

# ULTRASOUND EVALUATION OF UTERINE SCAR AFTER CESAREAN SECTION

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## Original paper

### ABSTRACT

**Introduction:** The rate of attempted vaginal birth after previous cesarean delivery has decreased, while the success rate of such births increased. Advances in surgical techniques, the development of anesthesiology services, particularly endotracheal anesthesia, very quality postoperative care with cardiovascular, respiratory and biochemical resuscitation, significantly reduce maternal mortality and morbidity after cesarean section. Progress and development of neonatal services, and intensive care of newborns is enabled and a high survival of newborn infants. Complications after cesarean section were reduced, and

the introduction of prophylaxis and therapy of powerful antibiotics, as well as materials for sewing drastically reduce all forms of puerperal infection. **Goal:** was to establish a measurement value of the parameters that are evaluated by ultrasound. **Material and methods:** Each of the measured parameters was scored. The sum of points is shown in tables. Based on the sum of points was done an estimate of the scar on the uterus after previous caesarian section and make the decision whether to complete delivery naturally or repeat cesarean section. We conducted a prospective study of 108 pregnant women. Analyzed were: shape scar thickness (thickening), continuity, border scar out, echoing

the structure of the lower uterine segment and scar volume. **Results:** The study showed that scar thickness of 3.5 mm or more, the homogeneity of the scar, scar triangular shape, qualitatively richer perfusion, and scar volume verified by 3D technique up to 10 cm are attributes of the quality of the scar. **Conclusion:** Based on the obtained results we conclude that ultrasound evaluation of the quality of the scar has practical application in the decision on the mode of delivery in women who had previously given birth by Caesarean section. **Key words:** lower uterine segment, ultrasound, cesarean section.

## 1. INTRODUCTION

The rate of attempted vaginal birth after previous cesarean delivery has 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. Before the only indication for cesarean section was narrowed pelvis. Over time, it was modified with other indications such as eclampsia, miomatous uterus, nephritis, viciium cordis, vulvar cancer, placenta previa, etc. At present, the incidence of cesarean section increases with increasing participation by the indication of the fetus. Survival of mother and fetus is increasing, so caesarean section begins to apply to reduce mortality of endangered fetus.

Advances in surgical techniques, the development of anesthesiology services, particularly endotra-

cheal anesthesia, quality of postoperative care with cardiovascular, respiratory and biochemical resuscitation, significantly reduce maternal mortality and morbidity after cesarean section. Progress and development of neonatal services and intensive care of newborns is enabled also high survival of newborn infants. Complications after cesarean section were reduced, and the introduction of prophylaxis and therapy with powerful antibiotics, as well as stitching materials drastically reduce all forms of puerperal infection. The incidence of caesarean sections is increasing from year to year. The consequence is the fact that a caesarean section in gynecological and obstetric institutions of the sovereign occupies first place as most preferred operating procedure. Such a high percentage of cesarean sections is largely influenced the increase of re-

peated cesarean sections. Analyzing most obstetric indications, a large proportion belongs to a previous cesarean section.

Despite numerous studies that show a very low risk of uterine rupture in vaginal birth after previous cesarean section (uterine rupture 0.2–0.7%) and very high efficiency of the delivery (70–85%) followed the recommendations of a large number of leading associations of gynecologists and obstetricians about safe childbirth, the repeated cesarean section rate is constantly growing.

Many studies have shown that the use of cesarean section must count on the fact of a large risk to the mother, which is related to increased morbidity and mortality compared with completing birth vaginally. In the postoperative period there is increased risk of infection especially in cases of premature rupture of mem-

branes. If the indications for previous cesarean section were from the fetus: fetal distress, placenta previa, breech presentation, unfavorable fetal position, prolonged labor, and now these indications do not exist, you can try a trial vaginal delivery without the threat for the fetus or mother. The risk that exists when it has to do with ignorance scar on the uterus and the possibility of uterine rupture during vaginal childbirth.

