



**Comparative Study Between Extra Corporeal  
Shock Waves Lithotripsy and Ureteroscopic  
Stone Extraction in Management of Upper and  
Middle Ureteric Stones**

Thesis

*Submitted for Partial Fulfillment of Master Degree  
in Urology*

**Amir Samuel Shawki**

*(M.B.B.Ch.)*

Supervised By

**Prof.Dr.Abelhamid Abdelkader Yousef**

*Professor of Urology*

*Faculty of Medicine, Ain Shams University*

**Dr. Mohammed Ahmed Gamal**

*Lecturer of Urology*

*Faculty of Medicine , Ain Shams University*

*Faculty of Medicine  
Ain Shams University*

2016



*First thanks to **ALLAH** to whom I relate any success in achieving any work in my life.*

*I wish to express my deepest thanks, gratitude and appreciation to **Prof. Dr. Abdelhamid Abdelkader Youssef**, Professor of Urology Faculty of Medicine, Ain Shams University for his meticulous supervision, kind guidance, valuable instructions and generous help.*

*Special thanks are due to **Dr. Mohammed Ahmed Gamal**, Lecturer of Urology Faculty of Medicine, Ain Shams University for his sincere efforts, fruitful encouragement.*

*Also I would like to thank my Family and who stood behind me to finish this work and for their great support.*

**Amir Samuel Shawki**

# *List of Contents*

Title	Page No.
List of Tables .....	<b>Error! Bookmark not defined.</b>
List of Figures.....	<b>Error! Bookmark not defined.</b>
List of Abbreviations .....	<b>Error! Bookmark not defined.</b>
Introduction .....	1
Aim of the study .....	4
Review of Literature	
▪ Anatomy of the Ureter .....	5
▪ Classification of urinary stones.....	14
▪ Diagnosis of Ureteric Stones.....	18
▪ Extracorporeal shock wave lithotripsy: technology, physics & complications .....	33
▪ Uretroscopy.....	49
Patients and Methods.....	74
Results .....	86
Discussion.....	106
Summary .....	118
Conclusion .....	120
References .....	121
Arabic Summary	

## *List of Tables*

Table No.	Title	Page No.
<b>Table (1):</b>	The Normal Ureteral Diameter .....	13
<b>Table (2):</b>	Plain X-ray characteristics .....	15
<b>Table (3):</b>	Stones classified according to their etiology .....	16
<b>Table (4):</b>	Stone composition.....	17
<b>Table (5):</b>	Recommendations: Basic analysis .....	19
<b>Table (6):</b>	Advantages, Disadvantages, and Relative Indications for KUB, US, IVP, NCCT, and MRI in the Evaluation of Stone Disease.....	32
<b>Table (7):</b>	Descriptive statistics for all the studied patients. ....	86
<b>Table (8):</b>	Number of ESWL sessions among studied cases in ESWL group.....	87
<b>Table (9):</b>	Comparison between ESWL group and URS group according to age, sex and BMI .....	90
<b>Table (10):</b>	Comparison between ESWL group and URS group according to size and Hounsfield unit.....	91
<b>Table (11):</b>	Comparison between ESWL group and URS group according to clearance rate and complications.....	92
<b>Table (12):</b>	Comparison between upper and mid ureteric stones in ESWL group according to clearance rate and complications.....	95
<b>Table (13):</b>	Comparison between upper and mid ureteric stones in URS group according to clearance rate and complications.....	98
<b>Table (14):</b>	Comparison between upper ureteric stones in ESWL group and upper ureteric stones in URS group according to clearance rate and complications.....	100
<b>Table (15):</b>	Comparison between mid ureteric stones in ESWL group and mid ureteric stones in URS group according to clearance rate and complications.....	102

## *List of Tables Cont...*

Table No.	Title	Page No.
<b>Table (16):</b>	Relation between hounsfield unit and number of ESWL sessions.....	104

