RESEARCH ARTICLE

Cesarean scar characteristics after scheduled and emergency Cesarean deliveries: A single center study

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Background: To study cesarean scar characteristics following scheduled and emergency cesarean deliveries.

Patients: Nine hundred patients were selected carefully to be enrolled in this study.

Results: Cesarean scar defects or niches were detected more frequently in emergency group 17.50% compared to 7.07% in scheduled group. Cutaneous cesarean scar examinations revealed that scars above symphysis pubis were more in scheduled group 84.14% while scars located at symphysis pubis were more in emergency groups 24.06% with p=0.002.

Conclusions: Scars resulting from scheduled cesarean sections are more thick, and with little incidence of defects than in emergency sections.

Key Words: *Cesarean section; Cesarean scar; Scar characteristics; Scheduled Cesarean section; Emergency Cesarean section*

Cesarean scar evaluation becomes important nowadays due to increased incidence of delayed scar complications. Reported scar complications included scar defect (niche), abnormal healing, abnormal vascularization, liability for rupture and placental invasion in subsequent pregnancy [1].

Studies designed to assess cesarean section scar had lot of controversies regarding the best time to evaluate the cesarean scar. Some author evaluated the scar early 6 weeks following cesarean section taking in consideration the great enthusiasm of patients for contraception while others recommended a period of 3 months and the majority recommended 6 months interval to allow complete healing of cesarean scar [2].

It was stated that proper apposition of myometrial edges with double-layerd repair leads to better healing with less incidence of cesarean scar defects. Ischemic necrosis of the myometrial tissue at the site of CS scar explains the formation of CS defects [3]. Assessment of cesarean scar is important as non-healthy or poor-healed scar are associated with some complication such as chronic pelvic pain, dyspareunia, and abnormal bleeding. Moreover these poor-healed scars may predispose to preterm labour and uterine dehiscence or rupture in subsequent pregnancy. It was reported also that poor-healed scar may predispose to abnormal placental invasion [4-7.]

This study was designed to evaluate cesarean scar characteristics following scheduled and emergency cesarean section and to evaluate if the type of cesarean section affects cesarean scar quality and complications incidence.

PATIENTS AND METHODS

Study design and settings

This study is a descriptive, cross-sectional, single center study conducted at Tanta University Hospitals, Tanta, Egypt.

Eligibility

Nine hundred patients were selected carefully according to inclusion and exclusion criteria. The inclusion criteria were: (i) Primipara having prior cesarean delivery whether scheduled or emergency (ii) Multipara having the last delivery by cesarean either scheduled or emergency (iii) Term delivery ≥ 37 weeks of gestation (iv) The interval following cesarean delivery to be 6 months at least and (v) Double-layer repair of uterus (vi) Cesarean by Pfannenstiel incisions and (vii) Uncomplicated cesarean sections. All operations were done previously at Tanta University hospitals by a group of surgeons using the same technique in cesarean section closure. The exclusion criteria were: (i) Repeat cesarean sections (ii) Preterm delivery (iii) Associated placental abnormalities (iv) Single-layer repair of uterus (v) Other uterine surgeries leaving a scar (vi) Pregnant women and (vii) IUD users.

Allocations

This study is not a clinical trial so allocation is made based on characteristics of patients and eligibility to be allocated in either scheduled cesarean group or emergency cesarean group. The allocation was not equal based on the percentage of patients in either group. The scheduled cesarean group included 580 cases while the emergency cesarean group included 320 cases.

Intervention

Cesarean scar assessment included both uterine scar and cutaneous scar. The uterine scar was assessed by transvaginal ultrasound by 2D, 3D and color Doppler modes. The used device was DC-30 device of Mindray Company, China. All ultrasound examinations were conducted by third author in this study. The uterine scars in both groups were examined for distance from internal os, length, thickness, volume, shape, vasculature and presence of any defects. Cutaneous scars were examined for distance from symphysis pubis, length, shape, any depressed areas, any defects (hernia orifice), sinus and presence of keloid or hypertrophic scar.

Parameters definitions

Cesarean scar: Well delineated hypoechoic shadow at the anterior wall of the lower segment, measurable in the 3 dimensions and lying between the vesico-uterine fold and the internal os.

Scar defect/niche: The presence of a hypoechogenic area (a filling defect) within the myometrium of the lower uterine segment, at the site of a previous Cesarean incision. Defect width, depth and residual myometrial tissue are measured for detected defects.

Scar hypertrophy: Erythematous, pruritic raised fibrous lesions that typically do not expand beyond the boundaries of the initial incision.

Scar keloid: overgrowth of dense fibrous tissue developing after healing of a skin incision and expanding beyond the borders of the original wound.

