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Review

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What are the Techniques of Clitoral Hoodoplasty? Who should Undergo Hoodoplasty and Why? What is the Effect of Clitoral Hoodoplasty on Sexual Functions?: A Narrative Review

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ABSTRACT

Labia minora reduction is the most commonly requested procedure by women who are concerned about the appearance of the vulvar region. In most cases, simultaneous clitoral hoodoplasty should be performed to achieve better aesthetic outcomes. There are various surgical techniques to remove excess tissue in the clitoral hood area. This study aims to evaluate the different surgical methods used in hoodoplasty and to demonstrate the changes in patients' sexual functions during the postoperative period. In patients with excess clitoral hood tissue, performing only labiaplasty can result in an unbalanced postoperative appearance where the hood looks larger. Additionally, in cases where postoperative clitoral hood prominence is evident, it should be noted that revision surgery may not always be necessary; instead, hoodoplasty can be concealed with labia majora fillers, eliminating the need for further surgery. When performed with proper techniques, clitoral hoodoplasty, and labiaplasty have no negative effects on sexual function.

Keywords: Hoodoplasty, clitoral hood reduction, aesthetic surgery, sexual function

INTRODUCTION

In recent years, the increasing demand for aesthetic cosmetic procedures involving the whole body has also brought about the desire for the idealization of external genitalia. With the influence of social media, women have started to compare their bodies with the bodies of others. Additionally, the increased accessibility of hair removal methods, along with the exposure of bare female external genitalia, has raised awareness. Women have started to aim for an anatomy characterized by minimal labial protrusion, where the labia minora are hidden between the labia majora, and the clitoral hood remains behind the anterior labial commissure.[1]

The most commonly performed aesthetic surgical procedure in women is labiaplasty.[2] Among labiaplasty techniques, trimming labiaplasty is the most commonly performed, while wedge labiaplasty is most commonly associated with complications.[3] However, due to their close anatomical proximity, it is evident that the labia minora and the clitoral hood should be evaluated together. It has been observed that most patients who apply with a request for labiaplasty have an underlying clitoral hood hypertrophy. Dissatisfaction with remnant labial tissue after labiaplasty and the prominence of the remaining clitoral hood due to excessive labial tissue removal are the most common reasons for revision labiaplasties.

This review has been written to summarize clitoral hoodoplasty techniques, the purpose and criteria for performing clitoral hoodoplasty, and the surgical techniques to avoid affecting sexual functions.

Surgical Anatomy of the Clitoris

The clitoris, which has both internal and external parts, is the largest erectile organ of a woman. It has six main parts: the glans, suspensory ligament, body, root, crura, and bulbs.[4-9] The external part of the clitoris, the glans, is covered from above by the prepuce (hood) and is bordered laterally by the frenulum (Figure 1).

The glans clitoris, located at the upper of the vulvar vestibule, is the most erectile part of the clitoris, approximately 1-2 cm in length and 0.5-1 cm in width with a cylindrical shape (Figure 2).[4,5,9-11] Shih et al.[12] describe the cutaneous corpuscular receptors, which are similar morphologically to

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the receptors found in the glans penis. It has been shown that immunohistochemical studies that the clitoris is rich in neurovascular components. And histological evaluation of the clitoris has also shown that the glans contains a higher density of both small and large nerve fibers compared to other parts.[13] However, the length and width of the glans clitoris and the width of the clitoral hood do not affect female sexual function, genital perception, or orgasm.[14]

The clitoral body and crura lie under the ischiocavernosus muscles and Colles' fascia.[15] The clitoral body is deep to the glans and is connected to the pubic symphysis by the suspensory ligament of the clitoris. This ligament contains both superficial and deep components.[4]

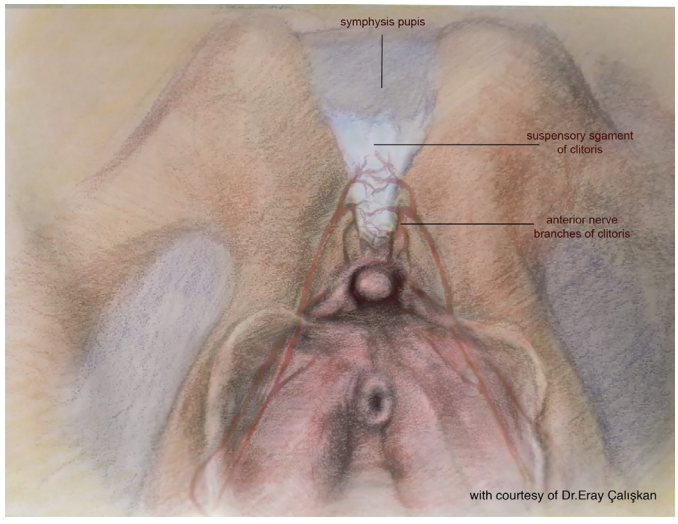

Figure 1. Anatomical parts and vascularization of the clitoris

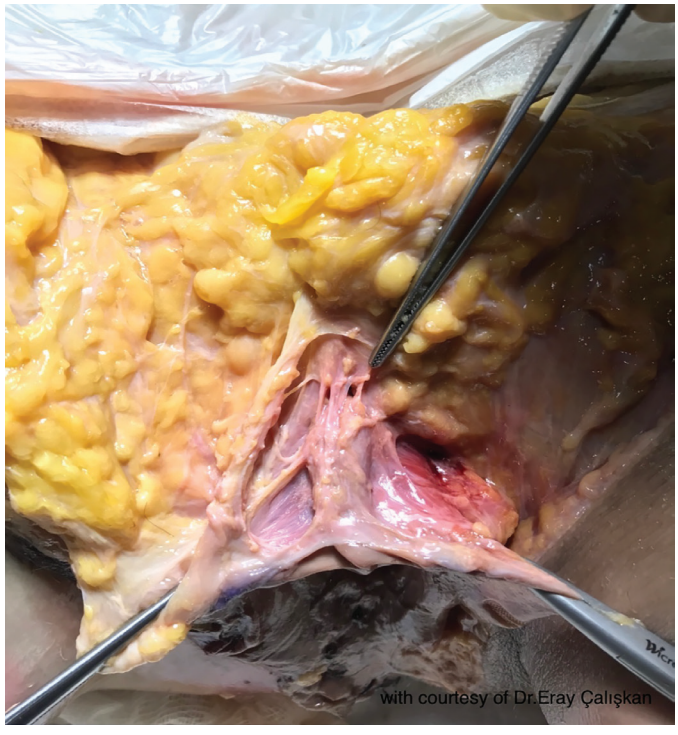

Figure 2. Dissection view of the clitoris

Preoperative anatomical evaluation of the clitoral hood should be performed both in the lithotomy position and standing. In the lithotomy position, the hood should cover more than two-thirds of the glans clitoris, with its free edges angled 30-60 degrees into the labia minora, and the skin surface should be smooth. In the standing position, the clitoral hood should not protrude from the anterior labial commissure, referred to as the "dolphin lip" appearance.[16]

The hypertrophic structure of the clitoral hood over the glans clitoris may cause dissatisfaction, leading to a loss of self-confidence and consequently sexual dysfunction. Additionally, excess tissue in this area can make it difficult to stimulate the glans clitoris and also result in sexual dysfunction. Whether or not there will be a loss of sensation after clitoral hoodoplasty is a separate topic of discussion, which will be addressed in later sections. Although female sexuality is a highly complex process, the functional contribution of the clitoris should be considered during clitoral hoodoplasty procedures. In this way, the innervation of the clitoris is another important issue for surgeons.

When performing surgery on the clitoral hood, it is crucial to remain in the superficial and lateral regions of the clitoral glans to avoid injury.[17] A thorough understanding of the dorsal nerve of the clitoris is essential for preventing iatrogenic damage. The pudendal nerve divides into three primary branches: the dorsal nerve of the clitoris, the perineal nerve supplying the external genitalia, and the inferior rectal nerve. The dorsal nerve of the clitoris is responsible for the afferent signaling involved in clitoral erection. The dorsal clitoral nerve becomes superficial by perforating the perineal membrane 2.4-3 cm lateral to the external urethral meatus and innervates the glans clitoris from 11 to 1 o'clock.[5]

In addition to the dorsal nerve, the clitoral cavernous tissue is innervated by the cavernous nerves originating from the uterovaginal plexus. The dorsal nerve of the clitoris splits into two cords, which terminate approximately 1 cm proximal to the glans. The clitoral shaft lies medial to the typical area of clitoral hood reduction and is positioned deeper relative to the surgical site.

The somatic innervation of the clitoris is through the dorsal clitoral nerve, a branch of the pudendal nerve, which originates from the pelvic sidewall.[4,5,7,18]

Respecting the innervation of the dorsal clitoral nerve during dissection and excision of the labial sulcus, as well as deep excisions of the clitoral hood, will help prevent sensitivity-related issues in the postoperative period.

The clitoral blood supply is complex and primarily derived from the pudendal vessels. It is nourished and drained from the anterolateral and posterolateral sides, as well as deeply along the midline. The prepuce receives its blood supply from the external pudendal artery, whereas the erectile tissues are vascularized by the dorsal clitoral artery, perineal arteries, and deep arteries.[19]

Various classification systems have been defined for clitoral hood hypertrophy to establish a common language in studies and to create standardization in surgery. In a classification made by Liu et al.[16] in 2022, clitoral hypertrophy was categorized

as central, lateral, and composite hypertrophy, and it was emphasized that 42.9% of women had lateral hypertrophy. In central hypertrophy, hypertrophic tissue is observed along the midline of the clitoral hood, with the labial sulcus continuous on the lateral sides and the edges of the hood fused with the labia minora. In lateral hypertrophy, the continuity of the labial sulcus is absent, and single or bilateral vertical hypertrophic tissues are observed. Another classification was made by Xia et al.[20] in 2022. In this classification, type 1 is described as isolated clitoral or labial hypertrophy, type 2 as combined hypertrophy, and type 3 as fusion hypertrophy, with an emphasis that type 2 is the most common type.[20] Triana et al.[21], in 2024, divided clitoral hypertrophy into two categories: longitudinal excess and horizontal excess.

Clitoral Hoodoplasty Techniques

In the literature, various hoodoplasty techniques, especially combined with labiaplasty, have been described; however, they all share the common goal of designing symmetrical external genitalia. Wedge resection techniques, pioneered by Alter[22], are considered more effective for addressing an enlarged clitoral hood compared to edge trim methods. By closing the wedge defect in the labia minora, these techniques not only reduce the hanging appearance of the labia minora but also decrease the forward projection of the clitoral hood by applying posterior tension.[1,22] The general principle in clitoral hood excisions is that it should be done superficially, leaving about a 1 cm bridge over the hood, while attention to the innervation of the dorsal clitoral nerve to prevent overstimulation of the clitoris in the postoperative period.[23] Since lateral clitoral hypertrophy is the most common type of clitoral hypertrophy, the most frequently used method is the excision of the lateral clitoral folds (Figure 3). The lateral clitoral folds can be excised in an oval, semicircular, or triangular shape.[24] Following the marking of the surgical area to be excised, a local anesthetic containing epinephrine should be administered in pinpoint injections to avoid distorting the contours of the marked surgical field (Figure 4). Excision can be performed using a scalpel, scissors, or needle-tip monopolar electrocautery. The excision should be done gently and superficially. For hemostasis after excision, care should be taken to avoid the spray mode of electrocautery to respect the neural innervation. During the closure of the surgical area, a multi-layered closure should be performed to allow for editing and modification. The deeper layers can be closed with a rapidly absorbable monofilament, but the skin should be closed with a rapidly absorbable multifilament suture material in the final stage (Figure 5).[17]

In the method described by Alter[22] in 2008, in which he operated on a total of 407 patients, he performed wedge resection on the labia minora and, in addition, excised the lateral folds in a hockey stick shape for the clitoral hood. Also, Alter[22] emphasized that preserving and approximating the subcutaneous tissue prevents wound separation and fistula formation. Although inverted V or resection of the lateral folds provides satisfactory cosmetic results in most cases when the clitoral hood is very prominent with wrinkled skin folds, it is necessary to extend the caudal incision and excision in an inverted Y shape (Figure 6). Eserdağ and Anğın[24], in 2021, emphasized that the reverse Y clitoral hoodoplasty performed on 63 patients after curvilinear labiaplasty is a very safe and cosmetically satisfactory method.

Another method is the composite reduction labiaplasty described by German plastic surgeon Gress[25] in 2013. In this technique, following the shaping of the labia minora with an S-shaped excision, pedicles of 2-3 cm were preserved. Then, a crescent-shaped superficial excision was performed under the clitoris, and a square-shaped excision was made above it. In this technique, which was performed on a total of 82 patients,

Figure 3. Lateral clitoral fold

Figure 4. Marking and removal of the lateral clitoral fold

Gress[25] emphasized that he achieved optimal functional and aesthetic results, especially in cases with excessive clitoral protrusion.

In addition to the described methods, three-step and two-step excisions combined with wedge labial resection, labioplasty with L-shaped flap, and clitoroplasty have been described.[20,26,27] The main goal is to ensure functional and aesthetic integrity after the excised clitoral tissue. It should be kept in mind that in deep dissections and excisions, overstimulation of the clitoris, in line with its histological structure, may cause patient dissatisfaction (Figure 7).[21]

Figure 5. Lateral clitoral fold excision before and after surgery

Figure 6. Inverted V plasty

The Effect of Clitoral Hoodoplasty on Sexual Functions

The sexual response in females is a series of events that may lead to orgasm followed by a resolution phase.[28] While clitoral stimulation is not essential for all women to complete this sequence, it often plays a central role in the process. The sexual response cycle is described as consisting of the phases of desire, arousal, orgasm, and resolution the clitoris is pivotal to arousal, orgasm, and resolution.[29] These stages are regulated by the previously described nerve pathways and vascular structures. When labioplasty and hoodoplasty are considered together, the aim of improving sexual function stands out among the surgical motivators.[30]

Along with the neurovascular density of the clitoris histologically, we now know that the labia minora are also densely neurovascular erectile tissues.[4,5] Therefore, surgical interventions involving these two tissues, which play a significant role in sexual function, raise the question of whether there will be issues with loss of sensation after surgery.

Recent studies have shown a significant decrease in the total Female Sexual Function Index score and subdomains in cases where the remnant tissue left after labioplasty is less than 1-1.5 cm.[31,32] After clitoral hoodoplasty, the current literature is still unclear. The most rational study on the subject was conducted by Placik and Arkins[33]. in 2014. In this prospectively designed study, a total of 37 patients who underwent labioplasty and clitoral hoodoplasty were included, and vulvar sensitivity was evaluated using the "Semmes-Weinstein" monofilament, which had been previously validated for the vulva.[33] On the 14th day, and during the follow-ups at the 3rd, 6th, and 12th months, it was shown that there was no change of sensitivity on the clitoris. In the sexual function questionnaire, it was noted that by the

Figure 7. Marking, before and after hoodoplasty and labiaplasty

6th month, there was an increase in the frequency of sexual intercourse and orgasm, as well as in the intensity of orgasms.

The study from Gress[25], composite reduction labioplasty, reports that approximately 30% of patients experienced more sexual stimulation, which is another study claiming that the surgery improves sexual functions. It was also reported by Eserdağ and Anğın[24] that after inverted Y plasties, there was no change in sensitivity or sexual satisfaction, and after the removal of the tissue over the clitoris, the clitoris became more stimulated during coitus. While there are studies indicating that approximately 70% of patients reported an improvement in their sexual life, Triana et al.[21], in the analysis of a large patient series, emphasized that he observed no changes in sensitivity or sexual satisfaction.[22,26] Contrary to these studies, Xia et al.[20] demonstrated that clitoral hood excisions added to labioplasty are more effective in terms of patient satisfaction compared to labioplasty alone, but have no impact on sexual life.

