



Comparison of classic single-layer uterin suture and double-layer purse-string suture techniques for uterus closure in terms of postoperative short-term uterine isthmocele: A prospective randomized controlled trial

Uterus kapatmada klasik tek kat kapatma ve çift kat kese ağzı uterus kapatma tekniklerinin postoperatif kısa dönem uterin istmosel oluşumu açısından karşılaştırılması: Prospektif randomize kontrollü çalışma

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Abstract

Objective: To compare the short-term results of classic single-layer uterine closure and double-layer purse-string uterine closure (Turan technique) techniques in cesarean section in terms of the incidence of ischiocele formation.

Materials and Methods: This was a prospective randomized controlled trial study. Participants undergoing first-time cesarean delivery were randomized into two groups. Fifty-eight participants were included in the double-layered uterine closure group (study group), while 53 participants were randomized into the classical single-layered uterine closure group (control group). For comparison of isthmocele formation, transvaginal ultrasound examination was planned in all patients 6 weeks after surgery. The operation data, the formation of isthmocele, its dimensions and volume were recorded.

Results: A total of 111 women were included in the study. The incidence of ischiocele at 6 weeks after birth was not significantly different between the groups ($p=0.128$). Isthmosel was detected in 20.8% of single-layer closures, and this rate was determined as 10.3% in the purse technique. In the Kerr incision made during surgery, the uterine incision size did not differ in either group, but the uterine incision length after suturing was significantly smaller in the purse technique compared with the other group ($p<0.001$).

Conclusion: The incidence of ischiocele formation after cesarean section and the depth of the ischiocele was independent of the uterotomy closure technique.

Keywords: Cesarean section, isthmocele, residual myometrium, suture technics, uterine scar

Öz

Amaç: Bu çalışmanın amacı sezaryen doğumda lasik tek kat rahmi mahatma ve çift kat kese-string rahmi mahatma (Turan tekniği) tekniklerinin istmosel oluşum insidansı açısından kısa dönem sonuçlarını karşılaştırmaktır.

Gereç ve Yöntemler: Bu çalışma prospektif randomize kontrollü bir çalışmadır. İlk kez sezaryen doğum yapacak olan hastalar iki ayrı gruba randomize edildiler. Elli sekiz katılımcı çift katmanlı kese ağzı uterus kapatma grubuna (çalışma grubu) alınırken, 53 katılımcı lasik tek katmanlı uterus mahatma grubuna (kontrol grubu) randomize edildi. Ameliyat sonrasında karşılaştırma için tüm hastalara ameliyattan 6 hafta sonra transvajinal ultrason muayenesi planlandı. Operasyon bilgileri, istmosel oluşum oluşmadığı, varsa boyutlar, hacmi kaydedildi.

PRECIS: Is uterus closure suture technique important in the formation of isthmocele?

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Bulgular: Araştırmaya toplam 111 kadın dahil edildi. Doğumdan 6 hafta sonra istmosel insidans gruplar arasındaki fark anlamlı değildi ($p=0,128$). Tek katlı uterus sapma grubunda %20,8 istmosel oran saptanırken, bu oran lese azo uterus mahatma uygulanan grupta %10,3 olarak saptandı. Ameliyat sırasında yapılan Kerr kerisinde uterine keribout her iki grupta da farklılık göstermezken, suture sonrası uterin insizyon uzunluğu kesi ağzı kapama tekniğinde diğer gruba göre olarak daha küçüktür ($p<0,001$).

Sonuç: Sezeryan sonrası istmosel oluşum insidans ve istmosel derinliği uterus mahatma tekniğinden bağımsızdır.

Anahtar Kelimeler: Sezeryan kesisi, istmosel, rezidüel miyometriyum, suture teknikleri, uterin star

Introduction

The cesarean section is the most frequently performed surgery in the world and its frequency is increasing^(1,2). This increase brings with it an increase in complications. The formation of an isthmocele after cesarean section is one such complication. "Isthmocele" was first described by Hugh Morris in 1995⁽³⁾. Uterine ischiocele is defined as a noncontinuous area of the hypoechoic myometrium found in the uterine incision due to a previous cesarean section⁽⁴⁾. When the literature is examined, the precise prevalence of niche formation is unknown. It varies widely from approximately 19%⁽⁵⁾ to 100%⁽⁴⁾. Many studies emphasize that this difference in prevalence may be because the standardization of the diagnosis and definition of ischiocele has yet to be clarified, or it may be related to the surgical technique during cesarean section⁽⁶⁾. The cesarean section technique has undergone many changes since it was first defined. With these continuous revisions, the aim is to prevent negative effects that may occur. The way to prevent a complication is to determine its etiology.