Morphological and functional properties of the scar on the uterus in everyday practice are largely a subjective estimate, based on palpation, bimanual inspection and ultrasonic thickness measurement and assessment of scarring. In 1875 Bandl was introduced into clinical practice the term the lower uterine segment (LUS). In 1905 Aschoff described the upper border of the LUS and the corpus as the ostium internum anatomicum and below the cervix as the ostium internum histologicum (1).

Planned vaginal birth after previous cesarean section applies to any woman whose previous birth was by Caesarean section, and decides on vaginal delivery. If a woman has vaginal birth after previous cesarean delivery, the delivery is considered successful. If pregnancy ends with repeated cesarean section, it is considered to be unsuccessful.

## 2. GOAL

The aim was to establish a measurement value of the parameters that are evaluated by ultrasound.

## 3. MATERIAL AND METHODS

The study was observational, prospective and cohort. It comprised 108 women over a period of one year and was conducted at the Gynecology and Obstetrics Clinic, Clinical Center of University of Sarajevo.

Criteria for inclusion in the study:

Pregnant women who have previously given birth by Caesarean section once with an unlimited number of vaginal deliveries.

\* Pregnant women who had hysterotomy by low transverse section.

\* Pregnant women who have signed the written consent to participate in the study.

\* Pregnant women whose presentation of fetus was nuchal head position and dorsoposterior head position in fetuses up to 2500g of body weight Pregnant women up to 42 years. Single fetus pregnancies without fetal anomalies. Gestational age older than 35 weeks.

Criteria for exclusion from the study:

- The absolute indications for cesarean section (absolute when the delivery ends in the interest of the mother or child or both, because their life is in immediate danger).
- The habitual fetal death.
- Anomalies of rotation of the head of the child.
- Women who have completed all previous pregnancies vaginally.
- Women who have previously performed surgery on the uterus for other reasons or a scar of unknown etiology (2).
- Fetal macrosomia (3).
- All presentations of the fetus, except occipital and dorsoposterior head position in fetuses up to 2500g of body weight.
- Twins pregnancy.
- Women older than 40 years, especially after long-term treatment for infertility.
- Induction of labor (4).
- Disturbance of fetal heart rate (determined with the CTG).
- Women with uterine anomalies such as uterus bicornatus (5).
- Gestational age younger than 35 weeks.
- Epidural anesthesia.
- Induction of labor.
- Women who had previous hysterotomy access by T-section (by Vigo).
- Secondary uterine inertia (3).
- Uterine tetany / "Active phase arrest disorder" (3).

### Methods:

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

### 2D ultrasound

2D ultrasound is currently considered the primary method of "imaging" of anatomical structures in obstetrics. This is a standard (con-

ventional) method that produces images made up of a series of thin slides. Only one slide can be seen in one point of time.

### 3D ultrasound

3D ultrasound is considered more advanced technology that is used only in specific cases of (unclear) problems like this with uterine cicatrix incurred by prior cesarean section. 3-D technology provides multi slice opportunities that have so far provided only computerized tomography and magnetic resonance imaging (6).

### Color Doppler

Colored and Color Doppler is semi quantitative method that is now widely accepted, that enters into the standard of most modern ultrasound machines. She has a great advantage in that it quickly shows where to quantitatively measure blood flow and in this sense is important for quick orientation and finding the area of pathological flow (7).

By ultrasound examination of uterine scar were analyzed:

- Form of scarring.
- Thickness (thickening).
- Continuity.
- Outer scar border.
- The echo structure of the lower uterine segment (aka Supersonic criteria, Popov et al., 1994) (8).
- Scar volume.

Quality control is assured with "interobserver and intraobserver reliability". Intraobserver reliability (same examiner) or the method of variation—is derived from review by the same obstetrician done twice on the same sample (patient) using the same methods (techniques) at different time intervals. Interobserver variability (between two different examiners) is obtained when the review is carried out twice by two or more different use obstetricians by same techniques (methods) on the same sample (patient) at different time intervals.

## 4. RESULTS

Results are presented by tables and graphs.

