# Role of Computerized Tomography in Evaluation of Urinary Bladder Neoplasms

***Essay***

*Submitted in Partial Fulfillment of*
*The Master Degree in Radiodiagnosis*

*Presented by*

***Mohammed Atef El-Desouky***

*M.B.B.Ch.*

*Supervised by*

**Prof. Dr. Youssef Hamed Zaki**

*Professor of Radiodiagnosis*
*Faculty of Medicine*
*Ain Shams University*

**Dr. Hesham Mahmmoud**

*Lecturer of Radiodiagnosis*
*Faculty of Medicine*
*Ain Shams University*

***1994***

بسم الله الرحمن الرحيم

وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

بسم الله الرحمن الرحيم

## *Acknowledgment*

I would like to express my profound gratitude and appreciation to ***Prof. Dr. Youssef Hamed Zaki,*** Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University for his kind supervision, support and cooperation.

I am also deeply grateful to ***Dr. Hesham Mahmmoud Ahmed,*** Lecturer of Radiodiagnosis, Faculty of Medicine, Ain Shams University who devoted his time, effort and experience most generously and without his aid and support, this work would not come to light.

I also want to express my great appreciation and deep thanks to ***Prof. Dr. Hoda Ahmed El-Deeb*** Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University for her continuous support, kind care, help, and guidance.

I also wish to thank ***Prof. Dr. Khaled Talaat Khairy,*** Assist. Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University for his remarkable effort, kind help, and continuous guidance.

## *Contents*

# *Introduction & Aim of The Work*

## *Introduction & Aim of the work*

Urinary bladder cancer is the most common type of cancer amongst Egyptian patients. It comprises up to 32% of all cancers reporting to the National Cancer Institute.

The selection of proper therapy for urinary bladder cancer as well as its prognosis depends upon accurate staging.

The introduction of Computed Tomography for staging urinary bladder carcinoma has been welcomed as a technique which can provide a precise information regarding local tumor spread, lymph node metastases as well as prostatic and seminal vesicle involvement.

The aim of this work is to emphasize the role of Computed Tomography as an important imaging tool for the proper imaging, follow up of the course of the disease and monitoring its response to therapy in patients with urinary bladder neoplasms.

# *Anatomy of The U.B.*

## *Anatomy of the Urinary Bladder*

The urinary bladder is located centrally in the anterior part of the pelvic cavity and is surrounded by the obturator internus muscles above, and by the levator ani muscles below (Gaiger R.G., 1992)

In infants, the bladder lies higher than it does in adult life, the internal sphincter of the urinary bladder often lying well above the symphysis pubis (Gaiger R.G., 1992 )

The bladder is made of smooth muscle (the detrusor muscle) arranged in whorls and spirals. It is adapted for mass contraction, not for peristalsis. The muscle is lined by a loose and readily distensible mucous membrane, surfaced by transitional epithelium (Last G.R., 1984).

The size of the bladder varies, but when filled in the child, the upper border of the bladder should not rise above the level of the lumbosacral joint, and in the adult the second or third sacral segment. The shape of the normal bladder is influenced by the degree of filling and the pressure of adjacent organs (Gaiger R.G., 1992).

The form and size of the bladder are the same in both sexes. The distended bladder is globular (ovoid) in both sexes, while the empty bladder is flattened from above downwards by the pressure of the overlying intestines (Last G.R., 1984).

As the bladder fills, it displaces the parietal peritoneum on the suprapubic region of the abdominal wall, so that, the inferolateral surfaces rest against the anterior abdominal wall (Warwich and Williams, 1980).

The standard description of the bladder applies to its undistended state, when it has the approximate shape of a three -sided pyramid with the sharp apex pointing to the top of the symphysis pubis and a triangular base facing backwards in front of the rectum or vagina (Romanes, 1969).

There are two inferolateral surfaces cradled by the anterior parts of levator ani, a neck where the urethra opens, and a superior surface which is the one that most obviously moves when the bladder fills (Last G.R., 1984).

The apex has the remains of the urachus attached to it, the later forming the median umbilical ligament which runs up the midline of the anterior abdominal wall in the median umbilical fold of peritoneum (Last G.R., 1984).

The base is the posterior surface, most of which in the male has no peritoneal covering, being below the level of rectovesical pouch, only the uppermost part is covered. On each side of the midline the deferens duct and seminal vesicle are applied to this surface and the ureter enter the external surface of the bladder at the upper outer corner (Last G.R., 1984).

In the female, the base has a firm connective tissue union with the anterior vaginal wall and upper part of the uterine cervix with no peritoneum intervening. The lowest part of the base is the trigone (Bo and Krueger, 1979).

Where the surfaces meet below the apex, there is a space behind the pubic bones and symphysis, the retropubic space (of Ratzius), containing loose fatty tissue and also denser condensations that form the pubovesical and puboprostatic ligaments in the male and the pubovesical ligaments in the female (Last G.R., 1984).

