**SEPTEMBER 2019 NURSING CLASS**

**RENAL AND GENITOURINARY SYSTEM**

MODULE OBJECTIVES

1. To perform assessment of renal system
2. To manage disorders of the kidney using nursing process
3. Manage disorders of the ureters, urinary bladder and urethra using the nursing process

**Introduction**

The **urinary system** consists of six organs: two **kidneys,** two **ureters,** the **urinary bladder,** and the **urethra.** It has a close physiological relationship with the endocrine, circulatory, and respiratory systems.

Anatomically, the urinary system is closely associated with the reproductive system. In humans, the systems develop together in the embryo and, in the male; the urethra continues to serve as a passage for both urine and sperm. Thus the urinary and reproductive systems are often collectively called the *urogenital (U-G) system*

**Functions of the Kidneys**

* Filter blood plasma; eliminate wastes and returns useful chemicals to the bloodstream.
* Regulate blood volume and pressure by eliminating or conserving water as necessary
* Regulate the osmolarity of the body fluids by controlling water and solutes eliminated
* Secrete *renin,* which is involved in control of blood pressure and electrolyte balance
* Secrete the hormone *erythropoietin,* which controls the red blood cell count
* Function with the lungs to regulate the PCO2 and acid-base balance of the body fluids.
* Calcium homeostasis through their role in synthesizing calcitriol (vitamin D)
* Detoxify free radicals and drugs with the use of peroxisomes
* In starvation, they carry out *gluconeogenesis;* they *deaminate* amino acids, excrete the amino group as ammonia (NH3),and synthesize glucose from the rest of the molecule.

**Renal system assessment**

**History taking**

General Biodata (name, age, sex, marital status etc.)

**Chief complains**

Chief concerns for seeking health care are assessed using**(OLDCARTSM)**- Onset, Location of symptom, Duration, Characteristics, Aggravating factors, Relieving factors, Treatment received so far, Severity of symptom, Meaning of symptom to patient.

* Dysuria and when it occurs; during voiding (at initiation or termination of voiding)
* Hesitancy, straining, or pain during or after urination
* Urinary incontinence (stress, urge, overflow, or functional incontinence)
* Hematuria or change in color or volume of urine
* Nocturia
* Renal calculi (kidney stones), passage of stones or gravel in urine
* Fever or chills

**Past Medical-Surgical History**

Past medical and surgical history, especially in relation to urinary problems

* Childhood diseases
* History of urinary tract infections (UTIs) before age 12
* History of urinary tract infections, past treatment or hospitalization, antibiotics given
* History of genital lesions or sexually transmitted diseases
* Diabetes mellitus, Hypertension, Allergies, Neurologic disease or dysfunction
* Surgery for bladder or prostate or traumatic injuries involving the pelvis
* Previous renal or urinary diagnostic tests, Cystoscopy, Kidney X-ray, catheterization,
* Did enuresis continue beyond the age when most children gain control?
* For the female patient: Number of children, Vaginal or cesarean delivery, forceps deliveries, vaginal discharge, Vaginal/vulvar itch or irritation, contraceptive use

**Family History**

* Family history of renal disease
* Family history of pelvic organ prolapse- bladder or uterus, urinary incontinence

**Socio-Economic History**

* Present and past occupations- occupational hazards related to the urinary tract; contact with chemicals, plastics, tar, rubber; also truck or school bus drivers.
* History of smoking tobacco, alcoholism, or use of recreational drugs
* Prescription or over-the-counter (OTC) drugs or herbal preparations used

**Physical examination**

Areas of emphasis include the abdomen, suprapubic region, genitalia and lower back, and lower extremities.

* Take vital signs and weight
* Ask the patient to urinate in a specimen cup, assess urine for colour, odour and clarity
* Ask the patient to undress then provide gowns and drapes
* Remember to expose only the area being assessed

***Inspection***

* Perform general inspection to rule out generalised edema including periorbital region
* Inspect abdomen for gross enlargement and symmetry, in a normal adult the abdomen is smooth, flat and scaphoid. Distension, skin tightness glistening and striae may signal fluid retention or ascites
* Inspect skin for scars, lesions, bruises and discolouration
* Check for prominent veins (associated with hypertension renal artery stenosis)
* Inspect the urethral meatus for inflammation, discharge, ulceration(signs of infection) or abnormal deviation (congenital defect)
* Inspect lower back for sacral edema
* Inspect lower limbs for edema

***Auscultation***

* Auscultate the renal arteries in the left and right upper quadrants by pressing the stethoscope bell lightly against the abdomen, the patient to exhale deeply. Begin from midline to the left, back to the midline then to the right. Listen for bruits (low-pitched murmurs that indicate renal artery stenosis, hypertension or an aortic aneurysm)

***Percussion***

* Percuss the kidneys for tenderness or pain, the bladder for position and contents
* tenderness or pain may indicate glomerulonephritis or glomerulonephrosis
* The bladder should be percussed after the patient voids to check for residual urine. This begins at the midline just above the umbilicus and proceeds downward.
* The sound changes from tympanic to dull. Dull sound when the patient has just passed urine suggests urine retention common in bladder dysfunction or infection

***Palpation***

* Palpate the kidneys for size and mobility
* The lower pole of the kidney feels smooth and rounded between the hands; right kidney is easier to feel because it is lower than the left one. Palpation of the kidneys is generally more difficult in obese patients.
* Tenderness over the costovertebral angle between the 12th rib and the spine indicates renal dysfunction.
* The bladder, which can be palpated only if it is moderately distended, feels like a smooth, firm, round mass rising out of the abdomen, usually at midline
* Peritoneal fluid may occur with kidney dysfunction.

**Investigations**

Common laboratory studies pertaining to renal and urologic disorders include blood and urinary excretion tests for renal function, prostate-specific antigen (PSA), and urinalysis.

**Renal concentration test**

1. Specific gravity
2. Osmolality of urine

Tests the ability to concentrate solutes in the urine

*Procedure:* withhold fluids for 12-24 hours to evaluate the concentrating ability of the tubules under controlled conditions.

**Creatinine clearance**

* Provides a reasonable approximation of rate of glomerular filtration.
* Measures volume of blood cleared of creatinine in 1 minute.
* Most sensitive indicator of early renal disease.
* Useful in following the progress of a patient's renal status.

*Procedure:*Collect all urine over 24-hour period, draw one sample of blood within the period.

**Serum creatinine**

* A test of renal function reflecting the balance between production and filtration by renal glomerulus.
* Most sensitive test of renal function

*Procedure:* Obtain sample of blood serum.

**Serum urea nitrogen (Blood urea nitrogen [BUN])**

* Shows renal excretory capacity.
* Serum urea nitrogen depends on the body's urea production and on urine flow (Urea is the nitrogenous end-product of protein metabolism)
* Affected by protein intake, tissue breakdown

*Procedure:* Obtain sample of blood serum.

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| **Protein** | Random specimen may be affected by dietary protein intake. Proteinuria >150 mg/24 hours may indicate renal disease. |  |

*Procedure:* Collect all urine over 24-hour period.

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| **Microalbumin/Creatinine ratio** |  |  |

Sensitive test for the subsequent development of proteinuria; >30 mcg/mg creatinine predicts early nephropathy.

**Procedure:** Collect random urine specimen

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|  |  | **Urine casts**Mucoproteins and other substances present in renal inflammation; help to identify type of renal disease (eg, red cell casts in glomerulonephritis, fatty casts in nephrotic syndrome, white cell casts in pyelonephritis).**Procedure:** Collect random urine specimen**Prostate-Specific Antigen**Description* PSA is an amino acid glycoprotein that is measured in the serum
* Elevated PSA indicates prostate disease, but not necessarily prostate cancer which should be confirmed with biopsy
* Level rises continuously with the growth of prostate cancer.
* Normal serum PSA level is less than 4 ng/mL. Levels less than 10 ng/mL may be indicative of benign prostatic hyperplasia (BPH) and not necessarily prostate cancer.
* Patients who have undergone treatment for prostate cancer are monitored periodically with PSA levels for recurrence.

**Urinalysis*****Description***Examination of the urine for overall characteristics, including appearance, pH, specific gravity, and osmolality, microscopic evaluation for normal and abnormal cells.**Appearance:** normal urine is clear.* Cloudy urine (phosphaturia) is not always pathologic, related to the precipitation of phosphates in alkaline urine.
* Urine may develop cloudiness on refrigeration or from standing at room temperature
* Abnormally cloudy urine could be due to pus (pyuria), blood, epithelial cells, bacteria, fat, colloidal particles, phosphate, or lymph fluid (chyluria).

**Odor**: normal urine has a faint aromatic odor.* Characteristic odors may be produced by ingestion of certain drugs.
* Cloudy urine with ammonia odor: urea-splitting bacteria such as Proteus, causing UTIs.
* Offensive odor: bacterial action in presence of pus.

