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ORIGINAL PAPER

Ultrasound Evaluation of Uterine Scar After Cesarean Section and Next Birth

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Introduction: Cesarean section (Sectio Caesarea) is a surgical method for the completion of delivery. After various historical modifications of operative techniques, modern approach consists in the transverse dissection of the anterior wall of the uterus. The rate of vaginal birth after cesarean section was significantly reduced from year to year, and the rate of repeated cesarean section is increased during the past 10 years. Evaluation of scar thickness is done by ultrasound, but it is still debatable size of thick scar that would be guiding "cut-off value" for the completion of the delivery method. **Goal:** The aim was to examine the most accurate ultrasonic method for assessing thickness scar on the uterus after previous cesarean delivery and determine the threshold thickness of scar that would allow the completion of birth vaginally. ***Material and methods:*** Conducted is prospective study of 108 pregnant women aged 20-42 years, who had previously had a Caesarean section. Diagnostic accuracy in assessing the success of scar scale by evaluation of delivery (spontaneous or caesarean section). Measurements were carried out by 2D and 3D ultrasound machines in the 20, 38-40 week of gestation and 48 hours after birth. **Results:** Tests have shown that there is a statistically significant difference in the rates of specificity (0.04), sensitivity (0.05), PPV (0.01) and NPV (0.01) between 2D and 3D ultrasound. Ultrasound images of uterine muscle scar after prior cesarean section are better by 3D methods. The marginal value, "cut-off value" thick scar, which provides the possibility of vaginal birth after previous incision was 3.5 mm. **Conclusion:** The study showed that ultrasound measurement of 3D ultrasound thick scar on the uterus after previous cesarean section has practical application in determining the mode of delivery among pregnant women who have previously given birth by Caesarean section. **Key words: uterus, scar, ultrasound.**

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1. INTRODUCTION

Cesarean section (Sectio Caesarea) is a surgical method for the completion of delivery. After various historical modifications of operative techniques, modern approach consists in the transverse dissection of the anterior wall of the uterus. Anatomical restitution of the incision is made in the surgical treatment by individual and/or extension sutures - the muscular annular and muscular serous suture allowing the continuity of the wall of the uterus. At this point, the front isthimic wall of the uterus scar remains. The scar during new pregnancy and especially childbirth is the new "locus minoris resistentiae" and a constant danger for spontaneous rupture of the uterus.

The rate of vaginal birth after cesarean section was significantly reduced from year to year, and the rate of repeated cesarean section is increased during the past 10 years. Evaluation of scar thickness is done by ultrasound, but it is still debatable scar thickness that would be guiding "cut-off value" for the completion of the delivery by vaginal method (J Dodd et al., 2004) (1).

In recent years, the most common indication for cesarean section is the previous cesarean section delivery.

Since 1996 in the U.S. started the active promotion of the natural vaginal birth after previous cesarean deliveries, all with the aim to:

- Reduce the rate of repeated cesarean delivery.
- Improve quality and shorten recovery time of mothers in the postpartum period.
- Increase the rate of vaginal births.
- To minimize delivery complications.

- Create economic preconditions for a more economical way to complete delivery.

It is noticeable that the rate of attempted vaginal birth after previous cesarean delivery decreased, but the success rate of such births increased. This is the result of a good selection of mothers and adequate quality of ultrasound assessment of uterine scar. The frequency of cesarean delivery in the U.S. was in 1970 5.5%. This figure gradually increased, reaching 27.6% in 2003 when the from ten vaginal deliveries one was completed surgically (2).

It's been a whole century from sentence of Edward Cragin "Once cesarian, always a caesarean section" from 1916. In 2003 in the U.S. in 31% of all deliveries completed by caesarean section belonged to the repeated cesarean sections, making this method one of the leading causes. In 1980 the Commission of the National Institute of the United States considers the need for repeated cesarean delivery and concluded that in properly selected patients vaginal delivery may be possible even with the transverse uterine scar from a cesarean section (3).

