INTRODUCTION

Bladder cancer is one of the most common urological cancers. Conventional cystoscopy is the standard method for the detection and direct visualization of bladder cancer, however, conventional cystoscopy has some disadvantages as an invasive, expensive, and time-consuming technique ***(Kivrak et al., 2009)***.

With the progressive development in diagnostic imaging and medical computer software technologies, it was possible to generate virtual images to aid the clinician to inspect the interior of the bladder. This technology is considered as a safe test for bladder cancer diagnosis and follow-up, and it is associated with cancer detection rates comparable with conventional cystoscopy. However, it is associated with some drawbacks that limit its use in routine clinical practice at the current time ***(Mohammed et al., 2008)***.

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 image of the bladder takes a short time ***(Kim et al., 2002).***

Remarkable technical progress regarding post-processing of high-resolution 3D datasets as well as a considerable reduction of the time required for post-processing made it possible to introduce virtual MDCT cystoscopy into the clinical routine. 3D post-processing that often required 7-8 hours when virtual endoscopy techniques were first developed can now be performed in less than 5 minutes after transfer of data to the 3D workstation ***(Heinz-Peer et al., 2005).***

As a minimally invasive procedure, virtual CT cystoscopy provides many advantages as compared to conventional cystoscopy. The virtual CT cystoscopy images could be stored in database and the lesion could be compared in follow up period with the previous images. The size of a tumor is measured objectively. Access to the anterior bladder wall or the lumen of a diverticulum is not restricted in virtual cystoscopy ***(Arslan et al., 2006).***

Patients with a severe urethral stricture or marked prostatic hypertrophy, who may be poor candidates for conventional cystoscopy, can safely undergo virtual CT cystoscopy ***(Julie et al., 2001).***

Aim of the Work

To focus on the value of the multidetector C.T. cystography with the virtual cystoscopy in diagnosis of urinary bladder carcinoma and its importance of being a non invasive technique in comparison to the conventional cystoscope.

ANATOMY OF THE URINARY BLADDER

(A) Gross Anatomy of urinary bladder

The urinary bladder is a hollow muscular organ, its main function being that of a reservoir ***(Tanagho, 1992).***

The bladder varies in size, shape, position and relations according to the amount of fluid it contains, as well as with the state of distention of the neighboring viscera ***(Williams et al., 1995),(figure 1).***

The bladder is an abdominal organ in infant and young child; it subsequently becomes a pelvic organ in adults ***(Tanagho, 1992).***

The empty bladder is situated entirely within the pelvic cavity. As the bladder distends, it domes up into the abdominal cavity. The empty bladder is a flattened three sided pyramid, with apex, triangular base (trigone), two infero-lateral surfaces, a neck and a superior surface (dome) ***(Sinnatamby, 1999).***

The fundus or **base** is triangular and postero-inferior. The base of the bladder receives the ureters at its supero-lateral angles and gives rise to the urethra at its infro-medial angle ***(Kabala et al., 2003).***

In females, it is closely related to the anterior vaginal wall, in males it is related to the rectum, although separated from it above by recto-vesical pouch and below that by seminal vesicles and deferent ducts. In a triangular area between the deferent ducts, the bladder and rectum are separated only by recto-vesical fascia, the inferior part of this area may be obliterated by approximation of the deferent ducts above the prostate ***(Dyson, 1999).***

The inferior angle of the bladder in female lies at a lower level than in male and is closely related to the lower levator ani muscle ***(Weiss et al., 2001).***

