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Risk factors and outcomes of vaginal mesh erosions after pelvic reconstructive surgery

A retrospective cohort study

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Abstract

Mesh erosions can occur in pelvic reconstructive surgeries for pelvic organ prolapse and stress urinary incontinence. The purpose of this study was to investigate the risk factors and outcomes of mesh erosion after surgical procedures using synthetic mesh. Pelvic reconstructive surgeries performed at a tertiary center during the 5 years between January 2019 and January 2024 were retrospectively analyzed. Patients were classified into the mesh erosion group and the non-erosion group. Clinical features and outcomes were compared. The study included 510 patients, 49 in the mesh erosion group and 461 in the non-erosion group. The incidence of mesh erosion was 9.6%. There was no significant difference between the groups in terms of age, parity, menopausal status, pelvic organ prolapse stage, and concomitant hysterectomy ($P = .243$, $P = .066$, $P = .349$, $P = .374$, and $P = .119$, respectively). In the mesh erosion group, body mass index (27.1 ± 3.3 vs 25.9 ± 3.6, $P = .016$), smoking (28.6% vs 14.3%), sexual activity (77.6% vs 61.8%), vaginal incision size (3.5 ± 1.7 vs 2.3 ± 0.8, $P = .001$) and hypertension (22.4% vs 13%, $P = .070$) were significantly higher. Vaginal incision size (>2.5 cm) and sexual activity were found to be independent risk factors for mesh erosion. In patients with mesh erosion, 18.3% (n = 9) received conservative treatment, and 81.7% (n = 40) received surgical treatment. In patients who underwent surgical treatment, mesh erosion size (>0.5 cm) and body mass index were significantly higher ($P = .015$ and $P < .001$, respectively). Erosion recurrence was detected in 16.3% (n = 8) of patients in the mesh erosion group. Although mesh erosions do not occur frequently in pelvic reconstructive surgeries, they are complications that can disrupt patient comfort. Vaginal incision size and sexual activity were determined as independent risk factors for mesh erosions. When mesh erosion is detected, conservative treatment may benefit small erosions. The surgical approach should be performed in patients with severe symptoms and extensive erosions.

Abbreviations: ASA = American Society of Anesthesiologists, BMI = body mass index, POP = pelvic organ prolapse, POP-Q = pelvic organ prolapse-quantification, SUI = stress urinary incontinence, TOT = trans obturator type, TVT = transvaginal tape.

Keywords: complication, erosion, pelvic organ prolapse, risk factor, surgical mesh

1. Introduction

Pelvic organ prolapse (POP) is the downward displacement of one or more of the anterior and posterior vaginal walls, uterus, or vaginal dome sections as a result of the loss of muscle and connective tissue support supporting the pelvic organs. The rectum and small intestine may also be among the herniated structures. The etiology is multifactorial, including advanced age, multiparity, birth trauma, obesity, pelvic floor dysfunction, menopause, hysterectomy, chronic constipation, and smoking.[1] Most POPs are asymptomatic or mildly symptomatic. In addition, since many women do not seek medical attention for their symptoms, it is difficult to determine the incidence of POP. However, it has been reported that 50% to 65% of women are affected, and only 6% to 18% undergo surgery.[2–4] POP surgery is most commonly performed on symptomatic women between the ages of 60 to 69.[4] In severe POP cases, problems such as dyspareunia, discomfort during intercourse, and stress urinary incontinence (SUI) negatively affect women quality of life. SUI is seen in 20% to 90% of women with POP, and it is stated that this condition negatively affects sexual functions.[5]

The "Pelvic Organ Prolapse-Quantification" (POP-Q) system is widely used in POP staging.[6] Treatment planning should be carried out after evaluating many factors, such as the degree of POP, the presence of symptoms, expectations from treatment, and sexual activity. Conservative or surgical treatment can be performed. Conservative treatment includes

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The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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Kegel exercises, known as pelvic floor physiotherapy, and the use of a pessary. Pelvic floor physiotherapy can be used in the 1st and 2nd stages of POP, while a pessary can be used in all stages.[7] In surgical treatment, reconstructive or obliterative surgery can be selected according to the effect of symptoms on quality of life, sexual activity, and the severity of the current prolapse. It has been reported that the majority of sexually active women prefer surgical treatment rather than conservative.[7,8]

