The Role Of 3-Dimensional Sonography and Virtual Sonographic Cystscopy In Detection of Bladder Tumors

Thesis

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5 ALA	**:**	5 aminolaevulinic acid
ADC	**:**	Apparent diffusion coefficient
AJCC	**:**	American Joint commission on cancer
ASR	**:**	Age standardized incidence rate
BC	**:**	Bladder cancer
BTA	**:**	Bladder tumour antigen
CIS	**:**	Carcinoma in situ
CPG	**:**	Guanine cystosine
CT	**:**	Computed tomography
DWI	**:**	Diffusion weighted imaging
EM	**:**	Endoscopic microscope
FDA	**:**	Food and drug administration
FISH	**:**	Fluorescence in situ hybridization
GWAS	**:**	Genome-wide association study
HA	**:**	Hyaluornic acid
HAL	**:**	Hexamino levulinate
IVU	**:**	Intravenous urography
MDCT	**:**	Multidetector CT
MPR	**:**	Multiplanar reconstruction
MRI	**:**	Magnetic resonant imaging
NAT	**:**	N-acetyle transferase
NBI	**:**	Narrow band imaging
NMIBC	**:**	Non muscle invasive bladder cancer
NMP2	**:**	Nuclear matrix protein
OCT	**:**	Optical coherence tomography
PDD	**:**	Photodynamic diagnosis
PUNLMP	**:**	Papillary urothelial neoplsia of low malignant potential
RS	**:**	Raman spectroscopy
TCC	**:**	Transitional cell carcinoma
SCC	**:**	Squamous cell carcinoma
TNM	**:**	Tumour, node, metastasis, classification
TURBT	**:**	Transurethral resection of bladder tumour
US	**:**	Ultrasound
UC	**:**	Urothelial carcinoma

UICC	**:**	Union international center le cancer
VC	**:**	Virtual cystoscopy
WLC	**:**	White light cystoscopy
3D	**:**	3 dimensional
2D	**:**	2 Dimensional
PSA	**:**	Prostatic specific antigen
CS	**:**	Conventional cystoscopy
Pca	**:**	Prostate cancer
TRUS	**:**	Trans rectal Ultrasonography
WHO	**:**	World health organization
PPV	**:**	Positive predictive value
NPV	**:**	Negative predictive value
DRE	**:**	Digital rectal examination

INTRODUCTION

Bladder cancer is the 9th most common cancer in the world, with 430,000 new cases diagnosed in 2012. It is three times more common in men compared with women. While smoking is a major cause of bladder cancer, also Infestations with schistosomes (particularly Schistosoma haematobium) is a cause of this cancer especially in middle- and low-income countries like Egypt which is the 10th highest country in the incidence of bladder cancer with 13.1 cases per 100.000 ***(Ferlay J et al,2013)***

At first diagnosis, almost 20% of patients with high grade bladder cancer have muscle invasive disease, which is the most common cause of death. Thus, to improve the prognosis, the early detection of bladder cancer is critical. ***(Kirkali et al, 2005)***

The current mode of evaluation for initial diagnosis traditionally involves IVU with two-dimensional ultrasonography (2D-US), CT, MRI and finally cystoscopy with eventual biopsy, of which the latter is an invasive and relatively expensive procedure. Trans-abdominal 2D-US is often used for examining patients when a bladder tumor is suspected. Most exophytic tumors can be detected, but especially small papillary tumors, flat 'lawn-like' tumors and those on the dome of the bladder are

hardly detectable or cannot be differentiated from benign lesions. ***(Kirkali et al, 2005)***

The sensitivity of US in detecting bladder tumors depends on operator experience and is variably reported to range from 26% to over 80%. However, this rate is much lower in patients with tumors smaller than 5mm or for tumors located on the bladder dome or anterior wall. ***(E. Ozden et al , 2007)***

Similarly, specificity is decreased in the presence of coexisting focal cystitis, bladder trabeculations, and hematuria with clots. For this reason, a significant number of bladder US are normal or inconclusive, and cystoscopy is necessary to discard the presence of a bladder tumor ***(G. D. Grossfeld et al, 2001)***.

The role of cross-sectional imaging in the initial evaluation of bladder cancer is limited, and computed tomography and magnetic resonance imaging are usually performed to evaluate extravesical extension or to stage the tumor. The radiation dose, potential allergies to contrast medium, and the reduced sensitivity in detecting tumors of 0.5–1.0 cm remain the primary drawbacks of this procedure ***(Barentsz JO et al, 1996)***.

Excretory urography has been reported to have sensitivity of only 23% for bladder tumors less than 5 mm in diameter, and it is usually performed to detect synchronous tumors of the upper

urinary tract, which occur in approximately 2% of patients with bladder cancer. ***(Wong-You-Cheong et al, 1998)***

Recent advances in computer technology and display techniques (eg, spiral and multidetector CT and MR imaging with rapid image acquisition and 3 dimensional rendering) have led to the development of virtual endoluminal views of hollow organs similar to those obtained with conventional endoscopy. Virtual cystoscopy performed with computed tomography or magnetic resonance imaging, have been developed with promising results. These techniques seem to be more sensitive than US but significantly more time consuming, expensive, and frequently inaccessible for clinicians. ***(R. I. Lopes et al, 2008) (E. Suleyman et al , 2006)***

Three-dimensional ultrasound is now an established imaging tool in several specialties, this technology is available in most medium and upscale equipment and is routinely used in obstetric US. In urology, it has been used in planning and guiding prostate cancer treatments ***(F. Shen et al, 2008)***, to accurately measure bladder volume ***(M. Riccabona et al, 2003)*** and in imaging the urethral sphincter in pelvic floor disorders ***(G. A. Digesu et al, 2009)***. Vining et al were the first to apply this technique in the detection of bladder cancers, after several studies including CT or

MR virtual endoscopy of the bladder had been published. ***(Vining DJ et al, 1996)***

This technology permits the acquisition and storage of a dataset, selected from a specific region of interest. This dataset can be further analyzed, either by multiplanar display, surface rendering, or volume calculation. As there is a considerable contrast gradient between the bladder lumen and its wall, the surface rendering algorithm can usually display with sufficient detail the surface of the bladder, revealing a cystoscopy like image, enhancing the characterization of bladder wall abnormalities ***(M. H. Moon et al, 2006)***.

Recently, the use of 3D US in the evaluation of bladder tumors has been reported showing a moderate-to-perfect inter-observer agreement. Yet more studies are needed to detect the value of this new technique in the diagnosis of bladder tumors. ***(E.Kocakoc et al ,2008)***