The optimal method for the closure of the uterus during cesarean section is still a matter of debate. Different suture materials⁽⁷⁾, different closure techniques^(8,9), and closures with different incisions^(10,11) have also been studied. Complications are attempted to be reduced by trying different methods and conducting studies on them. In the literature, the uterine closure technique is mostly blamed for the formation of ischiocele, and studies have focused on the technique. Accordingly, we evaluated the effects of ischiocele formation by comparing the two uterine closure techniques in the short term.

Materials and Methods

This prospective study was conducted between September 2022 and December 2022 at a training and research hospital. The study was approved by the institutional review board and ethics committee (approval number: 120, date:21/09//2022/) and complied with the Declaration of Helsinki. All patients were informed about the study, and written informed consent was obtained from all participants. In power analysis, it was found appropriate to include 28 people in each group with 80% power and 5% Type I error to detect a difference of at least 0.25 (medium level) effect size between the groups. The calculation was made in the MedCalc program.

A total of 111 women who underwent cesarean section were included in our study. The inclusion criteria were being older than 18 years, younger than 40 years, having been given an elective cesarean section date, and having a history of no previous

cesarean sections. All participants had previously decided to undergo cesarean section and were prepared under elective conditions. Women who had to have an emergency cesarean section for any reason, those who had a previous cesarean delivery, those with an early pregnancy below 37 weeks, multiple pregnancies, those who had a cesarean delivery while in active labor, and women who had a history of uterine surgery such as myomectomy, with diseases such as malnutrition, connective tissue disease, and diabetes that might impair wound healing were excluded from the study. All patients underwent their first cesarean section regardless of the number of births. The pregnant women were randomized using a simple random sampling method to one of the groups by a physician during their admission to the delivery room. There were two groups in the study. All operations were performed using Pfannenstiel for abdominal incisions and Kerr techniques for uterine incisions. During the operation, after the delivery of the baby, the size of the Kerr incision in the uterus was measured with a sterile ruler just before the uterus was closed. Uterine closure was then performed according to the technique randomized to the patient. The length of the incision area before and after uterine closure is shown in table as "Uterotomy incision length before-after suturing (cm)". To close the uterus during cesarean section, classic single-layer unlocked uterus closure was applied to one of the groups, and uterus closure was performed on the other group using the purse technique, a technique developed by Turan et al.⁽¹²⁾ The purse-string technique used in one group can be summarized as follows: starting in one corner, and then the incision is closed using no. 1 Vicryl suture. The first layer is transversely passed through the inner myometrium-decidua line. The second layer passes parallelly and transversely through the outer myometrium-visceral peritoneum line continuously in the form of a purse-string closure. With this method, the string starting from the first corner is returned to the starting point and knotted. After the string is tied, the opening in the middle of the uterine incision is closed with a separate figure-eight suture. With the purse suture technique, the uterine closure area is reduced to approximately 3-4 cm (Figure 1). All surgeries were performed by the same surgeon (EY). Polyglycolic Vicryl number: 1 (Johnson & Johnson, Somerville, NJ, USA) was used for uterine closure. Additional hemostatic sutures were placed in the case of bleeding. Preoperative antibiotics (cefuroxime 1 g) were given to all patients. Two grams were given to patients with obesity. The time for collecting data after surgery was determined as 6 weeks. In many studies in the literature, it is reported that uterine healing becomes reflective of whether an