Pelvic reconstructive surgery using synthetic mesh in cases of POP and SUI has been reported to have a superior anatomic healing rate compared to traditional repair methods. Although it is stated that the treatment is successful in the majority of patients and the patients are satisfied, an increasing number of women are reporting complications related to synthetic mesh.[9] Complications such as pain, infection, bleeding, dyspareunia, organ perforation, and urinary problems have been reported due to the use of synthetic mesh. Mesh erosion is the most common complication. Mesh erosion is the emergence of vaginal mesh that is visible during vaginal examination. Although there is no consensus on managing mesh erosion, some cases heal spontaneously with a conservative approach (topical estrogen use, provision of local hygiene, and use of analgesics), while others require revision surgery (mesh removal). Mesh erosions can recur and may require more than one surgery. This situation takes time and can reduce the patient quality of life. Therefore, determining the risk factors in mesh erosions is important for treatment management.

This study investigated the risk factors, treatment options, and outcomes of patients with vaginal mesh erosion after pelvic reconstructive surgery in a tertiary hospital.

2. Materials and methods

This retrospective cohort study was conducted according to the principles of the Declaration of Helsinki. It was initiated after the approval of the Istanbul Kanuni Sultan Süleyman Training and Research Hospital Clinical Research Ethics Committee (date: 09.05.2024 KAEK/2024.05.97). In the urogynecology clinic of the Health Sciences University Türkiye, Istanbul Kanuni Sultan Süleyman Training and Research Hospital, uterine suspension surgeries and sling surgeries, such as trans obturator type (TOT), are frequently performed on patients with POP and SUI diagnoses. Synthetic mesh is used in these operations. The study included patients who had mesh erosion after pelvic reconstructive surgery using synthetic mesh between January 2019 and January 2024. Patient data were accessed through the hospital information system and patient files.

Inclusion criteria: Age 18 years and older, pelvic reconstructive surgeries performed using a synthetic mesh with POP or SUI indication. Exclusion criteria: missing data. Demographic data, comorbidities, parity, smoking, the operation performed, hospital stay, vaginal incision size, comorbidities, American Society of Anesthesiologists (ASA) status, and other clinical features were recorded. The sample size was not determined in this retrospective cohort study, and it was planned to reach all patients between the relevant dates.

Mesh erosion was defined as any visible vaginal mesh detected during vaginal examination. Patients were classified into the mesh erosion group and the non-erosion group. In our clinic, patients with mesh erosion are initially treated with conservative treatment (topical estrogen, hygiene care, and infection treatment) for an average of 1 month. Patients who do not respond to conservative treatment undergo surgical operations. All removed tissues are subjected to pathological examination. Although rare, more than one operation may be required to repair mesh erosions completely. Patients with mesh erosion were also classified as conservative treatment and surgical treatment groups according to the treatment method applied. Demographic data and clinical features were compared between the groups.

2.1. Statistical analysis

The data were analyzed using the SPSS Inc., Chicago (SPSS v26.0) program. The data conformity to a normal distribution was evaluated using the Shapiro–Wilks test, histogram, skewness, and kurtosis. Descriptive statistics were expressed as number of patients, percentage, mean, and standard deviation (minimum–maximum). The Mann–Whitney *U* test was used to analyze quantitative data that did not show a normal distribution, and the independent sample *t* test was used to analyze data that showed a normal distribution. Qualitative data were analyzed using the Pearson chi-square test and Fisher exact test. Multivariate logistic regression analysis was performed to determine the independent risk factors that are effective in developing mesh erosion. Receiver operating characteristics curve analysis was performed to determine the prognostic value of vaginal incision size. The significance level was accepted as $P < .05$.

