SJIF Impact Factor: 5.464

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 7.
Issue: 6.
Page N. 13-19
Year: 2023

Original Article www.wjahr.com

OPTIMAL SUTURING TECHNIQUE FOR UTERINE INCISION DURING CESAREAN SECTION TO PREVENT THE INCIDENCE OF UTERINE ISTHMOCELE

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Received date: 24 March 2023 **Revised date:** 13 April 2023 **Accepted date:** 03 May 2023

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ABSTRACT

Background: uterine isthmocele is a hypoechoic area within the anterior uterine wall at the site of uterine incision during caesarean section with a depth greater than 2 mm. Large isthmocele were defined as those that occupy 50 to 80% of the myometrial thickness or that leave a residual myometrial thickness of less than 2.2 mm[1][4], resulting from a defect in the healing of the cesarean scar, which is a major concern for both doctors and patients because of its significant gynecological and obstetric complications such as abnormal uterine bleeding, dysmenorrhea, chronic pelvic pain, infertility, ectopic pregnancy, uterine rupture, and placenta previa. **The importance of the study:** Cesarean section is a common surgical procedure performed by obstetricians and gynecologists all over the world, and its rates have increased significantly in recent years. This led to an increase in associated complications, including uterine isthmocele, which has become one of the most common problems experienced by women after cesarean section, with a prevalence rate of more than 80%, according to international studies. **The reason of the study:** Several studies have investigated the independent risk factors associated with the occurrence of uterine isthmocele after cesarean section. In a study published in the American Journal of Obstetricians and Gynecologists in 2018, gestational diabetes, multiple caesareans, increased body mass index, amniotic sepsis, and retroversion of the uterus were all identified as independent risk factors for developing uterine isthmocele. In addition to factors related to the circumstances of childbirth, such as the length of labor time, the location of the incision on the uterus, and the type of suture used in suturing, in addition to other surgical steps such as closing the visceral and parietal peritoneum to prevent pelvic adhesions, which is still a topic of discussion that has not been resolved until now. The most important factor remains the type of uterine incision suture used, which ensures a good apposition of the two sides of the wound and sufficient blood supply for good scar healing. Therefore, it was necessary to find an ideal way to achieve these conditions to reduce the incidence of uterine isthmocele. **Objective:** The aim of this article is to determine the ideal method of suturing the uterine incision during cesarean section that can help prevent the occurrence of uterine isthmocele. We will discuss the results of recent studies on the types of sutures used to close the uterine incision during caesarean section. **Methods:** The study included patients with cesarean delivery in a randomized manner RCT in the Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia, who met the inclusion criteria. The patients were divided into three groups: **Group C:** It consisted of 50 patients who had their uterus closed on a single full-thickness layer with a closure. The second group **Group A:** consisted of 50 patients whose uterus was closed in double layers, the first covering the inner two-thirds of the uterine muscle without including the deciduous membrane, with continuous locked sutures, without unfair tension, and a good and symmetrical apposition of the two sides of the wound. The second is a continuous suture without locking the superficial third of the muscle, including the visceral peritoneum. The third group, **Group B:** consisted of 50 patients whose uterus was closed in two layers, the first covering the inner two-thirds of the uterine muscle without including the deciduous membrane, with continuous sutures without locking without unfair tension, and a good and symmetrical apposition of the two sides of the wound. The second is a continuous suture without locking the superficial third of the muscle, including the visceral peritoneum.

A transvaginal ultrasound was performed for all participating women at least 6 months after the date of cesarean section to investigate the presence and study the dimensions of the isthmocele. **Results:** Our results found that the percentage of uterine isthmocele in patients (group C 30.32%, group A16%, group B 8%) P<0.01. sectional area of uterine isthmocele measured by ultrasound mean ± SD: measured in mm squared (group C 6.2 ± 1.9, group A 4.6 ± 2.1, group B 3.8 ± 0.9) P<0.01. The thickness of the residual uterine muscle (RMT) also witnessed the same differences and had a very significant statistical value if we compared it as a measure between groups, (group C 5.9 ± 0.8, group A 8.1 ± 0.6, and group B 12 ± 0.9) P<0.01. To prevent bias and avoid differences between races and structural differences between normal individuals, we adopted a relative comparison between the thickness of the residual myometrium with the adjacent myometrial thickness, i.e. the ratio RMT/AMT, and we found this difference very clear in group C 60 ± 4.12 %), and group (A70 ± 3.81 %), and group B (82±1.78%), P<0.01. **Conclusion:** The ideal way to suture the uterine incision during cesarean section to prevent the occurrence uterineisthmocele is to use the unlocked double -layer suture technique, noting a significant improvement in the RMT/AMT ratio as an index of the success and effectiveness of this technique.

