-up from baseline scores. The Colorectal-Anal Distress Inventory 8 (CRADI-8, posterior compartment domain) scores were 14.5 points (p=0.0016) lower at follow-up than baseline and demonstrated no deterioration at the posterior pelvic compartment. Urinary Distress Inventory 6 (UDI-6, urinary incontinence domain) showed a decrease of 36.3 points (p=0.0167). The total PFDI score was decreased by 92.75 points (p=0.0001).

Postoperatively, one patient received one unit of packed cells and no events of urinary retention were recorded. One patient developed de novo stress urinary incontinence, which was treated successfully with pelvic floor muscle training. One case (5%) of frame erosion into the anterior vaginal wall was documented eight months following the procedure. The eroded part of the frame was resected under local anaesthesia in an ambulatory setting. The patient's symptoms were relieved immediately after the resection. This was the only case where a large frame was used, which we hypothesise to have caused excessive pressure on the vaginal mucosa, causing the erosion.

5.   CONCLUSION

1.   We found that the TVM operation is a highly effective method for the reconstruction of POP (91.3%) and a significantly higher proportion of the patients who underwent TVM experienced remarkable improvement in the POP–Q system compared to anterior colporrhaphy. Surprisingly, an extremely high success rate for SUI reconstruction (90%) was observed among patients who underwent mesh surgery.

2.   The overall reoperation rate, including the extrusion rate, was remarkably lower in the prosthesis group than in the colporrhaphy group (16.7% vs 35%).

3.   An ongoing prospective randomized double-blind study was designed to better evaluate the anti-incontinence effect of the original TVM method. We believe that the modification of the original TVM method with two suburethral anchoring sutures will lead to further improvement in the anti-SUI effect of mesh operations, a fact which is also examined in our prospective study.

4.   The rate for bladder perforation rate and consecutive vesicovaginal fistulas after mesh surgery is low, but the successful reconstruction of VVFs poses challenges for surgeons. The use of Lehoczky's island flap may be a good option for the repair of large vaginal defects caused by implants.

5.   The most common serious complication of prosthesis operations is mesh extrusion at a rate of 10.3%. Current operative techniques do not assure that the mesh is placed in a flat, non-folded, tension-free fashion, thus potentially leading to the extrusion of the implant. The SRS solid frame precludes mesh contraction and bunching and seems to have significantly better postoperative results with no mesh erosion, dyspareunia or UTI.

6. REFERENCES

1. Olsen A, Smith V, Bergstrom J, Colling J, Clark A. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence. Obstet Gynecol 1997;89:501–6.

2. Molander U., Milsom I., Ekelund P., Mellström D. An epidemiological study of urinary incontinence and related urogenital symptoms in elderly women. Maturitas, (1990); 12: 51-60

3. Rudnicki M, Laurikainen E, Pogosean R, Kinne I, Jakobsson U, Teleman P. (2016) A 3-year follow-up after anterior colporrhaphy compared with collagen-coated transvaginal mesh for anterior vaginal wall prolapse: a randomised controlled trial. BJOG. 123(1):136-42.

4. Sohbati S, Salari Z, Eftekhari N. (2015) Comparison between the transobturator tape procedure and anterior colporrhaphy with the Kelly's plication in the treatment of stress urinary incontinence: a randomized clinical trial Nephro Urol Mon. 7(5): e32046.

5. Maher C, Feiner B, Baessler K, Christmann-Schmid C, Haya N, Marjoribanks J. Transvaginalmesh or grafts compared with native tissue repair for vaginal prolapse. Cochrane Database of Systematic Reviews 2016, Issue 2. Art. No.: CD012079. DOI: 10.1002/14651858.CD012079.

6. US Food and Drug Administration. UPDATE on Serious Complications Associated with Transvaginal Placement of Surgical Mesh for Pelvic Organ Prolapse: FDA Safety Communication.   July   13,   2011 https://www.fda.gov/medicaldevices/safety/alertsandnotices/ucm262435.htm

7. Jasaits Y, Sergent F, Tanneau Y, Marpeau L. Vesicovaginal fistula after transobturator

tape. Prog Urol 2007; 17:253–5.

8. Yamada BS, Govier FE, Stefanovic KB, Kobashi KC. Vesicovaginal fistula and mesh erosion after Perigee (transobturator polypropylene mesh anterior repair). Urology 2006; 68:1121.e5–1121.e7.

9. Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society.Neurourology and Urodynamics (2002); 21(2):167–178.

10. Hannestad YS, Rortveit G, Sandvik H, Hunskaar S. A community-based epidemiological survey of female urinary incontinence: the Norwegian EPINCONT Journal of Clinical Epidemiology (2000) ;53(11):1150–1157.

11. DeLancey JO. Anatomy of the female bladder and urethra. (1991) In Ostergrad Dr, Bent AE, eds. Urogynecology and Urodynamics, 3rg ed. Williams &Wilkins, Baltimore.

12. DeLancey JO. Structural support of the urethra as it relates to stress urinary incontinence: the hammock hypothesis. Am J Obstet Gynecol (1994); 170:1713

13. Bergman A, Elia G. Three surgical procedures for genuine stress incontinence: five-year follow-up of a prospective randomized study. Am J Obstet Gynecol. (1995); 173(1):66-71.