3. Results

A total of 525 patients aged 18 years and over who underwent pelvic reconstructive surgery using mesh with the diagnosis of POP and urinary incontinence between January 2019 and January 2024 were reached. Cases with missing data (n = 15) were excluded from the study. A total of 510 cases were included in the study (Fig. 1). The mesh erosion incidence was 9.6% in the 5-year period (49/510). The median time for mesh erosion detection after the operation was 12 (2–31) months. Mesh erosion was detected in 2 patients late (48 and 50 months). The mean age of patients in the mesh erosion group was similar to that of the non-erosion group (50.2 ± 9.4 vs 51.8 ± 10.7 years, $P = .243$). The parity of patients in the mesh erosion group was lower than in the non-erosion group, although not significantly (3.2 ± 1.6 vs 4.3 ± 2.9, $P = .066$). The body mass index (BMI) of the mesh erosion group was significantly higher than that of the non-erosion group (27.1 ± 3.3 vs 25.9 ± 3.6 kg/m^2, $P = .016$). Smoking was significantly higher in the mesh erosion group (28.6% vs 14.3%, $P = .009$). The vaginal incision size in the pelvic organ reconstruction surgery was significantly higher in the mesh erosion group (3.5 ± 1.7 vs 2.3 ± 0.8 cm, $P < .001$). The proportion of patients in menopause, the POP stages, and the number of patients who underwent simultaneous hysterectomy did not differ significantly between the groups ($P = .349$, $P = .374$, and $P = .119$). The rate of sexually active patients in the mesh erosion group was significantly higher than in the non-erosion group (77.6% vs 61.8%, $P = .030$). The most common comorbidity in the entire population was hypertension. The rate of hypertensive patients was significantly higher in the mesh erosion group than in the non-erosion group (22.4% vs 13%, $P = .070$). Similarly, the rate of patients with ASA II status was significantly higher in the mesh erosion group (49% vs 31.9%, $P = .045$). The most commonly performed pelvic reconstructive surgeries were anti-incontinence and concomitant cystocele surgery (35.1%) and anti-incontinence and concomitant cystorectocele surgery (34.1%), respectively. No significant difference was observed in the operations performed between the groups (Table 1).

In our clinic, conservative treatment is primarily applied in cases detected with mesh erosion. In cases that do not show improvement and progress progressively or are symptomatic, mesh removal surgery is performed. A total of 49 patients were identified in the mesh erosion group. According to their management method, patients were divided into 2 groups: conservative (n = 9) and surgical (n = 40). The patient age, parity, menopausal status, and current smoking were similar in both groups ($P = .195$, $P = .970$, $P = 1.000$, and $P = .714$, respectively). Mesh

