

The Impact of Uterine Incision Closure Technique on the Post Cesarean Residual Myometrial Thickness and Scar Defects. A Novel Technique at a Tertiary Care Hospital

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Abstract

Background: Cesarean delivery (CD) is considered as one of the commonest obstetric surgeries as it comprises about one fourth of all deliveries in developed countries and may be more over in developing countries.

Aim of Study: To compare uterine incision closure with double layered first purse string, second continuous technique and double layered continuous non-locking technique during cesarean delivery (CD).

Patients and Method: This prospective, randomized clinical study was conducted at Mansoura University Hospitals, Obstetrics and Gynecology Department between April 2017 and April 2018 and included 160 patients allocated for elective CD. All women included in the study were randomized into two equal groups; group 1 (study group) where a double layered first purse string, second continuous closure maneuver was used, group 2 (control group), where the traditional continuous non-locking technique was done. Detailed transvaginal ultrasound examination was planned for all patients 6 months after discharge. Uterine dimensions, the presence of intracavitary, parametrial and sub-vesical hematoma formation were recorded. The length of the incision was measured in transverse axis and recorded. The integrity of the incision was checked in transverse and longitudinal axis, a wedge-shaped distortion in the integrity of the uterine incision scar was accepted as uterine scar defect and recorded as primary outcome measure of the short-term results of the study. The height of the defect was also recorded.

Results: Demographic data including age, gravidity, parity, body mass index was not significantly different between both groups. Also, operative time, hospitalstay, and preoperative as well as postoperative hemoglobin values were not significantly different between both groups. Uterine incision length after suturing is shorter in group 1 as in intraoperative measurements ($p < 0.001$, 95% CI=2.754-6.536). Significantly, the number of patients with ultra-sonographic visible uterine scar defects was 11 in the study group (32.35% of all scar defects) and 23 in the control group (67.65% of all scar defects; $p = 0.017$; $\chi^2 = 5.647$). The mean size of incisional defect is not significantly different between the groups.

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Conclusions: The new technique introduced in the present study documented shorter uterine incision length and also lower frequency of uterine scar defect.

Key Words: Cesarean delivery – Closure – Defects.

Introduction

CESAREAN delivery (CD) is considered as one of the commonest obstetric surgeries as it comprises about one fourth of all deliveries in developed countries and may be more over in developing countries [1,2]. One of the major drawbacks of CD is improper healing of the uterine scar with serious long-term complications including myometrial thinning and dehiscence at the scar site that may occurs in about 30-60 percent of cases [3,4].

Many obstetrical and gynecological complications may result latter from this defect. The encountered obstetric complications include ectopic scar pregnancies, morbidly adherent placenta and uterine rupture, whilst the gynecologic complications include postmenstrual spotting, dysmenorrhea and vague pelvic pain [4,5]. It had had been shown that the risk of uterine scar defect is related to the number of previous cesarean deliveries and method of uterine incision closure [4,5]. At present time there is no agreement about the method of uterine closure following cesarean delivery regarding one or two layers, locking or not the first layer, or inclusion or exclusion of the decidua [6,7]. Many prospective studies evaluating the residual myometrial thickness by ultrasound following cesarean delivery favored non-locking suture with exclusion of the decidua to optimize the tissue approximation and healing [8,9]. Similarly, large retrospective studies have provoked evidence that the risk of uterine rupture and placental accretion is related to the uterine closure technique [8,10]. Locked

single-layer closure, compared to double-layer closure, is associated with a 4-fold increase in risk of uterine rupture in a subsequent pregnancy as evidenced by Roberge et al., [8]. For follow-up and prediction of a thin scar or a scar defect, transvaginal ultrasound (TVU) is a well-known validated tool [11,12]. Therefore, the residual thickness of the myometrium at the scar site is measured giving an impression about the impact of uterine closure technique on scar healing and detecting scar defects if any and reported as isthmocele, niche, or wedge [12].

The current study was set to compare the technique of uterine incision closure with double layered, first purse string and second continuous, to the double layered continuous non-locking one during CD.

