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Does suture material affect cesarean section scar healing?

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Abstract

Background: Sutures are an essential part of any major surgery which serve to hold opposing tissues together and accelerate the healing process, resulting in decreased scarring of the affected areas. In the past, gold, silver, iron, and steel wires, dried animal gut, silk, and plant fibers (e.g., linen, cotton) have been used as suture materials. Obstetricians commonly use synthetic absorbent sutures for uterine closure during CS. This study aim to evaluate the effects of different synthetic absorbable suture materials on cesarean scar defect formation.

Methods: After excluding patients who did not meet inclusion criteria and those who declined to participate, the patients were randomly divided in to 2 groups: - study group I: - 35 patients and study group II: - 35 patients.

Patients were subjected to the following: Ultrasound evaluation Ultrasound was done to ensure viability, determine the gestational age, the position of the placenta, the presenting part, the amniotic fluid and the estimated fetal weight using convex transducer of (Samsung Medison H60, Korea & 50/60 HZ).

Results: Regarding demographic data of the studied patients, Age, gestational age and BMI there were no significant difference between both groups. Regarding time of operation and type of anesthesia there were no significant difference between both groups. There was no significant difference in the preoperative, post-operative and delta Hb concentration between both groups. Regarding post-operative pain, there was no significant difference between both groups. Regarding post-operative hospital stay was no significant difference between both groups. Regarding myometrial thickness, total and residual myometrial thickness was significantly thicker in group II compared to group I.

Conclusions: Our results showed that monofilament sutures reduced pathological inflammation during wound healing without increasing costs, operation time, or intraoperative complication rates; resulting in improved uterine scar recovery; and potentially reduced CSD. These findings suggest that gynecological sequelae due to CSD and serious obstetric complications that may occur in subsequent pregnancies can be reduced.

Keywords: Suture material, cesarean section, scar healing

Introduction

Caesarean section (CS) is one of the most common surgical procedures performed all over the world, which increased in the past two decades [1].

The rates of cesarean section vary from region to another; accounting for 3.3% in Africa, 33.7% in Latin America, 27.3% in Asia, and 40.5% in China [2], with a significant higher rate in Turkey than in other countries; it occurs in up to 53% of all deliveries [3].

CS can effectively prevent maternal and perinatal mortality and morbidity [4] but, there are many short and long-term complications of CS [5].

One of the most common complications is the CS scar defect, which is first described by Morris in 1995, is a wedge-shaped distortion at the uterine incision site, has been reported using radiologic, endoscopic, and histologic methods [6].

CSD, also known as a niche, an isthmocele, or Cesarean scar dehiscence, has been implicated as a factor in clinical problems, such as rupture of the uterus during a subsequent pregnancy, ectopic pregnancy at the Cesarean delivery scar, Cesarean scar endometriosis, secondary infertility, postmenstrual bleeding, spotting, and dysmenorrhea [7].

The development of CSD is related to a deficiency of uterine scar healing.

The prevention of CSD should be the first aim of overcoming CSD-related complications.

Therefore, numerous studies have recently focused on the development and prevention of CSD.

The suture materials that are used could be considered to be independent factors for the prevention of CSD.
Sutures are an essential part of any major surgery which serve to hold opposing tissues together and accelerate the healing process, resulting in decreased scarring of the affected areas [8].
In the past, gold, silver, iron, and steel wires, dried animal gut, silk, and plant fibers (e.g., linen, cotton) have been used as suture materials [9].
Obstetricians commonly use synthetic absorbent sutures for uterine closure during CS.
This study aim to evaluate the effects of different synthetic absorbable suture materials on cesarean scar defect formation [10].
Absorbable synthetic sutures are composed of chemical polymers that are absorbed by hydrolysis and cause a lesser degree of tissue reaction after placement [11].
It also exhibits less resistance to passage through tissue unlike multifilament suture which inflict more microtrauma as they pass through tissues [12].
Multifilament sutures also induce a more intense inflammatory response and contribute to larger knot volumes than monofilaments of equal sizes [13].
However, because multifilament materials have increased capillarity, the increased absorption of fluid may facilitate the introduction of pathogens, which increases the risk for wound infection and dehiscence [14].
This study aim to evaluate the effects of different synthetic absorbable suture materials on cesarean scar defect formation.

Methods
This Blind randomized clinical study. It was conducted in the department of obstetrics and gynecology, Tanta University Hospital, Gharbeya, Egypt. The study was conducted from October 2020 to March 2022.