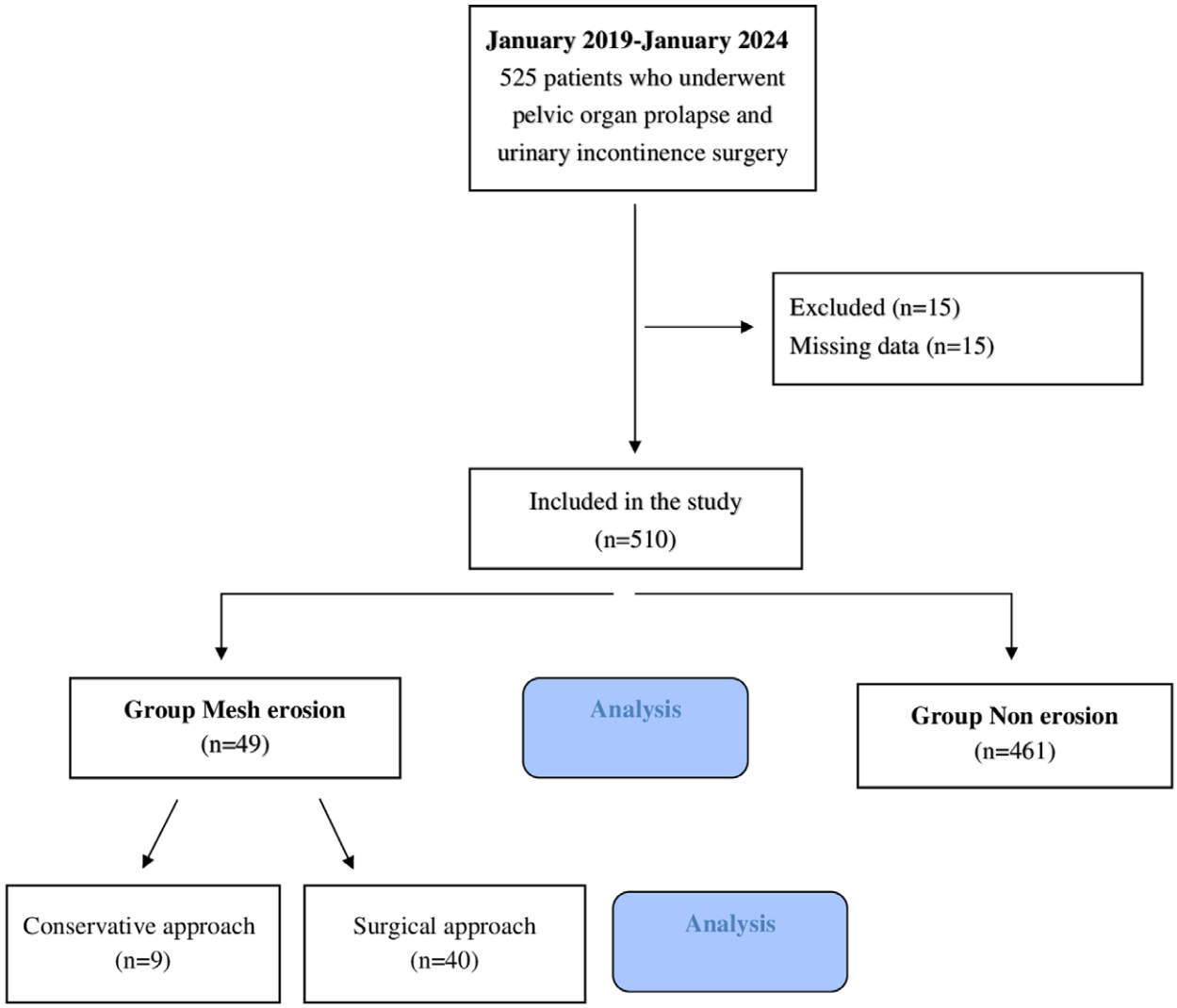

Figure 1. Flow chart of the study.

erosion size was significantly higher in patients in the surgical approach group (2.1 ± 0.9 vs 0.8 ± 0.5 cm, $P < .001$). The most common signs and symptoms in patients with mesh erosion are asymptomatic (44.9%, n = 22), spotting (24.5%, n = 12), discharge/infection (24.4%, n = 11), and dyspareunia (8.2%, n = 4). There was no significant difference between the rates of erosion recurrence (11.1% vs 17.5%, $P = 1.000$) and infection (11.1% vs 7.5%) in patients who underwent conservative and surgical approaches (Table 2).

Multivariate logistic regression analysis was performed on variables with significant differences in the mesh erosion and non-erosion groups. Vaginal incision size (odds ratio = 4.1, $P < .001$) and sexual activity (odds ratio = 3.1, $P = .006$) were found to be independent risk factors for mesh erosion (Table 3).

Receiver operating characteristic curve analysis of the prognostic values of vaginal incision size in predicting mesh erosion was performed. The cutoff value for vaginal incision size was 2.5 cm, and the area under the curve = 0.783 (95% confidence interval, 0.682–0.885; Table 4).

4. Discussion

This study, conducted in a tertiary center, explored the practical risk factors, treatment approaches, and clinical outcomes in the development of mesh erosion. The findings, which highlighted the significant role of high BMI, smoking, vaginal incision size, sexual activity, ASA II status, and hypertension in the mesh erosion group, have direct implications for clinical practice. The study multivariate regression analysis identified vaginal incision size and sexual activity as independent risk factors in the development of mesh erosion. Notably, a vaginal incision size of >2.5 cm was found to increase the probability of mesh erosion by 4.1 times, and sexual activity by 3.1 times. The study also found that BMI and mesh erosion sizes were significantly higher in patients with mesh erosion and surgical intervention, providing actionable insights for patient care.