Patients and Methods

This prospective, randomized clinical study was conducted at Mansoura University Hospitals, Obstetrics and Gynecology Departments, Mansoura, Egypt from April 2017 to April 2018. This study has been approved by the local ethics committee at Mansoura University and Mansoura Faculty of Medicine with institutional research board number (IRB, 02.03.2017, 712). A written and verbal informed consent was obtained from all cases after explaining the method of the research for all with the ability of any woman to withdraw at any time according her will. All pregnant women with cesarean section indication applying to the delivery room within the study period (1 year) were recruited prospectively into the study. Exclusion criteria, pregnant women who declined to participate, women under 18 years of age, preterm pregnancies, emergency situations including cord prolapse, severe pre-eclampsia, eclampsia, placental abruption, placenta previa, vasa previa and those with a history of uterine surgery (e.g. hysterotomy, myomectomy, perforation, previous cesarean section). Women presented with maternal disease (complicated diabetes mellitus, unstable maternal condition with connective tissue disorders), uterine malformations, chorioamnionitis, presence of myoma and multiple pregnancy were also excluded. Intraoperatively, the surgeon excluded cases with extension of the uterine incision or injury to the uterine artery or any unexpected operative complications affecting maternal general condition or scar healing.

All women included in the study were randomized into either double layer first purse string second continuous closure arm (study group) or the traditional double-layered uterine closure arm

(control group) using sealed, consecutively numbered envelopes containing computergenerated numbers (Randomization Generator Version 1.0), which were opened when the women were recruited. The allocation ratio was 1:1. The patients were blinded to the groups, and the operator performed the operations randomly. Complete blood count (CBC) was done for all patients in both groups and they were planned for another complete blood count on the next day of the operation as an indicator for intraoperative blood loss. All cesarean sections were performed using the Pfannenstiel and Kerr techniques for abdominal and uterine incisions, respectively and by the same surgery team. In the control group, one separate holding suture at each corner was applied then the uterine incision was closed including decidual layer with a double-layer continuous non-locking suture using no. 1 polyglactin vicryl. The technique used in the study group was as follows; After securing both angles with stay sutures using vicryl no 1 suture, The first layer is transversely passed through the inner myometrium-decidua line starting from one angle through the lower incision flap to the other angle to the upper incision flap returning to the start point in running manner (purse-string) to tie the suture ends to each other. The second layer is side to side passed through the outer myometrium-visceral. Peritoneum line continuously in the form of continuous non-locking sutures from one angle to the other. Exteriorization of the uterus and parietal peritonization and apposition of subdermal space were performed in both arms. During the operations, the type of uterine closure technique used, operation time (min), uterine incision length (cm) were recorded before and after suturing and whether additional sutures for hemostasis were needed. Every patient received a prophylactic dose of antibiotics (cefotaxime 1gm vial intravenous). All patients were discharged within 3 days of the operation a detailed transvaginal ultrasound examination was planned for all patients 6 months after the cesarean section. With an empty bladder using highfrequency transducers of 5-6 MHz (Samsung medison: Sonoace R3, serial no. S0GYM3HF 200011K), uterine dimensions as well as the presence of intracavitary, parametrial and sub-vesical hematoma formation were recorded. The length of the incision was measured in transverse axis and recorded. The integrity of the incision was checked in transverse and longitudinal sections. A wedge-shaped distortion in the integrity of the uterine incision scar was accepted as uterine scar defect and recorded as primary outcome measure of the short-term results of the study. The height of the defect was also recorded.

Complete blood count was done for all patients and recorded before and after the operation. All registration data were collected and plan for communication and medical supervision and follow up was made up. All of the patients were asked to inform about subsequent pregnancy or any pregnancy event or even any gynecological symptoms within the follow-up period.

Statistical analysis:

Data were analyzed using SPSS version 20.0. Continuous variables with normal distribution were compared by independent Student's *t*-test; otherwise, the Mann-Whitney U-test was used to compare two independent groups.

All categorical variables were compared by the χ^2 -test, Fisher's exact test and two-sided Z-test accordingly. The results were evaluated within 95% confidence interval, and *p*-values less than 0.05 were accepted as statistically significant.

