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Comparative analysis of classical primary continuous and novel technique uterine suturing methods on uterine scar formation after caesarian section: a prospective clinical study

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ABSTRACT

Objectives: The study investigated isthmocele rate, residual myometrium thickness, blood loss, and closure lengths through comparing the classical primary continuous suturing (CPCS) and novel technique uterine suturing (NTUS) after caesarian section.

Material and methods: A total of 402 C/S patients were included in this single-center prospective clinical study. All patients were divided into two groups according to suture technique. Classical primary continuous suturing (CPCS) was applied to the patients in Group 1, while the novel technique uterine suturing (NTUS) was applied in Group 2 as Z suture on both corners and 8 sutures in the remaining middle part incision closure.

Results: Patients in the NTUS group bled less than in the CPCS groups ($p < 0.0001$). Incision length after closure was longer in the CPCS than in the NTUS ($p < 0.0001$). Similarly, the number of sutures we applied was higher in the CPCS ($p < 0.0001$). In comparison of residual myometrium thickness, the mean values measured 197 ± 50 mm in the NTUS and 146 ± 39 mm in the CPCS ($p < 0.0001$). Residual myometrium thickness showed a negative strong correlation with incision length after closure ($r = –0.436$; $p < 0.0001$), how many times the needles have been passed ($r = –0.423$; $p < 0.0001$) and time for suturing ($r = –0.237$; $p < 0.0001$). NTUS and CPCS groups were similar in comparison to isthmocele.

Conclusions: The NTUS, termed as Erkayiran's suture, showed a successful reflection in our surgical cesarean section application compared to the classical suture. Although the occurrence of isthmocele in patients was similar, results were quite successful operationally in terms of both minimal blood loss and increased residual myometrium thickness.

Key words: caesarian section; uterine scar; isthmocele; suturing method; residual myometrium

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INTRODUCTION

In general, women have their first child at the beginning of their fertility years, and nowadays, the rate of preferring to deliver by the cesarean method has increased [1]. In cesarean operations, the lower regions of the uterus are opened in women, the baby is removed and then sutures are applied [2]. Normally this suture can be sewn in a single layer, double layer, or by locking the threads together, but there is no standard for the suture approach in practice [3]. When the cesarean section does not blend well, that area may remain open for any reason in women or create tissue in the open part there [4].

The isthmocele, which has a fluid, sac-like defect at the cesarean incision site, is detected in the anterior uterus in the previous cesarean area [5]. There is a prevalence that varies country by country, concerning the increasing number of cesarean sections [6]. Although patients with isthmocele are commonly asymptomatic, most of the symptoms are infertility, bleeding, and pain [7]. In particular, monthly menstrual blood can accumulate in this sac and cause continuous bleeding in the form of stains for 15–20 days [7]. Uterine rupture, ectopic pregnancy, and miscarriage implantation are among the pregnancy complications arising from this

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condition [8]. Although the surgical approach seems to be a controversial issue today, surgery should be recommended to women with future pregnancy expectations [9, 10].

Surgical sutures allow the tissues to be held together and have crucial importance in a cesarean [11]. Correctly applied sutures contribute to accelerating the healing process, thereby reducing scarring in the affected areas and reducing the recovery period and postoperative complications [6]. Although, new studies have reported possible risks [12], especially related to scar defect of cesarean section, there is no suture method comparison for isthmocele, which is one of the cesarean scar defects [13, 14]. The surgical method used during the closure of the incision to be made to the uterus increases and decreases the probability of occurrence of complications such as isthmocele, rupture, location, and invasion anomalies [15 16]. These complications cause difficulties in the next pregnancies. In cases such as isthmocele formation, the incidence of invasion anomalies such as scar pregnancy and percreata increata increases [17]. Besides, it is known that there is a relationship between residual myometrium tissue and rupture in subsequent pregnancies [18, 19].

In the present study, we wanted to examine the isthmocele rate, residual myometrium thickness, the difference in blood loss, duration of the closure, pre- and post-closure lengths compared to the classical primary continuous suturing (CPCS) of the operations performed with the novel technique uterine suturing (NTUS).

