



**Three-dimensional power Doppler ultrasound  
scanning for the prediction of endometrial  
cancer in women with postmenopausal  
bleeding and thickened endometrium**

*Thesis*

*Submitted for partial fulfillment of the master degree In  
Obstetrics and gynecology*

**By:**

**Amgad Farahat Abd Elkader Salim**

Resident of obstetrics and gynecology  
Ghamra Military Hospital  
M.B.B.Ch

**Supervised by**

**Prof. Hatem Hussein Elgamal**

*Professor of Obstetrics and Gynaecology  
Faculty of Medicine, Ain Shams University*

**Prof. Magdy Hassan Kolib**

*Professor of Obstetrics and Gynaecology  
Faculty of Medicine, Ain Shams University*

**Dr. Ahmed Elsayed Hassan Elbohoty**

*Lecturer of Obstetrics and Gynecology  
Faculty of Medicine, Ain shams University*

**Faculty of Medicine  
Ain Shams University**

**2014**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا  
إلا ما علمتنا إنك أنت  
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٢٢



## *Acknowledgement*

*First of all my deepest thank to **Allah** for enabling me to do right things.*

*I am greatly honored to express my deep respect and gratitude to **Prof. Hatem Elgama**, Professor of Obstetrics and Gynaecology, Faculty of medicine, Ain Shams University, for his faithful supervision, help and encouragement in initiating and completing this work,*

*I am very much grateful to **Prof. Magdy Hassan Kofib**, Professor of Obstetrics and Gynaecology, Faculty of medicine, Ain Shams University, for his valuable advice that helped me to finish this work,*

*I am very much obliged to **Dr. Ahmed Elsayed Hassan Elbohoty**, Lecturer of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University.*

*I owe much to **Dr. Amr Helmy Yehia** Lecturer of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, for his continues help, valuable suggestions and final revision of the manuscript.*

*Amgad Farahat Abd Elkader Salim*

---



**Dedication**

*To the soul of  
my family*

# Contents

List of Abbreviations .....	i
List of Tables .....	ii
List of Figures .....	iii
<b>Introduction and Aim of the Work .....</b>	<b>1</b>
<b>Review of Literature .....</b>	<b>4</b>
Chapter (1) Postmenopausal bleeding.....	5
Chapter (2): Ultrasonography .....	19
<b>Patients and Methods.....</b>	<b>45</b>
<b>Results .....</b>	<b>52</b>
<b>Discussion.....</b>	<b>65</b>
<b>Summary .....</b>	<b>71</b>
<b>Conclusion.....</b>	<b>74</b>
<b>References .....</b>	<b>75</b>
<b>Arabic Summary .....</b>	<b>--</b>

---

## List of Abbreviations

---

EMP	:	Endometrial Polyp
BMI	:	Body mass index
CT	:	Computerized tomography
MRI	:	Magnetic resonant imaging
D&C	:	Dilatation and curettage
DH	:	Diagnostic hysteroscopy
PMB	:	Postmenopausal bleeding
TVS	:	Transvaginal ultrasonography
US	:	Ultrasound
IV	:	Intravenous
VOCAL	:	Virtual Organ Computer-aided Analysis
3D	:	Three dimensional
2D	:	Two dimensional
3D-PDA	:	Three dimensional power Doppler angiography
EMP	:	Endometrial Polyp
WHO	:	World health organization
DH	:	Diagnostic hysteroscopy
VI	:	Vascularization index

FI	:	Flow index
VFI	:	Vascularization flow index
DM	:	Diabetes mellitus
AUC	:	Area under the curve
AE	:	Endometrial atrophy
EP	:	Endometrial polyp
EH	:	Endometrial hyperplasia
EC	:	Endometrial carcinoma
ROC	:	Receiver-operator characteristic
VI <sub>s</sub>	:	Vascularization indices
SIS	:	Saline infusion sonography
GIT	:	Gastrointestinal tract
ROC	:	Receiver-operator characteristic

## List of Table

<i>Table</i>	<i>Title</i>	<i>Page</i>
1	Differential Diagnosis of postmenopausal bleeding	6
2	Patients demographic data	53
3	Comparison of the characteristics of patients with benign or malignant lesions	55
4	Comparison of ultrasound parameters in patients with benign or malignant lesions	56
5	Comparison of ultrasound parameters according to the histopathologic type	58
6	Summary of the areas under the receiver-operator characteristic (ROC) curves (AUCs) for prediction of endometrial carcinoma using endometrial thickness, endometrial volume, VI, FI, or VFI	63
7	Comparison between previous study and our study	70