## *List of Figures*

Fig. No.	Title	Page No.
<b>Figure (1):</b>	Parts of the ureter.....	6
<b>Figure (2):</b>	The right ureter illustrated by retrograde injection of contrast material. ....	12
<b>Figure (3):</b>	Mean HU value of calcium oxalate, calcium phosphate, and uric acid stone.....	30
<b>Figure (4):</b>	Relationship between mean HU and number of ESWL sessions .....	30
<b>Figure (5):</b>	Electro hydraulic shock wave generation .....	35
<b>Figure (6):</b>	Piezoelectric shock wave generation .....	36
<b>Figure (7):</b>	Shows the electromagnetic shockwave generator with acoustic lens .....	37
<b>Figure (8):</b>	Shows the electromagnetic shockwave generator with focusing reflector.....	37
<b>Figure (9):</b>	Mechanisms of stone comminution. ....	43
<b>Figure (10):</b>	Rigid Ureteroscope.....	51
<b>Figure (11):</b>	Modern semirigid ureteroscope with separate working/irrigation channels.....	53
<b>Figure (12):</b>	Modern generation flexible ureterorenoscope with bilateral 270° maximal tip deflection.....	53
<b>Figure (13):</b>	Facial Dilators. ....	59
<b>Figure (14):</b>	One-step ureteral balloon dilator (white) attached to a locking screw syringe (white). ....	60
<b>Figure (15):</b>	Ureteroscopic baskets, left to right: four-wire Segura basket, three-wire helical basket, tip less helical basket, tieless non helical basket. ....	62
<b>Figure (16):</b>	Standard three-pronged grasping forceps.....	62
<b>Figure (17):</b>	Schematic illustration of the LithoClast (Electromedical Systems, Kaufering, Germany) handpiece mechanism. ....	64

## *List of Figures Cont...*

Fig. No.	Title	Page No.
<b>Figure (18):</b>	ESWL unit, Urology department, Ain Shams Hospitals. ....	79
<b>Figure (19):</b>	LithoClast.....	82
<b>Figure (20):</b>	Distribution of sex among all studied cases. ....	87
<b>Figure (21):</b>	Number of ESWL sessions among studied cases in ESWL group.....	88
<b>Figure (22):</b>	Outcome among all studied cases. ....	88
<b>Figure (23):</b>	Complications among all studied cases.....	89
<b>Figure (24):</b>	Comparison between ESWL group and URS group according to clearance rate.....	94
<b>Figure (25):</b>	Comparison between ESWL group and URS group according to complications.....	94
<b>Figure (26):</b>	Comparison between mid ureteric and upper stones in ESWL group according to clearance rate. ....	97
<b>Figure (27):</b>	Comparison between mid ureteric and upper stones in ESWL group according to complications. ....	97
<b>Figure (28):</b>	Comparison between mid ureteric and upper stones in URS group according to clearance rate. ....	99
<b>Figure (29):</b>	Comparison between mid ureteric and upper stones in URS group according to complications. ....	99
<b>Figure (30):</b>	Comparison between upper ureteric stones in ESWL group and upper ureteric stones in URS group according to clearance rate. ....	101
<b>Figure (31):</b>	Comparison between upper ureteric stones in ESWL group and upper ureteric stones in URS group according to complications. ....	101

## *List of Figures Cont...*

Fig. No.	Title	Page No.
<b>Figure (32):</b>	Comparison between mid ureteric stones in ESWL group and mid ureteric stones in URS group according to clearance rate. ....	103
<b>Figure (33):</b>	Comparison between mid ureteric stones in ESWL group and mid ureteric stones in URS group according to complications. ....	103
<b>Figure (34):</b>	Relation between hounsfield unit and number of ESWL sessions. ....	104



## *List of Abbreviations*

Abb.	Full term
BMI.....	Body Mass Index
CT scan.....	Computed tomography scan
ESWL.....	Extracorporeal shock wave lithotripsy
Fr .....	French scale
HU .....	Hounsfield unit
IV .....	Intravenous
IVU .....	Intravenous urography
KUB.....	Kidney-ureter-bladder radiograph
MCCS .....	Modified Clavien Classification System
MRI.....	Magnetic resonance imaging
NCCT.....	Non-contrast spiral computed tomography
PAUS .....	Pelvi abdominal ultra sound
PCNL.....	Percutaneous nephrolithotomy
PL.....	pneumatic lithotripsy
SR URS.....	Semi rigid ureteroscope
SSD .....	Skin to stone distance
U/S .....	Ultrasound
UPJ.....	Ureteropelvic junction
URS.....	Ureteroscopy
UTI.....	Urinary tract infection
UVJ.....	Ureterovesical junction

## **Abstract**

In our study we do comparison between extracorporeal shock wave lithotripsy and ureteroscopy in management of upper and mid ureteric calculi.