CONCLUSION

Clitoral hoodoplasty is almost an essential part of labioplasty. One of the most common causes of postoperative dissatisfaction after labioplasty is clitoral hood deformities. Therefore, preoperative anatomical evaluation should be carefully performed in both the lithotomy and standing positions. Hockey stick excisions are a more appropriate technic in cases with lateral clitoral hypertrophy, and inverted V-excision is the more appropriate technic in cases with central hypertrophy. In cases with prominent clitoral hypertrophy, wedge resection may be a better option based on the surgeon's experience. In cases with clitoral hood hypertrophy, not adding excision to labiaplasty will lead to patient dissatisfaction. It should also be noted that in cases where the postoperative clitoral hood is prominent, instead of revision surgery, the need for surgery can be eliminated by concealing the hood with labia majora fillers. When clitoral hoodoplasty and labioplasty are performed with the correct techniques, they do not have negative effects on sexual life. Superficial, gentle dissections and excisions, leaving at least a 1 cm bridge on the clitoral hood, and being cautious with energy modalities used for hemostasis are beneficial steps in preserving sensitivity. The definition of different clitoral hood excision techniques and studies with a large number of patients examining their effects on sexual function will be light on the literature.

Ethics

(All photos with courtesy of Dr. Eray Çalışkan).

Peer-Review: One author of this article, Eray Çalışkan, is a member of the editorial board of the Anatolian Journal of Obstetrics and Gynecology Research. However, he did not take part in any stage of the editorial decision of the manuscript.

Author Contributions

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Original Article

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Could Systemic Immune Inflammation Index Predict Adnexial Torsion?

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ABSTRACT

Purpose: We examined the potential of the systemic immune-inflammation index (SII) as an effective biomarker for early diagnosis and timely treatment of adnexal torsion, aiming to prevent organ dysfunction or loss.

Methods: This study included cases of adnexal torsion, admitted to our clinic between 2012 and 2022, who underwent surgery based on clinical suspicion of torsion and had the diagnosis confirmed intraoperatively. The control group comprised healthy patients who presented with pelvic pain, underwent surgery for benign adnexal masses, and had the diagnosis confirmed pathologically. Preoperative complete blood count (CBC) parameters of all patients were retrieved from the hospital database. Absolute neutrophil, lymphocyte, and platelet counts, along with neutrophil-lymphocyte ratio (NLR) and SII, were calculated. Differences between the torsion and control groups for inflammatory hematologic parameters and SII were compared.

Results: The patient group included 210 cases while the control group numbered 200 women. There was a significant difference between the mean SII value of the adnexal torsion cases (1,898.5) and the mean SII value of the control group cases (618.6) ($p<0.001$). According to receiver operating characteristic curve analysis, the SII cut-off value for diagnosing torsion was 821, with a sensitivity of 82% and a specificity of 81%. In addition, the mean NLR was 2.16 in the control group and 6.28 in the torsion group, showing a significant difference ($p<0.001$). The NLR cut-off value for adnexal torsion was 3.06, with a specificity of 80% and a sensitivity of 79%. The cut-off value for leukocyte white blood cells count was found to be 9,225/μL, with a sensitivity of 77% and a specificity of 76%.

Conclusion: This study indicated that the SII, an economical, straightforward, and easily accessible inflammatory marker derived from CBC parameters, shows potential utility in the diagnosis of adnexal torsion.

Keywords: Adnexial torsion, systemic immune inflammation index, ovarian torsion

INTRODUCTION

Adnexal torsion represents a significant gynecologic emergency, potentially leading to organ dysfunction, or even organ loss, if diagnosis and intervention are delayed. The condition arises from the twisting of adnexal structures around their supporting tissues, disrupting blood flow and leading to ischemia and tissue necrosis. Its incidence is approximately 2.7%, making it the fifth most common gynecologic emergency.[1] Risk factors include previous episodes of torsion, presence of adnexal masses, pregnancy, and prior tubal ligation. Untreated adnexal or ovarian torsion can lead to necrosis of the adnexa and ovaries, resulting in infections, peritonitis, thrombophlebitis, and potential loss of the affected organs. These acute complications can also have significant long-term consequences, including infertility. Therefore, prompt diagnosis and intervention are important to prevent complications and preserve organ function.[2-4]

The diagnosis of torsion remains challenging due to the non-specific nature of its clinical presentation, physical examination findings, and laboratory and imaging tests. Consequently, delays in diagnosis can adversely affect treatment outcomes and prognosis. Although diagnostic and imaging techniques have advanced, the definitive diagnosis of torsion is generally confirmed through the surgical identification of the torsed adnexa. This underscores the need for prompt patient referral and highlights the importance of improving diagnostic accuracy through enhanced laboratory and imaging assessments, as emphasized by numerous studies.[5-9]

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The systemic immune-inflammation index (SII) is currently used as a marker of systemic inflammatory response across various diseases. The SII serves as a predictive and prognostic marker, derived from complete blood count (CBC) parameters, [platelet count × neutrophil count/lymphocyte count (P × N/L)] in peripheral blood. It is easily accessible, cost-effective, and widely used in oncological and chronic inflammatory conditions.

The SII was initially developed by Hu et al.[10] in a retrospective study involving 133 hepatocellular carcinoma patients between 2005 and 2006. Its applicability was later confirmed in a prospective study of 123 patients between 2010 and 2011, establishing the SII as an independent prognostic marker in the postoperative period. Moreover, the prognostic value of SII has been explored in gynecologic cancers, including endometrial, cervical, and epithelial ovarian cancers, with several studies available in the literature.[11-13]

Studies have shown that neutrophilia and lymphopenia are indicators of systemic inflammation, and that an increase in platelet count enhances inflammation due to the active secretion of inflammatory mediators by platelets.[14,15] In light of this data, it is evident that the SII is a reliable marker for indicating inflammation. Thus, we hypothesize that detecting the inflammatory changes associated with adnexal torsion using the SII would facilitate the diagnosis of suspected torsion cases, thereby preventing treatment delays and reducing the risk of organ dysfunction or loss. The aim of this study was to evaluate the efficacy of SII in preventing diagnostic and therapeutic delays in adnexal torsion and mitigating the risk of organ dysfunction or loss.

METHODS

In our retrospective observational study, we identified all patients who presented to the emergency department with suspected torsion and were subsequently diagnosed with torsion through surgery between 2012 and 2022. The control group consisted of patients who presented with pelvic pain, were diagnosed with benign adnexal masses upon examination, and underwent surgical procedures for these masses, with no evidence of adnexal torsion. Patients with chronic inflammatory diseases, such as inflammatory bowel disease or autoimmune disease or who had concurrent acute inflammatory processes, including acute pneumonia or acute gastroenteritis, those who were pregnant, with a history of endometriosis, who were previously diagnosed with premalignant or malignant lesions, who had pelvic inflammatory disease or tubo-ovarian abscess and those whose data could not be accessed were excluded in both groups.

Ethics committee approval for our retrospective observational study was received from the University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Impact Committee (approval number: 2022-12-06, date: 20/06/2022).

Preoperative CBC parameters at the initial presentation of these patients were retrieved from the hospital database. In addition, socio-demographic characteristics, surgical details, and pathology results were collected. Absolute neutrophil, lymphocyte, and platelet counts, as well as neutrophil-lymphocyte ratio (NLR) and SII were calculated. Comparisons were subsequently performed to assess the significance of inflammatory hematologic parameters and SII between the torsion and control groups.

Statistical Analysis

Statistical analyses were conducted using SPSS for Windows, version 20.0 (IBM Inc., Armonk, NY, USA). Variables with a normal distribution between the two groups were compared using the Paired samples t-test, while the Mann-Whitney U test was employed for variables that did not follow a normal distribution. In addition, the cut-off values, sensitivity, and specificity of white blood cells (WBC), NLR, and SII for diagnosing torsion were determined using receiver operating characteristic (ROC) curve analysis. Continuous variables are reported as mean ± standard deviation, and a p-value of <0.05 was considered statistically significant.

RESULTS

Based on our exclusion criteria, 210 patients diagnosed with torsion were included in our study (Table 1) and the control group consisted of 200 women who were confirmed not to have had torsion. The age and parity values of both groups were subjected to statistical analysis and there was no significant differences in the age and parity distributions between the groups. Descriptive statistics for the patients in both groups are presented in Table 2.

Analysis of the torsion group revealed that 75% of cases (n=157) occurred during the reproductive period, 10% (n=21) during childhood/adolescence, and 15% (n=32) during the postmenopausal period (Table 2).

In the control group, 70% of cases (n=140) were in the reproductive period, 8% (n=16) were in childhood/adolescence, and 22% (n=44) were in the postmenopausal period (Table 2). The available data indicate that the groups were distributed homogeneously.

In the torsion group, the most common presenting complaint was abdominal pain reported by 83% of women (n=174), 10% (n=21) experienced a feeling of pelvic pressure, 2%

Table 1. Exclusion criteria and number of patients

Exclusion criteria	Number of patients (n)
Cases of torsion during pregnancy	19
Cases of torsion with endometriosis/ endometrioma	7
Previously diagnosed with premalignant/ malignant lesions	3
Pelvic inflammatory disease or tuboovarian abscess	7
Simultaneous surgery for torsion and other causes of acute abdomen	10
Cyst rupture in addition to torsion	19
Patients whose data could not be accessed	20
Total	**85**

(n=4) had abnormal uterine bleeding, and 5% (n=11) were asymptomatic (Table 2).

In cases operated on for torsion, detorsion was performed in 80% (n=168) of instances, salpingo-oophorectomy in 10% (n=21), oophorectomy in 7% (n=15), and salpingectomy in 3% (n=6) (Table 2).

In the torsion group, the average leukocyte count was 12,087/μL, the average neutrophil count was 9,643/μL, the average lymphocyte count was 1,684/μL, and the average platelet count was 264,000 cells/mL. In the control group, these values were 8,185/μL, 4,899/μL, 2,265/μL, and 270,000 cells/mL, respectively. The average SII value was 1,898.5 in the torsion group, compared to 618.6 in the control group (Table 3). A significant difference was found between the two groups in terms of average WBC, lymphocyte, neutrophil, and SII values (p<0.0001).

Upon categorizing the control group cases based on their pathology results, statistical analysis revealed no significant differences in the mean values of leukocytes, neutrophils, lymphocytes, platelets, SII across the subgroups (Table 4). In the present study, a significant difference was identified between the median WBC counts of individuals in the control group (7,650/μL) and those in the torsion group (11,900/μL) (p<0.001) (Table 5). ROC curve analysis showed that the cut-off value for WBC in adnexal torsion was 9,225/μL. This value had a specificity of 76% and a sensitivity of 77% for torsion (Figure 1).

A significant difference was observed between the median NLR values of the control group (2.09) and the patients in the torsion group (5.87) (p<0.001) (Table 5). ROC curve analysis showed that the cut-off value for NLR in adnexal torsion was 3.06, with a specificity of 80% and a sensitivity of 79% for torsion (Figure 1).

Finally, a significant difference was observed between the median SII values of the patients in the torsion group (1464.2) and the individuals in the control group (566.2) (p<0.001) (Table 5). The cut-off value for SII in torsion cases was 821.0 with a sensitivity of 82% and a specificity of 81% for the diagnosis of adnexal torsion (Figure 1).

DISCUSSION

Adnexal torsion is a gynecological emergency that can affect women of all ages and may result in severe comorbidities if diagnosis is delayed. Although history, physical examination, laboratory tests, and imaging studies contribute to the diagnostic process, definitive diagnosis of adnexal torsion still relies on intraoperative visualization of the torsioned adnexa. However, not all suspected cases necessitate surgical

Table 2. Common descriptive characteristics of patients

		Adnexal torsion group, (n=210)	Control group, (n=200)	p
Age				
Mean ± SD		27±9	32±5	p=0.064
Minimum-maximum		6-52	13-69	
Parity (mean)		2	3	p=0.091
Life cycle stage	Reproductive stage	157	140	
	Childhood - adolescent stage	21	16	
	Postmenopausal stage	32	44	
		Number of patients (n)	**(%)**	
Symptom	Abdominal and pelvic pain	174	83	
	Pelvic pressure	21	10	
	Abnormal uterine bleeding	4	2	
	Asympomatic	11	11	
Operation name	Detorsion	168	80	
	Salpingo-oophorectomy	21	10	
	Oophorectomy	15	7	
	Salpingectomy	6	3	

SD: Standard deviation

Table 3. Mean leukocyte, neutrophil, lymphocyte, platelet and SII values in adnexal torsion and control groups

	Leukocyte	Neutrophil	Lymphocyte	Platelet	SII
Adnexal torsion (mean)	12,087.5	9643.7	1684.2	264,000	1898.5
Control group (mean)	8,185.7	4899.4	2265.4	270,000	618.6
p	<0.0001	<0.0001	<0.0001	0.084	<0.0001

SII: Systemic immune-inflammation index

Table 4. Mean leukocyte, neutrophil, lymphocyte, platelet and SII values according to pathology results of the cases in the control group

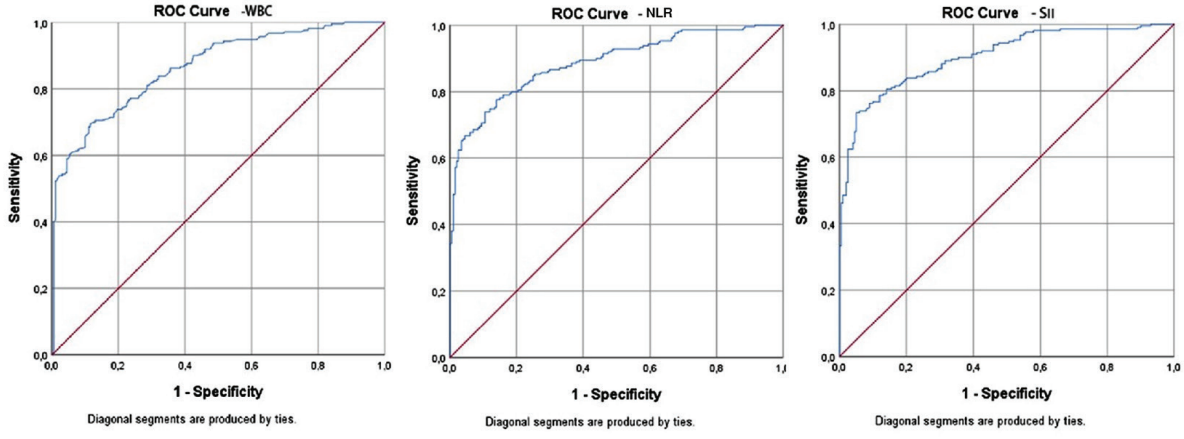
Pathology result	Leukocyte	Neutrophil	Lymphocyte	Platelet	SII
Follicle cyct	7721.3	5028	2099.7	257.4	671.1
Benign serous cyst	7877.7	4963.7	2264.4	280.9	648.5
Benign mucinous cyst	10760.8	4609.1	2510	277.2	525.7
Dermoid cyct	7592.6	4838.6	2210.6	280.2	638.0
Cystadenofibroma	8053.0	5102.3	2486.9	279.6	568.5
Fibroma	7984	4764	2566	202.4	364.3
p	**0.355**	**0.508**	**0.058**	**0.091**	**0.050**

SII: Systemic immune-inflammation index

Table 5. Analysis of WBC, NLR and SII values of torsion and control group

Groups	n	Mean ± SD leukocyte count	Min.-max. leukocyte count	Median leukocyte count	p
Control	200	8,186±1,500	1,070-27,043	7,650	<0.001
Torsion	210	12,087±2,500	5,700-32,000	11,900	
		Mean ± SD NLR	**Min.-max. NLR**	**Median NLR**	
Control	200	2.16±0.25	0.5-4.6	2.09	<0.001
Torsion	210	6.28±1.28	1.2-12	5.87	
		Mean ± SD SII value	**Min.-max. SII value**	**Median SII value**	
Control	200	618.6±23	103.9-2008.3	566.2	<0.001
Torsion	210	1898.5±91	307.8-8022.9	1464.2	

WBC: White blood cells, NLR: Neutrophil-lymphocyte ratio, SII: Systemic immune-inflammation index, SD: Standard deviation, Min.: Minimum, Max.: Maximum



Marker	AUC (95%)	Cut-off value	p	Sensitivity (%)	Specificity (%)
WBC	0.865 (0.831-0.899)	9,225	<0.0001	77.2	76.5
NLR	0.887 (0.856-0.919)	3.06	<0.0001	79	80
SII	0.903 (0.874-0.932)	821.03	<0.0001	82	81

Figure 1. Cut-off value of WBC, NLR and SII values of the patients included in the study according to ROC curve analysis and sensitivity-specificity ratio of this value

WBC: White blood cells, NLR: Neutrophil-lymphocyte ratio, SII: Systemic immune-inflammation index, ROC: Receiver operating characteristic, AUC: Area under the curve

intervention, as this could lead to unnecessary procedures. Therefore, accurate identification of true cases of adnexal torsion is essential. Also, in the case of acute torsion, the possibility that the time between the patient's diagnosis and surgery may result in organ dysfunction and resection has led clinicians to search for more specific and effective diagnostic methods such as WBC, NLR, SII and further imaging methods.