MATERIAL AND METHODS

Study design

A total of 402 C/S patients enrolled in this single-center prospective clinical study. We performed the current research at the Faculty of Medicine in the University. It was carried out after being approved by our institution's scientific research approval center and the Clinical Research Ethics Committee of the University (Approval Date: 2020/13-04; Protocol: 252). All individuals who participated in the study gave informed written consent before enrollment. The current study followed the guidelines of the Consolidated Standards of Reporting Trials and the Declaration of Helsinki [20].

Sample size

Before beginning the study, the participation of 176 individuals for each group in total was considered sufficient as a result of the power analysis performed at alpha: 0.05 and beta: 0.20 levels and the power of 0.80 test. We planned to include at least 200 patients for each group in the study to have higher participation or power in evaluation. As a result, 446 women were analzyed, with 412 eligible for inclusion, of whom 402 were enrolled (Fig. 1).

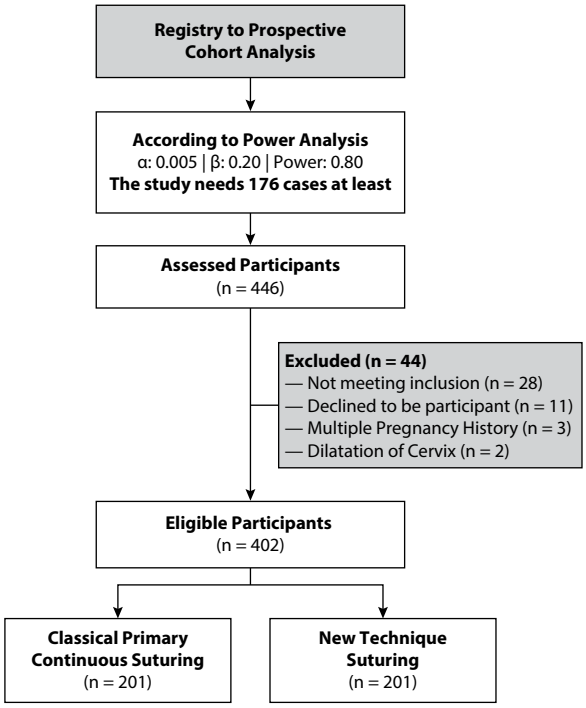

Figure 1. Flow chart for the selection and enrollment of study participants

Criteria for participants

The criteria for inclusion in the study were determined as follows: healthy patients between 18 and 40 years of age, who did not have a chronic disease, who did not take any anticoagulant drugs recently, who did not have a systemic disease such as blood pressure, and who had no previous uterine incision. Our exclusion criteria from the study were as follows: anticoagulant use, history of one or more cesarean section, uterine incision, hypertensive disease such as preeclampsia in pregnancy.

Surgical technique

Patients with primary cesarean section decided for cesarean section due to maternal or baby-related indications, regardless of the gestational age, were included in the study. Ages, cesarean indications, and weeks of gestation of the patients were recorded. All surgical procedures were applied to each patient as standard following working standards. The surgical process was performed by two surgeons (U.E. and T.A) experienced in obstetric surgery with the same suture materials and method. In patients with normal body mass index, 1g cefazolin sodium was administered one hour before the incision, while 2 g cefazolin sodium was used in patients with high BMI. The patients underwent cesarean delivery by making a lower segment uterine incision [21]. Classical primary continuous suturing (CPCS) was applied to the patients in Group 1, while the novel technique

