

**Renal #1 – Histology**

- 1.1) What is the basic functional unit of the kidney?
  - a) Glomerulus
  - b) Renal corpuscle
  - c) Nephron
  - d) Medullary ray
  - e) Cortical labyrinth
- 1.2) Which of the following areas contains the vasa recta, which is part of the counter-current exchange system that regulates the concentration of urine?
  - a) Adrenal
  - b) Capsule
  - c) Cortex
  - d) Medulla
  - e) Lobes/Lobules
- 2.1) Where does nephron blood filtration begin?
  - a) Bowman capsule
  - b) Vascular pole
  - c) Urinary pole
  - d) Proximal thick segment
  - e) Thin segment
- 2.2) Which of the following areas contains the modified epithelial cells that form the macula densa?
  - a) Between proximal convoluted tubule and proximal straight tubule
  - b) Between proximal straight tubule and thin descending limb
  - c) Between thin ascending limb and thick ascending limb
  - d) Between thick ascending limb and distal convoluted tubule
  - e) Between distal convoluted tubule and cortical collecting duct
- 3) Which of the following is NOT true of juxtamedullary nephrons?
  - a) Located proximal to the base of medullary pyramids
  - b) Are composed of short loops of Henle
  - c) Essential in the urine-concentrating mechanism
  - d) Extend into the inner region of the pyramid
- 4.1) Which of the following contains a large number of aquaporin-1 water channels that allow for fast movement of water?
  - a) Endothelium of the glomerular capillaries
  - b) Glomerular basement membrane (GBM)
  - c) Podocytes
  - d) Visceral layer of Bowman capsule
  - e) Filtration slit membrane
- 4.2) The GBM acts as a physical barrier, an ion-selective filter, and is composed of what type of collagen?
  - a) Type I
  - b) Type II
  - c) Type III
  - d) Type IV
  - e) Type V

- 5) What is the proposed role of the mesangium (mesangial cells)?
- Activate the renin-angiotensin-aldosterone system
  - Regulate blood pressure
  - Clean the GBM
  - Receives the ultrafiltrate
  - Equilibrates salt and water
- 6.1) What is a role of the collecting tubules and collecting ducts?
- Exchanges  $\text{Na}^+$  for  $\text{K}^+$  under aldosterone regulation
  - Allows for passive diffusion of  $\text{NaCl}$  into the interstitium
  - Has ADH-regulated water channels and contains light and dark cells
  - Has a positive gradient for re-absorption of ions such as  $\text{Ca}^{++}$  and  $\text{Mg}^+$
  - Permeable allowing for water diffusion out and salt diffusion in
- 6.2) Which of the following areas is responsible for re-absorbing about 80% of the daily filtrate (150L of fluid)?
- Proximal convoluted tubule
  - Proximal straight tubule
  - Thin segment of Loop of Henle
  - Distal straight tubule (thick ascending limb)
  - Distal convoluted tubule
- 6.3) What is a role of the thin ascending limb of the loop of Henle?
- Exchanges  $\text{Na}^+$  for  $\text{K}^+$  under aldosterone regulation
  - Allows for passive diffusion of  $\text{NaCl}$  into the interstitium
  - Has ADH-regulated water channels and contains light and dark cells
  - Has a positive gradient for re-absorption of ions such as  $\text{Ca}^{++}$  and  $\text{Mg}^+$
  - Permeable allowing for water diffusion out and salt diffusion in
- 6.4) What is a role of the distal convoluted tubule?
- Exchanges  $\text{Na}^+$  for  $\text{K}^+$  under aldosterone regulation
  - Allows for passive diffusion of  $\text{NaCl}$  into the interstitium
  - Has ADH-regulated water channels and contains light and dark cells
  - Has a positive gradient for re-absorption of ions such as  $\text{Ca}^{++}$  and  $\text{Mg}^+$
  - Permeable allowing for water diffusion out and salt diffusion in
- 6.5) What is a role of the distal straight tubule (thick ascending limb)?
- Exchanges  $\text{Na}^+$  for  $\text{K}^+$  under aldosterone regulation
  - Allows for passive diffusion of  $\text{NaCl}$  into the interstitium
  - Has ADH-regulated water channels and contains light and dark cells
  - Has a positive gradient for re-absorption of ions such as  $\text{Ca}^{++}$  and  $\text{Mg}^+$
  - Permeable allowing for water diffusion out and salt diffusion in
- 7) What is the role of the interstitial cells of the kidney parenchyma within the cortex?
- Compress tubular structures oriented to the long axis
  - Synthesize and secrete collagen and glycosaminoglycans
  - Resemble and function as myofibroblasts
  - Contain lipid droplets and secrete hormone that reduces blood pressure
  - Synthesis of prostaglandins and prostacyclins
- 8.1) A translocation of the AQP-2 containing intracytoplasmic vesicles into the apical surface would have what effect?
- Increased water permeability of the epithelium

- b) Decreased water permeability of the epithelium
  - c) Increased release of anti-diuretic hormone (ADH)
  - d) Decreased release of anti-diuretic hormone (ADH)
  - e) No effect
- 8.2) A patient presents with bouts of vomiting and diarrhea. Which of the following compensatory patterns would occur?
- a) Increased water permeability of renal epithelium
  - b) Decreased water permeability of renal epithelium
  - c) Increased release of anti-diuretic hormone (ADH)
  - d) Decreased release of anti-diuretic hormone (ADH)
  - e) No changes will occur
- 9.1) Which of the following describes the correct order of arteries, starting at the renal artery and ending at the renal capillaries?
- a) Segmental artery => Lobar artery => Interlobar artery => Arcuate artery => Interlobular artery => Afferent arteriole => Glomerulus => Efferent arteriole
  - b) Segmental artery => Lobar artery => Interlobar artery => Arcuate artery => Interlobular artery => Efferent arteriole => Glomerulus => Afferent arteriole
  - c) Segmental artery => Lobar artery => Interlobular artery => Arcuate artery => Interlobar artery => Afferent arteriole => Glomerulus => Efferent arteriole
  - d) Segmental artery => Lobar artery => Interlobular artery => Arcuate artery => Interlobar artery => Efferent arteriole => Glomerulus => Afferent arteriole
  - e) Arcuate artery => Lobar artery => Interlobar artery => Segmental artery => Interlobular artery => Afferent arteriole => Efferent arteriole => Glomerulus
- 9.2) Constriction of efferent arterioles would lead to:
- a) Reduced filtration and increased urine production
  - b) Reduced filtration and reduced urine production
  - c) Increased filtration and increased urine production
  - d) Increased filtration and reduced urine production
  - e) Vastly increased urinary output
- 9.3) Constriction of afferent arterioles would lead to:
- a) Reduced filtration and increased urine production
  - b) Reduced filtration and reduced urine production
  - c) Increased filtration and increased urine production
  - d) Increased filtration and reduced urine production
  - e) Vastly increased urinary output
- 10.1) Which of the following is derived from the mesonephric ducts (not cloaca)?
- a) Detrusor muscle
  - b) Urethral sphincter
  - c) Trigone
  - d) Prostatic urethra
  - e) Membranous urethra
- 10.2) Which of the following locations contains transitional epithelium and is lined with stratified or pseudostratified columnar epithelium?
- a) Penile (spongy) urethra
  - b) Membranous urethra
  - c) Prostatic urethra

- d) Urethral sphincter
- e) Detrusor muscle

**Renal #2 – Microbiology & Immunology**

1.1) What is the most common bacteria involved in community acquired urinary tract infections (UTIs)?

- a) *E. coli*
- b) *S. saprophyticus*
- c) *P. mirabilis*
- d) *K. pneumonia*
- e) *S. epidermidis*

1.2) What is the most common bacteria involved in glomerulonephritis?

- a) *E. coli*
- b) *S. pyogenes*
- c) *E. faecalis*
- d) *P. aeruginosa*
- e) Capnophilics (*Corynebacteria, Lactobacilli*)

1.3) Which of the following is most commonly associated with hospital acquired (nosocomial) UTIs?

- a) Urinary stones (calculi)
- b) Prostatitis
- c) Genital surgery
- d) CO<sub>2</sub> enriched environments
- e) Catheterization

1.4) A young, sexually active female presents with dysuria. An uncomplicated UTI is suspected. What is the most likely cause?

- a) *E. coli*
- b) *S. saprophyticus*
- c) *P. mirabilis*
- d) *K. pneumonia*
- e) *S. epidermidis*

2) Which of the following is usually only seen in hospital acquired UTIs?

- a) *S. saprophyticus*
- b) *C. trachomatis*
- c) *P. mirabilis*
- d) *E. coli*
- e) Candida species

3) A child is brought in by their mother with respiratory tract infection symptoms. The mother is concerned as the child has blood in his urine (hemorrhagic cystitis). Urinalysis shows that a virus is to blame. What is the most likely virus?

- a) Polyomavirus JC
- b) Polyomavirus BK
- c) Adenovirus
- d) Hanta virus
- e) CMV or Rubella

4) A medical student presents with hematuria after a mission trip to Africa. History reveals the student swam in a small pond at the bottom of a waterfall. A urine sample is significant for eggs (shown), which are associated with *Bulinus* snails during their life-cycle. The student is started on praziquantel. Which of the following is most likely?



- a) *Ascaris lumbricoides*
  - b) *Taenia saginata*
  - c) *Echinococcus granulosus*
  - d) *Schistosoma haematobium*
  - e) *Strongyloides stercoralis*
- 5) Which of the following does NOT predispose a patient to urinary tract infections?
- a) Vesicouteral reflux
  - b) Male circumcision
  - c) Sexual activity in a female
  - d) Residual urine > 2-3mL
  - e) Urinary catheterization
- 6.1) What adhesion virulence factor is most closely associated with uropathogenic *E. coli* (UPEC)?
- a) Colonization factor adhesions (CFA/I, II, III)
  - b) Aggregative adherence fimbriae (AAF/I, III)
  - c) Bundle forming pili (Bfp)
  - d) P fimbriae (pili)
  - e) S fimbriae (sialic acid)
  - f) Intimin and Ipa protein
- 6.2) K-Antigen Capsular Acid Polysaccharide is most associated with:
- a) Glomerulonephritis
  - b) Pyelonephritis
  - c) Cystitis
  - d) Urethritis
  - e) Sexually transmitted urethritis
- 7) What major *E. coli* virulence factor predisposes certain women to recurrent UTIs?
- a) Capsule
  - b) Pili
  - c) Lipopolysaccharide
  - d) Pyocyanin
  - e) Cytotoxin (leukocidin)
- 8) Which of following is most associated with urinary calculi, as the organism is able to produce potent urease, acting to form ammonia and thus alkaline urine?
- a) *E. coli*
  - b) *S. saprophyticus*
  - c) *P. mirabilis*
  - d) *K. pneumonia*
  - e) *S. epidermidis*
- 9) A midstream urine (MSU) catch is used to determine the presence of a single species (e.g. not periurethral flora). Which of the following describes the critical value for

bacteriuria when interpreting laboratory results obtained on urine submitted for urinalysis as well as culture and sensitivity?

- a)  $10^3$
- b)  $10^4$
- c)  $10^5$
- d)  $10^6$
- e)  $10^7$

10) A midstream urine (MSU) should be collected after a small urine void and cleansing of the area surrounding the urethra. The specimen should be transported to the lab promptly as urine is a good growth medium and may lead to distorted lab results. For *M. Tuberculosis*, three early morning urine samples are taken over consecutive days. Which of the following requires taking the last few mL of a morning sample after exercise?

- a) *Escherichia coli*
- b) *Staphylococcus saprophyticus*
- c) *Proteus mirabilis*
- d) *Staphylococcus epidermidis*
- e) *Schistosoma haematobium*

### Renal #3 – Physiology: Elements of Renal Function

1.1) Which of the following functions of the kidney manages creatinine (muscle creatine), urea (amino acids), and uric acid (nucleic acids)?

- a) Body fluid osmolality and volumes
- b) Electrolyte balance
- c) Acid-base balance
- d) Metabolic and foreign substance excretion
- e) Hormone production and secretion

1.2) Which of the following is a metabolite of vitamin D3 and is responsible for bone formation abnormalities if its production is impaired by kidney disease?

- a) Renin
- b) Calcitriol
- c) Erythropoietin
- d) Angiotensin
- e) Aldosterone

2) End-stage renal disease (ESRD) is defined as a glomerular filtration rate (GFR) of less than what percentage of normal?

- a) 1%
- b) 3%
- c) 5%
- d) 10%
- e) 15%

3) The medulla is divided into conical masses called the:

- a) Major calyx
- b) Minor calyx
- c) Pyramid
- d) Nephron
- e) Capsule

4) What is the major role of the juxtamedullary nephrons (as opposed to the superficial cortical nephrons)?

- a) Conveys oxygen to nephron segments
- b) Conveys nutrients to nephron segments
- c) Serves as a pathway for the return of reabsorbed water and solutes
- d) Delivers substances for nephron secretion
- e) Concentrates and dilutes urine

5.1) Which of the following does NOT cross the fenestrated (700-Ångström holes) renal filtration barrier?

- a) Water
- b) Platelets
- c) Urea
- d) Glucose
- e) Na<sup>+</sup>

5.2) Which of the following contains negatively charged glycoproteins and thus can prevent protein filtration into Bowman space based on ion charge?

- a) Podocytes
- b) Mesangial cells
- c) Filtration slits
- d) Basement membrane
- e) Macula densa

5.3) Which of the following is NOT a role of the mesangium (mesangial cells and mesangial matrix)?

- a) Calcitonin secretion
- b) Glomerular capillary structural support
- c) Extracellular matrix secretion
- d) Exhibit phagocytic activity
- e) Prostaglandin and proinflammatory cytokine secretion

6.1) What is a function of the macula densa cells, a component of the juxtaglomerular apparatus (JGA)?

- a) No function
- b) Renin secretion
- c) Calcitonin secretion
- d) Sodium sensing and vasopressor secretion
- e) Prostaglandin and proinflammatory cytokine secretion

6.2) What is a function of the granular cells, a component of the juxtaglomerular apparatus (JGA)?

- a) No function
- b) Renin secretion
- c) Calcitonin secretion
- d) Sodium sensing and vasopressor secretion
- e) Prostaglandin and proinflammatory cytokine secretion

7) Activation of nerve fibers in the renal tubule system would lead to:

- a) Blocked renin secretion
- b) Reduced norepinephrine production
- c) Enhanced Na<sup>+</sup> reabsorption

- d) Reduced dopamine production
  - e) Increased parasympathetic activity
- 8) Where do the ureters enter the bladder?
- a) Superior aspect
  - b) Posterior aspect
  - c) Anterior aspect
  - d) Lateral aspects
- 9) Which of the following nerves leads to closure of the bladder urethra and relaxation of the bladder detrusor muscle?
- a) Hypogastric sympathetic nerves
  - b) Sacral parasympathetics
  - c) Sacral pudendal nerves
  - d) None of the above
- 10.1) How is the external sphincter opened during micturition?
- a) Hypogastric nerve excitation
  - b) Sacral parasympathetic excitation
  - c) Sacral parasympathetic inhibition
  - d) Sacral pudendal nerve excitation
  - e) Sacral pudendal nerve inhibition
- 10.2) Destruction of which of the following would affect the micturition reflex and lead to complete bladder dysfunction?
- a) Hypogastric sympathetic nerves
  - b) Sacral parasympathetics
  - c) Sacral pudendal nerves
  - d) A & B
  - e) B & C
  - f) A & C
- 11) Creatinine can be used to estimate GFR by the equation  $GFR = Ccr * Vdot/Pcr$ , where Ccr is creatinine clearance, Vdot is urine flow, and Pcr is plasma creatinine concentration. Note that the creatinine secretory underestimation of 10% is canceled by the plasma concentration overestimation of 10%. Which of the following would NOT be a criterion for the use of creatinine, or any other substance, in estimating GFR?
- a) Not alter the GFR
  - b) Not be secreted by the nephron
  - c) Not be metabolized or produced by the kidney
  - d) Be freely filtered across the glomerulus into Bowman space
  - e) Be partially reabsorbed by the nephron
- 12) The glomerular filtration fraction is defined as  $GFR/RPF$ , where RPF is renal plasma flow. What is the normal filtration fraction (the actual fraction of plasma that is filtered when compared to what enters the glomerulus)?
- a) 0.05 to 0.10
  - b) 0.15 to 0.20
  - c) 0.25 to 0.30
  - d) 0.35 to 0.40
  - e) 0.45 to 0.50
  - f) 0.55 to 0.60



- 13) What is the minute GFR (rate of ultrafiltrate production) in a normal male adult?
- 80 to 125mL/min
  - 90 to 140mL/min
  - 100 to 180mL/min
  - 110 to 210mL/min
  - 120 to 275mL/min
- 14) Which of the following macromolecules (e.g. dextrans) would be filtered the fastest by the glomerulus?
- Large radius, polycationic (positive charge)
  - Large radius, polyanionic (negative charge)
  - Normal radius, neutral dextran
  - Small radius, polycationic (positive charge)
  - Small radius, polyanionic (negative charge)
- 15.1) The reflection coefficient ( $\sigma$ ) for proteins across the glomerular capillary is essentially 1 (unity), such that the glomerular ultrafiltrate is protein free. Thus, which of the following Starling forces is nearly zero?
- $P_{gc}$ , glomerular hydrostatic
  - $P_{bs}$ , Bowman space hydrostatic
  - $\pi_{gc}$ , glomerular oncotic
  - $\pi_{bs}$ , Bowman space oncotic
  - None of the above
- 15.2) Which of the following describes the GFR equation using Starling forces, given that  $K_f$  is the product of the intrinsic permeability of the glomerular capillary and the glomerular surface area available for filtration?
- $GFR = K_f * ((P_{gc} - P_{bs}) - \sigma * (\pi_{gc} - \pi_{bs}))$
  - $GFR = K_f * ((P_{gc} - P_{bs}) + \sigma * (\pi_{gc} - \pi_{bs}))$
  - $GFR = K_f * ((P_{bs} - P_{gc}) - \sigma * (\pi_{bs} - \pi_{gc}))$
  - $GFR = K_f * ((P_{bs} - P_{gc}) + \sigma * (\pi_{gs} - \pi_{gc}))$
  - $GFR = K_f + (P_{gc} - P_{bs}) - \sigma + (\pi_{gc} - \pi_{bs})$
- 15.3) An increase in renal arteriolar blood pressure would lead to which of the following?
- Increased  $P_{gc}$
  - Increased  $P_{bs}$
  - Decreased  $P_{gc}$
  - Decreased  $P_{bc}$
  - Increased  $\pi_{bs}$
- 15.4) Which of the following actions would both increase  $P_{gc}$  and thus GFR?
- Increased afferent arteriolar resistance, increased efferent arteriolar resistance
  - Increased afferent arteriolar resistance, decreased efferent arteriolar resistance
  - Decreased afferent arteriolar resistance, increased efferent arteriolar resistance
  - Decreased afferent arteriolar resistance, decreased efferent arteriolar resistance
- 16.1) Which of the following equations describes renal blood flow (RBF)?
- $(\text{aortic pressure} - \text{renal venous pressure}) * \text{renal vascular resistance}$
  - $(\text{aortic pressure} + \text{renal venous pressure}) * \text{renal vascular resistance}$
  - $\text{renal venous pressure} / \text{renal vascular resistance} + \text{aortic pressure}$
  - $(\text{aortic pressure} + \text{renal venous pressure}) / \text{renal vascular resistance}$
  - $(\text{aortic pressure} - \text{renal venous pressure}) / \text{renal vascular resistance}$

