Evaluation of Uterine Closure Technique in Residual Niche Formation After Laboring Cesarean Delivery

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BACKGROUND AND OBJECTIVE

Background: In the United States, ~31% of deliveries are performed via cesarean. Incomplete healing of the cesarean scar, visualized as a cesarean "niche", has been associated with poor obstetric outcomes including cesarean scar pregnancies, placenta accrete spectrum, and uterine dehiscence/rupture, as well as gynecologic pathology including intermenstrual spotting, pelvic pain, and dysmenorrhea.

Objective: To compare the effect of different uterine closure techniques during laboring cesarean deliveries (CD) and subsequent niche formation as determined by saline infusion sonohysterography (SIS).

METHODS

Study Design: Retrospective cohort study

Population: 111 non-pregnant individuals who had an SIS performed after their first or second CD at a single academic institution. Cesarean hysterotomy closure was performed by Technique A (endometrium-free closure technique (EFCT)) or closure B (routine closure), either during labor or before labor onset. Those with hysterotomy not in the lower uterine segment, an unsuccessful SIS, or with SIS images unavailable or inadequate (lower uterine segment not-visualizable) were excluded.

Study group: CD during labor (various levels of dilation)
Control group: CD before onset of labor

Outcomes:
1. Presence of clinically significant niche (depth >2mm)
2. Severity of Niche (depth, width, length, and residual myometrial thickness)

Analysis: Groups were compared using Chi-Square, ANOVA, t-test, and Kruskal-Wallis where appropriate, with primary outcome associations further analyzed via logistic regression. P< 0.05 was considered statistically significant.

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Table 1: Cohort characteristics grouped by labor progression

	No labor (n=60)	Cervical Dilation <6 cm (n=22)	Cervical Dilation ≥6 cm (n=29)	P-value
Maternal age, years	37.92 (7.25)	37.42 (6.40)	33.68 (5.94)	**0.021**
Gravidity	3.02 (2.65)	3.32 (2.42)	2.86 (2.88)	0.561a
Total parity	2.23 (2.13)	2.00 (1.60)	2.21 (2.65)	0.245a
SIS interval, months	44.73 (68.28)	32.22 (29.46)	20.28 (26.06)	0.076a
Double layer hysterotomy closure	54 (90.0)	18 (85.7)	25 (86.2)	0.81
Clinically significant niche	38 (70.4)	9 (47.4)	13 (50.0)	0.092
Niche width, mm	10.87 (4.23)	7.60 (2.73)	7.46 (4.49)	0.051
Niche depth, mm	4.96 (2.59)	5.09 (2.33)	7.29 (4.20)	0.149a
Niche length, mm	9.25 (4.25)	7.49 (3.05)	7.78 (3.32)	0.323
Residual myometrial thickness, mm	6.53 (4.19)	7.38 (5.00)	4.64 (2.97)	0.208a
Healing ratio	0.55 (0.23)	0.59 (0.27)	0.50 (0.30)	0.635

Table 2: Logistic Regression on Clinically Meaningful Niches

	Crude Odds Ratio [95% CI]	Crude P-value	Adjusted Odds Ratio [95% CI]	Adjusted P-value
Maternal age, years	1.04 [0.98, 1.11]	0.200	1.03 [0.96, 1.12]	0.413
SIS interval, months	1.01 [1.00, 1.02]	0.245	1.00 [0.99, 1.02]	0.820
SIS interval, years (ref: <=1 year)				
13 months to 5 years	3.00 [1.22, 7.73]	**0.019**	1.10 [0.32, 3.60]	0.876
> 5 years	1.83 [0.57, 6.2]	0.314	0.23 [0.02, 1.93]	0.189
Double layer hysterotomy closure	0.49 [0.10, 1.76]	0.304	2.28 [0.37, 12.45]	0.344
Technique B	7.34 [3.04, 19.01]	**<0.001**	15.69 [4.44, 69.77]	**<0.001**
Cervical Dilation (ref: no labor)				
<6 cm	0.38 [0.13, 1.11]	0.076	0.39 [0.10, 1.35]	0.142
>=6 cm	0.42 [0.16, 1.10]	0.079	0.27 [0.07, 0.92]	**0.042**

RESULTS

Of the 111 patients, 60 had SIS performed after non-laboring CD and 51 had SIS performed after laboring CD (of which 57% achieved active labor ≥6cm dilation preoperatively)

There were no significant differences in clinically significant niche formation overall across the degrees of cervical dilation in labor (P=0.092).

The average niche depth trended smaller following non-laboring cesarean compared to those who had achieved active phase labor (4.96mm ±2.59 vs 7.29 ±4.20, P=0.149).

Active labor ≥6cm was a significant predictor of clinically meaningful niche formation in the logistic regression model (aOR 0.27 [0.07, 0.92], P=0.042)

Closure via Technique A resulted in fewer clinically significant niches compared to Technique B (37% vs 81%, P< 0.001; *data not shown*) and this persisted in when controlling for maternal age, time to SIS, 2-layer closure, and labor status prior to CD (aOR 15.7, 95% CI 4.4-69.8, P< 0.001).

CONCLUSIONS

Active labor preceding cesarean delivery is associated with increased incidence of clinically significant niche formation, and possibly increased niche depth when compared to non-laboring and latent-phase labor cesareans. Further investigation with a larger cohort would help to better explore this relationship.

Endometrium-free hysterotomy closure technique results in fewer clinically significant niches post-cesarean compared to routine closure, irrespective of labor status at the time of cesarean.
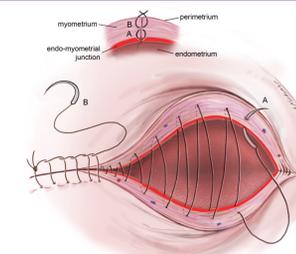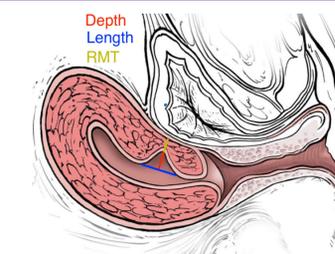

Figure 1. EFCT

Figure 2. Niche measurements
RMT = Residual myometrial thickness