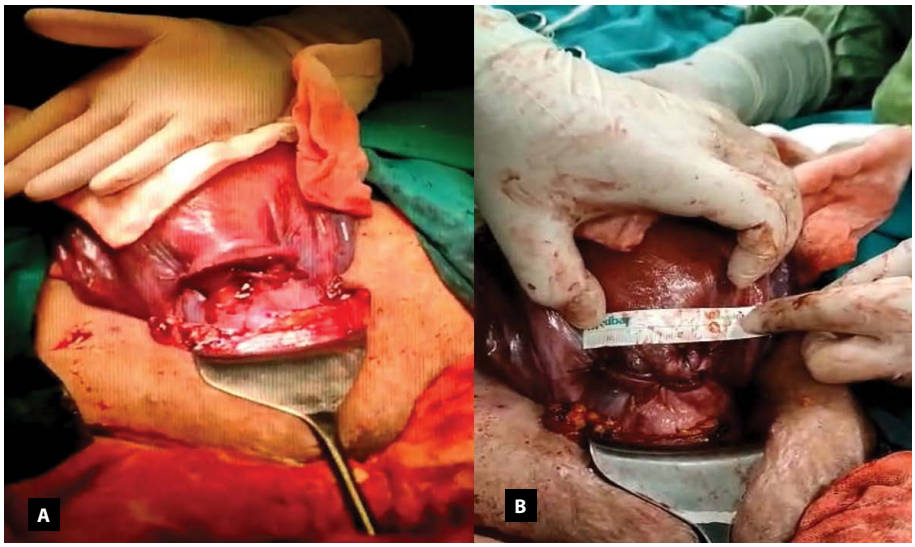

Figure 2. The pictures of the lower uterine segment before and after the NTUS; **A.** Closure of both corners of the uterine incision; **B.** Measurement of the uterine incision after closure

uterine suturing (NTUS) was applied in Group 2 as Z suture on both corners and eight sutures in the remaining middle part incision closure. The lengths were measured before and after the incision was closed (Fig. 2). During the closing of the incision, how many needles were passed through both uterine lips and how long this period was recorded, in addition to preoperative and postoperative hemogram values of the patients. Patients were called for the control at the postoperative 12th week and examined by transvaginal USG when they came. Uterine scar line thickness, size, and presence of isthmocele were evaluated.

Statistical technique

Data including continuous variables were expressed as mean ± standard deviation and categorical data as percentage. While the Chi-square test was used for categorical variables, the Mann-Whitney U test was used to compare the means of both groups in non-normal distributions. Student T-test was used to compare continuous variables between groups for normally distributed data. The paired analysis was performed to compare the preoperative and postoperative results of the patients. Chi-square analysis was applied for the categorical variables when the indications for the cesarean section were compared with the cross table. Data were analyzed using SPSS version 24 (SPSS) and a p-value less than 0.05 value was considered significant.

RESULTS

The patients' groups dividing according to the suture technique did not differ in terms of body mass, age, gestational week, uterine position, gravity-parity, cervical dilatation, and surgery indication, including demographic data ($p > 0.05$). Figure 1 provides a study flow chart for all the patients, including those enrolled in the present study and those who did not meet the criteria.

Paired analysis

The preoperative hemoglobin value measured for the comparison of the pre-and postoperative bleeding amount for all patients was 11.2 ± 1.2 mg/dL, while the postoperative value was found to be 10.1 ± 1.2 mg/dL ($p < 0.01$). The difference between preoperative and postoperative hemoglobin values in the CPCS group was 1.19 ± 0.83 mg/dL ($p < 0.0001$), while the difference in hemoglobin value between preoperative and postoperative in the NTUS group was 0.82 ± 0.65 mg/dL ($p < 0.0001$). It was observed that there was less bleeding in the NTUS group between the two groups.

Group comparison

In comparison to the suturing groups, pregnancy age and uterine incision length were similar between the groups. Incision length after closure was significantly longer in the CPCS than in the NTUS ($p < 0.0001$). Similarly, the number of sutures we applied was higher in the CPCS group ($p < 0.0001$). In the comparison of residual myometrium thickness, the mean values measured 197 ± 50 mm in the NTUS and 146 ± 39 mm in the CPCS ($p < 0.0001$). All the details of the group comparisons were given in Table 1.