The lowest part of the bladder is its neck, where the base and the inferolateral surfaces meet and is pierced by the urethra at the internal urethral orifice. In the male, it lies against the upper surface or base of the prostate (Note that the base of the prostate is its posterior surface). In the female, the neck is related to pelvic fascia surrounding the upper urethra (Bo and Krueger, 1979).

The superior surface is covered by peritoneum which sweeps upwards on to the anterior abdominal wall. At the back of this surface in the male, the peritoneum continues into the rectovesical pouch, but in the female it is reflected on to the undersurface of the uterus as the vesicouterine pouch, failing to reach as far back as the vaginal fornix. The body of the uterus thus rides up and down on the filling and emptying bladder (Last G.R., 1984).

The appearance of the interior of the bladder depends upon the state of distention of the organ. When collapsed, the mucous membrane is thick and thrown into folds while when distended, it is thin and smooth with the exception of the trigone (Gaiger R.G., 1992).

The trigone is a triangular area at the base of the bladder lying between the internal urethral orifice (centrally and below) and the two ureteral orifices (above and laterally). In the empty bladder these three openings are 2.5 cm apart from each other but when distended (as during cystoscopy), the ureteral orifices may be 5 cm apart (Last G.R., 1984).

Being fixed on top of the prostate by the urethra, the trigone is the least mobile part of the bladder. In the female, it is stabilized by the connective tissue (pelvic fascia) surrounding the upper urethra at the front of the vagina (Bo and Krueger, 1979).

The trigone is smooth-walled and the mucous membrane is rather firmly adherent to the underlying muscle. The ureteric orifices are connected by a transverse ridge, prominent when viewed through the cystoscope, called the interureteric bar. The orifices of the ureters lie at the ends of the bar, they are usually in the shape of an oblique slit, but considerable variations exist (Last G.R., 1984).

The ureters pierce the muscle and mucosal walls very obliquely. More than any sphincteric muscular action, the valve like flap of mucosa thus produced is the important factor in preventing reflux of urine when intravesical pressure rises (Last G.R., 1984).

The ureteric orifices are closed by this pressure, and open in response to ureteric peristalsis resulting in a jet of urine that is injected into the bladder four or five times a minute normally.

The base of the bladder may be indented in the male by a prostate gland of even normal size and the levator ani may produce a slight elevation of the floor in either sexes (Gaiger R.G., 1992).

***Blood supply:***

The superior and inferior vesical arteries provide most of the arterial blood but there are small contributions to the lower part of the bladder from the obturator, inferior gluteal, uterine and vaginal arteries.

The veins of the bladder do not follow the arteries. They form a plexus that converges on the vesicoprostatic plexus in the groove between bladder and prostate and which drains backwards across the pelvic floor to the internal iliac veins. There is a similar plexus in the female, communicating with veins in the base of the broad ligament (Last G.R., 1984).

***Lymph drainage:***

The lymphatics of the bladder follow the arteries backwards to the internal iliac nodes (Last G.R., 1984).

***Nerve supply:***

Parasympathetic fibers which provide the main motor innervation of the bladder reach it via the pelvic splanchnic nerves (from the lateral horn cells of mainly $S_3$ segment of the cord).

Sympathetic fibers come from $L_1$ and $_2$ segments of the cord via the superior hypogastric and pelvic plexuses. For most of the bladder, the sympathetic fibers are vasomotor and probably inhibitory to the detrusor muscle, but they supply the superficial trigonal muscle and (in the male) the internal sphincter (Last G.R., 1984).

Histologically, the wall of the urinary bladder consists of four layers:

1. The mucosa which is a thin layer of transitional cell epithelium (urothelium) arranged in 5 to 7 layers from basal cells to surface. The urothelium is continuous with that of the ureters and urethra, its histologic appearance depends on the degree of distension.

A basal lamina is present beneath the urothelium separating it from the richly vascularized subjacent lamina propria stroma.

2. The submucosa (The lamina propria), composed of loose collagen, vessels, lymphatics and nerves, is interspersed between the mucosa and the deeper muscularis layer.
3. The muscularis (detrusor muscle), consists of three layers of non striated muscle fibres: external and internal longitudenal fibres and middle circular muscle fibres, those middle circular muscle fibres form the sphincter vesicae, which surrounds the internal urethral orifice.
4. The serosa, the outermost layer derived from the peritoneum and only present on the superior surface of the bladder (Bo and Krueger, 1979).

The normal wall, when distended, n a 48Hmeasures approximately 2 mm, but undistended should not measure more than 5 mm.

***CT appearance of normal urinary bladder:***

The urinary bladder is homogenous midline structure of water density whose size and configuration vary greatly depending on the amount of urine present. The outer margin of the bladder wall is smooth and usually well delineated by perivesical fat.

The bladder wall (2 to 5 mm) appears as a rim of soft tissue whose inner margins are better identified if the bladder contains only urine, or if air, carbon dioxide or oil has been instilled into the bladder (Moss A.A.,1983) (Figures 1-3).

# *Pathology of U.B. Neoplasms*