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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

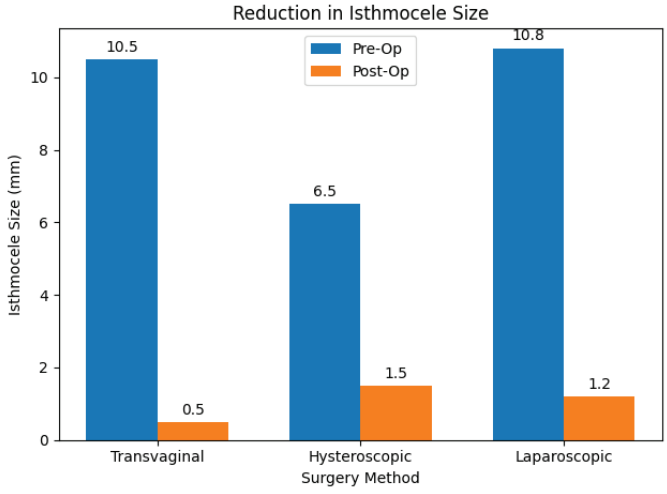

Figure 1. Reduction in isthmocele size before and after repair using vaginal, hysteroscopic, and laparoscopic surgical methods

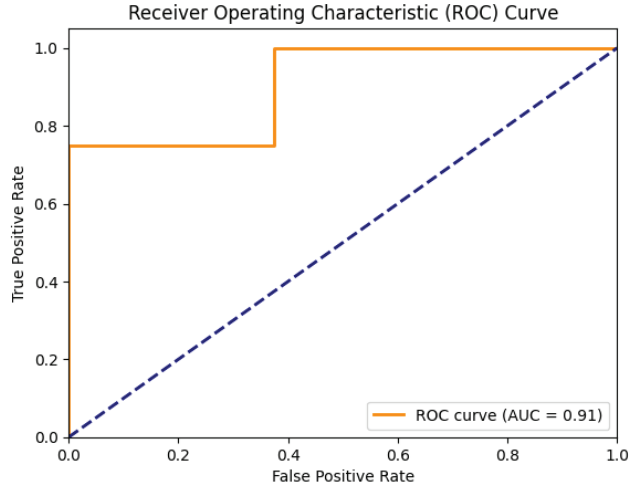

Figure 2. In the logistic regression analysis conducted for the three types of surgery, the model's ROC curve and an AUC value of 0.91 indicate that the model can predict the effect of surgeries on isthmocele size reduction with high accuracy

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 $p<0.05$

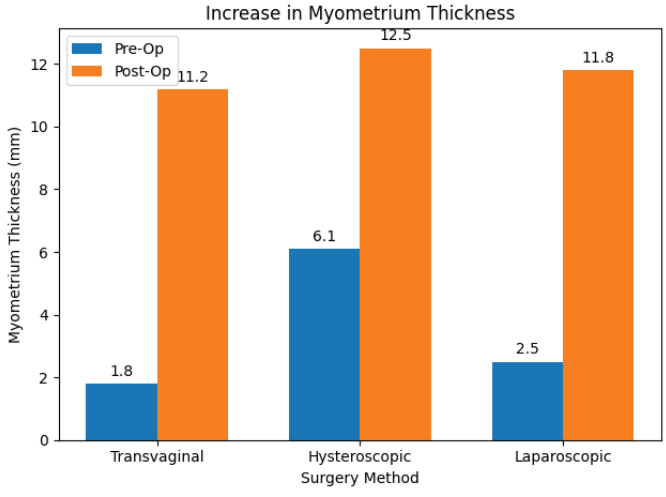

Figure 3. Increase in myometrium size before and after isthmocele repair using vaginal, hysteroscopic, and laparoscopic surgical methods

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.

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