- 16.2) RBF indirectly determines GFR. Which of the following describes the myogenic mechanism that autoregulates RBF and GFR?
- a) Tendency of smooth muscle to expand when stretched (compliance)
  - b) Tendency of smooth muscle to contract when stretched
  - c) Tendency of smooth muscle to expand in the presence of NaCl
  - d) Tendency of smooth muscle to contract in the presence of NaCl
  - e) Tendency of smooth muscle to contract with sympathetic innervation
- 16.3) The tubuloglomerular feedback mechanism helps to reduce GFR when it is increased. Increased GFR will increase NaCl in the loop of Henle, which is sensed by the macula densa, and finally leads to:
- a) Decreased afferent arteriolar resistance
  - b) Increased afferent arteriolar resistance
  - c) Decreased efferent arteriolar resistance
  - d) Increased efferent arteriolar resistance
- 16.4) Autoregulation of the glomerular filtration rate in the kidney stops when arterial blood pressure drops below:
- a) 120mmHg
  - b) 100mmHg
  - c) 90mmHg
  - d) 75mmHg
  - e) 60mmHg
- 17.1) Activation of alpha1-adrenoceptors leads to:
- a) Increased GFR
  - b) Decreased GFR
  - c) Increased RBF
  - d) No change in GFR
  - e) No change in RBF
- 17.2) Angiotensin II and epinephrine released during hemorrhage would lead to:
- a) Vasodilation
  - b) Decreased total peripheral resistance
  - c) Increased GFR
  - d) Decreased RBF
  - e) Decreased arterial blood pressure
- 17.3) How do prostaglandins work during hemorrhage?
- a) Increased RBF without affecting GFR
  - b) Decreased RBF without affecting GFR
  - c) Increased GFR without affecting RBF
  - d) Decreased GFR without affecting RBF
  - e) Decreased GFR and RBF
- 17.4) Nitric oxide (NO) causes dilation of afferent and efferent kidney arterioles. Increased production of NO is seen in hypertension and:
- a) Post-MI
  - b) Seizure disorders
  - c) Colorectal cancer
  - d) Diabetes
  - e) Autism

- 17.5) Endothelin is a potent vasoconstrictor leading to:
- Increased RBF without affecting GFR
  - Decreased RBF without affecting GFR
  - Increased GFR without affecting RBF
  - Decreased GFR without affecting RBF
  - Decreased GFR and RBF
- 17.6) What affect does the release of atrial natriuretic peptide (ANP) and brain (ventricular) natriuretic peptide (BNP) have?
- Increased RBF without affecting GFR
  - Decreased RBF without affecting GFR
  - Increased GFR without affecting RBF
  - Decreased GFR without affecting RBF
  - Decreased GFR and RBF
- 18) Which of the following substances is a renal vasoconstrictor?
- Atrial natriuretic peptide
  - Prostaglandins
  - Endothelin
  - Nitric oxide
  - Bradykinin
- 19) The urine of a 13-year-old boy turned dark brown several weeks after a bout of “strep throat.” The diagnosis is glomerulonephritis. The urine is dark brown because red blood cells are in the urine. Which of the following will also be found in high concentration in this patient’s urine?
- Na<sup>+</sup>
  - K<sup>+</sup>
  - Serum albumin
  - Creatinine
  - Urea
- 20) A 75-year-old woman (body weight = 60kg) was admitted to the intensive care unit after falling at home two days earlier. For the first four days in the hospital, her urine output was approximately 400mL/day. On physical examination, she had orthostatic changes in blood pressure, tachycardia, and poor skin turgor. Her serum creatinine level increased progressively from 1mg/dL on the day of admission to 5.9mg/dL on day four. After two weeks in the intensive care unit, she was transferred to a medical ward, where her urine output was noted to be approximately 1L/day and her serum creatinine concentration was stable at 1mg/dL. She also had signs and symptoms of congestive heart failure with decreased cardiac output. She fractured several ribs and requested medication to relieve the pain. An NSAID was prescribed. By morning, the patient’s rib pain was better. Because some edema had developed secondary to the congestive heart failure, she was treated with a diuretic. Her condition responded well to the diuretic, and the edema disappeared. Her serum creatinine level was stabilized at 1mg/dL. A 24-hour urine collection was performed to determine her GFR. Why did the serum creatinine level increased during the first four days of this patient’s hospitalization?
- The RBF decreased
  - Her urine output was low
  - Her creatinine metabolism decreased

- d) Her GFR decreased
  - e) Her blood volume decreased
- 21) In the previous patient, the NSAID given inhibits prostaglandin synthesis. What is an adverse effect of this pain reliever on renal function?
- a) It increased RBF
  - b) It decreases GFR
  - c) It increases urine output
  - d) It increases urinary protein excretion
  - e) It increases creatinine excretion

**Renal #4 – Physiology: Solute & Water Transport**

- 1.1) Which of the following substances is the least reabsorbed, with only about 50% re-entering the renal tubules?
- a) Water
  - b) Na<sup>+</sup>
  - c) K<sup>+</sup>
  - d) Glucose
  - e) Urea
  - f) Cl<sup>-</sup>
  - g) HCO<sub>3</sub><sup>-</sup>
- 1.2) Which of the following is considered the most important (key element) as a driving force for acid base balance?
- a) Water
  - b) Na<sup>+</sup>
  - c) K<sup>+</sup>
  - d) Glucose
  - e) Urea
  - f) Cl<sup>-</sup>
  - g) HCO<sub>3</sub><sup>-</sup>
- 2.1) All of the following are nearly 100% reabsorbed, EXCEPT for which of the following, which is a little over 85% reabsorbed?
- a) Na<sup>+</sup>
  - b) K<sup>+</sup>
  - c) Ca<sup>++</sup>
  - d) HCO<sub>3</sub><sup>-</sup>
  - e) Glucose
- 2.2) Which of the following is completely (100%) reabsorbed into the renal tubule?
- a) Na<sup>+</sup>
  - b) K<sup>+</sup>
  - c) Ca<sup>++</sup>
  - d) HCO<sub>3</sub><sup>-</sup>
  - e) Glucose
- 3.1) In the first half of the proximal tubule, Na<sup>+</sup> uptake into the cell is exchanged with:
- a) Cl<sup>-</sup>
  - b) HCO<sub>3</sub><sup>-</sup>
  - c) H<sup>+</sup>

- d)  $\text{Ca}^{++}$
  - e)  $\text{K}^{+}$
- 3.2) In the second half of the proximal tubule,  $\text{Na}^{+}$  is reabsorbed mainly with:
- a)  $\text{Cl}^{-}$
  - b)  $\text{HCO}_3^{-}$
  - c)  $\text{H}^{+}$
  - d)  $\text{Ca}^{++}$
  - e)  $\text{K}^{+}$
- 3.3) Inactivation mutations to the gene encoding which of the following would lead to decreased glucose reabsorption in the proximal tubule and glucosuria?
- a)  $\text{Cl}^{-}/\text{HCO}_3^{-}$  antiporter
  - b)  $\text{Na}^{+}/3\text{HCO}_3^{-}$  symporter
  - c)  $\text{Na}^{+}$  glucose transporter (SGLT2)
  - d)  $\text{Na}^{+}/\text{K}^{+}$  ATPase and glucose transporter (GLUT2)
  - e)  $\text{Na}^{+}/\text{amino acid}$ ,  $\text{Na}^{+}/\text{Pi}$ , or  $\text{Na}^{+}/\text{lactate}$  symporters
- 3.4) Which of the following can be found in the apical membrane, not the basolateral membrane?
- a)  $\text{Na}^{+}/3\text{HCO}_3^{-}$  symporter
  - b)  $\text{Na}^{+}/\text{H}^{+}$  antiporter and SGLT2
  - c)  $\text{Pi}$  and lactate transporters
  - d)  $\text{Na}^{+}/\text{K}^{+}$  ATPase transporter
  - e)  $\text{Na}^{+}/\text{amino acid}$ ,  $\text{Na}^{+}/\text{Pi}$ , or  $\text{Na}^{+}/\text{lactate}$  symporters
- 3.5) In the second half of the proximal tubule, which of the following forms an anion complex for transport into the cell as well as for recycling and reuse in the tubular fluid?
- a)  $\text{Cl}^{-}$
  - b)  $\text{HCO}_3^{-}$
  - c)  $\text{H}^{+}$
  - d)  $\text{Ca}^{++}$
  - e)  $\text{K}^{+}$
- 4) Approximately how much of the  $\text{NaCl}$  (and water) filtered by the kidney each day is reabsorbed in the proximal tubule?
- a) 25%
  - b) 33%
  - c) 50%
  - d) 66%
  - e) 75%
  - f) 100%
- 5) In the first half of the proximal tubule,  $\text{Na}^{+}$  reabsorption is coupled with organic solutes or:
- a)  $\text{Cl}^{-}$
  - b)  $\text{HCO}_3^{-}$
  - c)  $\text{H}^{+}$
  - d)  $\text{Ca}^{++}$
  - e)  $\text{K}^{+}$
  - f) Amino acids
  - g) None of the above

- 6) Approximately what percentage of the reabsorbed NaCl moves across the transcellular pathway (Na<sup>+</sup>/H<sup>+</sup> and Cl<sup>-</sup>/anion antiporters), with the rest moving across the paracellular (direct) pathway?
- a) 25%
  - b) 33%
  - c) 50%
  - d) 66%
  - e) 75%
- 7.1) Which of the following Na<sup>+</sup> entry mechanisms is seen at the distal tubule?
- a) Na<sup>+</sup>/H<sup>+</sup> exchange, Na<sup>+</sup> cotransport with amino acids
  - b) Na<sup>+</sup>, K<sup>+</sup>, 2Cl<sup>-</sup> symport
  - c) NaCl symport
  - d) Na<sup>+</sup> channels
  - e) All of the above
- 7.2) No water reabsorption occurs in which of the following locations?
- a) Proximal tubule
  - b) Distal tubule
  - c) Descending loop of Henle
  - d) Collecting duct
- 7.3) Which of the following Na<sup>+</sup> entry mechanisms is NOT seen in the proximal tubule?
- a) Na<sup>+</sup>, K<sup>+</sup>, 2Cl<sup>-</sup> symport
  - b) Na<sup>+</sup>, H<sup>+</sup>/Cl<sup>-</sup> anion exchange
  - c) Na<sup>+</sup> cotransport with amino acids
  - d) Na<sup>+</sup>/H<sup>+</sup> exchange
  - e) Na<sup>+</sup> cotransport with organic solutes
- 7.4) Which of the following hormone is associated with all segments of the tubule system EXCEPT the proximal tubule?
- a) Angiotensin II
  - b) Norepinephrine
  - c) Epinephrine
  - d) Dopamine
  - e) Aldosterone
- 8) As a consequence of osmotic water flow across the proximal tubule, which two ions in particular are entrained (dragged along) in the reabsorbed fluid?
- a) Cl<sup>-</sup> and K<sup>+</sup>
  - b) HCO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup>
  - c) H<sup>+</sup> and HCO<sub>3</sub><sup>-</sup>
  - d) Ca<sup>++</sup> and H<sup>+</sup>
  - e) K<sup>+</sup> and Ca<sup>++</sup>
- 9) Which of the following would most likely occur if the gene encoding for aquaporin-1 (AQP1) was “knocked out” in a normal mouse?
- a) The rate of water reabsorption by the proximal tubule would increase 100%
  - b) The rate of water reabsorption by the proximal tubule would increase 50%
  - c) The rate of water reabsorption by the proximal tubule would not change
  - d) The rate of water reabsorption by the proximal tubule would decrease 50%
  - e) The rate of water reabsorption by the proximal tubule would decrease 100%

- 10) Which of the following is NOT true regarding protein filtration and the kidney?
- a) Ultrafiltrate contains about 40mg/L of protein
  - b) Peptide hormones, small proteins, and even some large proteins (e.g. albumin) are filtered by the glomerulus
  - c) Proteins leave the cell across the basolateral membrane back into the blood
  - d) Enzymes on the surface of the proximal tubule cells degrade proteins
  - e) Proteinuria is a common consequence of kidney disease
- 11.1) Which of the following is an endogenous cation (positive charge)?
- a) Oxalate
  - b) Creatinine
  - c) Urate
  - d) cAMP
  - e) cGMP
- 11.2) Which of the following is an endogenous cation (positive charge)?
- a) Bile salts
  - b) Hippurates
  - c) PGE2
  - d) Dopamine
  - e) Ascorbate
- 11.3) Which of the following drugs is cationic (positive charge)?
- a) Penicillin
  - b) Furosemide
  - c) Salicylate (aspirin)
  - d) Hydrochlorothiazide
  - e) Cimetidine
- 11.4) Infusion of p-aminohippuric acid (PAH) would reduce secretion by the proximal tubule of which of the following?
- a) Penicillin
  - b) Atropine
  - c) Procainamide
  - d) Isoproterenol
  - e) Morphine
- 12.1) Which of the following is NOT true regarding reabsorption and the loop of Henle?
- a) Water reabsorption occurs exclusively in the descending thin limb via AQP1
  - b) NaCl reabsorption occurs in the thin ascending limb
  - c) NaCl reabsorption occurs in the thick ascending limb
  - d) NaCl reabsorption occurs in the descending limb
- 12.2) Which of the following does NOT get reabsorbed into the blood at the thick ascending segment of the loop of Henle?
- a) Na<sup>+</sup>
  - b) K<sup>+</sup>
  - c) Ca<sup>++</sup>
  - d) Mg<sup>++</sup>
  - e) H<sub>2</sub>O
- 12.3) Bartter syndrome is a rare inherited defect in the thick ascending limb of the loop of Henle. It is characterized by low potassium levels (hypokalemia), decreased acidity of

blood (alkalosis), and normal to low blood pressure. Mutations to which of the following would lead to Bartter syndrome?

- a) Apical membrane  $K^+$  channel (ROMK)
  - b) Apical membrane  $Na^+$ ,  $K^+$ ,  $2Cl^-$  symporter (NKCC1)
  - c) Basolateral  $Cl^-$  channel (ClCNKB)
  - d) CLC  $Cl^-$  channel (BSND)
  - e) Any of the above
- 12.4) What percentage of the  $NaCl$  reabsorbed at the thick ascending limb of the Henle loop is via the transcellular pathway?
- a) 25%
  - b) 33%
  - c) 50%
  - d) 66%
  - e) 75%
- 13.1) Thiazide diuretics inhibit  $NaCl$  reabsorption by affecting which of the following mechanisms at the cell entry side (tubular fluid) of the early distal tubule?
- a)  $Na^+$  passive diffusion
  - b)  $Cl^-$  passive diffusion
  - c)  $Na^+/Cl^-$  symporter
  - d)  $Na^+/K^+$  ATPase
  - e) Both A & B
- 13.2) What is the major function of intercalated cells at the last segment of the distal tubule (late distal tubule) and the collecting duct?
- a) Reabsorb  $NaCl$  and water, secrete  $K^+$
  - b) Secrete either  $H^+$  or  $HCO_3^-$
  - c) Reabsorb  $K^+$ , secrete  $Na^+$
  - d) Secrete  $Na^+$  and  $Ca^{++}$
  - e) Reabsorb water, secrete  $NaCl$
- 13.3) What is the major function of principle cells at the last segment of the distal tubule (late distal tubule) and the collecting duct?
- a) Reabsorb  $NaCl$  and water, secrete  $K^+$
  - b) Secrete either  $H^+$  or  $HCO_3^-$
  - c) Reabsorb  $K^+$ , secrete  $Na^+$
  - d) Secrete  $Na^+$  and  $Ca^{++}$
  - e) Reabsorb water, secrete  $NaCl$
- 13.4) Antidiuretic hormone (ADH) promotes water reabsorption. Which of the following aquaporins is NOT associated with water reabsorption at the late distal tubule?
- a) AQP1
  - b) AQP2
  - c) AQP3
  - d) AQP4
- 14.1) All of the following hormones increase  $H_2O$  reabsorption. Which hormone does NOT also increase  $NaCl$  reabsorption?
- a) Angiotensin II
  - b) Aldosterone
  - c) Antidiuretic hormone (ADH)



- 14.2) Which of the following decreases H<sub>2</sub>O and NaCl reabsorption?
- a) Atrial natriuretic peptide (ANP)
  - b) Brain natriuretic peptide (BNP)
  - c) Urodilatin
  - d) Dopamine
  - e) All of the above
- 14.3) Which of the following is stimulated by a decrease in extracellular fluid volume (ECFV)?
- a) ANP
  - b) BNP
  - c) Urodilatin
  - d) Sympathetic nerves
  - e) Dopamine
- 14.4) Which of the following is stimulated by both a decreased in ECFV and an increase in osmotic pressure?
- a) Angiotensin II
  - b) Aldosterone
  - c) ADH
  - d) ANP
  - e) BNP
- 14.5) Along with an increase in potassium concentration (hyperkalemia), what is the major stimulus for aldosterone release?
- a) Increased renin
  - b) Increased angiotensin II
  - c) Increased ECFV
  - d) Decreased ECFV
  - e) Increased osmotic pressure
- 14.6) What is the major stimulus for angiotensin II release?
- a) Increased renin
  - b) Increased angiotensin II
  - c) Increased ECFV
  - d) Decreased ECFV
  - e) Increased osmotic pressure
- 14.7) Which of the following is the only major hormone that directly regulates the amount of water excreted by the kidneys?
- a) Angiotensin II
  - b) Aldosterone
  - c) Renin
  - d) ADH
  - e) Urodilatin
  - f) Dopamine
- 14.8) Angiotensin II is a potent hormone that stimulates proximal tubule reabsorption of:
- a) NaCl
  - b) Water
  - c) NaCl and water

14.9) Aldosterone acts mostly on the distal tubule and collecting duct, with some action at the thick ascending limb of the loop of Henle, to stimulate reabsorption of:

- a) NaCl
- b) Water
- c) NaCl and water

14.10) Which of the following acts by decreasing the total peripheral resistance and by enhancing urinary NaCl and water excretion?

- a) Angiotensin II
- b) Dopamine
- c) ANP, BNP
- d) ADH
- e) Urodilatin

14.11) Where is ADH secreted from?

- a) Kidney
- b) Adrenal gland
- c) Hypothalamus
- d) Anterior pituitary gland
- e) Posterior pituitary gland

15.1) Filtration fraction (FF) is defined as  $FF = GFR/RPF$ , where RPF is renal plasma flow. Which of the following Starling forces is directly related to the filtration fraction?

- a)  $P_c$ , peritubular capillary hydrostatic pressure
- b)  $P_{ic}$ , lateral intercellular space hydrostatic pressure
- c)  $\pi_c$ , peritubular capillary osmotic pressure
- d)  $\pi_{ic}$ , lateral intercellular space osmotic pressure

15.2) Glomerulotubular (G-T) balance prevents wide fluctuations in urine ion content when there are spontaneous changes in GFR. However, filtered load is altered. Filtered load is defined as GFR times the concentration of what ion in the filtered fluid?

- a)  $K^+$
- b)  $Na^+$
- c)  $Cl^-$
- d)  $Ca^{++}$
- e)  $HCO_3^-$

16) A 45-year-old woman with breast cancer is enrolled in a clinical research trial to evaluate the effectiveness of a new chemotherapeutic drug. After the second dose of the drug, she reports feeling lightheaded when standing. Her blood pressure falls from 145/80 to 110/70mmHg when she goes from supine to standing (orthostatic hypotension). In addition, a routine urinalysis shows that her urine contains large quantities of glucose,  $HCO_3^-$ , amino acids, phosphate, and organic anions. On the basis of the urinalysis results, the physician suspects that the drug has damaged the patient's kidneys. Which portion of the nephron is most likely damaged?

- a) The glomerulus
- b) The proximal tubule
- c) The thick ascending limb of the loop of Henle
- d) The distal tubule
- e) The collecting duct

17) The physician attributes the 45-year-old patient's orthostatic hypotension to a decreased in the volume of the extracellular fluid secondary to increased renal Na<sup>+</sup> loss. In response to the decrease in extracellular fluid volume, there will be an increase in which of the following factors that regulate NaCl and water reabsorption by the nephron?

- a) Aldosterone
- b) ANP
- c) Urodilatin
- d) Dopamine
- e) Pc pressure

18) A new diuretic agent is developed and its effect on healthy volunteers is evaluated. After a single dose of this new diuretic, the urine flow rate increased threefold, the fractional excretion of Na<sup>+</sup> increased from 1% to 20%, the excretion of K<sup>+</sup> and Ca<sup>+</sup> increased, but neither glucose nor amino acids were found in the urine. On the basis of the urinalysis results, which portion of the nephron is the site of this new diuretic agent?

- a) The glomerulus
- b) The proximal tubule
- c) The thick ascending limb of the loop of Henle
- d) The distal tubule
- e) The collecting duct

19) For the new diuretic agent, which of the following membrane transport proteins is inhibited?

- a) Na<sup>+</sup>/glucose symporter
- b) Na<sup>+</sup>/H<sup>+</sup> antiporter
- c) Na<sup>+</sup>, K<sup>+</sup>, 2Cl<sup>-</sup> symporter
- d) Na<sup>+</sup>/Cl<sup>-</sup> symporter
- e) Na<sup>+</sup> channel

### **Renal #5 – Physiology: Control of Body Fluid Osmolality & Volume**

1.1) How much body weight is presents in the extracellular fluid (ECF)?

