



The role of Virtual cystoscopy in diagnosis of bladder mass

Thesis
Submitted for partial fulfillment of Master degree
In Urology

Presented By

MOHAMED HASSAN DAWOOD HASSAN
M.B.,B.Ch.

Under Supervision of

Prof. Dr. WAEL ALI MAGED
Professor of Urology,
Faculty of Medicine, Ain Shams university

Dr. MOHAMED MOHAMED YASSEN
Lecturer of Urology,
Faculty of Medicine, Ain Shams university

Faculty of Medicine
Ain Shams University
2011



دور منظار المثانة التخلي في تشخيص اورام المثانة

رسالة

توطئة للحصول على درجة الماجستير
في جراحة المسالك البولية

مقدمة من

الطبيب/ محمد حسن داود حسن

بكالوريوس الطب والجراحة
كلية الطب – جامعة عين شمس

تحت اشراف

الأستاذ الدكتور/ وائل على ماجد

أستاذ جراحة المسالك البولية
كلية الطب – جامعة عين شمس

الدكتور/ محمد محمد ياسين

مدرس جراحة المسالك البولية
كلية الطب – جامعة عين شمس

كلية الطب

جامعة عين شمس

٢٠١١

SUMMARY AND CONCLUSION

Bladder carcinoma is the most common tumor among the low urinary tract, accounting for 90% of cancer cases. Several imaging techniques are available to detect bladder neoplasia. However, there is no reliable method for tumor detection, and negative findings require cystoscopy.

Conventional cystoscopy represents the gold standard for diagnosis and local management of bladder carcinoma. However it has many draw backs such as intense discomfort for the patient and bleeding; furthermore, the high cost, invasiveness, and local complications such as infections and mechanical lesions are another well-known drawbacks. Additionally, conventional cystoscopy does not provide information about extravescical extensions of the tumors.

Recent advances in CT including software developments have led to the use of three dimensional (3D) imaging reconstruction techniques and allow CT urography and virtual endoscopy to be used in daily practice.

The main goal of VC was to develop a non-invasive diagnostic tool that would be easily tolerated by the majority of patients, by producing images similar to those acquired by the conventional endoscopy.

At present virtual cystoscopy based on volumetric data obtained with thin section multislice CT and the use of perspective volume rendering technique, seems to be the most accurate radiological method regarding lesion detection in the urinary bladder.

Acknowledgement

First and foremost , I feel always indebted to ALLAH, the most kind and the most merciful.

I would like to express my sincere thanks and deep gratitude to Prof. Dr Wael Ali Maged, Professor of Urology, Ain Shams University, for his encouragement, support and his extreme effort in making that study possible. I am greatly honored and pleased to have the opportunity to learn from his creative advice and expanded experience.

I would like also to emphasis the great help of Dr.Mohamed Mohamed Yassen , Lecturer of Urology, Ain Shams University ,for being a patient teacher and for his sincere help and guidance to bring this work to reality.

Finally, i would like to express my deep gratitude to my professors and colleagues in the Urology department of Eldemerdash Hospital, for their cooperation and continuos help and to all my family members for their support and encouragement.

Mohamed Hassan Dawood Hassan

CONTENTS

	Page
LIST OF TABLES.....	II
LIST OF FIGURES.....	III
LIST OF ABBREVIATIONS	V
INTRODUCTION AND AIM OF THE WORK	1
REVIEW OF THE LITERATURE.....	6
Anatomy of the urinary bladder	6
Pathology of bladder tumors.....	15
Imaging modalities of bladder tumors	23
Evolution of virtual endoscopy	30
Virtual cystoscopy	34
PATIENTS AND METHODS	41
RESULTS.....	45
ILLUSTRATIVE CASES	55
DISCUSSION	63
SUMMARY AND CONCLUSION	75
REFERENCES.....	78
ARABIC SUMMARY	-