All patients were selected according to inclusion and exclusion criteria as follow
Inclusion criteria are
- Women older than or equal 18 years.
- Women who undergo an elective cesarean delivery.
- Gestational age ≥ 38 week.
- Singleton pregnancy.
- Primigravida.

Exclusion criteria are
- Gestational hypertension / preeclampsia.
- Gestational diabetes.
- Patients with BMI ≥ 30.
- Patients who had preoperative or postoperative fever for any cause.
- Patients who suffered from postpartum hemorrhage whatever the cause.
- Patients who had unplanned pregnancy for short period after delivery (6 months).
- Complicated cesarean section with bowel, bladder or uterine vessels injury.

After excluding patients who did not meet inclusion criteria and those who declined to participate, the patients were randomly divided in to 2 Groups: Study group I: 35 Patients and study Group II: 35 Patients.

The Methods of Randomization was simple alternative randomization, patient with odd number was allocated in group I, and patient with even number was allocated in group II.

Patients were subjected to the following
- Complete history taking focusing on age of patient, gravidity, parity.
- Complete physical examination focusing on BMI.
- Complete obstetric examination.
- Laboratory investigation CBC, PT and ABO&Rh typing.
- Ultrasound evaluation Ultrasound was done to ensure viability, determine the gestational age, the position of the placenta, the presenting part, the amniotic fluid and the estimated fetal weight using convex transducer of (Samsung Medison H60, Korea & 50/60 HZ).

Operative technique
Patients in Group I
Closure of the low transverse uterine incision were made using a double layer unlocked suture using multifilament suture (vicryl) size no: 1, including decidua with the visceral peritoneum open and parietal peritoneum closed.

Patients in Group II
Closure of the low transverse uterine incision were made using a double layer unlocked suture using monofilament suture (monocryl) size no: 1, including decidua with the visceral peritoneum open and parietal peritoneum closed.

Immediate postoperative follow up of the patients for signs of postoperative bleeding or postoperative fever
Post-operative pain: The Numeric Category Scale was used to assess pain. It is a horizontal scale, whose left extremity, or 0 pain, represents the absence of pain and gradually increases up to the right extremity, or 10, which represents an extreme level of pain.

Assessment of cesarean section scar integrity
Detailed transvaginal ultrasound was done for patients 6 months after the cesarean section with the woman in the lithotomy position and with an empty bladder by transducer of (Samsung Medison H60, Korea & 50/60 HZ).

Residual myometrial thickness: Thickness of the residual myometrium over the cesarean scar.
- **Total myometrial thickness:** Myometrial thickness above the uterine scar.
- **Position of the uterus:** Anteverted or retroverted.

Statistical analysis
SPSS version 27 (IBM©, Chicago, IL, USA) for Windows was utilized to evaluate the data Quantitative data was reported as mean SD or median (range) according to normality, whereas qualitative data was expressed as number and percentage. According to the nature of the data, the relevant statistical tests were employed A were judged statistically significant (P value ≤ 0.05).

Results

Table 1: Demographics of the studied groups

		Group I (N=35)	Group II (N=35)	P Value
Age (Years)	Mean ± SD	21.7 ± 3.28	23 ± 3.66	0.126
	Range	18 – 33	18 - 32	
Gestational age (Mon)	Mean ± SD	39.3 ± 0.99	39.4 ± 0.85	0.605
	Range	38 – 41	38 - 41	
BMI (kg/m²)	Mean ± SD	23.58 ± 3.23	24.94 ± 2.89	0.070
	Range	18.43 - 29.4	18.63 - 29.78	

BMI: Body mass index.

Regarding demographic data of the studied patients, Age, gestational age and BMI there were no significant difference between both groups. [Table 1].

Table 2: Time of operation and type of anesthesia in the studied groups

		Group I (N=35)	Group II (N=35)	P Value
Time of operation (min)	Mean ± SD	36.09± 3.82	37.58 ± 3.49	0.093
	Range	29.23 - 43.52	30.23 - 45.12	
Type of anesthesia	Spinal	33 (94%)	32 (91%)	1
	General	2 (6%)	3 (9%)	

Regarding time of operation and type of anesthesia there were no significant difference between both groups. [Table 2].