**Color:** shows degree of concentration and depends on amount voided.* Normal urine is clear yellow or amber because of the pigment urochrome.
* Dilute urine is straw-colored.
* Concentrated urine is deeply colored; a sign of insufficient fluid intake.
* Cloudy or smoky colour may be from hematuria, spermatozoa, prostatic fluid, fat droplets, chyle.
* Red or red-brown: blood pigments, porphyria, and transfusion reaction, bleeding lesions in urogenital tract, some drugs and food (beets).
* Yellow-brown or green-brown: obstructive lesion of bile duct system or obstructive jaundice.
* Dark brown or black: malignant melanoma, leukemia.

**pH:** reflects the ability of kidney to maintain normal hydrogen ion concentration in plasma and extracellular fluid; indicates acidity or alkalinity of urine.* measured in **fresh urine** because the breakdown of urine to ammonia causes alkalinity
* Normal pH is around 6 (acid); varies from 4.6 to 7.5.
* Urine acidity or alkalinity has little clinical significance unless the patient is on a special diet or therapeutic program or is being treated for renal calculous disease.

**Specific gravity:** kidney's ability to concentrate or dilute urine; shows degree of hydration or dehydration.* Normal ranges: 1.005 to 1.025.
* Is fixed at 1.010 in chronic renal failure.
* In normal diet, inability to concentrate or dilute urine indicates disease.

**Osmolality**: indicates the amount of osmotically active particles in urine (number of particles per unit volume of water). Similar to specific gravity, but is considered a more precise test; Average value is 300 to 1,090 mOsm/ kg for females; 390 to 1,090 mOsm/kg for males. |

**Culture and sensitivity**

* Urine culture determines presence of bacteria, their strains and concentration.
* Sensitivity: the antibiotic best for a particular strains in a particular geographic region.

**Electrolytes**

Kidney regulates electrolyte balance through filtration at the glomerulus and reabsorbtion in the renal tubules.

Commonly measured are sodium, chloride, potassium, calcium, phosphorus, and magnesium.

*Procedure:* 24-hour urine collections.

**Imaging studies**

**General Ultrasonography**

Noninvasive procedure that uses sound waves passed into the body through a transducer.

Identifies fluid accumulation, masses, congenital malformations, changes in organ size, or obstructions

Requires a full bladder; therefore, fluid intake should be encouraged before the procedure.

**Bladder Ultrasonography**

Measures urine volume in the bladder

***Indications***: urinary frequency, inability to void after removal of an indwelling urinary catheter, postvoiding residual urine volume, inability to void postoperatively, assessment of the need for catheterization during the initial stages of an intermittent catheterization training

**Computed Tomography and Magnetic Resonance Imaging**

CT and MRI are noninvasive techniques that provide cross sectional views of the kidney and urinary tract.

Used in evaluating genitourinary masses, nephrolithiasis, chronic renal infections, renal or urinary tract trauma, metastatic disease, and soft tissue abnormalities

MRI is contraindicated in patients with pacemakers, surgical clips, or any metallic objects anywhere in the body. Occasionally, an oral or intravenous radiopaque contrast material is used in CT scanning to enhance visualization.

**Nuclear Scans**

Radioisotope is injected into the circulatory system then monitored as it moves through the blood vessels of the kidneys.

Used to evaluate acute and chronic renal failure, renal masses, and blood flow before and after kidney transplantation.

After the procedure the patient drinks fluids to promote excretion of the radioisotope by the kidneys.

**Intravenous Urography**

Intravenous urography includes excretory urography, intravenous pyelography (IVP), and infusion drip pyelography.

A radiopaque contrast agent is administered intravenously. It shows the kidneys, ureter, and bladder via x-ray imaging as dye moves through the upper and then lower urinary system.

Nephrotomogram may be carried out to visualize different layers of the kidney and to differentiate solid masses or lesions from cysts in the kidneys or urinary tract.

May be used as the initial assessment of any suspected urologic problem, especially lesions in the kidneys and ureters, It also provides a rough estimate of renal function.

**Retrograde Pyelography**

Catheters are advanced through the ureters into the renal pelvis by means of cystoscopy. A contrast agent is then injected.

Performed if intravenous urography provides inadequate visualization of the collecting systems

May also be used before extracorporeal shock-wave lithotripsy or in urologic cancer in patients allergic to intravenous contrast agents

Complications: infection, hematuria, and perforation of the ureter.

**Cystography**

Evaluates vesicoureteral reflux (backflow of urine from the bladder into one or both ureters) and assesses for bladder injury.

*Procedure:* A catheter is inserted into the bladder; a contrast agent is instilled to outline the bladder wall. The contrast agent may leak through a small bladder perforation due to bladder injury, such leakage is usually harmless.

**Voiding Cystourethrography**

Uses fluoroscopy to visualize the lower urinary tract and assess urine storage in the bladder

Can identify vesicoureteral reflux (between bladder and ureter)

*Procedure:* A urethral catheter is inserted, and a contrast agent is instilled into the bladder. When the bladder is full and the patient feels the urge to void, the catheter is removed, and the patient voids. Retrograde urethrography, in which a contrast agent is injected retrograde into the urethra, is always performed before urethral catheterization if urethral trauma is suspected.

**Renal Angiography**

A renal angiogram, or renal arteriogram, provides an image of the renal arteries.

*Procedure:* The femoral (or axillary) artery is pierced with a needle, and a catheter is threaded up through the femoral and iliac arteries into the aorta or renal artery. A contrast agent is injected to opacify the renal arterial supply.

Evaluates renal blood flow in suspected renal trauma, differentiates renal cysts from tumors, and evaluates hypertension.

It is used preoperatively for renal transplantation.

**UROLOGIC ENDOSCOPIC PROCEDURES**

Endourology, or urologic endoscopys, can be performed in two ways: using a cystoscope inserted into the urethra or percutaneously, through a small incision.

The cystoscopic examination visualizes the urethra and bladder.

*Procedure:* The cystoscope is inserted through the urethra into the bladder; a self-contained optical lens system provides a magnified, illuminated view of the bladder

High-intensity light and interchangeable lenses allow excellent visualization and permit still and motion pictures to be taken.

The cystoscope is manipulated to allow complete visualization of the urethra and bladder as well as the ureteral orifices and prostatic urethra. Small ureteral catheters can be passed through the cystoscope, allowing assessment of the ureters and the pelvis of each kidney.

**BIOPSY**

**Renal and Ureteral Brush Biopsy**

Important when abnormal x-ray findings of the ureter or renal pelvis are not conclusive for tumor, a stone, a blood clot, or an artifact.

*Procedure:* Through cystoscopic examination a ureteral catheter is introduced, followed by a biopsy brush that is passed through the catheter. The suspected lesion is brushed back and forth to obtain cells and surface tissue fragments for histologic analysis.

After the procedure, administer intravenous fluids to clear the kidney to prevent clot formation.

Urine may contain blood (usually clearing in 24 to 48 hours) from oozing at the brushing site. Postoperative renal colic occasionally occurs and responds to analgesics.

**Kidney Biopsy**

Used in diagnosing and evaluating the extent of kidney disease.

Indications: unexplained acute renal failure, persistent proteinuria or hematuria, transplant rejection, and glomerulopathies.

*Procedure:* small section of renal cortex is obtained either percutaneously (needle biopsy) or by open biopsy through a small flank incision.

**Disorders of the kidneys**

**Glomerulonephritis**

Glomerulonephritisis an inflammation of the glomerular capillaries.

Acute glomerulonephritis is primarily a disease of children older than 2 years of age, but it can occur at nearly any age.

**Pathophysiology**

An antigen antibody reaction produces immune complexes that deposit in the glomeruli, causing thickening of glomerular basement membrane; the renal vasculature, interstitium, and tubular epithelium.

Immune complexes activate secondary mediators such as neutrophils, macrophages, prostaglandins, and leukotrienes which affect vascular tone and permeability, resulting in tissue injury, scarring and loss of filtering surface and decreased glomerular filtration rate (GFR)

**Etiology**

* Group A betahemolytic streptococcal infection of the throat precedes the onset of glomerulonephritis by 2 to 3 weeks.
* Impetigo (infection of the skin)
* Acute viral infections (upper respiratory tract infections, mumps, varicella zoster virus, Epstein-Barr virus, hepatitis B, and human immunodeficiency virus infection)
* Antigens outside the body (eg, medications, foreign serum)
* The kidney tissue itself can serves as the inciting antigen (autoimmune)

**Clinical Manifestations**

* Mild disease is frequently discovered accidentally through a routine urinalysis.
* History of infection: pharyngitis or impetigo from group A streptococcus, such viral infections as Epstein Barr and hepatitis B
* Tea-colored urine, oliguria
* Puffiness of face, edema of extremities
* Fatigue and anorexia, possible headache
* Hypertension (mild, moderate, or severe), headache
* Anemia from loss of RBCs into the urine

The clinical course of acute glomerulonephritis proceeds as follows from onset of symptoms to recovery more than 90% of patients regain normal renal function within 60 days:

* + Diuresis usually starts 1 to 2 weeks after onset of symptoms.
	+ Renal clearances and blood urea concentration return to normal.
	+ Edema decreases, and hypertension lessens.
	+ Microscopic proteinuria or hematuria may persist for many months

**Diagnosis**

* Urinalysis for hematuria (microscopic or gross), proteinuria, cellular elements, and various casts
* 24-hour urine for protein (increased) and creatinine clearance (reduced)
* Elevated BUN and serum creatinine levels, low albumin level,
* increased antistreptolysin titer (from reaction to streptococcal organism), and decreased serum complement
* Needle biopsy of the kidney reveals obstruction of glomerular capillaries from proliferation of endothelial cells

**Management**

* Management is symptomatic and includes antihypertensives, diuretics, management of hyperkalemia (due to renal insufficiency), H2 blockers (to prevent stress ulcers), and phosphate-binding agents (to reduce phosphate and elevate calcium).
* Antibiotic therapy is initiated to eliminate infection (if still present).
* Fluid intake is restricted.
* Dietary protein is restricted moderately if there is oliguria and the BUN is elevated. It is restricted more drastically if acute renal failure develops.
* Carbohydrates are increased liberally to provide energy and reduce catabolism of protein.
* Potassium and sodium are restricted in hyperkalemia, edema, or signs of heart failure.