Atrophic scar: Sunken, depressed scar with pitted areas.

Methods

All patients' demographic data, characteristic of previous cesarean delivery, any postpartum complications, data of uterine scar assessment and data of cutaneous scar assessment were gathered and analyzed.

Ethical committee approval and study registration

This study was approved by ethical committee before start of the recruitment and was given the following code 316777/07/17. This study was registered on

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clinical.trial.gov and has the following ID: NCT03609281 and available on the link: https://clinicaltrials.gov/ct2/show/NCT03609281

Statistical methods

The statistical methods used were mean, standard deviation, percentage, student's t-test and chi-square with significant p-value ≤0.05. All statistical tests were managed by SPSS, version 18 (USA).

RESULTS

The total number of enrolled patients was 900 patients according to eligibility criteria allocated into scheduled cesarean group (n=580) and emergency cesarean group (n=320). The characteristics of enrolled patients are shown in Table 1.

The main indications for scheduled cesarean delivery were malpresentations 32.41%, placenta previa 19.83% and cesarean on maternal request 15.17% where the main indications for emergency cesarean delivery were fetal distress 28.13%, bleeding placenta previa 28.13% and obstructed labour 23.44%. The other indications of prior cesarean delivery were displayed in Table 2.

Ultrasonic assessment of cesarean scars revealed that more scars are located above internal os in scheduled group 81.55% while more scars are at the level of internal os in emergency group 60.00% (p<0.001) as shown in Figure 1. The length of cesarean scars were not significantly different in both groups (p=0.640) while scar depth, width and volume were increased in scheduled group than in emergency group 13.90 ± 2.30 mm, 4.11 ± 0.50 mm and 3.27 ± 0.70 cc versus 13.50 ± 2.18 mm, 3.44 ± 0.62 mm and 2.14 ± 0.33 cc respectively. Scar shape either barrel or triangular was not significantly different in both groups.

Cesarean scar defects or niches were detected more frequently in emergency group 17.50% compared to 7.07% in scheduled group as shown in Figure 2. The characteristics of scar defect regarding defect length, depth and width were more in emergency group rather than in scheduled group with 7.35 ±

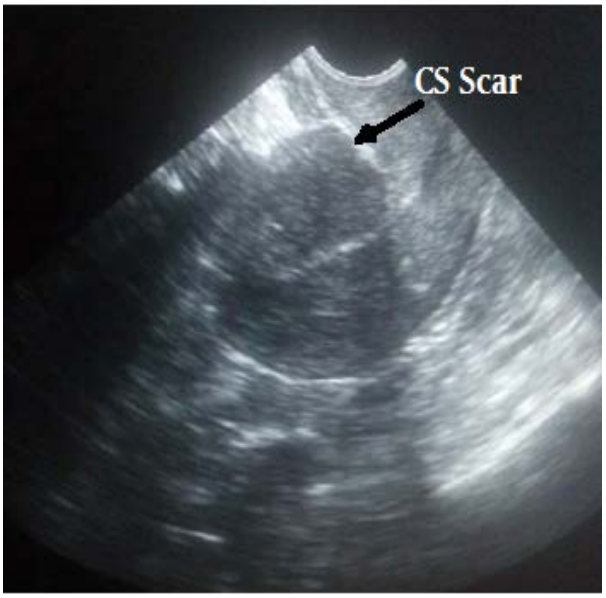

Figure 1: *Normal ultrasound sagittal view of cesarean scar*

TABLE 1

Characteristics of enrolled patients

	Scheduled cesarean group (n=580)	Emergency cesarean group (n=320)	95% CI	P-value
Age (years) *	25.97 ± 4.01	26.31 ± 4.11	-1.104	0.227
Gravidity *	3.02 ± 1.50	3.12 ± 1.70	-0.43	0.361
Parity *	3.42 ± 2.30	3.36 ± 2.11	-0.61	0.699
BMI *	24.12 ± 3.77	23.71±4.05	-0.939 - 0.119	0.128
Gestational age (weeks) *	38.32 ± 1.42	38.45 ± 1.38	-0.062 - 0.322	0.184
Neonatal birth weight (grams) *	3110±175.20	3120±165.77	-46.988	0.403
Duration since last CS (months) *	27.5±7.55	26.73±6.17	-1.938	0.362
Hospital stay (days) *	1.80±0.24	1.77±0.60	-0.085 - 0.025	0.289
Contraceptive methods (n,%)				
No methods	150 (25.86%)	60 (18.75%)		
Injectable methods	108 (18.62%)	75 (23.44%)	-0.651 - 10.577	0.085
Pills	220 (37.93%)	131 (40.94%)		
Implants	22 (3.79%)	18 (5.63%)		
Local methods	80 (13.79%)	36 (11.25%)		

