ROLE OF THREE DIMENSIONAL ULTRASOUND IN PREDICTION OF CESAREAN SECTION SCAR DEHISCENCE

Thesis

Submitted for Partial Fulfillment of the Master Degree
In Obstetrics & Gynecology

By

Sara Mohammed Ahmed Mahmoud
M.B.B.CH, Faculty of Medicine
Ain Shams University 2008

Under Supervision of

Prof. Dr. Ahmed Ramy Mohammed Ramy
Professor of Obstetrics and Gynecology
Faculty of Medicine –AinShamsUniversity

Dr. Mohammed Mahmoud Elsherbeny
Assistant Professor of Obstetrics and Gynecology
Faculty of Medicine –AinShamsUniversity

Dr. Tarek Aly Raafat
Lecturer of Obstetrics and Gynecology
Faculty of Medicine –AinShamsUniversity

Faculty of Medicine
AinShamsUniversity

2014

بِسْمِ اللّهِ الرّحمَنِ الرّحيمِ

[...رَبِّ أَوزعنِي أَنْ أَشكُرَ نِعمَتَكَ
الّتِي أَنْعَمْتَ عَلَيَّ و عَلى والِدَيَّ

و أَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ و أَدْخِلْنِي
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ]

صدق الله العظيم

النمل.. اية رقم ١٩

Acknowledgments

Thanks to **ALLAH** first and foremost. I feel always indebted to Allah; the Most Kind and the Most Merciful.

I would like to express my gratefulness and respect to **Prof. Dr. Ahmed Ramy Mohammed Ramy**, Professor of Obstetrics and Gynecology, Faculty of Medicine – Ain Shams University, for his moral and scientific support and for giving me the honor of working under his supervision and valuable guidance.

Special thanks and deepest gratitude go to **Dr. Mohammed Mahmoud Elsherbeny**, Assistant Professor of Obstetrics and Gynecology, Faculty of Medicine – Ain Shams University, for his constructive and instructive comments, valuable guidance throughout the work and for his scientific advices.

I would like also to express my great thanks to **Dr. Tarek Aly Raafat**, Lecturer of Obstetrics and Gynecology, Faculty of Medicine – Ain Shams University, for his valuable help and great efforts during the whole work.

I would like also to express my great thanks to **Ultrasound Special Care Unit for the Fetus** and especially **Dr. Mohamed Elsherbiny Hamed** for his great effort during the whole work.

I can't forget to thank my **Parents** and all **members** of my **Family** for their support and encouragement

Sara Mohammed Ahmed

Table of Contents

List of Abbreviations

β-hCG	: Beta-human chorionic gonadotropin
AAFP	: American Academy of Family Physicians
ACOG	: American College of Obstetricians and Gynecologists
AUC	: Area under the curve
BFGF	: Basic fibroblast growth factor
BMI	: Body mass index
BW	: Birth weight
CD	: Cesarean delivery
CI	: Confidence interval
CS	: Cesarean section
CSDs	: Cesarean scar defects
CTGF	: Connective tissue growth factor
DA	: Diagnostic accuracy
DVT	: Deep venous thrombosis
EBL	: Estimated Blood loss
ECV	: External cephalic version
GA	: Gestational age
ICU	: Intensive care unit
IGF-1	: Insulin like growth factor-1
LSCS	: Lower segment cesarean section
LUS	: Lower uterine segment
MRI	: Magnetic resonance imaging
NIH	: National Institutes of Health
NPV	: Negative predictive value

List of Abbreviations *(Cont...)*

OR	: Odds ratio
PASS	: Power Analysis and Sample Size
PCDS	: Previous cesarean delivery scar
PDGF	: Platelet-derived growth factor
PPV	: Positive predictive value
RCT	: Random controlled trial
ROC	: Receiver-operating characteristic
RR	: Relative risk
SACOG	: Society of American College of Obstetricians and Gynecologists
SCSH	: Saline contrast sonohysterography
SD	: Standard deviation
TAU	: Transabdominal ultrasound
TGF-β	: Transforming growth factor beta
TNF-α	: Tumor necrosis factor alpha
TOL	: Trial of labor
TOLAC	: Trial of labor after cesarean
TVU	: Transvaginal ultrasound
VBAC	: Vaginal birth after cesarean delivery
VEGF	: Vascular endothelial growth factor
VOCAL	: Virtual Organ Computer-aided Analysis
WHO	: World Health Organization
WMD	: Weighted mean difference
3D US	: Three-dimentional ultrasound
2D ultrasound	: Two-dimensional ultrasound
3D ultrasound	: Three-dimensional ultrasound