**Nursing management**

**Nursing Assessment**

* Medical history; recent infections or symptoms of chronic immunologic disorders (systemic lupus erythematosus, scleroderma).
* Urine specimen for blood, protein, color, and amount.
* Physical examination for signs of edema, hypertension, hypervolemia (engorged neck veins, elevated jugular venous pressure, adventitious lung sounds, cardiac arrhythmia).
* Evaluate cardiac status and serum laboratory values for electrolyte imbalance.

**Nursing Diagnoses**

* Ineffective (Renal) Tissue Perfusion related to damage to glomerular function as evidenced by elevated BUN
* Excess Fluid Volume related to compromised renal function as evidenced by edema

**Planning**

Goals:

1. To promote renal tissue perfusion
2. To ensure adequate fluid volume

**Nursing Interventions**

Promoting Renal Function

* Monitor vital signs, intake and output, and maintain dietary restrictions during acute phase.
* Encourage rest during the acute phase as directed until the urine clears and BUN, creatinine, and blood pressure normalize. (Rest also facilitates diuresis.)
* Administer medications as ordered, and evaluate patient's response to antihypertensives, diuretics, H2 blockers, phosphate-binding agents, and antibiotics (if indicated).

Improving Fluid Balance

* Carefully monitor fluid balance; replace fluids according to the patient's fluid losses (urine, respiration, feces) and daily body weight.
* Monitor pulmonary artery pressure and central venous pressure CVP, if indicated.
* Monitor for signs and symptoms of heart failure: distended neck veins, tachycardia, gallop rhythm, enlarged and tender liver, crackles at bases of lungs.
* Observe for hypertensive encephalopathy, any evidence of seizure activity.

Patient Education and Health Maintenance

* Explain that the patient must have follow-up evaluations of blood pressure, urinary protein, and BUN concentrations to determine if there is exacerbation of disease activity.
* Encourage patient to treat any infection promptly.
* Inform to report any signs of decreasing renal function and seek treatment immediately.

**Evaluation: Expected Outcomes**

* Urine output adequate; vital signs stable
* No edema, shortness of breath, or adventitious heart or lung sounds

**Complications**

* Hypertension, heart failure, endocarditis
* Fluid and electrolyte imbalances in the acute phase, hyperkalemia, hyperphosphatemia, hypervolemia
* Malnutrition
* Hypertensive encephalopathy, seizures
* End stage renal disease (ESRD)

**Urolithiasis/Renal calculi/Renal stones**

Stones, or calculi, are formed in the urinary tract from the kidney to bladder by the crystallization of substances excreted in the urine.

**Types of Stones**

There are four basic types of kidney stones:

1. Calcium stones (*i.e.*, oxalate or phosphate)-forms majority of kidney stones (70% to 80%) calcium oxalate, calcium phosphate or a combination of the two materials. Associated with: increased concentrations of calcium in the blood and urine, excessive bone resorption caused by immobility, bone disease, hyperparathyroidism, and renal tubular acidosis
2. Magnesium ammonium phosphate stones (*struvite stones)*, form in alkaline urine. Bacteria produses *urease* an enzyme which splits urea into ammonia and carbon dioxide.,
3. Uric acid stones develop in gout and high concentrations of uric acid in the urine.
4. Cystine stones are seen in cystinuria, which results from a genetic defect in renal transport of cystine and amino acid.

**Pathophysiology and Etiology**

 (75%) are composed mainly of calcium oxalate crystals; the rest are composed of calcium phosphate salts, uric acid, struvite (magnesium, ammonium, and phosphate), or the amino acid cystine.

Stones may be found anywhere in the urinary system and vary in size from granular deposits (called sand or gravel) to bladder stones the size of an orange.

Three out of four patients are men; in both sexes, peak age of onset is between 20 and 40yrs.

Most stones move downward (causing severe colicky pain) and are discovered in the lower ureter. Spontaneous stone passage can occur in 80% of patients.

Some stones may lodge in the renal pelvis, ureters, or bladder neck causing obstruction, edema, secondary infection and nephron damage.

People who have had two stones tend to have recurrences.

**Causes and predisposing factors:**

* Hypercalcemia and hypercalciuria caused by hyperparathyroidism, renal tubular acidosis, multiple myeloma, and excessive intake of vitamin D, milk, and alkali
* Chronic dehydration, poor fluid intake, and immobility
* Diet high in purines and abnormal purine metabolism (hyperuricemia and gout)
* Genetic disorders (cystinuria)
* Chronic infection with urea-splitting bacteria (Proteus vulgaris)
* Chronic obstruction with stasis of urine, foreign bodies within the urinary tract
* Excessive oxalate absorption in inflammatory bowel disease and bowel resection or ileostomy
* Living in mountainous, desert, or tropical areas

**Clinical Manifestations**

* Increased hydrostatic pressure and distention of the renal pelvis and proximal ureter causes renal colic, pain relief is immediate after stone passage.
* Large stones produce symptoms as they pass down the ureter (ureteral colic).
* Bladder stones produce symptoms similar to cystitis.
* Stones blocking the flow of urine will produce symptoms of UTI; chills and fever.
* GI symptoms include nausea, vomiting, diarrhea, abdominal discomfort due to renointestinal reflexes and shared nerve supply (celiac ganglion) between the ureters and intestine.

**Diagnostic Evaluation**

* Kidney, ureters, and bladder radiography
* IVU to determine site and evaluate degree of obstruction;
* Ultrasound may be as sensitive
* Spiral CT scan to assess for stone in ureter
* Urinalysis: hematuria and pyuria; pH < 5.5 indicates uric acid stone; > 7.5 indicates struvite stone; urine culture and drug sensitivity studies to detect infection.
* kidney function tests, electrolytes, calcium, phosphorus, uric acid, and magnesium levels;
* serum parathyroid hormone

**Management**

* Small stone (< 4 mm): treat as outpatient, 80% will pass stone spontaneously with hydration, pain control, and reassurance.
* Hospitalize for persistent pain vomiting, high-grade fever, obstruction with infection, and solitary kidney with obstruction

**Extracorporeal Shock Wave Lithotripsy**

* Treatment of choice for stones less than 2 cm in diameter that is located in the ureter above the iliac crest. Stones below the iliac crest require ureteroscopy
* High-energy shock waves are directed at the kidney stone, disintegrating it into minute particles that pass in the urine.
* Patient is placed on specially designed table and immersed in a water bath or placed on an adjustable stretcher positioned over a cushion of water.
	+ In water bath model, shock waves travel through water surrounding the patient.
	+ In cushion model, a layer of gel lies between the stretcher and water; shock waves move through the cushion and gel.

*Complications:* pain, urinary infection and temporary bleeding around kidney.

**Percutaneous Nephrostolithotomy**

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| Stones in renal collecting system or upper portion of ureter larger than 2.5 cm in diameter  |
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* Under fluoroscopic or ultrasound guidance, a needle is advanced into collecting system; guide wire is advanced into renal pelvis or ureter.
* Stones are broken with hydraulic shock waves or a laser beam administered by way of nephroscope; fragments are removed using forceps, graspers, or basket.
* May be combined with extracorporeal shock wave lithotripsy.

*Complications*: hemorrhage, infection, and extravasation of urine.

**Percutaneous Stone Dissolution (Chemolysis)**

* Nephrostomy tube (catheter) is placed in kidney; a solvent is introduced (depending on chemical composition of stone). A second catheter may be used for drainage.
* Used for struvite, uric acid, and cystine stones.
* Administer antibiotics before, during, and after procedure to maintain sterile urine.

*Complications*: infection (renal and perirenal abscesses, pyelonephritis, septic shock) thrombophlebitis and pulmonary embolism (associated with immobility).