Public Health Service in the U.S. in 1990 suggested that from the total number of births 15% being completed by caesarean section, and 35% of vaginal births after previous cesarean section. This result is supposed to be reached until 2000. As a result of this recommendation the number of vaginal birth after cesarean section increased from 3% in 1980 to 20% in 1990 and in 1996 amounted to 28%. Number of vaginal deliveries in Gynecology and Obstetrics Clinic, Clinical Center of Sarajevo University is in steady decline. On the other hand, increases the number of cesarean sections, so that today one in five pregnant women in our clinic have caesarian section. This can result in increased maternal and fetal morbidity and mortality. The decision on the mode of delivery in pregnant women previously delivered by caesarean section is not easy, since there is often a latent risk of uterine rupture in the scar area. Therefore, appropriate and timely assessment of uterine scar is of great importance for making the right decisions on the completion of pregnancy. The aim of this study was to confirm a reliable ultrasonic inspection method and set the "cut-off value" of scar thickness that would be guiding the manner of delivery completion.

Compared deliveries	CESARIAN SECTION	VAGINAL DELIVERY
2nd MEASUREMENT : 1st MEASUREMENT:		
Average differentiation: d	d = -0.58 mm	d = -0.49 mm
Stand. deviation of differentiation	SD_{dif} = 0.38	SD_{dif} = 0.249
t-test of differentiation	t= 6.70 SIGN. p<0.001	t= 5.953 SIGN. p<0.001
3rd MEASUREMENT : 2nd MEASUREMENT:		
Average differentiation: d	d = -1.35 mm	d = -0.65 mm
Stand. deviation of differentiation	SD_{dif} = 0.568	SD_{dif} = 0.388
t-test of differentiation	t= 6.968 SIGN. p<0.001	t= 5.759 SIGN. p<0.001
3rd MEASUREMENT : 1st MEASUREMENT:		
Average differentiation: d	d = -1.93 mm	d = -1.56 mm
Stand. deviation of differentiation	SD_{dif} = 0.65	SD_{dif} = 0.47
t-test of differentiation	t= 7.201 SIGN. p<0.001	t= 6.139 SIGN. p<0.001

Table 1. The average difference of scar thickness between measurements

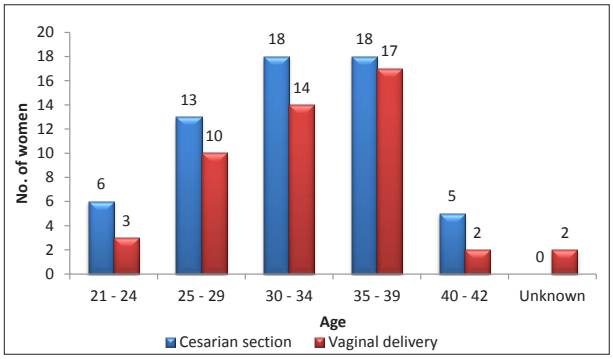

Figure 1. Age of patients according to the method of delivery at the Gynecology and Obstetrics Clinic Sarajevo in 2007 - representation of women by age groups

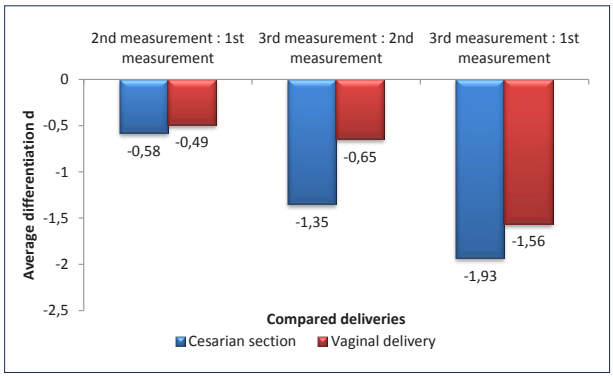

Figure 2. The average difference between scar thicknesses between measurements

2. GOAL

The aim was to examine the most accurate ultrasonic method for assessing thick scar on the uterus after previous cesarean delivery and determine the threshold thick scar that would allow the completion of birth vaginally.

3. MATERIAL AND METHODS

Observational, prospective cohort study includes 108 women over a period of one year was performed at the Gynecology and Obstetrics Clinic, Clinical Center of Sarajevo University.

Criteria for inclusion in the study were:

- Pregnant women who have previously had a caesarean section, with an unlimited number of vaginal deliveries.
- A low transverse section.
- Informed consent.
- Singleton pregnancies.

Methods

- History of pregnancy.
- Clinical examination of pregnant women.
- 2D ultrasound.
- 3D ultrasound.
- Color Doppler ultrasound.

