

Objectives:

1. Identify the significant subjective and objective information related to the urinary system that should be obtained from a client.
2. Describe the appropriate techniques used in the physical assessment of the urinary system.
3. Explain the nursing management of urinary tract infections.
4. Describe the common causes and management of bladder dysfunctions.
5. Differentiate among ureteral, suprapubic, nephrostomy, and urethral catheters with regard to indications for use and nursing responsibilities.
6. Explain the nursing management of the client undergoing nephrectomy or urinary diversion surgery.
7. Differentiate between acute and chronic renal failure.
8. Explain the conservative management and related nursing management of the client with chronic renal failure.
9. Differentiate between peritoneal dialysis and hemodialysis in terms of purpose, indication for use, advantages and disadvantages, and nursing responsibilities.

Readings:

1. Lewis, Medical/Surgical Nursing: 7th edition, chapters 45-47; 6th edition, chapters 43-45.
2. “How acute renal failure puts the brakes on kidney function”, by Diana Campbell, RN, BSN, MPA. Nursing 2003, January 2003, volume 22 Number 1, pages 59 – 63.
http://findarticles.com/p/articles/mi_qa3689/is_200301/ai_n9190956
3. “Anemia in Patients with Chronic Renal Failure and in Patients undergoing Chronic Hemodialysis,” by Edmund G. Lowrie et al,
<http://msl1.mit.edu/esd10/kidneys/hndbkhtml/ch19.htm>
4. In order to see what educational material is available for lay people, browse the website of the National Kidney Foundation, <http://www.kidney.org/>

Urinary/Renal Homework Assignment:

1. Case Study: Chronic Kidney Disease, p. 1231 in Lewis, 7th edition (p. 1244 in Lewis, 6th edition).
2. Complete the quiz located at the end of this module. Return both parts of homework assignment to instructor at nursetheory@pcc.edu.

Urinary/Renal System

Urination occurs when the detrusor muscle (controlled by the parasympathetic nervous system).

Urinary incontinence affects approximately 10 million people in the U. S. and is caused by:

- Confusion
- Depression
- Infection
- Medication
- Restricted mobility
- Stool impaction
- Disease process

Stress incontinence is the leaking of urine with sneezing, coughing, increased physical activity, lifting heavy objects, laughing - often caused from multiple child birth, obesity, muscle strains, aging and the atrophy of the female urethra, obstetric complications, in men after prostate surgery.

Urinary retention – the inability to completely empty the bladder with a voiding—is caused by:

- CVA
- CNS disorder such as back surgeries, tumors
- Diabetes
- Multiple Sclerosis
- Spinal cord injury
- Medications/narcotics

There is increased risk of infection if urine is left in the bladder; also risk for over-distension of bladder wall causing the capillaries to break and allow pathogens to enter the blood stream.

To measure retention, the most desirable method is to use an ultrasound bladder scanner. If a scanner is not available, catheterize for a post-void residual – have the patient void and immediately insert a sterile straight catheter and drain out any residual urine from the bladder. Normal residual should be less than 50cc. If the amount is over 100 – 150cc the physician will most likely order routine straight catheterization – usually every 6 hours. The goal should be to keep less than 300cc in the bladder maximum; the frequency of the straight catheterization will depend on how much urine is drained from the bladder.

Teaching clean intermittent catheterization: see Lewis, 7th edition, p. 1187-1188.

Foley catheter care – keeping the drainage system “closed” is considered best as any break in the system increases the risk of infection that the indwelling foley already causes.

Current catheter care includes:

- Cleansing of the urinary meatus with soap and water twice a day or every shift, per facility protocol.
- Positioning of the bag and tubing to promote gravity flow
- Changing catheter and bag every 6 weeks or per facility protocol

Catheters should be placed only for the patient’s welfare, never for convenience of staff.