14. Aldridge AH. Transplantation of fascia relief of urinary stress incontinence. Am. J. Obstet Gynecol (1942); 44:398.

15. Richardson D. A. Preliminary report: Modification of the needle urethropexy in the management of stress incontinence. Int Urogynecol J (1991) 2: 123.

16. Ulmsten U, Petros P. Intravaginal slingplasty (IVS): An ambulatory surgical procedure for the treatment of female urinary incontinence. Scand J Urol Nephrol (1995); 29:75–82.

17. Delorme E, Droupy S, de Tayrac R, Delmas V. Transobturator tape (Uratape): a new minimally invasive procedure to treat female urinary incontinence. Eur Urol 2004;45:203–207

18. Boyles SH, Weber AM, Meyn L. Procedures for pelvic organ prolapse in the United States, 1979-1997 Am. J of Obstetrics and Gynecology (2003);188: 108–115.

19. DeLancey JO. Standing anatomy of the pelvic floor. J Pelvic Surg. (1996); 2:260.

20. Bump RC, Mattiasson A, Bø K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. Am J Obstet Gynecol. 1996;175:10-7.

21. Baden WF, Walker T, Lindsay JH. The vaginal profile. Tex med 1968;64:56.

22. Persu C, Chapple CR, Cauni V, Gutue S, Geavlete P. Pelvic Organ Prolapse Quantification System (POP–Q) – a new era in pelvic prolapse staging. J Med Life. 2011;4(1):75–81

23. Letouzey V, Deffieux X, Gervaise A, Mercier G, Fernandez H, de Tayrac R. Trans-vaginal cystocele repair using a tension-free polypropylene mesh: more than 5 years of follow-up. Eur J Obstet Gynecol Reprod Biol. 2010;151(1):101–5.

24. Hiltunen R, Nieminen K, Takala T, Heiskanen E, Merikari M, Niemi K, Heinonen PK. Low-weight polypropylene mesh for anterior vaginal wall prolapse: a randomized controlled trial. Obstet Gynecol. 2007; 110(2):455–62.

25. Sergent F, Resch B, Diguet A, Verspyck E, Marpeau L. Vaginal prolapse and stress urinary incontinence: combined treatment by a single prosthesis. Prog Urol. 2006;16 (5):361–7.

26. Hannestad YS, Rortveit G, Sandvik H, Hunskaar S. A community-based epidemiological survey of female urinary incontinence: The Norwegian EPINCONT. J Clin Epid. 2000;53(11):1150–7.

27. Abbott S, Unger CA, Evans JM, Jallad K, Mishra K, Karram MM, Iglesia CB, Rardin CR, Barber MD. Evaluation and management of complications from synthetic mesh after pelvic reconstructive surgery: a multicenter study. Am J Obstet Gynecol. 2014;210 (2):163.e1–8.

28. Yonguc T, Bozkurt IH, Sen V, Aydogdu O, Yonguc GN, Gunlusoy B. Double-sling procedure for the surgical management of stress urinary incontinence with concomitant anterior vaginal wall prolapse. Int Urol Nephrol. 2015;47(10):1611–7.

29. van der Ploeg JM, Oude Rengerink K, van der Steen A, van Leeuwen JH, Stekelenburg J, Bongers MY, Weemhoff M, Mol BW, van der Vaart CH, Roovers JP. Transvaginal prolapse repair with or without the addition of a midurethral sling in women with genital prolapse and stress urinary incontinence: a randomised trial. BJOG. 2015;122(7):1022–30.

30. Minaglia S, Ozel B, Klutke C, Ballard C, Klutke J. Bladder injury during transobturator sling. Urology 2004; 64:376–7.

31. Smith PP, Appell RA. Transobturator tape, bladder perforation, and paravaginal defect: a case report. Int Urogynecol J Pelvic Floor Dysfunct 2007; 18:99–101.

32. Jasaits Y, Sergent F, Tanneau Y, Marpeau L. Vesicovaginal fistula after transobturator tape. Prog Urol 2007; 17:253–5.

33. Yamada BS, Govier FE, Stefanovic KB, Kobashi KC. Vesicovaginal fistula and mesh erosion after Perigee (transobturator polypropylene mesh anterior repair). Urology 2006; 68:1121.e5–1121.e7.

34. Lehoczky G. Neue Fisteloperation. Wiss Z Humbold-Univ Berl 1963;12: 171–2.

35. Feiner B, Maher C. Vaginal mesh contraction: definition, clinicalpresentation, and management. Obstet Gynecol. 2010;115(2 Pt 1):325–30.

36. Margulies RU, Lewicky-Gaupp C, Fenner DE, McGuire EJ, Clemens JQ, Delancey JO. Complications requiring reoperation following vaginal mesh kit procedures for prolapse. Am J Obstet Gynecol. 2008;199(6): 678.e1–4.