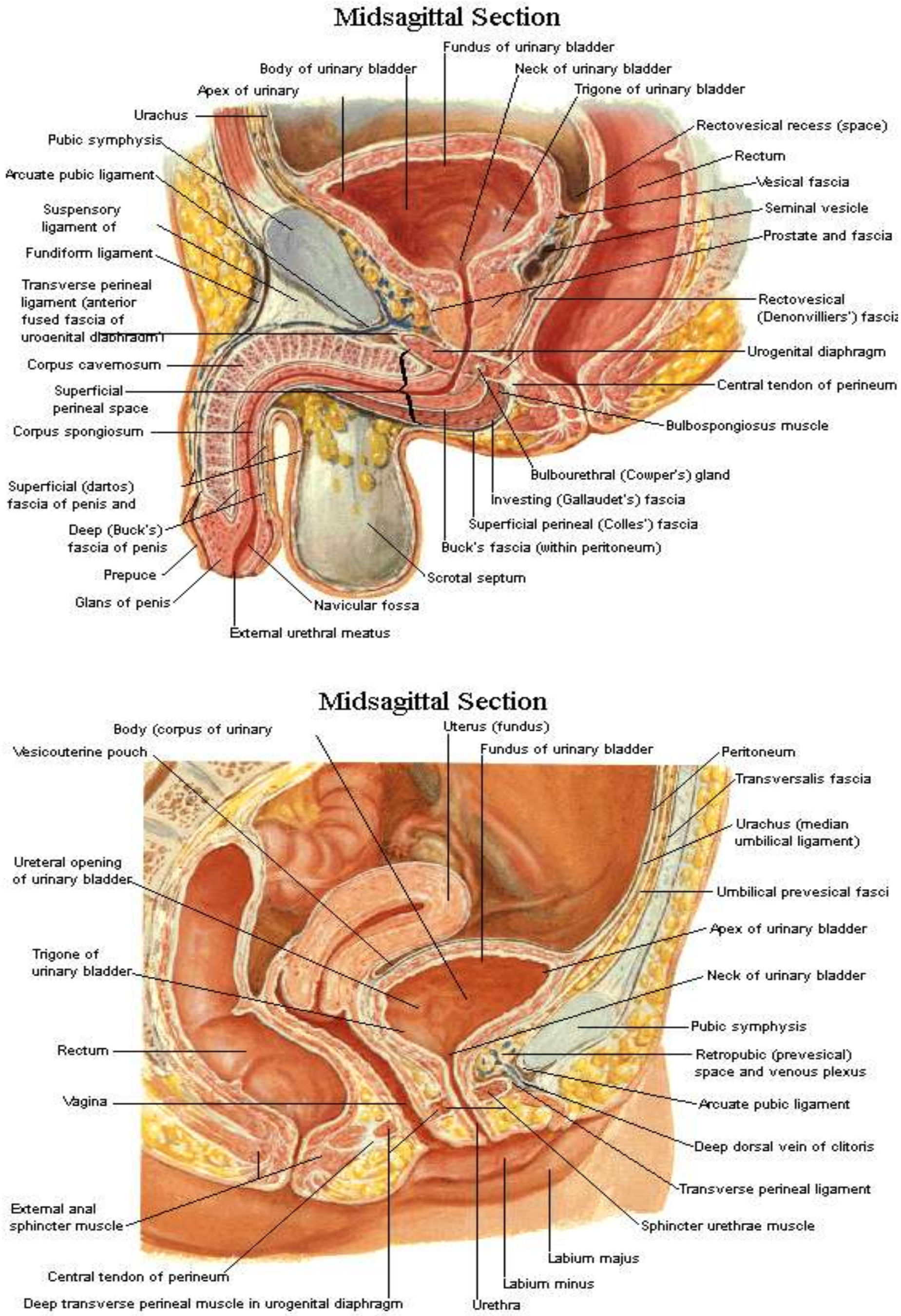

Fig. (1): Schematic drawing: for sagittal view revealing the anatomy of the male & female pelvis ***(Quoted from Snell, 1997).***

The **neck** is in fact the lowest and also the most fixed, it is 3-4 cm behind the lower part of the symphysis pubis ***(Dyson, 1999).***

It lies in a plane that passes through the top of the symphysis pubis and the tip of the coccyx ***(Hinman, 1993).***

It is pierced by the internal urethral orifice and alters in position with varying conditions of the bladder. In males the neck rests on, and is in direct continuity with the base of prostate; in females it is related to the pelvic fascia which surrounds the upper urethra ***(Dyson, 1999).***

The **apex** lies immediately behind the upper margin of the symphysis pubis and gives rise to urachus, which is the fibrous remnant of allantois. The urachus runs superiorly in the extraperitoneal fat to the umbilicus as the median umbilical ligament ***(Kabala et al., 2003).***