CS: Cesarean section, SD: Standard deviation, BMI: Body mass index. *= Data presented as Mean±SD

Table 2: Indications of cesarean delivery in both groups

Indications	Scheduled cesarean group (n=580)	Percent %	Emergency cesarean group (n=320)	Percent %
Placenta previa	115	19.83%	78	24.38%
Abruptio placenta	-	-	13	4.06%
Fetal distress	-	-	90	28.13%
Cord prolapse	-	-	7	2.19%
Failed trial of labor	-	-	75	23.44%
Cesarean section on maternal demand	88	15.17%	-	-
Fetal macrosomia	60	10.43%	21	6.56%
Genital warts	22	3.79%	-	-
Contracted pelvis	65	11.21%	-	-
Malpresentations	188	32.41%	18	5.63%
Previous uterine perforation in D&C	7	1.21%	5	1.56%
Bad obstetric history	35	6.03%	13	4.06%

D&C: Dilatation and curettage

1.77 mm, 2.07 ± 0.33 mm and 4.87 ± 1.52 mm versus 8.20 ± 1.34 mm, 3.20 ± 0.80 mm and 5.11 ± 1.45 mm respectively. The residual myometrial tissue was increased in scheduled group than in emergency group 2.11 ± 0.56 mm versus 1.83±0.60 mm. Cesarean scars vasculature was significantly different in both groups (p=0.003).

Cutaneous cesarean scar examinations revealed that scars above symphysis pubis were more in scheduled group 84.14% while scars located at symphysis pubis were more in emergency groups 24.06% with p=0.002. Scar length, width and morphology were significantly different in both groups. The incidence of reported scar complications is shown in Tables 3 and 4.

DISCUSSION

Literature review regarding incidence of CS scar defects showed a wide range of 0.3% to 19.4%. [8-10] More recently it was reported that the incidence of CS scar defects is between 24% and 70% in a random sample of patients with at least one cesarean delivery [11] In another study the prevalence of isthmocele was 73.8% [12].

Figure 2: Cesarean scar defect /niche

In the current study we found that no differences were found between both groups regarding length or shape of uterine scars. Differences were found regarding depth, width and volume of scars with increase of fore mentioned parameters in scheduled than emergency groups denoting that scheduled deliveries were linked to thicker stronger scars than in emergency ones.

Relation of scar to internal os (IO) was assessed where more scars were above IO in the scheduled group while in emergency group scars were located at IO level. Pomorski et al (2017) found that higher scars above internal os were not linked to scar defects than those with lower scars [8]. Similar results were reported by Vikhareva et al (2010) found that cesarean sections done during active labour ≥ 5 hours with low station of presenting part were linked to more incidences of uterine niches [6].

In the current study, the defect characteristics regarding depth, width, length were increased in the emergency group denoting poor healing or no cooptation of uterine incision edges during repair. The RMT was decreased in the emergency group denoting weaker or dehiscent scar.

In the current study, the incidence of cesarean scar defects was more in the emergency 17.5% than in scheduled groups 7.07% as shown in Table 3. Park et al. (2018) conducted a case control study on 404 patients where several risk factors to uterine isthmocele were assessed. Elective or emergency cesarean delivery was not correlated to occurrence of isthmocele (p=0.087) while in the same study authors found that open cervix during cesarean section was linked to occurrence of isthmocele [12]. Similarly, Hayakawa et al (2006) and Yazicioglu et al (2006) found that emergency Cesarean delivery was not linked to more incidence cesarean scar defects [13,14].

On the other hand Chen et al (2017) conducted a retrospective study to assess different risk factors for scar defects. They found that more defects were linked to elective cesarean deliveries more than emergency ones [15]. These findings are opposite to our study results.

The cutaneous CS scar also was evaluated in the current study where no significant differences were found between both groups regarding shape of scars, incidence of hypertrophy and keloids. Scars length, width were increased in emergency than in scheduled group. The location of scars to symphysis pubis (SP) was assessed where most scars were above SP while scars at the SP were more in emergency group. Depressed scars and hernia defects were more in emergency group.

