The Egyptian Journal of Hospital Medicine (January 2023) Vol. 90, Page 294-299

Effect of Blunt Extension of Myometrial Incision Versus Sharp Extension during Cesarean Section on Isthmocele Development

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ABSTRACT

Purpose: Isthmocele or cesarean scar defect/niche and its consequences are becoming more common worldwide, which is unlikely to be because of improved diagnosis or rising cesarean rates.

Objective: This study aimed to see how the development of niche and maternal problems were affected by the method of uterine incision extension.

Subjects and Methods: A total of 280 women from Kasr Alainy Teaching Hospital's Labor and Delivery section were included in the study. Two groups were observed over 10 months: group A sharp extension group and group B blunt extension group (1:1).

Results: There were no significant statistical differences between the two groups with respect to placental location, presentation, amniotic fluid, incision extension, and the presence of niche 6 weeks or 3 months postoperatively by transvaginal sonography. No significant differences were also found in scar thickness or surrounding myometrium thickness between the two groups. However, there were statistically significant variations between the two groups with respect to operational time, blood loss during closure, and uterine vascular damage.

Conclusion: There was no difference in the establishment of a cesarean scar niche or scar thickness between sharp and blunt uterine incision extensions. Sharp incisions may be preferable to blunt incisions because they result in properly aligned myometrial layers. More clinical trials with bigger sample sizes are needed to assess the impact of the technique of extending the uterine incision on the establishment of cesarean niches.

Keywords: Cesarean scar, Defect, Niche, Blunt extension, Sharp extension.

INTRODUCTION

The incidence of cesarean section (CS) is risen in the Western world from an average of 14.5% to reach in the last two decades to 27.2% [(1)]. The rising prevalence of CS has sparked curiosity in the deeply rooted consequences on the scar of cesarean section, including abnormal placentation, a uterine scar disruption or rupture uterus. Two other durable less severe but more common effects are gynecological problems and infertility [(2)].

The niche in the uterine cesarean scar is a relatively recent long-term sequelae. After one or more CSs, a scar niche is described as "a depression of the anterior myometrium at the level of uterine isthmus where the uterine cesarean scar was previously done with at least 2 mm depth on ultrasonography" and is found in 56%–84% of women [(3)].

The ways of performing CS and uterine closure differ. Double-layer closure versus single-layer closure, unlocked sutures in contrast to locked sutures, and whole flap thickness in contrast to split thickness are some of the differences (including or excluding the decidual layer, respectively) [(4)].

Although a sharp scalpel is used to make the incision, it can be expanded to either side with scissors or by blunt dissection with hands [(5)]. It was hypothesized that when a uterine incision is bluntly extended, the resulting edge may be uneven or ragged, and hence the myometrium healing may be poor, as opposed to sharp extension, which produces unique edges. Our work aimed at studying the impact of blunt extension of uterine incision during CS on the development of niche in comparison to sharp extension.

Methodology

Study design and setting

An observational cohort study was conducted using a convenience sample of pregnant women undergoing primary elective CS from May 2021 to March 2022. The study was conducted at Kasr Alainy Teaching Hospital's Labor and Delivery section, which is part of the Obstetrics and Gynecology Department.

Ethical considerations:

The study was carried out following the World Health Organization's ethical standards for human studies and the Helsinki Declaration. The Research Ethics Committee of Cairo University's Faculty of Medicine approved the study (IRB: MS-100-2021). All potential participants signed informed written consents after a thorough description of the study's goal and potential advantages.

Study population

All women who had their first CS were included in the study. Other requirements to be a part of the study included a singleton pregnancy with a parity of fewer than three, an age range of 18–35 years, and signed informed permission. Women with a previous CS, previous myomectomy either open or laparoscopic, known causes of abnormal uterine bleeding (e.g., uterine anomaly, cervical dysplasia, or hormonal

Received: 15/7/2022
Accepted: 18/9/2022

imbalance disturbing ovulation), abnormally invasive placenta, polyhydramnios, maternal diabetes, anemia and connective tissue disorder, body mass index > 35 kg/m^2, and multiple gestation were excluded from the study to avoid confounding effects on niche development. Sample size was calculated before the study, and when the target number of participants was reached in each group (i.e., 140 cases), all the required inputs were met, and the pooled data were analyzed.

Study measurements

All the CS had been done under spinal anesthesia using heavy Marcaine injected by a spinal needle no. 25. The abdomen was opened by the usual Pfannenstiel incision in layers maintaining hemostasis till entering the parietal peritoneum. The visceral peritoneum overlaying the lower uterine segment was incised, and the bladder flap was dissected downward.