The triangular **superior surface** is bounded by lateral borders extending from the apex to the ureteric entrances and by a posterior border joining them. In males the superior surface is completely covered by peritoneum, extending slightly on the base and continues posteriorly into the recto-vesical pouch, laterally into the paravesical fossa and anteriorly into the median umbilical fold. It is in contact with sigmoid colon and the terminal coils of the ileum ***(Dyson, 1999).***

In females, the posterior part of the superior surface of the bladder is related to the body of the uterus. The peritoneum passes from the superior surface of the bladder to the uterine body, which forms the vesicouterine pouch ***(Weiss et al., 2001).***

The **infero-lateral surfaces** relate anteriorly to the retropubic fat and pubic bones and posterioly to the obturator internus (superiorly) and the levator ani (inferiorly) ***(Kabala et al., 2003).***

Between the bladder and these muscles run the obturator nerve and vessels and the superior vesical vessels ***(Weiss et al., 2001).***

The infero-lateral surfaces are not covered by peritoneum ***(Dyson, 1999).***

As the bladder fills it becomes ovoid. In front it displaces the parietal peritoneum from the suprapubic region of the abdominal wall, so that the infero-lateral surfaces become anterior and rest against the abdominal wall without intervening peritoneum for a distance above the symphysis pubis, varying with the degree of distention but commonly about 5cm ***(Dyson, 1999).***

(B) Histological Anatomy of Urinary Bladder

The component parts of the wall of the urinary bladder are the innermost layer, the mucosa, consists of transitional epithelium, underlined by a prominent lamina propria. The thickness of the epithelium is reduced upon stretching.

The muscular layer of the bladder is generally recognized as consisting of three layers:

(1) Inner longitudinal.

(2) Middle circular or spiral.

(3) Outer longitudinal.

The definition of these as discrete layers is difficult by the intertvining of muscle bundles of adjacent layers. Such a muscular arrangement does, however, facilitate the occlusion of the bladder lumen upon voiding, and the avoidance of residual urine in the bladder. The urinary bladder is covered by a connective tissue adventitia, except on its superior aspect, which bears a serosa of reflected peritoneum. Present within this layer are blood vessels, nerves, and underlying adipose tissue ***(Hornick et al., 2006).***

Bladder Urothelium

The urothelium of the normal bladder is a transitional cell epithelium three to seven cell layers thick. There is a basement cell layer upon which rests one or more layers of intermediate cells. The most superficial layer is composed of the large flat umbrella cells. The cells of the urothelium are oriented with the long axis of the oval nuclei being perpendicular to the basement membrane, giving the urothelium its normal appearance of cellular polarity. The urothelium rests upon a lamina propria basement membrane. In the lamina propria, there is a tunica muscularis mucosal containing scattered muscle fibers, which are irregularly arranged ***(Zuk et al., 1989),(figure 2).***

The interior of the bladder is completely covered by transitional epithelium several layers deep. There is a loose underlying connective tissue that permits considerable stretching of the mucosa; for that reason, the mucosal lining is wrinkled when the bladder is empty but quite smooth and flat when the bladder is distended. This arrangement exists throughout except over the trigonal area, where the mucous membrane is firmly adherent to the underlying trigonal musculature; this is why the trigone is always smooth, whether the bladder is full or empty ***(Tanagho, 1992),(figure 3).***

In the infant the internal urethral orifice is at the level of the upper border of the symphysis pubis; the bladder therefore lies relatively at a much higher level in the infant than in the adult ***(Bullock et al., 1990).***