Correlation analysis

There was a significant positive correlation between gestational age and the suture related parameters including uterine incision length ($r = 0.601$; $p < 0.0001$), incision length

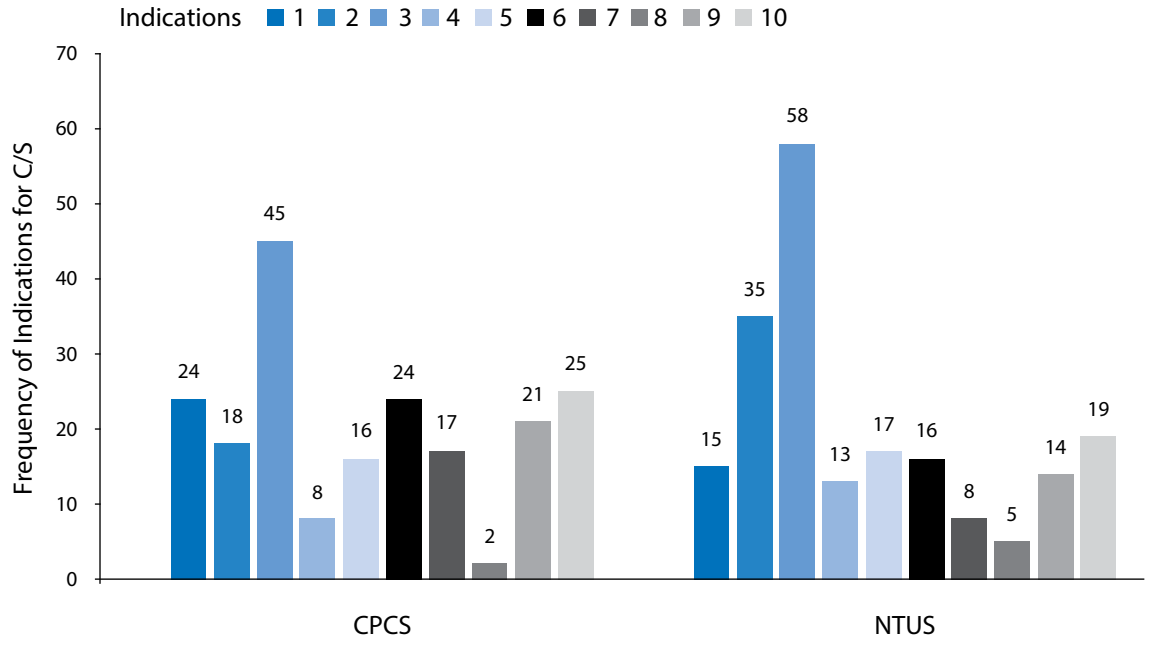

Figure 3. Frequency of cesarean section indications by the suture groups

after closure (r = 0.195; p = 0.009), how many times the needles have been passed (r = 0.253; p < 0.0001) and time for suturing (r = 0.307; p < 0.0001). Residual myometrium thickness showed a negative strong correlation with incision length after closure (r = –0.436; p < 0.0001), how many times the needles have been passed (r = –0.423; p < 0.0001) and time for suturing (r = –0.237; p < 0.0001).

Indications and isthmocele prevalence

A comparison graph of the patients' indications which we included in the present study was given in Figure 3. According to the chi-square analysis, the frequency of indications including cephalopelvic disproportion, fetal distress, multiple pregnancies, and maternal heart disease was found higher in the NTUS group than in CPCS (p = 0.025). NTUS and CPCS groups were similar in comparison to isthmocele. It was found in only one patient in both suture groups.

DISCUSSION

The NTUS, termed as Erkayiran's suture technique, which we examined in the present prospective study, showed a successful reflection in the results in our surgical cesarean section application compared to the classical suture approach. Although the occurrence of isthmocele in patients was similar, we showed that the results were quite successful operationally in terms of both minimal blood loss and increased residual myometrium thickness.

Most cesarean-related studies held several mechanisms that were associated with scar formation responsible, attributing to the surgical procedure. As one of these, Vervoort et al. directly tried to explain scar formation as the use of lower segment transverse incision [22]. Their results showed that the surgical incisions they applied due to the difficulty of separating the cervix from the uterus brought it closer to the cervix. Although this situation slows wound healing due to the accumulation of secretion in the wound area, these hypotheses are insufficient to explain scar formation after previous cesarean section. In another study conducted on scar formation, Yasmin et al. stated that scar formation is directly related to uterine wall closure techniques [23]. According to them, the inclusion/removal of the decidua, how many times the uterine wall was closed, the suture technique were the most effective parameters on scar development, such as the isthmocele. Tulandi et al. supported the results of Yasmin et al. that closing the uterus with a single layer reduced the risk of scars [24].