We observed the route of uterine incision extension done by the same level of senior resident in the third year. By a scalpel blade, a C-shaped incision (Figure 1) was done on the lower uterine segment, but only the central part of the incision was opened, and the rest of the incision was extended either sharply (group A, n = 140) using a curved Metzenbaum dissecting scissors, and the surgeon should ensure that a finger is placed between fetal parts and myometrium so that the fetus is protected from unintentional injury, or bluntly (Figure 2) (group B, n = 140) using the index finger of both hands and pulling the fingers apart cephalad.

Fig (1): sharp incision technique

Fig (2): blunt incision technique

After fetal expulsion, uterotonic drugs were given, the placenta was delivered, and intrauterine wiping was done when placental membranes were seen. Any uterine artery injury, operative time in minutes, and any incision extension were recorded. Extension was defined as any myometrial involvement away from the originally deliberate uterine incision based on a previous study [6].

Exteriorization of the uterus during repair was standardized in all cases, as was double-layer uterine closure, where a continuous unlocked suture that included the decidual layer was used to tighten the first layer and the second layer being a continuous unlocked suture that imbricates the first layer using number 1 polyglactin 910 (VICRYL^{TM}) Ethicon- Johnson & Johnson MedTech, US. Then, the abdomen was closed in layers using the suitable suture technique and suitable suture material. Participating women were followed up in the immediate postpartum as the standard hospital protocol. They were asked to come again after 6 weeks for follow-up ultrasound prior to their discharge (Figures 3 and 4).

Fig (3): The same woman in fig.1
6 weeks postpartum, no defect

Fig (4): the same case in fig.2,
6 weeks postpartum, with CS defect

The assessment of the scar niche development was done on scheduled intervals, after 6 weeks postpartum with transvaginal sonography (TVS) using Ultrasound Mindray Dp5, and finally if no niche was detected, further assessment was done by TVS versus saline infusion sonohysterography using Samsung S23CMU1HS at 3 months postpartum (Figure 5).

Fig (5): The same woman in fig.1, 3 months postpartum.

The transversal plane was used to measure niche width, whereas the sagittal plane was used to measure niche length and depth (from the cervical canal to the peak of the isthmocele), residual myometrium thickness (from the deepest section of the niche to the serosa), and neighboring myometrium thickness (myometrium thickness near the niche's base, distance from the niche's apex to the vesicovaginal fold). The primary objective of the study was to assess the frequency of scar niche development, and uterine artery injury, operative time, and incision extension were considered as secondary outcome.

Statistical analysis

All of the information collected was double-checked for accuracy and logical consistency. Microsoft Office Excel Software Program 2019 was used to enter pre-coded data into the computer. The pre-coded data were then transferred and statistically analyzed using the Statistical Package of Social Science Software application, version 26 (SPSS). The mean and standard deviation of quantitative variables, as well as the median and interquartile range, were calculated and compared using an independent t-test, with a *p*-value of ≤ 0.05 considered as significant. The frequency and percentage of qualitative variables were described and compared using the Chi-square test, with a *p*-value of ≤ 0.05 considered as significant. Tables and graphs were used to present the data.

RESULTS

Table (1) showed that there were no statistically significant differences between the two groups with respect to gestational age, parity, and indication of section, but statistically significant variations with respect to maternal age were reported.

Table (1): Patients demographics

		Sharp incision n=140		**Blunt incision n=140**		**P value**
Age (years) mean ± SD, median (IQR)		28 ± 4	28 (25,31)	29 ± 4	29 (26,33)	0.025*
Parity n (%)	**0**	55 (39.3)		56 (40.0)		0.291
	1	43 (30.7)		35 (25.0)		
	2	40 (28.6)		49 (35.0)		
	3	2 (1.4)		0 (0.0)		
GA by weeks mean ± SD, median (IQR)		38 ± 2	38 (37,40)	39 ± 2	38 (37,40)	0.723
Indication of section n (%)	**Failed IOL**	1 (0.7)		6 (4.3)		0.25
	Fetal distress	65 (46.4)		69 (49.3)		
	Poor progress	9 (6.4)		8 (5.7)		
	Post date	28 (20.0)		30 (21.4)		
	Other	37 (26.4)		27 (19.3)		

*significant, S.D= Standard deviation, CS= Cesarean section, GA=Gestational age

No significant differences between the two groups were reported regarding placental location, presentation, and amniotic fluid as shown in table (2).

