The Role of Multidetector Computed Tomography Urography in the Diagnosis and Staging of Urothelial Malignancy

Essay

Submitted for partial fulfillment of Master Degree in Radiodiagnosis

By

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M.B., B.Ch, 2005

Ain Shams University

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دورالأشـــعة المقطعيّة المتعددة المقاطع في تشخيص وتحديد المراحل السرطانيّة لسرطان النسيج الطلائي المبطن للجِهاز البَوْلي

دراسـة مقدمة من الطبيب
محمد زكريا محمد محمد فاضل
بكالوريوس الطب والجراحة العامَّة – 2005
جامعة عين شمس

توطئة للحصول على درجة الماجيستير في الأشعة التشخيصيَّة

تحت إشراف

الدكتور / شيرين قدري أمين

أستـــاذ مساعد بقسم الأشعة التشخيصيَّة

كلية الطب - جامعة عين شمس

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كلية الطب - جامعة عين شمس

كلية الطب
جامعة عين شمس
2008

بِسْمِ اللهِ الرَّحْمَنِ الرَّحِيمِ

﴿ وَقُل رَّبِّ زِدْنِى

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{ 114 سورة طه }

صَدَقَ اللهُ العَظِيمُ

ACKNOWLEDGEMENT

First and foremost, thanks to Allah for helping me in achieving this work and every other work in my life.

I wish to express my highest and respectful appreciation and deepest gratitude to :

Assistant Prof. Dr. Sherine Kadry Amin Assistant Prof. of Radiodiagnosis, Faculty of Medicine, Ain Shams University, for her kind supervision, moral support, great efforts in supervising the work and for the valuable suggests and advices.

I wish to extend my warmest appreciation and cardinal thanks to:

Assistant Prof. Dr. Dalia Zaki Zidan, Assistant Prof. of Radiodiagnosis, Faculty of Medicine, Ain Shams University, for her persistent effort, valuable guidance and meticulous revision of the work.

Last but not least, I wish to thank all professors, staff members, colleagues and workers in the Department of Radiodiagnosis in Ain Shams University.

Mohammed Zakaria Fadel

Abstract

Mohammed Zakaria Fadel

Urothelial tumours arise in the epithelial lining of the urinary tract and include transitional cell carcinoma (TCC), squamous cell carcinoma, and adenocarcinoma.The vast majority are transitional cell carcinomas (90%).

TCC is 30-50 times more common in the bladder than ureters and renal pelvis.Urothelial carcinoma has a propensity to be multicentric with synchronous and metachronous bladder and upper tract tumors. Hematuria is present in 72% of patients.

Patients with suspected urinary tract disease are often referred for multiple studies such as excretory urography (EU), ultrasound (US), CT or MRI. Multi-examination work-up require much patient effort and are expensive. A single imaging test that comprehensively evaluates the urinary tract has advantages in terms of both convenience and cost.

CT is already widely acknowledged superior to EU and US in its ability to detect and characterize renal masses. The last remaining potential limitation of CT for examination of the urinary tract is its perceived limited accuracy in assessment of the mucosal surfaces of the renal collecting systems and ureters.

Finally, with the advent of multidetector CT, CT became capable of producing a large number of thin section images in a short period of time. As a result, the spatial, temporal, and contrast resolution became sufficient to image the urothelium. CT urography can demonstrate not only urinary tract lumen but also the wall of the urinary tract and its surrounding structures.

Increased volume coverage is combined with thinner slice thickness to obtain better quality volume data sets for workstation analysis, either in 2-D axial, multiplanar reformation (MPR), or three-dimensional (3-D) imaging.

One of the main advantages of Multi detector CT urography (MDCTU) is its ability to display the entire urinary tract, including renal parenchyma, pelvicalyceal systems, ureters, and the bladder using a single non-invasive imaging test, in one breath-hold. The alternative imaging studies alone do not offer equivalent coverage. So that , MDCTU became the “core” imaging study for investigation of hematuria as it has the potential to stand alone as a comprehensive “one-step” test for imaging the upper and lower urinary tract.

Multiphasic CT urography offers superior detection of urothelial tumors over EU and US and allows accurate staging of detected lesions at the same examination.

Magnetic resonance urography (MRU) has advantages over MDCTU including the ability to detect early stages of the urothelial tumors (T0a ,Tis) & imaging the pelvicalyceal systems without intravenous iodinated contrast agents using heavily T2 weighted ultrafast sequences. Another advantage of MRU is that the significant radiation dose associated with the other modalities is avoided.

The early detection of TCC is very important for the planning of limited surgical treatment. MDCTU is capable of identifying lesions at an early stage, thereby allowing nephron-sparing surgery.

CONTENTS

List of Contents

Continued

List of Tables

List of Figures

List of Abbreviations

AJCC	American Joint Committee on Cancer
CECT	Contrast enhanced computed tomography
CPR……	Curved planar reformat
CT.....	Computerized Tomography
CTU….....	Computerized Tomography Urography
DNA.....	Deoxyribonucleic Acid
EU	Execretory urography
HNPCC	Hereditary nonpolyposis colon cancer
HU……..	Housefield unit
IV……	Intravenous
IVC…….	Inferior vena cava
IVU.....	Intravenous urogram
MIP…….	Maximum intensity projection
MPR……	Multi planar reconstruction
MR……..	Magnetic resonance
MRI……	Magnetic resonance imaging
MRU……...	Magnetic resonance urography
MSCTU……..	Multislice computed tomography urography
mSv…….	milliSievert
NECT……..	Non enhanced computed tomography
PACS……	Picture archiving and communication system
PUNLMP…...	papillary urothelial neoplasm of low malignant potential
RCC.....	Renal cell carcinoma
RP……...	Retrograde pyelography
SCC…….	Squamous cell carcinoma
SCI.....	Spinal cord injured
SSD	Shaded surface displays
TCC	Transitional cell carcinoma
TNM.....	Tumor-Node-Metastasis system Classification of Malignant Tumours
US.....	Ultrasound
UUT	Upper urinary tract
UUTT	Upper urinary tract tumors
3D-VRT	3 Dimensional Volume-rendering technique