

Renal Pelvis, Ureter and Ureteral Cancer-Etiology, Epidemiology, Diagnosis and Treatment

Sri Vidya A, Subrahmanyeswari PN* and Babu PS

Department of Pharmacology, Vignan Pharmacy College, Vadlamudi, Guntur, Andhra Pradesh, India

*Corresponding author: Subrahmanyeswari PN, Department of Pharmacology, Vignan Pharmacy College, Vadlamudi, Guntur, Andhra Pradesh, India, Tel: (91) 9030961817; E-mail: p.nagaeswari@gmail.com

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Abstract

Cancer has become more common for its progress and has less chance of treatment. The identification and prevention of cancer has been a bit difficult. Among all the types of cancers ureteral cancer is a new arising cancer which is mostly seen in women when compared to men and also in the patients with renal cancer, pelvic cancer and even in kidney failure patients. Most of the studies reported that people with renal cancer has high probability of occurrence of ureteral cancer.

Keywords: Renal pelvis; Lymph nodes; Ureteral cancer; Anorexia

Introduction

Ureter are 22-30 cm long a tube like structures of 3 mm diameter arising from either of the kidneys through which urine passes and enters the bladder for micturition. Renal pelvis is a funnel shaped structure that opens into ureters of kidneys [1-7].

Malignancy of ureter is called ureteral cancer which is a rare carcinoma seen commonly in man than in women (100 out of 5 are women). This is a type of metastatic cancer that may invade to other parts of the body especially to parts of kidney like renal pelvis or to the entire kidney or to bladder or genitourinary tract etc.

Kidneys

A pair of kidneys are located on either side of spine deep in the abdomen in retroperitoneal region at a slightly oblique angle appeared to be 10-15 cm long in bean shape. Each kidney weighs about 160 g on an average (males-125-170 g, females 115-155 g). These are the major organs that involve in cleansing of waste materials like organic, inorganic salts, water, electrolytes, toxins, metabolic waste, pigments etc., in

the form of urine from the body (about 1-1.5 L of urine per day of which constitute 200 ml of body fluid).

Structure of kidney

Kidney is a vital bean shaped organ having a convex and concave border, renal hilum is present on the concave border where the renal artery enters and renal vein leaves the kidney by collecting impure blood from tissue cells of kidneys.

Kidneys are surrounded by tough fibrous tissue, the renal capsule which is again enveloped by perirenal fat (Adipose capsule), renal fascia, and Para renal fat (Para nephric body). Each kidney opens into tubular structures called ureter through a funnel shaped opening called renal pelvis through which the formed urine passes and opens into urinary bladder.

Renal Pelvis and Ureter

Renal pelvis and ureter appears to be a fused structure, both functions unitedly. The funnel shaped renal pelvis appears to be enlarged on the upper end of ureter it is a one side curved structure that is enclosed in the deep indentation on concave side of kidney i.e., in the sinus. Renal pelvis has cup like extensions which are named as calyces where the urine is collected before entering the ureter.

Ureters are 22-30 cm long tube like muscular structures of 3 mm diameter that connects kidneys to urinary bladder for excretion of formed urine from kidneys. It is continuous with the funnel shaped renal pelvis and passes down through the abdominal cavity behind the peritoneum in front of the psoas muscle into the pelvic cavity and obliquely through the posterior wall of bladder.

Only because of this type of arrangement, the accumulation and pressure in the bladder rises during micturition and the ureters are compressed and the openings are occluded which prevents the reflux of urine back into the ureter and kidneys.

Histology of ureter

As renal pelvis and ureter appears to be united as a single structure both of them have more histological similarities.

The walls of ureter/renal pelvis consist of longitudinal smooth muscle fiber which is covered with a few cell thick layer of moist mucous membrane layer and connective tissue which is continuous with fibrous capsule of kidney. Similar to renal pelvis ureter is lined with 4-5 cell thick layer of urothelium, beneath this layer an elastic lamina propria is richly innervated with connective tissue and blood vessels and lymphatic vessels [8-12] and a rich vascular plexus. On cross-section of ureter it is observed to have a layer composed of smooth muscle called tunica muscularis and inner layer of longitudinal muscle fibers and outer layer of circular muscle fiber or spiral layer of muscle.

The radiographic anatomy of the ureter is divided into three sections namely:

- Upper third-Renal pelvis to the top edge of sacrum.
- Middle third-Top edge to lower edge of sacrum.
- Distal third-Lower edge of sacrum to the urinary bladder.