## List of Figures

<b><i>Fig.</i></b>	<b><i>Title</i></b>	<b><i>Page</i></b>
1	Microscopic picture of senile atrophic endometrium	5
2	Microscopic picture of an EMP	8
3	Microscopic picture of adenomyomatous polyp	8
4	Microscopic picture of simple hyperplasia	11
5	Microscopic picture of complex hyperplasia	11
6	Five-year survival depending on stage and type of cancer	12
7	Microscopic picture of endometrioid adenocarcinoma	13
8	Microscopic picture of endometrial adenoacanthoma	13
9	Microscopic picture of uterine papillary serous carcinoma	14
10	Ultrasound of endometrial polyp	22
11	Ultrasound of endometrial polyp	22
12	Ultrasound of intramural fibroids	24
13	Ultrasound of submucous fibroid.	25
14	Ultrasound of subserous fibroid	25
15	Ultrasound of adenomyosis	26
16	Ultrasound of adenomyosis	26
17	Ultrasound of endometrial hyperplasia	27
18	Ultrasound of endometrial hyperplasia	28
19	Ultrasound of endometrial carcinoma.	29
20	Ultrasound of endometrial carcinoma.	29
21	Ultrasound of endometrial carcinoma	30
22	Ultrasound of atrophic endometrium	31

## List of Figures (Cont.)

<b><i>Fig.</i></b>	<b><i>Title</i></b>	<b><i>Page</i></b>
23	Calculation using VOCALTM software of endometrial volume (a) and power Doppler indices (vascularization index (VI), flow index (FI) and vascularization flow index (VFI)) in the endometrium (b)	39
24	Consort flow chart	54
25	Mean Doppler indices in patients with benign or malignant lesion	57
26	Mean endometrial thickness associated with the various histopathologic types.	59
27	Mean endometrial volume associated with the various histopathologic types.	60
28	Mean Doppler indices associated with the various histopathologic type	61
29	A composite graph showing the areas under the receiver-operator characteristic (ROC) curves (AUCs) for prediction of endometrial carcinoma using endometrial thickness, endometrial volume, VI, FI, or VFI.	64



## **Introduction**

Postmenopausal bleeding (PMB) accounts for five per cent of office gynaecology presentations (*Anon., 2007*). Its definition is self-explanatory, as any bleeding from the genital tract occurring in the postmenopausal period, arising after 12 months of amenorrhoea in a woman of menopausal age (*Goodman, 2014*). It is known that about 90–95% of postmenopausal women with endometrial cancer report a vaginal bleeding experience whereas about 10% of symptomatic postmenopausal women reveal an intrauterine malignancy. So, a postmenopausal vaginal bleeding is a sign that should not be underestimated (*Giannella et al., 2014*). A good clinical practice provides, as first diagnostic step, a transvaginal ultrasound in order to discriminate a woman at high or low risk of malignancy. Usually, an endometrial thickness  $\leq 4\text{mm}$  is a cutoff value for which a conservative management should be adopted. Indeed, in the latter case the probability of having an endometrial cancer drops from 10% to 0.8 % (*Ali et al., 2014*). An endometrial biopsy is considered the gold standard for evaluation of PMB. Endometrial biopsy can be obtained with an endometrial pipelle in the outpatient setting, or by hysteroscopy and curettage (with or without dilatation) in either the outpatient or inpatient setting.

Sampling of the endometrium may miss pathology, as often less than 50 per cent of the endometrium is sampled. Risks involved in this procedure include infection, bleeding, uterine perforation and insufficient sampling (*Feldman., 2014*). Sonohysterography appears to accurately evaluate the endometrial cavity and can be successfully performed in more than 85% of postmenopausal women in an office setting. Saline infusion sonography seems superior to TVUS in defining intrauterine lesions in women with postmenopausal bleeding and endometrial thickness greater than 5 mm, particularly for the delineation of endometrial polyps, for which it seems as accurate as hysteroscopy but There is no current evidence suggesting that saline infusion sonography (SIS) enhances the diagnosis of malignancy (*Munro., 2014*). Three-dimensional (3D) ultrasonography and power Doppler angiography (PDA) is a novel sonographic diagnostic modality. This technology permits acquisition of the volume of the endometrium and assessment of its vasculature using 3D power Doppler mapping. Using Virtual Organ Computer-aided Analysis (VOCAL™) software, three vascularity indices can be obtained automatically: the vascularization index (VI), the flow index (FI), and the vascularization flow index (VFI). This method has been proven to be highly reproducible for analyzing the volume of the endometrium and 3-dimensional

power Doppler indices of patients with malignancy of the endometrium (*Hanafi et al., 2014*). Magnetic resonance imaging (MRI) is a powerful noninvasive but costly technique with a demonstrated, promising potential for visualization of uterine myoma. However, data on MRI visualization of endometrial polyps are scarce. MRI has limitations for the evaluation of intrauterine lesions because they need high medical expenses due to the use of expensive equipment (*Ahmad et al., 2014*).

## **Aim of the Work**

To evaluate the role of 3-dimensional power Doppler angiography (3D-PDA) to discriminate between benign and malignant endometrial disease in women with postmenopausal bleeding and thickened endometrium.