Results

In total, 160 patients were eligible for our study; 80 patients were allocated to the study group and 80 patients were allocated to the control group. Due to expansion of uterine incision, two patients in the control group did not receive their allocated intervention. In addition, 12 patients in the study group and 10 patients in the control group were lost to follow-up and did not come to the 6-month checkup visit. Statistical analysis is therefore based on data from the remaining 68 in the study group and 68 control group patients. In our study, there was no significant difference between the two groups as regard of the demographic criteria, age, gravidity, parity, and body mass index, (*p* is more than 0.05; Table 1). Also, there was no significant difference between the study and control group as regard of operative time and length of hospital stay (*p*-value; 0,785 and 0.118) respectively, Table 2). The evaluated hemoglobin concentration in the two groups pre- and post-operative again showed no significant difference (*p*-value 0.760 and 0.457, Table 2).

Table (1): Baseline characteristics of both studied groups.

Variables	Study group (n=68)	Control group (n=68)	<i>p</i> -value
	25.94±3.23	26.94±3.43	0.083
Gravidity (median)	1 (1-6)	1 (1-8)	0.454
Parity (median)	0 (0-1)	0 (0-1)	1.000
BMI	28.90±2.40	28.85±2.16	0.905

Values are presented as mean ± SD, number (percentage). *p*-value was set significant when <0.05.

Table (2): Operative and postoperative data of the studied groups.

Variables	Study group (n=68)	Control group (n=68)	<i>p</i> -value
Operation time (min)	26.50±1.86	26.41±1.89	0.785
Length of uterine incision before suturing (cm)	11.67±0.78	11.66±0.72	0.945
Length of uterine incision after suturing (cm)	4.13±0.52	8.33±0.89	<0.001*
No. of patients who needed additional sutures	18 (26.47%)	29 (42.64%)	0.02
Duration of hospital stay (days)	1.04±0.21	1.12±0.32	0.118
Preoperative hemoglobin value (g/dL)	11.45±0.57	11.48±0.60	0.760
Postoperative 1 st day hemoglobin value (g/dL)	11.02±0.56	10.95±0.57	0.457

Values are presented as mean ± SD, number (percentage). *p*-value was set significant when <0.05.

Intraoperatively, mean uterine incision lengths before suturing were 11.67±.78cm in the study group vs 11.66±0.72cm in the control group (*p*=0.945, 95% CI=0.413-1.154). After suturing, the uterine incision mean lengths were 4.13±0.52cm in the study group vs 8.33±0.89cm in the control group, consequently, this difference was found statistically significant (*p*<0.001, 95% CI=4.286-5.254, Table 2). Also, the number of patients who needed additional hemostatic sutures in the study group was 13.24% whereas it was 19.11 % in the control group and this difference appeared statistically significant (*p*-value=0.02, Table 2). Significantly, the number of patients with ultrasonographic visible uterine scar defects was 11 in the study group (32.35% of all scar defects) and 23 in the control group (67.65% of all scar defects; *p*=0.017; $\chi^2=5.647$, Table 3). The mean size of incisional defect is not significantly different between both groups.

Table (3): Data of postoperative ultrasonographic evaluation after 6th months.

Variables	Study group (n=68)	Control group (n=68)	<i>t</i>	<i>p</i>
Uterine incision length (mm)	21.28±2.28	23.83±3.35	2.274	0.030
Height of uterine incision defect (mm)	3.36±0.69	3.90±0.62	2.292	0.029
No. of patients with uterine incision defect	11	23		0.017 ($\chi^2=5.647$, d.f=1)

Data are presented by mean ± SD. *p*-value was set statistically significant when <0.05.

Discussion

Our study documented a significant lower scar defects when the novel technique using one purse string and second continuous closure maneuver than the traditional closure as 2 layers continuous non locking one. To our knowledge, this is an innovative technique in our locality.

Actually, surgical technique in CD differs from surgeon to another, and not all these techniques have been evaluated in randomized controlled trials. Although it is likely that application of different surgical techniques will produce relatively different outcomes [13]. Uterine incision closure technique is one of the most important factors that promote good healing and cesarean-related future complications. With the classical uterine closure techniques, uterine incisional defects or cesarean scar defect (niche) are reported to occur in about 20-60% of cases [14,15].

It is logic to believe that uterine scar defects reflect bad healing of the scar and incomplete healing of part of the hysterotomy incision and this defective healing may be related to the mechanical tension on the lower uterine segment with a suggested impaired blood perfusion and oxygenation of the healing tissues [16]. From this point of view, a new uterine incision closure technique was used in the present study which is double layer first purse string second continuous nonlocking sutures, in order to decrease the mechanical tension on the lower uterine segment then a statistical analysis of its effect on the post cesarean residual myometrial thickness was done.