Infectious Diseases

Urinary Tract Infection (UTI)

- Second most common bacterial infection.
- Sexually active women outnumber men 30 – 1
- 100,000 people a year are hospitalized
- 8,000 die each year
- 35 – 45% of all nosocomial (hospital acquired) infections
- E. coli (Escherichia coli) the most common culprit

Symptoms include:

Frequency, urgency, suprapubic pain, dysuria, foul smelling urine, frequent voiding, concentrated urine, hematuria, pyuria, flank pain, fever, vomiting.

Pyelonephritis

Acute or chronic inflammatory process of renal pelvis and parenchyma of the kidney; generally caused by bacterial invasion of E. coli, often associated with vesicoureteral reflux.

- Pre-existing factors:
- Bladder tumors
- Prostatic hyperplasia
- Strictures
- Urinary stones
- Pregnancy

Clinical manifestations vary from mild lassitude to severe, sudden onset of chills, fever, vomiting, malaise, flank pain, dysuria, frequent urination, costovertebral tenderness.

Urinary Tract Calculi (Nephrolithiasis)

- Stone disorders are more common in men than women, except for struvite (magnesium-ammonium-phosphate) stones associated with UTI.
- Increased incidence in ages 20-55
- More often Caucasian
- Increased incidence with family history
- Recurrence 80%
- Seasonal variation – increased incidence in summer, possible due to dehydration

Etiology:

- Metabolic – calcium, oxaluric acid, uric acid, citric acid
- Dietary – increased intake of proteins can increase uric acid in body; increased intake of teas, fruit can increase oxalic acid in the body; increased calcium intake
- Warm climate
- Sedentary, immobile lifestyle

Management:

- Pain control with narcotics
- Hydration
- Surgical intervention if necessary
- Laser treatment
- Lithotripsy
- Evaluate composition of stone to determine if etiology

Acute Renal Failure (ARF)

The normal glomerular filtration rate (GFR) is approximately 125ml/min, with an average of 1ml/min urine excreted.

ARF is a rapid decline in renal function with progressive azotemia, an accumulation of nitrogenous waste products (BUN/creatinine). Uremia is the condition in which the azotemia progresses to a symptomatic state.

- The most common causes: see Lewis, 7th ed., ch. 47
- Prolonged hypotension
- Hypovolemia
- Nephrotoxic agent
- Pre-renal causes – caused by factors outside the kidney that impair renal blood flow and lead to decreased glomerular filtration.
- Intrarenal causes – conditions that lead to damage; acute tubular necrosis caused by ischemia, nephrotoxins, hemoglobin from hemolyzed RBC's, myoglobin from necrotic muscles.
- Post-renal causes – benign prostatic hyperplasia, tumors, mechanical obstruction, calculi, trauma.

Clinical manifestations and nursing management—Lewis, 7th edition, ch. 47.

Phases of ARF

Initiating phase

- 1-7 days from the causative event
- An average duration of 10-14 days
- Urine less than 400cc in 24 hours
- Potential for fluid volume excess
- Metabolic acidosis
- Sodium imbalances – cannot conserve Na^+
- Potassium imbalances
- Calcium deficit/phosphate excess/Vitamin D deficit
- Nitrogenous product accumulation – BUN/creatinine

Diuretic phase

- Gradual increase in daily urine output to 1-3 liters/day, may reach 3-5 liters/day in 1-3 weeks
- May still have severe uremia
- Elevated BUN/creatinine levels
- End of the phase the acid-base, electrolyte, and BUN/creatinine values begin to normalize.

Recovery phase

- Glomerular Filtration Rate increases so BUN/creatinine stabilize and return to normal or near normal; major improvements in the first 1-2 weeks of this phase, may take up to 12 months to complete.
- Outcome is influenced by the patient's overall health as well as complications.
- Elderly are less likely to recover full kidney function.

Treatment

Temporary dialysis to control fluid volume, nitrogenous wastes, and potassium imbalances.

- Hemodialysis
- Peritoneal dialysis
- Continuous arterial venous filtration (CAVH)

Treating the cause(s) of the renal failure.