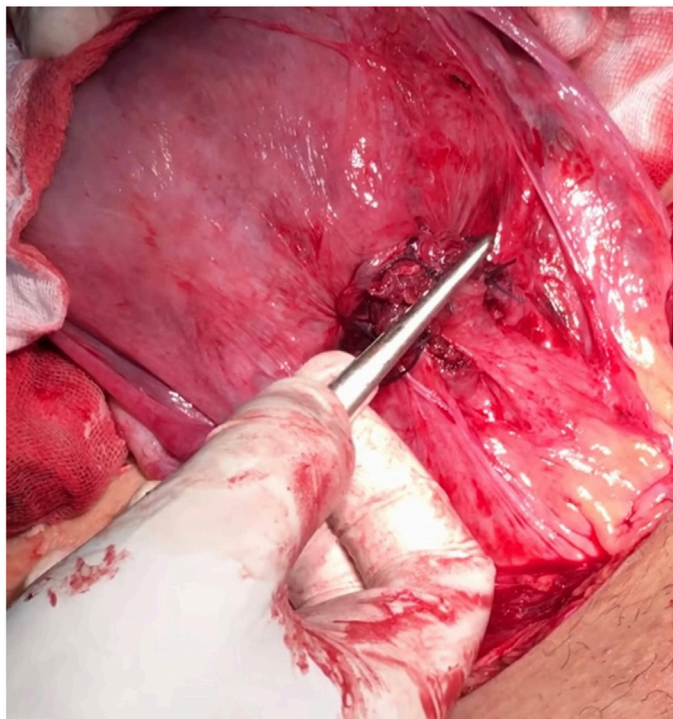


Figure 1. The intraoperative view of uterine closure with double-layer purse-string suture technique

ischiocele will occur after 1 month, and ultrasonography (USG) evaluations at the end of 1 month reflect long-term results⁽¹³⁾. All participants were called to the clinic 6 weeks after the surgery. There is no defined gold standard method yet, but the most frequently used diagnostic method is transvaginal sonography (TVS), although sonohysterography has proven to be at least an equally viable alternative method⁽¹⁴⁾. In our study, all 6th-week evaluations were performed by the same physician (EY) with using a transvaginal ultrasound who was blinded to the surgical technique to provide standardization and to facilitate objective evaluations. All USG was examined using a 5-9-MHz transvaginal transducer (Mindray DC 8 Expert, Wauwatosa). To achieve standardization, measurements were made and recorded as defined by Naji et al.⁽¹⁵⁾. All examinations were observed in two dimensions, independent of the menstrual cycle, with the bladder empty, on the gynecologic examination table in the dorsal lithotomy position, with the uterus total, endometrium, and cervico displayed. Scar tissue was measured in 3D in both the sagittal and transverse planes. The uterus was examined for ismocele, defined as anechoic areas at the site of the scar with a depth of at least 1 mm⁽¹⁶⁾. The length of the scar in the uterotomy area, scar thickness, the presence of an isthmocele, the 3D volume in the presence of an isthmocele, myometrial thickness at cesarean scar site (X) myometrial thickness of the uterus at the level of the internal cervical os (Z), and the myometrial thickness of final neighborhood of scar with interval of scar-isthmus distance (Y). The measured parameters are shown in Figure 2. The data collected for both groups were compared.

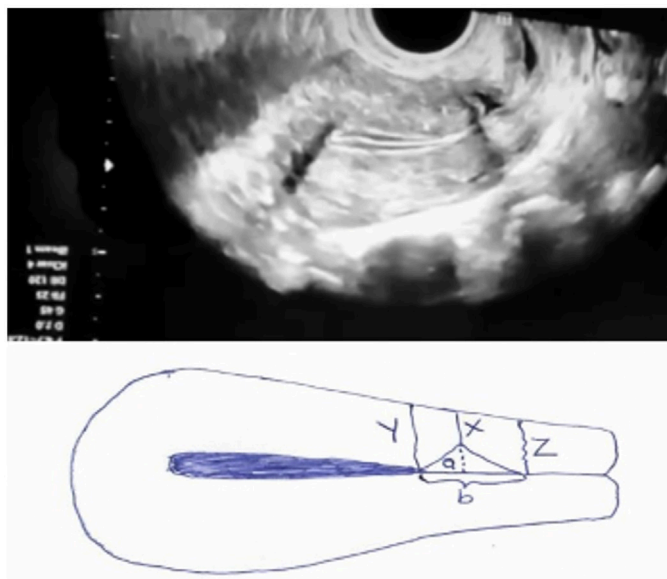


Figure 2. The measured parameters with ultrasound

Ethical Statement

The study protocol was approved by the Ethics Committee of Gaziosmanpaşa Training and Research Hospital (no: 120, date: 21/09/2022), and was conducted according to the principles of the Helsinki Declaration. Written informed consent was obtained from all participants. The clinical trial registration number is NCT05517018.