PARAMETER	FINDING
Scar shape	Triangular vs. balloon shape

Scar thickness (thickening in mm)	3,5 mm or more/less
Outer scar borders	Inside or outside
Scar continuity	YES or NO
Echo structure of the LUS	Homogenous or non-homogenous
Vascularisation	Hipervaskularisation vs./or hipovaskularisation

**Table 1.** The parameters that are evaluated by ultrasound [by Popov et al., 1994]

The difference in the number of women by the form of the scar, depending on the type of cesarean/vaginal delivery is statistically highly significant. The value of chi-square test is:  $\chi^2 = 88.69$ ,  $p < 0.0001$ . (figure 1)

The difference in thickness of the scar, depending on the type of delivery—highly statistically significant. The value of chi-square test is:  $\chi^2 = 82.837$ ,  $p < 0.0001$ . (figure 2.)

The difference in the number of women by the continuity of the scar, depending on the type of delivery is statistically highly significant. The value of chi-square test is:  $\chi^2 = 81.510$ ,  $p < 0.0001$ . (figure 3.)

The difference in the outer border of the scar between women who had cesarean section/vaginal delivery is statistically highly significant. The value of chi-square test is:  $\chi^2 = 75.878$ ,  $p < 0.0001$ . (figure 4.)

The difference in echogenic structure of the lower uterine segment, depending on the type of delivery is highly statistically significant. The value of chi-square test is:  $\chi^2 = 69.449$ ,  $p < 0.001$ . (figure 5.)

The difference in the vascularization of the scar between women who had cesarean section/vaginal delivery is highly statistically significant. The value of chi-square test is:  $\chi^2 = 51.617$ ,  $p < 0.001$  (figure 6.)

Each of the measured parameters was scored. The sum of points is shown in tables. Based on the sum of points shall be made

an estimate of the scar on the uterus after the previous caesarian section. (Table 1)

Based on this score we will decide whether to complete delivery by natural means or again by cesarean section. (Table 2)

If the score is 9-14 a vaginal birth will be used. Score less than 9 leads to repeated cesarean section. (Table 3).

In the event that the thickness of the scar is less than cut-off, or less than 2.5 mm the scoring will not be applied. These mothers will be subject to the surgical mode of delivery.

### 5. DISCUSSION

The peculiarity of the lower uterine segment, given the thin muscle layer and poor vascularization make it elective place to make incision, and “locus minoris” resistance to rupture of the uterus. Particularly at risk are considered pregnancy and birth after previous cesarean section because of scar tissue that further threatens the area of the lower uterine segment (LUS).

Good condition of the lower uterine segment (LUS), with appropriate

Scar shape	CESARIAN SECTION		VAGINAL BIRTH		TOTAL	
	N	%	N	%	N	%
Balloon shape	58	96.67	2	4.2	60	55.56
Triangular	2	3.33	46	95.8	48	44.44
Total	60	100	48	100	108	100

**Table 2.** Scar form

Scar shape	Triangular	2	Balloon shape	1
Scar thickness	More than 3.5mm	2	Less than 3.5mm	1
Outer scar borders	Inside	2	Outside	1
Echo structure of the LUS	Homogenous	2	Non homogenous	1
Scar vascularisation	Hipervaskularisation	2	Hipovaskularisation	1
Scar volume	more than 3.5mm	2	Up to 10 mm	1
Scar continuity	Clear continuity	2	Discontinuity	1
Total score		14		7

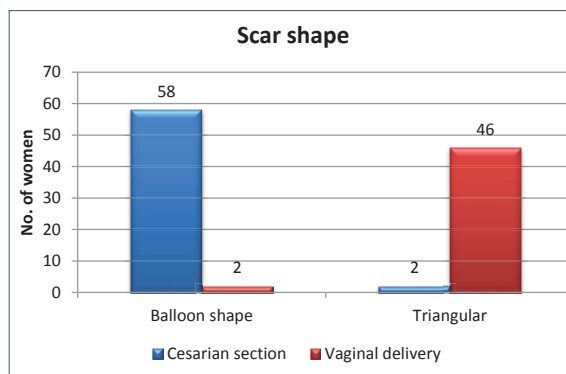
**Table 3.** The score of uterine scar

precautions and intense intrapartal control, reduce the risk of scar rupture and ensure the successful completion of such pregnancies vaginally (9, 10).