Recent studies have predominantly investigated the predictive and diagnostic capabilities of laboratory and imaging tests in suspected cases of adnexal torsion.[7,16] Despite evidence indicating that these methods can aid in diagnosis, there remains a lack of consensus and standardization concerning their clinical applicability.

Adnexal torsion predominantly occurs during the reproductive years and rarely affects women in the postmenopausal period.[17,18] Consistent with existing literature, 75% of the patients with adnexal torsion in the present study were in the reproductive age group, 10% were in childhood or adolescence, and 15% were postmenopausal.

Detorsion was performed in 80% of patients in the current study undergoing surgery for adnexal torsion. This result aligns with contemporary approaches to managing torsion cases, as reported in recent literature.[19-21] Furthermore, salpingo-oophorectomy was conducted in approximately 10% of patients. The reason for this was that the majority of patients who underwent salpingo-oophorectomy were in the postmenopausal period.

Current research focuses on the use of laboratory and imaging modalities to diagnose adnexal torsion. Studies have investigated the effectiveness of Doppler ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) in this context. Béranger-Gibert et al.[22] reported that MRI exhibited a sensitivity of 77% and a specificity of 86% for detecting adnexal torsion. Conversely, Lee et al.[23] found MRI sensitivity to be 77% with a specificity of 100%, while Mandoul et al.[24] identified CT as having 97% sensitivity and 81% specificity. Bar-On et al.[25] reported a Doppler ultrasound sensitivity of 43% and specificity of 91%, whereas Lee et al.[26] noted a sensitivity of 87% for Doppler ultrasound. Although these studies provide promising insights, their sample sizes are limited. Furthermore, the cost, accessibility, applicability, and subjective interpretation of MRI, CT, and Doppler ultrasound pose challenges to their widespread use, particularly in developing and underdeveloped regions.

The limitations associated with imaging tests have led researchers to explore alternative diagnostic tools that offer greater objectivity, affordability, and accessibility, while maintaining comparable effectiveness. Recent studies have highlighted the clinical relevance of SII in a range of gynecological and non-gynecological malignant and inflammatory conditions.[27-29] Numerous studies have shown the NLR to be a significant marker of inflammation in adnexal torsion.[7-9,30] A retrospective study assessing NLR's diagnostic performance identified a cut-off value of 2.44, yielding a sensitivity and specificity of 70%.[31] Another study reported an NLR cut-off value of 3.35, with sensitivity of 62% and specificity of 86% for diagnosing torsion.[32] In our study, the average NLR values were significantly higher in the torsion group compared to the control group. The cut-off value for NLR in our analysis was lower than previously reported at 3.06, with sensitivity of 80% and specificity of 79%.

Elevated WBC count is a well-established marker of inflammation, as demonstrated in previous studies of adnexal torsion.[5,33] In the present study, the population WBC count was significantly higher in the torsion group compared to the control group, with 70% of cases in the torsion group exhibiting leukocytosis. Chiou et al.[34] reported leukocytosis in 64% of torsion cases. We identified a WBC cut-off value of 9,225/μL for diagnosing adnexal torsion, which demonstrated 77% sensitivity and 76% specificity. Additionally, Ercan et al.[8], in a retrospective analysis of 27 cases, established a WBC cut-off value of 8,800/μL, achieving 73% sensitivity and 84% specificity.

In the present study, when comparing the sensitivity and specificity of WBC, NLR, and SII for diagnosing torsion, SII demonstrated higher sensitivity and specificity compared to both WBC and NLR.This suggests that SII may be a slightly more effective biomarker than WBC and NLR in diagnosing torsion due to the inclusion of thrombocytosis as a third parameter in its calculation. Therefore using SII instead of WBC or NLR in adnexial torsion cases may give clinicians somewhat better information to make a diagnosis.

Studies have also examined the prognostic value of SII in gynecological cancers, such as endometrial, cervical, and epithelial ovarian cancers. Matsubara et al.[11] found SII to be an independent prognostic marker in endometrial cancer. A retrospective study conducted by Nie et al.[12] demonstrated that SII is an independent marker of poor progonosis in epithelial ovarian cancer. Huang et al.[13] showed that in cervical cancer, SII is a strong marker of post-surgical prognosis, and high levels of SII indicated poor prognosis. Furthermore, in studies conducted in the field of obstetrics, Tanacan et al.[35] identified SII as a predictor of poor neonatal outcomes in cases of premature preterm rupture of the membranes. Keles et al.[36] found SII to be an effective marker in predicting the spectrum of placenta accreta in cases of placenta previa. In our study, we found that SII demonstrated an 82% sensitivity and an 81% specificity in diagnosing adnexal torsion, suggesting its potential applicability in this clinical setting. The difference between the torsion group and the control group in WBC, NLR and SII levels can provide information to clinicians about whether the masses are torsioned and also inflammatory proceses of the masses before the operation.

Even in low resource settings SII can be an accessible and efficent way to help diagnose ovarion torsion. The results of this study suggest that clinicians may have a firmer diagnosis of ovarian torsion with a single blood test that may shorten the process between diagnosis and surgery, with the attendant proven benefits. Integrating SII into the diagnostic algorithm may prevent loss of time during the diagnostic process, which may provide better surgical outcomes such as reducing resectional proceses and better reproductive results in the future. This would all contribute to better patient outcomes.

Study Limitations

The limitations of our study were mainly represented by its retrospective nature and dependency on the hospital database to gain patient data.

CONCLUSION

This study, which included a larger cohort of torsion cases compared to previous studies, is the first to investigate the association between the SII and adnexal torsion. We determined that SII, a cost-effective, straightforward, and readily accessible inflammatory marker derived from CBC parameters, could be advantageous in the diagnosis of adnexal torsion. Further large scale, prospective studies may provide additional evidence about the diagnostic effectiveness of SII in case of adnexal torsion.

Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee of the University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital (approval number: 2022-12-06, date: 20/06/2022).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Concept: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Design: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Data Collection or Processing: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Analysis or Interpretation: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Literature Search: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G., Writing: D.E.A., Y.C., T.Ö.A., Ö.D.S., H.G.

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Original Article

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The Association Between C-Reactive Protein and the Duration of the Latent Phase of Labor in Women with Term Premature Rupture of Membranes

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ABSTRACT

Purpose: Intrauterine inflammation in the term period of pregnancy may be an important etiological factor in the occurrence of premature rupture of membranes. C-reactive protein (CRP) is one of the first mediators to rise in the inflammatory process. In this study, the association between CRP blood levels in women who gave birth at term on the duration of the latent phase of labor was investigated.

Methods: Fifty pregnant women who met the study criteria, were older than 18 years, had spontaneous rupture of membranes at 36 weeks and later, and had vaginal delivery were included. Records with missing data, patients who underwent cesarean section, those with non-spontaneous membrane rupture, patients showing signs of chorioamnionitis (fever >38 °C, leukocytes >15,000 mm^3, maternal tachycardia >100 bpm, fetal tachycardia >160 bpm, foul-smelling vaginal discharge, and/or uterine tenderness), and other causes that could elevate CRP were excluded. CRP was evaluated in those pregnancies that presented with spontaneous rupture of membranes at term. All patients were observed until birth by labor follow-up.

Results: There was no significant difference between the two groups in terms of active phase of labor, birth weight and 5' APGAR of the baby. The duration of the latent phase of labor was 661±298 minutes for group A and 347±219 minutes for group B (p=0.001).

Conclusion: In this study, the latent phase was found to be significantly shorter in the patient group with high CRP. CRP elevation may be a marker showing that the latent phase of labor is likely to be shorter and suggests a higher degree of inflammatory activity.

Keywords: Premature rupture of membranes, C-reactive protein, labor

INTRODUCTION

In 2-3% of pregnant women, the amniotic sac may rupture spontaneously before 37 weeks of gestation, which may occur because of infection or may cause infection in the mother and fetus afterwards. Premature rupture of membranes (PROM) occurs in 4.5-7.6% of all deliveries. PROM is a serious obstetric problem that may increase the risk of prematurity, cord prolapse, hypoxia, and infection that may affect the fetus, as well as risks that may concern the mother, such as increased cesarean section rate and choriodecidual infection.[1] Diagnosis of PROM may be made in 90% of cases by traditional methods, such as patient history, physical examination, nitrazine test, and fern test.[2,3] In cases where PROM is prolonged or amniotic fluid loss is intermittent, amniotic fluid flow and amniotic fluid pooling may not be observed in the vagina. In some cases, the liquid pooled in the vagina is contaminated with blood, urine, semen, meconium, vaginal discharge and vaginal douching. These can cause false positives and false negatives in test results. Currently, there is no defined gold standard test for the detection of PROM. Premature fetal membrane rupture, which occurs in 5-10% of all deliveries, has been associated

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with an increase in intrauterine infections, thus increasing both maternal and perinatal mortality and morbidity.

The number of leukocytes increases during pregnancy as well as during infection. Since the leukocyte count is also affected by some factors, such as stress and physical activity, it is not a reliable test for detecting infection in preterm labor. Fever, which is also a sign of infection, increases in the advanced stage of the infection. C-reactive protein (CRP) is a very sensitive acute phase reactant and can be used in the early investigation of inflammation due to its short half-life. CRP is primarily released from the liver as a result of cytokine action triggered by various infections. These cytokines include interleukin-1 (IL-1), IL-6, and tumor necrosis factor.[4] Due to its rapid synthesis and breakdown, it is a good indicator of the degree of inflammatory activity.[5] In human serum in the absence of inflammation, CRP is present at a low level of up to 0.5 mg/dL. Serum levels begin to rise as early as six hours after the onset of inflammation and can increase 24-fold within 24 hours. Even at very highest levels, CRP catabolism remains constant, meaning the only factor determining serum CRP levels is the rate of synthesis by hepatocytes. Due to its short half-life, CRP levels rapidly return to normal once inflammation subsides. Other advantages of CRP as an inflammatory marker include its ability to be measured in stored serum and its resistance to interference from serum proteins.[5] It has been suggested that CRP concentrations >1 mg/dL (10 mg/L) indicate clinically significant inflammation while concentrations between 0.3 and 1 mg/dL (3 and 10 mg/L) that is minor CRP elevation, indicate what is commonly referred to as low-grade inflammation.[6]

In the present study, we investigated the association between CRP levels and the latent phase of labor. Variables taken into account included demographic and clinical characteristics of the women including CRP level. We also investigated the relationship between outcomes, phases of labor and fetal effects on the newborn.

METHODS

This study was carried out in University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital, Clinic of Obstetrics and Gynecology between 2013 and 2014. The University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital Ethics Committee approval was obtained for the study (approval number: 319, date: 22.04.2014).

Inclusion criteria were over the age of 18 years, pregnant women who completed the 36th gestational week according to the last menstrual date or first trimester ultrasound measurements, the delivery was terminated vaginally with spontaneous PROM, and the files were complete.

Exclusion criteria were having incomplete records, patients terminated with caesarean section, and non-spontaneous rupture of membranes. In addition any patient with evidence of other causes of inflammation, such as showing signs of chorioamnionitis, which included fever >38 °C, leukocytes >15,000 mm^3, maternal tachycardia (>100 bpm), fetal tachycardia (>160 bpm), foul-smelling vaginal discharge, and/or uterine tenderness, and other causes that could elevate CRP were excluded from the study.

Patients who met the inclusion criteria and whose consented were selected from the patient files. The patient's information from these files, and hemogram (HMG), hematocrit (HCT), white blood cell count (WBC) and CRP level results from laboratory tests were recorded. In addition, information such as the patient's gravitational status, body mass index, any comorbidities, and cigarette and/or alcohol use were recorded. Information such as the birth weight, 5' APGAR score, and active phase and latent phase of labor durations were recorded. The latent phase was defined as the period until the cervical dilation was 4 cm and the effacement was 80%,[7] when labor contractions were detected in pregnant women above 36 weeks of age who were admitted to our hospital with the diagnosis of PROM. The period from cervical dilation to 4 cm and effacement 80% to delivery was defined and measured as the active phase. Those with a CRP of 5 mg/L or below were defined as group A, and those with a CRP above 5 mg/L were defined as group B.

Statistical Analysis

SPSS, version 17.0 was used for statistical calculations (IBM Inc., Armonk, NY, USA). The Kolmogorov-Smirnov test was used to evaluate the normal distribution of continuous variables. The analysis of normally distributed data was performed with the independent t-test, and analysis of non-normally distributed data was performed with the Mann-Whitney U test. Chi-square was used to compare categorical variables and Fisher's exact test was used for appropriate data. P-values <0.05 were considered statistically significant.

RESULTS

In this study, 50 patients diagnosed with PROM between 2013 and 2014 were evaluated. There were 23 patients in group A with a CRP higher than 5 mg/L, and 27 patients in group B with a CRP lower than 5 mg/L. The clinical features of the two groups are compared in Table 1. No significant differences were found between the groups for demographic, pregnancy history or for hematology parameters (HMG, HCT and WBC).

In Table 2, the comparison of birth phases, birth weight and 5' APGAR are shown. There was no significant difference between the two groups in terms of duration of active phase of labor, birth weight and 5' APGAR of the baby. The duration of the latent phase of labor was 661±298 minutes for group A and 347±219 minutes for group B (p=0.001). The latent phase duration was significantly shorter in patients in group B.