**Ureteroscopy**

* Used for distal ureteral calculi and midureteral calculi.
* Flexible or rigid ureteroscopes are used in conjunction with baskets or graspers.
* Electrohydraulic, ultrasonic, or laser equipment to fragment stone.
* A stent may be inserted and left in place after surgery to maintain patency of ureter.

**Open Surgical Procedures**

* Indicated for only 1% to 2% of all stones
* Surgical removal of stones from kidney pelvis, kidneys, ureters, bladder or injection of coagulation factors into the renal pelvis, the coagulum entraps the stones helping in their removal. If these fail partial or total nephrectomy is done (removal of kidney)

*Complications:*

* Obstruction from remaining stone fragments
* Infection: disseminated by infected stone particles or bacteria resulting from obstruction
* Impaired renal function from prolonged obstruction
* Perirenal hematoma caused by trauma of shock waves or laser treatments

**Nursing Management**

**Nursing Assessment**

* History focusing on family history of calculi, episodes of dehydration, prolonged immobility, UTI, dietary and medication
* Assess pain location and radiation; assess level of pain using a scale of 1 to 10. Associated symptoms: nausea, vomiting, diarrhea, abdominal distention.
* Signs and symptoms of UTI: such as chills, fever, dysuria, frequency and hematuria.
* Signs and symptoms of obstruction: frequent urination in small amounts, oliguria, anuria.

**Nursing Diagnoses**

* Acute Pain related to inflammation, obstruction, and abrasion of urinary tract by migration of stones as evidenced by patient verbalizing
* Impaired Urinary Elimination related to blockage of urine flow by stones as evidenced by frequent urination in small amounts, oliguria, anuria
* Risk for Infection related to obstruction of urine flow and instrumentation during treatment

**Planning**

**Goals:**

1. Control pain
2. Maintaining urinary elimination
3. Prevent infection

**Nursing Interventions**

Controlling Pain

* Administer prescribed opioid analgesic (usually I.V. or I.M.) increasing pain may indicate inadequate analgesia, very large doses of opioids are required to relieve pain, so monitor for respiratory depression and drop in blood pressure (side effects of opioids).
* Encourage patient to assume position that brings some relief.
* Reassess pain frequently using pain scale.
* Administer antiemetics (I.M. or rectal suppository) as indicated for nausea.

Maintaining Urine Flow

* Administer fluids orally or I.V. to reduce concentration of urinary crystalloids and improve urine output.
* Monitor total urine output and patterns of voiding. Report oliguria or anuria.
* Strain all urine through strainer or gauze to harvest the stone; uric acid stones may crumble. Crush clots, and inspect sides of urinal/bedpan for stones or fragments.
* For outpatient treatment, the patient may use a coffee filter to strain urine.
* Help patient to walk, ambulation may help move the stone through the urinary tract.
* Avoid over hydration, which may increase distention at stone location, causing an increase in pain and associated symptoms.

Controlling Infection

* Administer parenteral or oral antibiotics as and monitor for adverse effects.
* Assess urine for color, cloudiness, and odor.
* Obtain vital signs, monitor for fever and symptoms of sepsis (tachycardia, hypotension).

**Patient Education and Health Maintenance**

Recovery from Surgical Interventions for Stone Disease

* Encourage fluids to accelerate passing of stone particles.
* Teach about analgesics that still may be necessary for colicky pain, which may accompany passage of stone debris.
* Warn that some blood may appear in urine for several weeks.
* Encourage frequent walking to assist in passage of stone fragments.
* Teach patient to strain urine through a coffee filter.

**Prevention of Recurrent Stone Formation**

***For calcium oxalate stones***

* Avoid excesses of calcium and phosphorus; maintain a low-sodium diet (sodium restriction decreases amount of calcium absorbed in intestine).
* Teach purpose of drug therapy; thiazide diuretics to reduce urine calcium excretion, allopurinol therapy to reduce uric acid concentration.

***For uric acid stones***

* Alkalinize urine to enhance urate solubility.
* Instruct on testing urine pH.
* Teach purpose of taking allopurinol to lower uric acid concentration.
* Reduction of dietary purine intake (low protein red meat, fish, fowl)

***For infection (struvite) stone***

* Teach signs and symptoms of urinary infection (in patients with neurologic or spinal cord disease teach use of dipsticks to evaluate urine for nitrites and leukocytes); encourage to report infection immediately; must be treated vigorously.
* Avoid prolonged periods of recumbency -slows renal drainage and alters calcium metabolism.

***For patients with cystine stones*** *(occur in cystinuria, a hereditary disorder of amino acid transport).*

* Alkalinize urine by taking sodium bicarbonate tablets to increase cystine solubility; instruct patient how to test urine pH with a pH indicator.
* D-penicillamine to lower cystine concentration, or dissolution by direct irrigation with thiol derivatives.
* Explain importance of maintaining drug therapy consistently.

**For all patients with stone disease**

* Increased fluid intake (24-hour urinary output greater than 2 L) lowers the concentration of substances involved in stone formation.
* Drink enough fluids to achieve a urinary volume of 2,000 to 3,000 mL or more every 24 hours.
* Drink larger amounts during periods of strenuous exercise, if patient perspires freely.
* Take fluids in evening to guarantee a high urine flow during the night.
* Encourage a diet low in sugar and animal proteins; refined carbohydrates lead to hypercalciuria and urolithiasis; animal proteins increase urine excretion of calcium, uric acid, and oxalate.
* Increased consumption of fiber inhibits calcium and oxalate absorption.
* Save any stone passed for analysis. (Only patients with more than one episode of urolithiasis are advised to have a metabolic evaluation.)
* Can discontinue urine straining 72 hours after symptoms resolve

**Evaluation: Expected Outcomes**

* Verbalizes reduced pain level
* Urine output adequate with low specific gravity
* Afebrile; urine clear

**Acute pyelonephritis**

Bacterial pyelonephritis is an acute infection and inflammatory disease of the kidney and renal pelvis involving one or both kidneys.

**Pathophysiology and Etiology**

Pyelonephritis is frequently secondary to ureterovesical reflux; an incompetent ureterovesical valve allows the urine to back up (reflux) into the ureters.

* Enteric bacteria, such as E. coli, other gram-negative pathogens include Proteus species, Klebsiella, and Pseudomonas. Gram-positive bacteria are less common, but include Enterococcus and Staphylococcus aureus.
* Pathogens usually ascend from the lower urinary tract; hematogenous migration is possible (particularly with S. aureus).
* Vesicoureteral reflux (incompetence of ureterovesical valve), allows urine to regurgitate into ureters, usually at time of voiding),
* Urinary tract obstruction (bladder tumors, strictures, benign prostatic hyperplasia, urinary stones, trauma, or pregnancy).
* Low-grade inflammation, interstitial infiltrations of inflammatory cells may lead to tubular destruction and abscess formation.
* Chronic pyelonephritis may cause scarring, atrophy, and nonfunctioning kidneys.

**Clinical Manifestations**

* Fever, chills
* Flank pain (with or without radiation to groin)
* Nausea, vomiting, anorexia
* Costovertebral angle tenderness
* Urgency, frequency, and dysuria may be present

**Diagnostic Evaluation**

* Urinalysis (dipstick or microscopic) to identify leukocytes, bacteria, and RBCs and WBCs in urine; white cell casts may also be seen.
* Urine culture to identify causative bacteria.
* Complete blood count (CBC) elevated WBC count consisting of neutrophils and bands.
* Intravenous urography (IVU) or renal ultrasound to evaluate for urinary tract obstruction;

**Management**

For severe infections (dehydrated, cannot tolerate oral intake) or complicating factors (obstruction, pregnancy, advanced age), inpatient antibiotic therapy is recommended.

* + Penicillin or aminoglycoside I.V. to cover the prevalent gram-negative pathogens; subsequently adjusted according to culture results.
	+ Oral antibiotic may be started 24 hours after fever has resolved and continued for 3 weeks.
* Oral therapy antibiotic therapy is acceptable for outpatient treatment.
	+ Co-trimoxazole (Septrin) or a fluoroquinolone for 10 to 14 days.
* Repeat urine cultures should be performed after the completion of therapy.
* Supportive therapy- fever, pain control and hydration.

**Complications**

* Bacteremia with sepsis
* Papillary necrosis leading to renal failure
* Renal abscess requiring percutaneous drainage or prolonged antibiotic therapy
* Perinephric abscess
* Paralytic ileus

**Nursing Assessment**

* Monitor symptoms and assess ability to tolerate oral fluids and food.
* Urologic history -could suggest recurrent infections or urinary tract obstruction.
* Vital signs; monitor for impending sepsis.
* Assess bowel sounds for possible paralytic ileus.