KEYWORDS: Cesarean scar defect, uterine isthmocele, double layer suture, one layer suture, residual myometrial thickness.

Abbreviations
CSD: Cesarean Scar Defect, **RMT**: Residual Myometrial Thickness, **AMT**: Adjacent Myometrial Thickness.

INTRODUCTION

Cesarean section (CS) is a surgical intervention performed most frequently in up to 27.2% of deliveries in developed regions.[1] The rate of caesarean sections has been reported to be constantly rising over the past years worldwide, touching nearly 52%. % of all births all over the world.[1-3]

Therefore, a greater number of complications associated with this operation are expected to occur, including complications that occur during caesarean section such as anesthesia issues and complications of surgery such as serious hemorrhage, amniotic embolism, damages to internal organs such as bladder and intestines, and late complications such as infection, pelvic adhesions, infertility and Chronic pelvic pain and uterine isthmocele.

The uterine isthmocele was defined as a hypoechoic area within the anterior uterine wall at the site of uterine incision during caesarean section with a depth greater than 2 mm. Large isthmocele was defined as those that occupy 50 to 80% of the uterine myometrial thickness or that leave a residual myometrial thickness of less than 2.2. mm[4], and can be well diagnosed using transvaginal sonograph with or without saline injection, and more accurately using endometrial endoscopy.

Uterine isthmocele is associated with important gynecological and obstetric complications such as postmenstrual bleeding(spotting), chronic pelvic pain, abnormal uterine bleeding unresponsive to drug therapy, and uterine rupture[7], and an increased incidence of ectopic pregnancy on the cesarean section[8], Placenta previa, accrete when it is placed on the anterior wall of the uterus above the previous cesarean section scar[9] and the failure of the pregnancy experiment. One of the hypotheses for explaining infertility is the accumulation of blood in the uterine isthmocele, which leads to changes in the cervical mucus, and this affects sperm transport. This has been suggested as a possible cause of secondary infertility and described by Fabres et al.[11]

Risk factors for uterine isthmocele

Several studies have investigated the independent risk factors associated with the occurrence of uterine isthmocele after cesarean section. In a study published in the American Journal of Obstetricians and Gynecologists in 2018, gestational diabetes, multiple caesareans, increased body mass index, amniotic sepsis, and posterior uterine reflection were identified as independent risk factors for developing uterine isthmocele. In addition to factors related to the circumstances of childbirth, such as the length of labor time, the place of making the incision on the uterus, the type of suturing materials, and the most important factor is the type of suture technique, which ensures a good apposition of the two ends of the wound and sufficient blood supply for good healing of the scar, whether it is on one or double layers. In addition to other surgical steps such as closing the visceral and parietal peritoneum to prevent pelvic adhesions, which is still a topic of discussion that has not been resolved until now.[1][31]

Studies using MRI suggest that scar remodeling may not be complete until 6 months after cesarean section.[12] Full scar healing can take up to 6 months or longer.[13]

Study Design

Randomised controlled trial (RCT). In which randomness is applied in distributing patients into three groups using a computer system. They were admitted to the Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia between 7/1/2021 and 7/1/2022 for a caesarean section.

Inclusion criteria

The patient's consent after seeing the informed consent.

- Maternity women who will undergo a cesarean section. They do not have any health factor that affects the outcome of the study.
- Patients' age ranges from 20-40 years.
- Mass index less than 30 kg / m2.

- Class I & II according to the classification of American Society of Anesthesiology ASA.

