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Ultrasonographic Evaluation of Lower Uterine Segment Scar in Women with Previous Cesarean Section

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Abstract: ***The global rise in cesarean section rates has resulted in an increasing number of pregnancies complicated by uterine scars. Assessment of lower uterine segment (LUS) scar integrity is essential to predict complications such as uterine rupture, scar dehiscence, and abnormal placentation. Ultrasonography has emerged as the most practical and non-invasive imaging modality for evaluating cesarean scars during pregnancy. This review summarizes current evidence regarding ultrasonographic evaluation of the lower uterine segment scar in women with previous cesarean section. Parameters such as scar thickness, residual myometrial thickness, scar morphology, and echogenicity are discussed along with their clinical significance. The predictive value of LUS thickness in determining the risk of uterine rupture and guiding mode of delivery is highlighted. Conclusion: Ultrasonography remains an essential tool for risk stratification and management planning in pregnancies following cesarean section. Standardization of measurement techniques and establishment of universally accepted cut-off values are needed to improve clinical utility.***

Keywords: Cesarean scar, Lower uterine segment, Ultrasonography, Residual myometrial thickness, VBAC

1. Introduction

Cesarean section is one of the most frequently performed surgical procedures in obstetrics. Over recent decades, cesarean delivery rates have increased worldwide, leading to a growing population of women with uterine scars.

Although cesarean delivery has contributed significantly to reductions in maternal and perinatal mortality, uterine scars pose risks in subsequent pregnancies. Important complications include uterine rupture, scar dehiscence, placenta previa, placenta accreta spectrum disorders, and preterm delivery.

Evaluation of cesarean scar integrity is therefore essential for safe obstetric management. Traditionally, scar assessment was based on obstetric history and intraoperative findings. However, these methods lack predictive value during pregnancy.

Ultrasonography has emerged as the most widely used imaging modality for evaluation of cesarean scars because it is safe, non-invasive, inexpensive, and widely available.

Measurement of lower uterine segment thickness and residual myometrial thickness has been proposed as a predictor of uterine rupture and successful vaginal birth after cesarean (VBAC).

This review aims to summarize the current knowledge regarding ultrasonographic evaluation of lower uterine segment scar in women with previous cesarean section.

1.1 Rising Cesarean Section Rates and Clinical Implications

Global cesarean section rates have increased significantly over the past decades and currently exceed recommended levels. The rise in cesarean delivery has resulted in increased incidence of uterine scar-related complications.

Factors contributing to increased cesarean rates include:
- Institutional deliveries
- Maternal preference
- Medico-legal concerns
- Improved surgical safety
- Changing obstetric practices

Repeated cesarean sections increase the risk of:
- Uterine rupture
- Placenta accreta spectrum
- Placenta previa
- Scar pregnancy
- Postpartum hemorrhage

Early evaluation of uterine scar integrity is therefore essential for prevention of maternal and fetal morbidity.

1.2 Importance of Lower Uterine Segment Scar Evaluation

Evaluation of lower uterine segment scar integrity is important for:

1) Prediction of Uterine Rupture

Uterine rupture is a life-threatening complication associated with previous cesarean section. Ultrasonographic

measurement of LUS thickness helps identify women at increased risk.

Thinner scars are associated with increased risk of rupture and dehiscence.

2) Planning Mode of Delivery

Scar thickness measurement helps in deciding:
- Trial of labour after cesarean (TOLAC)
- Elective repeat cesarean section

Women with adequate scar thickness have higher chances of successful VBAC.

3) Detection of Placental Abnormalities

Cesarean scar defects increase the risk of abnormal placentation including:
- Placenta previa
- Placenta accreta spectrum

Early diagnosis allows better delivery planning and reduced maternal morbidity.

1.3 Ultrasonographic Techniques for Scar Evaluation

Ultrasonography is the primary modality for assessing cesarean scars during pregnancy.

1) Transabdominal Ultrasound (TAS)

Advantages:
- Easily available
- Non-invasive
- Suitable for late pregnancy

Limitations:
- Lower resolution
- Less accurate for thin scars

2) Transvaginal Ultrasound (TVS)

Transvaginal ultrasound provides superior visualization of the lower uterine segment and is considered the most accurate method for scar thickness measurement.

Advantages:
- Better resolution
- Accurate thickness measurement
- Early pregnancy assessment

3) Advanced Imaging

Other modalities include:
- Sonohysterography
- Gel instillation sonography
- MRI

These are usually reserved for complex cases.

1.4 Ultrasonographic Parameters of Scar Assessment

1) Lower Uterine Segment Thickness

LUS thickness is the most widely studied parameter.

Studies suggest:
- < 2 mm → High risk
- 2–3.5 mm → Intermediate risk
- > 3.5 mm → Low risk

However, universal cut-off values are still lacking.

2) Residual Myometrial Thickness

Residual myometrial thickness (RMT) represents the muscular layer overlying the scar.

Reduced RMT is associated with:
- Scar dehiscence
- Uterine rupture

3) Scar Morphology

Scar morphology includes:
- Triangular defects
- Niche formation
- Irregular scars

Scar defects may indicate incomplete healing.

4) Echogenicity and Continuity

Abnormal echogenicity and discontinuity of the scar may indicate poor healing.

These features correlate with intraoperative scar findings.

1.5 Biological Basis of Cesarean Scar Healing

Uterine scar healing involves three phases:

Inflammatory Phase
- Platelet activation
- Cytokine release
- Tissue cleaning

Proliferative Phase
- Fibroblast activity
- Collagen formation
- Angiogenesis

Remodeling Phase
- Collagen maturation
- Scar strengthening

Scar tissue is weaker and less elastic than normal myometrium.

Factors Affecting Scar Integrity

Surgical Factors
- Suturing technique
- Single vs double layer closure
- Timing of cesarean

Double-layer closure is associated with stronger scars.

Maternal Factors
- Short interpregnancy interval
- Diabetes
- Obesity
- Infection

Obstetric Factors
- Multiple cesareans
- Placental location
- Previous scar complications

Clinical Applications

Ultrasonographic scar assessment helps in:

Risk Stratification
Identifying high-risk patients for:
- Uterine rupture
- Placenta accreta
- Preterm birth

Delivery Planning
Helps determine:
- VBAC eligibility
- Timing of cesarean section

2. Limitations of Ultrasonographic Evaluation

Limitations include:
- Operator dependency
- Lack of standardization
- Variable cut-off values
- Influence of gestational age

Despite these limitations, ultrasonography remains the best available tool.

3. Future Directions

Future research should focus on:
- Standardized measurement techniques
- Universal cut-off values
- 3D ultrasound evaluation
- Risk prediction models

4. Conclusion

Ultrasonographic evaluation of the lower uterine segment scar is an effective and non-invasive method for assessing scar integrity in women with previous cesarean section. It plays a crucial role in predicting uterine rupture risk and guiding obstetric management.

Measurement of lower uterine segment thickness and residual myometrial thickness provides valuable information for delivery planning. However, standardized protocols and validated cut-off values are needed to improve clinical decision-making.

Ultrasonography should be incorporated into routine antenatal care for women with previous cesarean section to improve maternal and perinatal outcomes.