The studies reporting CS wound complications either early or late with demonstrated variable incidence of these complications. Regarding the incidence of hernia after cesarean section, the current study reported 0.52% and 2.19% after scheduled and emergency CS respectively. Shand et al. (2015) conducted a population-based cohort study in Australia to determine whether CS is a risk factor for incisional hernia or not. They found that the

Table 3: Cesarean scar ultrasound characteristics in enrolled patients

	Scheduled cesarean group (n=580)	Emergency cesarean group (n=320)	95% CI	P-value
Scar location from IO (n,%)				
At IO	107 (18.45%)	192 (60.00%)	35.142 - 47.542	< 0.001*
Above IO	473 (81.55%)	128 (40.00%)		
Scar length (mm) *	35.73 ± 11.20	36.09 ± 10.77	-1.150 - 1.870	0.64
Scar depth (mm) *	13.90 ± 2.30	13.50 ± 2.18	0.096 - 0.703	0.009*
Scar width (mm) *	4.11 ± 0.50	3.44 ± 0.62	0.590 - 0.749	< 0.001*
Scar volume (CC) *	3.27 ± 0.70	2.14 ± 0.33	1.062 - 1.197	< 0.001*
Scar shape (n,%)				
Barrel	188 (32.41%)	113 (35.31%)	-3.476 - 9.421	0.377
Triangular	392 (67.59%)	207 (64.96%)		
Scar defects (n,%)	41 (7.07%)	56 (17.50%)	5.970 - 15.321	< 0.001*
Defect width (mm) *	4.87 ± 1.52	5.11 ± 1.45	-0.441- -0.038	0.019*
Defect depth (mm) *	2.07 ± 0.33	3.20 ± 0.80	1.055 - 1.204	< 0.001*
Defect length (mm) *	7.35 ± 1.77	8.20 ± 1.34	0.627 - 1.072	< 0.001*
Defect RMT (mm) Mean±SD	2.11 ± 0.56	1.83 ± 0.60	-0.358 - -0.201	< 0.001*
Scar vascularity				
Hypervascular	110 (18.97%)	88 (27.50%)	2.812 - 14.470	0.003*
Hypovascular	470 (81.03%)	232 (72.50%)		

IO: Internal os, RMT: Residual myometrial tissue. *= Data presented as Mean±SD
*= significant

Table 4: Cesarean cutaneous scar surgical assessment

	Scheduled cesarean group (n=580)	Emergency cesarean group (n=320)	95% CI	P-value
Scar location from SP				
At SP	92 (15.86%)	77 (24.06%)	2.795 - 13.881	0.002*
Above SP	488 (84.14%)	243 (75.94%)		
Scar length (mm) *	15.77 ± 2.31	17.66 ± 3.01	1.537 - 2.242	< 0.001*
Scar width (mm) *	2.20 ± 0.1	2.18 ± 0.1	-0.033 - -0.006	0.004*
Scar morphology (n,%)				
Good healed	538 (92.76%)	254 (79.38%)	8.652 - 18.491	< 0.001*
Poor healed	42 (7.24%)	66 (20.63%)		
Hernial defects (n,%)	3 (0.52%)	7 (2.19%)	0.169 - 3.954	0.022*
Scar sinus (n,%)	0 (0.00%)	1 (0.31%)	-	-
Atrophic scar (n,%)	18 (3.10%)	37 (11.56%)	4.939 - 12.586	< 0.001*
Scar hypertrophy (n,%)	14 (2.41%)	15 (4.69%)	-0.146 - 5.339	0.063
Scar keloid (n,%)	7 (1.21%)	6 (1.88%)	-0.951 - 2.914	0.42
Scar endometrioma (n,%)	0 (0.00%)	3 (0.94%)	-	-

SP: Symphysis pubis, *= Data presented as Mean±SD
*=significant

incidence increased as the number of cesarean deliveries increased where 0.2% of women with one CS had incisional hernia repair and women with five CS had a sixfold increased risk of incisional hernia repair (aHR=6.29, 95% CI 3.99-9.93, P < 0.001) [16].

Scar sinuses were very rare in the current study where presented only in emergency group (0.31%). Literature review in this issue found this complication of rare incidence [17,18].

The presence of depressed areas in CS scar is due to healing by secondary intension after infection in the cutaneous wound with expectant or surgical management. In the current study we found that depressed areas were more in emergency group than in scheduled group 3.10% and 11.56% respectively. Suwal et al. (2013) found that complications were higher in emergency cesarean group than elective group regarding wound complications and other parameters [19].

The incidence of scar hypertrophy or keloid was reported in the current study to be non-significant between both study groups denoting that these complications may be due to genetic or hereditary predisposition more than surgical trauma or suturing techniques. Keloid or hypertrophic scars incidence after cesarean was not well stated in published studies and most studies concentrated more on prevention and management [20].

Scar endometriosis is a rare condition which was reported in the current study in 3 (0.94%) in the emergency group only. Many studies reported rare incidence or case report presentations on its symptoms, diagnosis and management [21,22].

CONCLUSIONS

Cesarean scars following scheduled sections were found to be thicker than those of emergency cesarean sections. The incidence of scar defects was little in the scheduled sections. Cutaneous scars were also better in scheduled group regarding size, shape and cutaneous abnormalities.

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