Exclusion criteria

Diabetic patients, those taking immunosuppressive compounds, previous caesarean section or previous uterine surgery, diagnosed uterine malformation, connective tissue diseases, bleeding disorders, patients with amniotic fluid infection, and a body mass index of 30 kg/m2.

Research Plan

The following will take place

- Admitting the woman to the obstetrics department and conducting the necessary laboratory tests.
- Conducting a lottery to select patients for both groups in a blinded way.
- Ensure the medical, surgical anamnesis of the accepted woman and that she fulfills the conditions of the study.
- All patients were given a preventive dose of antibiotics before the caesarean section.

(Using 1 Vicryl suture for the 3 groups) During all CS procedures performed in this study, uterine closure was performed using an absorbable synthetic material No: 1 Polyglactin.

A Pfannenstiel incision and a Kerr's incision were performed on the lower part of the uterus for all patients. After a 2 cm transverse incision, the lower part of the uterus was opened by cutting the myometrium with scissors.

The study sample was randomly divided into three groups according to the suturing method used to close the uterine incision.

✓ **Group C:** consisted of 50 patients who had their uterus closed on a single locked full-thickness layer.

✓ The second group, **Group A**: consisted of 50 patients whose uterus was closed in two layers, the first covering the inner two-thirds of the myometrium without including the placental decidua, with continuous locked sutures, without unfair tension, ensuring a good and symmetrical apposition of the two sides of the wound. The second is a continuous unlocked suture for the superficial third of the muscle, including the visceral peritoneum.

✓ **Group B**: consisting of 50 patients whose uterus was closed in two layers, the first covering the inner two-thirds of the uterine muscle without including the placental decidua, with continuous unlocked suture without unfair tension, and a good and symmetrical apposition of the two sides of the wound. The second is a continuous ulocked suture for the superficial third of the muscle, including the visceral peritoneum.

- Performing a transvaginal ultrasound for all participating women at least 6 months after the date of cesarean section to check for the presence of an uterine isthmocele. Each measurement was performed three times from different frozen images and the mean values were recorded. The area under the scar (bell-shaped pouch area) was calculated as a triangle (base ¥ depth/2). The scar cyst, when identified, was measured with an accuracy set to the first decimal millimeter.

- Conducting a comparative statistical study of the results between the three groups to investigate the optimal way to close the caesarean incision.

RESULTS

The demographic data of the patients were recorded, the patients' age, body mass index, previous pregnancies, number of deliveries, dilatation and vaginal discharges, and cervical dilatation was also recorded in the process for patients during labour. Indications for CS, duration of operation and any additional suture requirements are noted. In order to calculate the amount of blood loss.

Table 1: The demographic data of the patients.

		Group A	Group B	Group C	P-value
Age(yrs.)	Range (min- max)	20 – 35	20 - 40	21 - 37	**0.962**
	Mean ± SD	26.73± 9.85	26.42± 10.57	26.51±10.16	
Weight (kilogram)	Range (min- max)	36 - 98	61 - 85	63 - 95	**0.435**
	Mean ± SD	70+- 3.74	72 ±63	73±35	
BMI	Range (min- max)	21,4-30.0	29,8–23,1	28,9 - 22.1-	**0.95**
	Mean ± SD	25± 3.8	26± 2.6	25 ± 2.9	
Duration of surgery (in minutes)	Range (min- max)	40 - 20	35 - 20	30 - 17	**P<0.01**
	Mean ± SD	32.3 ± 2.45	28.6 ± 2.86	23.4 ± 3.45	
Pregnancy (weeks)	Mean ± SD	1±38	1±38	1±38	**NS**
ASA I	**[n (%)]**	**%8**	**%10**	**9%**	**NS**

All patients included in the study were asked to return for a monitoring visit six months after CS. During this visit, a clinical examination using ultrasound was performed to determine the presence of the isthmus, dimensions of the isthmocele, and the thickness of the residual and adjacent uterine myometrial (Amt, RMT). All patients were asked about the presence of dysmenorrhea, and the occurrence of abnormal uterine

bleeding in the form of postmenstrual spotting, and chronic pelvic pain.