DISCUSSION

In many studies, the role of intrauterine inflammation and infection in preterm labor and last trimester pregnancy with PROM has been investigated. However, recently, there has been increased evidence that subclinical intrauterine inflammatory cytokine response may be very important in early pregnancy as well.[8] It is hypothesized that in intrauterine inflammation in the very early period of pregnancy, the fetus exacerbates the

Table 1. Comparison of clinical features of group A and group B

	Group A CRP >5 mg/L (n=23)	Group B CRP <5 mg/L (n=27)	p	RR (95% CI)
Age	26.1±4.8	28.4±6.6	0.161	
Gravidity	1.7±1.1	2.6±2.2	0.084	
Parity	0.6±1.1	1.6±1.3	0.142	
Gestational age	37.1±0.7	37.7±0.8	0.698	
BMI	27.5±3.5	22.1±2.8	0.496	
Smoking	2 (0.7)	3 (11.1)	0.777	0.7 (0.1-5.0)
Alcohol	1 (4.3)	1 (3.7)	0.98	1.1 (0.1-17.7)
Comorbidities	3 (13.6)	4 (14.8)	0.407	0.9 (0.2-3.6)
HMG	11.3±1.4	11.6±0.9	0.394	
HCT	33.9±4.1	35.1±2.8	0.238	
WBC	10.4±2.0	12.1±3.1	0.123	

Data are shown as mean ± standard deviation or n (%). BMI: Body mass index, HMG: Hemogram, HCT: Hematocrit, WBC: White blood cell, CRP: C-reactive protein, CI: Confidence interval, RR: Relative risk

Table 2. Comparison of duration of latent and active phases of labor and fetal outcomes between groups A and B

	Group A CRP >5 mg/L (n=23)	Group B CRP <5 mg/L (n=27)	p
Latent phase (min)	661±298	347±219	**0.001**
Active phase (min)	460±335	401±287	0.904
Birth weight (g)	3200±485	3212±378	0.926
5' APGAR	8.8±0.2	8.9±0.5	0.45

CRP: C-reactive protein, min.: Minute

event by increasing the subclinical inflammatory response. In a study, it was suggested that with high CRP value (>110 ng/mL) detected during genetic amniocentesis (at 16-20 weeks of gestation), increased the probability of delivery before 34 weeks of gestation with a sensitivity of 80.8% and a specificity of 69.5%.[9] Ozer et al.[10] reported that when the CRP value in the amniotic fluid was above the cut-off value of 0.65 mg/L, its sensitivity in predicting delivery before 37 weeks of gestation was 92.9% and specificity was 78.7%. However, Tarim et al.[11] in a larger cohort showed that the amniotic fluid CRP value was not significantly different between groups with term and preterm birth in pregnant women (9.3% and 9.9%) whose preterm birth frequency was similar to the previous study. In one study, a correlation was found between a CRP level higher than 1.5 mg/dL and a short latent period in PPROM.[12] In the present study, the latent phase duration was significantly shorter in the group with high CRP. In a study conducted in patients with CRP >1.5 mg/dL, high maternal blood levels of CRP were found to be associated with triggering of preterm birth.

It has been reported that patients with a threat of premature birth with high CRP levels did not respond to tocolytic therapy, and patients with a threat of premature birth with normal CRP levels responded well to tocolytic therapy.[13]

There is no standard CRP value that can be considered normal. However, individuals with CRP levels <1 mg/L are thought to be at the lowest risk of some form of inflammation.[14] The detection limit of traditional assays developed to aid in the diagnosis of infectious or inflammatory diseases ranges from 3 to 5 mg/L. Several publications support or conclude that CRP is an indicator of preterm labor and chorioamnionitis.[15-18]

Recent studies support the role of infection in the etiology of PROM. The cause-effect relationship between PROM and infection is intertwined. So, while choriodecidual infection is shown as the most important cause in the etiology of PROM. However, if delivery does not occur after a certain period, PROM itself may result in choriodecidual infection. The longer the latent period in PROM, the higher the risk of this infection.[19] PROM remains one of the most troubling issues in obstetrics, as it increases maternal and fetal morbidity and mortality. Many studies have been conducted into optimal clinical management in PROM, and it is generally accepted that the gestational week is a major determinant of type of management, together with whether the fetus has reached the viability limit, and the maternal and fetal obstetric balance. The most important parameter determining perinatal complications in these cases is the week of gestation. Tocolysis is not indicated in pregnancies that have completed the 34th

gestational week, and when there is thought to be sufficient fetal lung development for the fetus to survive in the external environment. There are always some exceptions to this, such as if cervical dilation has started above 36 weeks of gestation, immediate delivery of the fetus is the recommended approach. In other cases, a period of waiting may be appropriate, but this waiting period is limited to 12 hours in many centers. It has been proven that obstetric balance is negatively impaired in prolongation of PROM, that is, maternal and fetal complication rates increase.[20] Induction of labor is recommended in cases where spontaneous labor or uterine contractions do not start after 12 hours.

The purpose of induction is to deliver vaginally whenever possible and to avoid caesarean delivery. Although oxytocin infusion is the most used approach for induction, there are reports that using oxytocin without cervical softening increases caesarean rates in cases with inappropriate cervix. In such cases, preinduction to prepare the cervix for delivery shortens the delivery time and increases the success of vaginal delivery.

Study Limitations

The limitations of our study were that it was conducted retrospectively with a small number of cases and the evaluation of a single mediator, CRP, with only two groups. The results should be validated with prospective studies with a larger number of cases, more careful division of cases by CRP level grouping, for example <3, 3-10 and >10 mg/dL and evaluating more parameters.

CONCLUSION

In this study, it was shown that CRP levels above 5 mg/dL were associated with significant shortening of the latent phase of labor. In clinical practice, measuring blood CRP may help in predicting premature birth, considering its effect on the duration of birth.

Ethics

Ethics Committee Approval: The University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital Ethics Committee approval was obtained for the study (approval number: 319, date: 22.04.2014).

Informed Consent: Retrospective study.

Authorship Contributions

Concept: R.A., Design: R.A., Data Collection or Processing: O.A., Analysis or Interpretation: F.Ş., İ.Ö., Literature Search: R.A., F.Ş., Writing: S.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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Original Article

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Clinical Outcomes of Isthmocele Repair Methods: A Comparison of Transvaginal, Hysteroscopic, and Laparoscopic Approaches

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ABSTRACT

Purpose: To compare the clinical and surgical outcomes, including efficacy and complication rates, of transvaginal, hysteroscopic, and laparoscopic surgical methods for isthmocele repair after cesarean delivery.

Methods: This retrospective observational study included 186 women aged 18-49 treated for isthmocele at University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital between April 30, 2020, and August 1, 2023. Patients underwent transvaginal (n=60), hysteroscopic (n=42), or laparoscopic (n=84) surgical methods. The primary outcomes were changes in myometrial thickness, isthmocele size, and clinical symptoms including; dysmenorrhea, abnormal uterine bleeding (AUB), dyspareunia, chronic pelvic pain). Secondary outcomes included operative duration, hospital stay, recurrence rates, and complications.

Results: Preoperative isthmocele size was significantly larger in the transvaginal group (10.5±3.2 mm) compared to the hysteroscopic (6.5±2.1 mm) and laparoscopic (10.8±3.5 mm) groups ($p<0.001$). Postoperative reductions in isthmocele size were most pronounced in the transvaginal group (-10±3.1 mm, $p<0.05$). Myometrial thickness increased significantly in all groups ($p<0.05$) and more thicker myometrium was achieved via the transvaginal approach (+9.4±1.5 mm, $p<0.001$). Clinical symptoms, including dysmenorrhea and AUB, improved significantly in all groups ($p<0.05$). The hysteroscopic method had the shortest hospital stay (1 day for all of patients), whereas the laparoscopic method required the longest operation times (141.4±25.2 minutes, $p<0.05$). Recurrence rates were low and comparable among the groups ($p>0.05$).

Conclusion: The transvaginal method demonstrated superior outcomes in reducing isthmocele size and increasing myometrial thickness, making it suitable for severe cases. advantageous of the hysteroscopic method was shorter hospital stays, while the laparoscopic method were effective for complex defects requiring reconstruction. These findings provide clinical insights into selecting the most appropriate surgical method based on patient characteristics.

Keywords: Isthmocele, transvaginal repair, hysteroscopic surgery, laparoscopic surgery, cesarean section complications

INTRODUCTION

The global increase in cesarean section rates, from 7% in 1990 to 21% currently, and reaching 62.4% in Turkey, has been associated with a rising prevalence of uterine scar defects such as isthmocele, emphasizing the necessity for further research to elucidate the prevalence of post-cesarean complications and their implications for women of reproductive age.[1-3]

Isthmocele is a cesarean-related defect in the anterior uterine wall, characterized by a sac-like indentation measuring at least 2 mm in depth, as defined by the modified Delphi procedure.[4] This condition is typically diagnosed using transvaginal ultrasound or saline infusion sonography, which provide precise measurements of the defect.[5] Histopathological studies reveal that isthmocele consists of fibromuscular stromal tissue interspersed with endocervical, endometrial, and isthmic mucosa, often accompanied by thick-walled blood vessels.[6]

The prevalence of isthmocele ranges from 30% to 74% among women with prior cesarean deliveries.[7-9] Clinical manifestations include abnormal uterine bleeding (AUB), dysmenorrhea, chronic pelvic pain (CPP), dyspareunia, and secondary infertility, with the defect potentially impairing sperm motility and embryo implantation.[10,11]

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Treatment options include hormonal therapy and various surgical approaches such as hysteroscopic, laparoscopic, transvaginal, laparotomic, and robotic procedures.[12] While surgical intervention effectively alleviates symptoms in over 80% of patients, its impact on fertility outcomes and obstetric complications in asymptomatic cases remains unclear.[13,14]

Although multiple surgical techniques are available for isthmocele repair, comparative data on their relative efficacy and safety are limited. This retrospective study seeks to address this gap by systematically comparing the outcomes of transvaginal, hysteroscopic, and laparoscopic techniques. The analysis focuses on changes in myometrial thickness and isthmocele dimensions, operative duration, hospital stay, recurrence rates, and clinical symptom improvement. By providing a comprehensive assessment, this study aims to guide clinicians in selecting the most appropriate surgical method for isthmocele repair based on patient characteristics.

METHODS

Study Design

This retrospective observational study was conducted at the Department of Obstetrics and Gynecology, University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital. Surgical records of women who underwent isthmocele repair between April 30, 2020, and August 1, 2023, were reviewed. Patients were followed for at least one year postoperatively to evaluate surgical outcomes, focusing on symptoms such as dysmenorrhea, AUB, dyspareunia, and CPP. Outcomes related to infertility, such as fertility status or subsequent pregnancy outcomes, were not assessed in this study, as they were beyond the scope of our investigation. Written informed consent was obtained from all participants.

Potentially influential factors, including surgeon experience, patient comorbidities (e.g., obesity, diabetes, hypertension), and differences in postoperative care (e.g., follow-up schedules, use of medications, or rehabilitation protocols), were not assessed in this study. These unmeasured confounding variables may have influenced the outcomes, such as changes in isthmocele size, myometrial thickness, and symptom relief. The absence of these variables represents a limitation that should be considered when interpreting the results. Future studies addressing these factors could provide a more comprehensive understanding of the determinants of surgical success.

Hypothesis

The primary hypothesis is that transvaginal, hysteroscopic, and laparoscopic surgical methods differ in terms of their efficacy in reducing isthmocele size and increasing myometrial thickness.

Study Population

A total of 268 medical records were reviewed. After applying inclusion and exclusion criteria, 186 patients were included in the final analysis. Of these, 60 patients underwent transvaginal repair, 42 underwent hysteroscopic repair, and 84 underwent laparoscopic repair.

Research Question

How do transvaginal, hysteroscopic, and laparoscopic surgical methods compare in their effects on postoperative changes in isthmocele size, myometrial thickness, and symptom relief?

Outcomes

- Primary outcomes: Operation time, complication rates, changes in isthmocele size, and myometrial thickness.

- Secondary outcomes: Improvement in symptoms, including dysmenorrhea, AUB, dyspareunia, and CPP.

Inclusion Criteria

Women aged 18-49 years with a history of at least one cesarean delivery were included in the study. Eligible patients had a diagnosis of isthmocele confirmed by transvaginal ultrasound or saline infusion sonography and reported symptoms such as AUB, dysmenorrhea, dyspareunia, or CPP. Patients were required to be available for at least one year of follow-up after surgery and to have provided signed written informed consent.

Exclusion Criteria

Patients were excluded if they had incomplete medical records (n=9), uterine anomalies (n=4), or a history of prior uterine surgeries (n=5). Additional exclusion criteria included pregnancy during the study period (n=9), previous non-surgical treatments (n=15), or a history of isthmocele surgery within the last year (n=19). Patients with ovulatory dysfunction (n=2) or endometritis (n=2) were also excluded.

Surgical Techniques

Transvaginal repair: Transvaginal repair is routinely performed under spinal or general anesthesia. A transverse incision is made on the anterior vaginal wall to expose the isthmocele. The isthmocele sac is identified using a hysterometer, which guides the precise excision of the defect. Scar tissue is excised, and the defect is repaired in two layers using absorbable sutures (Vicryl, polyglycolic acid 910). The vaginal mucosa is then closed with continuous sutures to ensure optimal healing.

Hysteroscopic repair: Hysteroscopic repair is performed under sedation or general anesthesia. A hysteroscope is inserted into the uterine cavity to visualize the isthmocele. Fibrotic tissue at the base of the defect is resected using a monopolar loop. The edges are smoothed to improve drainage of menstrual blood and alleviate symptoms.

Laparoscopic repair: Laparoscopic repair is conducted under general anesthesia. After placing trocars, the isthmocele sac is identified with the aid of a hysterometer, which facilitates precise localization of the defect. Once identified, the scar tissue is excised, and the myometrial defect is repaired in two layers using barbed absorbable Vicryl sutures (polyglycolic acid 910). Adhesion barriers are routinely applied to minimize postoperative adhesions.

Data Collection

Data were retrospectively collected from medical records, including demographic data, obstetric history, and laboratory results. Pre- and postoperative isthmocele dimensions and

myometrial thickness were measured using calibrated B-mode transvaginal ultrasound by two independent obstetricians to ensure consistency. Symptom changes, including AUB, dysmenorrhea, dyspareunia, and CPP, were evaluated based on patient reports. Operative times, hospital stays, and surgical complications were documented.

Definitions

- Isthmocele size: Measured as the depth in millimeters from the apex of the defect to the point of intersection with the endometrium.

- Myometrial thickness: Measured as the thickness in millimeters from the apex of the defect to the parametrium.

- Abnormal uterine bleeding: Defined according to the criteria set by the International Federation of Gynecology and Obstetrics, which includes heavy menstrual bleeding, intermenstrual bleeding, and other deviations from normal menstrual patterns.

- Chronic pelvic pain: Defined as non-cyclic pain of at least six months' duration occurring in the pelvis, severe enough to cause functional disability or require medical care. Patients were interviewed to assess the presence and severity of CPP.

- Dyspareunia and dysmenorrhea: Assessed through patient interviews. Dyspareunia was defined as pain during intercourse, while dysmenorrhea was defined as painful menstruation.

Ethical Approval

This study was conducted with ethical approval from the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (approval number: E-96317027-514.10-246504114, KAEK/12.06.2024.24, date: 26.06.2024). Written informed consent was obtained from all participants. All procedures adhered to the principles outlined in the Helsinki Declaration.