37. Serati M, Sorice P, Bogani G, Braga A, Cantaluppi S, Uccella S, Caccia G, Salvatore S, Ghezzi F. TVT for the treatment of urodynamic stress incontinence: efficacy and adverse effects at 13-year follow-up. Neurourol Urodyn. 2015;36:192-7.

38. Nauth MA, Fünfgeld C. Correction of cystocele and stress incontinence with anterior trans obturator mesh. Eur J Obstet Gynecol Reprod Biol. 2007;136:249–53.

39. Sergent F, Sentilhes L, Resch B, Verspyck E, Medeiros R, Descamps P, Marpeau L. Treatment of concomitant prolapse and stress urinary incontinence via a transobturator subvesical mesh without independent suburethral tape. Acta Obstet Gynecol Scand. 2010;89:223–9.

40. Reid F. Assessment of pelvic organ prolapse: a practical guide to the pelvic organ prolapse quantification. Obstet Gynaecol Reprod Med. 2014;24(6):170–6.

41. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004;240(2):205–13.

42. Matthew D. Barber, MD, MHS, Linda Brubaker, MD, MS, Ingrid Nygaard, MD, Thomas L. Wheeler, II, MD, MSPH, Joeseph Schaffer, MD,Zhen Chen, MS, and Cathie Spino, DSc, for the Pelvic Floor Disorders Network. Defining Success After Surgery for Pelvic Organ Prolapse Obstet Gynecol. 2009;114(3): 600–609.

43. Takahashi S, Obinata D, Sakuma T, Matsui T, Takenobu Y, Igarashi T, Yoshizawa T, Sato K, Mochida J, Sugimoto S. Transvaginal mesh (TVM) reconstruction with TVT/TOT sling

for vaginal prolapse concurrent with stressurinary incontinence. Aktuelle Urol. 2010;41 Suppl 1:S20-3.

44. Urinary Incontinence EBU Guideline 2016 November. http://uroweb.org/guideline/urinary-incontinence/

45. Urinary incontinence in women: management 2015 NICE guidelines [CG171] https://www.nice.org.uk/guidance/cg171

46. Ingelman-Sundberg A. Urinary incontinence in women, excluding fistulas. Acta Obstet Gynecol Scand. 1952;31:266-91.

47. Majoros A, Hamvas A, Keszthelyi A, Romics I. Value of testing the abdominal leak point pressure in the differential diagnosis of urinary stress incontinence. Orv. Hetilap 2003;144:2321−5 [Article in Hungarian].

48. Tunn R, Petri E. Introital and transvaginal ultrasound as the main tool in the assessment of urogenital and pelvic floor dysfunction: an imaging panel and practical approach, Ultrasound Obstet Gynecol. 2003;22:205−13.

49. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39:175−91.

50. Moher D, Hopewell S, Schulz KF, Montori V, Gotzsche PC, Devereaux PJ, et al.i CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. BMJ 2010;340:c869.

51. Altman D, Väyrynen T, Engh ME, Axelsen S, Falconer C. Nordic Transvaginal Mesh Group. Anterior colporrhaphy versus transvaginal mesh for pelvic-organ prolapse. N Engl J Med. 2011;364(19):1826−36.

52. Cervigni M, Natale F, La Penna C, Panei M, Mako A. Transvaginal cystocele repair with polypropylene mesh using a tension-free technique. Int Urogynecol J Pelvic Floor Dysfunct. 2008;19(4):489–96.

53. Dwyer PL, O'Reilly BA. Transvaginal repair of anterior and posterior compartment prolapse with Atrium polypropylene mesh. BJOG. 2004; 111(8):831–6.

54. Giberti C, Gallo F, Cortese P, Schenone M. Transobturator tape for treatment of female stress urinary incontinence: objective and subjective results after a mean follow-up of two years. Urology 2007; 69(4):703–7.

55. Maher C. Anterior vaginal compartment surgery. Int Urogynecol. J 2013; 24:1791–1802.

56. Kapur K, Dalal V. Mesh repair of vaginal wall prolapse. Med J Armed Forces India. 2014;70(2):105–110.

57. Jasaits Y, Sergent F, Tanneau Y, Marpeau L. Vesicovaginal fistula after transobturator tape. Prog Urol 2007; 17:253–5.

58. Yamada BS, Govier FE, Stefanovic KB, Kobashi KC. Vesicovaginal fistula and mesh erosion after Perigee (transobturator polypropylene mesh anterior repair). Urology 2006; 68:1121.e5–1121.e7.

59. Starkman JS, Meints L, Scarpero HM, Dmochowski RR. Vesicovaginal fistula following a transobturator midurethral sling procedure. Int Urogynecol J Pelvic Floor Dysfunct 2007; 18:113–5.

60. Kelemen Z, Lehoczky G. Repair of fistulas in the vesicovaginal area by forming a urinary reservoir. Eur Urol 1986; 12:398–9.

61. Abed H. Rahn DD, Lowenstein L, Balk EM, Clemons JL, Rogers RG, et al. Incidence and management of graft erosion, wound granulation, and dyspareunia following vaginal

prolapse repair with graft materials: a systemic review. Int Urogynecol J 2011;22(July 7);789-98.