LIST OF TABLES

Table No.	Title	Page
1	TNM Staging system	21
2	Anatomic Stage/Prognostic Groups	22
3	Shows number of lesions on each patient	46
4	Shows the localizations of lesions in different bladder walls	47
5	Shows the number of lesions according to their morphological description	48
6	Shows the number of patients with combined lesions	49
7	Shows the number of sessile and polypoid lesions according to their size in virtual images	50
8	Shows the number (No) of lesions as seen by CC, VC	51
9	Shows the sensitivity of CC and VC	52
10	Shows the number of masses regarding their size at CC, VC	52
11	Shows comparison between conventional cystoscopy (CC), virtual cystoscopy (VC), regarding the morphological description of the lesions	53
12	Shows the sensitivity of conventional cystoscopy, virtual cystoscopy, regarding the morphological description of the lesions	53
13	Shows the histopathological diagnosis of the true positive 21 lesions in 15 patients	54

LIST OF FIGURES

Fig. No.	Title	Page
1	Median sagittal section through female pelvis showing the urinary bladder relations.....	6
2	Median sagittal section through male pelvis showing relation of the urinary bladder	7
3	Bladder neck and sphincter of the urinary bladder	9
4 (A)	CT cut of female pelvis	13
4 (B)	Another CT cut.....	13
5	Normal CT cuts of male pelvis at different levels.....	14
6	3D US image of bladder tumor showing wall invasion	25
7	Male to female ratio	45
8	The patients' age distribution.....	46
9	Shows the localization of the lesions at virtual images	47
10	Shows the morphological appearance of the lesions as seen by virtual cystoscopy images	49
11	Shows the number of the mass lesions (polypoid and sessile) according to their sizes as seen in virtual cystoscopy.....	50
12	Shows the number of mass lesions according to their histopathological results	54
13 (A, B, C)	Axial (supine and prone at different levels) and coronal images showing polypoidal mass at the left superior bladder wall with trabiculations.....	56
13 (D)	Virtual image showing polypoidal mass.....	56
13 (E)	Bladder wall trabiculation as seen by virtual cystoscopy	56
14 (A)	Axial image in right lateral decubitus shows the left posteroinferior mass.....	58
14 (B)	Sagittal reconstructed non contrast image shows that the lesion is inseparable from uterine cervix and upper vagina.....	58
14 (C, D)	Virtual images show intravesical irregular sessile lesion at different distances.....	58
15 (A)	Supine view: no mass seen	60

Fig. No.	Title	Page
15 (B)	Prone view: the mass easily detected when the residual urine shifted anteriorly	60
15 (C)	VC image showing clear sessile lesion	60
15 (D)	Another view of the small polypoidal lesion which is seen only in virtual images	60
16 (A)	Shows the exophytic component of the poteroinferior vesical mass and the wall thickening	62
16 (B)	Shows the posterior polypoidal projection ,the posterior mass lesion and the wall thickening	62
16 (C,D)	Virtual images at different distances show the postrior polypoid projection	62

LIST OF ABBREVIATIONS

2D	: Two dimension
3D	: Three dimension
CC	: Conventional cystoscopy
CIS	: Carcinoma in situ.
CT	: Computed tomography
F+ve	: False positive
Fig.	: Figure
F-ve	: False negative
HU	: Hounsfield unit
IV	: Intravenous
KVP	: Kilovolt peak
mAs	: Milliampere.seconed
MDCT	: Multidetector CT
MIP	: Maximum intensity projection
MPR	: Multiplaner reconstruction
MRI	: Magnetic resonant imaging
MSCT	: Multislice CT
No.	: Number
SCC	: Squamous cell carcinoma

SSCT : Single slice CT
TCC : Transitional cell carcinoma
TUR : Transurethral resection
VC : Virtual cystoscopy

INTRODUCTION

Bladder cancer is one of the most common neoplasms of the urinary tract ,ranking the second most common genitourinary malignancy, also it is considered the forth most common male cancer (after prostate, lung and colon cancers). In women, bladder cancer ranks eighth. (*Aldousari & Kassouf, 2010*)

It is responsible for 4.5% of all newly diagnosed malignant tumors and 1.9% of cancer deaths in the USA. The incidence of bladder cancer has greatly increased over the last few decades , with more than 60,000 new cases now diagnosed each year in the United States alone. The tumor has a peak incidence in patients 60 years of age and progressively increases with age. It affects males three- times more than females (*Jamel et al, 2007*).