Statistical Analysis

Descriptive statistics, including mean, standard deviation, median, minimum, maximum, frequency, and percentage, were utilized to summarize the data. The distribution of variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Quantitative variables that were non-normally distributed and dependent were analyzed using the Kruskal-Wallis and Wilcoxon tests, respectively. For qualitative variables, dependent variables were assessed with the McNemar's test, while independent variables were evaluated using the chi-square test or Fisher's exact test when chi-square assumptions were not met. A p-value of <0.05 was considered the threshold for statistical significance across all analyses.

The receiver operating characteristic (ROC) curve and the area under the curve (AUC) value were calculated to assess the model's performance in predicting the effect of surgeries on isthmocele size reduction. An AUC value of 0.91 demonstrated high predictive accuracy. All statistical analyses were conducted using SPSS version 28.0 software.

RESULTS

Demographic and clinical characteristics: There was no statistically significant difference between the transvaginal, hysteroscopic, and laparoscopic isthmocele repair groups in terms of age, body mass index, comorbidity rate, gravida, parity, number of cesarean section, type of final cesarean section (emergency or elective), and number of living children ($p>0.05$). However, the gestational age was statistically significantly higher in the hysteroscopic, and laparoscopic groups compared to the transvaginal group ($p<0.05$). No statistically significant difference in gestational age was observed between the hysteroscopic and laparoscopic groups ($p>0.05$) (Table 1).

Hemoglobin levels: There was no statistically significant difference in pre- and post-operative hemoglobin (HGB) values and post-operative HGB decrease between the groups ($p>0.05$). In all groups, the post-operative HGB value showed a statistically significant decrease ($p<0.05$) (Table 2).

Operation and length of hospitalization: The duration of operation was statistically significantly higher in the laparoscopic group than in the transvaginal and hysteroscopic groups ($p<0.05$). There was no statistically significant difference between the transvaginal and hysteroscopic groups in terms of operation time ($p>0.05$). In addition, the length of stay was statistically significantly higher in the laparoscopic group than in the transvaginal and hysteroscopic groups ($p<0.05$). The length of stay was statistically significantly lower in the hysteroscopic group than in the transvaginal group ($p<0.05$) (Table 2).

Isthmocele depth: The preoperative isthmocele size was statistically significantly larger in the transvaginal group compared to the hysteroscopic and laparoscopic groups ($p<0.05$). There was no statistically significant difference in preoperative isthmocele size between the hysteroscopic and laparoscopic groups ($p>0.05$). Postoperative isthmocele size showed a statistically significant decrease in all groups ($p<0.05$). The reduction in isthmocele size from preoperative to postoperative period was statistically significantly greater in the transvaginal group compared to the other groups ($p<0.05$). There was no statistically significant difference in the amount of reduction in isthmocele size between the hysteroscopic and laparoscopic groups ($p>0.05$) (Table 3, Figure 1).

In the logistic regression analysis conducted for the three types of surgery, the model's ROC curve and an AUC value of 0.91 indicate that the model can predict the effect of surgeries on isthmocele size reduction with high accuracy (Figure 2).

Myometrial thickness: Preoperative myometrial thickness was statistically significantly higher in the hysteroscopic group compared to the transvaginal and laparoscopic groups ($p<0.05$). Postoperative myometrial thickness was statistically significantly higher in the transvaginal and laparoscopic groups compared to the hysteroscopic group ($p<0.05$). All groups showed a statistically significant increase in myometrial thickness postoperatively ($p<0.05$). The increase in myometrial thickness from preoperative to postoperative

period was statistically significantly greater in the transvaginal group compared to the other groups ($p<0.05$). In the laparoscopic group, this increase was statistically significantly greater than in the hysteroscopic group ($p<0.05$) (Table 3).

Dysmenorrhea: The preoperative dysmenorrhea rate in the vaginal isthmocele repair group was statistically significantly higher than in the hysteroscopic isthmocele repair group ($p<0.05$). There was no statistically significant difference in pre- and postoperative dysmenorrhea rates between the

Table 1. Demographic and clinical characteristics of transvaginal, hysteroscopic and laparoscopic isthmocele repair methods

			Transvaginal isthmocele repair (n=60)[1]	Hysteroscopic isthmocele repair (n=42)[2]	Laparoscopic isthmocele repair (n=84)[3]	p
Age	Mean ± SD		32.8±6.6	33.9±6.2	32.6±5.9	0.563[K]
	Median		33.0	33.5	33.0	
BMI	Mean ± SD		30.6±5.9	28.2±3.6	29.2±5.3	0.239[K]
	Median		30.1	27.1	29.4	
Comorbidity	(-)	n, %	45 (75.0%)	35 (83.3%)	59 (70.2%)	0.280[X²]
	(+)	n, %	15 (25.0%)	7 (16.7%)	25 (29.8%)	
Last cesarean section	Urgent	n, %	34 (56.7%)	21 (50.0%)	56 (66.7%)	0.168[X²]
	Elective	n, %	26 (43.3%)	21 (50.0%)	28 (33.3%)	
Gravidity	Mean ± SD		3.0±1.4	3.1±1.4	2.9±1.3	0.761[K]
	Median		3.0	3.0	3.0	
Parity	Mean ± SD		2.6±1.3	2.7±1.2	2.6±1.2	0.808[K]
	Median		2.0	2.0	2.0	
C-section number	Mean ± SD		2.2±0.9	2.4±1.0	2.3±1.0	0.745[K]
	Median		2.0	2.0	2.0	
Number of children living	Mean ± SD		2.5±1.0	2.6±1.1	2.5±1.0	0.819[K]
	Median		2.0	2.0	2.0	
Gestational age at last delivery	Mean ± SD		35.4±2.6	37.1±1.6	36.6±2.2	**0.002**[K]
	Median		35.9[2,3]	37.3	37.2	

[K]Kruskal-Wallis (Mann-Whitney U test), [W]Wilcoxon test, [X²]Chi-square test, [1]Difference with transvaginal isthmocele repair group $p<0.05$, [2]Difference with hysteroscopic isthmocele repair group $p<0.05$, [3]Difference with laparoscopic isthmocele repair group $p<0.05$, SD: Standard deviation

Table 2. Hemoglobin levels, surgical duration, postoperative hospitalization period and recurrence

			Transvaginal isthmocele repair, (n=60)[1]	Hysteroscopic isthmocele repair, (n=42)[2]	Laparoscopic isthmocele repair, (n=84)[3]	p
Hemoglobin						
Before the operation	Mean ± SD		11.5±1.3	11.7±1.3	11.4±1.2	0.717[K]
	Median		11.3	11.7	11.3	
After the operation	Mean ± SD		10.6±1.2	10.8±1.4	10.5±1.2	0.668[K]
	Median		10.7	10.9	10.8	
Change	Mean ± SD		-0.9±0.7	-0.9±0.8	-0.9±0.6	0.912[K]
	Median		-0.9	-1.0	-1.0	
Within-group change (p)			**0.000**[within]	**0.000**[within]	**0.000**[within]	
Operation time and stay						
Operation time (minute)	Mean ± SD		43.6±15.9	41.3±13.6	141.4±25.2	**0.000**[K]
	Median		40.0[3]	41.0[3]	144.0	
Length of stay	1 day	n, %	11 (18.3%)[2,3]	42 (100.0%)[3]	0 (0.0%)	**0.000**[X²]
	2 days	n, %	47 (78.3%)	0 (0.0%)	75 (89.3%)	
	3 days	n, %	2 (3.3%)	0 (0.0%)	9 (10.7%)	

[K]Kruskal-Wallis (Mann-Whitney U test), [W]Wilcoxon test, [X²]Chi-square test, [1]Difference with transvaginal isthmocele repair group $p<0.05$, [2]Difference with hysteroscopic isthmocele repair group $p<0.05$, [3]Difference with laparoscopic isthmocele repair group $p<0.05$, SD: Standard deviation

laparoscopic isthmocele repair group and the vaginal and hysteroscopic groups (p>0.05). However, in all three groups, the postoperative dysmenorrhea rate showed a statistically significant decrease compared to the preoperative rate (p<0.05) (Table 4, Figure 3).

Abnormal uterine bleeding, dyspareunia, chronic pelvic pain: There was no statistically significant difference in pre- and postoperative AUB, dyspareunia, and CPP rates between the vaginal, hysteroscopic, and laparoscopic isthmocele repair groups (p>0.05). However, in all three groups, the postoperative AUB, dyspareunia, and CPP rates showed a statistically significant decrease compared to the preoperative rates (p<0.05) (Table 4).

DISCUSSION

With the increasing rates of cesarean sections, the prevalence of isthmocele, a defect often detected in the lower uterine segment during ultrasound examination, has also risen in

Table 3. Comparison of preoperative and postoperative isthmocele dimensions and myometrial thickness across repair methods

		Transvaginal isthmocele repair, (n=60)[1]	Hysteroscopic isthmocele repair, (n=42)[2]	Laparoscopic isthmocele repair, (n=84)[3]	p
Myometrium size (mm)					
Before the operation	Mean ± SD	2.4±1.2	5.5±2.4	2.7±1.5	**0.000**[K]
	Median	2.0[2]	5.0	2.0[2]	
After the operation	Mean ± SD	11.6±2.2	13.1±4.0	11.4±2.1	**0.028**[K]
	Median	11.0[2]	13.0	11.0[2]	
Change	Mean ± SD	9.2±2.6	7.7±5.4	8.7±2.7	0.137[K]
	Median	9.0	7.0	8.0	
Within-group change (p)		**0.000**[w]	**0.000**[w]	**0.000**[w]	
Isthmocell size (mm)					
Before the operation	Mean ± SD	10.7±2.8	6.7±1.9	9.9±2.9	**0.000**[K]
	Median	10.0	7.0[1,3]	9.5	
After the operation	Mean ± SD	0.52±1.76	1.12±1.55	0.92±2.19	**0.024**[K]
	Median	0.00[2]	0.00	0.00	
Change	Mean ± SD	-10.2±3.1	-5.6±1.9	-9.0±2.7	**0.000**[K]
	Median	-10.0	-5.5[1,3]	-9.0[1]	
Within-group change (p)		**0.000**[w]	**0.000**[w]	**0.000**[w]	

[K]Kruskal-Wallis (Mann-Whitney U test), [w]Wilcoxon test, [1]Difference with vaginal isthmocele repair group p<0.05, [2]Difference with hysteroscopic isthmocele repair group p<0.05, [3]Difference with laparoscopic isthmocele repair group p<0.05, SD: Standard deviation

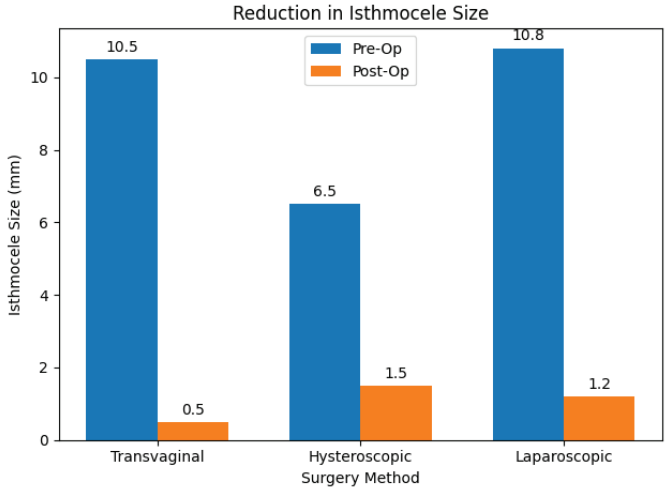

Figure 1. Reduction in isthmocele size before and after repair using vaginal, hysteroscopic, and laparoscopic surgical methods

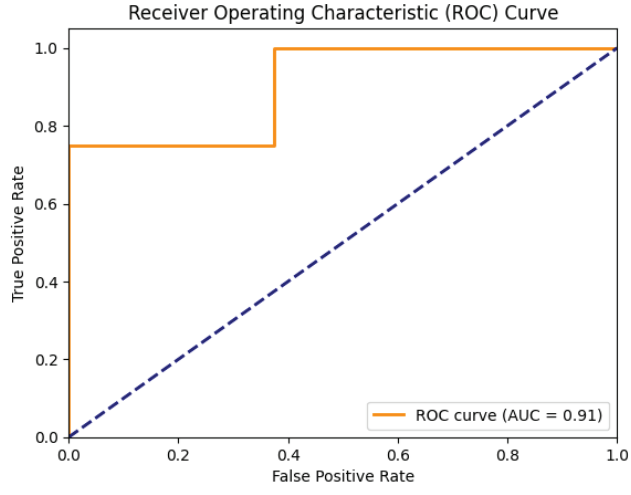

Figure 2. In the logistic regression analysis conducted for the three types of surgery, the model's ROC curve and an AUC value of 0.91 indicate that the model can predict the effect of surgeries on isthmocele size reduction with high accuracy

AUC: Area under the curve

Table 4. Impact of transvaginal, hysteroscopic, and laparoscopic isthmocele repair methods on dysmenorrhea, abnormal uterine bleeding, dyspareunia, and chronic pelvic pain

			Transvaginal isthmocele repair, (n=60)[1]	Hysteroscopic isthmocele repair, (n=42)[2]	Laparoscopic isthmocele repair, (n=84)[3]	p
Dysmenorrhea						
Before the operation	(-)	n, %	11 (18.3%)	18 (42.9%)	24 (28.6%)	**0.026**$^{X^2}$
	(+)	n, %	49 (81.7%)	24 (57.1%)	60 (71.4%)	
After the operation	(-)	n, %	54 (89.4%)	37 (88%)	71 (85.5%)	0.448$^{X^2}$
	(+)	n, %	6 (9.6%)	5 (12%)	13 (15.5%)	
Intra-group change (p)			**0.000**^{N}	**0.000**^{N}	**0.000**^{N}	
Abnormal uterine bleeding						
Before the operation	(-)	n, %	3 (5%)	2 (4.8%)	3 (3.6%)	0.053$^{X^2}$
	(+)	n, %	57 (95%)	40 (95.2%)	81 (96.4%)	
After the operation	(-)	n, %	54 (90.0%)	37 (88%)	76 (90.5%)	0.915$^{X^2}$
	(+)	n, %	6 (10.0%)	5 (12%)	8 (9.5%)	
Intra-group change (p)			**0.000**^{N}	**0.000**^{N}	**0.000**^{N}	
Dysparonia						
Before the operation	(-)	n, %	11 (18.3%)	10 (23.8%)	25 (29.8%)	0.289$^{X^2}$
	(+)	n, %	49 (81.7%)	32 (76.2%)	59 (70.2%)	
After the operation	(-)	n, %	53 (88.3%)	30 (71.4%)	67 (79.8%)	0.100$^{X^2}$
	(+)	n, %	7 (11.7%)	12 (28.6%)	17 (20.2%)	
Intra-group change (p)			**0.000**^{N}	**0.000**^{N}	**0.000**^{N}	
Chronic pelvic pain						
Before the operation	(-)	n, %	15 (25%)	18 (42.8%)	24 (28.5%)	0.134$^{X^2}$
	(+)	n, %	45 (75%)	24 (57.2%)	60 (71.5%)	
After the operation	(-)	n, %	54 (90.0%)	33 (78.6%)	69 (82.1%)	0.257$^{X^2}$
	(+)	n, %	6 (10.0%)	9 (21.4%)	15 (17.9%)	
Intra-group change (p)			**0.000**^{N}	**0.000**^{N}	**0.000**^{N}	

^{K}Kruskal-Wallis (Mann-Whitney U test), ^{w}Wilcoxon test, $^{X^2}$Chi-square test, [1]Difference with transvaginal isthmocele repair group $p<0.05$, [2]Difference with hysteroscopic isthmocele repair group $p<0.05$, [3]difference with laparoscopic isthmocele repair group $p<0.05$

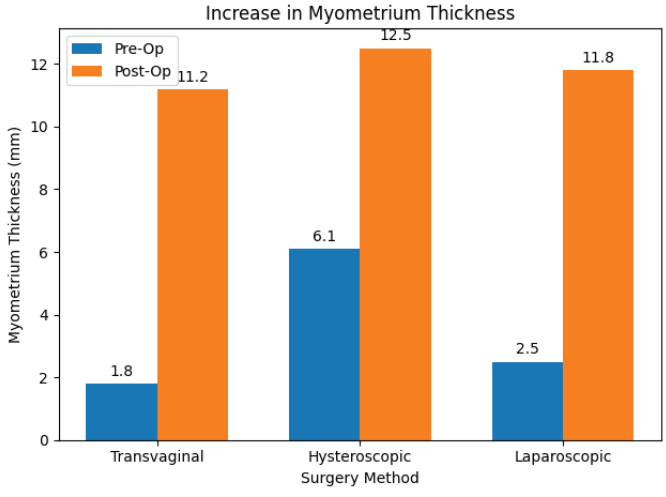

Figure 3. Increase in myometrium size before and after isthmocele repair using vaginal, hysteroscopic, and laparoscopic surgical methods

recent years. Isthmocele can be asymptomatic or present with symptoms such as AUB.[15] In this study, we compared the clinical outcomes of transvaginal, hysteroscopic, and laparoscopic repair methods in symptomatic isthmocele patients. We found that the gestational age at last delivery was statistically significantly higher in the hysteroscopic, and laparoscopic isthmocele repair groups compared to the transvaginal isthmocele repair group.