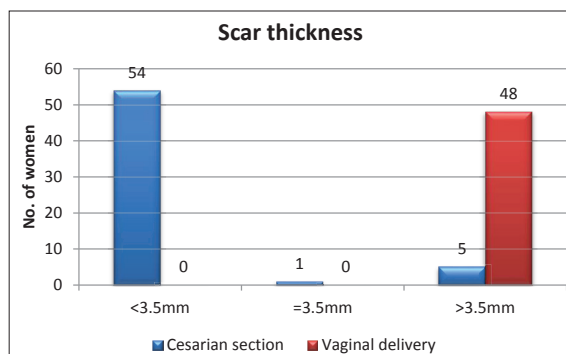
Among the latest studies by the group of French authors, which are based on the results obtained by analyzing the scar of the lower uterine segment, LUS in 642 patients, concluded that the risk of rupture of the scar depends on the LUS thinning measured at 37 week of pregnancy (11).

The possibility of intensive supervision of labor and related applications outside tocography, give us more security and better insight into uterine activity and thus a lower risk of uterine rupture. Thus, in recent times more likely to decide on a vaginal birth.

Study by Asakura et al. (2000) based on measuring the thickness of the lower uterine segment as a predictor of uterine scar dehiscence. “Cut-off” value of the lower uterine segment was established at 1.6 mm. Sensitivity and specificity of transvaginal ultrasound was 77.8% and 88.6%, respectively. At the same time the positive predictive value of ultrasound was 25.9% and negative predictive value 98.7% (Asakura H et al., 2000). Another study (Lebedev et al., 1991) (12) analyzed using sonography the uterine myometri-



**Figure 1.** Scar shape



**Figure 2.** The thickness of the scar

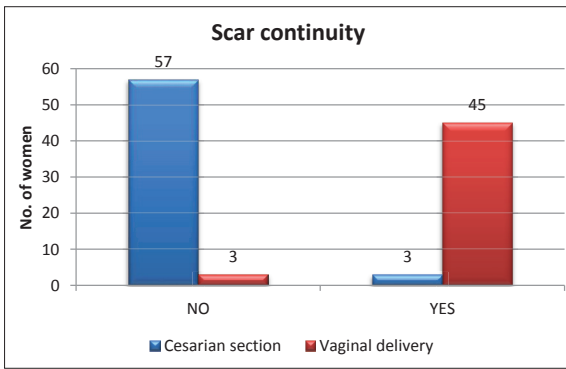


Figure 3. Scar continuity

um and determines the following criteria:

Myometrium adequate for vaginal delivery: a V shape of the lower uterine segment, the minimum thickness of 3-4 mm, continuous contour of the lower uterine segment, homogeneous echo structure or structures with small areas of increased echogenicity.

Myometrium inadequate for vaginal delivery: Balloon like shape of the lower uterine segment, thickness less than 3 mm, the discontinuity of uterine structures, predominance of areas of increased echogenicity in the scar area (12).

Study by Flamma et al. (1988) (13) examined the percentage of successful vaginal delivery in pregnant women who have previously given birth by Cesarean section. 74% of pregnant women with previous cesarean section were delivered successfully without significant maternal and fetal mortality. Conclusion by Flamma et al. is that vaginal delivery is possible and safe for most patients who have previously given birth by Cesarean section. Bujold E., Pasquier JC. ultrasound studies were published in the literature related to the thickness of the lower uterine seg-

ment in relation to the risk of scar separation and uterine rupture during labor in women who delivered their babies by Cesarean section. The incidence of scar separation during delivery was 7%. Analysis of the thickness of the lower uterine segment found that the lower uterine segment

cases, of which 18% of cases of scar separation is found. The study concluded that the lower uterine segment thickness of 2 mm and 3.0–3.5 mm are associated with the risk of separation scars on the uterus during pregnancy and childbirth.