List of Tables

List of Tables *(Cont...)*

List of Figures

List of Figures *(Cont...)*

List of Figures *(Cont...)*

Introduction

Cesarean sections delivery is a surgical operation to deliver a baby through an incision in the uterus. The number of deliveries by Cesarean section (CS) has been increasing steadily worldwide in recent decades. Its rate varies internationally from 10 to 25%. The main indication for CS has become repeat cesarean section. During the second half of 20th century, a cesarean section implied that all subsequent pregnancies were very likely to be delivered in the same way. This policy was the result from the fear of catastrophic uterine scar rupture of classical CS, which persisted even after its replacement with lower segment cesarean section (LSCS) without the same basis ***(Nargis et al., 2012).***

In Egypt, a significant rise in cesarean deliveries has been occurred for all births from as low as 4.6% in 1992 to 10.3% in 2000. However, hospital-based cesarean deliveries were much higher as they represented 13.9% of all deliveries in 1988 that increased to 22.0% in 2000. Although the CS rate was higher in private hospitals, the rate also increased consistently in public hospitals. This high increase in CS rates was attributed partly to cesarean sections that are not medically indicated and suggested that physician practice patterns, financial incentives or other profitability factors and patient preferences should be explored ***(Khawaja et al., 2004).***

Although it is often assumed that CS improves neonatal outcomes, there is no hard scientific evidence to support this. The safety of CS, however, has increased owing to improvements in surgical and anesthetic techniques, increased safety of blood transfusion and routine use of antibiotics and thromboprophylaxis ***(Ofili-Yebovi et al., 2008).***

Cesarean section is also associated with longterm risks such as postoperative pelvic adhesions, uterine scar rupture, and placental complications such as placenta previa and accreta. The latter two complications are likely to be associated with the poor uterine scar healing & cesarean scar defects following Cesarean section ***(Chongsuvivatwong et al., 2010).***

Cesarean scar defects (CSDs), i.e. deficient uterine scars or scar dehiscence following a CS, involve myometrial discontinuity at the site of a previous CS scar. These anatomical defects resulting from previous Cesarean surgery have been reported to be associated with prolonged postmenstrual spotting and chronic pelvic pain. A histopathological study of hysterectomy specimens with CS scars proposed three possible mechanisms underlying the pathogenesis of this condition: firstly, the presence of a congested endometrial fold (found in 31/51 (61%) cases) and a small polyps in the scar recess (8/51 (16%)) are potential causes of menorrhagia and abnormal uterine bleeding; secondly, lymphocytic infiltration (33/51 (65%)) and distortion of the lower uterine segment (LUS) (38/51 (75%)) could contribute to chronic pelvic pain and dyspareunia; thirdly, iatrogenic adenomyosis confined to the scar (28%) could account for dysmenorrhea ***(Wang et al., 2009).*** It has also been noted that the CSDs in patients with retroflexed uteri appear to be larger than are those in patients with anteverted uteri. Moreover, patients who have undergone multiple Cesarean sections have been observed to have larger scar defects ***(Ofili-Yebovi et al., 2008).***

Various imaging modalities have been used to determine the integrity of the scarred uterus, from hysterography in the periconceptional period (which has not proved useful) to ultrasonographic evaluation ***(Sen et al., 2004).*** With application of ultrasonography, clearer visualization of the LUS can be obtained and various changes in the anterior uterine wall following the operation have been revealed ***(Suzuki et al., 2000; Jarvela et al., 2002).*** It has been suggested that uterine rupture is more common in cases with a sonographically thin uterine wall ***(Gizzo et al., 2013).***

To assess the risk of uterine rupture in a subsequent pregnancy, researchers have used two-dimensional (2D) ultrasound in the evaluation of the uterine scar in third trimester. However, it remains insufficient because of the portion observed by 2D ultrasound is actually 1-2 cm caudal to the scar tissue ***(Asakura et al., 2000).***

Among the newest technological advances in the evaluation of cesarean scar defect is the ability to use three-dimensional (3D) ultrasound which can demonstrate more precisely the location, shape and size of a defective scar ***(Taiple et al., 2005).***

The advantage of 3D ultrasound is the possibility of obtaining coronal planes and their surface reconstruction which provides new image features which are not possible to obtain with conventional 2D ultrasound ***(Shih, 2004).*** The use of 3D ultrasound may decrease the interobserver variability of results as compared to 2D ultrasound ***(Martins et al., 2009).***A combination of multiplanar views and 3D-rendered images usually enhances the ability to identify anatomic details and allows a comprehensive diagnosis ***(Shih, 2004).*** Three-dimensional ultrasound is highly accurate in detecting cesarean scar dehiscence ***(Royo et al., 2009).***