We notice an important difference in the formation of the uterine isthmocele with the single-layer closure compared to the double-layer closure, and we also found a difference between the two-layer closure whether the suture was locked or unlocked as well. 8%)P<0.01.

Also, the measured dimensions of uterine isthmocele differed between the groups with statistically significant differences.

1. Depth Mean ± SD: Measurement in millimeters (group C 3.5 ± 0.57, group A 2.8 ± 0.30, group B 1.7 ± 0.34) P<0.01.
2. Width Mean ± SD: Measurement in millimeters (group C 0.8 ± 0.4, group A 0.9 ± 3.5, group B 0.6 ± 3,8) P<0.01.
3. Isthmocele cross-sectional size in Echography mean ± SD: measurement in mm squared (group C 6.2 ± 1.9, group A 4.6 ± 2.1, and group B 3.8 ± 0.9) P<0.01.

Table 2: Comparison between groups according to the formation of the isthmic uterome, its dimensions, and its size.

Uterine isthmocele dimension		Group C	Group A	Group B	p Value
N		50	50	50	
Frequency	[n]	15	8	4	<0.01
	[n (%)]	30.32%	16%	8%	
Depth(mm)	Range (min- max)	3.2-4.9	1.9-3.5	1,3-2.8	<0.01
	Mean ± SD	3.5 ± 0.57	2.8 ± 0.30	1.7 ±0.34	
Width(mm)	Range (min- max)	3.5-5,3	3,5-4,1	3.1-3,9	<0.01
	Mean ± SD	4.0± 0.8	3.8±0.6	3.5± 0.9	
Uterine isthmocele Size (mm^2)	Range (min- max)	2.1 – 14.0	2.0 -8.2	2 – 7.9	<0.01
	Mean ± SD	6.2 ± 1.9	4.6 ± 2.1	3.8 ± 0.9	

- Figure 1 shows the different forms of uterine isthmocele.[18]
- Shapes as mentioned in our study: they were triangular (74%), oval (18.5%), circular (7.5%), and we did not see other shapes.
- As for the groups: Group A 29.62%, Group B 14.81%, and Group C 55.55%.

Table 3: Forms of uterine isthmocele and their percentage according to forms and groups.

	A	B	C	Total
Triangular	5	3	12	20
Oval	2	1	2	5
Circular	1	0	1	2
Total	8	4	15	27
Ratio	**29.62%**	**14.81%**	**55.55%**	

- The thickness of the uterine myometrial adjacent to the scar AMT showed differences between single-layer closure and double-layer closure and between locked and unlocked sutures, (group C 8.8 ± 0.57, group A 11.0 ± 0.3, and group B 14.77 ± 0.34) P<0.01.
- The thickness of the remaining uterine myometrial (RMT) also showed the same differences and had a very significant statistical value if we compared it as a measure between groups, (group C 5.9 ± 0.8, group A 8.1 ± 0.6, and group B 12 ± 0.9) P<0.01.
- In order to prevent bias and avoid differences between races and structural differences in normal individuals, we adopted a relative comparison between the thickness of the remaining uterine myometrial with the thickness of the uterine myometrial adjacent to the scar, which is the ratio RMT / AMT, and we found this difference very clear in the group (C 60 ± 4.12%), group (A70 ± 3.81%), and group (B 82 ± 1.78%) P<0.01.

Table 4: Statistical differences between RMT\AMT Ratio.

		Group A	Group B	Group C	*P Value*
N		50	50	50	
Number of cases and Frequency	[n]	**8**	**4**	**15**	*<0.01*
	[n (%)]	**16%**	**8%**	**30.32%**	
AMT (mm)	Range (min-max)	**11.9-15. 5**	**13.2-17. 8**	**8.2-13.9**	*<0.01*
	Mean ± SD	11.0± 0.3	14.77±0.34	8.8±0.57	
RMT (mm)	Range (min-max)	**7,8-10,2**	**9.1-13,9**	**0,5-8,2**	*<0.01*
	Mean ± SD	**8.1± 0,6**	**12± 0,9**	**5.9± 0,8**	
RMT/AMT	**[n (%)]**	**%70±3.81**	**82±1.78%**	**60± 4.12**	***<0.01***