**Nursing Diagnoses**

* Hyperthermia due to infection
* Acute Pain related to renal swelling and edema

**Planning**

**Goals:**

1. To control body temperature
2. To reduce pain

**Nursing Interventions**

Reducing Body Temperature

* Administer antibiotics, monitor effectiveness/ adverse effects.
* Assess vital signs frequently, and monitor intake and output;
* Administer antiemetic medications to control nausea and vomiting.
* Administer antipyretic medications according to temperature.
* Report fever that persists beyond 72 hours after initiating antibiotic therapy; further testing for complicating factors will be ordered.
* Decrease body temperature using cooling blanket, application of ice to armpits and groins
* Correct dehydration using IV or oral fluids if possible
* Monitor CBC, blood cultures, and urine studies for resolving infection.

**Relieving Pain**

* Administer or teach self-administration of analgesics, and monitor their effectiveness.
* Use comfort measures, such as positioning, to relieve flank pain.
* Assess patient's response to pain control measures.

**Patient Education and Health Maintenance**

* Explain to patient possible causes of pyelonephritis and its signs and symptoms; also, review signs and symptoms of lower UTI.
* Review antibiotic therapy and importance of completing prescribed course of treatment and having follow-up urine cultures.
* Explain preventive measures- good fluid intake, personal hygiene measures, and healthy voiding habits.

**Evaluation: Expected Outcomes**

* Afebrile within 48 hours
* Verbalizes reduced pain

**Nephrotic syndrome**

Nephrotic syndrome is a clinical disorder characterized by marked increase of protein in the urine (proteinuria), decrease in albumin in the blood (hypoalbuminemia), edema, and excess lipids in the blood (hyperlipidemia). These occur as a consequence of excessive leakage of plasma proteins into the urine because of increased permeability of the glomerular capillary membrane.

**Pathophysiology and Etiology**

* Seen in any condition that seriously damages the glomerular capillary membrane.
	+ Chronic glomerulonephritis
	+ Diabetes mellitus
	+ Amyloidosis of kidney
	+ Systemic lupus erythematosus
	+ Renal vein thrombosis
	+ Secondary to malignancy (older adults)
* Hypoalbuminemia results in decreased oncotic pressure, causing generalized edema as fluid moves out of the vascular space
* Decreased circulating volume then activates the renin-angiotensin system causing retention of sodium and further edema.

**Clinical Manifestations**

* Insidious onset of pitting dependent edema, periorbital edema, and ascites; weight gain
* Fatigue, headache, malaise, irritability
* Marked proteinuria leading to depletion of body proteins
* Hyperlipidemia may lead to accelerated atherosclerosis

**Diagnostic Evaluation**

* Urinalysis: marked proteinuria, microscopic hematuria, urinary casts, appears foamy
* 24-hour urine for protein (increased) and creatinine clearance (decreased)
* Needle biopsy of kidney for histologic examination of renal tissue to confirm diagnosis
* Serum chemistry: decreased total protein and albumin, normal or increased creatinine, increased triglycerides, and altered lipid profile

Management

* Treatment of causative glomerular disease
* Diuretics (used cautiously) and angiotensin converting enzyme inhibitors to control proteinuria
* Corticosteroids or immunosuppressant agents to decrease proteinuria
* General management of edema
	+ Sodium and fluid restriction; liberal potassium
	+ Infusion of salt-poor albumin
	+ Dietary protein supplements
* Low-saturated-fat diet

**Complications**

* Hypovolemia
* Thromboembolic complications renal vein thrombosis, venous and arterial thrombosis in extremities, pulmonary embolism, coronary artery thrombosis, cerebral artery thrombosis
* Altered drug metabolism due to decrease in plasma proteins
* Progression to end-stage renal failure

**Nursing Assessment**

* History of onset of symptoms, changes in characteristics of urine and onset of edema.
* Perform physical examination looking for evidence of edema and hypovolemia.
* Assess vital signs, daily weights, intake and output, and laboratory values.

**Nursing Diagnoses**

* Risk for Deficient Fluid Volume related to fluid shift
* Risk for Infection related to treatment with immunosuppressant

**Planning**

**Goals:**

Increase circulating fluid volume

Prevent infections

**Nursing Interventions**

Increasing Circulating Volume and Decreasing Edema

* Monitor daily weight, intake and output, and urine specific gravity.
* Monitor CVP (if indicated), vital signs, orthostatic blood pressure, and heart rate to detect hypovolemia.
* Monitor serum BUN and creatinine to assess renal function.
* Administer diuretics or immune suppressants as prescribed, and evaluate patient's response.
* Infuse I.V. albumin as ordered to replace plasma albumin.
* Encourage bed rest for a few days to help mobilize edema; however, some ambulation is necessary to reduce risk of thromboembolic complications.
* Enforce mild to moderate sodium and fluid restriction if edema is severe; provide a high-protein diet.

Preventing Infection

* Monitor for signs and symptoms of infection.
* Monitor temperature routinely; check laboratory values for neutropenia.
* Use aseptic technique for all invasive procedures and strict hand washing by patient and all contacts; prevent contact with persons who may transmit infection.

Patient Education and Health Maintenance

* Teach patient signs and symptoms of nephrotic syndrome, causes, purpose of prescribed treatments, and importance of long-term therapy to prevent ESRD.
* Instruct patient on adverse effects of prescribed medications and methods of preventing infection if taking immunosuppressant.
* Carefully review with patient and family dietary and fluid restrictions; consult dietitian for assistance in meal planning.
* Discuss the importance of maintaining exercise, decreasing cholesterol and fat intake, and changing other risk factors, such as smoking, obesity, and stress, to reduce risk of severe thromboembolic complications.
* In patients with severe disease, prepare for dialysis and possible transplantation.

**Evaluation: Expected Outcomes**

* Vital signs remain stable; edema decreased
* No signs of infection

**Tuberculosis of the urinary tract**

**Pathophysiology**

Tuberculosis of the urinary tract is caused by *Mycobacterium tuberculosis* which travels from the lungs by means of the bloodstream to the kidneys.

In the kidney, it may lie dormant for years causing low-grade inflammation and the characteristic tubercles.

If it continues to multiply, the tubercles enlarge to form cavities hence destruction of parenchymal tissue. It spreads down the urinary tract into the bladder and may also infect the prostate, epididymis, and testicles in men.

**Clinical Manifestations**

Signs and symptoms are mild;

* Slight afternoon fever, weight loss, night sweats, loss of appetite, and general malaise.
* Hematuria (microscopic or gross) and pyuria may be present.
* Pain, dysuria, and urinary frequency show bladder involvement.
* Cavity formations and calcifications are noted on an intravenous urogram.

**Assessment and Diagnostic Findings**

A search for tuberculosis elsewhere in the body is conducted when tuberculosis of the kidney or urinary tract is found.

* Ask about possible exposure to tuberculosis.
* Obtain three or more clean-catch, first-morning urine specimens for culture for *M. tuberculosis.*
* Erythrocyte sedimentation rate (ESR) is usually elevated and is helpful in monitoring response to treatment.
* Intravenous urography, biopsy, and urine culture for acid-fast bacilli.
* Polymerase chain reaction (PCR) provides a much faster diagnosis of urinary *M. tuberculosis.*

**Medical Management**

The goal of treatment is to eradicate the offending organism.

* Combinations of ethambutol, isoniazid, and rifampin
* Surgical intervention to treat obstruction and to remove an extensively diseased kidney
* Proper nutrition, adequate rest, and good hygiene practices.
* A scrotal support may be used by male patients with genital swelling.

**Nursing Management**

Nursing interventions focus on patient education to promote effective self-care at home and to prevent active recurrence or transmission of disease.

* Teach to adhere to prescribed medications, side effects, and to complete the therapy.
* Educate on the nature of tuberculosis; cause, its spread, treatment and follow-up care.
* Men to use condoms during sexual intercourse to prevent spread of the organisms;
* Those with penile or urethral tuberculosis to abstain from intercourse during treatment.
* Encourage to maintain a well-balanced diet, adequate intake of fluids, and exercise
* Follow-up to reinforce the importance of taking medications exactly as prescribed
* Counsel on follow-up examinations (urine cultures, intravenous urograms) for 1 year.
* Reinstitute treatment if a relapse occurs
* Monitor for complications: ureteral stenosis or bladder contractures during healing

**Renal trauma**

Trauma to abdomen, flank, or back may produce renal injury. Suspect renal trauma in a patient with multiple injuries.

**Pathophysiology and Etiology**

* Blunt trauma (falls, sporting accidents, motor vehicle accidents) can suddenly move the kidney out of position and in contact with a rib or lumbar vertebral transverse process, resulting in injury.
* Penetrating trauma (gunshot and stab wounds) may directly injure the kidneys

**Blunt renal trauma is classified into four groups**

1. Contusion: bruises or hemorrhages under the renal capsule; capsule and collecting system intact
2. Minor laceration: superficial disruption of the cortex; renal medulla and collecting system are not involved
3. Major laceration: parenchymal disruption extending into cortex and medulla, possibly involving the collecting system
4. Vascular injury: tears of renal artery or vein
* Minor injuries: contusion, minor lacerations, hematomas
* Major injuries: major lacerations and rupture of kidney capsule (by expanding hematoma)
* Critical injuries: multiple and severe lacerations and renal pedicle injury (renal artery and vein are torn away from the kidney)

Eighty percent of patients with renal trauma will have injuries to other organ systems

**Clinical Manifestations**

* Hematuria is common but not indicative of severity of injury.
* Flank pain; perirenal hematoma.
* Nausea, vomiting, abdominal rigidity from ileus (in retroperitoneal bleeding).
* Shock from severe or multiple injuries.