And giving supportive care until renal function returns, which may be up to 4-6 weeks.

Managing fluid and electrolyte balance.

Infection is the leading cause of death in ARF

Chronic Kidney Disease (CKD)

Progressive permanent failure of the kidneys to remove the nitrogenous wastes from the body.

Etiology

- Unresolved ARF
- Metabolic disorders, i.e. Diabetes

- Autoimmune disorders, such as Lupus
- Congenital disorders such as Polycystic Kidney Disease
- Nephrotoxins
- Trauma
- Environmental, lead poisoning
- Chronic analgesic abuse
- Chronic urinary reflux, chronic pyelonephritis
- Renal stones

Treatment

- Dialysis; hemodialysis, peritoneal dialysis
- Kidney transplant
- Diet restrictions – 2 gram sodium, 1 gram protein per kg of body weight, limited phosphorus, fluid restriction to 600 ml plus previous day's output.

Pathophysiologic changes:

Integumentary system – related to retained pigments, anemia, decreased sweat glands, decrease oil glands, deposition of phosphate crystals

- Pallid, grayish-bronze color
- Dry, scaly skin
- Ecchymoses, purpura
- Itchy skin

Cardiovascular system

- Hypertension – related to fluid and sodium overload, malfunction of the angiotensin system
- Pericarditis – pericardial sac irritated by uremic toxins
- Pericardial effusion – clinical sign – peridoxical pulse
- Tamponade – pericardial sac so full of fluid the heart is unable to pump

Pulmonary changes

- Pulmonary edema related to fluid overload
- Pleuritic pain
- Pleural rub
- Pleural effusions
- Pneumonitis – sputum thick, cough reflex depressed, pulmonary macrophage activity decreased

Gastrointestinal system

- Fetor uremicus (bad breath), gum ulceration, bleeding metallic taste, generalized stomatitis related to the urea in saliva
- Anorexia, nausea, vomiting
- Gastritis, ulcers
- Constipation – related to the use of phosphate binders to used to decrease the serum phosphate levels

Neurological system

- Mentation changes – shortened memory and attention span, lack of interest, confusion, stupor, coma, convulsions
- Slowing of peripheral nerve conduction – numbness, burning, restless leg syndrome, foot drop, burning feet

Skeletal system

- Calcium, phosphate, Vitamin D disorders
- Hypocalcaemia
- Hyperphosphatemia
- Hyperparathyroidism
- Inadequate Vitamin D metabolism (Vitamin D conversion to active metabolite occurs in the kidney and liver)
- Osteodystrophies

Genito-urinary system

- Decreased urinary output
- Decreased erythropoietin production
- Alteration in the angiotensin system
- Altered buffering capabilities

Significant lab values -

BUN (blood urea nitrogen) – measurement of urea nitrogen in serum; normal 20-25mg/100ml; rough determination of kidney function; can also be affected by protein in diet, blood in GI tract, and catabolic state.

Serum creatinine – superior to BUN in determining kidney function; creatinine is liberated from muscle tissue at a constant rate and is excreted via the kidneys at the same rate; normal 1-2mg/100ml

Creatinine clearance (calculated from the comparison of creatinine in volume of urine collected over 24 hours and serum creatinine) – is roughly equal to the glomerular filtration rate (GFR)

<u>Creatinine Clearance</u>	<u>Serum Creatinine</u>	<u>Renal function</u>
85 – 150	1.0 – 1.4	normal
50 – 84	1.5 – 2.0	mild failure/insufficiency
10 – 49	2.1 – 6.5	moderate failure
less than 10	over 6.5	severe
0	over 12	anuric

Potassium – normal 3.5 – 5.0 – elevated in renal failure

Calcium – normal 9.0 – 10.5mg/100ml

Phosphate – normal 3.0 – 4.5

**There is an inverse relationship between calcium and phosphate – as the phosphate rises, because it cannot be excreted by the kidneys, the serum calcium drops.