Statistical Analysis

All statistical analyzes were performed using IBM SPSS 21 and MedCalc Version 20.104 programs. The normality control of continuous variables was evaluated using the Shapiro-Wilk test. Quantitative variables are expressed as mean \pm standard deviation and qualitative variables as percentages. The Mann-Whitney U test and Student's t-test were used to compare two independent groups. Student's t-test was used for variables with normal distribution and quantitative variables with nonnormal distribution were compared using the Mann-Whitney U test. Categorical data were analyzed using the chi-square and Fisher's exact tests. A p-value of ≤ 0.05 was considered statistically significant.

Results

A total of 111 participants were included in our study, 53 of whom underwent classic single-layer unlocked closure as the control group, and 58 participants received uterine closure using the purse technique as the case group. There were no significant differences between the two groups in terms of age, gravidity, parity, abortion, body mass index (BMI), gestational week during cesarean section, baby weight, and baby height at birth. The demographic characteristics of the study participants are shown in Table 1.

The indications of the patients for a cesarean section are shown in Table 2.

There was no significant difference between the two groups in terms of the anesthesia method performed during surgery, the need for additional suturing for hemostasis during surgery, whether to make a brace for contraception, the sex of the babies, and breastfeeding status in the postoperative period (Tables 3 and 4).

In the Kerr incision made before surgery, the uterine incision size did not differ between the two groups. In the postoperative purse technique, the uterotomy area was significantly smaller than that in the other group (Table 4).

In the 6th-week follow-ups of the patients, 11 (20.8%) niche formations were found among 53 women who had classic closures and 6 (10.3%) of 58 women who had closed using the purse technique. The incidence of niche formation was not statistically different between the two groups (p=0.128 and p≤0.001, respectively). TV USG findings at the 6th-week follow-up are shown in Table 5.

Discussion

The main results of the present study indicate that the two techniques used showed no differences in the formation of ischiocele in the short postoperative 6-week period, and neither was superior to the other. The purse technique had a significantly smaller wound site in the postoperative period and a significantly smaller scar was associated with the defect at the 6th-week follow-up (p<0.001).

In a cohort study by Hosseini et al.⁽⁷⁾, women were divided into two groups and two different suture materials were used to affect the formation of ischiocele. The authors found ischiocele formation was statistically significantly higher in the group in which they used catgut and defined it as a risk factor. In addition, the residual myometrial tissue thickness, which is thought to be associated with uterine rupture, was found to be higher, and it was argued that using Vicryl was more advantageous as a result. However, there was no standardization for patients in

the study. The fact that factors other than suture materials were not excluded may have affected the results.

In the study performed by Sisti et al.⁽¹⁷⁾ to define patient-related risk factors for the development of isthmocele, it was found that the patient's age and the stage of birth at which the patient was

Table 2. Distribution of cesarean section indications according to the groups

	Classic single-layer uterine suture	Uterine closure technique		Total
		Double-layer purse-string suture		
Brow presentation	2	1	3	
Aneurysm	1	0	1	
Scoliosis	2	1	3	
Breech (Footling)	1	1	2	
Failed induction	2	1	3	
Cephalopelvic disproportion	9	9	18	
Gestational diabetes	2	1	3	
Patient prompt	4	4	8	
HPV	3	6	9	
Slow progress	1	3	4	
Fetal macrosomia	9	6	15	
Cholestasis	3	5	8	
Lumbar hernia	0	2	2	
Breech (Frank)	9	13	22	
Overdue pregnancy	0	1	1	
Occiput posterior	2	2	4	
Shoulder/transverse	3	2	5	
Total	53	58	111	