Vascular network of ureter

Pyelocaliceal system and ureter are supplied with segmental arterial supply which varies along with its course.

Upper part of ureter which is close to kidney is supplied with renal arteries, middle part of the ureter is supplied by common iliac arteries, direct branches from the abdominal aorta and gonadal arteries, lower part of ureter is supplied with branches from the internal iliac arteries and superior vesical artery, middle rectal artery, uterine artery (in females), vaginal artery (females) inferior vesical artery (in males) renal vein, gonadal vein, internal iliac vein, vesical venous plexus. Rich vascular supply is observed in the adventitia of ureter.

Lymphatic drainage to ureter

Para aortic lymph nodes are drained with the left upper ureter and the right upper ureter into Para caval and inter aortocaval lymph nodes. The caudal ureter drains into iliac lymph nodes and obturator lymph nodes, which are together called as pelvic lymph nodes.

Functions of ureter

The main function of ureter is to propel urine from the kidneys into bladder wall by peristaltic contractions originated from the pace maker in the minor calyces which causes contraction of smooth muscle layer.

It helps bladder by occluding its opening during micturition.

Ureteral Cancer

Introduction

Transitional cell carcinoma [13-16] is defined as uncontrolled growth of cells lining the kidneys and collecting duct, ureter. This occurs because of the loss in ability of the body's immune system to destroy the cancerous cells, due to their rapid growth a mass of these cancerous cells aggregate to form a lump which is identified as tumour these tumours may or may not be invasive. If the formation of tumour is observed in urine collection system then it is supposed to be renal carcinoma which is most uncommon but more often observed in male than in female (3:1).

Etiology

The etiological cause for occurrence of ureteral cancer is not well defined but expected to be one from the following reasons that causes tumor in the collecting system of kidney i.e., ureter:

- Analgesic nephropathy (long term usage of pain killers which contain phenacetin, cocaine etc.
- Tobacco smoking.
- Chemical nephropathy due to over exposure to chemicals used in manufacturing of leather goods, plastic, textiles, and rubber etc.
- Genetic factor may also be a reason for ureteral cancer.
- Continuous exposure to heavy metals, dyes, petrochemicals, coal, tar, asphalt etc., also causes ureteral cancer.
- Excessive usage of like cyclophosphamide and ifosfamide.
- Patients with a history of bladder cancer can also cause ureteral cancer.
- Infection or cystitis to bladder or renal pelvis may also ascend its effect to ureter and in chronic conditions leads to cancer.
- Metastatic prognosis of cancerous cell from any part of the body or kidney may cause cancer to ureter.
- Congenital anomalies of ureter in children and infants.
- Sometimes lymphoma and sarcoma in the surrounding areas may lead to ureteral cancer.

Signs and symptoms of ureteral cancer

The signs and anticancer drugs [17-20] symptoms of ureteral cancer are not identical in all the cases till today because of its uncommon occurrence hence appeared differently in different people but can be assumed by the following symptoms and signs which are majorly observed in chronic stage rather in acute stage. They include:

- Haematuria (blood in urine).
- Persistent back pain.
- Fatigue (loss of consciousness).
- Sudden and unexplained weight loss.
- Nocturia (frequent urination at night).

- Dysuria (feeling of pain, burning or discomfort upon urination).
- Flank pain (pain in upper back or pain in inside of the body between the upper belly area (abdomen) and the back).
- Dyspareunia (pain during sexual inter course due to medical or physiological causes).
- Loss of urinary retention.
- Tiredness.
- Anorexia (loss of appetite).
- Hydronephrosis (condition where urine is up held in kidney or ureter).
- Night sweats or coughs.

Diagnosis

Many techniques are employed to diagnose the ureteral cancer they are:

- Ureteroscopy.
- FISH test.
- CTU.
- MRU.
- IVP.
- Biopsy.
- Urine analysis.
- Retrograde pyelography.

Ureteroscopy

It is a procedure where a small camera or scope (as a flexible telescope) is injected into the bladder and/or ureter to diagnose and treat various problems of urinary tract. In case of ureteral cancer it is employed to remove the entire ureter or a part of the ureter in order to prevent metastasis of the cancerous cells from ureter to other parts either of the kidney or any part of the body. Recently helium laser device Ureteroscopy has been developed to perform laparoscopic surgery instead of cut open the abdomen surgery. In some cases there is a chance of infection, bleeding or injury to the ureter can be observed as a major side effect of this technique.

