Reliability of Ultrasound Modalities in Assessment Lower Uterine Segment in Women with Previous Cesarean Section

Thesis

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List of Abbreviations

ACOG	:	American Collage Of Obestetric and Gynecology
AUC	:	Area under the curve
AVMs	:	Arteriovenous malformations
CI	:	Confidence interval
CPD	:	cephalopelvic disproportion
CS	:	Caesarian section
EFW	:	Expected fetal weight
ERCD	:	Elective repeat caesarian delivery
FIG	:	Figure
IGF	:	Insulin like growth factor
IVF	:	In vitro fertilization
LUS	:	Lower uterine segment
PCDS	:	previous caesarean delivery scar
ROC	:	Receiver operating characteristic
SCSH	:	Saline contrast sonohysterography
SD	:	standard deviation
TAS	:	Trans abdominal sonography
TAUS	:	Trans abdominal ultrasound
TOLAC	:	Trial of labour after caesarian
TVS	:	Trans vaginal sonography
TVUS	:	Trans vaginal ultrasound
US	:	Ultrasound
VBAC	:	Vaginal birth after caesarian
WHO	:	World Health Organization
2D	:	Two dimensions
3D	:	Three dimensions

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Introduction

Three layers of the lower uterine segment (LUS) can be identified on ultrasound: the chorioamniotic membrane with decidualized endometrium; the middle muscular layer; and the uterovesical peritoneal reflection juxtaposed with muscle and mucosa of the bladder(***Michaels.et al.,1988).***

Rozenberg et al.1996,&Asakura et al.2000, reported a significant relationship between the transabdominal sonographic measurement of the entire LUS thickness in women near term who had had a previous Cesarean section and the risk of uterine rupture or dehiscence, the separation of the muscular layer with an intact serosa. No uterine rupture or dehiscence was noted when the entire LUS thickness was >4.5 mm. Furthermore, the risk of uterine rupture or dehiscence was 0.66% when this measurement was ≥3.5 mm, compared with 11.7% in women who had a LUS thickness <3.5 mm.

Several studies using various methods have been conducted to evaluate the correlation of LUS measurement with the risk of uterine rupture or dehiscence, with relative success. In some studies, the sonographers measured the entire LUS by transabdominal ultrasound while in others, only the middle muscle layer was assessed using transvaginal ultrasound and some studies used both approaches **(*Rozenberg1996,Qureshi1997, Rozenberg1999,Asakura2000, Gotoh H 2000Sen 2004,Cheung2005)*.**

Those studies evaluated the reliability of transabdominal ultrasound in patients with full or half full bladder and of transvaginal ultrasound, analyzing only the measurement of the entire LUS thickness. The authors concluded that reliability was not improved by a full patient bladder and that transvaginal ultrasound was more reliable than were the two transabdominal methods. However, this

study did not examine the measurement of the LUS muscular layer, which is the most commonly used method for evaluation by the transvaginal approach ***(Asakura2000,Qureshi1997***, ***Gotoh H 2000, Jastrow, 2006).***

In the previous studies the researchers tried to assess whether the three-dimensional (3D) ultrasound could improve the reliability of LUS measurement since its reliability and validity for the measurement of in-vitro models have proved to be excellent ***(Farrell2001, Raine-Fenning2003, Martins 2007).***

In this study, we will evaluate the reliability of the two most commonly used means of measuring LUS thickness: the entire LUS thickness will be measured by transabdominal ultrasound and the LUS muscular thickness will be measured by transvaginal ultrasound.

We also will evaluate whether the use of 3D ultrasound will be able to improve LUS measurement reliability or there is significant difference between the different modalities of the ultrasound.

Aim of the work

To compare the abilities of different ultrasound modalities (abdominal and vaginal 2D&3D) to evaluate the cesarean section scar within 24 hours prior to the next cesarean section.

Caesarean Section

Definition

Caesarean delivery is defined as the birth of a fetus through incisions in the abdominal wall (laparotomy) and the uterine wall (hysterotomy). This definition does not include removal of the fetus from the abdominal cavity in the case of rupture of the uterus or in the case of an abdominal pregnancy ***(Cunningham et al., 2009)***.

Caesarean delivery is the most common obstetric intraperitoneal operation, and the number of caesarean deliveries is increasing worldwide ***(Malvasi et al., 2009)***.