Ultrasound examinations (2D, 3D ultrasound) were performed in the following intervals:

The first examination: In 20th gestational week. *The second examination:* Between 38th and 40th gestational weeks. *The third examination:* Postpartum examination (48 hours after birth).

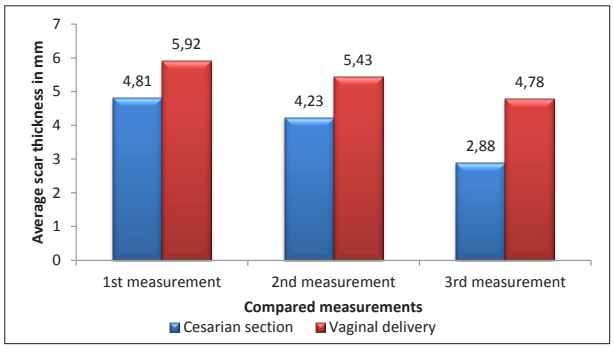

Figure 3. Average difference of scar thickness in 1st, 2nd and 3rd the measurement

Ultrasonic methods are controlled by tests of sensitivity and specificity. Youden statistical test (J) was used as a summary (total) validity index that takes into account the sensitivity and specificity.

4. RESULTS

Results are presented by tables and graphs. The difference in the average age of women depending on the mode of the last delivery: cesarean section/vaginal delivery - is not statistically significant. The value of t-test was: t = 0.299

The coefficients of linear correlation between age and thickness of the scar in the third measurement:

- For caesarean section: r = -0.092–not sign.
- For vaginal delivery: r = 0.112–no sign.

The coefficients of linear correlation between the number of gestation weeks and scar thickness in the third measurement:

- For caesarean section: r = -0.176–not sign.
- For vaginal delivery: r = 0.163–no sign.

Results of differences significance tests in the average thickness of the scar between women according to the last birth: cesarean delivery - vaginal birth by t-test

The difference in the distribution of women according to the thickness of the scar in the second measurement is statistically highly significant. The value of chi-square test was $\chi2=70.833$, $p<0.001$.

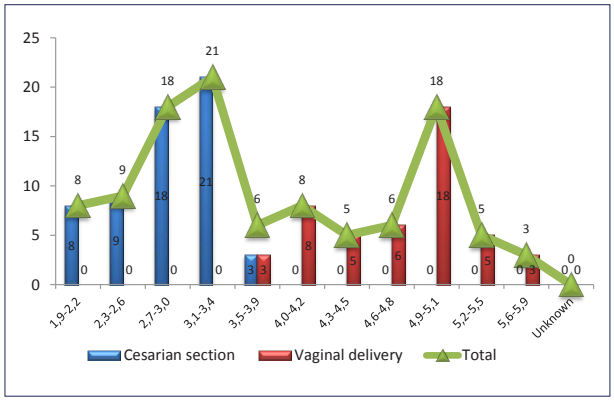

Figure 4. Distribution of women according to the thickness of the scar in the third measurement by type of the previous delivery

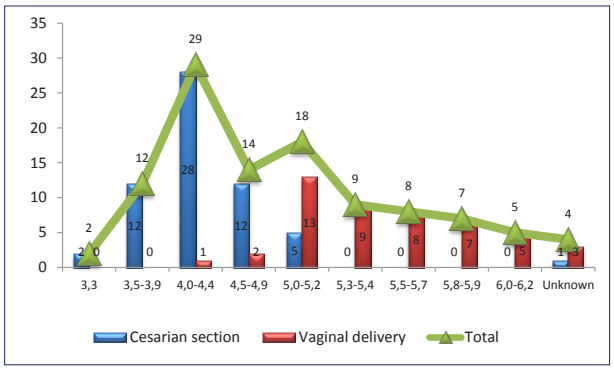

Figure 5. Distribution of women according to the thickness of the scar in the second measurement and the type of previous delivery

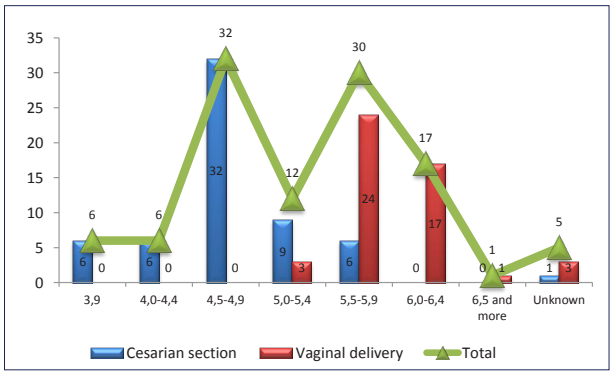

Figure 6. Distribution of women according to the thickness of the scar and 1st measurement and the type of previous delivery