Fish test: Fluorescence In Situ Hybridization (FISH) test is a cytogenetic technique that employees fluorescent probes that bind to only those parts of the chromosomes with a high degree of sequence complementarities which was used to detect and localize the presence or absence of specific DNA sequences on chromosomes. In medicine FISH can be used to diagnose, to evaluate prognosis or remission of diseases like cancer. Comparative genomic hybridization is a method that uses FISH in a parallel manner with the comparison of the hybridization strength to recall any major disruptions in the duplication process of DNA sequences in the genome of nucleus during cell division cycle.

CTU: Computed Tomography Urography is a computer based radiographic technique which employees the use of X-rays to demonstrate various structures based on their ability to block the X-ray beam and output the images in two dimensional or

three dimensional images. It became an important tool in medical imaging to supplement X-rays and medical ultrasonographic technique it is sensitive method for diagnosing the stage of cancer in the abdominal region.

MRU: Magnetic Resonance Urography or Nuclear Magnetic Resonance Urography (NMRU) is a medical imaging technique used in radiology to image the anatomy and physiological processes of the body in both healthy and diseased conditions. This technique uses magnetic field, radio waves and field gradients to form images of the body. MRU is based on the principles of nuclear magnetic resonance where certain atomic nuclei can absorb and emit radio frequency energy. In clinical and research studies hydrogen atoms are frequently used to generate detectable radio frequency signal. It is used in a wide range in hospitals for medical diagnosis, staging of diseases like cancer. These days MRI/MRU is widely employed instead of CT scan/CTU because it does not require any high frequency radiations like X-rays in case of CTU/CTscan.

IVP: Intra Venous Pyelogram is a radiological procedure to visualize abnormalities of the urinary system including kidneys ureter and bladder. It is done by injecting X-ray contrast medium to the patient through a needle or cannula into the vein which is excreted or removed from the blood stream through the kidneys and the contrast media becomes visible on X-rays almost immediately after injection. This technique is widely used to diagnose chronic pyelonephritis, kidney stones, RCC, TCC, polycystic kidneys anatomical variations or duplex collecting system, obstruction in pelvic-ureteric junction.

Biopsy: Biopsy [21-24] is a medical test that involves extraction of samples of cells or tissues for examination or determining the presence or absence or extent of disease or infection. This technique is widely performed for possible cancerous and inflammatory conditions. In this technique a small part of tissue is isolated from the affected area or few ml of the body fluid is extracted from the affected area and analyzed for the sample for the presence diseased condition or cancerous cell or tumor.

Urine analysis: A sample of urine is collected from the patient and observed for the presence of any abnormal cells in the sample and haematuria is one of the characteristic features to confirm the presence of any of the disorder or disease in kidney.

Retrograde pyelography: Retrograde pyelography is an imaging test that uses X-rays to observe the conditions of ureter, bladder, and kidneys. This test is usually done during a test called cystoscopy where a contrast dye is injected directly into the ureter. This test is generally used to identify for any presence of block in the ureter or kidneys due to a possible cause of blood clot, tumor, stones, and strictures (narrowing of ureteral opening). This technique has some complications which include sepsis, UTI, bladder tear, bleeding, nausea or vomiting; this test may not be useful in severe dehydrated conditions.

Staging of ureteral cancer: After diagnosing the presence of ureteral cancer it is necessary to identify the stage of cancer. Staging refers to how far the cancer has grown in the tissues of

ureter or renal pelvis whether it has spread to lymph nodes or other organs knowing the stage of cancer is more helpful in planning the treatment.

Stages may be described as a number from 0-4 as:

- Stage 0: also called non-invasive papillary carcinoma or cancer *in situ*. In this stage the cancer is observed as growing on the mucosa of ureter but not through it.
- Stage 1: In this stage cancer has spread through inner lining of mucosa of ureter into the connective tissue.
- Stage 2: In this stage the cancer has grown into the muscle layer of the ureter.
- Stage 3: In this stage cancer has grown through muscle into fat that surrounds the ureter.
- Stage 4: In this stage cancer has spread into one or more of the following:

Layer of the fat surrounding the kidney, nearby organs, one or more lymph nodes, and distant parts of the body such as liver bone lungs.