Table 1. Demographic characteristics of study participants

	Classic single-layer uterine suture			Double-layer purse-string suture			p
	Mean ± SD	Median (IQR)	Min-Max	Mean ± SD	Median (IQR)	Min-Max	
Age (years)	29±6.2	28 (24-33)	19-47	27.3±5.9	27.5 (23-30.3)	18-47	0.128
Height (cm)	159.8±5.4	160 (157-163.5)	150-170	160.3±5.7	160 (157.3-165)	150-172	0.637
Weight (kg)	75.3±10.6	75 (68-83)	56-95	75.4±11.5	75.5 (67-82.3)	53-99	0.958
BMI (kg/m ²)	29.5±4.2	29.3 (26.7-32)	20,3-41,3	29.4±4.9	28.5 (25.4-33.3)	21.1-40.6	0.929
Gravidity (n)	2.6±2	2 (1-3.5)	1-11	2.4±1.9	2 (1-3)	1-11	0.479
Parity (n)	1.2±1.5	1 (0-2)	0-6	1.1±1.5	0.5 (0-2)	0-7	0.563
Abortion (n)	0.4±0.9	0 (0-0)	0-5	0.3±0.8	0 (0-0)	0-5	0.451
Gestational age (weeks)	39.2±1.1	39.3 (38.6-40)	37-41	39.2±1.1	39.3 (38-40)	37-42	0.940

p: Independent Sample t-test *Mann-Whitney U test, BMI: Body mass index (kg/m²), IQR: Interquartile range, Min-Max: Minimum-maximum, SD: Standard deviation

Table 3. Operative data group⁽¹⁾

		Uterine closure technique				Total		p
		Classic single-layer uterine suture		Double-layer purse-string suture		n	%	
		n	%	n	%			
Presentation	Normal	40	75.5	41	70.7	81	73.0	0.768
	Other	5	9.43	4	6.89	9	8.1	
	Frank	8	15.1	13	22.4	21	18.9	
Anesthesia	General	7	13.2	6	10.3	13	11.7	0.639
	Spinal	46	86.8	52	89.7	98	88.3	
Needed additional hemostasis sutures	No	41	77.4	40	69.0	81	73.0	0.320
	Yes	12	22.6	18	31.0	30	27.0	
Tubal ligation	No	48	90.6	50	86.2	98	88.3	0.562*
	Yes	5	9.4	8	13.8	13	11.7	
Baby sex	Boy	30	56.6	33	56.9	63	56.8	0.975
	Girl	23	43.4	25	43.1	48	43.2	
Breast-feeding	No	11	20.8	6	10.3	17	15.3	0.128
	Yes	42	79.2	52	89.7	94	84.7	

p: Chi-square test, *Fisher's exact test

Table 4. Operative data of group⁽²⁾

	Classic single-layer uterine suture			Double-layer purse-string suture			p
	Mean ± SD	Median (IQR)	Min-Max	Mean ± SD	Median (IQR)	Min-Max	
Uterotomy incision length before suturing (cm)	10.8±1.4	11 (9.5-12)	8.1-12.9	11.1±1.3	11.5 (10-12)	8.1-12.9	0.334
Uterine incision length after suturing (cm)	8.4±1.1	8 (7.7-9)	7-11	4.2±0.7	4.3 (4-4.5)	2.5-5.7	<0.001
Preop Hgb (g/dL)	11.2±1.1	11.4 (10.4-11.8)	8.2-13.9	11±1.1	11.1 (10.5-11.7)	8.2-13.5	0.548
Postop 24 th hour Hgb (g/dL)	10.4±1	11 (10-11)	7.3-13	10.3±1	11 (9-11)	7.3-13	0.805
Baby weight (g)	3405.3±574.1	3350 (3010-3675)	2380-5140	3312.4±550.6	3245 (2990-3655)	2380-4650	0.386
Baby height (cm)	49.4±2	49 (48-51)	46-55	49.2±2.7	49.5 (47-51)	44-57	0.645
Hospital stay (days)	2±0.3	2 (2-2)	1-3	2±0.3	2 (2-2)	1-3	0.779