The thickness of the lower uterine segment from 3.0 to 3.5 mm is associated with very low risk of uterine scar separation from previous cesarean section and in these patients allows the vaginal childbirth. Patients in whom the lower uterine segment thickness is below 2.0 mm have a high risk of uterine scar separation (14).

### 6. CONCLUSION

Gynecology and Obstetrics Clinic, Clinical Center, University of Sarajevo belongs to a group of health care institutions with a high rate of cesarean sections (over 25%). The rate of spontaneous labor after previous cesarean section is decreasing. Multidimensional Color Doppler is the “gold standard” in assessing the quality of the scar after a previous cesarean section and ability for spontaneous labor.

The thickness of the scar after a previous cesarean section, or “cut off” is 3.5 mm and more. The homogeneity of the scar is an attribute that contributes to the quality of the scar. Triangular shape of the scar in the assessment of scar quality. Qualitatively richer the quality of perfusion around scar in assessing the value of the scar (detected on color Doppler). Volume scar verified 3D is a new technique in the evaluation of the most important attribute of quality of the scar and his “cut off” in our research is up to 10 cm.

Parity is not crucial in assessing the scar. A longer time interval after a previous cesarean section gives more quality attributes of the scar. Multidimensional methods and methods of conventional ultrasonic techniques should take place in everyday obstetrics practice to assess the relevant quality attributes scar on the uterus and spontaneous decisions, secure, upcoming birth. Based on the obtained results we conclude that the ultrasonic measurement of thickness of the LUS (the lower uter-

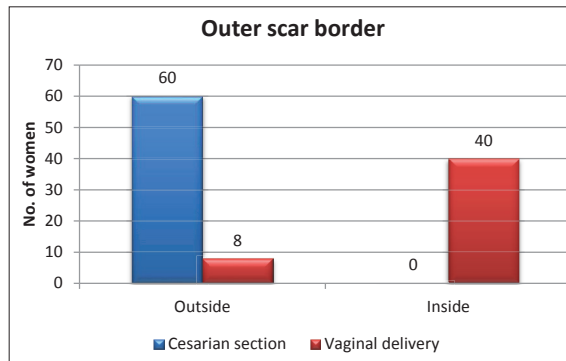


Figure 4. The outer scar border

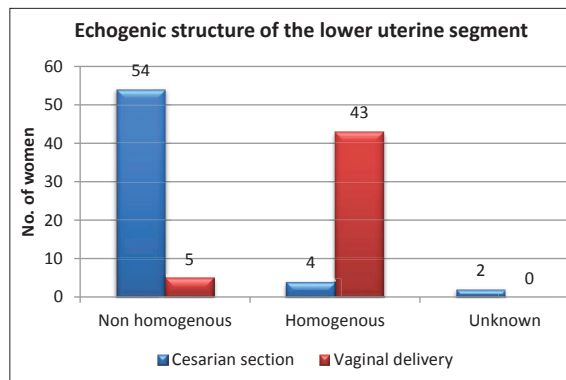


Figure 5. Echogenic structure of the lower uterine segment

thickness 2mm and less was found in 17.4% of women and that in 22% of them scar separation occurred. In 3.4% of patients in whom the scar was thicker than 2 mm was found scar separation. Scar thickness from 3.0 to 3.5 mm was found in 36% of

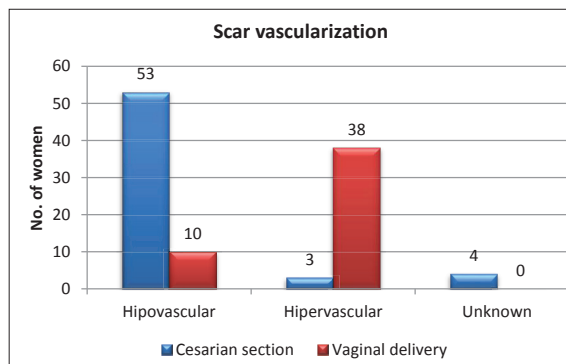


Figure 6. Scar vascularization

ine segment) has a practical application in the decision on the mode of pregnancies in women who had previously given birth by Caesarean section.

**Conflict of interest: none declared**

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