Treatment: Treatment of ureteral cancer has many ways they are as follows:

- Nephroureterectomy.
- Diathermy.
- Radiotherapy.
- Chemotherapy.
- Segmental resection.

Nephroureterectomy: Nephroureterectomy is a surgical technique involving the surgical removal of entire kidney along with ureter and bladder or only kidney and ureter irrespective of bladder. This is generally preferred by the physicians in cases which are diagnosed with a small, solitary, well differentiated papillary tumor. These days the surgical nephroureterectomy is replaced with laser nephroureterectomy called laparoscopic radical nephroureterectomy which has minimal in ways surgical procedure in removing renal pelvis, kidney and entire ureter along with bladder. This laparoscopic technique has many advantages compared to the surgical one like faster healing less postoperative pain, smaller incisions and less scarring. This is a widely used technique by the doctors in case of cancer which has not started its metastatic stage.

Diathermy: It is a physical therapy in which deep heating of tissue is accomplished by the use of high frequency electrical current. There are three forms of diathermy which are widely used by physical therapists in and around the world they are short wave, ultra sound and microwave diathermy. In short wave diathermy the part to be treated is placed between two condenser plates and highest temperature is subjected in the subcutaneous tissues this technique is usually prescribed in the treatment of deep muscles and joints etc. In ultra sound diathermy high frequency acoustic vibrations are used which increases the heating effect, and speeds up circulation and metabolism and the rate of ion diffusion across the cellular membranes. This technique is significantly affected by surface heating. Microwave diathermy uses radiation of high

frequency and short wave length similar to those used in microwave ovens, all the physiological responses are due to its heating effect.

Radiotherapy: Radiation therapy in the treatment of ureteral cancer usually uses high powered X-rays, seeds or some radioactive material to shrink or destroy the tumor in ureter. In general IGRT (Image Guided Radiation Therapy) is used in case of many oncology treatments in various parts of the body that involve in movement and this therapy is divided into 2 types namely external beam radiation therapy and internal beam radiation therapy. This technique has many side effects.

Chemotherapy: Chemotherapy in ureteral cancer involves combination of anti-cancer drugs like:

- Gemcitabine+cisplatin.
- Carboplatin+gemcitabine.
- Methotrexate+vinblastine+doxorubicin+cisplatin.
- Mitomycin C.
- Carboplatin.

All these chemotherapeutic agents have numerous side effects which may lead to dangerous effects in the body and sometimes they may cause genetic disorders. The major side effects of these chemotherapeutic agents is alopecia (loss of hair), loss of self defense mechanisms may also occur.

Segmental resection: It is also a type of surgical method which involves the removal of specific effected area in the body which may be by opening the part of the body or by laparoscopic techniques.

Conclusion

Based on the above mentioned data different kinds of cancer are explained and surgical methods used to cure cancer. In all the above mentioned methods chemotherapy is the most widely used one to best treat cancer.

References

1. Silva AAA, Rodrigues AG, da Silva AA, Silva CAA (2016) Functional and Morphostructural Evaluation of the Kidneys of Wistar Rats after the Use of a Protein-Based Food Supplement. *J Nephrol Ther* 6: 270.
2. Shulkina SG, Smirnova EN, Trushin MV (2016) Interrelation of Adipokines with Functional State of Kidneys in Patients with Metabolic Syndrome. *Biol Med (Aligarh)* 8: 360.
3. Kabat-Koperska J, Kolasa-Wolosiuk A, Baranowska-Bosiacka I, Safranow K, Kosik-Bogacka D, et al. (2015) Influence of Intrauterine Exposure to Safe and Contraindicated Immunosuppressive Drugs In Combinations during Pregnancy on Morphology and Function of Kidneys in Juvenile Wistar Rats. *Clin Exp Pharmacol* 5: 196.
4. Akintunde JK, Oboh G (2012) *In Vitro* Oxidative Damage Induced in Livers, Hearts and Kidneys of Rats Treated with Leachate from Battery Recycling Site: Evidence for Environmental Contamination and Tissue Damage. *J Clin Exp Pathol* 2: 129.