A purse-string suturing closure technique was described for the first time as a new technique by Cem Turan and his team at 2015 [17]. In our study was directed to compare double layer first purse string second continuous technique with classical double layer uterine closure technique. This post-operative defective healing of the uterine incision in the form of cesarean scar defect is considered as short-term outcome complications but subgroup analysis for long term complications namely incisional ectopic pregnancy, placental invasion problems, complete or incomplete uterine rupture intra-abdominal adhesion during subsequent pregnancy is defective and in truth is considered as a point of weakness in our work. In the present study, it was found that with the double layer first purse string second continuous closure technique uterine incision length after suturing becomes shorter (4.13cm vs 8.33cm) and uterine scar defect frequency is lower than in the traditional double-

layered uterine closure technique (16.17% [11/68] vs 33.82% [23/68]).

In comparison with Turan et al., [17] we found that with the double layer first purse string second continuous technique uterine incision length after closure of the incision was not greatly different from Turan's technique (4.1 vs 3.7cm) respectively, which is slightly longer in the present study. This difference may be due to the tightness of Turan's technique as a double layer purse string uterine incision suturing technique which was intentionally avoided in order to improve tissue oxygenation that was supposed to improve tissue healing. Compared to Turan et al., [17] the frequency of uterine scar defect with our technique was lower than that with purse string double layer uterine incision closure technique performed by Turan (16.17% [11/68] vs 23.52% [12/51]), respectively. The lower frequency of uterine incision defect observed in our patients may be due to the fact that we examined the incision site after complete healing at 6 month which was done earlier by Turan; just 6 weeks after the operation, when there is still sufficient fluid collection in the uterine cavity that enable detection of even the smallest defect in the uterine incision. As long as the uterine scar is considered to heal completely after a minimum of 6 months following delivery, each patient was invited for an ultrasound examination of the uterine scar at 6 months after the cesarean delivery [18]. The following data was collected; presence or absence of cesarean scar defect, uterine incision length (mm) and height of uterine incision defect (mm) and then prevalence of severe scar defect was calculated and defined as the RMT <2.3mm. Studies about uterine scar defect conducted at a later period, when menstruation resumes, after cesarean section report that 50-60% of scars become defective [19]. Another Studies about uterine scar defect conducted 6-12 weeks after a classical cesarean section reported approximately 60% uterine scar defect [20].

In light of this published work, both in the early (6-12 weeks after cesarean section) and late (after menstruation resumes) period, the frequency of post-cesarean uterine scar defect remains similar and it is approximately 50-60% after the classical cesarean section.

In the present study it was found that the prevalence of cesarean scar defect reduced in both control group (34%) and study group (16%). This reduction may be due to limitation of our trial to primary cesarean section only.

The previously published work by Turan et al., [17] proved the uterine scar defect rates in patients with previous cesarean sections were 33.3% in the study group and 74.3% in the control group. However, the uterine scar defect rates in patients with primary cesarean section were 9.5% in the study group and 43.3% in the control group and decreasing the defect rate to 0% must be the goal of future trials. Such an ideal technique for uterine incision closure in cesarean section should be as follow: Ensuring hemostasis without impairing blood perfusion and oxygenation in the incision line and myometrial approximation (inner to inner and outer to outer) with decidual exclusion and decidual embedding into the uterine cavity in order to avoid endometrial inversion at the scar site, as these are believed to be the cause of incomplete scar healing.

The evaluation of surgical techniques for cesarean section should include an assessment of their long-term effect on the functional integrity of the uterine scar. This can be assessed by measuring subsequent morbidity associated with the scars, for example, the incidence of clinically recognized scar dehiscence, uterine rupture, placenta accreta, adhesions, distortion of pelvic anatomy, and bladder adherence to the uterus in subsequent pregnancies [13]. For this purpose, we recommend following-up this cohort during subsequent pregnancies to assess their long-term outcomes.

In our department, we have performed this new technique for one year, and according to our previous experience the long-term results are promising. From the scientific aspect, we will continue to follow the patients in this study cohort.