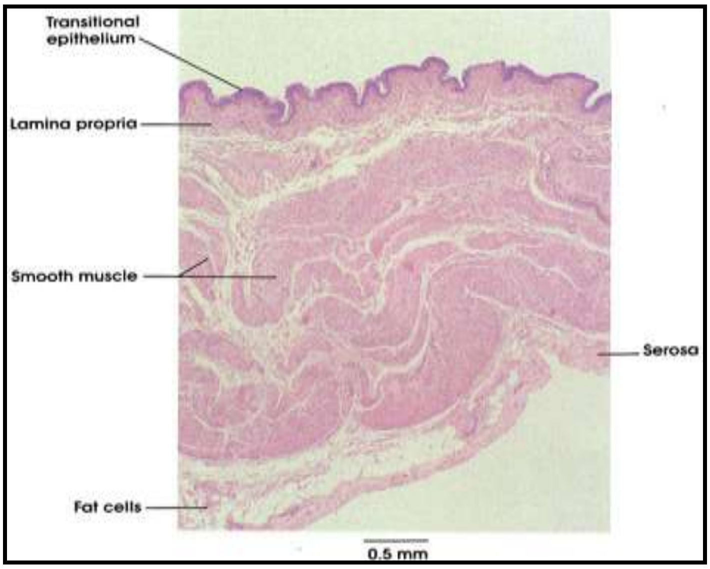

Fig. (2): Histology of U.B. ***(Quoted from Hornick et al., 2006).***

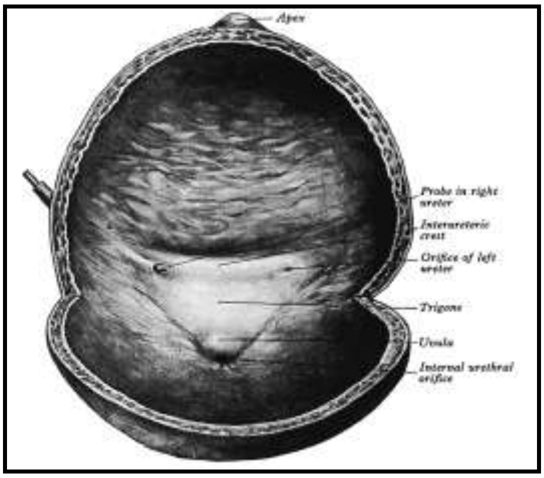

Fig. (3): Interior aspect of the urinary bladder

(Quoted from Williams et al., 1995).

Blood supply of the urinary bladder

Arterial supply:

The arteries supplying the bladder are the superior, middle and inferior vesical, derived from the anterior trunk of the internal iliac artery. The obturator and inferior gluteal arteries also supply small visceral branches to the bladder, and in female additional branches are derived from uterine and vaginal arteries ***(Williams et al., 1995),(figure 4).***

Venous drainage:

Surrounding the bladder, there is a rich plexus of veins usually lying between the bladder wall proper and the adventitial layer covering it. These veins ultimately terminate in the internal iliac vein after gathering together in several main trunks; some of them accompany the arteries, others do not. The vesical venous plexus also communicates with the retro pubic venous plexus (plexus of Santorini), which drains the penis as well as other perineal organs ***(Tanagho, 1992).***

Lymphatic drainage (figure 5, 6):

Lymphatics from most pelvic viscera pass first to regional nodes related to the iliac arteries and their branches before reaching the lateral aortic group. These include common, external, internal, circumflex iliac, obturator, inferior epigastric and sacral groups ***(Williams et al., 1995).***

1- Lateral aortic nodes:

This group is anterior to medial margins of the psoas major muscle, diaphragmatic crura and sympathetic trunks. They receive afferents from the regional pelvic nodes ***(Williams et al., 1995).***

2- Common iliac nodes:

They are grouped around the common iliac artery, inferior to the aortic bifurcation ***(Williams et al., 1995).***

3-Internal iliac nodes:

They lie along the course of the internal iliac artery and its branches below the bifurcation of common iliac artery situated posteriorly within the pelvis ***(Amendola et al., 1990).***

4- External iliac lymph nodes:

They surround the external iliac vessels from the bifurcation of the common iliac vessels, anterior to sacroiliac joint, to the inguinal vessels, 2 cm above the acetabulum ***(Amendola et al., 1990).***

5-Inferior epigastric & circumflex iliac nodes:

They are associated with their vessels and drain the corresponding areas. This group is forming the outline of the external iliac groups and inconstant in number ***(Williams et al., 1995).***

6- Obturator lymph nodes:

This group carries special importance, as it is the first site in the lymphatic system to which urinary bladder and prostatic carcinoma spread ***(Smith, 1988).***

