Questions and Answers

1. Features of mild cognitive impairment (MCI) include all of the following except:
   A. Loss of memory is a requirement for diagnosis
   B. MCI progresses to dementia at the rate 10–15% per year
   C. MCI cannot be diagnosed by routine blood tests and neuroimaging (MRI)
   D. MCI represents cognitive impairment beyond that expected for normal aging and less than that for dementia
   
   Answer: A.

   Although memory loss is a common feature of MCI, it is not a requirement. MCI can present as the more common amnestic form (where memory loss is characteristic) or as a nonamnestic form. In the amnestic form, there may be self reported memory loss and/or objective evidence of memory impairment. Routine blood tests, neuroimaging and even the mini mental state examination are not helpful in diagnosis, unlike in the case of dementia. The Montreal Cognitive Assessment scale is a better tool for detection of MCI. Approximately 12% of adults over the age of 70 years have MCI; conversion from MCI to Alzheimer’s disease or another form of dementia occurs at the rate of 10–15% annually.

2. A 70-year-old retired male comes to you with insomnia for 6 months. Since he retired about 5 years ago, he has been lonely. The problem became worse after his wife’s death 4 years ago. He goes to bed at 8 p.m. and wakes up around 4 a.m. In the afternoon he takes a nap for an hour or more. He drinks wine every evening with dinner around 6 p.m. He requests sedative hypnotics. Which of the following is the best choice here?
   A. Trial of hypnotics for about 3 months and monitor response
   B. Address measures to improve sleep hygiene
   C. Continue to observe, as he is depressed and going through bereavement
   D. Explain to the patient that he has phase advance from aging, an inevitable change

   Answer: B.

   While the changes in his sleep pattern are consistent with age-related physiological changes, nevertheless he has made the pattern worse through poor sleep hygiene. Bereavement is unlikely to last 4 years. As he is lonely, he goes to bed early and hence wakes up early. The day time nap is excessive; 30–60 min may be reasonable. Alcohol does not improve, but worsens sleep. The best approach would be for him to change his lifestyle: address alcohol intake, avoid or minimize the afternoon nap, consider evening activity and a warm shower. Phase advance should be addressed by shifting dinner time to a later hour and retiring to bed around 10 p.m. Exposure to evening sunlight and socializing in the evening may help phase advance. Hypnotics are not useful for chronic insomnia; the use may become habitual and associated with adverse effects.

3. A 90-year-old female from the nursing home is hospitalized with fever and abdominal pain. A diagnosis of diverticulitis is entertained. Her white blood cell count is elevated, consistent with the diagnosis. The serum creatinine is 1.5 mg/dL (N: 0.5–1.5 mg/dL). Her body weight is 50 kg. You are entertaining the use of gentamicin or vancomycin in addition to medications to cover the gut flora. Which one of the following statements is incorrect with regard to management?
   A. As the serum creatinine is in the normal range there is no risk in using vancomycin or gentamicin
   B. Serum creatinine is an inaccurate measure in older persons
   C. Measure the eGFR using a formula such as the Cockroft–Gault equation (CGF) or the Modification of Diet in Renal Disease Study equation (MDRD)
   D. The kidney function is likely to be lower in a 90 year old based on physiological deterioration over her past 50 years

   Answer: A.

   GFR tends to decline at a rate of about 8.0 mL/min/1.73 m²/decade (or about 0.8–1% annually) after the third decade,
based on longitudinal studies; the rate of decline however is highly variable. Serum creatinine levels would be expected to be higher in a 90 year old based on the decline in renal function; however, creatinine generation declines with age due to simultaneous decline in muscle mass (sarcopenia) with aging. The expected rise in creatinine is offset by the decline in synthesis of creatinine, rendering serum creatinine level a poor indicator of renal function. The recommendation is to measure renal function utilizing an acceptable formula. While GFR is an overall index of renal function, it is not measured directly. Derived eGFR using the CGF or the MDRD equation is commonly used; the CKD-EPI equation introduced in 2009 may be another option. The CGF approximates eGFR from creatinine clearance, while the other two require computer assistance. The eGFR in this 90 year old female, weighing 50 kg, using the CGF is about 20 mL/min, a value that is significantly low and requires much alteration in the dosing of gentamicin and vancomycin, both excreted through the renal route.