Urinary/Renal - Homework Assignment:

A. Case Study: Chronic Kidney Disease—Lewis, 7th edition, p. 1231; 6th edition, page 1244.

B. Urinary/Renal Quiz:

1. A patient's urinalysis indicates a large amount of protein in the urine. The nurse recognizes that this finding most likely indicates damage of the:
 - a. Glomerulus
 - b. Loop of Henle
 - c. Collecting duct
 - d. Proximal convoluted tubule

2. To assist the patient with stress incontinence, the nurse teaches the patient to:
 - a. Void every two hours to prevent leakage
 - b. Use absorptive perineal pads to contain urine
 - c. Perform pelvic floor muscle exercises 40-50 times a day.
 - d. Increase intra-abdominal pressure during voiding to empty the bladder completely.

3. The result of a patient's creatinine clearance test is 60 ml/min. The nurse equates this finding to a glomerular filtration rate of:
 - a. 30 ml/min
 - b. 60 ml/min
 - c. 120 ml/min
 - d. 240 ml/min

4. A patient with an elevated blood urea nitrogen (BUN) and serum creatinine is scheduled for a renal arteriogram. The nurse should question an order from radiology for bowel preparation with the use of:
 - a. Castor oil
 - b. Fleet enema
 - c. Tap-water enemas
 - d. Bisacodyl (Dulcolax) tablets

5. Trimethoprim and sulfamethoxazole (Bactrim) twice a day for 7 days is ordered for a patient who has a recurrent relapse of an E. coli urinary tract infection. The nurse identifies a nursing diagnosis of risk for infection related to lack of knowledge regarding prevention of recurrence and instructs the patient to:
 - a. Take the anti-infective drug for the full 7 days, even if the symptoms are improved in a few days.

- b. Return to the clinic in 3 days so that a urine culture can be done to evaluate the effectiveness of the drug
 - c. Increase the effectiveness of the drug by drinking at least a quart of cranberry juice a day to acidify the urine
 - d. Take 2 of the pills a day for 5 days and reserve the rest of the pills to take if the symptoms reappear within 2 weeks
6. When analyzing the results of a patient's urinalysis, the nurse recognizes that a urinary tract infection is indicated by the finding of:
- a. Protein: 4+
 - b. Glucose: 3+
 - c. WBC: 20-26/hpf
 - d. Specific gravity: 1.01
7. A 79 year old patient with diabetes mellitus is hospitalized with fever, anorexia, and confusion. The physician suspects acute pyelonephritis when the urinalysis reveals bacteriuria. An appropriate collaborative problem identified by the nurse for the patient is:
- a. Potential complication: urosepsis
 - b. Potential complication: hydronephrosis
 - c. Potential complication: acute renal failure
 - d. Potential complication: chronic pyelonephritis
8. A 72 year old man has benign prostatic hypertrophy, which has contributed to repeated bouts of cystitis. He is now admitted to the hospital with chills, fever, and nausea and vomiting. A urinalysis is positive for bacteria, RBC's, and WBC's. The nurse suspects the presence of an upper urinary tract infection when assessment of the patient reveals:
- a. Suprapubic pain
 - b. Foul-smelling urine
 - c. A distended bladder
 - d. Costovertebral tenderness
9. When teaching a patient with acute glomerulonephritis about the condition, the nurse explains that injury to the kidneys results from:
- a. Prolonged high blood pressure in the renal arteries
 - b. A severe bacterial infection that is unresponsive to antibiotics
 - c. Invasion of the kidney by viruses that cause measles or hepatitis
 - d. Accumulation of antibody-antigen complexes and complement in the glomeruli of the kidney
10. To evaluate the effectiveness of treatment for the patient with nephrotic syndrome, the nurse:
- a. Monitors the blood pressure q4hr
 - b. Measures the abdominal girth daily

- c. Measures daily dietary protein intake
- d. Checks the urine of each voiding for protein