Various techniques such as native tissue repairs, autologous materials such as autologous fascia lata or rectus sheath, and synthetic mesh surgeries are widely used in SUI surgery. It has been reported that the use of local tissues in pelvic reconstructive surgeries is associated with a high rate of recurrence.[10] High recurrence rates have been attributed to the low amount of collagen in the local connective tissue matrix and the technique used. The use of autologous materials such as fascia lata or rectus sheath may increase the duration of surgery and morbidity since it requires graft preparation. For these reasons, suburethral sling procedures using synthetic mesh have become frequently applied in recent years. A Cochrane review reported that suburethral slings have similar efficacy to bladder neck needle injections, cop suspension, and mini slings.[11] However, it has been reported that the increasing use of synthetic mesh materials is associated with complications such as

Table 1

Clinical characteristics of patients.

Variable	Mesh erosion (n = 49)	Non-erosion (n = 461)	*P*
Age (yr)	50.2 ± 9.4 (37–74)	51.8 ± 10.7 (31–78)	.243
Parity	3.2 ± 1.6 (1–7)	4.3 ± 2.9 (1–13)	.066
Parity			.257
≤2	22 (44.9)	169 (36.7)	
>2	27 (55.1)	292 (63.3)	
Body mass index (kg/m^2)	27.1 ± 3.3 (20–34)	25.9 ± 3.6 (19–33)	.016
Current smoking	14 (28.6)	66 (14.3)	.009
Menopausal status	21 (42.9)	230 (49.9)	.349
Vaginal incision size (cm)	3.5 ± 1.7 (0–5)	2.3 ± 0.8 (0–4)	<.001
Length of hospital stay (d)	2.7 ± 1.4 (1–7)	2.9 ± 1.1 (2–7)	.244
ASA status			.045
I	24 (49)	308 (66.8)	
II	24 (49)	147 (31.9)	
III	1 (2)	6 (1.3)	
POP stage			.374
<2	7 (14.3)	90 (19.5)	
≥2	42 (85.7)	371 (80.5)	
Concomitant hysterectomy	11 (22.4)	65 (14.1)	.119
Sexual activity	38 (77.6)	285 (61.8)	.030
Comorbidity			
Hypertension	11 (22.4)	60 (13)	.070
Diabetes mellitus	10 (20.4)	85 (18.4)	.736
Thyroid disorder	7 (14.3)	55 (11.9)	.631
Asthma/COPD	4 (8.2)	27 (5.9)	.525
Type of operation			
Anti-incontinence and concomitant cystocele surgery	13 (26.5)	166 (36)	.186
Anti-incontinence and concomitant rectocele surgery	19 (38.8)	155 (33.6)	.469
Lateral suspension	8 (16.3)	84 (18.2)	.743
Anti-incontinence surgery and concomitant vaginal hysterectomy	9 (18.4)	66 (14.3)	.447

Values are expressed as the number of patients and percentage, mean ± standard deviation (min–max).

ASA = American Society of Anesthesiologist, COPD = chronic obstructive pulmonary disease, POP = pelvic organ prolapse.

Table 2

Characteristics of patients in the mesh erosion group according to treatment method.

Variable	Conservative (n = 9)	Surgical (n = 40)	*P*
Age (yr)	47 ± 7.2 (38–59)	50.9 ± 9.7 (37–74)	.195
Parity	3.4 ± 2.3 (1–7)	3.1 ± 1.5 (1–7)	.970
Body mass index (kg/m^2)	24.5 ± 3.1 (20–30)	27.8 ± 3.0 (21–33)	**.015**
Current smoking	2 (22.2)	12 (30)	1.000
Menopausal status	3 (33.3)	18 (45)	.714
Mesh erosion size (cm)	0.8 ± 0.5 (0.5–2)	2.1 ± 0.9 (0.5–4)	**<.001**
Mesh erosion size (cm)			**<.001**
<0.5 cm	6 (66.7)	2 (5)	
0.5–2 cm	3 (33.3)	25 (62.5)	
≥2 cm	0	13 (32.5)	
Signs and symptoms			.681
Asymptomatic	4 (44.4)	18 (20)	
Spotting	1 (11.1)	11 (27.5)	
Discharge/infection	3 (33.3)	8 (20)	
Dyspareunia	1 (11.1)	3 (7.5)	
Complication			
Erosion recurrence	1 (11.1)	7 (17.5)	1.000
İnfection	1 (11.1)	3 (7.5)	.569

Bold value indicates statistically significant.

tissue rejection, infection, dyspareunia, and erosion.[12] It has been stated that mesh erosions may occur as a result of bacterial infections contaminating the mesh material and devascularization occurring in the vaginal incision.[13] The literature reports that the incidence of mesh erosion is between 0% and 10.5%, although it is affected by various conditions.[14,15] In our study, the incidence of mesh erosion was 9.6%, which is consistent with the literature.