- a) 42L
- b) 28L
- c) 14L
- d) 10.5L
- e) 3.5L

1.2) Plasma volume (non-interstitial fluid) accounts for how much body weight?

- a) 42L
- b) 28L
- c) 14L
- d) 10.5L
- e) 3.5L

2.1) Intracellular fluid (ICF) contains a high amount of potassium (150mEq/L) as well as:

- a) Na<sup>+</sup>
- b) Ca<sup>++</sup>
- c) Cl<sup>-</sup>
- d) HCO<sub>3</sub><sup>-</sup>
- e) Pi

- 2.2) What is the approximate pH of the ICF?
- 7.7
  - 7.4 (body pH)
  - 7.1
- 2.3) What is the approximate concentration of sodium in the ECF?
- 145mEq/L
  - 105mEq/L
  - 25mEq/L
  - 5mEq/L
  - 2mEq/L
- 2.4) What is the approximate concentration of chloride in the ECF?
- 145mEq/L
  - 105mEq/L
  - 25mEq/L
  - 5mEq/L
  - 2mEq/L
- 3.1) On a very hot day, a marathon runner presents to the finish line first aid tent with confusion and weakness. During questioning, the runner starts getting combative. Another runner in the tent said the patient skipped most of the water stations and was trying to “make time” to qualify for the Boston Marathon. Physical exam reveals skin tenting. Which of the following is most likely?
- Dehydration; Hyponatremia
  - Dehydration; Hypernatremia
  - Hyperhydration; Hyponatremia
  - Hyperhydration; Hypernatremia
- 3.2) A marathon runner presents to the finish line first aid tent with confusion and muscle cramps. History reveals this is the runner’s first marathon and they did not do extensive training. They state that they made a point to stop and drink water at every rest station. Which of the following is most likely?
- Dehydration; Hyponatremia
  - Dehydration; Hypernatremia
  - Hyperhydration; Hyponatremia
  - Hyperhydration; Hypernatremia
- 4) Which of the following is the major route of water excretion from the body?
- Insensible
  - Sweat
  - Feces
  - Urine
- 5) Antidiuretic hormone (ADH), also known as vasopressin, is synthesized in neuroendocrine cells located within the supraoptic and paraventricular nuclei of the hypothalamus. The hormone is then packaged and stored for release at what location?
- Tuberal hypothalamus
  - Anterior hypothalamus
  - Posterior hypothalamus
  - Anterior pituitary
  - Posterior pituitary

- 6.1) Which of the following inhibits the release of ADH?
- a) Angiotensin II
  - b) Ethanol
  - c) Hypovolemia
  - d) Nausea
  - e) Nicotine
- 6.2) Plasma ADH concentration would be highest when plasma osmolality is at which of the following values:
- a) 270mOsm/kg H<sub>2</sub>O
  - b) 280mOsm/kg H<sub>2</sub>O (healthy adult low end)
  - c) 290mOsm/kg H<sub>2</sub>O
  - d) 295mOsm/kg H<sub>2</sub>O (healthy adult high end)
  - e) 310mOsm/kg H<sub>2</sub>O
- 6.3) Plasma ADH concentration begins to rise drastically when blood pressure:
- a) Increases 20mmHg
  - b) Increases 10mmHg
  - c) Decreases 10mmHg
  - d) Decreases 20mmHg
  - e) ADH is not affected by blood volume
- 6.4) ADH affects the water permeability at which location?
- a) Proximal tubule
  - b) Distal tubule
  - c) Loop of Henle
  - d) Distal tubule
  - e) Collecting duct
- 7) What is the most potent stimulator of the water intake (thirst) center in the hypothalamus?
- a) Hyperosmolality
  - b) Aldosterone
  - c) Angiotensin II
  - d) ADH
  - e) K<sup>+</sup> and Cl<sup>-</sup>
- 8.1) What is the major site where solute and water are separated, allowing for hypo- or hyperosmotic urine?
- a) The glomerulus
  - b) The proximal tubule
  - c) The thick ascending limb of the loop of Henle
  - d) The distal tubule
  - e) The collecting duct
- 8.2) After the isoosmotic fluid exits the proximal tubule, where is passive permeability to water the greatest?
- a) Descending thin limb of the loop of Henle
  - b) Ascending thin limb of the loop of Henle
  - c) Thick ascending limb
  - d) Distal tubule
  - e) Collecting duct (cortex and medulla)

- 8.3) After the isoosmotic fluid exits the proximal tubule, where is passive permeability to NaCl the greatest?
- a) Descending thin limb of the loop of Henle
  - b) Ascending thin limb of the loop of Henle
  - c) Thick ascending limb
  - d) Distal tubule
  - e) Collecting duct (cortex and medulla)
- 8.4) Where is active transport the greatest in the nephron?
- a) Descending thin limb of the loop of Henle
  - b) Ascending thin limb of the loop of Henle
  - c) Thick ascending limb
  - d) Distal tubule
  - e) Collecting duct (cortex and medulla)
- 8.5) The generation of a hyperosmotic medullary interstitial gradient, termed countercurrent multiplication, particularly depends on which of the following?
- a) Descending thin limb of the loop of Henle
  - b) Ascending thin limb of the loop of Henle
  - c) Thick ascending limb
  - d) Distal tubule
  - e) Collecting duct (cortex and medulla)
- 8.6) The single effect of the countercurrent multiplication process occurs due to which of the following being impermeable to water and thus allowing for re-absorption of solute from the tubular fluid?
- a) Proximal tubule
  - b) Descending limb
  - c) Ascending limb
  - d) Distal tubule
  - e) Collecting duct
- 8.7) As tubule fluid reaches the collecting duct, it is hypoosmotic. Since the collecting duct is permeable to water, water moves out of the tubule and osmolality increases. Although the osmolality reaches about 290mOsm/kg H<sub>2</sub>O, the concentration of which of the following is much lower than in earlier segments of the tubule?
- a) Uric acid
  - b) Creatinine
  - c) NH<sub>4</sub><sup>+</sup>
  - d) K<sup>+</sup>
  - e) Na<sup>+</sup>
- 9) A baseball fan is attending a World Series home game for his favorite team. Which of the following is most likely to occur after the consumption of salty nachos and a salt-covered pretzel?
- a) Stimulation of ADH release and stimulation of the thirst center
  - b) Stimulation of ADH release and inhibition of the thirst center
  - c) Inhibition of ADH release and stimulation of the thirst center
  - d) Inhibition of ADH release and inhibition of the thirst center
- 10.1) Which of the following is NOT a primary sensor for changes in renal NaCl excretion?

- a) Blood pressure
  - b) Cardiac output
  - c) Vascular volume
  - d) Hepatic sensors
- 10.2) Due to the location of the primary sensors for NaCl excretion, which of the following would lead to an increase in renal NaCl excretion?
- a) Hepatic cirrhosis
  - b) Congestive heart failure
  - c) Both A and B
  - d) Neither A nor B
- 10.3) Low pressure sensors, responding primarily to vascular volume, are found in which of the following locations?
- a) Juxtaglomerular apparatus
  - b) Aortic arch
  - c) Cardiac atria
  - d) Carotid sinus
- 10.4) Brain natriuretic peptide (BNP) is released when there is excessive distension in which location?
- a) Brain
  - b) Renal proximal tubule
  - c) Renal distal tubule
  - d) Cardiac atria
  - e) Cardiac ventricle
- 10.5) Aldosterone stimulates reabsorption of NaCl in all of the following locations EXCEPT: (where angiotensin II stimulates NaCl reabsorption)
- a) Proximal tubule
  - b) Ascending limb
  - c) Distal tubule
  - d) Collecting duct
- 10.6) Increased activity/secretion of which of the following would decrease H<sub>2</sub>O excretion?
- a) Renal sympathetic nerves
  - b) Renin-angiotensin-aldosterone
  - c) Natriuretic peptides
  - d) ADH
- 10.7) Quantitatively, which of the following is the most important segment influenced by sympathetic nerve activity?
- a) Proximal tubule
  - b) Descending limb
  - c) Ascending limb
  - d) Distal tubule
  - e) Collecting duct
- 11.1) Where is angiotensin I converted to angiotensin II via angiotensin converting enzyme (ACE)?
- a) Brain
  - b) Lungs

- c) Liver
  - d) Kidney
  - e) Adrenal
- 11.2) Which of the following is NOT a stimulus for renin secretion?
- a) Decreased perfusion pressure
  - b) Increased sympathetic nerve activity
  - c) Concentrated urine sensed at the collecting duct
  - d) Delivery of NaCl to the macula densa
- 12) Which of the following is NOT a physiologic function of angiotensin II?
- a) Stimulates aldosterone secretion by the adrenal cortex
  - b) Stimulates ADH secretion and thirst
  - c) Stimulates movement of fluid into the distal tubule
  - d) Enhances NaCl reabsorption by the proximal tubule
  - e) Arteriolar vasoconstriction to increase blood pressure
- 13.1) Aldosterone is secreted from what location?
- a) Brain
  - b) Lungs
  - c) Liver
  - d) Kidney
  - e) Adrenal
- 13.2) Aldosterone mostly affects Na<sup>+</sup> reabsorption at what location, which is the major location for adjusting levels in euvolemic patients with normal dietary sodium intake?
- a) Glomerulus
  - b) Proximal tubule
  - c) Descending limb of Henle loop
  - d) Ascending limb of Henle loop
  - e) Distal tubule and collecting duct
- 14) Which of the following increases the excretion of NaCl and water by the kidneys?
- a) ANP
  - b) BNP
  - c) ADH
  - d) A & B
  - e) All of the above
- 15) Which of the following increases during volume expansion (increased ECF)?
- a) Sympathetic activity
  - b) Renin and angiotensin II secretion
  - c) Aldosterone secretion
  - d) ANP and BNP secretion
  - e) ADH secretion
- 16) A previously health 45-year-old man is admitted to the hospital with pneumonia. His blood pressure is 140/75mmHg and his plasma [Na<sup>+</sup>] is 142mEq/L. His condition is treated with intravenous antibiotics and fluids. On the third hospital day, his blood pressure is unchanged but his [Na<sup>+</sup>] is 130mEq/L. His urine osmolality is 450mOsm/kg H<sub>2</sub>O. He has no edema and no orthostatic changes. Which of the following is the most likely cause for the development of hyponatremia in this patient?
- a) Decreased ingestion of NaCl



- b) Increased renal excretion of NaCl
  - c) Positive water balance
  - d) Shift of water from the ICF to the ECF
  - e) Shift of Na<sup>+</sup> from the ECF to the ICF
- 17) In the 45-year-old patient, what would be the most appropriate way to return the plasma [Na<sup>+</sup>] to its normal value?
- a) Administer ADH
  - b) Restrict water intake
  - c) Increase water intake
  - d) Restrict NaCl intake
  - e) Increase NaCl intake
- 18) A 56-year-old woman has a history of congestive heart failure. Because of poor cardiac output, she is easily fatigued and has developed generalized edema with swelling of her ankles and legs. Her plasma [Na<sup>+</sup>] has decreased from a normal value of 145 to 130mEq/L. As part of her therapy, she receives a drug that inhibits ACE. What would be the most appropriate change in this patient's intake of NaCl and water?
- a) Water intake is increased and NaCl intake is increased
  - b) Water intake is increased and NaCl intake is restricted
  - c) Water intake is restricted and NaCl intake is increased
  - d) Water intake is restricted and NaCl intake is restricted
  - e) No changes to water intake or NaCl intake
- 19) Administration of an ACE inhibitor would be expected to have which of the following effects on circulating levels of renin, aldosterone, and bradykinin?
- a) Renin decreased, aldosterone decreased, bradykinin decreased
  - b) Renin decreased, aldosterone decreased, bradykinin increased
  - c) Renin increased, aldosterone increased, bradykinin decreased
  - d) Renin increased, aldosterone decreased, bradykinin increased
  - e) Renin increased, aldosterone increased, bradykinin decreased

### Renal #6 – Physiology: K<sup>+</sup>, Ca<sup>++</sup>, & Pi Homeostasis

- 1.1) Nearly all (98%) of body potassium is stored in cells. What is a normal potassium level, measured in the extracellular fluid (ECF)?
- a) 3mEq/L
  - b) 4mEq/L
  - c) 5mEq/L
  - d) 6mEq/L
  - e) 7mEq/L
- 1.2) Hyperkalemia would be most likely seen in:
- a) 20% of hospitalized patients
  - b) Gitelman syndrome
  - c) Hyperglycemia
  - d) Diuretic use
  - e) Surreptitious vomiting
- 2) After a normal meal, potassium levels would increase to a potentially lethal value (33mEq K<sup>+</sup> in food \* 14L ECF = 2.4mEq/L increase). Which of the following mechanisms prevents the potentially life-threatening hyperkalemia?

- a) Renal excretion
  - b) GI excretion
  - c) Prevention of GI absorption
  - d) Rapid cell uptake
  - e) Ion binding to a non-active form
- 3.1) Which of the following is NOT involved in maintaining plasma concentration of potassium?
- a) Angiotensin II
  - b) Aldosterone
  - c) Epinephrine
  - d) Insulin
- 3.2) What effect does beta adrenergic receptor activation during exercise having on potassium levels?
- a) Causes drastic hypokalemia
  - b) Causes drastic hyperkalemia
  - c) Prevents hypokalemia
  - d) Prevents hyperkalemia
  - e) Exercise does not affect potassium levels
- 3.3) Along with patients who are taking propranolol (beta2 antagonist), which of the following conditions would lead to a sharp rise in plasma K<sup>+</sup> after a potassium-rich meal?
- a) Gastroenteritis
  - b) Gastric ulcers
  - c) Epilepsy
  - d) COPD
  - e) Diabetes
  - f) Cholecystitis
- 3.4) Which of the following acid-base disorders would lead to hypokalemia?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis
  - d) Metabolic alkalosis
  - e) None of the above
- 3.5) Which of the following situations would decrease urinary excretion of potassium?
- a) Hyperkalemia
  - b) Chronic aldosterone increase
  - c) Glucocorticoid release
  - d) Acute acidosis
  - e) Chronic acidosis
- 4) Potassium secretion from the blood into the tubular fluid at which location is the major determinant of urinary potassium secretion?
- a) Glomerulus
  - b) Proximal tubule
  - c) Descending limb of Henle loop
  - d) Ascending limb of Henle loop
  - e) Distal tubule and collecting duct

- 5.1) Which of the following describes the two step process in potassium secretion?
- Na<sup>+</sup>/K<sup>+</sup> ATPase pump at basolateral membrane and passive diffusion at apical membrane
  - Na<sup>+</sup>/K<sup>+</sup> ATPase pump at basolateral and apical membrane
  - Passive diffusion at basolateral membrane and Na<sup>+</sup>/K<sup>+</sup> ATPase pump at apical membrane
  - Passive diffusion at basolateral and apical membrane
  - H<sup>+</sup>/K<sup>+</sup> ATPase pump at basolateral membrane and Na<sup>+</sup>/K<sup>+</sup> ATPase pump at apical membrane
- 5.2) Along with plasma potassium concentration, which of the following is the major regulator of potassium secretion?
- Osmolality
  - Aldosterone
  - Epinephrine
  - Insulin
  - Renin
- 6) Which of the following increases the electrochemical driving force for potassium secretion across the apical membrane of principle cells via increased sodium uptake?
- Chronic hypokalemia (<3.5mEq/L)
  - Chronic hyperkalemia (>5mEq/L)
  - Acute hyperkalemia
  - Aldosterone
  - ADH
- 7) Which of the following would NOT have a significant effect on potassium excretion?
- Increased tubular flow during diuretic use
  - Increased tubular flow during water diuresis
  - Increased Na<sup>+</sup> uptake into cells
  - Increased K<sup>+</sup> permeability at apical plasma membrane
  - Increased tubular flow minimizing tubular fluid K<sup>+</sup> concentration rise
- 8.1) Hypocalcemia may occur with decreased bone resorption, intestinal absorption, or renal tubular reabsorption. Which of the following is the most likely symptom?
- Lethargy
  - Cardiac arrhythmia
  - Tetany
  - Disorientation
  - Flaccidity
- 8.2) Bone formation via the calcium pool is regulated by:
- Calcitriol
  - Calcitonin
  - Parathyroid hormone (PTH)
  - PTH and calcitriol
  - PTH, calcitonin, and calcitriol
- 8.3) Intestinal calcium absorption is regulated by:
- Calcitriol
  - Calcitonin
  - PTH and calcitriol

- d) PTH, calcitonin, and calcitriol
  - e) None of the above
- 8.4) Kidney excretion of calcium is inhibited by:
- a) Calcitriol
  - b) Calcitonin
  - c) PTH and calcitriol
  - d) PTH, calcitonin, and calcitriol
  - e) None of the above
- 8.5) Primary hyperparathyroidism would lead to which of the following?
- a) Hyperkalemia
  - b) Hypokalemia
  - c) Hypercalcemia
  - d) Hypocalcemia
- 8.6) Which of the following would increase calcium reabsorption at the distal tubule of the nephron?
- a) Volume expansion
  - b) Hypercalcemia
  - c) Phosphate depletion
  - d) Acidosis
  - e) Vitamin D
- 9) The majority of filtered calcium is reabsorbed at what location, with most of the reabsorbed calcium being through the paracellular (across tight junctions) route?
- a) Glomerulus
  - b) Proximal tubule
  - c) Descending limb of Henle loop
  - d) Ascending limb of Henle loop
  - e) Distal tubule and collecting duct
- 10) What is the most potent regulator of renal calcium excretion?
- a) Calcitriol
  - b) Calcitonin
  - c) PTH
  - d) Na<sup>+</sup> concentration
  - e) K<sup>+</sup> concentration
- 11) Phosphate (Pi) homeostasis is regulated in a similar fashion to calcium for GI absorption as well as bone formation and resorption. However, phosphate differs in that which of the following causes increased renal excretion?
- a) Calcitriol
  - b) Calcitonin
  - c) Parathyroid hormone (PTH)
  - d) PTH and calcitriol
  - e) PTH and calcitonin
- 12) Which of the following would decrease proximal tubule reabsorption of phosphate?
- a) Chronic vitamin D use
  - b) Chronic metabolic alkalosis
  - c) Phosphate depletion
  - d) Volume depletion

- e) Acute hypercalcemia
- 13.1) What is the major stimulus for parathyroid hormone (PTH) secretion?
- a) Volume depletion
  - b) Ventricular pressure
  - c) Hyponatremia
  - d) Hypocalcemia
  - e) Hyperkalemia
- 13.2) A Muslim woman undergoes a head CT scan, which reveals craniotabes (abnormal softening of the cranium). History reveals she wears a traditional burqa that cloaks her entire body whenever she is outside. Which of the following is likely to be decreased in this patient?
- a) Calcium release from the bone
  - b) Phosphate absorption in the intestine
  - c) Plasma phosphate concentration
  - d) Calcium reabsorption in the kidney
  - e) Bone resorption rate
- 14) Post-menopausal women, who are deficient in estrogen, are more likely to develop:
- a) Diabetes mellitus
  - b) Achondroplasia
  - c) Ricketts
  - d) Osteoporosis
  - e) Paget disease of the bone
- 15) An 18-year-old man with insulin-dependent diabetes mellitus was seen in the Emergency Department. He did not take his insulin during the previous 24-hours because he did not feel well and was not eating. He was weak, nauseated, thirsty, and urinated frequently. On physical exam, he had deep and rapid respiration (Kussmaul breathing). Diabetic ketoacidosis is diagnosed and the patient is admitted. After insulin was administered, the plasma  $[K^+]$  decreased. What cause hyperkalemia in this patient?
- a) Frequent urination
  - b) Ketoacidosis
  - c) Increased plasma glucose levels
  - d) Glucose and ketones in the urine
  - e) Metabolic alkalosis
- 16) In the 18-year-old patient, why did plasma  $[K^+]$  decreased after administration of insulin?
- a) Promotion of  $K^+$  uptake into cells
  - b) Correction of the ketoacidosis, allowing  $K^+$  to enter cells in exchange for  $H^+$
  - c) Decrease in polyuria, stimulating the amount of  $K^+$  excreted in the urine
  - d) Stimulation of glucose uptake in cells, increasing plasma osmolality
  - e) Insulin inhibition of  $Na^+/K^+$  ATPase thereby causing  $K^+$  uptake into cells
- 17) A 55-year-old woman came to the Emergency Room with severe flank pain caused by a renal stone lodged in her right ureter. Tests revealed that the renal stone formed because of demineralization of bone and elevated serum levels of PTH. A benign PTH-secreting adenoma of the parathyroid gland was identified. What values of serum  $[Ca^{++}]$  and  $[Pi]$  would be predicted for this patient?
- a) Increased serum  $[Ca^{++}]$ , decreased serum  $[Pi]$