Patients with isthmocele exhibit a high prevalence of AUB, characterized by unique bleeding patterns such as prolonged menstrual bleeding and intermenstrual bleeding early in the cycle, suggesting that isthmocele should be included as a separate entity in AUB classification systems.[16] Women with severe isthmocele have a high risk of adhesions, dysmenorrhea, dyspareunia, and pelvic pain.[17] In our study, AUB, dyspareunia, dysmenorrhea, and CPP complaints were highly prevalent, and a statistically significant reduction in these complaints was observed after surgical intervention.

Transvaginal repair of isthmocele is described as a minimally invasive, safe, and effective surgical approach in terms of

residual myometrial thickness after surgery.[18] A study by Deng et al.[19] involving 183 cases of transvaginal surgical repair demonstrated that it successfully increased residual myometrial thickness and improved symptoms such as AUB and pelvic pain. These findings suggest that the transvaginal surgical method is an effective option, especially in symptomatic patients.

After hysteroscopic treatment, a reduction in irregular menstrual bleeding, pelvic pain, and dyspareunia symptoms, along with an improvement in the quality of sexual activity, has been observed.[20] Results from a systematic review indicated that surgical treatment of isthmocele, particularly through hysteroscopy, could be effective with a relatively low complication rate, especially in patients with a residual myometrial thickness of at least 2.5 mm.[21] Comprehensive hysteroscopic surgical excision of isthmocele can be an effective treatment method in symptomatic patients with irregular menstrual bleeding, and the quality of excision can increase the success rate.[22] These findings support that the hysteroscopic surgical method is a safe and effective option.

In our study, although hysteroscopic treatment primarily aimed to optimize the angle of the isthmocele to reduce blood retention, a statistically significant increase in myometrial thickness was also observed postoperatively. This increase can be attributed to the surgical excision of fibrotic tissues and the subsequent remodeling of the myometrial tissue during the healing process. While this finding aligns with the effectiveness of hysteroscopy in alleviating symptoms, it also suggests a potential reconstructive role of hysteroscopic excision in specific cases, warranting further investigation.

The laparoscopic surgical method has been reported to be effective in increasing myometrial thickness and reducing dysmenorrhea rates, as well as successfully treating symptoms associated with isthmocele, with these benefits continuing after subsequent cesarean deliveries.[23] It was found that laparoscopic correction of isthmocele increased myometrial thickness from an average of 2 mm to 8.7 mm, representing more than a fourfold increase.[24] Our study, consistent with these findings, showed that it effectively increased myometrial thickness and improved quality of life by alleviating symptoms.

Although there is no observational study comparing transvaginal, hysteroscopic, and laparoscopic isthmocele repair, a meta-analysis by Vitale et al.[25] indicated that hysteroscopic correction is the safest and most effective strategy with the lowest complication risk. Laparoscopic and transvaginal surgeries were recommended for patients with thinner residual myometrium (<2.5 mm) and those for whom hysteroscopic treatment did not yield definitive results.[25] Compared to hysteroscopy, hysteroscopy-assisted transvaginal isthmocele repair is associated with better clinical outcomes.[26] Mashiach and Burke[27] recommended hysteroscopic repair for women with a residual myometrial thickness of more than 2 to 3 mm and hysteroscopy-guided laparoscopic repair for women with a thickness of less than 2 to 3 mm. Transvaginal repair may be a more cost-effective option compared to laparoscopic repair, with similar efficacy, shorter surgery times, and lower hospital costs.[28] According to our study results, when comparing the efficacy and safety of transvaginal, hysteroscopic, and laparoscopic surgical methods, all three methods showed statistically significant reductions in dysmenorrhea, dyspareunia, AUB, and CPP rates. However, the transvaginal surgical method was found to be more advantageous in terms of reducing isthmocele size and increasing myometrial thickness compared to the other methods.

Both laparoscopic and transvaginal methods have been shown to be similarly effective in improving symptoms of isthmocele defects, with the transvaginal approach being less invasive.[29] However, transvaginal surgery has also been reported to be more effective than operative hysteroscopy, despite being associated with longer operation times and greater blood loss.[30] In our study, the operation time was significantly longer in the laparoscopic group. However, there was no significant difference in operation time between the transvaginal and hysteroscopic groups. Additionally, the hospital stay was significantly longer in the laparoscopic group, while it was significantly shorter in the hysteroscopic group compared to the transvaginal group.

Study Limitations

However, this study has limitations, including its retrospective design, which may introduce biases such as variability in surgeon expertise, patient comorbidities, and differences in postoperative care protocols. Additionally, the minimum one-year follow-up period may not fully capture long-term outcomes, such as recurrence rates, subsequent fertility, and pregnancy outcomes.

CONCLUSION

This study compared the clinical outcomes of transvaginal, hysteroscopic, and laparoscopic methods for isthmocele repair, providing insights into the effectiveness and applicability of each surgical approach. The transvaginal method was the most effective in reducing isthmocele size and increasing myometrial thickness, making it a strong option for patients requiring substantial tissue restoration. All three methods significantly reduced postoperative symptom rates, improving quality of life in symptomatic patients.

The hysteroscopic method demonstrated advantages in terms of the shortest hospital stay and lower invasiveness, particularly for patients with adequate residual myometrial thickness. Conversely, the laparoscopic method, while associated with longer operation and hospital stay durations, effectively increased myometrial thickness and may be more suitable for patients with thinner residual myometrium or complex cases.

To enhance clinical applicability, future guidelines for selecting surgical methods should consider individual patient characteristics such as residual myometrial thickness, symptom severity, and comorbid conditions. Further prospective studies with larger cohorts and longer follow-up periods are essential to validate these findings and explore non-surgical alternatives and their role in isthmocele management.

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Ethics

Ethics Committee Approval: This study was conducted with ethical approval from the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (approval number: E-96317027-514.10-246504114, KAEK/12.06.2024.24, date: 26.06.2024).

Informed Consent: Written informed consent was obtained from all participants.

Authorship Contributions

Surgical and Medical Practices: E.A., G.Ş.D., Concept: E.A., G.Ş.D., Design: E.A., N.B., Data Collection or Processing: E.A., N.B., R.A., Analysis or Interpretation: E.A., R.A., Literature Search: E.A., Writing: E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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Original Article

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Transvaginal Gynecological Procedures in Hymen Intact Cases: Defloration and Revision Outcomes

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ABSTRACT

Purpose: This study aimed to examine transvaginal gynecological procedures performed in virgin women and to evaluate hymen revision, if necessary.

Methods: This retrospective study analyzed transvaginal procedures performed on 154 patients with intact hymens who presented to a private clinic for fertility treatments between 2012 and 2024.

Results: Among the 154 virgin patients, transvaginal procedures were successfully completed with the hymen remaining intact in 126 patients. Hymenal rupture occurred in 28 patients: 21 during oocyte retrieval, 3 during cyst drainage, and 4 during hysteroscopy.

Conclusion: Limited literature exists regarding transvaginal procedures in virgins. Virginity is a religious and socio-cultural value that holds significant importance in certain societies. This study evaluated the preservation of hymenal integrity in virgin women undergoing transvaginal gynecological procedures, as well as defloration and revision outcomes in cases where the hymenal rupture occurred.

Keywords: Hymen, vagina, vaginal mucosa, genital system

INTRODUCTION

The hymen is a mucosal fold at the entrance of the vagina that partially closes the vaginal opening. It is named after Hymenaios, the god of marriage and weddings in ancient Greek mythology.[1] The hymen contains few nerve fibers and is lined with non-keratinized squamous epithelium. It is an avascular membrane lacking glands and muscle fibers. The hymen varies morphologically and can be crescent-shaped, annular, cribriform, septate, fimbriated, navicular, or imperforate. It is traditionally thought to tear during a woman's first sexual intercourse, with its intact state often considered an indicator of virginity.[2]

The importance of virginity varies across cultures and societies, but in many religions, it symbolizes self-control and is regarded as a superior moral value. For this reason, virginity is considered essential by many women, who seek to preserve it by ethical and socio-cultural norms.[3] Due to these societal sensitivities, there is often a desire to preserve virginity during medical procedures that must be performed vaginally in virgin women. When virginity cannot be preserved during such procedures, hymen reconstruction may be performed. Hymen revision aims to reconstruct the torn hymenal remnants to their original virginal position so that bleeding can occur during sexual penetration.

Cervical or endometrial polyps, hyperplasia, and neoplasms may present as abnormal uterine bleeding or increased endometrial thickness. Consequently, endoscopic procedures such as hysteroscopy and vaginoscopy are essential for diagnosis and treatment. Additionally, transvaginal methods may be required for oocyte retrieval and cyst drainage in fertility preservation cases. However, due to the societal importance attached to virginity, patients often avoid these procedures, fearing the loss of virginity. Surgery through the vagina in women with intact hymen is technically challenging and requires a highly skilled surgeon.[4]

This study had two objectives. First, we aimed to evaluate transvaginal gynecological procedures in virgin women and assess the feasibility of preserving the hymen during these procedures. Second, we aimed to evaluate hymenal

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revision and healing in women whose hymen ruptured during transvaginal gynecological procedures. Our findings demonstrated that transvaginal procedures can be safely performed in patients with intact hymens while preserving virginity. This ensures that medically necessary gynecological procedures are neither denied nor delayed for these patients.

METHODS

This retrospective study was approved by the local ethics committee of Bolu İzzet Baysal State Hospital (approval number: 2024/317, date: 05.11.2024). It involved a retrospective analysis of transvaginal procedures performed on 154 patients with intact hymens who presented to a private clinic for fertility procedures between 2012 and 2024.

The study included all virgin women with annular and crescentic hymens undergoing transvaginal procedures. For the transvaginal endoscopic procedures, a 2.9 mm rigid telescope with a 30° angle and a 3.5 mm working sheath diameter was used (Karl Storz, Germany). The procedure was conducted using a vaginoscopic technique through the suburethral area of the hymenal ring. An assistant ensured that the hysteroscope was correctly positioned and the hymen remained intact.

All virgin patients who underwent transvaginal procedures were included in the study. Cases with septate hymens (n=2), vaginal septa (n=3), and cribriform hymens (n=1) were excluded from the analysis, as hymen tears were unavoidable in these cases.

The patients' ages, complaints, indications for the gynecological procedures, duration and outcomes of the procedures, and types of anesthesia administered during the procedures and hymenoplasties were recorded. Outcome variables included the incidence of hymen rupture by procedure and the results of hymenoplasties performed. For patients who underwent hymen revision, hymenal edges were trimmed using the Goodman technique and sutured end-to-end with 3.0 Vicryl sutures.[5]

Statistical Analysis

Data management and analysis were performed using the Statistical Package for the Social Sciences version 23.0 (SPSS Inc., USA). The obtained data were analyzed using percentages and the chi-squared test. Results were evaluated at a 95% confidence interval, and $p<0.05$ was considered statistically significant.

RESULTS

This study included 154 virgin patients who underwent transvaginal gynecological procedures, with their files retrospectively reviewed. The transvaginal procedures were categorized as endoscopic treatments and diagnostic procedures, including vaginoscopy, office hysteroscopy, transvaginal ultrasound-guided oocyte retrieval, and ovarian cyst drainage.

The patients were divided into three groups based on age: adolescent (n=17), reproductive age (n=124), and postmenopausal (n=13). The adolescent group was defined as ages 13-18 years. The mean age of the patients was 32±7.3 years (range: 13-61). The transvaginal procedures performed included oocyte pick-up (OPU), ovarian cyst drainage, endometrial polyp/biopsy, cervical polyp/biopsy, and removal of suspicious foreign substances. The most common procedure in the adolescent and postmenopausal groups was endometrial biopsy or polyp removal. In the reproductive age group, OPU was the most common procedure (Table 1).

Among the 154 virgin patients, transvaginal procedures were performed with the hymen remaining intact in 126 patients. Hymen rupture occurred in 28 patients: 21 during OPU, 3 during cyst drainage, and 4 during hysteroscopy. All 21 patients who underwent vaginoscopy had intact hymens following the procedure. The p value between transvaginal gynecological procedures and hymen rupture was 0.05.

Hymen rupture was also analyzed by age group. Two of the 17 adolescent patients, 21 of the 124 reproductive-age patients, and 5 of the 13 postmenopausal patients experienced hymen rupture during the procedures. The statistical difference in hymen rupture across age groups was p=0.05 (Table 2).

A total of 107 patients underwent OPU and cyst drainage procedures. These patients were grouped under transvaginal ultrasonography-guided procedures. Among these 107 patients, 62 had annular hymens, and 45 had crescentic hymens. Hymen rupture occurred in 19 of 62 patients with annular hymens and 5 of 45 patients with crescentic hymens. During transvaginal ultrasonography-guided procedures, patients with annular hymens were significantly more likely to experience hymenal rupture than those with crescentic hymens ($p<0.05$).

A total of 47 patients underwent vaginoscopy and hysteroscopy, categorized as endoscopic procedures. Among these 47 patients, hymen rupture occurred in 4 patients, all of whom had annular hymens. In patients with crescentic hymens who underwent endoscopic procedures, the hymens remained

Table 1. The indications of gynecological procedures in virgin women according to age group

Indication/goal of the procedure	Adolescents, (n=17) (%)	Reproductive age, (n=124) (%)	Postmenopausal, (n=13) (%)
Oocyte pick-up	1 (5.8)	93 (75)	0
Ovarian cyst drainage	1 (5.8)	9 (7.2)	3 (23)
Endometrial polyp/biopsy	6 (35.2)	13 (10.4)	7 (53.8)
Cervical polyp/biopsy	5 (29.4)	8 (6.4)	3 (23)
Suspected foreign material	4 (23.5)	1 (0.8)	0

intact. There was no significant difference in hymen rupture by hymen type in the endoscopic procedure group (p>0.05) (Table 3).

