

***The Use of Transvaginal Ultrasound to
Study the Anatomy of the Lower Urinary
Tract in Stress Urinary Incontinence***

Thesis

*Submitted for Partial Fulfillment of
The M.Sc. Degree*

In

Obstetrics and Gynecology

By

Mohamed El-Mandooh Mohamed
M.B., B. Ch., Ain Shams University

Supervised By

Prof. Dr. Magdy Mohamed Kamal
Professor of Obstetrics and Gynecology
Faculty of Medicine - Ain Shams University

Dr. Mohamed Ibrahim Mohamed Amer
Assistant Professor of Obstetrics and Gynecology
Faculty of Medicine - Ain Shams University

Dr. Khaled Abd El-Fattah Teamia
Lecturer in Urology Department
Faculty of Medicine - Ain Shams University

Faculty of Medicine - Ain Shams University

1999



Acknowledgment

First, all due thanks are to Allah for blessing this work till it has reached its end, as a part of his generous help throughout my life.

*I would like to express my immense gratitude and appreciation to **Prof. Mohamed Nagy El-Makhzangy**, Professor of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, for his guidance and encouragement to accomplish this work.*

*I would like to direct special thanks to **Prof. Magdy Mohamed Kamal**, Professor of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, for the great support and encouragement he gave me throughout the whole work. It is a great honor to work under his guidance and supervision.*

*I am greatly honored to express utmost thanks to **Prof. Mohamed Ibrahim Mohamed Amer**, Assistant Professor of Obstetrics and Gynaecology, Faculty of Medicine, Ain Shams University, from whom I received faithful supervision, valuable suggestions, and continuous guidance throughout this work.*

*Also I would like to express my sincere gratitude to **Dr. Khaled Abd El-Fattah Teama**, Lecturer in Urology Department, Faculty of Medicine, Ain Shams University, for his close supervision, continuous help, and tremendous efforts he has done in the meticulous revision of the whole work.*

Mohamed El-mandooh Mohamed Ibrahim

Contents

<i>~Introduction</i>	<i>1</i>
<i>~Aim of the Work.....</i>	<i>3</i>
<i>~Review of Literature.....</i>	<i>4</i>
Chapter (1) : Anatomy of the lower urinary tract	
* Embryology.....	4
* The urinary bladder.....	7
* The trigone.....	10
* The urethra.....	12
* The anatomy of bladder neck support.....	17
* Innervation of the lower urinary tract.....	24
Chapter (2) : Physiology	
* Micturition.....	29
* Dynamics of continence and micturition....	30
* Pathophysiology of urinary incontinence...	38
Chapter (3) : Stress urinary incontinence	
* Definition and Epidemiology.....	42
* Classification and grading.....	44
* Etiology.....	49
* Risk factors.....	52

Chapter (4) : Evaluation of urinary incontinence

* History.....	56
* Physical examination.....	59
* Specific tests.....	62
* Investigations.....	67
* Urodynamics.....	69

Chapter (5) : Transvaginal Ultrasound in the Study of

Anatomy of Lower Urinary Tract.....	82
<i>~Subjects and Methods.....</i>	<i>96</i>
<i>~Results.....</i>	<i>105</i>
<i>~Discussion.....</i>	<i>122</i>
<i>~Summary</i>	<i>130</i>
<i>~References.....</i>	<i>132</i>
<i>~Arabic Summary.....</i>	

List of Figures

<i>Figure No.</i>	<i>Details</i>	<i>Page No.</i>
1	Development of the cloaca.	5
2	Anatomy of the bladder and its outlet.	11
3	Diagrammatic representation showing the component parts of the internal and external sphincteric mechanisms.	16
4	The levator ani muscle.	19
5	The levator ani fascia.	19
6	Diagrammatic representation showing the regions of the levator fascia.	23
7	Diagram showing the detrusor sphincter reflexes.	28
8	Diagram representing the physiology of micturition.	37
9	Proposed mechanism of sphincteric incontinence resulting from urethral hypermobility.	41
10	The normal cystometrogram.	76
11	Schematic representation of the urethral pressure profile.	76
12	A block diagram depicting videourodynamic evaluation.	81
13	The anatomical field represented in each scan.	99
14	The BS distance.	100

List of Figures (continued)

<i>Figure No.</i>	<i>Details</i>	<i>Page No.</i>
15	The urethrovesical angle.	101
16	Descent of the bladder neck.	101
17	Funneling of the bladder neck.	102
18	The rotational angle.	102
19	A photograph taken to patient with stress urinary incontinence during rest and strain.	110
20	A photograph taken to one of the control group during rest and strain.	111
21	Mean BS distance in both groups during rest and strain.	115
22	Mean change in BS distance in both groups.	115
23	Mean UVA in both groups during rest and strain.	116
24	Mean change in UVA in both groups.	116
25	Mean change in RA in both groups.	117
26	Mean D in both groups during rest and strain.	118
27	Mean change in D in both groups.	118
28	Mean F in both groups during rest and strain.	119
29	Mean change in F in both groups.	
30	A photograph showing a patient with successful surgery for stress incontinence before and after the operation.	121

List of Tables

Table No.	Details	Page No.
1	Descriptive data of cases studied.	105
2	The effect of age on the ultrasonographic anatomy of the cases studied.	106
3	The effect of weight on the ultrasonographic anatomy of the cases studied.	107
4	Effect of parity on the ultrasonographic anatomy of the cases studied.	108
5	Effect of hormonal state on the ultrasonographic anatomy of the cases studied.	109
6	Descriptive data of the anatomical parameters in the incontinent group.	112
7	Descriptive data of the anatomical parameters in the control group.	113
8	Comparison of the ultrasonographic findings in both continent and incontinent groups	114
9	Comparison of the ultrasonographic findings before and after successful operation.	120

List of Abbreviations

BS₁	Distance from the bladder neck to the middle of inferior border of the symphysis pubis.
BS₂	Distance from the bladder neck to the center of symphysis pubis.
BS	Average of BS ₁ and BS ₂ .
BMI	Body mass index.
D	Descent of the bladder neck.
F	Funneling of the bladder neck.
MRI	Magnetic resonance imaging.
RA	Rotational angle.
UVA	Urethrovesical angle.

Introduction and Aim of the Work