Table 3: Preoperative, post-operative and delta Hb concentration (baseline hemoglobin concentration - postoperative 6th hour hemoglobin concentration) in the studied groups

		Group I (N=35)	Group II (N=35)	P Value
Preoperative Hb concentration (g/dl)	Mean ± SD	11.17 ± 0.42	10.93 ± 0.57	0.050
	Range	10.5 - 12	9.6 - 12	
Post-operative Hb oncentration (g/dl)	Mean ± SD	10.09 ± 0.45	9.91 ± 0.48	0.111
	Range	9.4 - 11.1	9 - 10.9	
Delta Hb concentration (g/dl)	Mean ± SD	1.09 ± 0.25	1 ± 0.23	0.144
	Range	0.3 - 1.5	0.5 - 1.4	

Hb: Hemoglobin

There was no significant difference in the preoperative, post-operative and delta Hb concentration between both groups. [Table 3].

Table 4: Postoperative pain in the studied groups

		Group I (N=35)	Group II (N=35)	P Value
Post-operative pain	Mild	21(60.0%)	28 (80.0%)	0.118
	Moderate	14 (40.0%)	7 (20.0%)	0.124

Regarding post-operative pain, there was no significant difference between both groups. [Table 4].

Table 5: Postoperative hospital stay in the studied groups

		Group I (N=35)	Group II (N=35)	P Value
Postoperative hospital stay (hr.)	Mean ± SD	25.6±6.09	24.8±4.38	0.562
	Range	24-48	24-48	

Regarding post-opeartive hospital stay was no significant difference between both groups. [Table 5].

Table 6: Total and residual myometrial thickness in the studied groups after 6-9 months of CS

		Group I (N=35)	Group II (N=35)	P Value
Total myometrial thickness (mm)	Mean ± SD	7.6 ± 1.19	9 ± 0.98	< 0.001*
	Range	5.8 - 10.5	7.3 - 10.6	
Residual myometrial thickness (mm)	Mean ± SD	3.74 ± 1.06	4.56 ± 1.47	0.022*
	Range	2.1-6.7	2.1 - 6.7	

*: Significant as P value ≤ 0.05.

Regarding myometrial thickness, total and residual myometrial thickness was significantly thicker in group II compared to group I (P values < 0.001, 0.022 respectively). [Table 6].

Table 7: Cesarean scar defect (niche) in the studied groups after 6-9 months of CS

		Group I (N=35)	Group II (N=35)	P Value
Cesarean scar defect (niche)	Mean ± SD	7 ± 1.19	3 ± 0.98	0.34
	Range	6.80 - 7.20	2.02 – 3.98	

P Value ≤ 0.05.

Follow up after 6-9 months it was found that 7 cases in group I (out of 35) was suffering of cesarean scar defect (niche), while 3 cases in group II (out of 35) was suffering of cesarean scar defect (niche), so there was no significant difference between both groups [Table 7].

Table 8: Position of the uterus after 6-9 months of CS in the studied groups

	Group I (N=35)	Group II (N=35)	P Value
AVF	28 (80%)	23 (65.71%)	0.463
RVF	6 (17.14%)	8 (22.86%)	0.548

AVF: Anteverted uterus. RVF: Retroverted uterus.

Regarding anteverted and retroverted uterus, there was no significant difference between both groups. [Table 8].

Discussion

In this study, we aimed to evaluate the effects of synthetic suture materials on uterine scar healing after cesarean section?

Our study agreed with Başbuğ *et al.* 2019 who found that there was no significant difference in the preoperative, post-operative and delta Hb concentration between both groups (p value was 0.050, 0.111 and 0.144 respectively).

Regarding post-operative pain, there was no significant difference between both groups (p value was 0.118) and Post-operative hospital stay was insignificantly different between both groups (p value was 0.562) which agreed with Başbuğ *et al.* 2019.

In our study we found there was no significant difference between both groups in anteverted and retroverted uterus, (p value was 0.463) which agreed with Başbuğ *et al.* 2019.

Regarding myometrial thickness, total and residual myometrial thickness was significantly thicker in group II compared to group I (P values < 0.001, 0.022 respectively) which agreed with Başbuğ *et al.* 2019.

Our study agreed with Başbuğ *et al.* 2019 conducted a study in women with singleton pregnancies undergoing elective primary cesarean delivery after the 38th week of gestation to evaluate uterine scar closure was performed using synthetic absorbable monofilament and multifilament sutures. Residual myometrial thickness (RMT) in the area of the scar, measured by transvaginal ultrasound 6–9 months after birth. RMT was thicker in the monofilament compared to the multifilament suture group (5.5 ± 2.24 vs. 4.18 ± 1.76, $p = 0.01$).