1st measurement:	t=14.796	SIGN.	p<0.001
2nd measurement:	t=15.516	SIGN.	p<0.001
3rd measurement:	t=18.715	SIGN.	p<0.001

The difference in the distribution of women according to the thickness of the scar in 1st measurement is statistically highly significant. The value of chi-square test was $\chi2=167.815$, $p<0.001$.

The difference in the average number of points among women according to type of previous delivery: cesarean section/vaginal delivery, was statistically highly significant. The value of t-test is: t=36.762, p<0.0001.

In the group of women who had Caesarean section, the difference in the number of women by the time elapsed since the last C-section is not statistically significant. The value of chi-square test is: $\chi2 = 1.67$.

In the group of women who had vaginal delivery, the difference in the number of women by the time elapsed since the last C-section is statistically highly significant. The value of chi-square test is: $\chi2 = 27.0$, $p<0.001$.

The difference in time elapsed since last cesarean delivery among women depending on the mode of delivery in the last pregnancy was statistically significant. The value of chi-square test is: $\chi2 = 9.706$, $p <0.005$.

The difference in thickness of the scar, depending on the type of cesarean birth/vaginal delivery is highly statistically significant. The value of chi-square test is: $\chi2 = 82.837$, $p <0.0001$.

The diagnostic accuracy

The diagnostic accuracy in assessing the scar was made by success of delivery (spontaneous or caesarean section)

2 D estimate	Spontaneous	Surgical
N = 54	22	33
Delivery after estimate	40	44
p	0.05	0.05

3 D estimate	Spontaneous	Surgical
N = 54	44	10
Delivery after estimate	42	12
p	NS	NS

Comparing successfulness of scar evaluation between 2D and 3D techniques there is a significant statistical difference ($p<0.01$), and it was 98% (3D) compared to 66% (2D) false-positive estimates by 2D is 52% and for 3D was 4%,

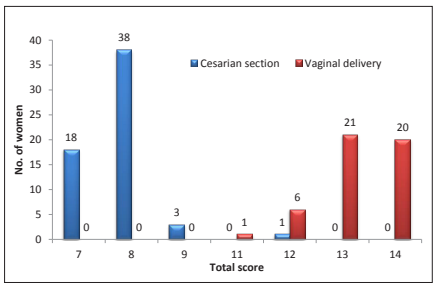

Figure 7. The difference in the average number of points among women according to type of previous last delivery: cesarean section/vaginal delivery

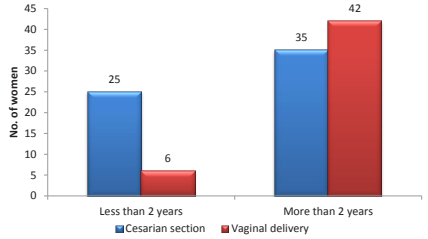

Figure 8. The time elapsed since the last C-section

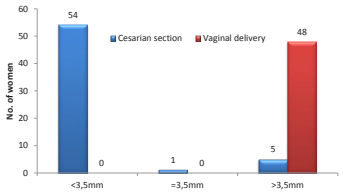

Figure 9. The thickness of the scar

while false-negative assessment of 2D was 44% and 10% in case of 3D.

Sensitivity	2D	3D	p
A/A+C	30/54	52/54	
%	55%	95%	0.05
Specificity	2D	3D	p
D/B+D	32/54	48/54	
%	53%	83%	0.04
PPV	2D	3D	p
A/A+B	30/54	50/54	
%	55%	93%	0.09
NPV	2D	3D	p
A/C+D	31/54	51/54	
%	57%	94%	0.01

There was a statistically significant difference in the rates of specificity (0.04), sensitivity (0.05), PPV (0.01) and NPV (0.01) between 2D and 3D ultrasound image of the muscle scar of the uterus after a previous cesarean section in favor of 3D method use in evaluation of scar compared between 2D and 3D techniques there is a significant statistical difference (p> 0.01), or it was 98% (3D) in comparison to 66% (2D), false-positive estimates 52% of the 2D and 3D with 4% and false-negative assessment of 2D was 44%, 10% in 3D.