- b) Increased serum  $[Ca^{++}]$ , increased serum  $[Pi]$
  - c) Unchanged serum  $[Ca^{++}]$ , unchanged serum  $[Pi]$
  - d) Decreased serum  $[Ca^{++}]$ , decreased serum  $[Pi]$
  - e) Decreased serum  $[Ca^{++}]$ , increased serum  $[Pi]$
- 18) High levels of serum PTH found in the 55-year-old patient would be expected to increase  $Ca^{++}$  reabsorption in which segment of the nephron?
- a) The glomerulus
  - b) The proximal tubule
  - c) The thick ascending limb of the loop of Henle
  - d) The distal tubule
  - e) The collecting duct
- 19) High levels of serum PTH found in the 55-year-old patient would be expected to decrease  $Pi$  reabsorption in which segment of the nephron?
- a) The glomerulus
  - b) The proximal tubule
  - c) The thick ascending limb of the loop of Henle
  - d) The distal tubule
  - e) The collecting duct

**Renal #7 – Physiology: Regulation of Acid-Base Balance**

- 1) An acid is a substance that adds what ion to body fluids?
- a)  $H^+$
  - b)  $Na^+$
  - c)  $Cl^-$
  - d)  $OH^-$
  - e)  $Ca^{++}$
- 2) Which of the following is considered a volatile acid?
- a)  $H_3PO_4$
  - b) Methionine
  - c)  $CO_2$
  - d) Lysine
  - e) Lactic acid
- 3) Which of the following serves to reabsorb the filtered load of bicarbonate ( $HCO_3^-$ )?
- a)  $Na^+$
  - b)  $NH_4^+$
  - c)  $H^+$
  - d)  $Ca^{++}$
  - e)  $Pi$
- 4.1) Most of the  $HCO_3^-$  is reabsorbed at what location in the nephron?
- a) The glomerulus
  - b) The proximal tubule
  - c) The thick ascending limb of the loop of Henle
  - d) The distal tubule
  - e) The collecting duct
- 4.2) What is the primary mechanism that regulates  $H^+$  secretion?
- a) Renin-angiotensin-aldosterone

- b) Blood volume
  - c) Medulla receptors
  - d) Acid-base balance
  - e)  $\text{HCO}_3^-/\text{Cl}^-$  antiporter on apical membrane
- 5) Secretion of which of the following is critically involved in the formation of new bicarbonate?
- a)  $\text{Na}^+$
  - b)  $\text{NH}_4^+$
  - c)  $\text{H}^+$
  - d)  $\text{Ca}^{++}$
  - e) Pi
- 6.1) Which of the following is NOT a defense mechanism to acid-base imbalance?
- a) Extracellular buffering
  - b) Intracellular buffering
  - c) Adjustments in net acid excretion
  - d) Alterations in ventilatory rate
  - e) Alterations in heart rate
- 6.2) Which of the following are ways to help move toward normal pH in a patient with metabolic acidosis?
- a) Increased renal net acid excretion (NAE) and increased respiratory rate
  - b) Increased renal net acid excretion (NAE) and decreased respiratory rate
  - c) Decreased renal net acid excretion (NAE) and increased respiratory rate
  - d) Decreased renal net acid excretion (NAE) and decreased respiratory rate
- 6.3) Which of the following mechanisms can adjust (toward normal pH) in a patient with respiratory acidosis or alkylolosis?
- a) Extracellular buffering and NAE
  - b) Extracellular buffering and ventilatory rate
  - c) Intracellular buffering and NAE
  - d) Intracellular buffering and ventilatory rate
  - e) NAE and ventilatory rate
- 7.1) Which of the following is characterized by low plasma pH (<7.4) and decreased  $\text{PCO}_2$  (<40mmHg)?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis
  - d) Metabolic alkalosis
- 7.2) Which of the following is characterized by high plasma pH (>7.4) and decreased  $\text{PCO}_2$  (<40mmHg)?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis
  - d) Metabolic alkalosis
- 8) A 22-year-old man with insulin-dependent diabetes mellitus (IDDM) is seen in the ER. He reports that he "has had the flu for the past couple days." Because he has not felt well, he has not taken his insulin. He reports taking two aspirin pills because of a headache. On

examination, he is found to have rapid and deep respirations. Lab results show decreased arterial pH and decreased  $[\text{HCO}_3^-]$ . What type of acid-base disorder does this man have?

- a) Metabolic acidosis
  - b) Metabolic alkalosis
  - c) Respiratory acidosis
  - d) Respiratory alkalosis
  - e) Mixed disorder (metabolic acidosis and respiratory alkalosis)
- 9) Why are the 22-year-old patient's respirations rapid and deep?
- a) The decreased in  $\text{PCO}_2$  has stimulated his respiratory center
  - b) Hypoxemia has stimulated his respiratory center
  - c) This is normal due to his acid-base disturbance
  - d) There is poor pulmonary gas exchange due to infection
  - e) Aspirin has stimulate his respiratory center
- 10) In the 22-year-old patient, what is the most important component of the compensatory response by his kidney's to his acid-base disorder?
- a) Increased filtered load of  $\text{HCO}_3^-$
  - b) Decreased secretion of  $\text{H}^+$  by the proximal tubule
  - c) Increased production and excretion of  $\text{NH}_4^+$
  - d) Decreased  $\text{H}^+$  secretion by the collecting duct
  - e) Increased secretion of  $\text{HCO}_3^-$  by the collecting duct
- 11) A 50-year-old woman with a history of a duodenal ulcer comes to the ER because she has had intermittent vomiting for several days. She is admitted to the hospital and a nasogastric tube is introduced to continuously remove the stomach contents. After 24-hours, the woman has signs of volume depletion. Lab results show increased arterial pH and a  $\text{PCO}_2$  of 45mmHg. What type of acid-base disorder does this patient have?
- a) Metabolic acidosis
  - b) Metabolic alkalosis
  - c) Respiratory acidosis
  - d) Respiratory alkalosis
  - e) Mixed disorder (metabolic acidosis and respiratory alkalosis)
- 12) In the 50-year-old patient, why is her urine acidic?
- a) Collecting duct  $\text{H}^+$  secretion is stimulated by aldosterone
  - b)  $\text{H}^+$  secretion by the proximal tubule is impaired
  - c) The filtered load of  $\text{HCO}_3^-$  is increased
  - d)  $\text{NH}_4^+$  production and secretion is increased
  - e) Titratable acid excretion is increased

### Renal #8 – Pharmacology: Urinary Tract Infections

1) Over 10% of women in the U.S. report having a urinary tract infection (UTI) in a given year. What is the lifetime probability that a woman will have a UTI?

- a) 20%
- b) 40%
- c) 60%
- d) 80%
- e) 100%



- 2) A 20-year-old woman, married without children presents with complaints of burning urination, frequent urination of small amounts, and bladder pain. She has a history of UTIs. She has no fever or costovertebral angle (CVA) tenderness. A clean-catch midstream urine sample shows gram-negative rods on Gram stain. A culture and sensitivity (C&S) test is ordered, and the results of a STAT urinalysis (UA) are: appearance straw-colored; specific gravity 1.015; pH 8.0; protein, glucose, ketons, bilirubin, and blood negative; WBC 10-15 cells/mm<sup>3</sup>. Based on these findings, what is the most likely cause of this patient's lower UTI?
- C. trachomatis*
  - S. pyogenes*
  - P. aeruginosa*
  - P. mirabilis*
  - E. coli*
- 3) What is the drug of choice for a lower UTI even before C&S results are available?
- Ampicillin
  - Amoxicillin
  - TMP-SMX
  - Ciprofloxacin
  - Nitrofurantoin
- 4) A UA and C&S is completed on a patient with a suspected UTI. Bacteria is iridescence (pearlescent) and grows on nutrient agar, producing a blue-green pigment (pyocyanin) that diffuses into the medium to give the plate a distinctive color. The lab attendant says the bacteria smells like tortilla and jokes that it can grow in jet fuel. Which of the following is most likely?
- C. trachomatis*
  - S. pyogenes*
  - P. aeruginosa*
  - P. mirabilis*
  - E. coli*
- 5) Which of the following is NOT a recommended antibiotic (single daily dose) treatment period for an uncomplicated UTI?
- 1-day
  - 3-days
  - 5-days
  - 7-days
  - 10-days
- 6) Which of the following patients is a candidate for single-dose antimicrobial therapy?
- Female patient with systemic manifestations of UTI
  - Male patient with an uncomplicated UTI
  - UTI patient with renal disease
  - Female patient with *Escherichia* species UTI
  - UTI patient with diabetes mellitus and pregnancy
- 7) A patient is being treated for cystitis and returns to the primary care clinic complaining of a rash, fever, and photosensitivity. They know they are suppose to take the drug once a day for three days. What is the most likely drug the patient is on?
- Nitrofurantoin macrocrystals

- b) Ciprofloxacin
  - c) Ampicillin
  - d) TMP-SMX
  - e) Fosfomycin tromethamine
- 8) A 60-year-old patient is brought into the Emergency Room with trouble walking. History reveals they are taking corticosteroids and “some big horse pill” for a UTI. A Thompson test (plantarflexion with calf squeeze) is positive for an Achilles tendon rupture on the right side. What UTI drug is the patient likely taking?
- a) Nitrofurantoin macrocrystals
  - b) Ciprofloxacin
  - c) Ampicillin
  - d) TMP-SMX
  - e) Fosfomycin tromethamine
- 9) Which of the following drugs may be reduced to active intermediates by flavoproteins to inactivate ribosomal proteins, and inhibit DNA, RNA, and cell wall synthesis, which would help explain why bacteria-acquired resistance to the drug is rare?
- a) Nitrofurantoin macrocrystals
  - b) Ciprofloxacin
  - c) Ampicillin
  - d) TMP-SMX
  - e) Fosfomycin tromethamine
- 10) A 48-year-old women presents with a community-acquired UTI. She has a history of Type I hypersensitivity to penicillins. Initial lab analysis shows *P. aeruginosa* as a possible cause. What is the drug of choice for this patient?
- a) Nitrofurantoin macrocrystals
  - b) Ciprofloxacin
  - c) Ampicillin
  - d) TMP-SMX
  - e) Fosfomycin tromethamine
- 11) A 70-year-old patient with chest pain is hospitalized to rule out acute myocardial infarction. This is her third hospitalization for chest pain in the last six months. Two days after admission, she complains of burning on urination and bladder pain. The patient is told her nosocomial UTI may prolong hospitalization by an average of 2.5 days. What drug should this patient be started on?
- a) Nitrofurantoin
  - b) Pencillin G
  - c) TMP-SMX
  - d) Ciprofloxacin
  - e) Fosfomycin
- 12) Which of the following is a reasonable option for a patient without prior UTI and only moderate illness?
- a) Cefazolin
  - b) Ampicillin-sulbactam
  - c) Ampicillin-sulbactam with aminoglycoside
  - d) Ampicillin with aminoglycoside
  - e) Levofloxacin

- 13) Which of the following is the most frequent cause of nosocomial UTI, where ceftriaxone can be used?
- a) *Escherichia coli*
  - b) *Staphylococcus saprophyticus*
  - c) *Enterococcus faecalis*
  - d) *Providencia stuartii*
  - e) *Morganella morganii*
- 14) A 45-year-old diabetic woman comes to the ER complaining of frequent urination, fever, shaking chills, and flank pain. She takes 20 units of NPH insulin SQ every morning. Positive physical findings include 103°F temp, 110bpm pulse, 90/60 blood pressure, and CVA tenderness. Gram stain of urine shows gram-negative rods. A STAT UA shows glucosuria, macroscopic hematuria, 20-25 WBC/mm<sup>3</sup>, and numerous bacteria. Blood sugar is very high at 400mg/dL. She is admitted and started on IV normal saline, 1gm of ampicillin IV Q 6 hours, and a sliding scale schedule of regular insulin based on Q 6 hour blood sugars. Why was this patient hospitalized?
- a) Glomerulonephritis
  - b) Pyelonephritis
  - c) Cystitis
  - d) Urethritis
  - e) Diabetic ketoacidosis
- 15) In the above 45-year-old patient, which of the following drugs would NOT be appropriate as she is diabetic?
- a) Ceftriaxone
  - b) Aztreonam
  - c) Streptomycin
  - d) Cefotaxime
  - e) Ampicillin
- 16) On routine screening, asymptomatic bacteriuria is noted in a 30-year-old pregnant woman during her first trimester. Five years ago, during her first pregnancy, she developed acute bacterial pyelonephritis which required hospitalization and treatment with parenteral antibiotics. These subsided when she started taking nitrofurantoin, but she discontinued the practice before this pregnancy because she was afraid of the potential effects of this drug on the fetus. What drug is appropriate for this patient?
- a) Tetracycline
  - b) Sulfamethoxazole
  - c) Ciprofloxacin
  - d) Cefotaxime
  - e) Moxifloxacin
- 17) Which of the following drugs used for acute cystitis is taken over a 7-day period (in contrast to a 3-day period)?
- a) Cephalexin
  - b) Ciprofloxacin
  - c) Nitrofurantoin
  - d) Norfloxacin
  - e) Ofloxacin

18) Acute pyelonephritis can be treated with ampicillin, ciprofloxacin or TMP-SMX.

How long should treatment last?

- a) 3-days
  - b) 5-days
  - c) 7-days
  - d) 14-days
  - e) 21-days
- 19) How long should antibiotic treatment last for chronic pyelonephritis?
- a) 7 to 21-days
  - b) 1 to 2-months
  - c) 3 to 6-months
  - d) 9 to 12-months
  - e) At least a year

**Renal #9 – Pharmacology: Renal Stones & Polyuria**

1) Which of the following would NOT likely lead to the formation of stony concretions in the kidney (nephrolithiasis)?

- a) Presence of bacteria
  - b) Changes in urine pH
  - c) Greatly increased vitamin C intake
  - d) High urine volume
  - e) Supersaturation of urine
- 2) Accumulation of salts in the kidney can lead to branching stones that form a cast of the pelvic and calyceal system. What are these types of stones called?
- a) Smooth stones
  - b) Jagged stones
  - c) Branching stones
  - d) Irregular stones
  - e) Staghorn stones
- 3) Which of the following types of kidney stone is either white or tan in color, forms mostly in females, forms in relatively alkaline urine, and is not seen on x-ray nor CT?
- a) Calcium
  - b) Uric acid
  - c) Struvite
  - d) Cystine
- 4) Which of the following types of kidney stone is orange in color, forms most in men, and forms in acidic urine?
- a) Calcium
  - b) Uric acid
  - c) Struvite
  - d) Cystine
- 5) What color are the kidney stones that result from cystine accumulation?
- a) Honey
  - b) Tan
  - c) Brown
  - d) Black

- e) White
- 6) Which of the following types of kidney stones is the most common?
- a) Calcium
  - b) Uric acid
  - c) Struvite
  - d) Cystine
- 7) Which of the following is associated with acidosis or chronic diarrhea of unknown cause?
- a) Hypercalciuria
  - b) Hyperuricosic
  - c) Hypercalcemia
  - d) Hyperoxaluria
  - e) Hypocitraturia
- 8) Which of the following is a common cause of struvite stones due to its ability to split urea, forming alkaline ammonia and causing salts to precipitate?
- a) *Escherichia* species
  - b) *Staphylococcus* species
  - c) *Proteus* species
  - d) *Klebsiella* species
  - e) *Streptococcus* species
- 9) A patient with which of the following abnormalities should restrict their salt intake and consider thiazide and amiloride?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
- 10) A patient with which of the following abnormalities should add calcium carbonate to their diet and possibly use pyridoxine?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
- 11) A patient with which of the following abnormalities should reduce purine intake?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
- 12) What is the recommended treatment for a patient with a suspected small, smooth, unilateral kidney stone that has a potential of passage?
- a) Percutaneous nephrolithotomy (nephrolithotripsy)
  - b) Minimally invasive intraureter surgery
  - c) Open surgery
  - d) Extracorporeal shock-wave lithotripsy (ESWL)
  - e) No treatment necessary
- 13) Which of the following is NOT an adverse effect seen in thiazide diuretics?
- a) Hyponatremia

- b) Hyperuricemia
  - c) Hyperglycemia
  - d) Hyperlipidemia
  - e) Hypokalemia
- 14) A patient with which of the following abnormalities should undergo urine alkalization?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
- 15) A patient with which of the following abnormalities could receive acetazolamine (during night), sodium bicarbonate (during day), and possibly a xanthine inhibitor?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
- 16) A patient with which of the following should increase their water intake, increase their urine pH, and possibly take d-penicillamine?
- a) Hyperuricosuria
  - b) Hyperoxaluria
  - c) Hypocitraturia
  - d) Hypercalciuria
  - e) Hypercystinuria
- 17) Polyuria is defined as daily urine output in excess of:
- a) 500mL
  - b) 1L
  - c) 2L
  - d) 3L
  - e) 4L
- 18) Which of the following would NOT likely lead to polyuria?
- a) Polydipsia (5-10L/day)
  - b) Inadequate secretion of arginine-vasopressin (AVP)
  - c) Failure of renal tubules to respond to arginine-vasopressin (AVP)
  - d) Inadequate filtration of poorly reabsorbed solutes
- 19) In a patient with polyuria, solute diuresis should be started if urine osmolality is greater than:
- a) 200mOsm
  - b) 250mOsm
  - c) 300mOsm
  - d) 350mOsm
  - e) 400mOsm
- 20) A patient presents with central (vasopressin-sensitive) diabetes insipidus (CDI). They are treated with desmopressin, an AVP synthetic analog that acts on V2 receptors in the kidney. Which of the following is NOT a cause of CDI?
- a) Sheehan syndrome
  - b) Hypophysectomy

- c) Amyloidosis
  - d) Guillain-Barré syndrome
  - e) Supra- or intrasellar tumor
- 21) Which of the following is NOT a cause of nephrogenic (vasopressin-insensitive) diabetes insipidus (NDI)?
- a) Sjögren syndrome
  - b) Empty sella
  - c) Multiple myeloma
  - d) Sarcoidosis
  - e) Sickle cell anemia
- 22) Which of the following is NOT a treatment option for NDI?
- a) Lithium
  - b) Amiloride
  - c) Hydrochlorothiazide
  - d) Indomethacin
  - e) Reduce sodium intake
- 23) A 24-year-old male was admitted to the hospital with intense pain radiating over the abdomen and into his groin. The patient is training for a marathon and ran 18 miles several hours earlier in the day in 80F weather. Afterwards, he felt lightheaded and thirsty; for the next hour he drank water freely. He experienced frequency to urinate and painfully passed bloody urine. Along with increased fluid intake, what should this patient be prescribed?
- a) ESWL
  - b) Potassium-sparing diuretic
  - c) ACE inhibitor
  - d) Thiazide diuretic
  - e) Beta blocker

**Renal #10 – Pharmacology: Diuretics**

- 1) Thiazide diuretics increase the excretion of Na<sup>+</sup> and Cl<sup>-</sup> at what nephron location?
- a) The glomerulus
  - b) The proximal tubule
  - c) The descending limb of the loop of Henle
  - d) The ascending limb of the loop of Henle
  - e) The collecting duct
- 2) What is the onset of action for hydrochlorothiazide?
- a) Immediately
  - b) 15-minutes
  - c) 30-minutes
  - d) 1-hour
  - e) 2-hours
- 3) What drug interaction is seen when lithium is combined with thiazide diuretics?
- a) Increased lithium levels
  - b) Decreased lithium levels
  - c) Increased thiazide levels
  - d) Decreased thiazide levels

- 4) What drug interaction is seen when NSAIDs are combined with thiazide diuretics?
- Increased NSAID levels
  - Decreased NSAID levels
  - Increased thiazide levels
  - Decreased thiazide levels
- 5) What drug interaction is seen when anti-gout, sulfonyleureas, or insulin are combined with thiazide diuretics?
- Increased levels of anti-gout, sulfonyleureas, and insulin
  - Decreased levels of anti-gout, sulfonyleureas, and insulin
  - Increased thiazide levels
  - Decreased thiazide levels
- 6) Which of the following is an indication for a thiazide diuretic (instead of a loop diuretic)?
- Congestive heart failure
  - Renal disease
  - Mild hypertension
  - Hepatic cirrhosis
  - Pulmonary edema
- 7) Which of the following loop diuretics is more chloruretic and does not act on the distal tubule?
- Furosemide
  - Ethacrynic acid
  - Bumetanide
  - Torsemide
- 8) A pediatric patient presents with congenital heart disease that causes severe edema. What loop diuretic should be used?
- Furosemide
  - Ethacrynic acid
  - Bumetanide
  - Torsemide
- 9) Which of the following is NOT an adverse reaction to loop diuretics?
- Ototoxicity
  - Hypermagnesemia
  - Hyperuricemia
  - Hypokalemia
  - Hypercalcemia
- 10) What is the site of action for potassium-sparing diuretics?
- The glomerulus
  - The proximal tubule
  - The descending limb of the loop of Henle
  - The ascending limb of the loop of Henle
  - The distal tubule
- 11) An elderly patient presents with congestive heart failure and hyperkalemia. The clinician fears the patient may soon have fatal Torsade de Pointes. Which of the following diuretics would be beneficial for this patient?
- Spironolactone



- b) Triamterene
  - c) Furosemide
  - d) Amiloride
- 12) What drug interaction is seen when amiloride is combined with digoxin?
- a) Increased digoxin levels
  - b) Decreased digoxin levels
  - c) Increased amiloride levels
  - d) Decreased amiloride levels
- 13) What drug interaction is seen when spironolactone is combined with digoxin?
- a) Increased digoxin levels
  - b) Decreased digoxin levels
  - c) Increased Spironolactone levels
  - d) Decreased Spironolactone levels
- 14) What drug interaction is seen when triamterene is combined with amantadine?
- a) Increased amantadine levels
  - b) Decreased amantadine levels
  - c) Increased triamterene levels
  - d) Decreased triamterene levels
- 15) Which of the following is associated with gynecomastia and carcinoma formation?
- a) Hydrochlorothiazide
  - b) Triamterene
  - c) Furosemide
  - d) Amiloride
  - e) Spironolactone
- 16) Which of the following is associated with diarrhea and thrombocytopenia?
- a) Acetazolamide
  - b) Triamterene
  - c) Furosemide
  - d) Amiloride
  - e) Spironolactone
- 17) Carbonic anhydrase inhibitors (e.g. acetazolamide) increase the secretion of all of the following EXCEPT:
- a) Na<sup>+</sup>
  - b) K<sup>+</sup>
  - c) H<sup>+</sup>
  - d) HCO<sub>3</sub><sup>-</sup>
  - e) H<sub>2</sub>O
- 18) Acetazolamide levels can increase with salicyclates (e.g. aspirin) and may lead to toxicity. What other drug interactions does acetazolamide have?
- a) Increases cyclosporine levels and increases primidone levels
  - b) Increases cyclosporine levels and decreases primidone levels
  - c) Decreases cyclosporine levels and increases primidone levels
  - d) Decreases cyclosporine levels and decreases primidone levels
- 19) A patient is being treated with an unknown diuretic and develops numbness and tingling of the fingers and toes. They say they have had taste alterations (parageusia),

especially when drinking carbonated drinks. Physical exam reveals mild urticaria. Which of the following drugs is the patient most likely taking?