In the present study, we found the time of operation was statistically insignificant in both groups, (36.09± 3.82 vs. 37.58 ± 3.49, P = 0.093) which disagreed with Başbuğ *et al.* 2019 who found that operating time was shorter in the multifilament compared to the monofilament suture group (35.62 ± 6.64 vs. 38.33 ± 5.86, respectively; P = 0.08) which explained by the greater number of knotting throws, low tensile strength, and longer operation time with monofilament sutures does appear to be less beneficial for hemostasis.

Başbuğ *et al.* 2019 found Hemoglobin delta was higher in the monofilament suture group (1.59 ± 0.96 vs. 1.25 ± 0.60, $p = 0.04$) which disagreed with the present study, there was an insignificant difference in the preoperative, post-operative and delta Hb concentration between both groups and there was no patients included in this study experienced hemorrhage requiring transfusion in either group which explained by difference in technique of uterine incision closure Başbuğ *et al.* closed the uterine incision by single layer locked sutures while in our study we closed the uterine incision by double layer unlocked sutures [100].

In our study, the residual myometrial thickness was significantly greater in the monofilament compared to the multifilament suture group (4.56 ± 1.47 vs. 3.74 ± 1.06, respectively; p = 0.022). The total myometrial thickness was also greater in the monofilament suture group; however, this difference was not statistically significant (9 ± 0.98 vs. 7.6 ± 1.19, respectively; p = < 0.001). CSD was lower in the monofilament suture group compared to the multifilament suture group which agreed with Başbuğ *et al.* 2019.

A cesarean scar defect, niche, or isthmocele is a coincidental finding on TVS and is usually asymptomatic. While the exact prevalence of symptomatic isthmocele is unclear, as the number of recurrent cesarean sections increases, there is no doubt that the number of women with known uterine scar defects will also raise. (15)

Several mechanisms have been implicated in the formation of CSD, with most cases attributed, at least in part, to the surgical procedure used. A study by Vervoort *et al.* directly attributed the formation of CSD to use of a lower segment transverse incision [16].

Başbuğ *et al.* 2019 hypothesized that surgical incisions performed during active labor mostly made more proximal to the cervix due to the difficulty to distinguish between the uterus and effaced cervix. In these cases, the mucus-producing glands of the lower segment become included in the defect, which can interfere with wound healing due to accumulation of secretions in the wound [100, 103], this hypothesis fails to explain cases who develop niche after cesarean section performed prior to the initiation of active labour. Another hypothesis regarding CSD formation is related to uterine wall closure techniques. Closing the uterine wall with either single or double layers, use of a locked or unlocked suture technique, and the inclusion or exclusion of decidua may affect the development of CSD [17].

In a review by Tulandi *et al.*, closing the uterus using a single layer was shown to reduce the risk of CSD defects compared with double-layer closure, though this difference was not statistically significant [18].

Multifilament suture materials also aid in bacterial migration, allowing bacteria to enter via the interior of the suture material, impairing the host's immunologic response and adversely affecting wound healing [19]. We therefore believe that the prolonged inflammatory phase in patients treated using multifilament sutures, as well as immunologic changes that occur in host cells, play a role in the formation of CSD.

The strengths of our study include a homogeneous population with no active labour, primary cesarean delivery without a prior uterine scar, high follow-up rates, and a sufficiently long recovery period of 6-9 months for CSD assessment. The main limitations of this study are the use of only glycolide-cocaprolactone-containing material as the monofilament suture material and glycolide-co-lactide as the multifilament suture material. Plain or chromic catgut, polydioxanone (PDS®), and antibacterial coated sutures are not used. The use of only the double-layer continuous unlocked closure technique, including the decidua; and the lack of short and long-term follow-up for endometritis and chorioamnionitis, secondary infertility, and complications in subsequent pregnancies could also be considered a study limitation [20].

While the discussions of the last few years have been largely focused on uterine closure methods, this study emphasized the importance of other factors that affect uterine scar healing, such as suture materials.

Conclusions

Our results showed that monofilament sutures reduced pathological inflammation during wound healing without increasing costs, operation time, or intraoperative complication rates; resulting in improved uterine scar recovery; and potentially reduced CSD. These findings suggest that gynecological sequelae due to CSD and serious obstetric complications that may occur in subsequent pregnancies can be reduce.

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Declarations

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Conflict of interest: Nil

Ethical approval

The study was approved from the ethics committee of Faculty of Medicine, Tanta University.

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