Among the 28 women with ruptured hymens, 2 were in the adolescent group and requested hymenoplasty. In the reproductive-age group, 21 women experienced hymen rupture, and 8 requested hymenoplasty. None of the 5 patients in the postmenopausal group who experienced hymen rupture requested hymenoplasty. Thirteen women of reproductive age who did not request hymen revision were provided with a medical report stating that the transvaginal procedure was performed due to medical necessity.

A total of 10 patients underwent hymen revision. A second revision was required in 3 of these patients. Revisions were performed again using end-to-end trimming and suturing techniques. Among the 7 cases that healed, 5 showed complete hymen healing, while 2 exhibited partial healing.

DISCUSSION

Virginity is essential in many religions and cultures worldwide. For this reason, the preservation of the hymen is seen as a socio-cultural and religious necessity for many people. The hymen typically ruptures during the first sexual intercourse, resulting in bleeding. For women who have not engaged in sexual intercourse, it is important that the hymen remains intact. Medical approaches should consider this cultural sensitivity, and necessary medical procedures should be performed accordingly.

The importance of virginity varies socio-culturally across societies. Consequently, there are fewer publications on this topic. This study primarily aimed to evaluate the preservation of the hymen according to age, the reason for the procedure, and the type of hymenal structure. Secondly, we sought to analyze the method and success of hymenoplasty in cases where hymen rupture occurred during transvaginal medical procedures. Hymen repair can be performed using primary repair, the lateral wall flap technique, the submucosal suture technique, and the cerclage technique.[5] In this study, hymen revision was achieved using primary repair.[1]

Endometrial polyps are benign tumors that cause symptoms such as abnormal uterine bleeding and infertility, which are common among women of reproductive age. Treatment options include conservative, medical, or surgical methods. Removal of cervical or endometrial polyps via hysteroscopy is a radical approach, but its application in virgin patients requires experience and skill.[5] There are few publications on hysteroscopic procedures in patients with intact hymens.

In 2019, a study conducted in Taiwan reported the hysteroscopic outcomes of 836 patients, with all procedures completed while preserving the hymen.[6] Another study involving 14 patients with intact hymens successfully diagnosed and treated endometrial changes.[7] A separate retrospective analysis of 32 patients found that endometrial and cervical polyps were excised while preserving the hymen in all cases.[5] In our study, hymen rupture was observed in four out of 47 patients who underwent hysteroscopy/vaginoscopy. No complications, such as cervical trauma, uterine perforation, or transurethral

Table 2. Hymenal tears according to procedure and age group

Variable	Hymen tear, (n=28)	No hymen tear, (n=126)	p
Procedure			
Oocyte pick-up, (n=94) n (%)	21 (22.4)	73 (77.6)	0.05
Cyst drainage, (n=13) n (%)	3 (23)	10 (76.9)	
Hysteroscopy, (n=26) n (%)	4 (15.3)	22 (84.6)	
Vaginoscopy, (n=21) n (%)	0	21 (100)	
Age group			
Adolescent, (n=27) n (%)	2 (7.4)	25 (92.5)	0.05
Reproductive age, (n=124) n (%)	21 (16.9)	103 (83)	
Postmenopausal, (n=13) n (%)	5 (38.4)	8 (61.5)	
*Chi-square test			

Table 3. Hymenal tears according to the procedure and hymen type

Variable			p
Transvaginal ultrasound, (n=107)	**Hymentear, (n=24)**	**No tear, (n=83)**	
Annular hymen, (n=62) n (%)	19 (30.6)	43 (69.4)	0.01
Crescentic hymen, (n=45) n (%)	5 (11.1)	40 (8.9)	
Endoscopic procedure (n=47)	**Hymentear, (n=4)**	**No tear, (n=43)**	
Annular hymen, (n=26) n (%)	4 (15.4)	22 (84.6)	0.1
Crescentic hymen, (n=21) n (%)	0	21 (100)	
*Chi-square test			

resection of the prostate syndrome, were reported in any of the patients.

Various methods are used for OPU in vitro fertilization (IVF), including laparoscopic, transvaginal ultrasound-guided, and transabdominal ultrasound-guided approaches. While oocyte collection was initially performed laparoscopically during the early years of IVF, the transvaginal method has since gained widespread preference. The advantages of the transvaginal approach include better visualization of the ovaries, shorter access distance, the use of sedation instead of general anesthesia, reduced risk of bowel injury, faster recovery, and lower costs.[8]

In 2024, Fakih et al.[9] conducted a study involving 105 patients in the United Arab Emirates, where the transrectal method was employed for oocyte collection in virgin patients. In Turkey, a 2020 study with 64 patients reported the use of a vaginal ultrasound probe for transabdominal oocyte collection.[10] Considering the benefits of the transvaginal approach, its application in virgin women becomes increasingly significant. In this study, we wanted to show that transvaginal techniques can be performed in virgin patients while preserving their hymen and respecting socio-cultural sensitivities.

Cyst drainage and oocyte collection procedures were performed under transvaginal ultrasound guidance. In 2007, it was reported that a cyst drainage procedure in a virgin patient with a vaginal Mullerian cyst was performed via hymenotomy.[11] To date, no hymen-preserving transvaginal ultrasound-guided studies have been published in the literature. In this respect, the results of our research are valuable for their contribution to the literature.

In transvaginally guided cyst drainage and OPU procedures, the hymen remained intact in 83 out of 107 patients. Compared to endoscopic procedures such as hysteroscopy and vaginoscopy, a statistically significant rate of hymen rupture was observed in these cases.

Ten out of the 28 women with ruptured hymens requested hymenoplasty. Although the hymen has no physiological function, hymenoplasty is performed to restore its ability to bleed during sexual intercourse. In our study, hymen repair following rupture during medical procedures was performed because patients wanted to demonstrate their virginity before marriage. These operations, aimed at restoring pre-marital virginity, are ethically and morally debated among physicians. Some gynecologists argue that performing non-essential surgeries for social reasons may be deceptive and misleading. Conversely, others view hymenoplasty as a woman's right to control her body, emphasizing its role in emotional well-being and social welfare.[12]

Study Limitations

The strength of this study lies in its focus on hymen-preserving surgical techniques, which are underrepresented in the literature. However, its limitation is the inability to monitor the long-term success of hymen reconstruction and to compare different surgical techniques and methods.

CONCLUSION

Hymen-preserving methods can be applied during transvaginal gynecological procedures, especially in societies where virginity holds significant cultural importance. However, preserving the hymen during such procedures requires considerable skill and experience. The limited studies available on hymen-preserving techniques highlight the significance of this research in providing guidance for future surgical practices.

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Ethics

Ethics Committee Approval: This retrospective study was approved by the local ethics committee of Bolu İzzet Baysal State Hospital (approval number: 2024/317, date: 05.11.2024).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: N.E.A., F.D., N.M.E., Concept: N.E.A., F.D., Design: F.D., N.M.E., Data Collection or Processing: N.E.A., N.M.E., Analysis or Interpretation: F.D., Literature Search: N.E.A., N.M.E., Writing: N.E.A.

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Case Report

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Glomus Tumor of the Vulva: A Case Report and Review of Literature

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ABSTRACT

A glomus tumor is a rare benign soft tissue neoplasm that originates from the neuromuscular cells of the glomus apparatus, a specialized arteriovenous anastomosis involved in thermoregulation. Although primarily found in the deep dermis and subcutaneous tissues of the extremities, typically in the subungual region of the fingers, it is occasionally reported to be found in the gastrointestinal, respiratory, and genitourinary tracts. In terms of female reproductive tract, glomus tumors have been described to be seen in the external genitalia, vagina, cervix, and myometrium. These tumors are often associated with localized intense pain at the tumor site, and surgical excision usually provides a definitive cure with permanent relief from symptoms. Herein, we present the case of a 39-year-old woman with longstanding vulvar pain and severe introital dyspareunia, who was diagnosed with a clitoral glomus tumor. The clinicomorphologic and immunohistochemical characteristics are discussed, along with a review of the literature.

Keywords: Glomus tumor, vulva, dyspareunia

INTRODUCTION

A glomus tumor is a rare benign mesenchymal neoplasm of the skin that arises from the glomus body.[1-3] The glomus body is a contractile, richly innervated arteriovenous anastomosis in the dermis of neuromyoarterial origin, which regulates blood pressure and temperature by controlling peripheral blood flow.[4,5] While frequently located in the subcutaneous tissue of extremities, glomus tumors account for less than 2% of all soft tissue tumors. They are most commonly encountered in the subungual region of the digits, where glomus bodies are normally present.[6] Rarely, glomus tumors have been reported in the mediastinum, lungs, intestines, bone, mesentery, heart, lymph nodes, trachea, stomach, oral cavity, neural tissue,[1,2,6-10] and also seen in genitourinary tract, including the clitoris, vagina, cervix, ovary, and periurethral tissue.[6,11-15]

Glomus tumors are composed of round cells with surrounding vascular spaces of varying sizes, along with glomus cells, vascular structures, and smooth muscle cells in differing proportions.[16] They typically present as solitary, painful nodules, although in some cases-particularly those arising in childhood-they may appear as multiple lesions and are occasionally familial.[2,5] Paroxysmal pain radiating from the lesion is a characteristic symptom. The diagnostic triad includes localized pinpoint pain, exquisite tenderness even to light pressure, and exacerbation of symptoms upon exposure to temperature changes, particularly cold (cold hypersensitivity).[7]

Clinical examination, conventional radiography, ultrasonography, and magnetic resonance imaging (MRI) can be utilized to support the diagnosis.[17] Complete surgical excision typically results in permanent symptom relief and a definitive cure. While the majority of glomus tumors follow a benign course, rare cases of atypical or malignant behavior have been reported.[18-20]

In this report, we present the clinicopathologic features of a patient diagnosed with a vulvar glomus tumor, along with a review of the literature.

CASE REPORT

A 39-year-old woman (G3 P2 A1) admitted to our institution with longstanding vulvar pain, severe introital dyspareunia, and a tender vulvar mass. Gynecological examination revealed a solitary, well-circumscribed, palpable subcutaneous mass in the clitoral region. The mass measured 1 × 1 × 1.5 cm, was soft, tan-brown in color, slightly mobile, and exquisitely

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tender to light pressure. No relevant findings were noted in the family history or laboratory evaluation. The mass was completely excised with a margin of surrounding normal tissue under local anesthesia. The specimen consisted of a well-circumscribed nodule measuring 1 × 1 × 1.5 cm in size. The sections revealed a yellowish, fleshy mass. Histopathological examination indicated that the tumor was composed of numerous blood vessels of varying sizes, surrounded by collars of glomus cells (Figure 1a). The tumor cells were round, with punched-out round nuclei and amphophilic cytoplasm (Figure 1b). Pleomorphism, mitotic activity, and necrosis were not observed. Immunohistochemical analysis revealed diffuse, strong immunoreactivity for actin, whereas S-100, EMA, cytokeratin, and CD34 immunostaining were negative. The diagnosis was confirmed as a "glomus tumor". The postoperative course was uneventful, and excision of the tumor provided permanent relief of symptoms. Informed consent was obtained.

DISCUSSION

Glomus tumors, first described in 1924 by Masson, are special perivascular neoplasms believed to originate from modified smooth muscle cells in the walls of specialized arteriovenous shunts involved in thermoregulation. The exact incidence is unknown; however, it is estimated to be 1.6%.[6] Glomus tumors typically present as painful, small blue-red nodules located in the deep dermis or subcutis of the lower or upper extremities. There appears to be no sexual predisposition, except for subungual lesions, which occur more frequently in females.[2] They are most commonly encountered in individuals in their third to fifth decade of life. These tumors may appear as solitary or multiple lesions, with multiple lesions being more frequently reported in young populations associated with neurofibromatosis type 1. Some investigators suggest an autosomal dominant inheritance with incomplete penetration, and a gene for inherited glomus tumors has been identified on chromosome 1p21-22.[5]

Hemangiopericytoma, leiomyosarcoma with epithelioid change, rhabdomyosarcoma, Ewing's sarcoma, and nodular hidradenoma should be considered in the differential diagnosis. The diagnosis is made histologically. Glomus tumors are divided into three groups: glomus tumor proper (the most common variant), glomangioma, and glomangimyoma, based on the proportion of glomus cells, vascular structures, and smooth muscle cells. Immunohistochemically, glomus cells are positive for vimentin, smooth muscle actin, and neuron-specific enolase, while they are negative for cytokeratin and S100, and variably positive for CD34, caldesmon, and calponin.

Glomus tumors typically have a benign course, but at times they can be infiltrative. Recurrence is rare and can usually be managed through conservative reexcision. Malignant glomus tumors are extremely rare. Clinically, they may extend into surrounding tissue or recur but seldom metastasize.[2] Deep location, a size over 2 cm, atypical mitotic figures (five or more mitoses per 50 HPF), and moderate-to-high grade nuclear atypia should be considered as criteria for malignancy.

A few cases of glomus tumors involving the female genital tract have been reported in the literature. Clinical and pathological features of vulvar,[12,13] clitoral,[14,15,26] periurethral,[14,23] and vaginal[20-22,27] glomus tumors have been documented as isolated cases (Table 1). In these reported cases, pain was the most common symptom. Most of the cases occurred in individuals in their third to fifth decade of life. While glomus tumors are most commonly encountered as solid masses, they can also present as cystic nodules or skin thickening.[12-14,20,22,24] Atypia or mitosis was not commonly observed in the microscopic examination of the tumors, although Suharwardy et al.[25] reported a case with atypia and mitosis. All reported cases were treated with local excision of the mass, as in our case.