- a) Acetazolamide
  - b) Triamterene
  - c) Furosemide
  - d) Mannitol
  - e) Spironolactone
- 20) A patient is brought into the Emergency Room by ambulance after a car crash. Physical exam reveals increased intracranial pressure. Which of the following drugs can help relieve this patient's pressure?
- a) Acetazolamide
  - b) Triamterene
  - c) Furosemide
  - d) Mannitol
  - e) Spironolactone
- 21) What is the drug of choice for a patient that has ascities due to liver cirrhosis?
- a) Acetazolamide
  - b) Triamterene
  - c) Furosemide
  - d) Mannitol
  - e) Spironolactone
- 22) Which of the following drugs would be most useful in quickly (within 1 hour) reducing the formation of aqueous humor in the eye?
- a) Dichlorphenamide
  - b) Methazolamide
  - c) Acetazolamide
  - d) Mannitol
  - e) Spironolactone
- 23) Which of the following drugs would lead to hyperchloremic metabolic acidosis?
- a) Carbonic anhydrase inhibitor
  - b) Osmotic diuretic
  - c) Loop diuretic
  - d) Thiazide diuretic
  - e) Potassium-sparing diuretic
- 24) Carbonic anhydrase inhibitors work at what location in the nephron?
- a) The glomerulus
  - b) The proximal tubule
  - c) The descending limb of the loop of Henle
  - d) The ascending limb of the loop of Henle
  - e) The distal tubule
- 25) Aldosterone antagonists (e.g. spironolactone) work at what nephron location?
- a) Proximal convoluted tubule
  - b) Thick ascending limb
  - c) Distal convoluted tubule
  - d) Cortical collecting tubule
  - e) Medullary collecting tubule

- 26) What is the drug of choice for renal insufficiency?
- a) Carbonic anhydrase inhibitor
  - b) Osmotic diuretic
  - c) Loop diuretic
  - d) Thiazide diuretic
  - e) Potassium-sparing diuretic
- 27) Labs return on a patient, showing albumin >2gm/dL. Nephrotic syndrome is diagnosed. What is the initial drug of choice?
- a) Hydrochlorothiazide
  - b) Triamterene
  - c) Furosemide
  - d) Mannitol
  - e) Metolazone
- 28) What is the initial drug of choice for edema cause by mild congestive heart failure?
- a) Carbonic anhydrase inhibitor
  - b) Osmotic diuretic
  - c) Loop diuretic
  - d) Thiazide diuretic
  - e) Potassium-sparing diuretic

### **Renal #11 – Pathology**

- 1) What is the most common anomaly of the kidney?
- a) Unilateral agenesis of the kidney
  - b) Genetic hypoplasia of the kidney
  - c) Hypoplasia due to vascular or infectious disease
  - d) Ectopic kidney due to genetic defect
  - e) Horseshoe kidney
- 2) A newborn presents with an abdominal mass. Pyelogram shows an abnormal kidney on the right. Surgical removal shows a large reniform mass of cysts of various sizes that obscures the renal parenchyma. It is likely due to anomalous differentiation of the metanephros. Which of the following is most likely?
- a) Autosomal dominant polycystic kidney disease
  - b) Autosomal recessive polycystic kidney disease
  - c) Nephrotic syndrome
  - d) Acute nephritic syndrome
  - e) Cystic renal dysplasia
- 3.1) A 40-year-old presents with signs of renal failure. X-ray reveals very large kidneys. Biopsy of the kidney shows cysts with functioning nephrons outside of the cystic area. Hepatic cysts are found as well. The patient's problem is likely due to either a polycystin-1 (PKD1) mutation or a polycystin-2 (PKD2) mutation. Which of the following is most likely?
- a) Autosomal dominant polycystic kidney disease
  - b) Autosomal recessive polycystic kidney disease
  - c) Nephrotic syndrome
  - d) Acute nephritic syndrome
  - e) Cystic renal dysplasia

3.2) A two-year-old presents with signs of renal failure. CT scan shows the kidneys are enlarged and smooth, but have small cysts in the medulla and cortex. Hepatic fibrosis is also found. A fibrocystin (PKHD1) defect is the likely cause. Which of the following is most likely?

- a) Autosomal dominant polycystic kidney disease
- b) Autosomal recessive polycystic kidney disease
- c) Nephrotic syndrome
- d) Acute nephritic syndrome
- e) Cystic renal dysplasia

4) A patient presents with acute onset hematuria, proteinuria, oliguria (decreased urine production), and azotemia (nitrogen compounds in the blood). History reveals a recent streptococcal infection. Which of the following is most likely?

- a) Autosomal dominant polycystic kidney disease
- b) Autosomal recessive polycystic kidney disease
- c) Nephrotic syndrome
- d) Acute nephritic syndrome
- e) Cystic renal dysplasia

5) A diabetic patient presents with a streptococcal infection and leg pain. History reveals recent staphylococcal infections. Physical exam includes Homans sign (calf pain with dorsiflexion), which is positive for thrombosis. Urinalysis shows massive proteinuria. Blood tests show hypoalbuminemia. Which of the following is most likely?

- a) Autosomal dominant polycystic kidney disease
- b) Autosomal recessive polycystic kidney disease
- c) Nephrotic syndrome
- d) Acute nephritic syndrome
- e) Cystic renal dysplasia

6) A 17-year-old boy is brought to the emergency department by his parents with the complaint of coughing up blood. He is stabilized, and his hemoglobin and hematocrit levels are determined to be in the safe range. During his hospitalization, he is noted to have persistently elevated blood pressures, and his urinalysis is remarkable for hematuria and proteinuria. You are suspicious the patient has which of the following?

- a) Hemolytic-uremic syndrome
- b) Goodpasture syndrome
- c) Nephrotic syndrome
- d) Poststreptococcal glomerulonephritis
- e) Renal vein thrombosis

7) An Australian child presents with fever, nausea, oliguria, and hematuria. Physical exam reveals hypertension and periorbital edema. Labs show elevated ASO titers and a decline in serum C3 concentration. History reveals the child had a mild cough a week prior. Which of the following is most likely?

- a) Hemolytic-uremic syndrome
- b) Goodpasture syndrome
- c) Nephrotic syndrome
- d) Poststreptococcal glomerulonephritis
- e) Renal vein thrombosis
- f) Henoch-Schönlein purpura

- 8) A patient presents with hematuria, proteinuria, edema, and hypertension. Glomerular biopsy reveals crescents. Rapidly progressive glomerulonephritis (RPGN) is diagnosed. Which form of this disease is associated with systemic lupus erythematosus (SLE) and Henoch-Schönlein purpura?
- a) Anti-GBM antibody-induced disease
  - b) Immune complex-mediated disease
  - c) Pauci-immune type disease
  - d) None of the above
- 9) A patient presents with hematuria and mild hypertension. Questioning and exam reveal insidious onset of nephrotic syndrome. History reveals the patient has rheumatoid arthritis (RA) and is being treated with penicillamine. Renal testing reveals lesions very similar to those of experimental Heymann nephritis. Uniform presence of complement is found. Which of the following is most likely?
- a) Lipoid nephrosis (minimal change disease)
  - b) Cystic renal dysplasia
  - c) Membranous glomerulopathy
  - d) Focal segment glomerulosclerosis
  - e) Membranoproliferative glomerulonephritis
- 10) A 3-year-old presents with massive proteinuria. No hematuria or hypertension are present. History reveals a recent respiratory infection. Nephrotic cells show effacement of the foot processes. Which of the following is most likely?
- a) Lipoid nephrosis
  - b) Cystic renal dysplasia
  - c) Membranous glomerulopathy
  - d) Focal segment glomerulosclerosis
  - e) Membranoproliferative glomerulonephritis
- 11) An HIV-positive heroin addict presents with heavy proteinuria. Nephrotic epithelial damage is found, showing hyalinosis and hardening of the glomeruli. Which of the following is most likely?
- a) Lipoid nephrosis
  - b) Cystic renal dysplasia
  - c) Membranous glomerulopathy
  - d) Focal segment glomerulosclerosis
  - e) Membranoproliferative glomerulonephritis
- 12) A 30-year-old presents with signs of nephrotic syndrome (massive proteinuria) and signs of nephritic syndrome (hematuria, mild hypertension). Glomeruli are found to be large and hypercellular. Capillary loops show a tram track appearance on silver stain. Dense deposits are seen in the GBM proper. Which of the following is most likely?
- a) Lipoid nephrosis
  - b) Membranous glomerulopathy
  - c) Focal segment glomerulosclerosis
  - d) Membranoproliferative glomerulonephritis Type I
  - e) Membranoproliferative glomerulonephritis Type II
- 13) A patient presents with recurrent hematuria. Berger disease would be suspected for this patient if immunofluorescence study of the glomeruli showed mesangial deposits of:
- a) IgA

- b) IgD
  - c) IgE
  - d) IgG
  - e) IgM
- 14) A child presents with nephritis and hearing loss. History reveals the father has had nephritis and the mother has had occasional hematuria. A mutation to collagen type IV is suspected. Which of the following is most likely?
- a) Berger disease
  - b) Buerger disease
  - c) Thin GBM disease
  - d) Goodpasture syndrome
  - e) Alport syndrome
- 15) A patient with recurrent kidney problems presents with loss of appetite, anemia, and renal insufficiency. Testing reveals IgA deposits in the glomeruli, glomeruli sclerosis, and signs of glomeruli obliteration. Physical exam reveals hypertension and early signs of uremia. Which of the following is most likely?
- a) Lipoid nephrosis
  - b) Membranous glomerulopathy
  - c) Focal segment glomerulosclerosis
  - d) Membranoproliferative glomerulonephritis
  - e) Chronic glomerulonephritis
- 16) Which of the following is NOT a renal change likely to be seen in systemic lupus erythematosus (SLE)?
- a) Chronic renal failure
  - b) Nephritic syndrome
  - c) Anti-GBM antibodies
  - d) Recurrent hematuria
  - e) Hypertension
- 17) A 6-year-old child presents with abdominal pain and vomiting. Lesions are found on the extensor surfaces of the arms, legs, and buttocks. Testing shows mesangial IgA deposits. Which of the following is most likely?
- a) Hemolytic-uremic syndrome
  - b) Goodpasture syndrome
  - c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Renal vein thrombosis
  - f) Henoch-Schönlein purpura
- 18) Which of the following is NOT a renal change likely to be seen in bacterial endocarditis?
- a) Hematuria
  - b) Proteinuria
  - c) Hypertension
  - d) Acute nephritis
  - e) Rapidly progressive glomerulonephritis

- 19) Which of the following diseases is associated with increased GFR, hypertension, capillary basement membrane thickening, diffuse mesangial sclerosis, and nodular glomerulosclerosis (Kimmelstiel-Wilson disease)?
- a) Systemic lupus erythematosus
  - b) Bacterial endocarditis
  - c) Diabetes mellitus
  - d) Amyloidosis
  - e) Plasma cell dyscrasia
- 20) Which of the following would show apple-green birefringence on Congo red stain of the mesangium and renal capillary walls?
- a) Systemic lupus erythematosus
  - b) Bacterial endocarditis
  - c) Diabetes mellitus
  - d) Amyloidosis
  - e) Plasma cell dyscrasia
- 21) A patient presents with proteinuria, hypertension, azotemia, and nephritic syndrome. Electrophoresis shows a spike in M protein. Which of the following is most likely?
- a) Systemic lupus erythematosus
  - b) Bacterial endocarditis
  - c) Diabetes mellitus
  - d) Amyloidosis
  - e) Plasma cell dyscrasia
- 22) Urine containing which of the following would be most suggestive of acute tubular necrosis?
- a) White blood cells
  - b) WBC casts
  - c) Red blood cells
  - d) Lipid casts
  - e) Epithelial cell casts
- 23.1) A diabetic patient with a urinary tract infection presents with suspected acute pyelonephritis. Patchy interstitial suppurative inflammation is found as well as intratubular aggregates of neutrophils. Polyoma virus is suspected. X-ray shows a “golf Ball-on-Tee sign,” with the “tee” being formed as a blunted calyx. What complication does this diabetic patient likely have?
- a) Pyelonephrosis
  - b) Papillary necrosis
  - c) Perinephric abscess
  - d) Xanthogranulomatous pyelonephritis
  - e) Rapidly progressive glomerulonephritis (RPGN)
- 23.2) A young child presents with back pain, fever, and pyuria (pus in urine). X-ray shows asymmetric contracted kidney with coarse scars and blunting of calyces. Chronic pyelonephritis is suspected. What is the most likely cause in this patient?
- a) Vesicoureteral reflux
  - b) Renal dysplasia
  - c) Struvite calculi
  - d) Anatomic anomaly

- e) Urinary tract obstruction
- 24) Tubulointerstitial nephritis can be caused by all of the following EXCEPT:
- a) NSAIDs
  - b) Phenacetin
  - c) Phenytoin
  - d) Penicillin
  - e) Diuretics
- 25) An overweight man from Kentucky presents with slowly progressing renal disease. Past testing showed increased deposits of monosodium urate crystals. History reveals he had a recent “moonshine tasting” party with friends and felt very badly afterwards. Lab testing shows birefringent crystals deposits. What underlying disorder is likely involved in this patient’s nephropathy?
- a) Diabetes
  - b) Hypertension
  - c) Anemia
  - d) Gout
  - e) Hemochromatosis
- 26) A diabetic African American man with high blood pressure presents to the nephrologist for a renal consult. Testing finds medial and interstitial thickening as well as hardening of the renal arterioles with hyaline. Which of the following is most likely?
- a) Goodpasture syndrome
  - b) Acute tubular necrosis
  - c) Benign nephrosclerosis
  - d) Atheroembolic renal disease
  - e) Polycystic kidney disease
- 27) A patient with nephrosclerosis presents with hematuria and proteinuria. Testing shows an onion-skin appearance of the arteriolar smooth muscle. What is the most likely cause of this patient’s progressing nephrosclerosis?
- a) Diabetes
  - b) Hypertension
  - c) Anemia
  - d) Gout
  - e) Hemochromatosis
- 28) A middle-aged patient with diabetes with essential hypertension presents for a physical exam. A unilateral renal bruit is auscultated. Angiography shows renal artery stenosis due to an atheromatous plaque. What is the best treatment option for this patient?
- a) ACE inhibitors
  - b) Thiazide diuretics
  - c) Direct steroid injection
  - d) NSAIDs
  - e) Surgery
- 29) A child presents with a gastrointestinal infection due to verocytotoxin-producing *E. coli* (VTEC). A blood smear shows burr cells. Kidneys are found to have diffuse cortical necrosis and mesangiolysis. Which of the following is most likely?
- a) Hemolytic-uremic syndrome
  - b) Goodpasture syndrome



- c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Renal vein thrombosis
- 30) A patient presents with fever and hemolytic anemia. A blood smear shows burr cells. Further testing reveals a defect in ADAMTS-13, the protease that cleaves vWF. Which of the following is most likely?
- a) Hemolytic-uremic syndrome
  - b) Goodpasture syndrome
  - c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Thrombotic thrombocytopenic purpura
- 31) Atheroembolic renal disease is commonly seen in elderly patients with atherosclerosis after what type of surgery?
- a) Gastrointestinal
  - b) Appendectomy
  - c) Lung resection
  - d) Abdominal aorta
  - e) Pelvic fracture
- 32) Sickle cell disease can lead to nephropathy due to which characteristic of the renal medulla environment?
- a) High sodium
  - b) Low potassium
  - c) High nitrogen
  - d) Low oxygen
  - e) High tension
- 33.1) A woman presents with a UTI positive for *Proteus vulgaris*. Microscopic urinalysis reveals crystals with a “coffin lid” (quartz crystal) appearance. What type of kidney stone is this patient at risk for?
- a) Ammonium magnesium phosphate
  - b) Calcium oxalate
  - c) Uric acid (urate)
  - d) Cystine
- 33.2) A young man presents with extreme flank pain and hematuria. Physical exam is positive for CVA tenderness (Lloyd punch). History reveals the patient used up to a pack a day of chewable vitamin C tablets to “keep from getting the cold.” What type of kidney stone is this patient at risk for?
- a) Ammonium magnesium phosphate
  - b) Calcium oxalate
  - c) Uric acid (urate)
  - d) Cystine
- 34) Autopsy of a patient who died of a heart attack reveals kidney neoplasms. The tumors are small, less than 5mm in diameter, found in the cortex, and appear as pale yellow-gray nodules. The pathologist suggests that the patient probably had no renal symptoms. Which of the following is most likely?
- a) Wilm tumor
  - b) Renal cell carcinoma