Lymphatic drainage can go directly from the anterior bladder wall to the external iliac nodes, from the lateral bladder wall to the obturator nodes, and from the posterior bladder wall to the internal iliac nodes ***(Friedman et al., 1990).***

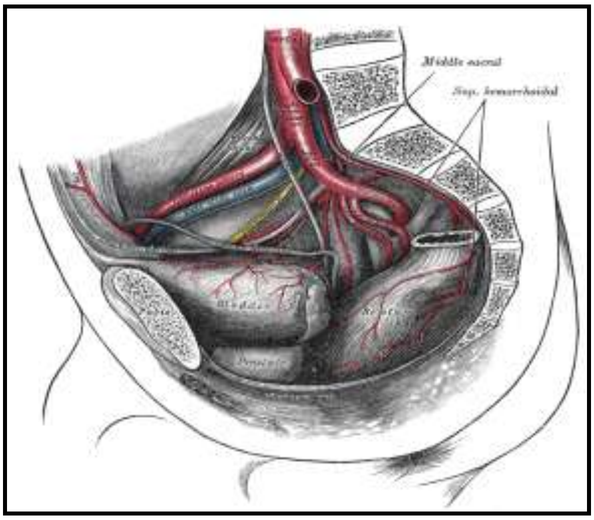

Fig. (4): Blood Supply of Urinary Bladder ***(Quoted from Williams et al., 1995)***

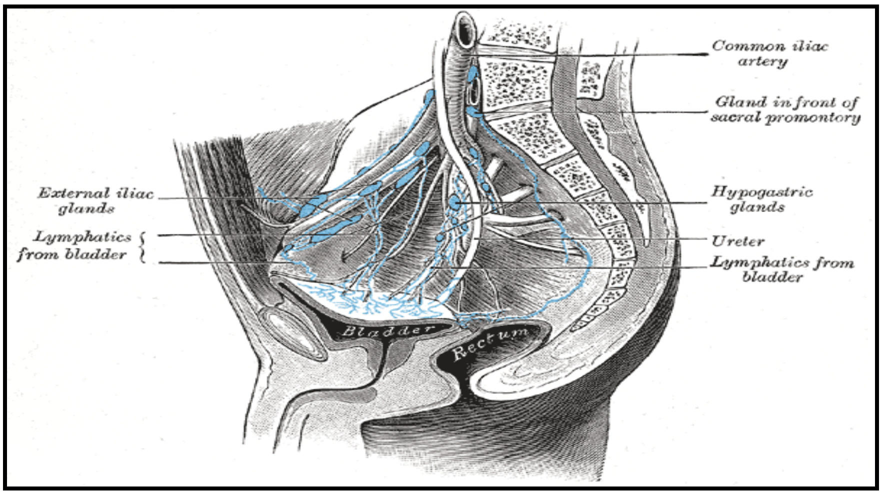

Fig. (5): Lymphatic Drainage of Urinary Bladder
(Quoted from Williams et al., 1995)

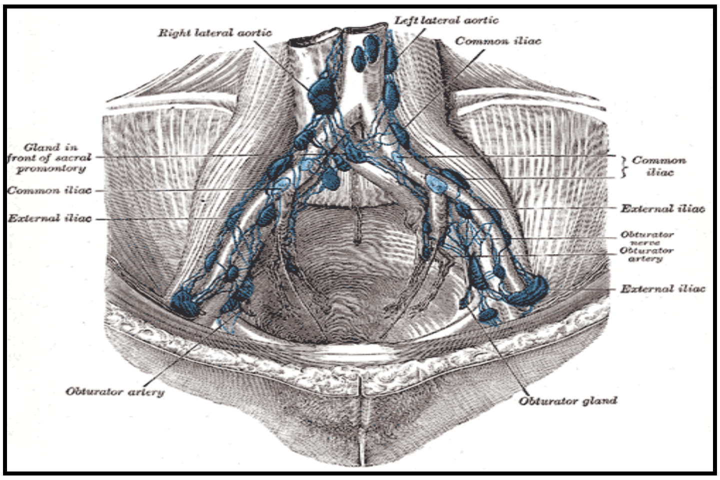

Fig. (6): The parietal lymph glands of the pelvis
(Quoted from Williams et al., 1995)