**Diagnostic Evaluation**

* History of injury; determine if injury was caused by blunt or penetrating trauma
* IVU with nephrotomograms to define extent of injury to involved kidney and the function of contralateral kidney.
* CT scan differentiates between major and minor injuries.
* Arteriography if necessary to evaluate the renal artery.

**Management**

* Contusions and minor lacerations are managed conservatively: bed rest, I.V. fluids, and monitoring of serial urines for clearing of hematuria.
* Major lacerations are surgically repaired.
* Ruptures are surgically repaired, usually by partial nephrectomy.
* Renal pedicle injury this hemorrhage requires immediate surgical repair and possible nephrectomy.

History of renal injury, the patient presents in shock, suspect a renal pedicle injury. This is a hemorrhagic emergency requiring immediate treatment of shock and preparation for surgery.

**Complications**

* Shock with cardiovascular collapse
* Hematoma or urinoma formation, abscess formation
* Hypertension
* Pyelonephritis
* Nephrolithiasis

**Nursing management**

**Nursing Assessment**

* Obtain history of traumatic event and any history of renal disease.
* Inspect for any abrasions, lacerations, or entrance and exit wounds to upper abdomen or lower thorax.
* Monitor blood pressure and pulse to assess for bleeding and impending shock; perirenal hemorrhage may cause rapid exsanguination.
* Assess for presence and degree of hematuria.

Watch for sudden change in the patient's condition, drop in blood pressure, increasing flank or abdominal pain and tenderness, or palpable mass in flank; may indicate hemorrhage, which requires surgical intervention.

**Nursing Diagnoses**

* Ineffective (Renal) Tissue Perfusion related to injury
* Impaired Urinary Elimination related to injury
* Acute Pain related to injury

**Planning**

**Goals:**

* To restore and maintain renal perfusion
* Preserving urinary elimination
* Controlling pain

**Nursing Interventions**

Restoring and Maintaining Renal Perfusion

* Assess vital signs frequently; BP, heart rate, and CVP to monitor for hemorrhage and impending shock.
* Assess abdomen and back for local tenderness and palpable mass, swelling, and ecchymosis, indicating hemorrhage or urine extravasation.
* Outline original mass with marking pen for future comparison of size.
* Establish I.V. access for support of blood pressure with fluids or vasopressors, replacement of blood, and perfusion of kidneys.
* Monitor serial hematocrit determinations to rule out continued bleeding

Preserving Urinary Elimination

* Save, inspect, and compare each urine specimen to follow the progression of hematuria.
	+ Label each specimen with date and time.
	+ If specimen is not grossly bloody, dipstick for blood or send to laboratory for microscopic examination.
* Monitor intake and output carefully.
* Give antibiotics to prevent infection from perirenal hematoma or urinoma, or severely contaminated wounds.
* Monitor for paralytic ileus (lack of bowel sounds) caused by retroperitoneal bleeding.
	+ Keep patient NPO until bowel sounds return.
	+ Administer I.V. fluids to maintain urine output.

Controlling Pain

* Administer analgesic medication; be cautious with drugs that may aggravate hypotension or mask complications of hemorrhage.
* Encourage bed rest and position of comfort until hematuria clears to facilitate healing of minor injuries.
* Expect a low-grade fever with retroperitoneal hematomas as absorption of the clot occurs; administer antipyretics as ordered for comfort.

Patient Education and Health Maintenance

* Instruct patient not to engage in strenuous activity for at least 1 month after blunt trauma to minimize incidence of delayed or secondary bleeding.
* Teach patient signs and symptoms of late complications infection and nephrolithiasis.
* Advise patient to have blood pressure measured frequently and consistently to monitor self for hypertension.
* Review safety precautions to prevent injuries for the future.

**Evaluation: Expected Outcomes**

* Vital signs stable
* Serial urines clearing
* Reports decreased pain

**Renal tumours**

Renal cell carcinoma is the most common malignant renal tumor, twice more common in men than in women. Most renal cell tumors are found in the renal parenchyma and develop with few (if any) symptoms.

Pathophysiology and Etiology

* Unknown etiology; weak association with cigarette smoking
* Most frequently occurs in persons between ages 40 and 60
* Aggressive cancer in which metastasis occurs rapidly, commonly before diagnosis

**Clinical Manifestations**

* Many renal tumors are asymptomatic only discovered on routine physical examination as a palpable abdominal mass.
* Weight loss, fever, and night sweats from systemic effects of renal cancer.
* Classic triad (late symptoms):
	+ Hematuria intermittent or continuous, microscopic or gross
	+ Flank pain from distention of renal capsule, invasion of surrounding structures
	+ Palpable mass in flank

**Diagnostic Evaluation**

* Ultrasonography helpful in differentiating renal cyst from renal tumor.
* CT scan or MRI for patients with urographic findings suggesting tumor; useful for detecting, categorizing, and staging a renal mass.
* IVP used as a screening procedure but may fail to detect some renal tumors.

**Management**

Goal: to eradicate the tumor and prevent metastasis.

**Radical Nephrectomy**

Removal of kidney and associated tumor, adrenal gland, surrounding perirenal fat, Gerota's fascia, and possibly regional lymph nodes provides maximum opportunity for disease control

**Renal Artery Embolization**

Preoperative occlusion of renal artery followed by nephrectomy for patient with large vascular tumor

* Catheter is advanced into renal artery.
* Embolizing material (Gelfoam, steel coils, blood clot) is injected into artery to occlude the tumor vessels.
* This decreases tumor vascularity and minimizes blood loss, relieves pain, and devitalizes the tumor, decreasing the chance for tumor cell dissemination at time of surgery.
* Monitor for postinfarction syndrome (lasts 2 to 3 days) severe abdominal pain, nausea, vomiting, diarrhea, fever.
* Complications arterial obstruction, bleeding, decreased renal function.

**Chemotherapy** **and Immunotherapy**

Renal cell carcinomas are generally refractory to chemotherapeutic agents, radiation, and hormonal manipulation.

**Complications**

Metastasis to the lung, bone, liver, brain, and other areas

**Nursing Assessment**

* Assess for clinical manifestations of systemic disease fatigue, anorexia, weight loss, pallor, fever as well as evidence of metastasis.
* Assess cardiopulmonary and nutritional status before surgery.
* Monitor for adverse effects and complications of diagnostic tests and treatment.
* Assess pain control and coping ability.

**Nursing Diagnoses**

* Anxiety related to diagnosis of cancer and possibility of metastatic disease
* Acute Pain and Hyperthermia related to post infarction syndrome

**Nursing Interventions**

Reducing Anxiety

* Explain each diagnostic test, its purpose, and possible adverse reactions. Obtain informed consent
* Assess patient's understanding about diagnosis and treatment options. Answer questions, and encourage more thorough discussion
* Encourage patient to discuss fears and feelings; involve family and significant others in teaching.

Controlling Symptoms of Postinfarction Syndrome

* Administer analgesics as prescribed to control flank and abdominal pain
* Encourage rest, and assist with positioning for 2 to 3 days until syndrome subsides
* Obtain temperature every 4 hours, and administer antipyretics as indicated
* Restrict oral intake and provide I.V. fluids while patient is nauseated
* Administer antiemetics as ordered

Patient Education and Health Maintenance

* Inform the patient where and when to go for follow-up (surgeon, primary care provider, oncologist, and radiologist for metastatic workup and treatment).
* Explain the importance of follow-up for hypertension and renal function, even if patient feels well.
* Advise patient with one kidney to wear a Medic Alert bracelet and notify all health care providers because potentially nephrotoxic medications and procedures must be avoided.

**Evaluation: Expected Outcomes**

* Asks questions and verbalizes fears
* Afebrile; states reduced pain

**Hydronephrosis**

Hydronephrosis is dilation of the renal pelvis and calyces of one or both kidneys due to an obstruction.

**Pathophysiology**

Obstruction to the normal flow of urine causes the urine to back up, resulting in increased pressure in the kidney.

If obstruction is in the urethra or the bladder the back pressure affects both kidneys, but if the obstruction is in one of the ureters because of a stone or kink, only one kidney is damaged.

**Causes of obstruction**

* Renal stone that has formed in the renal pelvis moves into the ureter
* Tumor pressing on the ureter
* Bands of scar tissue resulting from an abscess or inflammation near the ureter that pinches it.
* Odd angle of the ureter as it leaves the renal pelvis or an unusual position of the kidney, favoring a ureteral twist or kink
* Enlarged prostate gland common in elderly men,
* In pregnancy because of the enlarged uterus

Urine accumulates in the renal pelvis and distends the pelvis and its calyces resulting in atrophy of the kidney. As one kidney undergoes gradual destruction, the other kidney gradually enlarges (compensatory hypertrophy).

