Two Dimensional Versus Three Dimensional Trans Abdominal Sonography for the Measurement of Lower Uterine Segment Thickness in pregnant Women with Previous Cesarean Delivery

Thesis

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ABSTRACT

Cesarean section is the commonest operation performed by the gynecologists and due to the risks and benefits of ERC and VBAC, cases selection and counseling are of out most importance

AIM: to evaluate inter method and inter observer reliability of 2D versus 3D trans abdominal sonography for lower uterine segment measurement.

Method: the study enrolled 100 pregnant women under going elective lower uterine segment cesarean section, all sonographic examination was performed by an ultrasound Voluson 730

Transducer for 2D and 3D trans abdominal sonography, inner myometrial thickness and full thickness will be measured at the thinnest portion and perpendicular to the contour of the lower uterine segment, then measurement intra operatively using graduated sound.

Results: Lower uterine segment inner and full diameter measurements were strongly and directly correlated by both 2D and 3D ultrasonography which means the 3D method of assessment added no more value

Both 2D and 3D method of assessment were correlated to a lower uterine segment measurement intra operatively with a comparable correlation factor.

Conclusion: multiple cesarean section patients had significant a lower value of lower uterine segment thickness by all means of measurements.

Key words:

Lower uterine segment thickness;

Previous cesarean section

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List of Abbreviations

2-D	:	Two dimensional
3-D	:	Three dimensional
ACOG	:	American college of obstetricians and gynecologists
ALARA	:	As low as reasonably achievable
BFGF	:	Basic Fibro blast Growth Factor
C.S	:	Cesarean section
CPD	:	Cephalo pelvic disproportion
CTGF	:	Connective tissue Growth Factor
EMJ	:	European Medical Journal
ERC	:	Elective repeat cesarean section
GIS	:	Gel instillation sonography
HPV	:	Human papilloma virus
LUS	:	Lower uterine segment
MRI	:	Magnetic resonance imaging
MTCT	:	Mother to child transmission
NIH	:	National institute of health
PDGF	:	Platelet Derived Growth Factor
RCOG	:	Royal college of Obstetrician and Gynecologists
RDS	:	Respiratory distress syndrome
SCSH	:	Saline contrast sono hysterography
SD	:	Standard deviation
TA	:	Trans abdominal
TGF-B	:	Trans forming Growth Factor Beta
TNF-α	:	Tumor Necrosis Factor Alpha
TVS	:	Trans vaginal sonography
US	:	Ultrasound
VBAC	:	vaginal birth after cesarean section
VEGF	:	Vascular Endothelial Growth Factor

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INTRODUCTION

Cesarean section is the commonest operation performed by the gynecologists and one of the commonest surgical procedures in general. The rates of Cesarean section are continuing to rise all over the world ***(Crowther et al., 2012)***.

For women who have had previous Caesarean section, choices for mode of birth in their next pregnancy are either trial of vaginal birth after caesarean (VBAC) or an elective repeat caesarean (ERC). Cesarean section is associated with complications in subsequent pregnancies, such as placenta previa, placenta accreta, increta or percreta1 dehiscence or uterine rupture. Also the surgical maternal morbidity including risk of bowel and bladder injury is significantly increased ***(Vikhareva et al., 2011).***

In the recent years vaginal birth after Cesarean (VBAC) was found to be less safe than was thought previously. This fact led to less obstetricians offering and less patients accepting VBAC. Decreased utilization of VBAC and increased rates of ERC is one of the major factors behind global increase in Cesarean section rates ***(Tahseen et al., 2010)***.

According to the available evidence, VBAC is associated with increased risk of maternal hemorrhage, blood transfusion, peripartum hysterectomy and uterine rupture. Fetal risks of VBAC includes Hypoxic Ischemic Encephalopathy and stillbirth ***(Crowether et al., 2012)***. However, the absolute risk of all previously mentioned adverse events is still low and the success rate of VBAC is estimated to be 72-76% in most of studies ***(Wen et al., 2004)***.

Uterine rupture due to dehiscence of the previous C.S scar is one of the most morbid and catastrophic complications that may happen with VBAC trial. The risk of uterine rupture during VBAC trial is estimated to be 74/10000 **(Landon et ale.,2004)**

Both VBAC and ERC have their own risks and benefits. However, VBAC is proved to be practical and relatively safe mode of delivery. Due to possible complications on both sides, case selection and patient counseling are of outmost importance. A non recurrent indication for previous cesarean section such as breech presentation or fetal distress is associated with a much higher success rate of VBAC than recurrent indications such as cephalopelvic disproportion (CPD). Even with history of CPD; two thirds of women will have successful VBAC. Also prior vaginal deliveries are excellent indicators of successful VBAC especially if the previous vaginal delivery was VBAC ***(Brill et al., 2003)***.

Many authors have tried to predict the possibility of scar dehiscence and uterine rupture in patients candidates for VBAC. Prediction of scar dehiscence will help in patient selection for VBAC. Trails have been made to visualize the lower uterine segment (LUS) and previous C.S scar. Many methods have been suggested, including Hysterography, sono hysterography, hysteroscopy, magnetic resonance imaging and ultra sonography ***(Jastrow et al. 2010)***.

The role of ultrasound in visualization of the lower uterine segment and detection of C.S scar defects has been investigated by many authors. Two dimensional (2-D) transvaginal ultrasound was found to be an accurate method for measurement of scar thickness. The addition of saline

sonohysterography can improve the demarcation of the scar ***(Vikhareva et al., 2011)***.