We concluded that ureteral stones 1cm or less in size can be treated safely and effectively by ESWL with a stone free rates more than pneumatic ureteroscopic lithotripsy, while in mid ureteral stones 1 cm or less in size can be treated safely and effectively by ESWL with a stone free rates equal to pneumatic ureteroscopic lithotripsy.

Most of the complications are minor and can be treated either conservatively or endourologically without further morbidity or mortality. ESWL and URS lithotripsy failures can be salvaged by further endourological procedures.

**Key words:** Extra Corporeal Shock Waves Lithotripsy- Ureteroscopic Stone Extraction- Middle Ureteric Stones



## INTRODUCTION

Patients with urolithiasis constitute an important part of everyday urological practice. The optimal clinical management of this disease requires knowledge of the diagnostic procedures, the rational treatment of acute stone colic, stone expulsive treatment and the modern principles of stone removal. Management of renal and ureteric stones includes pharmacotherapy, extra corporeal shock waves lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), flexible and rigid ureteroscopy and open surgery (*Tiselius et al., 2011*).

In 1980, **Dr. Christian Chaussy** of the University of Munich was the first to treat renal stone in humans using a new concept termed extracorporeal shock wave lithotripsy. Using this technology, he determined that patients could have renal or ureteral stones removed without the need of an incision or skin puncture, due to its non-invasive nature ESWL has completely changed therapeutic strategies for urolithiasis, The first lithotripter model (Dornier HM-1™) was soon replaced by the (Dornier HM-2™) IN 1982, and the (Dornier HM-3™) in 1984. The HM-3 was first used in the United States on February 23<sup>rd</sup>, 1984 at Methodist Hospital in Indianapolis. With technological advances in lithotripter models, ESWL has become the preferred line of treatment for renal & upper ureteric calculi of <2 cm in diameter (*Andreas et al., 2006*).

The outcome of ESWL depends on many factors, including stone size, location, composition, density (Hounsfield unit: HU), and the number of shocks delivered & skin to stone distance (SSD) (*Tan et al., 2002*).

Extracorporeal shock wave lithotripsy (ESWL) represents a well established and effective therapeutical method for ureteric stones (*Segura et al., 1997*).

The overall success rates have been reported to be or even overcoming 90% in many prospective studies (*Wang et al., 2011*).

ESWL is a safe, non-invasive and effective method to treat a majority of stones with a minimal number of complications (*Skolarikos et al., 2006*).

Even after successful treatment in terms of stone fragmentation, side-effects like renal colic and ureteric obstruction can occur. In rare cases a ‘stein strasse’ can develop, defined as an accumulation of fragments behind a leading, obstructing fragment (*Skolarikos et al., 2006*).

The introduction of ureteroscope, as well as development of intracorporeal lithotripsy method has substantially improved the ureteroscopic (URS) manipulated stone free rate (71 – 78%) and significantly decreased the complication rate (*Youssef et al., 2009*).

A combination of ureteroroscopy and intracorporeal lithotripsy has proven to be a viable alternative to ESWL (*Tipu et al., 2007*).

ESWL remains the primary treatment modality for upper and middle ureteric calculi. However, some urologists have recommended ureteroscopic manipulation as first line treatment (*Leistner et al., 2007*).

The debate still continues whether ESWL or ureteroscopic manipulation should be the first line of treatment for upper and middle ureteric stone.

## **AIM OF THE STUDY**

The aim of this study is to compare between extracorporeal shock wave lithotripsy (ESWL) and ureteroscopic (URS) manipulation in the treatment of upper and middle ureteric stones as regard the stone free rate and the complications.