Reconstructive and obliterative surgeries are performed in cases with POP. Patients' expectations and preferences are important in determining the treatment method. Reconstructive surgeries, rather than obliterative surgeries, aim to restore vaginal anatomy as well as preserve sexual activity.[16] Various risk factors have been reported for mesh erosions after pelvic reconstructive surgery using synthetic mesh. These factors are generally classified as patient-related, synthetic mesh-related, and surgical technique-related. Advanced age, genital atrophy and estrogen deficiency, diabetes, smoking, type and size of mesh used, performing SUI and POP surgery together, and performing simultaneous hysterectomy have been reported as risk factors.[17] Another study reported that young age and sexual activity are risk factors for mesh erosion.[18] Studies also emphasize that simultaneous hysterectomy is not a risk factor for mesh erosion.[19,20] It has been investigated in various studies that comorbidities of patients may also be risk factors for mesh erosions. Cheng et al[21] stated that diabetes and hypertension are risk factors for mesh erosion. The authors also reported that performing hysterectomy in POP surgery is one of the risk factors. It has been emphasized that hypertension and diabetes are associated with peripheral vascular disease and may cause mesh erosion by causing decreased nutrient and oxygen transmission at the cellular level. It has been stated that small vaginal incisions and tension-free mesh closures are also effective in reducing the risk of erosion.[22] Vaginal flaps prepared with appropriate thickness help prevent mesh erosion. It is known that the properties of synthetic meshes pose a risk in mesh erosion formation. It has been reported that placing a collagen barrier between the synthetic mesh and the vaginal mucosa is effective in preventing erosion and that using collagen-coated polypropylene mesh may be beneficial.[23] It has been reported that vaginal mesh erosions may occur late (more than 2 years after the initial surgery) after POP surgery.[24] In another study, it

Table 3

Multivariate logistic regression analysis of risk factors.

	Odds ratio	95% CI (min–max)	*P*
Vaginal incision size	4.179	2.810–6.217	**<.001**
Sexual activity	3.084	1.391–6.840	**.006**
Hypertension	1.857	0.670–5.150	.234
Current smoking	1.174	0.525–2.625	.696
ASA II status	1.079	0.472–2.469	.857
Body mass index	1.064	0.961–1.178	.233

Bold value indicates statistically significant.
CI = confidence interval (minimum–maximum).

Table 4

Prognostic performance of vaginal incision size in predicting mesh erosion.

	Cutoff	Sensitivity	Specificity	AUC (95% CI)
Vaginal incision size	2.5	0.776	0.612	0.783 (0.682–0.885)

AUC = area under curve, CI = confidence interval (minimum–maximum).

was reported that delayed mesh erosion was detected in the 4th year of follow-up.[25] Our study found that age was not a risk factor in patients with mesh erosion. At the same time, menopausal status, concomitant hysterectomy, parity, and POP stage (<2 or ≥2) were not risk factors for mesh erosions. We found that high BMI, smoking, sexual activity, large vaginal incision size, hypertension from comorbidities, and ASA II status were risk factors for mesh erosions. In our study, patient outcomes over 5 years were analyzed. The median mesh erosion detection time in cases was 12 (2–31) months. However, we detected mesh erosion in 2 patients after 4 years. In the current study, we determined that vaginal incision size (>2.5 cm) increased the risk of mesh erosion by 4.1 times and regular sexual activity by 3.1 times, contributing to the literature. However, we determined that both vaginal incision size >2.5 cm and sexual activity are independent risk factors for mesh erosion. Clinical characteristics of the patients, the quality of synthetic meshes, and many parameters related to the operation may affect the risk of mesh erosion. Based on the results of our study, we think that having a vaginal incision as small as possible (<2.5 cm) and informing about sexual activity may help reduce the risk of mesh erosion. Predicting complications and effective management will be possible by determining risk factors. Mesh erosions may occur in the late period after the first operation.