Table (2): Preoperative preparation in both groups

		Sharp incision n=140	Blunt incision n=140	P value
placental location n (%)	**Anterior**	32 (22.9)	28 (20.0)	0.842
	Fundal	43 (30.7)	44 (31.4)	
	Fundal anterior	8 (5.7)	6 (4.3)	
	Fundal posterior	6 (4.3)	4 (2.9)	
	Posterior	51 (36.4)	58 (41.4)	
Presentation n (%)	**Normal**	123 (87.9)	128 (91.4)	0.561
	Breech	13 (9.3)	10 (7.1)	
	Transverse	4 (2.9)	2 (1.4)	
Fluid n (%)	**Normal**	131 (93.6)	134 (95.7)	0.426
	Oligohydramnios	9 (6.4)	6 (4.3)	

There were statistically significant variations between the two groups with respect to operational time, blood loss during closure, and uterine vascular damage. However, no significant difference was reported between the groups with respect to incision extension as shown in table (3).

Table (3): Intraoperative intervention among both groups

		Sharp incision n=140		Blunt incision n=140		P value
Operative time (minutes) mean ± SD, median (IQR)		50 ± 6	51 (45,55)	38 ± 5	38 (34,43)	<0.001*
Presence of incision extension n (%)	**Yes**	10 (7.1)		4 (2.9)		0.1
	No	130 (92.9)		136 (97.1)		
Uterine vessel injuries n (%)	**Yes**	7 (5.0)		18 (12.9)		0.021*
	No	133 (95.0)		122 (87.1)		
	No	140 (100.0)		140 (100.0)		

*Significant

Table (4) highlighted the postoperative follow-up relationship between the two groups. No significant differences were observed in the presence of niche 6 weeks or 3 months postoperatively by TVS, and no significant differences were found in scar thickness or surrounding myometrium thickness.

Table (4): Postoperative follow up

		Sharp incision n=140		Blunt incision n=140		p value
The presence of niche by TVS 6 wks postpartum n (%)	**Present**	32 (22.9)		42 (30.0)		0.175
	Absent	108 (77.1)		98 (70.0)		
The presence of niche by TVS 3 months postpartum n (%)	**Present**	6 (4.3)		11 (7.9)		0.211
	Absent	134 (95.7)		129 (92.1)		
If niche is present after 3 months		**Sharp incision n=6**		**Blunt incision n=11**		**p value**
Scar thickness (mm) mean ± SD, median (IQR)		2 ± 1	3 (1,3)	2 ± 1	2 (1,3)	0.58
adjacent myometrium thickness mean ± SD, median (IQR)		9.4 ± 1.7	9.9 (8.5,10.5)	7.3 ± 2.9	8.7 (5.2, 10.0)	0.08

IQR= interquartile range

DISCUSSION

The presence of indentation signifying uterine wall discontinuity or a triangular hypoechoic defect in the myometrium having its base connected to the uterine cavity at the location of a previous CS scar is referred to as an isthmocele, a cesarean scar defect (CSD), or a uterine niche [7]. One of the possible explanations of isthmocele formation is the "ischemia and mal-apposition theory," which clarify that the technique of uterine incision and closure represent one of the most important factors for CS defect creation [8]. We tried in our study to investigate the impact of blunt extension of uterine incision during CS on the development of niche in comparison to sharp extension. Previous trials were discussing methods of closure of cesarean scar and development of isthmocele including one layer closure versus double layer, suture material, and technique of closure. This study evaluated methods of myometrial incision.

A total of 280 pregnant women were observed over 10 months and were divided into two equal groups: group A, "sharp extension group" and group B, "blunt extension group." Statistical analysis of the current study reported that there were no differences between the groups with respect to gestational age (weeks), parity, and indication of CS. On the other hand, women in the blunt incision group were statistically significantly older than those in the sharp incision one ($p = 0.025$), but this significant difference had no impact on study outcomes. There were no differences between groups regarding placental location, presentation, and amniotic fluid volume.

No statistical differences were reported between the two groups regarding the presence of incision extension. Operative time in minutes was found to be higher in the sharp incision group. The percentage of uterine vessel injuries was larger in the blunt incision group (18 vs. 7; $p = 0.021$), but it was noted that all injuries were mostly on the side of the dominant hand of the surgeon. **El-Berry *et al*.** [9] reported that operating time, extension to broad ligament, and extension to uterine vessels do not differ significantly between groups (group A "blunt uterus incisions" and group B "sharply uterine incised"). This finding might be because of different study methods or population criteria. They concluded that sharp uterine expansion may be healed quicker than blunt uterine expansion, and that with a sharp uterine expansion technique, the demand for blood transfusion is lower. The present study disagrees with the study by **El-Berry *et al***. [9].