- c) Transitional cell carcinoma
  - d) Renal adenoma
  - e) Metastasized cancer
- 35) A 70-year-old obese smoker presents with a triad of flank pain, palpable flank mass, and hematuria. History reveals weakness and night sweats. Biopsy of the kidney superior pole shows tubular epithelial cells with translucent cytoplasm. Which of the following forms of renal cell carcinoma does this patient have?
- a) Clear cell carcinoma
  - b) Papillary carcinoma
  - c) Chromophobe renal carcinoma
  - d) Collecting duct carcinoma
  - e) Von Hippel-Lindau disease
- 36) A patient presents with hematuria mild flank pain. Physical exam reveals no palpable mass. History reveals phenacetin use. Retrograde imaging and ureteroscopy reveal cancer of the renal pelvis. Which of the following is most likely?
- a) Wilm tumor
  - b) Renal cell carcinoma
  - c) Transitional cell carcinoma
  - d) Renal adenoma
  - e) Metastasized cancer
- 37) During abdominal surgery, the surgeon finds aggregated clusters on the ureter that looks like grapes hanging off a vine. A histological section of the cluster shows modified transitional epithelium. A review of the patient's chart shows a very recent urinary tract infection. Which of the following is most likely?
- a) Cystic renal dysplasia
  - b) Polycystic kidney disease
  - c) Ureteritis follicularis
  - d) Ureteritis cystica
  - e) Minimal change disease
- 38) A patient presents with complains of difficult urination. Testing reveals urethral narrowing due to inflammatory fibrosis with marked lymphocyte infiltrates. What is the most common cause of this patient's sclerosing retroperitoneal fibrosis?
- a) Ormond disease
  - b) Crohns disease
  - c) Beta-blocker use
  - d) Ergot-derivative use
  - e) Malignancy
- 39) A 50-year-old patient presents with recently recurrent urinary tract infections. Testing reveals acquired urinary bladder diverticula. What is the most likely cause?
- a) Congenital defect
  - b) Diabetes
  - c) Pregnancy
  - d) Malignancy
  - e) Prostate enlargement
- 40) Which of the following is NOT part of the clinical triad for cystitis?
- a) Urinary frequency

- b) Polyuria
  - c) Dysuria
  - d) Lower abdominal pain
- 41) A female presents with urinary frequency, urinary urgency, and hematuria. Although she has had symptoms for some time, she has not visited a health facility until now due to lack of insurance. Testing including cystoscopy with hydrodistention reveals mast cells and Hunner ulcers. Which of the following is most likely?
- a) Transitional cell carcinoma
  - b) Sclerosing retroperitoneal fibrosis
  - c) Interstitial cystitis
  - d) Malakoplakia
  - e) Acute cystitis
- 42) An immune-suppressed transplant patient presents with recurrent *E. coli* cystitis. Cystoscopy with biopsy reveals flat plaques and inflammatory exudate. The plaques have large foamy macrophages with multinucleated giant cells. Macrophages have granular cytoplasm and are periodic acid Schiff (PAS) positive. Calcium is found engulfed by large lysosomes (Michaelis-Gutmann bodies). Which of the following is most likely?
- a) Transitional cell carcinoma
  - b) Sclerosing retroperitoneal fibrosis
  - c) Interstitial cystitis
  - d) Malakoplakia
  - e) Acute cystitis
- 43.1) With chronic bladder irritation (e.g. extrophy, calculi, schistosomiasis), metaplasia will occur turning the urothelium into:
- a) Simple squamous epithelium
  - b) Glycogenated squamous epithelium
  - c) Simple cuboid epithelium
  - d) Simple columnar epithelium
  - e) Transitional epithelium
- 43.2) Which of the following cell types is used in the detection of recent sexual activity (males) or the presence of a foreign body (females)?
- a) Simple squamous epithelium
  - b) Glycogenated squamous epithelium
  - c) Simple cuboid epithelium
  - d) Simple columnar epithelium
  - e) Transitional epithelium
- 44) A patient presents with painless, gross hematuria. Which of the following forms of transitional cell carcinoma of the urinary bladder can progress to muscle-invasive cancer and has a poor prognosis once it invades the detrusor muscle?
- a) Papillary urothelial neoplasms of low malignant potential (PUNLMP)
  - b) High grade papillary urothelial cancers
  - c) Carcinoma in situ (CIS)
  - d) Papilloma
- 45) What benign tumor of the urinary bladder is seen in children and presents as a polypoid, grapelike mass (botryoides)?
- a) Rhabdomyosarcoma

- b) Leiomyosarcoma
  - c) Leiomyoma
  - d) Wilm tumor
  - e) Carcinoma In situ
- 46) Transitional cell carcinoma of the urethra is most common in what population?
- a) Young females
  - b) Young males
  - c) Elderly females
  - d) Elderly males
  - e) Immunosuppressed
- 47) A 7-year-old child is noted to have 3+ protein on urinalysis. A 24-h collection of urine reveals a protein excretion of 3.7g/24h. A thorough history might reveal ingestion of which of the following medications?
- a) Tetracycline
  - b) Streptomycin
  - c) Trimethadione
  - d) Diazepam
  - e) Chlorambucil
- 48) A 1-year-old child presents with failure to thrive, frequent large voids of dilute urine, excessive thirst, and three episodes of dehydration not associated with vomiting or diarrhea. Over the years, other family members reportedly have had similar histories. Which of the following is the most likely diagnosis?
- a) Water intoxication
  - b) Diabetes mellitus
  - c) Diabetes insipidus
  - d) Nephrotic syndrome
  - e) Child abuse
- 49) Azothemia characteristically has which of the following lab results?
- a) Increased BUN, Increased creatinine, BUN:creatinine = 10
  - b) Increased BUN, Decreased creatinine, BUN:creatinine > 15
  - c) Decreased BUN, Decreased creatinine, BUN:creatinine = 10
  - d) Decreased BUN, Increased creatinine, BUN:creatinine < 5
  - e) Increased BUN, Increased creatinine, BUN:creatinine > 15
- 50) What would be the approximate expected BUN:creatinine ratio in a patient with pre-renal azothemia?
- a) About 10
  - b) More than 15
  - c) More than 20
  - d) Less than 5
  - e) Less than 1
- 51) Severity of which of the following differentiates nephritic from nephrotic syndrome?
- a) Hypertension
  - b) Hematuria
  - c) Dysuria
  - d) Proteinuria
  - e) Fever

- 52) Post-streptococcal glomerular nephritis is what type of hypersensitivity reaction?
- a) Type I
  - b) Type II
  - c) Type III
  - d) Type IV
- 53) Goodpasture syndrome is what type of hypersensitivity reaction?
- a) Type I
  - b) Type II
  - c) Type III
  - d) Type IV
- 54) What is the first sign of renal failure when examining a urine specimen?
- a) Hypoalbuminuria
  - b) Hyperglycosuria
  - c) Hematuria
  - d) Hypoproteinuria
  - e) Dilute urine
- 55) A 3-year-old child presents with an extremely large abdominal mass. Which of the following is most likely?
- a) Wilm tumor (nephroblastoma)
  - b) Renal cell carcinoma
  - c) Transitional cell carcinoma
  - d) Renal adenoma
  - e) Leiomyoma
- Match the urine finding with the likely disorder:*
- 56) Renal failure                      a) White blood cells
- 57) Nephritis syndrome              b) Red blood cells
- 58) Nephrotic syndrome              c) White blood cell casts
- 59) Pyelonephritis                    d) Lipid casts
- 60) Cystitis                              e) Epithelial cell casts
- 61) A 3-year-old boy presents with facial edema, malaise, and proteinuria. What is the appropriate treatment?
- a) Spironolactone
  - b) Triamterene
  - c) Furosemide
  - d) Amiloride
  - e) Steroids
- 62) A patient describes a two-year history of acetaminophen use. What is this patient at risk for?
- a) Pyelonephrosis
  - b) Papillary necrosis
  - c) Perinephric abscess
  - d) Xanthogranulomatous pyelonephritis
  - e) Rapidly progressive glomerulonephritis (RPGN)
- 63) A patient taking enalapril complains of constant coughing. What is an appropriate alternative drug?
- a) Losartan

- b) Ethacrynic acid
  - c) Spironolactone
  - d) Mannitol
  - e) Furosemide
- 64) A patient with congestive heart failure needs diuretic therapy but has a sulfa allergy. What is an appropriate alternative drug?
- a) Losartan
  - b) Ethacrynic acid
  - c) Spironolactone
  - d) Mannitol
  - e) Furosemide
- 65) What artery keeps a horseshoe kidney low in the abdomen?
- a) Inferior pancreaticoduodenal artery
  - b) Middle colic artery
  - c) Superior mesenteric artery
  - d) Inferior mesenteric artery
  - e) Aorta
- 66) A patient presents with hypertension, hypokalemia, metabolic alkalosis, and low plasma renin. Conn syndrome is diagnosed. What is the treatment of choice?
- a) Losartan
  - b) Ethacrynic acid
  - c) Spironolactone
  - d) Mannitol
  - e) Furosemide

**Renal #12 – Clinical: Glomerular Disease Clinical Presentation**

- 1) Microalbuminuria becomes overt proteinuria when urinary albumin is greater than what value over 24-hours?
- a) 10mg
  - b) 30mg
  - c) 100mg
  - d) 300mg
  - e) 500mg
- 2) Nephrotic syndrome is defined as urinary protein greater than what value over 24-hours?
- a) 2.5g
  - b) 3g
  - c) 3.5g
  - d) 4g
  - e) 5.5g
- 3) Which of the following is NOT a urinary finding associated with nephrotic syndrome?
- a) Lipiduria “Maltese crosses”
  - b) Oval fat bodies
  - c) Free fat
  - d) Waxy casts
  - e) Hematuria

- 4) What thrombotic complication is commonly seen in patients with nephrotic syndrome, especially membranous glomerulonephritis?
- a) Deep vein thrombosis (DVT)
  - b) Cerebral thrombosis (stroke)
  - c) Myocardial infarction (MI)
  - d) Pulmonary embolism (PE)
  - e) Renal vein thrombosis
- 5) Which of the following is NOT a urinary finding associated with nephritic syndrome?
- a) Epithelial casts
  - b) Oliguria
  - c) Lipiduria
  - d) RBCs or RBC casts
  - e) Methemoglobinuria (“Coca-Cola” urine)
- 6) What test is used to definitively diagnose all glomerulonephropathies?
- a) Urinalysis
  - b) Renal biopsy
  - c) Serum and urine albumin
  - d) BUN:creatinine ratio
  - e) CT scan

*Match the glomerulopathy with the microscopic finding:*

- 7.1) Diffuse proliferation lupus nephritis      a) Mesangial deposits  
7.2) Membranous nephropathy                      b) Subepithelial deposits  
7.3) IgA nephropathy                                c) Subendothelial deposits  
7.4) Post-infectious glomerulonephropathy  
7.5) Membranoproliferative glomerulonephritis
- 8) Which of the following is a characteristic urinalysis finding of nephrotic syndrome?
- a) Pyuria with WBC casts
  - b) Hematuria
  - c) Mild proteinuria
  - d) Oval fat bodies
  - e) RBC casts

### **Renal #13 – Clinical: Glomerular Disease with Nephritis Syndrome**

- 1) A hospitalized patient has labs that return with hypocomplementemia including decreased serum C3 and CH50 levels. Renal biopsy shows granular deposits of IgG and C3 with large subepithelial humps. Which of the following is most likely?
- a) IgA nephropathy (Berger disease)
  - b) Goodpasture syndrome
  - c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Hemolytic-uremic syndrome
- 2) A 25-year-old male presents with painless, macroscopic hematuria during a minor flu-like illness. History reveals similar symptoms after vigorous exercise. Which of the following is most likely?
- a) IgA nephropathy (Berger disease)
  - b) Goodpasture syndrome

- c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Hemolytic-uremic syndrome
- 3) What type of study is the most diagnostic for IgA nephropathy?
- a) CBC with differential
  - b) Urinalysis
  - c) Electron microscopy
  - d) Light microscopy
  - e) Immunofluorescence
- 4) A child presents with abdominal pain and vomiting. Lesions are found on the extensor surfaces of the arms. Testing shows mesangial IgA deposits. Which of the following is most likely?
- a) Hemolytic-uremic syndrome
  - b) Goodpasture syndrome
  - c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) IgA nephropathy (Berger disease)
  - f) Henoch-Schönlein purpura
- 5) A patient with hepatitis C presents with hematuria, proteinuria, and cryoglobulinemia. Labs also show low complement values and C3 nephritic factor. Which of the following is most likely?
- a) Lipoid nephrosis (minimal change disease)
  - b) Cystic renal dysplasia
  - c) Membranous glomerulopathy
  - d) Focal segment glomerulosclerosis
  - e) Membranoproliferative glomerulonephritis
- 6) Although treatment options are unknown in adults with membranoproliferative glomerulonephritis, what treatment has been shown to be helpful in children?
- a) NSAIDs
  - b) Steroids
  - c) Furosemide
  - d) Spironolactone
  - e) DMARDs

**Renal #14 – Clinical: Rapidly Progressing Glomerulonephritis**

- 1) A patient with Goodpasture syndrome presents with recent onset of severe renal failure occurring over a matter of weeks. Testing reveals inflammatory crescents. Which of the following is most likely?
- a) Hemolytic-uremic syndrome
  - b) Thrombotic thrombocytopenic purpura
  - c) Nephrotic syndrome
  - d) Poststreptococcal glomerulonephritis
  - e) Rapidly progressive glomerulonephritis
- 2) A middle-aged Caucasian male presents with complaints of continually changing symptoms (protean symptoms) including nosebleed, hearing problems, strawberry gingivitis, and joint pain. Neutrophil staining is ANCA positive. The clinician fears



rapidly progressive segmental necrotising glomerulonephritis may occur. Which of the following is most likely?

- a) Goodpasture syndrome
  - b) Wegener granulomatosis
  - c) Churg-Strauss syndrome
  - d) Microscopic polyangiitis (MPA)
  - e) Polyarteritis nodosa (PAN)
- 3) A patient with hepatitis B presents with testicular pain and myalgia. Physical exam reveals an increased diastolic blood pressure. Lab testing shows increased serum BUN and increased serum creatinine. Neutrophil staining is ANCA negative. Which of the following is most likely?
- a) Goodpasture syndrome
  - b) Wegener granulomatosis
  - c) Churg-Strauss syndrome
  - d) Microscopic polyangiitis (MPA)
  - e) Polyarteritis nodosa (PAN)
- 4) Aside from affecting the glomerular basement membrane of the kidney, what other major organ is affected by Goodpasture disease?
- a) Brain
  - b) Heart
  - c) Lungs
  - d) Spleen
  - e) Liver

**Renal #15 – Clinical: Glomerular Disease Presenting as Nephrotic Syndrome**

1) A 3-year-old boy presents with facial edema, malaise, and proteinuria. Which of the following is most likely?

- a) Lipoid nephrosis (minimal change disease)
  - b) Cystic renal dysplasia
  - c) Membranous glomerulopathy
  - d) Focal segment glomerulosclerosis
  - e) Membranoproliferative glomerulonephritis
- 2) Minimal change disease has been associated with which of the following diseases?
- a) Diabetes insipidus
  - b) Alport syndrome
  - c) Hodgkin lymphoma
  - d) Kaposi sarcoma
  - e) Bubonic plague
- 3) Which of the following is the most effective treatment for minimal change disease?
- a) Spironolactone
  - b) Triamterene
  - c) Furosemide
  - d) Amiloride
  - e) Prednisone

- 4) A 45-year-old Caucasian male presents with proteinuria >5g/day. Renal testing shows in situ deposits of cationic antigens in the subepithelial space. Which of the following is most likely?
- a) Diffuse proliferation lupus nephritis
  - b) Membranous nephropathy
  - c) IgA nephropathy
  - d) Post-infectious glomerulonephropathy
  - e) Goodpasture syndrome
- 5) What is the most common cause of membranous nephropathy?
- a) Autoimmune disease
  - b) Infection (Hepatitis)
  - c) Malignancies
  - d) Idiopathic
  - e) Drugs
- 6) What medications can cause membranous nephropathy?
- a) Penicillamine, gold, NSAIDs
  - b) Chloramphenicol, tricyclic antidepressants
  - c) Macrolide antibiotics and fluoroquinolones
  - d) Beta-blockers, spironolactone, aspirin
  - e) Acetaminophen, aspirin
- 7) After discovering subepithelial deposits, IgG, and C3 along capillary walls via immunofluorescence, membranous nephropathy is diagnosed. What is the main treatment for this disease?
- a) ACE inhibitors
  - b) AR blockers
  - c) Mycophenolate mofetil
  - d) Heparin
  - e) Supportive

**Renal #16 – Clinical: Other Glomerular Disorders**

- 1) What is the most common cause of end stage renal disease (ESRD) in the United States?
- a) Hypertensive nephropathy
  - b) Obesity & cholesterolemia
  - c) Diabetic nephropathy
  - d) Necrotizing papillitis
  - e) IgA nephropathy
- 2) What is the early manifestation of renal disease that is associated with diabetic nephropathy?
- a) Hematuria
  - b) Microalbuminuria
  - c) Proteinuria
  - d) WBC casts in the urine
  - e) Dysuria
- 3) Kimmelstiel-Wilson nodules are pathognomonic for which of the following?
- a) Hypertensive nephropathy

- b) Obesity & cholesterolemia
  - c) Diabetic nephropathy
  - d) Necrotizing papillitis
  - e) IgA nephropathy
- 4) Aside from glycemic control, what other intervention can be done to slow the progression of diabetic nephropathy?
- a) Corticosteroids
  - b) Anticoagulation
  - c) Cholesterol control
  - d) Blood pressure control
  - e) Increase exercise
- 5) Which of the following has a role in slowing the progression of diabetic nephropathy?
- a) ACE inhibitors and AR blockers
  - b) Mycophenolate mofetil and heparin
  - c) Prednisone and indomethacin
  - d) Ethambutol and chloramphenicol
  - e) Ibuprofen and acetaminophen
- 6) A patient with insulin-dependent diabetes mellitus (IDDM) and diabetic nephropathy presents with proteinuria and retinopathy. Which of the following is indicated for further testing in this patient with atypical disease course?
- a) Renal MRI
  - b) Renal biopsy
  - c) SPECT scan
  - d) Fasting urinalysis
  - e) No testing is needed
- 7) A “full-house” pattern of immune deposits may be seen in systemic lupus erythematosus, including IgG, IgM, IgA, C1q, and C4. Where are these deposits localized?
- a) Glomerular basement membrane
  - b) Glomerular podocytes
  - c) Intraglomerular mesangium
  - d) Glomerular capillary subendothelium
  - e) None of the above

**Renal #17 – Clinical: Hemolytic Uremic Syndrome & Thrombocytopenic Purpura**

- 1) Which of the following causes of hemolytic uremic syndrome (HUS) and thrombocytopenic purpura (TTP) presents with diarrhea?
- a) Contraceptives
  - b) Tacrolimus
  - c) Quinine
  - d) Cyclosporin
  - e) *E. coli*
- 2) Which of the following is more commonly associated with HUS, not TTP?
- a) Pregnancy
  - b) Children and raw meat
  - c) Diseases including HIV

- d) Bone marrow transplantation
- e) Cancer and drugs

**Renal #18 – Clinical: Acute Interstitial Nephritis (AIN)**

1) A child presents with pyuria, oligouria, fever, arthralgias, and a maculopapular rash. Urinalysis finds microscopic hematuria. Acute interstitial nephritis (AIN) is diagnosed.

What is the most likely cause?

- a) Diabetes
  - b) Drugs
  - c) Viral
  - d) Idiopathic
  - e) Bladder fluke
- 2) What types of medications are most commonly associated with AIN?
- a) Acetaminophen and antibiotics
  - b) Diuretics and antihypertensives
  - c) Antihistamines and anticoagulants
  - d) Anticoagulants and diuretics
  - e) Antibiotics and NSAIDs

**Renal #19 – Clinical: Analgesic Chronic Interstitial Nephritis**

1) A female patient presents with pain, headaches, arthritis, and muscle aches. History reveals she is taking a mixed analgesic preparation. Testing reveals small kidneys bilaterally with bumpy contours and papillary calcifications. If analgesic nephropathy is suspected, what other disorder might she have a history of?

- a) Diabetes mellitus
- b) Nephrotic syndrome
- c) Streptococcal infection
- d) Peptic ulcer
- e) Vitamin B12 deficiency

**Renal #20 – Clinical: Electrolyte & Toxin Induced Interstitial Nephritis**

1) Which of the following is NOT associated with uric acid nephropathy?

- a) Hypothermia
- b) Lesch-Nyhan syndrome
- c) Tumor lysis syndrome
- d) Myeloproliferative disorders
- e) Status epilepticus

2) Serum uric acid is usually greater than what value in patients with uric acid nephropathy?

- a) 5mg
- b) 10mg
- c) 15mg
- d) 20mg
- e) 25mg

3) Along with hemodialysis and alkaline diuresis, what drug is useful for prophylaxis against uric acid nephropathy?

- a) Spironolactone
- b) Indomethacin
- c) Prednisone
- d) Metoprolol
- e) Allopurinol

**Renal #21 – Clinical: Cystic Renal Disease**

1) An adult presents with flank pain and hematuria. X-ray shows large bilateral renal masses. History reveals hypertension, diverticulosis, and cardiac valve myxomatous degeneration. Testing would reveal changes to PKD1 or 2. Which of the following is most likely?