Many authors have tried to utilize transabdominal and transvaginal 2-D ultrasound to measure the scar thickness and detect the healing defects. Some authors measured the entire thickness of the lower uterine segment ***(Bujold et al., 2010)***, while others measured the muscular layer thickness ***(Cheung et al., 2005)***. The optimal cut-off value predicting scar dehiscence varied from 2.0 to 3.5 mm for full LUS thickness and from 1.4 to 2.0 for myometrial layer ***(Jastrow et al., 2010)***.

Three dimensional ultrasound gets more and more applications in the field of obstetrics and gynaecology. New horizons for the use of 3-D ultrasound imaging are explored every day, giving rise to new diagnostic modalities. Although 3-D ultrasound will not replace 2D ultrasound, many additional benefits will be identified and its use will continue to grow in the field in obstetrics and gynecology ***(Bethesda, 1949)***. One of the main advantages of 3-D ultrasound is the ability to reconstruct and display any arbitrarily chosen section within the volume dataset. Many of these planes cannot be obtained on conventional two dimensional sonography, as a result of the restrictions on probe movements during examination imposed by pelvic anatomy ***(Jurkovic, 2002)***.

The use of three dimensional ultrasound in visualizing LUS and measuring Cesarean scar thickness has started to be investigated recently. Martins and co-workers in 2009 have suggested that 3-D ultrasound decrease the inter observer variability in sonographic measurement of scar thickness, making the use of ultrasound for this goal more accurate. However, Cheung et al., 2011, have reached different conclusion as 3D in

comparison to 2-D transabdominal approach did not seem to improve the reliability of LUS thickness measurement.

Uterine rupture is an uncommon complication of vaginal birth after cesarean (VBAC), the maternal and fetal consequences of which can be serious and potentially life threatening ***(Jones et al., 1991; Leung et al., 1993; Grobman et al., 2008; Grobman et al., 2009)***. At present there are no reliable methods for predicting the risk of uterine rupture in women attempting VBAC. Some authors have suggested that sonographic measurement of the lower uterine segment (LUS) may help to select women with the lowest risk of uterine rupture during labor ***(Rozenberg et al., 2005; Cheung, 2005; Bujold et al., 2009; Jastrow et al., 2010)***. Although it has been shown that the risk of a scar defect is inversely correlated with LUS thickness, the technique of this measurement remain controversial ***(Cheung, 2005; Bujold et al., 2009; Jastrow et al., 2010)***. In a recent systemic review of 12 studies involving 1834 women, ***Jastrow et al. (2010)*** confirmed that women with uterine defects had thinner LUS than those without defects. of the the 12 studies included in the review,7 measured the full LUS thickness,4 measured the myometrial layer only, and one measured both. However, owing to the heterogeneity of the studies, no ideal cut-off for lower uterine thickness could be recommended for clinical purposes, and the optimal cut-off value varied from 2 to 3 mm for the full LUS thickness and from 1.4 to 2 mm for the myometrial layer ***(Jastrow et al., 2010)***.

In late pregnancy, the LUS appears sonographically as a 2-layered structure comprising the echogenic muscularis and mucosa of the bladder wall, including part of the visceral-parietal peritoneum, and the relatively

hypoechoic myometrial layer. The chorioaminiotic membrane and the decidualized endometrial layer cannot usually be seen separate from the myometrium ***(Rozenberg et al., 2005; Cheung, 2005)***. In vertex-presenting fetuses, the presenting part may be firmly applied against the LUS with no amniotic fluid visible between these 2 structures. Various techniques have been used to measure the LUS, including transabdominal (TA) and trans vaginal approaches. In some studies ***(Rozenberg et al., 2005; Sen et al., 2004; Suzuki et al., 2000)***, the entire full LUS thickness was measured, whereas only the inner myometrial layer was included in the measurement in other studies ***(Cheung, 2005; Asakura et al., 2000; Gotoh et al., 2000)***. However, almost all studies reported up-to-date use of 2D sonography in measuring the lower uterine segment.

The introduction of 3D volume sonography has enabled multiplanar display of 3D images of LUS, which potentially can improve the reliability of lower uterine segment measurement. One of the best uses of 3D ultra sound is in finding the true center of an object of interest; thus, it could theoretically locate the thinnest area in the US. Inter method and inter observer reliability are important when evaluating a clinical test because they ensure reliable measurements when made via another technique or observer, respectively. Previously, only one study addressed the reliability of LUS measurement using 2D and 3D approaches ***(Martins et al., 2009)***. However that study did not assess the inter method reliability of lower uterine segment measurement using 3D sonography compared with the 2D approach.

AIM OF WORK

The objective of the present study is to evaluate inter method and inter observer reliability of 2D versus 3D transabdominal sonography for lower uterine segment measurement.

CHAPTER I

History of Vaginal Birth after Cesarean Section (VBAC)

The relative safety of VBAC has been cited in the literature since the early 1900s, and was well summarized in a recent review ***(Enkin et al., 2000).***

For many years, the scarred uterus was believed to contraindicate labor out of fear of uterine rupture. ***(Craigin, 1916)*** made his famous announcement: *Once a Cesarean, always a Cesarean.* ***Craigin*** should not be blamed for the fact that his dictum was followed for more than 60 years. At the time of his report ,classical high uterine incision were performed for Cesarean section and a high rate of complete uterine rupture was occurring during labor in subsequent pregnancies. Craigin's declaration actually took time to catch on; some standard obstetrics texts did not recommend repeat Cesarean sections until the 60s or 70s ***(Begin, 1989).***

However, ***ACOG (1999)*** reported that: It *has become apparent that VBAC is associated with a small but significant risk of uterine rupture with poor outcome for mother and infant* .These developments, which have led to a more limited approach to trial of labor, by even the most ardent supporters of VBAC, illustrate the need to reevaluate VBAC recommendations.