P: Independent Sample t-test *Mann-Whitney U test, IQR: Interquartile range, Min-Max: Minimum-maximum, SD: Standard deviation

given the decision for cesarean section were risk factors. These were very important findings, but it is not always easy to exclude these factors in practice. Knowing risk factors is important, but categorizing them as controllable and uncontrollable and focusing on modifiable risk factors allows us to go further in terms of preventing isthmocele. Factors such as older age, the number of cesarean sections, the stage at which the cesarean section decision is made, surgery performed under emergency or elective conditions, and the presence of additional diseases have been emphasized in the literature as negative factors on isthmocele and wound healing; however, these factors cannot be

controlled. This has led to the need to focus on the technique and improve the surgical technique. Accordingly, different uterine closure techniques have been described in the literature. Although Sisti et al.⁽¹⁷⁾ found residual myometrial tissue to be significantly thick in their retrospective study in which they closed the uterus as a single layer and a double layer, they found the results to be similar in terms of isthmocele formation. Although it seems to be protective in terms of uterine rupture potential in pregnancies after double-layer closure, there seems to be no difference in isthmocele formation. While closing the uterus, the locked or unlocked method may affect wound healing as much as the closure coefficient.

Table 5. Comparison of postoperative 6th-week ultrasonographic results

	Classic single-layer uterine suture			Double-layer purse-string suture			p
	Mean ± SD	Median (IQR)	Min-Max	Mean ± SD	Median (IQR)	Min-Max	
Uterine incision length (mm)	6.4±1.1	6 (5.5-7)	5-9	3.2±0.7	3.3 (4-4.5)	2.5-4.7	<0.001
Distance from internal os to uterine serosal surface (Z) (mm)	9.4±1.1	9 (8.5-10.5)	8-11.3	10.8±1.5	11 (9.9-12)	8-12	0.053
Myometrial thickness adjacent to scar (Y) (mm)	10.3±1.3	10 (9-11)	8.6-13.3	11.7±1.5	12.2 (10.7-12.9)	8.9-13	0.059
Myometrial thickness at cesarean scar site (X) (mm)	5.4±0.6	5.2 (4.9-6)	4.6-6.2	6±0.5	6.1 (5.7-6.3)	5-6.5	0.066
Length of uterine incision defect (c) (mm)	6.9±1.7	7 (5.5-8.5)	4.4-9	7.8±0.9	7.8 (7-8.7)	6.8-9	0.252
Height of uterine incision defect (a) (mm)	3.7±0.5	4 (3.1-4)	2.9-4.5	3.7±0.7	3.8 (3-4.3)	2.9-4.5	0.924
Weight of uterine incision defect (b) (mm)	4.2±0.7	4 (3.6-4.9)	3-5.2	4.5±1	4.3 (3.6-5.3)	3.4-6.2	0.594
Niche volume (cm ³)	104.7±24.4	100.8 (91.1-129.6)	70.9-144	128±35.6	131.2 (95.1-156.8)	80.9-173.6	0.131

p: Independent Sample t-test *Mann-Whitney U test, IQR: Interquartile range, Min-Max: Minimum-maximum, SD: Standard deviation

In a study by Turan et al.⁽¹¹⁾ in which locked and unlocked single-layer closures were compared, it was found that unlocked uterine closure caused less damage to the myometrium and therefore might be associated with better wound healing and less isthmocele formation. However, in a meta-analysis conducted in 2011, single-layer closure was associated with twice as many uterine ruptures in a postpartum trial⁽¹⁸⁾.

The comprehensive study results of Bamberg et al.⁽¹⁹⁾, in which both the locked and unlocked methods and the single- and double-layer methods were compared in the same study, showed that there was no significant difference in the formation of ischiocele between these three techniques. The results of this study are consistent with our results. However, after the study, Sciosa published a letter to the editor mentioning this study, suggesting that this might be due to the difference in standardization in the evaluation⁽²⁰⁾.

The purse-string closure technique, which is the subject of our study, described by Turan et al.⁽¹²⁾ and known in the literature as the Turan technique, was introduced in a comparative study. In their study, classic double-layer uterine closure and double-layer purse-string uterine closure were compared and short-term 6-week results were reported. The incidence of ischiocele was found to be significantly lower in the study group than in the control group. We compared the single-layer unlocked method and the Turan technique in our study, and to the best of our knowledge, ours is the first study to compare these two techniques. Some strengths of our study are that all participants underwent their first cesarean section and the standardization we provided through the strict exclusion criteria. In our study, there was no significant difference between isthmocele development between the two techniques. This may be due to

the superiority of single-layer over double-layer closure and the fact that our sample group consisted of highly selected cases. Further studies are needed to clarify this distinction.