- a) Autosomal dominant polycystic kidney disease
- b) Autosomal recessive polycystic kidney disease
- c) Nephrotic syndrome
- d) Acute nephritic syndrome
- e) Cystic renal dysplasia

**Renal #22 – Clinical: Acute Renal Failure (ARF)**

1) Which of the following would cause an increase in serum creatinine levels that are independent of glomerular filtration rate?

- a) Ketoacidosis
- b) Vegetarian diet
- c) Acetaminophen
- d) Celiac disease
- e) Stroke

2) Which of the following would NOT cause an increase in serum blood urea nitrogen (BUN) independent of glomerular filtration rate?

- a) GI bleeding
- b) Tissue trauma
- c) Furosemide
- d) Glucocorticoids
- e) Tetracycline

3) Acute renal failure (ARF) is categorized into anuria, oliguria, and polyuria. Oliguria is defined as urine output that is less than what daily volume?

- a) 50mL
- b) 200mL
- c) 400mL
- d) 1,200mL
- e) 3,000mL

**Renal #23 – Clinical: Pre-Renal Failure**

1) Pre-renal acute renal failure (ARF) is most commonly caused by:

- a) Renal hypertension
- b) Decreased renal blood flow
- c) Renal vein thrombosis
- d) Increased glomerular filtration rate (GFR)

- e) Diabetes mellitus
- 2) Which of the following would increase a patient's risk for an acute decrease in GFR when they are taking an ACE inhibitor or angiotensin receptor blocker (ARB)?
  - a) Hypertension
  - b) Chronic obstructive lung disease
  - c) Diabetes insipidus
  - d) Low platelet count
  - e) Congestive heart failure
- 3) Renal failure causing splanchnic vasodilation, increased cardiac output, and decreased systemic resistance would likely affect which of the following within close proximity of the kidneys?
  - a) Aorta
  - b) Liver
  - c) Spleen
  - d) Pancreas
  - e) Gallbladder
- 4) A patient with acute tubular necrosis presents with signs of hepatorenal syndrome (HRS). What are the expected lab findings?
  - a) Hyponatremia, hypokalemia, hypoalbuminemia
  - b) Hypernatremia, hypokalemia, hypoalbuminemia
  - c) Hyponatremia, hypokalemia, hyperalbuminemia
  - d) Hypernatremia, hypokalemia, hypoalbuminemia
  - e) Hyponatremia, hyperkalemia, hypoalbuminemia

**Renal #24 – Clinical: Intrinsic ARF**

- 1) Which of the following is NOT an etiology of intrinsic acute renal failure?
  - a) Acute tubular necrosis
  - b) Acute interstitial necrosis
  - c) Adult polycystic kidney disease
  - d) Rapidly progressive glomerulonephritis
- 2) What are the two etiologic categories of acute tubular necrosis (ATN)?
  - a) Ischemia and toxins
  - b) Hypertension and trauma
  - c) Bleeding and coagulation
  - d) Hyperemia and stone formation
  - e) Hypotension and hypoxia
- 3) What is the first sign seen in acute renal failure due to acute tubular necrosis?
  - a) Increased BUN
  - b) Increased creatinine
  - c) Decreased BUN:creatinine
  - d) Increased urine output
  - e) Hematuria
- 4) Which of the following has been associated with tubular damage?
  - a) Antibiotics
  - b) Contrast dye
  - c) Uric acid

- d) Myoglobinuria
  - e) All of the above
- 5) Which of the following is NOT a major cause of acute interstitial nephritis?
- a) Allergic reaction to a drug
  - b) Immunologic reaction
  - c) Systemic infection
  - d) Hemophilia
- 6) Which of the following is NOT a renal toxicity associated with NSAIDs?
- a) ARF due to prostaglandin inhibition
  - b) Acute tubulointerstitial nephritis
  - c) Acute nephritic syndrome
  - d) Hyponatremia
  - e) Hypokalemia
- 7) Which of the following patients has the greatest risk of contrast-induced ARF?
- a) Gout
  - b) Diabetes
  - c) Bleeding disorder
  - d) Systemic lupus erythematosus
  - e) Rheumatoid arthritis
- 8) Which of the following is NOT a risk factor associated with atheroembolic-induced renal failure?
- a) Obesity
  - b) Smoking
  - c) Hypertension
  - d) Diabetes
  - e) History of atherosclerotic vascular disease

**Renal #25 – Clinical: Post-Renal Failure**

- 1) Which of the following would lead to post-renal acute renal failure?
- a) Hypovolemia
  - b) Hepatorenal syndrome
  - c) Atheroembolic disease or other vascular problems
  - d) Bladder outflow obstruction due to prostatic hypertrophy
  - e) Sepsis

**Renal #26 – Clinical: Diagnosis & Management of ARF**

- 1) The presence of urine eosinophils and leukocytes would indicate which of the following?
- a) Pre-renal azotemia
  - b) Acute tubular necrosis
  - c) Acute interstitial nephritis
  - d) Acute renal failure caused by heme pigments
- 2) What condition would lead to the fractional excretion of sodium less than 1%?
- a) Hypertension
  - b) Diabetes
  - c) CHF

- d) Increased intravascular volume
  - e) High salt diet
- 3) Which of the following would lead to a fractional excretion of sodium greater than 3%?
- a) Hypovolemia
  - b) Hepatorenal syndrome
  - c) Atheroembolic disease or other vascular problems
  - d) Acute tubular necrosis
  - e) Sepsis
- 4) Which of the following electrolytes needs to be limited in the diets of patients who have acute renal failure?
- a) Phosphorus
  - b) Potassium
  - c) Magnesium
  - d) Sodium
  - e) All of the above

**Renal #27 – Clinical: Chronic Renal Failure**

- 1) Which of the following is NOT a reversible cause of renal insufficiency?
- a) Congestive heart failure
  - b) Medications
  - c) Diabetes
  - d) Renal infarct
  - e) Volume loss
- 2) What is the most common cause of chronic renal failure (CRF)?
- a) Diabetes
  - b) Hypertension
  - c) Glomerulonephritis
  - d) Polycystic kidney disease
  - e) Congestive heart failure
- 3) Although patients with chronic renal failure usually have small atrophic kidneys, which of the following would be an exception to this rule?
- a) Hypertension
  - b) Glomerulonephritis
  - c) Polycystic kidney disease
  - d) Hypothyroidism
  - e) Infection
- 4) Blood pressure should be maintained at what level to slow the progression of chronic renal disease (without proteinuria)?
- a) 140/90
  - b) 135/85
  - c) 130/80
  - d) 125/75
  - e) 120/70
- 5) What are the first line antihypertensive medications for patients with early renal disease?



- a) ACE inhibitors and AR blockers
  - b) Loop diuretics and thiazide diuretics
  - c) Thiazide diuretics and potassium-sparing diuretics
  - d) Thiazide diuretics and beta-blockers
  - e) Beta-blockers and ACE inhibitors
- 6) Which of the following is bound by aluminum hydroxide, which is used in the treatment of patients with chronic renal failure?
- a) Phosphate
  - b) Potassium
  - c) Magnesium
  - d) Sodium
- 7) What type of anemia is seen in patients with chronic renal failure, leading to treatment with subcutaneous erythropoietin?
- a) Microcytic anemia
  - b) Macrocytic anemia
  - c) Normocytic anemia
  - d) Dimorphic anemia
  - e) Heinz body anemia

**Renal #28 – Clinical: End Stage Renal Disease**

- 1) Hypertension and what other condition contributes to cardiovascular morbidity and mortality in patients with end-stage renal disease?
- a) Diabetes mellitus
  - b) Hyperthyroidism
  - c) Anemia
  - d) Hyperlipidemia
  - e) Hypercoagulability
- 2) Which of the following would help patients who have hyperkalemia in end-stage renal disease (ESRD)?
- a) ACE inhibitors
  - b) NSAIDs
  - c) Beta-blockers
  - d) ARBs
  - e) Thiazide diuretics
- 3) Which of the following should be done immediately (and first) for a patient who had ECG changes due to hyperkalemia?
- a) Insulin infusion
  - b) Calcium infusion
  - c) Resin doses
  - d) Dialysis
- 4) What is the classic bone disease seen in patients with chronic renal disease due to hyperphosphatemia?
- a) Osteitis fibrosa cystic (Von Recklinghausen disease)
  - b) Osteitis deformans (Paget disease)
  - c) Osteoporosis
  - d) Gorham vanishing bone disease

- e) Osteogenesis imperfect (brittle bone disease)
- 5) Which of the following is an early neuromuscular symptoms of uremia?
- a) Fasciculations
  - b) Cramping
  - c) Sleep disturbances
  - d) Hiccups
  - e) Twitching
- 6) Diverticulosis is a particular gastrointestinal abnormality in which of the following patients, whom also have chronic renal disease?
- a) Minimal change disease
  - b) Polycystic kidney disease
  - c) Nephrotic syndrome
  - d) Acute nephritic syndrome
  - e) Cystic renal dysplasia

**Renal #29 – Clinical: Dialysis**

- 1) Which of the following is NOT an indication for dialysis?
- a) Fluid overload
  - b) Acidosis
  - c) Hypokalemia
  - d) Hypernatremia
  - e) Uremic signs and symptoms
- 2) All dialysis patients should be vaccinated against which of the following, which they are at increased risk for?
- a) Varicella
  - b) DTaP
  - c) MMR
  - d) Rotovirus
  - e) Hepatitis B

**Renal #30 – Clinical: Disorders of Water Balance**

- 1) What hormone is most responsible for regulating body water?
- a) Angiotensin II
  - b) Aldosterone
  - c) ADH
  - d) ANP
  - e) BNP
- 2) Which of the following symptoms of hyponatremia is the most serious?
- a) Confusion
  - b) Cramps
  - c) Decreased deep tendon reflex
  - d) Lethargy
  - e) Seizures
- 3) What is the first test for evaluating hyponatremia?
- a) Serum albumin
  - b) Serum osmolality

- c) Extracellular fluid volume
  - d) Urine creatinine
  - e) Urine BUN
- 4) Which of the following would cause a hyperosmotic hyponatremia (versus an isoosmotic hyponatremia)?
- a) Severe hyperglycemia
  - b) Severe hypertriglyceridemia
  - c) Severe hyperproteinemia
  - d) Waldenstrom macroglobulinemia
- 5) Which of the following would NOT cause hyperosmotic hyponatremia?
- a) 0.9% normal saline infusion
  - b) 30% glucose infusion
  - c) 1.5% glycine infusion
  - d) 20% mannitol infusion
- 6) After assessing a patient's serum osmolality, what is the next test in the workup for hypoosmotic hyponatremia?
- a) Serum albumin
  - b) Serum creatinine
  - c) Extracellular fluid volume
  - d) Urine creatinine
  - e) Urine BUN
- 7.1) Which of the following is NOT an etiology of hypotonic euvolemic hyponatremia?
- a) Hyperthyroidism
  - b) Edematous states
  - c) Addison disease
  - d) Psychogenic polydipsia
  - e) Syndrome of inappropriate antidiuresis (SIAD)
- 7.2) Which of the following is NOT an etiology of hypoosmotic hypovolemic hyponatremia?
- a) Severe volume depletion
  - b) Thiazide diuretics
  - c) Renal failure
  - d) Renal insufficiency
- 8) How is diagnosis made for syndrome of inappropriate antidiuresis (SIAD)?
- a) Hypotonic plasma value
  - b) Urine dilution value
  - c) Serum BUN
  - d) Serum uric acid
  - e) Exclusion
- 9) What is the most serious cause of SIAD?
- a) Diabetes mellitus
  - b) Small cell carcinoma
  - c) Sickle cell disease
  - d) Wilson disease
  - e) Hemorrhagic stroke
- 10) What is a major adverse effect of 3% hypertonic saline?

- a) Renal vein thrombosis
  - b) Renal artery stasis
  - c) Glomerular damage
  - d) Hyperkalemia
  - e) Sodium poisoning
- 11) A patient presents with hypovolemic hyponatremia. The clinician wants to increase the patient's sodium levels quickly over the next 24-hours, but not so quickly as to cause central pontine myelinolysis. How much sodium does the patient need if they are 100kg, have serum sodium of 110mEq/L, and targeted sodium of 120mEq/L?
- a) 100mEq
  - b) 75mEq
  - c) 50mEq
  - d) 25mEq
  - e) 5mEq
- 12) Which of the following is used to treated chronic syndrome of inappropriate antidiuretic hormone (SIADH/SIAD)?
- a) Demeclocycline
  - b) Amitriptyline
  - c) Hydrochlorothiazide
  - d) Mannitol
  - e) Sprinolactone
- 13) What is the treatment for hypervolemic hyponatremia?
- a) Antihypertensives
  - b) Diuretics
  - c) Dialysis
  - d) ADH
  - e) Antibiotics
- 14) An elderly, hospitalized patient with diabetes insipidus has lab values showing hypernatremia. Which of the following would be used to treat this patient?
- a) Antihypertensives
  - b) Diuretics
  - c) Diuresis
  - d) ADH
  - e) Antibiotics

**Renal #31 – Clinical: Diabetes Insipidus**

- 1) Central nephrogenic diabetes insipidus is due to an inability of the kidney to respond to which of the following?
- a) Angiotensin II
  - b) Aldosterone
  - c) Renin
  - d) ADH
  - e) Urodilatin
  - f) Dopamine
- 2) Lithium, demeclocycline, and amphotericin B may induce what renal disease?
- a) Nephrogenic diabetes insipidus

- b) Polycystic kidney disease
  - c) Nephrotic syndrome
  - d) Minimal change disease
  - e) Cystic renal dysplasia
- 3) What electrolyte abnormalities may induce nephrogenic diabetes insipidus?
- a) Hypocalcemia and hypokalemia
  - b) Hypocalcemia and hyperkalemia
  - c) Hypercalcemia and hypokalemia
  - d) Hypercalcemia and hyperkalemia
- 4) In diabetes insipidus, serum sodium levels deviate toward \_\_\_\_ and in primary polydipsia, serum sodium levels deviate toward \_\_\_\_.
- a) Low; Low
  - b) Low; High
  - c) High; High
  - d) High; Low

**Renal #32 – Clinical: Disorders of Sodium Balance**

- 1) Which of the following is the most suggestive of volume depletion and sodium deficiency?
- a) Edema
  - b) Skin tenting
  - c) Orthostatic hypotension
  - d) Conjunctival pallor
  - e) Dry cough
- 2) Which of the following is most suggestive of volume excess and sodium excess?
- a) Edema
  - b) Skin tenting
  - c) Orthostatic hypotension
  - d) Conjunctival pallor
  - e) Dry cough

**Renal #33– Clinical: Disorders of Potassium Balance**

- 1) Which of the following is NOT seen in hypokalemia?
- a) Polyuria
  - b) Rhabdomyolysis
  - c) Peaked T-waves
  - d) Ileus
  - e) Weakness
- 2) An Emergency Room patient is found to be hypokalemic. Which of the following should be done if the patient is normotensive and the loss is renal?
- a) Check plasma HCO<sub>3</sub><sup>-</sup> levels and urine chlorine
  - b) Check plasma renin levels
  - c) Check plasma aldosterone and ask about licorice/tobacco use
  - d) Do a laxative screen and ask about diarrhea
  - e) Check for acute alkylolysis and vitamin B12 levels
- 3) An Emergency Room patient is found to be hyperkalemic. What should be done next?

- a) Heparinized plasma potassium level
- b) Assess for tourniquet ischemia
- c) Perform an ECG
- d) Assess for hemolysis of clotted blood
- e) Check for leukocytosis or thrombocytosis

**Renal #34 – Clinical: Acid Base Disorders**

- 1) What is the primary disturbance seen in metabolic acidosis?
  - a) Increased Na<sup>+</sup>
  - b) Increased H<sup>+</sup>
  - c) Decreased CO<sub>2</sub>
  - d) Decreased HCO<sub>3</sub><sup>-</sup>
  - e) Increased K<sup>+</sup>
- 2) What is the secondary response seen in metabolic acidosis?
  - a) Increased ventilation with increased CO<sub>2</sub> partial pressure
  - b) Increased ventilation with decreased CO<sub>2</sub> partial pressure
  - c) Decreased ventilation with increased CO<sub>2</sub> partial pressure
  - d) Decreased ventilation with decreased CO<sub>2</sub> partial pressure
- 3.1) Which of the following would NOT lead to metabolic acidosis?
  - a) Uremia
  - b) High altitude
  - c) Renal tubular acidosis
  - d) Iron tablets
  - e) Vomiting
- 3.2) Which of the following is an EARLY effect of aspirin ingestion?
  - a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis
  - d) Metabolic alkalosis
- 4) A diabetic patient presents with Kussmaul breathing. Which of the following arterial blood gases (pH/PaCO<sub>2</sub>/PaO<sub>2</sub>/HCO<sub>3</sub>/O<sub>2</sub>sat/BE) is considered metabolic acidosis?
  - a) 7.28/28/110/24
  - b) 7.3/55/85/24
  - c) 7.56/20/110/24
  - d) 7.5/52/78/24
  - e) 7.4/40/100/24
- 5) Which of the following causes of metabolic acidosis is due to an increased (non-normal) anion gap? (Anion gap = Na<sup>+</sup> – (Cl<sup>-</sup> + HCO<sub>3</sub><sup>-</sup>))
  - a) Glue sniffing
  - b) Renal tubular necrosis
  - c) Hyperchloremia
  - d) Diarrhea
  - e) Lactic acidosis
- 6) What is the normal range for anion gap?
  - a) 2 to 4mEq/L
  - b) 4 to 8mEq/L

- c) 8 to 12mEq/L
  - d) 12 to 14mEq/L
  - e) 14 to 17mEq/L
- 7) Which of the following is associated with high anion gap metabolic acidosis?
- a) Diuretics
  - b) Antacids
  - c) Narcotics
  - d) Iron tablets
  - e) Hyperventilation
- 8) A patient in the Intensive Care Unit receives large volumes of saline after a low blood volume event that required resuscitation. Which of the following is most likely?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis, high anion gap
  - d) Metabolic acidosis, normal anion gap
  - e) Metabolic alkalosis
- 9) Which of the following drugs would cause hypokalemic normal anion gap metabolic acidosis?
- a) Acetazolamide
  - b) Triamterene
  - c) Furosemide
  - d) Amiloride
  - e) Spironolactone
- 10) Acid loads such as ammonium chloride, arginine chloride, lysine chloride, cholestyramine, and total parenteral nutrition would lead to which of the following?
- a) Hypokalemic normal anion gap metabolic acidosis
  - b) Hyperkalemic normal anion gap metabolic acidosis
  - c) Hypokalemic high anion gap metabolic acidosis
  - d) Hyperkalemic high anion gap metabolic acidosis
- 11) Which of the following is a cause of type 4 renal tubular acidosis (RTA)?
- a) Nephrocalcinosis
  - b) Amyloidosis
  - c) Osteopetrosis
  - d) Hypoaldosteronism
  - e) Hyperaldosteronism
- 12) A normal osmolar gap ( $\text{Na}^+ * 2 + \text{glucose}/18 + \text{BUN}/2.8$ ) is less than what value?
- a) 2mOsm/L
  - b) 4mOsm/L
  - c) 6mOsm/L
  - d) 8mOsm/L
  - e) 10mOsm/L
- 13) An anion gap greater than what value usually indicates poison ingestion?
- a) 5mEq/L
  - b) 10mEq/L
  - c) 15mEq/L
  - d) 20mEq/L