5. DISCUSSION

By measuring the thickness of the scar on the uterus, after a previous cesarean section, we came to the cut off that allows the vaginal delivery. That value was ≥3.5 mm.

Similar results were obtained by Rozenberg et al. (1996, 1997) (4), which ultrasonically measured thickness of the uterine scar in pregnant women with previous caesarean section in assessing the risk of uterine rupture in the current pregnancy. The authors showed that the "cut-off value" for the size of the scar is 3.5 mm and the evaluation was performed using ultrasound. The sensitivity of the ultrasound was 88% and specificity of 73.2%. At the same time the positive predictive value of ultrasound method was 11.8% and negative 99.3% (Rosenberg et al., Lancet, 1996; J Gynecol Obstet Biol Reprod (Paris) (1997). Also Rosenberg et al. showed that the risk of rupture is directly proportional to the thinning of the lower uterine segment, which is analyzed in the 37th gestational week.

Study by Montanari et al. (1999) (5) has questioned the accuracy of transvaginal ultrasound in the assessment of the lower uterine segment in pregnant women with previous caesarean section. The study has established a scoring thickness of the scar on the uterus in the following way:

Score 1 (well-formed scar): mean thickness: 4.2 mm ± 2.5 mm;

Score 2 (poorly formed scar): 2.8 mm ± 1:06 mm, which implies that the stimulation of labors in case of scoring 2 is associated with a significantly increased risk of uterine rupture.

Sensitivity and specificity of ultrasonography were 100% respectively while the positive predictive value of ultrasound was 60.7% and negative predictive value 100% (5).

Study by Flamm et al. (1988) (6) examined the percentage of successful vaginal delivery in pregnant women who have previously given birth by caesarean section. 74% of pregnant women with previous cesarean section were completed delivery successfully without significant maternal and fetal mortality. Conclusion of Flamm et al. was that vaginal delivery is possible and safe for most patients who have previously given birth by caesarean section. Since 1996 in the U.S. are trying to access the active promotion of the natural vaginal birth after previous cesarean section and assuming all; Reduce the rate of repeated caesarean sections; Improve the quality and recovery time for women in the birth process; Increase rate of vaginal births; Minimize delivery complications; Create economic preconditions for a cheaper way to complete delivery.

After each successful birth by vaginal, the natural way after cesarean delivery has been a request to perform a manual review of the uterus and to track whether the scar on the uterus remains intact.

6. CONCLUSION

From these results we can conclude that the ultrasonic measurement of thickness of the scar on the uterus has practical application in the decision on the mode of delivery among pregnant women who have previously given birth by Caesarean section. With ultrasound, antenatal measurement of scar thickness doctor gives certainty to the decision on the completion of vaginal delivery and while reducing, caesarean section rates as by the recommendations of the World Health Organization and the world's leading association of obstetricians and gynecologists. Tests have shown that the method of choice for assessment of uterine wall scar thickness is 3D ultrasound technique and a threshold value of scar thickness 3.5 mm.

REFERENCES

1. Dodd J, Crowther C. Vaginal birth after Caesarean versus elective repeat Caesarean for women with a single prior Caesarean birth: a systematic review of the literature. Aust N Z J Obstet Gynaecol. 2004; 44: 387-391.
2. Lavin JP, Stephens RJ, Miodovnik M, Barden TP. Vaginal delivery in patients with a prior cesarean section. Obstet Gynecol. 1982; 59: 135-148.
3. Cragin EB.Conservatism in obstetrics NY Med J. 1916: 103: 1-3.
4. Rozenberg P, Goffinet F, Phillippe HJ, Nisand I. Echographic measurement of the inferior uterine segment for assessing the risk of uterine rupture. J Gynecol Obstet Biol Reprod. 1997; 26: 513-519.
5. Lydon-Rochelle M, Holt VL, Easterling TR. Martin DP. Risk of uterine rupture during labor among women with a prior cesarean delivery. N Engl J Med. 2001; 345: 3-8.
6. Flamm BL, Lim OW, Jones C, Fallon D, Newman LA, Mantis JK. Vaginal birth after cesarean section: results of a multicenter study. Am J Obstet Gynecol. 1988; 158: 1079-1084.