5. Poinern GEJ, Ali N, Berry C, Singh P, Berchmans S, et al. (2012) Biocompatibility of Synthesised Nano-Porous Anodic Aluminium Oxide Membranes for Use as a Cell Culture Substrate for Madin-Darby Canine Kidneys Cells: A Preliminary Study. *J Tissue Sci Eng* 3: 119.
6. Lau KK, Butani L (2012) Expanding the Organ Donor Pool: Using En Bloc Kidneys in Pediatric Recipients. *J Nephrol Therapeut* 2: e106.
7. Mubarak M (2011) Collapsing Glomerulopathy in Transplanted Kidneys: Only a Tip of the Iceberg? *J Transplant Technol Res* 1: 105e.
8. Longo JPF, Muehlmann LA, Almeida-Santos MFM, Azevedo RB (2015) Preventing Metastasis by Targeting Lymphatic Vessels with Photodynamic Therapy Based on Nanostructured Photosensitizers. *J Nanomed Nanotechnol* 6: 318.
9. Tomita T, Mah K (2015) Lymphatic Vessels in the Human Endometrium: Are they Present or Absent? *J Clin Exp Pathol* 5: 241.
10. Mathias R, von der Weid PY (2014) Immunity and Gastrointestinal Disease: A Role for Lymphatic Vessels. *J Clin Cell Immunol* 5: 262.
11. Vranova M, Halin C (2014) Lymphatic Vessels in Inflammation. *J Clin Cell Immunol* 5: 250.
12. Ogata F, Koshima I (2013) Histopathological Study of Time Course Changes in Obstructed Lymphatic Vessels in Rats. *Surgery Curr Res* 3: 143.
13. Giliberto GL, Franco CAD, Rovereto B (2016) A Rare Case of Cutaneous Metastases from Transitional Cell Carcinoma of Bladder in a Patient Who Underwent Radical Cystectomy. *Med Sur Urol* 5: 175.
14. Skarda J, Michalek J, Tichy T, Smakal O, Kral M, et al. (2015) High-Grade Non-Invasive Transitional Cell Carcinoma with Osseous Metaplasia of the 3-Year-Old Boy Urinary Bladder. *J Clin Exp Pathol* 5: 236.
15. Yang B (2012) Percutaneous Nephroscopic Resection of Pyelocaliceal Transitional Cell Carcinoma in Solitary Kidney. *J Clinic Case Rep* 2: 104.
16. Abbaszadeh S, Azizi T, Pourkhayat MJ, Nourbala MH, Taheri S (2011) Transitional Cell Carcinoma in an Iraqi Child: A Case Report. *J Cytol Histol* 2: 112.
17. Adcock AF, Trivedi G, Edmondson R, Spearman C, Yang L (2015) Three-Dimensional (3D) Cell Cultures in Cell-based Assays for *in-vitro* Evaluation of Anticancer Drugs. *J Anal Bioanal Tech* 6: 247.
18. Agrawal P (2015) Recent Advances in Anticancer Drug Development: G-Quadruplex as New Drug Target. *J Pharmacovigilance* 3: e134.
19. González-Sabin J, Morís F (2013) Exploring Novel Opportunities for Aureolic Acids as Anticancer Drugs. *Biochem Pharmacol* 2: e140.
20. Grillier-Vuissoz I, Mazerbourg S, Boisbrun M, Kuntz S, Chapleur Y, et al. (2012) PPAR γ -independent Activity of Thiazolidinediones: A Promising Mechanism of Action for New Anticancer Drugs? *J Carcinogene Mutagene* 58: 002.
21. Sarkar D (2016) The Role of Multi-Parametric MRI and Fusion Biopsy for the Diagnosis of Prostate Cancer—A Systematic Review. *J Pros Canc* 1: 112.
22. Kumar SM (2016) Detection and Molecular Characterization of Circulating Tumor Cells (CTCs) in Patient with Metastatic Melanoma: A Potential Application of Liquid Biopsy. *Clin Med Biochemistry Open Access* 2: 119.
23. Kim EK, Kim EA, Kim EH, Kim NH, Choi DH, et al. (2015) Day 4 Biopsy Improves Pregnancy Outcome Comparing to Day 3 Biopsy in Preimplantation Genetic Screening. *Gynecol Obstet (Sunnyvale)* 5: 330.
24. Maeno K, Ito T, Koyama H, Kanai T, Mochizuki Y, et al. (2016) Significance of Sentinel Lymph Nodes with Low Gamma Counts in Breast Cancer Patients via Radioisotopic Sentinel Lymph Node Biopsy. *Arch Surg Oncol* 2: 109.