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).

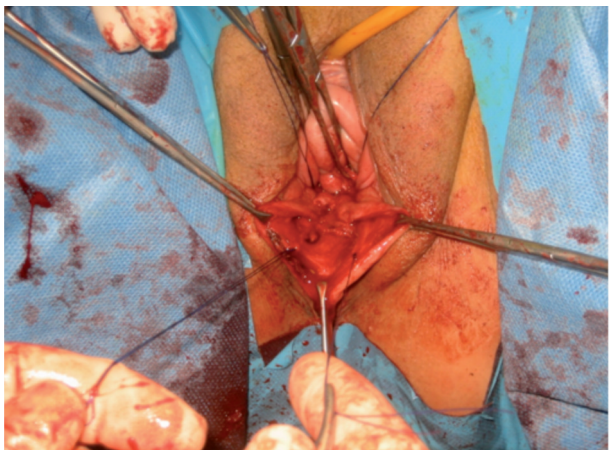


Figure 1A. – The 4-point-fixation of mesh: Upper two sutures come from the uterosacral ligaments and lower two sutures come from the either sides of perineal body.

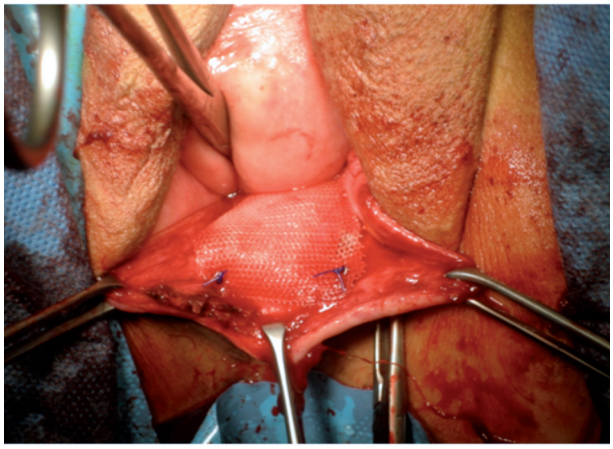


Figure 1B. – The perineal fixation of mesh.

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.

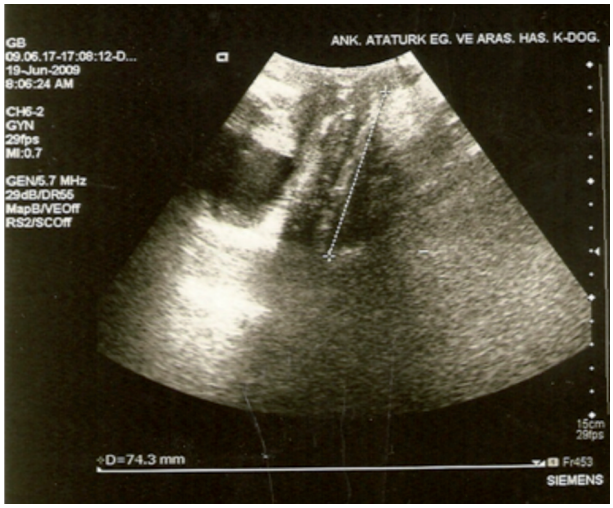
Symptoms	**Preoperative**	**Postoperative (12th month)**	**p value**
Pelvic pain	14 (53%)	5 (19%)	0.023
Pollacuria	16 (61%)	4 (7%)	0.004
Urge incontinence	19 (73%)	5 (19%)	0.035
Nocturia	13 (50%)	3 (11%)	0.041
Faecal incontinence	5 (19%)	–	
Difficulty in defacation	3 (11%)	–	
Dyspareunia	2 (7%)	–	

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

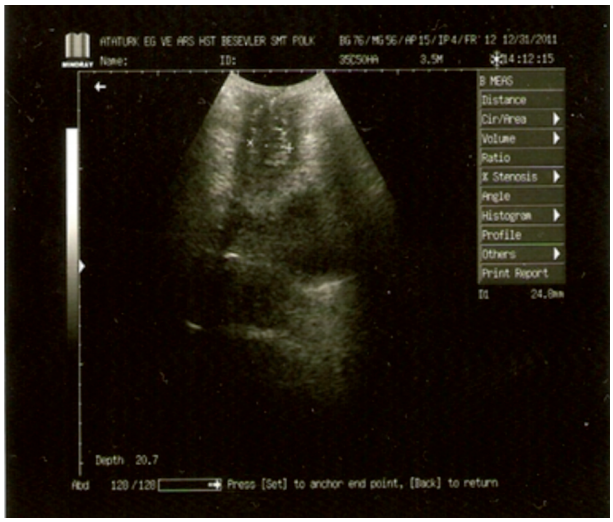
The Operation Technique

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.



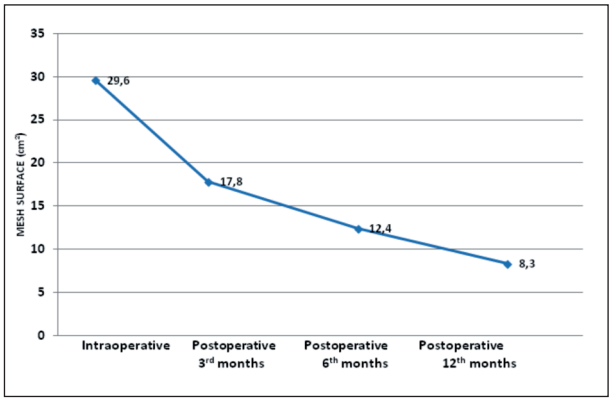
View 1A. – The measurement of the longest edge sagittaly by means of ultrasonography.



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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