The variety of surgical techniques performed using synthetic mesh affects the incidence of mesh erosion. It has been reported that mesh erosion is more common after trans obturator tape (TOT) procedures for SUI than after transvaginal tape (TVT) procedures.[19] This situation is attributed to the fact that more mesh can pass through the vaginal cavity in TOT procedures, which increases the risk of mesh erosion. In our study, only TOT procedures were performed during the study period, and TVT procedures were not performed. The most frequently performed pelvic reconstructive surgery was anti-incontinence and concomitant cystocele surgery, and mesh erosion was most frequently observed in anti-incontinence and concomitant cystocele surgeries. However, the types of surgery did not significantly affect the occurrence of mesh erosion.

The size of the erosion, its location, and the severity of the patient symptoms are important in patients with mesh erosion. First, a conservative approach should be tried. In appropriate patients, it may be beneficial to limit mesh erosion by allowing the vaginal mucosa layer to grow with topical estrogen use. In addition to the conservative approach, avoiding sexual intercourse and ensuring vaginal flora hygiene are also important. In cases that do not benefit from conservative treatment or have severe symptoms, the mesh extrusion can be partially excised vaginally. The remaining incision should be closed by creating a flap with absorbable suture. Complete excision of the mesh is another approach.[17] It has been reported that 20% of mesh erosion cases respond to estrogen use alone, while 47% are reported to be inadequate with conservative treatment and require a surgical procedure.[14] In another study, 20 out of 56 patients with mesh erosion were treated conservatively, while 36 (64.3%) required surgical revision.[21] The authors stated that a significantly higher surgical revision rate was performed in patients with mesh erosion >0.5 cm. In our study, the rate of patients who underwent surgical approach was higher (40/49 = 81.6%), consistent with the literature. The size of mesh erosion was significantly higher in patients who underwent surgical revision, consistent with the literature. However, BMI was significantly higher in the surgical approach group. While some of the cases with mesh erosion were asymptomatic, bleeding in the form of spotting and serious infections that could lead to fistulas could be seen in some of them. In our study, the majority of the patients with mesh erosion (44.9%) were asymptomatic. Spotting, infection, and dyspareunia were among the other symptoms and findings. Mesh erosion recurrence was seen in 8 out of 49 patients (16.3%) who underwent conservative or surgical approaches. In line with the literature, we believe that a conservative approach should be considered first in the management of cases with mesh erosion. However, a surgical approach would be beneficial in symptomatic cases where the erosion size is >1 cm.

The study has some limitations. First, it is retrospective and single-center, with a relatively small sample. Second, the study includes cases of mesh erosion in pelvic reconstructive surgeries performed using synthetic mesh over 5 years. A standard follow-up period has not been determined for the entire population. Although control examinations of the cases are performed at certain intervals, there may be patients with mesh erosion who do not apply to our hospital. This situation may lead to a low incidence of mesh erosion in patients.

5. Conclusion

In conclusion, although mesh erosions do not have a high incidence in pelvic reconstructive surgeries performed using synthetic mesh, they are complications that can disrupt patient comfort and should be considered. High BMI, smoking, increased vaginal incision size, sexual activity, and preoperative ASA II status (hypertension, smoking) are risk factors for mesh erosion. Regular follow-up should be performed for all patients who undergo surgery using synthetic mesh. When mesh erosion is detected, conservative treatment may benefit small erosions. A surgical approach should be performed for severely symptomatic and extensive erosions.

Author contributions

Conceptualization: Hale Çetin Arslan, Kadir Arslan.
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Formal analysis: Hale Çetin Arslan, Kadir Arslan.
Methodology: Hale Çetin Arslan, Kadir Arslan.
Supervision: Hale Çetin Arslan, Kadir Arslan.
Writing – original draft: Hale Çetin Arslan.
Writing – review & editing: Hale Çetin Arslan, Kadir Arslan.

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