Many variations in cesarean section technique have been devised in order to shorten operating time, simplify the operation and increase efficiency, reduce costs, decrease the risk of adverse effects, and shorten postoperative morbidity and duration of hospital. In the present study, there were no or insignificant differences in operation time, morbidity or duration of hospital stay between our new technique and traditional closure technique. However, the incidence of uterine incisional defect, the most important factor in adverse postoperative effects, was significantly lower in our new technique (16%) than that in the traditional closure technique (34%) making our new technique more favorable. Also, the amount of suturing materials used was less with the first layer purse-string second continuous uterine incision closure technique than that with the traditional closure technique which is important for reducing the operation cost. In parallel with this study Turan et al., [17],

conducted a lower operation cost by applying double layer purse string uterine suturing in uterine incision closure during cesarean section.

Reducing the blood loss is another important issue in cesarean section. Lee et al., [21] exhibited less blood loss in myomectomy using purse-string suture at cesarean section; in parallel with the present study, the need of additional hemostatic sutures was lower in study group than in control group (13% vs 19%), showing superiority of this technique in hemostasis.

In the present study, cases in active labor were excluded, which may be a limitation or a bias of the study as thinned uterine wall in dilated and effaced cases may respond differently and this comes in agreement with Osser et al., [22] who reported that cesarean section in advanced labor is associated with increased risk of incomplete healing of the uterine incision. For this reason, further clinical studies including cases in active labor is recommended.

Information available about selection of the most appropriate suturing technique for uterine incisions is still little. Techniques vary depending on the clinical situation and surgeon preferences. Here, in the present study a new uterine incision closure technique was introduced, which still not named yet, as an alternative method and the authors recommend to be done as multicentric national or international study to be more valuable.

Conclusion:

Uterine incision closure technique is really one of the most important factors determining time consumed and promoting good healing and cesarean scar related future complications.

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أثر طريقة قطب الجرح الرحمى على سمك الجدار الرحمى المتبقى ما بعد التئام الشق القيصرى

فى السنوات الأخيرة زادت نسبة الولادات القيصرية من مجمل عدد الولادات حتى فى الدول المتقدمة. أحد أهم العوائق الجوهرية فى الولادات القيصرية هو الالتئام الغير جيد للشق الرحمى والمضاعفات المصاحبة لذلك التى تصل نسبة حدوثه من ٣٠٪ إلى ٥٠٪ من مجمل الولادات القيصرية والمضاعفات التى قد تحدث للحامل بسبب ذلك منها الحمل خارج الرحم فوق الشق الرحمى الملتئم، تقدم المشيمة والتصاقها بجدار الرحم وانفجار الرحم مع تقدم عمر الجنين والمضاعفات التى قد تحدث للسيدات غير الحوامل فإنها تتضمن نزيف ما بعد الدورة الشهرية وزيادة الأمها المرضية والأم الحوض المزمنة. وقد أظهرت العديد من الدراسات العلاقة ما بين ضعف جدار الرحم وعدد الولادات القيصرية وطريقة قطب الجرح الرحمى ونسبة حدوث المضاعفات المتعلقة بسوء التئام الجرح الرحمى.

وفى الوقت الحالى لا يوجد إجماع على طريقة واحدة لقطب الجرح الرحمى ما بعد الشق القيصرى حيث يوجد العديد من الطرق وفى الوقت نفسه يمكن تقييم الالتئام الناتج عن أى طريقة من خلال الموجات فوق الصوتية عن طريق المهبل لتصوير الرحم وسمك جداره وأماكن الضعف فيه وذلك بهدف الوصول لأفضل الطرق لقطب الجرح الرحمى.

الغرض من هذا البحث هو تقييم أثر قطب الجرح الرحمى بطريقة سرية متبوعة بخياطات متصلة وتقييم أثر ذلك على الجزء المتبقى أثر التئام الشق الرحمى وقد أجرى هذا البحث بقسم النساء والتوليد بمستشفيات جامعة المنصورة على المريضات التى يخضعن لولادة قيصرية أولية بتقسيمهم إلى مجموعتين بطريقة عشوائية حيث أجريت الولادة القيصرية للمجموعة الأولى بالطريقة العادية والمجموعة الثانية ثم قطب الجرح الرحمى بطريقة سرية متبوعة بخياطات متصلة و قد تم متابعة المجموعتين عن طريق الأشعة المهبلية بعد ثلاث وستة أشهر حيث تبين فعالية الطريقة الثانية فى الحصول على جرح رحمى جيد بعد الولادة القيصرية.