Bladder cancer is more common in smokers and those exposed to certain chemicals, such as aniline dyes, a-naphthylamine and benzidine (which are used in the textile, rubber and leather industry) (*O'Donnell,2007*).

The majority of bladder cancers are transitional cell carcinomas. They are either superficial (confined to the bladder mucosa or submucosa) or invasive (extending into the muscle layer of the bladder). The two entities vary greatly in terms of management and prognosis, with the former being associated with excellent prognosis and the latter being associated with worse prognosis (*Mohamed A et al, 2008*).

The patient usually presents with hematuria. Gross hematuria is an important finding that requires complete

evaluation of the entire urinary tract. Intravenous urography (IVU) and ultrasound, which until now have been used as the first step in evaluating urinary tract, have limitations such as a low sensitivity for small lesion detection (*Kim and Cho, 2003*).

Diagnosis of bladder cancer depends on direct visualization of the tumor. This is performed by using Conventional Cystoscopy. This technique directly visualizes lower urinary tract anatomy and macroscopic pathology, and provide biopsy for histopathological diagnosis. It is the criterion standard and the most reliable method in the diagnosis of bladder tumors. During the procedure, diagnosis, staging, and treatment of the tumor can be performed, especially on superficial tumors in which biopsy and resection procedures are possible. (*Kim et al.,2002*)

Although cystoscopy is the gold standard modality for detecting bladder cancer, it is an invasive procedure with some risk of complications, such as urinary sepsis and iatrogenic injury to the urethra or bladder. Besides, it is often difficult to perform adequate visualization when exploring the anterior bladder wall or a diverticulum cavity. Additionally, there are relative contraindications for conventional cystoscopy, such as urethritis, prostatitis, acute cystitis, obstructive prostatic enlargement and urethral stricture. (*Lammle M et al,2002*)

CT is usually recommended as a useful radiologic approach for assessing bladder mass, but previous reports have shown that CT has low sensitivity for detection of small bladder lesions. (*Kim et al, 2002*).

For CT to depict a small bladder lesion, optimal imaging conditions, including adequate bladder distention and thin-slice scanning, must be satisfied. Therefore, negative findings on CT warrant performance of conventional cystoscopy in patients with hematuria (*Kim et al, 2002*).

Recently, three-dimensional computer-rendering techniques with rapid image acquisition have led to the development of virtual-reality imaging. With commercially available software, virtual-reality imaging allows interactive intraluminal navigation through any hollow viscus, simulating conventional endoscopy (*Gualdi et al, 1999*).

The urinary bladder is a good candidate for virtual endoscopy because of its simple luminal morphology, its relatively small volume, and the absence of involuntary peristalsis. Therefore, a virtual cystoscopic rendering of the bladder takes a short time to navigate and does not require that the operator have great skill. (*Kim et al, 2002*)

CT virtual endoscopy images are generated from dedicated multislice helical CT data sets and various three-dimensional reconstruction techniques. These imaging technique can provide endoscopic images of the urinary tract and also provide high spatial resolution images helping overcome some of the limitations of intravenous urography and ultrasound. (*Kim and Cho, 2003*)

One of the major drawbacks of any radiological technique, as sophisticated and refined as it could become, is that many bladder lesions start as tiny flat lesions more likely to be identified

by conventional cystoscopy rather than by any imaging technique requiring a minimal tumor volume. Inescapably though, it is likely that in the next decade, medicine will move more and more towards completely non-invasive diagnostic techniques, including functional imaging rather than invasive procedures even minimally invasive. (*Zlotta AR., 2011*)

AIM OF THE WORK

To evaluate and analyze the efficacy of Virtual CT Cystoscopy in complementation of the role of conventional cystoscopy and providing additional data in diagnosis and management of patients with bladder mass and this is achieved by: Comparison between the results of Virtual Cystoscopy and Conventional Cystoscopy in these patients.