Other gynecological glomus tumors include those found in the uterus,[28] cervix,[29] and ovary,[15,30] with one case associated with a teratoma.[8] The difficulty in diagnosis arises from the

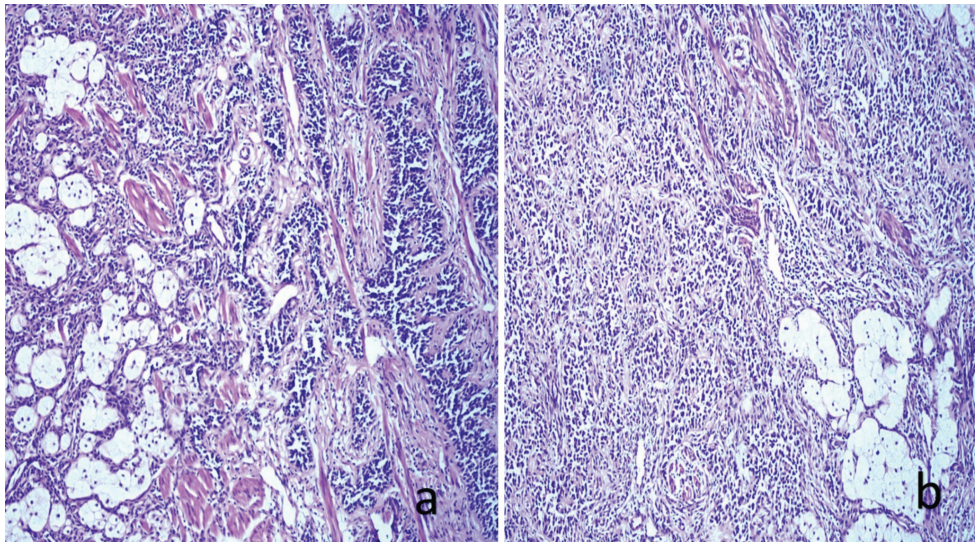

Figure 1. (a) Microscopic appearance of the tumor composed of numerous and varying sized blood vessels surrounded by collars of glomus cells. (b) Microscopic appearance of round cells of the glomus tumor with a punched out round nuclei and amphophilic cytoplasm

Table 1. Glomus tumor which reported by literatures

Study	Number of case	Age	Symptoms	Localization	Macroscopic pattern	Microscopic pattern	Diameter	Treatment
Banner and Winkelmann[21]	1	46	Vaginal tenderness, dyspareunia	Posterior vaginal wall (left)	Purplish-red, slightly elevated mass	Large vascularization, smooth muscle arranged in fascicles and about large vessels	1 cm	Local excision of mass
Katz et al.[12]	1	29	Intense pain	Labium minora (left)	Solid, extremely tender mass	Solid, angiomatous, tumor cells grew in cluster and associated with thin walled vascular spaces	1 cm	Local excision of mass
Kohorn et al.[13]	1	45	Pain, dyspareunia	Labium minus (left)	Redness area, slight thickening of skin	Solid No mitosis No pleomorphisim	0.5*0.5 cm	Local excision of mass
Sonobe et al.[14]	2	53	Dyspareunia	Clitoris	Oval, smooth outer surface	Solid,large vascularization The cells formed nests that were permeated by thin-walled masses network. No mitosis No pleomorphisim	2*1.5 cm	Local excision of mass
		46	Pain	Periurethral region	Solid	Solid No mitosis No pleomorphisim	3*2 cm	Local excision of mass
Moldavsky et al.[22]	1	45	Asymptomatic	Anterior vaginal wall	Solid angiomatous	Solid and angiomatous	1 cm	Local excision of mass
Malowany et al.[23]	1	61	Postmenopausal bleeding	Periurethral region	Focally ulcerated periurethral mass	Between the tumor cell nests and sheets were numerous capillaries and small blood vessels with associated edematous and hyalinized stroma. No areas of atypia, necrosis, or mitotic activity were seen.	1 cm	Local excision of mass
Mahapatra et al.[24]	1	39	Pain	Labium minus	Painful smooth swelling	The cells were arranged around the blood vessels at the periphery of the tumor. No atypia No mitosis	3*2*1 cm	Local excision of mass
Rahimi et al.[20]	2	53	Pain	Posterior vaginal wall	Solid mass	Small, circum- scribed clusters and nests or epithelioid cells were scattered throughout the neoplasm, between fascicles of smooth muscle cells No mitoisis, No necrosis	2 cm	Local excision of mass
		56	Asymptomatic	Anterior vaginal wall	Cystic nodule	tumor that contained small, circumscribed clusters and nests of bland epithelioid cells in a perivascular distribution	1 cm	Local excision of mass
Suharwardy et al.[25]	1	41	Painful mass	Clitoris	Firm, mobile, tender mass	Highyl vascular lesion, composed of plump cells, minimal atypia ,6 mitotic figures 50 high powered fields	1 cm	Excision of mass
Xie et al.[26]	1	36	Post-coital ache no pain	Glans clitoris	Tender mass, no ulceration	The vessels were separated by cells with mostly round uniform nuclei merging with spindle cells with fusiform nuclei and cytoplasmic eosinophilia	14*10*13 mm	Local excision of mass

unexpected locations of these tumors, as they can mimic nevi, cutaneous, adnexal, and neuroendocrine neoplasms.

Glomus tumors are most commonly found in the digits but can occur anywhere in the body. The combination of clinical examination and MRI enables early and accurate diagnosis of glomus tumors. Complete excision typically provides permanent relief of symptoms and an effective cure. Benign histopathologic features, including a uniform appearance with minimal atypia and a low mitotic rate, along with complete surgical removal, are associated with an excellent clinical outcome.

Ethics

Informed Consent: It was obtained.

Authorship Contributions

Surgical and Medical Practices: M.Ç.K., Concept: B.M., Design: B.M., Data Collection or Processing: M.Ç.K., Analysis or Interpretation: L.A., Literature Search: B.A., Writing: S.Ö.

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Case Report

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The Management of a Patient with Pelvic Kidney and High-Grade Endometrial Cancer: A Case Report

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ABSTRACT

Endometrial cancer is the most common gynaecological malignancy in high-income countries. Endometrial cancers are typically diagnosed at an early stage and are associated with favourable clinical outcomes in the majority of cases. The international guidelines recommend a sentinel lymph node biopsy for low-risk endometrial cancers, whereas a systematic pelvic and aortic lymphadenectomy is still recommended for high-risk patients. Pelvic kidney is a relatively common congenital renal anomaly, with an incidence of 1 in 1,000 to 2,000; such anomalies can be seen during pelvic or paraaortic lymphadenectomy the aim of this case report is to represent the intraoperative management of a patient diagnosed with serous endometrial cancer following histopathological examination, whose preoperative imaging revealed a pelvic type of right kidney. Anatomical anomalies of the kidney can be challenging to the surgeon in the context of pelvic surgery. However, a thorough preoperative evaluation, precise intraoperative dissection and proper exposure of surrounding structures can reduce the risk of such complications.

Keywords: Pelvic kidney, lymphadenectomy, gynaecology, gynaecological oncology

INTRODUCTION

Endometrial cancer is one of the most prevalent gynaecological malignancies. High-risk histologic endometrial cancers, including serous, clear cell, and grade 3 endometrioid histology, represent 28% of cancer cases. However, due to their high recurrence rates, they account for 74% of endometrial cancer-related deaths. The role of complete surgical staging in high-grade endometrial cancer remains a topic of debate. Nevertheless, the diagnostic importance of lymph node evaluation in this group is an established aspect of clinical practice.[1]

Renal ectopia means that the kidney is not in its normal or orthotopic position in the upper retroperitoneum or "renal" fossa. Renal ectopia is a relatively common congenital anomaly of the kidneys and urinary tract. A pelvic kidney is a developmental anomaly that arises due to the kidney's inability to ascend from its developmental region in the pelvis to its typical anatomical position during the embryonic developmental stage. The prevalence of pelvic kidney disease is estimated to be between 1 in 2200 and 1 in 3000.[2] It is established that pelvic ectopic kidney is associated with a multitude of vascular supply and origin variations.[3]

Additionally, as a consequence of its shared embryonic origin, genital developmental problems can be seen such as; vaginal atresia frequently manifests alongside other congenital anomalies of the urogenital system, including a hypoplastic uterus, a rudimentary fallopian tube, and an ovary. While pelvic kidneys are frequently asymptomatic and discovered incidentally, they can be associated with other conditions, including nephrolithiasis, ureteropelvic junction obstruction, and extrarenal calyces.

It is estimated that only one in ten ectopic kidneys is diagnosed. The diagnosis of an ectopic kidney is typically made incidentally. The diagnosis of a pelvic ectopic kidney can be established through the use of a variety of imaging techniques, including ultrasound, computed tomography (CT), voiding cystourethrogram, radionuclide scan, and magnetic resonance imaging (MRI). An initial ultrasound scan can identify ectopic kidneys in the pelvis.

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The presence of a pelvic kidney can present challenges during surgical procedures due to its impact on the pelvic anatomy. Anatomy and vascular structure information can be obtained via preoperative imaging. Variable pelvic anatomy is very important in patients scheduled for abdominal or pelvic surgery. This case report represents the surgical management of a patient with serous endometrial cancer and a known ectopic right pelvic kidney, employing paraaortic lymphadenectomy.

CASE REPORT

A 59-year-old postmenopausal female patient presented with a complaint of vaginal spotting that had been ongoing for 4 months. A diagnosis of serous endometrial carcinoma was made following the analysis of endometrial biopsy. MRI revealed the presence of a 33 mm mass lesion with evidence of superficial invasion into the myometrium. Furthermore, imaging revealed that the patient's right kidney was situated within the pelvic region. It was observed that the right kidney was situated between the L2-L3 and L4-L5 intervertebral levels (Figure 1). The patient was being treated for essential hypertension with a calcium channel blocker. No abnormalities were observed in the patient's blood count or biochemical parameters.

The patient underwent total abdominal hysterectomy, bilateral salpingo-oophorectomy, bilateral pelvic lymphadenectomy, para-aortic lymphadenectomy and infragastric omentectomy.

The paraaortic lymphadenectomy procedure was performed with technical difficulties due to ectopic pelvic kidney, which presented a challenge in terms of surgical access. The dissection was initiated along the right pelvic plane. The right ureter, vesicovaginal, and rectovaginal connections were identified. The right kidney was then mobilised from its connections with the cecum and other pelvic structures. The right kidney and ureter were dissected with precision, employing both sharp and gentle techniques. The renal vascular structure was observed to comprise two arteries and one vein. One artery was observed to originate from the left renal artery, while the other was identified as a branch from the iliac bifurcation, situated 1 cm above the latter. The renal vein was observed to drain into the vena cava inferior posteriomedial to the VCI (Figure 2). Following the exploration, a successful lymphadenectomy was performed. Prior to discharge, the patient was provided with comprehensive information and obtained informed consent in accordance with standard practice.

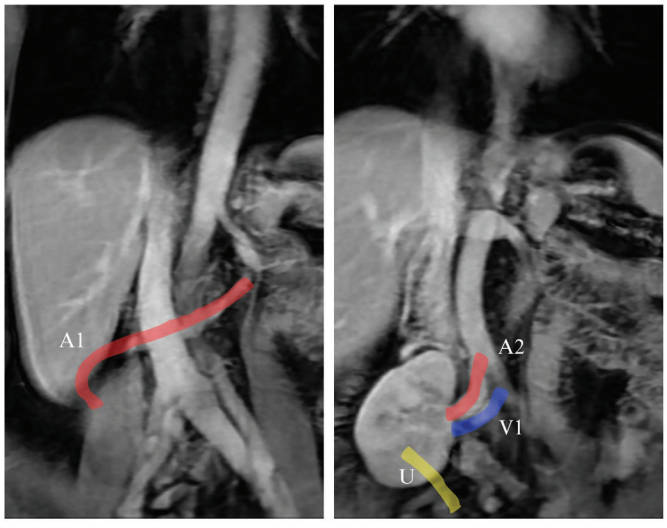

Figure 1. The image of the pelvic ectopic kidney is visible on the preoperative MR evaluation

MR: Magnetic resonance

DISCUSSION

The principal treatment modality for patients diagnosed with serous endometrial cancer is a multimodal approach that incorporates surgical, chemotherapeutic, and/or radiotherapeutic interventions. For patients with early-stage serous endometrial cancer, surgery is the best option for treatment. A hysterectomy in conjunction with a bilateral salpingo-oophorectomy permits the removal of the primary tumour and the identification of risk factors that may indicate the necessity for adjuvant therapy. The current guidelines recommend the implementation of retroperitoneal staging to evaluate the extent of disease and inform the decision regarding adjuvant therapy.[4]

The dissection of the paraaortic lymph nodes commences at the midpoint of the right common iliac artery. The dissection

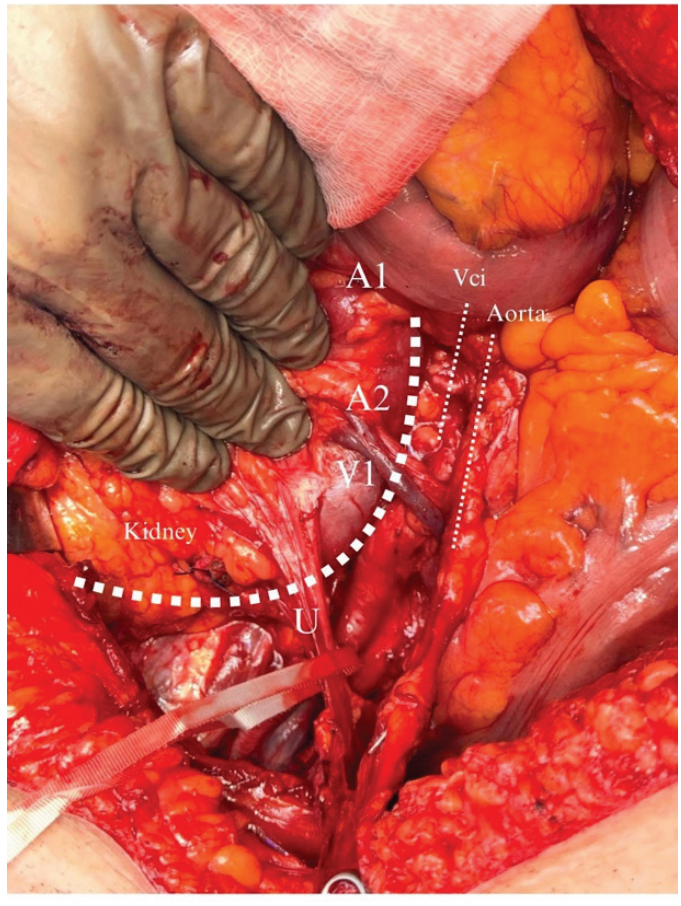

Figure 2. The intraoperative anatomy of the pelvic kidney

of the precaval and preaortic lymph nodes is performed down to the level of the left renal vein.[5] The position of the kidney, ureters and renal vein represent the fundamental anatomical points for a suitable para-aortic lymphadenectomy.

In patients with a pelvic kidney diagnosis, initiating the lymph dissection with the mobilization of the kidney, followed by the dissection of the bowel and other pelvic connections, and then the sharp and gentle dissection of the renal vessels and ureter, facilitates the surgical procedure. It is inadvisable to commence lymph dissection without first identifying any pelvic renal vascular variations.

Pelvic ectopic kidney is a rare condition that requires caution during para-aortic lymph node dissection in gynaecological surgery due to alterations in vascular structures. Anatomical anomalies of the kidney and ureter present a challenge in the formulation of appropriate dissection plans. The inelaborate performance of lymphadenectomy in patients with a pelvic kidney and also with a lack of attention may result in vascular and ureteral injuries and potentially lead to irreversible kidney damage.

In order to overcome these difficulties, it is essential to determine the origin of the kidney and ureter in the renal pelvis and to monitor this in its integrity with great care. The meticulous dissection is crucial due to the anatomical variations observed in the kidney.

A pelvic kidney may be misdiagnosed as an adnexal mass or a bulky lymph node during preoperative imaging. Bader et al.6 described two cases of a pelvic kidney mimicking a bulky lymph node during pelvic lymphadenectomy in gynaecological cancer patients.

Both CT and MRI are effective in demonstrating the vasculature of the pelvic kidney and the anatomical location of the ureter and renal pelvis. MRI is performed in order to obtain information regarding the myometrial invasion of the endometrial tumour. In patients with a pelvic kidney diagnosis, three-dimensional CT and angiography are also recommended.

Previously, similar cases of surgical intervention in women with pelvic ectopic kidney anomalies have been documented in the literature.[6-8] Similarly, the case reports described the surgical challenges associated with performing surgery on patients with pelvic ectopic kidneys and highlighted the benefits of preoperative evaluation in this patient population.

In conclusion, the pelvic kidney represents a significant challenge in the context of surgical staging for patients with gynaecological oncology conditions. In the case of patients with a diagnosis of pelvic kidney, it is of the utmost importance to perform a gentle dissection of the renal vessels and ureter, taking great care to avoid any damage to the ureter and vasculature.

Ethics

Informed Consent: The patient was obtained informed consent in accordance with standard practice.

Authorship Contributions

Surgical and Medical Practices: A.O.A., G.Ö.Ş., A.G.B., M.S., Concept: C.A., M.S., Design: C.A., M.S., Data Collection or Processing: S.K., A.O.A., G.Ö.Ş., Analysis or Interpretation: G.Ö.Ş., Literature Search: C.A., A.G.B., Writing: C.A., A.G.B., M.S.

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