Suggested Pathophysiology

The golden standard of success for any method of suturing the uterine incision during caesarean section in order to achieve good healing of the scar later is its ability to accomplish a good apposition of the two sides of the wound and to ensure adequate local blood supply. locked one layer including full thickness suture is ideal for hemostasis, but it leads to mal- apposition of the layers and overturning and divergence towards the outside with the creation of holes within the incision, in addition to that the locked suture reduces blood flow due to the confinement of vessels coming to the wound area. In addition to the insertion of the placental decidua between the two sides of the wound. and this local ischemia and the mal-apposition of the layers negatively affects the healing of the scar. While suturing on two layers achieved an excellent apposition and matching of the edges without unfair tightening on both ends of the wound and good blood perfusion because the suture line does not intersect with the blood vessels connecting the wound area but rather is parallel to them in order to prevent ischemia, especially when unlocked the first layer.[31]

Comparison with the results of previous studies

The shapes as described by several investigators in the studies: triangular (82%), oval (10.1%), circular (4.5%), square and semicircular (2.2%), completely defective (1.1%)[19][20], which converges with the results that we have seen, because the number of our observations is 27, but in international studies (meta-analysis), the number of observations was much greater. However, after a period of more than 6 months from the date of the caesarean section, the shape of the scar in most cases turns into a bell-like shape.[12]

The researchers noted a significantly thicker RMT using the double unlocked technique, but their results were limited by the presence of previous cesarean sections in all women and ultrasounds performed before the uterine scar had fully healed (6 weeks post-cesarean section).[21]

Hayakawa et al compared an intermittent single layer including the peritoneum, an intermittent double layer with a first layer including the peritoneum, and continuous dual layer with an unoccluded first layer preferring inclusion of the peritoneum, similar to the third technique used in our current study, and they observed a significantly reduced risk of uterine hmocele within the scar using the third technique compared to the single layer (5.6% vs 34%); odds ratio 0.08; confidence interval 95%, p<0.01.[22]

Sevket et al observed a greater RMT (9.95 -1.94 mm vs 7.53 -2.54 mm; P < .005) using a two-layer suture technique with first layer lock compared to single-layer closed suture in a randomized controlled trial of 36 patients and evaluation of uterine scarring after 6 months from caesarean section.[23]

Interestingly, a recent randomized controlled trial conducted in France observed no difference in RMT between unoccluded single-layer closure excluding the peritoneum and double-layer closure with an unlocked first layer (7.7 vs. 7.3 mm).[24][25]

Turan et al. showed that monolayer locked suture was associated with a lower cure rate than non-locked monolayer suture (62% vs. 76%; P < .001).[26]

The conclusion concluded by Stegwee S that double-layer sutures are preferred over single-layer closed sutures with respect to RMT, cure rate, and dysmenorrhea.[27] Two-layer uterine closure after caesarean section is better than single-layer uterine closure in preserving residual muscle thickness better than RMT.[27][28][29]

Roberge et al reviewed and reported that the risk of uterine rupture was not significantly different between locked single-layer closure and double-layer closure, but that the risk of uterine rupture was higher in patients with a history of uterine rupture. Or close one unlocked layer.[30]

TVS at the 24th month revealed that the uterine isthmocele was larger after single-layer continuous suture compared to single-layer intermittent suturing. We might argue that this may be secondary to a greater ischemic effect performed by locked continuous sutures on muscle tissue, as also suggested by Cruickshank, and that this becomes more obvious with time after cesarean section.[14]

CONCLUSION

The results of the current study show that the best way to suture the uterine incision during cesarean section to prevent the incidence of an uterine isthmocele is to use a continuous unlocked double layer suture technique. It ensures an adequate thickness of residual myometrial thickness (RMT) after CS.

Study limitations

The exceptional circumstances that the country is going through, which negatively affected the access to a larger sample size that supports the results of this research.

ACKNOWLEDGMENTS

We wish to thank all medical staff in Obstetrics and Gynecology Department at Tishreen University Hospital for their hard work even with great difficulties.

Disclosures

The authors have no financial interests to disclose. This research didn't receive any specific grant from funding agencies in the puplic, commercial or non -profit sectors.

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