Ultimately, renal function is impaired.

**Acute renal failure**

Acute renal failure is a syndrome that results in a sudden decline in renal function. It is associated with increased BUN and creatinine, oliguria (less than 500 mL urine/24 hours), hyperkalemia, and sodium retention.

**Pathophysiology and Etiology**

**Causes**

* Prerenal causes result from conditions that decrease renal blood flow (hypovolemia, shock, hemorrhage, burns, impaired cardiac output, diuretic therapy)
* Postrenal causes arise from obstruction or disruption to urine flow anywhere along the urinary tract
* Intrarenal causes result from injury to renal tissue; intrarenal ischemia, toxins, immunologic processes, systemic and vascular disorders

**Clinical Progression**

* Onset: begins when the kidney is injured and lasts from hours to days.
* Oliguric/anuric phase (urine volume less than 400 to 500mL/24 hours).
	+ Rise in serum concentration of urea, creatinine, organic acids, and the intracellular cations potassium and magnesium.
	+ Decreased renal function: increased nitrogen retention but the patient is excreting more than 2 to 3 L of urine daily (nonoliguric or high-output renal failure).
* Diuretic phase: begins when the 24-hour urine volume exceeds 500 mL and ends when the BUN and serum creatinine levels stop rising.
* Recovery phase.
	+ Usually lasts several months to 1 year.
	+ Scar tissue remains, but the functional loss is not always clinically significant.

**Clinical Manifestations**

* Prerenal: decreased tissue turgor, dryness of mucous membranes, weight loss, hypotension, oliguria or anuria, flat neck veins, tachycardia
* Postrenal: obstruction to urine flow, BPH, nephrolithiasis
* Intrarenal: presentation based on cause; edema usually present
* Changes in urine volume and serum concentrations of BUN, creatinine, potassium etc.

**Diagnostic Evaluation**

* Urinalysis: proteinuria, hematuria, casts
* Rising serum creatinine and BUN levels
* Urine chemistry examinations to distinguish various forms of acute renal failure; decreased sodium
* Renal ultrasonography for renal size and to exclude a treatable obstructive uropathy

**Management**

Preventive Measures

* Identify patients with preexisting renal disease.
* Initiate adequate hydration before, during, and after any procedure requiring NPO status.
* Avoid nephrotoxicity; majority of drugs or their metabolites are excreted by the kidneys.
* Nonsteroidal anti-inflammatory drugs (NSAIDs), including the newer COX-2 inhibitors, may reduce glomerular filtration rate in people at risk for renal insufficiency
* Monitor chronic analgesic use; may cause interstitial nephritis and papillary necrosis.
* Prevent/treat shock with blood and fluid replacement. Prevent prolonged hypotension.
* Monitor urinary output and CVP hourly in critically ill to detect onset of renal failure
* Schedule diagnostic studies requiring dehydration so there are rest days especially in aged who may not have adequate renal reserve.
* Draining wounds, burns, can lead to dehydration, sepsis and renal damage.
* Avoid infection; give meticulous care to patients with indwelling catheters and I.V. lines
* Ensure the right person receives the right blood to avoid severe transfusion reactions

**Corrective and Supportive Measures**

* Correct reversible cause of acute renal failure; surgical relief of obstruction
* Monitor and correct underlying fluid excesses or deficits.
* Correct and control biochemical imbalances e.g. hyperkalemia.
* Restore and maintain blood pressure.
* Maintain nutrition.
* Hemodialysis, peritoneal dialysis, or continuous renal replacement therapy for patients with progressive renal failure

**Complications**

* Infection
* Arrhythmias due to hyperkalemia
* Electrolyte (sodium, potassium, calcium, phosphorus) abnormalities
* GI bleeding due to stress ulcers
* Multiple organ systems failure

**Nursing Assessment**

* History of cardiac disease, malignancy, sepsis, or intercurrent illness.
* Assess for exposure to nephrotoxic agents (antibiotics, NSAIDs, contrast agents).
* Physical examination for tissue turgor, pallor, alteration in mucous membranes, blood pressure, heart rate, pulmonary edema, and peripheral edema.
* Monitor intake and output.

**Nursing Diagnoses**

* Excess Fluid Volume related to decreased glomerular filtration rate and sodium retention
* Risk for Infection related to alterations in the immune system and host defenses
* Imbalanced Nutrition: Less Than Body Requirements related to catabolic state, anorexia, and malnutrition associated with acute renal failure
* Risk for Injury related to GI bleeding
* Disturbed Thought Processes related to the effects of uremic toxins on the central nervous system (CNS)

**Planning**

**Goals:**

Achieving Fluid and Electrolyte Balance

Preventing Infection

Maintaining Adequate Nutrition

Preventing GI Bleeding

Preserving neurological function

**Nursing Interventions**

Achieving Fluid and Electrolyte Balance

* Monitor for signs and symptoms of hypovolemia or hypervolemia
* Monitor urinary output and urine specific gravity; measure and record intake and output: urine, gastric suction, stools, wound drainage, perspiration (estimate).
* Monitor serum and urine electrolyte concentrations.
* Weigh the patient daily to estimate fluid balance; expected loss is 0.25 to 0.5 kg daily.
* Adjust fluid intake to avoid volume overload and dehydration.
	+ Fluid restriction is not usually initiated until renal function is quite low.
	+ During oliguric/anuric phase, give only enough fluids to replace losses (usually 400 to 500 mL/24 hours plus measured fluid losses).
	+ Fluid allowance should be distributed throughout the day.
	+ Avoid restricting fluids for prolonged periods because dehydration is dangerous to patients who cannot produce concentrated urine.
	+ Restrict salt and water intake if there is evidence of extracellular excess.
* Measure blood pressure regularly with patient in supine, sitting, and standing positions.
* Auscultate lung fields for rales.
* Inspect neck veins for engorgement, extremities, abdomen, sacrum, eyelids for edema.
* Evaluate for signs and symptoms of hyperkalemia, and monitor serum potassium levels.
	+ Report values above 5.5 mg/L.
	+ Watch for ECG
* Administer sodium bicarbonate or glucose and insulin to shift potassium into the cells.
* Administer cation exchange resin (sodium polystyrene sulfonate) orally or rectally to provide more prolonged correction of elevated potassium.
* Watch for cardiac arrhythmia and heart failure from hyperkalemia, electrolyte imbalance, or fluid overload. Have resuscitation equipment on hand in case of cardiac arrest.
* Instruct on importance of following prescribed diet, avoiding foods high in potassium.
* Prepare for dialysis when rapid lowering of potassium is needed.
* Administer blood transfusions during dialysis to prevent hyperkalemia from stored blood.
* Monitor acid base balance.
	+ Monitor arterial blood gas (ABG) levels as necessary.
	+ Prepare for ventilator therapy if severe acidosis is present or respiratory problems develop.
	+ Administer sodium bicarbonate for symptomatic acidosis (bicarbonate deficit).
	+ Be prepared to implement dialysis for uncontrolled acidosis.

Preventing Infection

* Monitor for infection, renal failure does not always demonstrate fever and leukocytosis.
* Remove bladder catheter as soon as possible; monitor for UTI.
* Ensure proper pulmonary hygiene to prevent lung edema and infection.
* Carry out meticulous wound care.
* Adjust the dosage of antibiotics because of renal impairment.

Maintaining Adequate Nutrition

* Collaborate with dietitian to regulate protein intake, metabolites that accumulate in blood are almost entirely from protein catabolism.
	+ Protein should be of high biologic value, rich in essential amino acids (dairy products, eggs, meat to prevent tissue catabolism for essential amino acids.
	+ Low-protein diet may be supplemented with essential amino acids and vitamins.
	+ As renal function declines, protein intake may be restricted proportionately.
	+ Protein will be increased if the patient is on dialysis to allow for the loss of amino acids occurring during dialysis.
* High-carbohydrate feedings promote protein-sparing and provide additional calories.
* Weigh daily.
* Monitor BUN, creatinine, electrolytes, serum albumin, total protein, and transferrin
* Restrict food and fluids containing large amounts of sodium, potassium, and phosphorus

Preventing GI Bleeding

* Examine all stools and emesis for gross and occult blood.
* Administer H2-receptor antagonist, such as cimetidine or ranitidine or nonaluminum or magnesium antacids as prophylaxis for gastric stress ulcers.
* If H2-receptor antagonist is used, adjust the dose for the degree of renal impairment.
* Prepare for endoscopy when GI bleeding occurs.

Preserving Neurologic Function

* Speak to the patient in simple statements, using repetition when necessary.
* Maintain predictable routine, with minimum change.
* Watch for and report mental status changes: somnolence, lassitude, lethargy, fatigue, irritability, disorientation, twitching, seizures
* Correct cognitive distortions.
* Use seizure precautions: padded side rails, airway and suction equipment at bedside.
* Encourage and assist patient to turn and move due to drowsiness and lethargy
* Use music tapes to promote relaxation.
* Prepare for dialysis, which may help prevent neurologic complications.