As an indisputable result, it is inevitable that the number of wounds in the uterus increases as the preference of cesarean section increases in both patients and surgeons. Bamber et al. conducted a study to investigate the outcome of uterine closure and evaluate uterine scar thickness, and ultimately compared the single/double layer suture. According to the results of their studies, double-layer closure was associated with a thicker myometrial scar in the primary or elective cesarean section [13]. While the focus of current studies is on suture material or surgical approaches in isthmocele formation, these analyzes do not address the importance of wound healing in the development of the suture type or technique. In this sense, it would be appropriate to work on different techniques to reduce the risks according

to each cesarean operation as a forward return risk for the patient. In the caesarean section surgical techniques study, researchers found no difference in postpartum blood loss when comparing catgut, a monofilament suture, and Vicryl, a multifilament suture [25]. The more sutures, lower tension, and longer operative time with monofilament sutures seemed less beneficial for hemostasis.

Başbuğ et al. [26] reported the effectiveness of suture material on the cesarean scar in a clinical analysis in single pregnancies. They performed closure using absorbable sutures and measured myometrial thicknesses remaining in the scar area, as measured by a transvaginal USG. Secondary results covered alterations in blood loss, operation time, and postoperative outputs. Although they could not find a significant alteration between the compared subgroups in terms of gynecological sequelae, according to their results, scar closure showed a positive difference on the increased myometrial thickness and healing. Unlike their study, we focused on the suture technique, not the suture material, and investigated similar clinical values in the same patient group. Besides, we included not only single pregnancies but also patients with different indications.

In the present study, according to the comparison of preoperative and postoperative hemoglobin values to assess the bleeding amounts, we observed fewer amounts of blood loss in the NTUS than in the CPCS. In comparison to the suturing groups, pregnancy age showed a similarity. Incision length after closure was significantly longer in the CPCS than in the NTUS. Similarly, the number of sutures we applied was higher in the CPCS as expected due to the longer incision length in this group. In the comparison of residual myometrium thickness, NTUS had a higher thickness than classical suturing. Our acknowledgment supports that the increase in endometrial thickness may lead to a decrease in the rupture risk. Gestational age showed a positive relationship with all the suture-related parameters including uterine incision length, incision length after closure, how many times the needles have been passed, and time for suturing. Residual myometrium thickness showed a negative strong correlation with incision length after closure, how many times the needles have been passed, and time for suturing. NTUS and CPCS groups were similar in comparison to isthmocele. It was found in only one patient in both suture groups.

There are some limitations in this clinical study. We included all patients with cesarean section without separating any indications according to the admission and exclusion criteria, and therefore we could not rule out the possibility of bias due to indication differences. Although we found the isthmocele occurrence rate similar in both groups, we could reach stronger data if we could also perform ROC analysis with a higher number of cases. The strengths of the study were enough participants according to the power analysis, having a prospective design, high follow-up rates, and successful results.

CONCLUSIONS

While recent clinical studies have focused directly on the closure methods and suture material of the uterine tissue, the current study focused on different, specifically, the suture technique and the importance of its factors affecting uterine scar healing. Our results showed that the 'Erkayiran' technique decreased the number of sutures and suture time, by the way, reduced the operation time and the rate of intraoperative complications with intraoperative less bleeding. Besides all these benefits of the 'Erkayiran' technique, we noted our surgical expectation for the possibility of a decreased intra-abdominal adhesion due to the less incision length after suturing and the possibility of a decrease in the rupture risk due to the increased endometrial thickness that needs to be investigated with future planned studies.

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Availability of study data

The data has not been publicly available due the institution policy but it has been available for the corresponding author on a reasonable demand.

Ethics approval

The present study was carried out after being approved by our institution's scientific research approval center and the Clinical Study/Research Ethics Committee of the University(Approval Details: 2020/13-04; Protocol: 252).

Consent to participate

All individuals who participated in the study gave informed written consent before enrollment.

Conflict of interest

The authors declared no conflicts of interest relevant to the present article.

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