There were no differences between study groups regarding formation of cesarean scar niche 6 weeks and 3 months postpartum. The mean adjacent myometrium was thicker in the sharp incision group than in the blunt one (9.4 ± 1.7 vs. 7.3 ± 2.9 mm; $p = 0.08$). In addition, there was no significant statistical difference between both groups with respect to the scar thickness ($p = 0.58$). Uterine vessels injuries were observed only at the side of the dominant hand of the surgeon in blunt group cases. **Budny-Winska *et al***. determined that the kind of uterine incision expansion has no effect on the uterine scar healing in women who have a complete thickness of the myometrium that was closed with single-layer continuous suture, excluding the decidua [10]. The study included 204 women who had undergone a single-layer myometrial closure for a low transverse CS. A niche was discovered following a cesarean delivery in 153 cases. Only 5 individuals had a residual myometrial thickness of < 2.2 mm, and 35 had a ratio of residual myometrial thickness to adjacent myometrial thickness of < 0.5 [10].

Regarding unintended extension, our study disagrees with **Rodriguez *et al***. [11] who conducted a randomized trial where women were scheduled for a nonemergency cesarean birth and were divided into two groups: 139 women in blunt extension group and 147 women in sharp expansion group. The indication and length of labor were similar in both the blunt and sharp expansion groups. No change was reported in the rate of unintentional extension, puerperal sepsis, operative time, or anticipated blood loss. Whereas, **Saad *et al***. [12] reported that blunt enlargement of the uterine incision after CS was linked to fewer unintentional extensions and better maternal outcomes. In spite of the reduction in hemoglobin level, hematocrit value, and surgical durations favored blunt expansion, the magnitude of the reduction may be of no clinical significance.

Five studies (with a total of 2608 patients) examined the frequencies of unplanned extensions. Extension was characterized by **Asicioglu *et al***. [13] as a myometrial tear that may be vertical involving the lower uterine segment down to the cervix or lateral that may involve uterine vasculature. They found that the blunt expansion group had fewer unintended extensions (4.8% vs. 8.8%; $p = 0.009$), uterine vessels damage (0.55% vs. 2%), and the need for uterine artery ligation (14.6% vs. 24.8%; $p = 0.003$) than the sharp expansion group. Lateral extension was found to be common in either groups [13]. The sharp group had a higher rate of extension than the blunt group according to **Magann *et al***. [6] who defined extension as any uterine defect beyond the original targeted uterine incision [6]. **Rodriguez *et al***. [11] defined extension as a uterine wall defect that extends beyond the target incision by > 2 cm. The incidence of extensions was similar in both groups (blunt [11.7%] vs. sharp [13.7%]; $p = 0.61$). No cases of cervical, wide ligament, or vaginal involvement have been reported.

Regarding adjacent myometrial thickness and scar thickness, **Alalfy *et al***. [14] compared 2D sonohysterography versus 3D sonohysterography for evaluation of scar niche in women with secondary infertility undergoing intracytoplasmic sperm injection. Adjacent myometrial thickness was 7.24 ± 1.09 mm by 2D and 7.97 ± 1.13 mm by 3D. Niche depth was 1.9 ± 0.44 mm by 2D and 2.26 ± 0.45 mm by 3D. According to our study, adjacent myometrial thickness was 9.4 ± 1.7 mm in the sharp group and 7.3 ± 2.9 mm in the blunt group, and scar thickness was 2 ± 1 mm for both groups.

Rasheedy *et al*. [(15)] compared TVS to saline contrast sonohysterography (SCSH) for assessing CS defects. Six weeks after CS, 102 consecutive participants who had a primary CS were tested using saline contrast sonohysterography and TVS to see if they had scar defects. Saline contrast sonohysterography had a mean residual myometrium of 10.09 ± 2.74 mm, whereas TVS had a mean residual myometrium of 11.18 ± 2.50 mm. When measured by TVS and saline contrast sonohysterography, the mean anterior myometrial thickness did not differ, whereas the mean niche depth was found to be 2.76 ± 2.02 mm for saline contrast sonohysterography and 1.57 ± 1.51 mm for TVS.

CONCLUSION AND RECOMMENDATIONS

There was no difference between sharp and blunt extension of uterine incision with respect to formation of cesarean scar niche and scar thickness. Sharp incision might be better than blunt one as it causes well-aligned myometrial layers. More clinical trials with larger sample sizes are needed for further evaluation of impact of technique of extension of uterine incision on cesarean scar niche formation.

Declaration of conflict interest:

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Funding: The author(s) received no financial support for the research.

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