Patient Education and Health Maintenance

* Explain residual defects in kidney function for long period after acute illness.
* Explain need for routine urinalysis and follow-up examinations.
* Advise avoidance of any medications unless specifically prescribed.
* Recommend resuming activity gradually because muscle weakness will be present from excessive catabolism.

**Evaluation: Expected Outcomes**

* Blood pressure stable, no edema or shortness of breath
* No signs of infection
* Food intake adequate, maintaining weight
* Stools heme negative
* Appears more alert, sleeps less during the day

**Chronic renal failure (end-stage renal disease)**

Chronic renal failure (CRF, end-stage renal disease, ESRD) is a progressive deterioration of renal function.

It leads to fatal uremia (an excess of urea and other nitrogenous wastes in the blood) unless dialysis or kidney transplantation is performed.

Most cases are asymptomatic until later stages.

**Pathophysiology and Etiology**

Causes

* Hypertension, prolonged and severe
* Diabetes mellitus
* Glomerulopathies (from lupus or other disorders)
* Interstitial nephritis
* Hereditary renal disease, polycystic disease
* Obstructive uropathy
* Developmental or congenital disorder

**Consequences of Decreasing Renal Function**

Stages: decreased renal reserve- renal insufficiency- renal failure- ESRD.

* Retention of sodium and water causes edema, heart failure, hypertension and ascites.
* Decreased glomerular filtration rate (GFR) causes stimulation of renin angiotensin axis and increased aldosterone secretion, which raises blood pressure.
* Metabolic acidosis results from the kidney's inability to excrete hydrogen ions, produce ammonia, and conserve bicarbonate.
* Decreased GFR causes increase in serum phosphate, decrease in serum calcium and subsequent bone resorption of calcium.
* Erythropoietin production by the kidney decreases, causing profound anemia.
* Uremia affects the CNS, causing altered mental function, personality changes, seizures, and coma.

**Clinical Manifestations**

* GI: anorexia, nausea, vomiting, hiccups, ulceration of GI tract, and hemorrhage
* Cardiovascular: hyperkalemic ECG changes, hypertension, pericarditis, pericardial effusion, pericardial tamponade
* Respiratory: pulmonary edema, pleural effusions, pleural rub
* Neuromuscular: fatigue, sleep disorders, headache, lethargy, muscular irritability, peripheral neuropathy, seizures, coma
* Metabolic and endocrine: glucose intolerance, hyperlipidemia, sex hormone disturbances causing decreased libido, impotence, amenorrhea
* Fluid, electrolyte, acid base disturbances usually salt and water retention but may be sodium loss with dehydration, acidosis, hyperkalemia, hypermagnesemia, hypocalcemia
* Dermatologic: pallor, hyperpigmentation, pruritus, ecchymoses, uremic frost
* Skeletal abnormalities: renal osteodystrophy resulting in osteomalacia
* Hematologic: anemia, defect in quality of platelets, increased bleeding tendencies
* Psychosocial functions: personality and behavior changes, alteration in cognitive processes

**Diagnostic Evaluation**

* Complete blood count (CBC) anemia (a characteristic sign)
* Elevated serum creatinine, BUN, phosphorus
* Decreased serum calcium, bicarbonate, and proteins, especially albumin
* ABG levels: low blood pH, low carbon dioxide, low bicarbonate
* 24-hour urine for creatinine, protein, creatinine clearance

**Management**

**Goal:** conservation of renal function as long as possible.

* Detection and treatment of reversible causes of renal failure (eg, bring diabetes under control; treat hypertension)
* Dietary regulation low-protein diet supplemented with essential amino acids or their keto analogues to minimize uremic toxicity and to prevent wasting and malnutrition
* Treatment of associated conditions to improve renal dynamics
	+ Anemia: recombinant human erythropoietin, a synthetic hormone
	+ Acidosis: infusion or oral administration of sodium bicarbonate
	+ Hyperkalemia: restriction of dietary potassium; administration of cation exchange resin
	+ Phosphate retention: decrease dietary phosphorus (chicken, milk, legumes, carbonated beverages); administer phosphate-binding agents because they bind phosphorus in the intestinal tract
* Maintenance dialysis or kidney transplantation when symptoms can no longer be controlled with conservative management

**Complications**

Death

**Nursing Management**

**Nursing Assessment**

* Obtain history of chronic disorders and underlying health status.
* Assess degree of renal impairment and involvement of other body systems by obtaining a review of systems and reviewing laboratory results.
* Perform thorough physical examination, including vital signs, cardiovascular, pulmonary, GI, neurologic, dermatologic, and musculoskeletal systems.
* Assess psychosocial response to disease process including availability of resources and support network.

**Nursing Diagnoses**

* Excess Fluid Volume related to reduced kidney functions
* Imbalanced Nutrition: Less Than Body Requirements related to anorexia, nausea, vomiting, and restricted diet
* Impaired Skin Integrity related to uremic frost and changes in oil and sweat glands
* Constipation related to fluid restriction and ingestion of phosphate-binding agents
* Risk for Injury while ambulating related to potential fractures and muscle cramps due to calcium deficiency
* Ineffective Therapeutic Regimen Management related to restrictions imposed by CRF and its treatment

**Planning**

**Goals:**

Maintaining Fluid and Electrolyte Balance

Maintaining Adequate Nutritional Status

Maintaining Skin Integrity

Preventing Constipation

Ensuring a Safe Level of Activity

Increasing Understanding of and Compliance with Treatment Regimen

**Nursing Interventions**

Maintaining Fluid and Electrolyte Balance

Same as in acute renal failure,

Maintaining Adequate Nutritional Status

Same as in acute renal failure,

Maintaining Skin Integrity

* Keep skin clean while relieving itching and dryness.
	+ Basis soap
	+ Sodium bicarbonate added to bath water
	+ Oatmeal baths
	+ Bath oil added to bath water
* Apply ointments or creams for comfort and to relieve itching.
* Keep nails short and trimmed to prevent excoriation.
* Keep hair clean and moisturized.
* Administer antihistamines for relief of itching if indicated, but discourage patient from taking over the counter drugs without discussing with health care provider.

Preventing Constipation

* Be aware that phosphate binders cause constipation that cannot be managed with usual interventions.
* Encourage high-fiber diet, bearing in mind the potassium content of some fruits and vegetables.
	+ Commercial fiber supplements may be prescribed.
	+ Use stool softeners as prescribed.
	+ Avoid laxatives and cathartics that cause electrolyte toxicities (compounds containing magnesium or phosphorus).
	+ Increase activity as tolerated.

Ensuring a Safe Level of Activity

* Monitor serum calcium and phosphate levels; watch for signs of hypocalcemia or hypercalcemia
* Inspect patient's gait, range of motion, and muscle strength
* Administer analgesics, and provide massage for severe muscle cramps
* Monitor X-rays and bone scan results for fractures, bone demineralization, and joint deposits.
* Increase activity as tolerated avoid immobilization because it increases bone demineralization.
* Administer:
	+ Phosphate-binding medications or calcium carbonate, with meals and snacks to lower serum phosphorus
	+ Calcium supplements between meals to increase serum calcium
	+ Vitamin D to increase absorption and utilization of calcium

Increasing Understanding of and Compliance with Treatment Regimen

* Prepare patient for dialysis or kidney transplantation.
* Offer hope with reality.
* Assess patient's understanding of treatment regimen as well as concerns and fears.
* Explore alternatives that may reduce or eliminate adverse effects of treatment.
	+ Adjust schedule so rest can be achieved after dialysis.
	+ Offer smaller, more frequent meals to reduce nausea and facilitate taking medication.
* Encourage strengthening of social support system and coping mechanisms to lessen the impact of the stress of chronic kidney disease.
* Provide social work referral.
* Enforce behavioral changes if noncompliant with therapy or control of underlying condition.
* Discuss option of supportive psychotherapy for depression.
* Promote decision making by the patient.
* Refer patients and family members to renal support agencies

Patient Education and Health Maintenance

* To promote adherence to the therapeutic program, teach the following:
	+ Weigh self every morning to avoid fluid overload.
	+ Drink limited amounts of fluids only when thirsty.
	+ Measure allotted fluids, and save some for ice cubes; sucking on ice is thirst quenching.
	+ Eat food before drinking fluids to alleviate dry mouth.
	+ Use hard candy or chewing gum to moisten mouth.
* Encourage all people with the following risk factors to obtain screening for chronic kidney disease: elderly people, ethnic minorities, diabetics, hypertension, those with autoimmune disease, and those with family history of kidney disease.

**Evaluation: Expected Outcomes**

* Blood pressure stable, no excessive weight gain
* Tolerates small feedings of low-protein, high-carbohydrate diet
* No skin excoriation; reports some relief of itching
* Passes small, firm stool daily
* Ambulates without falls
* Asks questions and reads education materials about dialysis