The uterus in pregnancy

The function of the uterus in pregnancy is to retain the developing fetus and to provide a protected environment until a stage at which the fetus is capable of surviving ex utero. The uterus must grow, facilitate delivery of the fetus and then involute. At the same time smooth muscle cells must be stretched by the growing fetus without producing miscarriage or premature labour ***(Standring et al., 2008).***

The uterus grows dramatically during pregnancy, increasing in weight from about 50 g at the beginning of pregnancy to up to 1 kg at term. Most of the weight gain is the result of increased vascularity and fluid retention in the myometrium. The increased growth of the uterine wall is driven by a combination of mechanical stretching and endocrine input. The mechanical load that the growing fetus imposes on the uterine wall induces hypertrophy of uterine smooth muscle cells, and is the major stimulus that increases smooth muscle mass. Some hyperplasia occurs early in

pregnancy, mainly from the growth of the media of the myometrial arteries and veins. The myometrium is relatively unresponsive to additional endocrine stimulation during most of pregnancy, a relative quiescence that is in part attributed to progesterone. However, a number of growth factors, e.g. insulin-like growth factor-1 (IGF-1), have been identified which interact with oestrogen in promoting uterine growth. The myometrium thins with advancing gestation from 2-3 cm thick in early pregnancy to 1-2 cm at term ***(Standering et al., 2008).***

The upper third of the cervix (isthmus) is gradually taken up into the uterine body during the second month to form the ‘lower segment' (Fig. 1). The isthmus hypertrophies like the uterine body during the first trimester and triples in length to about 3 cm. From the second trimester the wall of the isthmus and that of the body are the same thickness and their junction is no longer visible externally. This condition persists until the middle of the third trimester when the junction between the body and the isthmus can sometimes be recognized as a depression is thicker than that below. The depression forms just below the vesico-uterine pouch and is thought to correspond to the level of the anatomical internal os (upper margin of lower segment). It is the anatomical landmark used at the time of a lower segment caesarean section to ensure that the uterine incision is not in the body of the uterus. The lower segment is less vascular than the upper part of the transverse linear depression; the musculature above the uterus. Moreover, the risk of rupture of a lower segment uterine scar in subsequent pregnancies is significantly reduced compared to rupture of a scar in the body of the uterus (classical caesarean section) ***(Standering et al., 2008).***

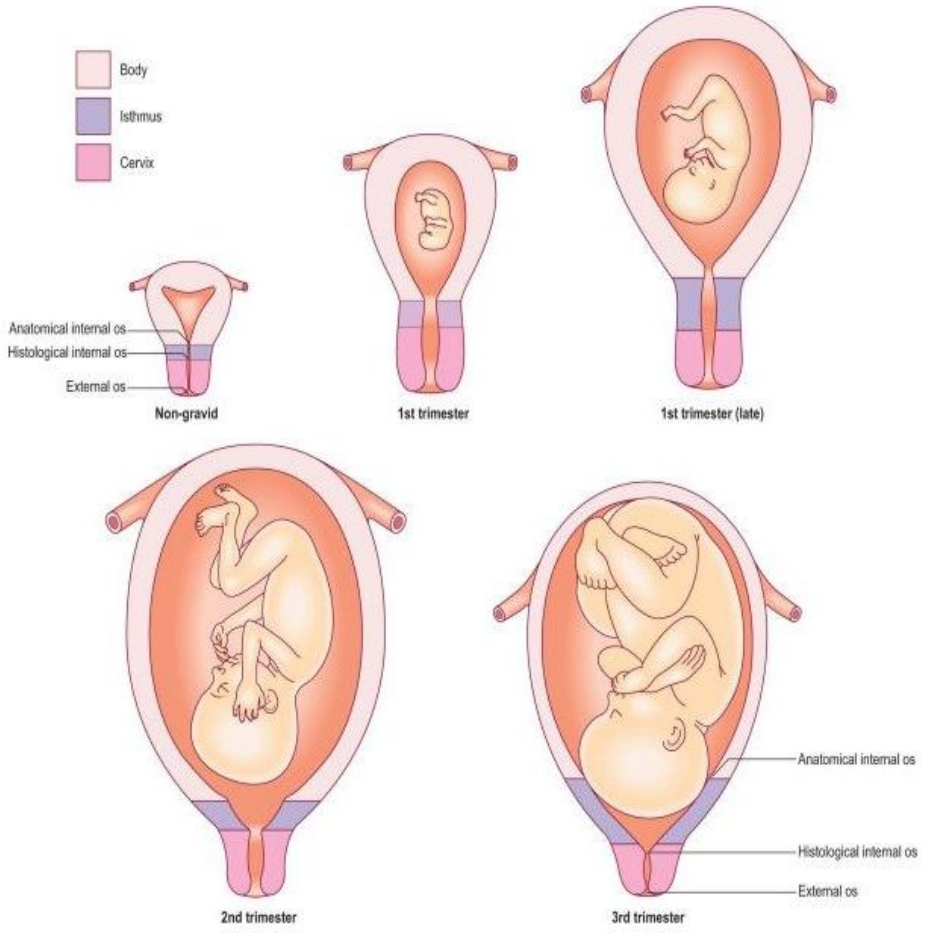

Fig. (1): Frontal view of the uterus showing the location and extent of the body, isthmus and cervix in the non-gravid and gravid uterus at different stages in gestation. The isthmus forms the lower uterine segment with advancing gestation **(Standering et al., 2008)**