The study has several other strengths: the randomized trial design, location in a single tertiary care center, all examinations were performed by an experienced sonographer who was blinded to the uterine closure technique, the absence of emergency surgeries, and the fact that all surgeries were performed under elective conditions by a single experienced surgeon. Another strength is that all postoperative evaluations were performed standard for women using the same TVS method.

Study Limitations

This study also has some limitations. Because the patients were included in our study when they were pregnant, diseases such as adenomyosis in the uterus that have the potential to affect the formation of ischiocele were not recognized or excluded. It would be more accurate to evaluate surgical techniques in patients who were evaluated in detail before and after pregnancy. In USG follow-up examinations, the study population was not evaluated for gynecologic symptoms such as postmenstrual spotting, which may be associated with cesarean scar defects. Some of the patients had not yet returned to their normal menstrual cycles, and symptoms such as postmenstrual spotting, postcoital spotting, and menstrual irregularity were not questioned in our study. Although ischiocele was not visualized on USG in patients, clinical symptoms may have occurred because a gold standard method for the diagnosis of ischiocele has not yet been defined. There is no consensus on the advantages and disadvantages of hystero-graphy, sonography, or USG imaging methods. Our results may have provided a limited evaluation because we used only one diagnostic method. This may be

the subject of other studies where the diagnosis is confirmed and supported using several methods. In addition, the patients could not be standardized in terms of breastfeeding, and their breastfeeding patterns were not recorded. At the beginning of the study, we calculated our sample size in line with article⁽¹²⁾ in the literature and concluded that 28 people in each group would be sufficient. When we were calculating we aimed to compare the incidence and first occurrence of isthmocele, not the percentage decrease in the difference between the two groups, and we used our statistical analysis in this direction. We calculated our sample size in line with the information in the literature and the statistical methods we should use. At the beginning of our research, we did not know exactly what the isthmocele ratio of the data set we were going to collect would result in, and therefore, the sample width we calculated using the literature was sufficient at first. We completed exceeding the number calculated. According to the rates we calculated, we concluded that the incidence of isthmocele is 2 times higher in the classical single-layer uterine closure group than in the purse string closure group. This ratio is clinically important for us.

However, when we looked at our results when we completed our study, we did not find any statistically significant difference, although the 50.48% decrease was clinically significant. This result may be due to the fact that we did not have enough sample size to see this difference statistically. The insignificance of this difference seems to be due to the limited number of our sample. However, we could not detect a statistically significant difference between the rates we obtained, although we have more samples than calculated. This is a limitation of our study. This situation may be the subject of further studies.

The fact that the isthmocele was higher in the control group than in the study group may not only be related to the closure technique (classical vs purse string). The number of sutures (single-double layer) may have been as effective as the closure technique (classical vs purse string). In future studies, a comparison of case groups with classical single fold, classical double fold, and purse-string double fold may provide more accurate information.

Estimation of surgical techniques should include the evaluation of the long-term effects on the functional integrity of the uterine scar. We do not know the subsequent pregnancy history of the patients and the clinical course after the 6th week. Therefore, our study needs to be confirmed with studies involving longer durations.

Conclusion

As a result of our study, we determined that there was no difference in the short-term results of classical single-layer closure and purse suture techniques in terms of isthmocele formation. The fact that the isthmocele was higher in the control group compared to the study group may not only be related to the closure technique (classical vs. bag string). The number of stitches (single-double fold) may have been as effective as the

closure technique (classic and purse string). In future studies, the comparison of classic single-ply, classical double-ply and purse-string double-ply case groups may provide more accurate information. In addition, the limited number of participants may have caused the results to not be statistically different.

However, our results suggest that the technique used does not affect isthmocele formation when the patient population is standardized. In the success of surgery, the perfect application of the technique is as important as the choice of the technique. We believe that the choice of surgical procedure should be decided by discussing the risks associated with the patient and the surgeon's experience.

Ethics

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of Gaziosmanpaşa Training and Research Hospital (no: 120, date: 21/09/2022), and was conducted according to the principles of the Helsinki Declaration.

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

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Authorship Contributions

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