- e) 25mEq/L
- 14) Which of the following would increase the osmolar gap, but not the anion gap?
- a) Isopropyl alcohol (rubbing alcohol)
  - b) Ethylene glycol (engine antifreeze)
  - c) Acetone (nail polish remover)
  - d) Methanol (windshield washer fluid)
  - e) Ethanol (drinking alcohol)
- 15) An 18-year-old male presents with signs of methanol intoxication. History reveals him and his friends were trying to make homemade moonshine in a crock-pot. What is the treatment for this patient?
- a) IV hypertonic mannitol
  - b) IV hypotonic saline
  - c) Immediate diuresis
  - d) IV ethanol
  - e) No treatment is necessary
- 16) What is the primary disturbance seen in metabolic alkalosis?
- a) Decreased Na<sup>+</sup>
  - b) Decreased H<sup>+</sup>
  - c) Increased CO<sub>2</sub>
  - d) Increased HCO<sub>3</sub><sup>-</sup>
  - e) Decreased K<sup>+</sup>
- 17) Which of the following would NOT lead to metabolic alkalosis?
- a) Diuretic use
  - b) Vomiting
  - c) Antacid use
  - d) Paraldehyde use
  - e) Hyperaldosteronism
- 18) What secondary response is seen in metabolic alkalosis?
- a) Increased ventilation with increased CO<sub>2</sub> partial pressure
  - b) Increased ventilation with decreased CO<sub>2</sub> partial pressure
  - c) Decreased ventilation with increased CO<sub>2</sub> partial pressure
  - d) Decreased ventilation with decreased CO<sub>2</sub> partial pressure
- 19) What is the primary disturbance seen in respiratory acidosis?
- a) Decreased CO<sub>2</sub>
  - b) Decreased H<sup>+</sup>
  - c) Increased CO<sub>2</sub>
  - d) Decreased HCO<sub>3</sub><sup>-</sup>
  - e) Increased O<sub>2</sub>
- 20) What is the secondary response seen in respiratory acidosis and when does the compensation occur?
- a) Renal excretion of bicarbonate, very quickly (minutes)
  - b) Renal excretion of bicarbonate, very slowly (days)
  - c) Renal retention of bicarbonate, very quickly (minutes)
  - d) Renal retention of bicarbonate, very slowly (days)
- 21) An airway obstruction or acute lung disease would cause which of the following?
- a) Respiratory acidosis



- b) Respiratory alkalosis
  - c) Metabolic acidosis, high anion gap
  - d) Metabolic acidosis, normal anion gap
  - e) Metabolic alkalosis
- 22) What is the primary disturbance seen in respiratory alkalosis?
- a) Decreased CO<sub>2</sub>
  - b) Decreased H<sup>+</sup>
  - c) Increased CO<sub>2</sub>
  - d) Decreased HCO<sub>3</sub><sup>-</sup>
  - e) Increased O<sub>2</sub>
- 23) What is the secondary response seen in respiratory alkalosis and when does the compensation occur?
- a) Renal excretion of bicarbonate, very quickly (minutes)
  - b) Renal excretion of bicarbonate, very slowly (days)
  - c) Renal retention of bicarbonate, very quickly (minutes)
  - d) Renal retention of bicarbonate, very slowly (days)
- 24) Hyperventilation due to anxiety or acute high altitude would cause which of the following?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis, high anion gap
  - d) Metabolic acidosis, normal anion gap
  - e) Metabolic alkalosis
- 25) What is the normal bicarbonate to carbon dioxide ratio, given that HCO<sub>3</sub><sup>-</sup> = 24 and PCO<sub>2</sub> = 40 normally?
- a) 2:1
  - b) 8:1
  - c) 12:1
  - d) 20:1
  - e) 40:1
- 26) Which of the following arterial blood gases (ABGs) is respiratory acidosis (primary) with renal compensation to metabolic alkalosis (secondary)?
- a) 7.44/30/77/24
  - b) 7.44/30/77/30
  - c) 7.36/50/77/24
  - d) 7.36/50/77/30
- 27) A 16-year-old asthmatic girl is brought to the emergency room with dyspnea and wheezing after playing with a friend's cat. On physical exam BP is 144/88, HR 112, conjunctiva are injected and there is loud wheezing in both lungs. ABG is 7.55/25/84. Which of the following is most likely?
- a) Respiratory acidosis
  - b) Respiratory alkalosis
  - c) Metabolic acidosis
  - d) Metabolic alkalosis
- 28) A 32 year old woman with a history of Crohn disease presents with a complaint of 10-15 watery bowel movements per day. She also complains of severe fatigue and

muscle weakness. Serum chemistries are sodium 136mEq/L, potassium 2.9mEq/L, HCO<sub>3</sub> 10mEq/L, chloride 114mEq/L, BUN 24mg/dL, creatinine 0.9mg/dL. ABG is 7.28/28/110. Which of the following is most likely?

- a) Respiratory acidosis
- b) Respiratory alkalosis
- c) Metabolic acidosis
- d) Metabolic alkalosis

29) A middle aged man falls out of his chair clutching his throat while eating at a restaurant. He quickly becomes cyanotic and loses consciousness. ABG is 7.00/80/45. Which of the following is most likely?

- a) Respiratory acidosis
- b) Respiratory alkalosis
- c) Metabolic acidosis
- d) Metabolic alkalosis

30) You are asked to evaluate the acid base status of a 58 year old man with advanced cirrhosis due to alcoholic liver disease. On exam BP is 92/50, he has asterixis and ascites. Serum chemistries are sodium 128mEq/L, potassium 3.2mEq/L, HCO<sub>3</sub> 16mEq/L. ABG is 7.50/20/72. Which of the following is most likely?

- a) Respiratory acidosis
- b) Respiratory alkalosis
- c) Metabolic acidosis
- d) Metabolic alkalosis

### Renal #35 – Clinical: Urolithiasis

1) What is the most common type of kidney stone?

- a) Ammonium magnesium phosphate
- b) Calcium oxalate
- c) Uric acid (urate)
- d) Cystine

2) What is the conservative treatment for a calcium stone?

- a) Increase dietary vitamin C
- b) Increase and decrease urine acidity in phases
- c) Daily exercise
- d) Increase urine volume
- e) Daily aspirin regimen

3) Which of the following is a common treatment for uric acid urolithiasis?

- a) Decrease urine pH and increase protein intake
- b) Decrease urine pH and decrease protein intake
- c) Increase urine pH and increase protein intake
- d) Increase urine pH and decrease protein intake

4) What is the treatment for struvite stones?

- a) Antibiotics for 6-12 weeks, stone will pass
- b) Antibiotics for 6-12 months, stone will pass
- c) Surgical removal and antibiotics for 6-12 weeks
- d) Surgical removal and antibiotics for 6-12 months
- e) No treatment is necessary

**Renal #36 – Clinical: Transplantation**

- 1) Which of the following immunosuppressive drugs taken by renal transplant patients blocks the production of interleukin-1 by macrophages as well as cytokine production?
- a) Prednisone
  - b) Azathioprine
  - c) Cyclosporine
  - d) A & B
  - e) B & C
- 2) What is the most common cause of death in renal transplant patients?
- a) Nephritic syndrome
  - b) Nephrotic syndrome
  - c) Acute renal failure
  - d) Cardiovascular disorders
  - e) Opportunistic infections
  - f) Cerebral or myocardial infarction

**Renal #37 – Clinical: Pregnancy & The Kidney**

- 1) Which of the following is NOT a change seen in pregnancy?
- a) GFR increases
  - b) Plasma urea decreases
  - c) Creatinine levels increase
  - d) Glucosuria occurs
  - e) Proteinuria occurs

**Renal #38 – Clinical: Leukocyte Esterase**

- 1) In what conditions does a urine-dip test positive for red blood cells, but there are no RBCs on microanalysis?
- a) Myoglobinuria and aminoaciduria
  - b) Hemoglobinuria and myoglobinuria
  - c) Glucosuria and proteinuria
  - d) Proteinuria and hemoglobinuria
  - e) Glucosuria and hematuria
- 2) Transient proteinuria requires re-testing after the acute event has passed. Which of the following would NOT cause transient proteinuria?
- a) Febrile illness
  - b) Congestive heart failure
  - c) Chronic obstructive pulmonary disease
  - d) Sleeping > 14 hours
  - e) Benign orthostatic proteinuria
- 3) Which of the following is NOT a cause of microalbuminuria?
- a) Early diabetic nephropathy
  - b) Very alkaline urine
  - c) Hypertension
  - d) Early glomerular injury

**Renal #39 – Clinical: Minerals**

- 1) A patient presents with myalgias. Physical exam reveals decreased tendon reflexes. Hypokalemia is suspected. What ECG findings are expected?
- Increased PR interval
  - Narrow QRS complexes
  - Ventricular bigeminy
  - Peaked T waves
  - Presence of U waves
- 2.1) Hypercalcemia found incidentally in an asymptomatic patient is usually due to which of the following?
- Malignancy
  - Renal insufficiency
  - Hyperparathyroidism
  - Diuretic use
  - Aspirin use
- 2.2) Hypercalcemia found in a hospitalized patient is usually due to which of the following?
- Malignancy
  - Renal insufficiency
  - Hyperparathyroidism
  - Diuretic use
  - Aspirin use
- 3) A newborn presents with limb deformities, facial deformities, and pulmonary hypoplasia. Bilateral renal agenesis is found, likely due to a malformation of ureteric bud. Which of the following is most likely?
- Autosomal recessive polycystic kidney disease
  - Minimal change disease
  - Potter syndrome
  - Wilm tumor
  - Alport syndrome
- 4) A clinical study is performed of laboratory findings in subjects with renal diseases. Loss of physiologic function accompanies many diseases. Loss of which of the following renal functions is most likely to be identified by laboratory measurement of the urine specific gravity?
- Filtration
  - Reabsorption
  - Secretion
  - Concentration
  - Blood Flow

**Renal #40 – Extra: Lyme Disease**

- 1) The lone star tick (*Amblyomma americanum*) has been identified as the carrier for *Borrelia lonestari* Lyme disease and is endemic to what region?
- Midwestern United States
  - Northeastern United States
  - Western United States

- d) Southern United States
- 2) Which of the following is the vector for *Borrelia burgdorferi* Lyme disease in the Eastern and Midwestern United States?
- a) Castor bean tick (*Ixodes ricinus*)
  - b) Deer tick (*Ixodes scapularis*)
  - c) Lone star tick (*Amblyomma americanum*)
  - d) Black-legged tick (*Ixodes pacificus*)
- 3) In general, Lyme disease carrying ticks must feed for at least how long to transmit enough spirochetes to infect humans?
- a) 1-hour
  - b) 12-hours
  - c) 24-hours
  - d) 48-hours
  - e) 72-hours
- 4) Which of the following is specifically seen in stage 1 Lyme disease?
- a) Multiple annular skin lesions
  - b) Myalgias and arthralgias
  - c) Splenomegaly
  - d) Atrioventricular heart block
  - e) Erythema migrans
- 5) What percentage of patients who are diagnosed with Lyme disease recall a tick bite?
- a) 33%
  - b) 50%
  - c) 66%
  - d) 75%
  - e) 95%
- 6) In a non-endemic area, Lyme disease is diagnosed with a “bull’s eye” skin lesion and involvement of how many organ systems?
- a) 1
  - b) 2
  - c) 3
  - d) 4
  - e) 5
- 7) A patient with early Lyme disease has an allergy to penicillin (amoxicillin). What is the drug of choice for treatment?
- a) Claforan (cefotaxime)
  - b) Rocephin (ceftriaxone)
  - c) Vibramycin (doxycycline)
  - d) Zithromax (azithromycin)
  - e) Bactrim (TMP-SMX)
- 8) What is the treatment of choice for a patient with serious Lyme disease (e.g. meningitis or cardiac disease)?
- a) Claforan (cefotaxime)
  - b) Rocephin (ceftriaxone)
  - c) Vibramycin (doxycycline)
  - d) Zithromax (azithromycin)

- e) Bactrim (TMP-SMX)
- 9) A hospitalized patient with serious Lyme disease has a pacemaker implanted due to their developing third-degree AV block. What antibiotic treatment should they receive?
- a) Claforan (cefotaxime)
  - b) Rocephin (ceftriaxone)
  - c) Vibramycin (doxycycline)
  - d) Zithromax (azithromycin)
  - e) Bactrim (TMP-SMX)
- 10) What is the method of choice for removing a tick from the skin using a forceps?
- a) Grasp tick thorax and pull directly
  - b) Grasp tick head and pull directly
  - c) Grasp tick thorax and rotate outward
  - d) Grasp tick head and rotate outward
  - e) Scrap tick out using a plastic card
- 11) Prophylaxis for a patient with a tick bite in a Lyme disease endemic area is a single dose of which of the following?
- a) Claforan (cefotaxime)
  - b) Rocephin (ceftriaxone)
  - c) Vibramycin (doxycycline)
  - d) Zithromax (azithromycin)
  - e) Bactrim (TMP-SMX)

## AnswerKey

**Renal #1**

1.1) C  
1.2) D  
2.1) A  
2.2) D  
3) B  
4.1) A  
4.2) D  
5) C  
6.1) C  
6.2) A  
6.3) E  
6.4) A  
6.5) D  
7) B  
8.1) A  
8.2) C  
9.1) A  
9.2) C  
9.3) B  
10.1) C  
10.2) B

**Renal #2**

1.1) A  
1.2) B  
1.3) E  
1.4) B  
2) E  
3) C  
4) D  
5) B  
6.1) D  
6.2) B  
7) B  
8) C  
9) C  
10) E

**Renal #3**

1.1) D  
1.2) B  
2) D  
3) C  
4) E

5.1) B  
5.2) C  
5.3) A  
6.1) D  
6.2) B  
7) C  
8) B  
9) A  
10.1) E  
10.2) B  
11) E  
12) B  
13) B  
14) D  
15.1) D  
15.2) A  
15.3) A  
15.4) C  
16.1) E  
16.2) B  
16.3) B  
16.4) C  
17.1) B  
17.2) D  
17.3) A  
17.4) D  
17.5) E  
17.6) C  
18) C  
19) C  
20) D  
21) B

**Renal #4**

1.1) E  
1.2) B  
2.1) B  
2.2) E  
3.1) C  
3.2) A  
3.3) D  
3.4) B  
3.5) C  
4) D  
5) B  
6) D

7.1) C  
7.2) B  
7.3) A  
7.4) E  
8) E  
9) D  
10) C  
11.1) B  
11.2) D  
11.3) E  
11.4) A  
12.1) D  
12.2) E  
12.3) E  
12.4) C  
13.1) C  
13.2) B  
13.3) A  
13.4) A  
14.1) C  
14.2) E  
14.3) D  
14.4) C  
14.5) B  
14.6) A  
14.7) D  
14.8) C  
14.9) A  
14.10) C  
14.11) E  
15.1) C  
15.2) B  
16) B  
17) A  
18) C  
19) C

**Renal #5**

1.1) C  
1.2) E  
2.1) E  
2.2) C  
2.3) A  
2.4) B  
3.1) B  
3.2) C

4) D  
5) E  
6.1) B  
6.2) E  
6.3) C  
6.4) E  
7) A  
8.1) C  
8.2) A  
8.3) B  
8.4) C  
8.5) C  
8.6) C  
8.7) E  
9) A  
10.1) D  
10.2) D  
10.3) C  
10.4) E  
10.5) A  
10.6) D  
10.7) A  
11.1) B  
11.2) C  
12) C  
13.1) E  
13.2) E  
14) D  
15) D  
16) C  
17) B  
18) D  
19) D

**Renal #6**

1.1) B  
1.2) C  
2) D  
3.1) C  
3.2) C  
3.3) E  
3.4) D  
3.5) D  
4) E  
5.1) A  
5.2) B

6) E  
7) B  
8.1) C  
8.2) B  
8.3) A  
8.4) D  
8.5) C  
8.6) E  
9) B  
10) C  
11) E  
12) A  
13.1) D  
13.2) C  
14) D  
15) C  
16) A  
17) A  
18) D  
19) B

**Renal #7**

1) A  
2) C  
3) C  
4.1) B  
4.2) D  
5) B  
6.1) E  
6.2) A  
6.3) C  
7.1) C  
7.2) B  
8) A  
9) C  
10) C  
11) B  
12) A

**Renal #8**

1) C  
2) E  
3) C  
4) C  
5) E  
6) D

- 7) D
- 8) B
- 9) A
- 10) B
- 11) C
- 12) A
- 13) C
- 14) B
- 15) E
- 16) D
- 17) C
- 18) E
- 19) C

**Renal #9**

- 1) D
- 2) E
- 3) C
- 4) B
- 5) A
- 6) A
- 7) E
- 8) C
- 9) D
- 10) B
- 11) A
- 12) E
- 13) A
- 14) C
- 15) A
- 16) E
- 17) D
- 18) D
- 19) C
- 20) B
- 21) B
- 22) A
- 23) D

**Renal #10**

- 1) D
- 2) E
- 3) A
- 4) D
- 5) B
- 6) C

- 7) C
- 8) B
- 9) B
- 10) E
- 11) C
- 12) B
- 13) A
- 14) A
- 15) E
- 16) B
- 17) C
- 18) B
- 19) A
- 20) D
- 21) E
- 22) A
- 23) A
- 24) B
- 25) D
- 26) C
- 27) C
- 28) D

**Renal #11**

- 1) E
- 2) E
- 3.1) A
- 3.2) B
- 4) D
- 5) C
- 6) B
- 7) D
- 8) B
- 9) C
- 10) A
- 11) D
- 12) E
- 13) A
- 14) E
- 15) E
- 16) B
- 17) F
- 18) C
- 19) C
- 20) D
- 21) E

- 22) E
- 23.1) B
- 23.2) A
- 24) C
- 25) D
- 26) C
- 27) B
- 28) E
- 29) A
- 30) E
- 31) D
- 32) D
- 33.1) A
- 33.2) B
- 34) D
- 35) A
- 36) C
- 37) D
- 38) A
- 39) E
- 40) B
- 41) C
- 42) D
- 43.1) A
- 43.2) B
- 44) C
- 45) A
- 46) C
- 47) C
- 48) C
- 49) A
- 50) C
- 51) D
- 52) C
- 53) B
- 54) E
- 55) A
- 56) E
- 57) B
- 58) D
- 59) C
- 60) A
- 61) E
- 62) B
- 63) A
- 64) B

- 65) D
- 66) C

**Renal #12**

- 1) D
- 2) C
- 3) E
- 4) E
- 5) A
- 6) B
- 7.1) C
- 7.2) B
- 7.3) A
- 7.4) B
- 7.5) C
- 8) D

**Renal #13**

- 1) D
- 2) A
- 3) E
- 4) F
- 5) E
- 6) B

**Renal #14**

- 1) E
- 2) B
- 3) E
- 4) C

**Renal #15**

- 1) A
- 2) C
- 3) E
- 4) B
- 5) D
- 6) A
- 7) E

**Renal #16**

- 1) C
- 2) B
- 3) C
- 4) D
- 5) A

- 6) B
- 7) D

**Renal #17**

- 1) E
- 2) B

**Renal #18**

- 1) B
- 2) E

**Renal #19**

- 1) D

**Renal #20**

- 1) A
- 2) C
- 3) E

**Renal #21**

- 1) A

**Renal #22**

- 1) A
- 2) C
- 3) C

**Renal #23**

- 1) B
- 2) E
- 3) B
- 4) A

**Renal #24**

- 1) C
- 2) A
- 3) B
- 4) E
- 5) D
- 6) E
- 7) B
- 8) A

**Renal #25**

- 1) D



**Renal #26**

- 1) C
- 2) C
- 3) D
- 4) E

**Renal #27**

- 1) D
- 2) A
- 3) C
- 4) C
- 5) A
- 6) A
- 7) C

**Renal #28**

- 1) D
- 2) E
- 3) B
- 4) A
- 5) C
- 6) B

**Renal #29**

- 1) C
- 2) E

**Renal #30**

- 1) C
- 2) E
- 3) B
- 4) A
- 5) A
- 6) C
- 7.1) B
- 7.2) C
- 8) E
- 9) B
- 10) E
- 11) C
- 12) A
- 13) B
- 14) D

**Renal #31**

- 1) D

- 2) A
- 3) C
- 4) D

**Renal #32**

- 1) C
- 2) A

**Renal #33**

- 1) C
- 2) A
- 3) C

**Renal #34**

- 1) D
- 2) B
- 3.1) B
- 3.2) B
- 4) A
- 5) E
- 6) C
- 7) D
- 8) D
- 9) A
- 10) B
- 11) D
- 12) E
- 13) E
- 14) A
- 15) D
- 16) D
- 17) D
- 18) C
- 19) C
- 20) D
- 21) A
- 22) A
- 23) B
- 24) B
- 25) D
- 26) D
- 27) D
- 28) C
- 29) A
- 30) B

**Renal #35**

- 1) B
- 2) D
- 3) D
- 4) D

**Renal #36**

- 1) A
- 2) E

**Renal #37**

- 1) C

**Renal #38**

- 1) B
- 2) D
- 3) B

**Renal #39**

- 1) E
- 2.1) C
- 2.2) A
- 3) C
- 4) D

**Renal #40**

- 1) D
- 2) B
- 3) E
- 4) E
- 5) A
- 6) B
- 7) C
- 8) B
- 9) B
- 10) D
- 11) C