4. Sleep patterns consistent with aging include all of the following except:
   A. Increase in sleep time over 24 h
   B. Increase in sleep latency
   C. Decrease in sleep efficiency
   D. Decrease in non-rapid-eye-movement (NREM) stages 3 and 4 of the sleep cycle

   Answer: A.

   Sleep physiology undergoes several changes with age. They include a decrease in the NREM stages 3 and 4 (deep, restorative sleep), which results in less satisfaction of sleep; stages 1 and 2 of REM increase relatively. Older adults actually spend less time in sleep; they tend to go to bed earlier, with earlier awakening (phase advance). There is a delay in sleep latency (time required to fall asleep once in bed) and the sleep efficiency is impaired (time asleep while in bed). Nocturnal awakenings are common, and there is sleep fragmentation. The result is daytime drowsiness and an increase in napping tendency.

5. Hormonal changes with aging include all of the following except:
   A. Decreased production of free thyroxine with decreased clearance
   B. Growth hormone declines steadily with aging
   C. Decrease in the cortisol blood levels with age
   D. Decrease in basal renin and aldosterone levels

   Answer: C.

   With age several changes in hormone function occur. A decline in free thyroxine production is offset by lower clearance to retain normal levels. A decline in basal and stimulated renin and aldosterone occur with increased risk for hyperkalemia from disease or medications. Decline in growth hormone secretion occurs steadily with age, to markedly low levels by 80 years. A decline in cortisol levels is offset by decline in clearance; the cortisol levels remain normal with good response to stress. Any decline in response to ACTH stimulation is a result of adrenal suppression.

6. True statements regarding glucose intolerance in older adults include all of the following except:
   A. Glucose levels remain normal with age
   B. Insulin secretion declines with age but clearance is decreased, levels are normal
   C. Insulin resistance develops with age
   D. Glucose intolerance can be modified or prevented by diet and physical activity

   Answer: A.

   Insulin resistance, denoting a lower rate of glucose disposal for a given insulin level, develops with aging. The pathogenesis involves alterations in insulin signaling pathway. Aging is associated with alterations in the fat and muscle compartments, and visceral obesity correlates with insulin resistance. Fasting blood glucose levels rise by 1–2 mg/dL/decade, but there is a greater rise in the postprandial glucose with healthy aging. Inspiratory muscular training in healthy subjects improves insulin sensitivity; in general a healthy diet and physical activity can delay or favorably alter the development of insulin resistance.

7. Regarding renal tubular function and aging, all of the following are true except
   A. Tubular clearance decreases with age
   B. Renal tubular concentrating and diluting abilities are impaired
   C. Decline in ability to excrete a sodium load
   D. Decline in ability to excrete a calcium and magnesium load

   Answer: D.

   Several tubular functions decline with age. A decline in tubular secretion occurs in parallel with a decline in eGFR. A decline in both tubular concentration and dilution capacity occurs with failure to conserve or excrete large water loads. A decline in ability to conserve sodium or excrete a large sodium load occurs; there is also a reduced ability to excrete a potassium and acid load. However, the ability to handle calcium, phosphorus and magnesium remains intact with age. Tubular functional derangements are of practical importance in the management of heart failure or volume depleted states entailing fluid and electrolyte removal or administration in the older adult. Close monitoring is recommended to avoid poor outcomes.
8. With regards to alterations in body composition, which of the following is not correct regarding the administration of medications or alcohol?
A. More fluid is required to correct deficits in older people
B. Although the lipid compartment increases with age, hypnotics are not recommended in older adults
C. Recommended alcohol amounts for the older adults are lower than in the young, and even lesser for women compared to men
D. Water-soluble drugs attain higher levels in usual doses

Answer: A.

In young and middle age adults, body water takes up about 60% of body weight. With age a decline in body water brings the water compartment closer to 50% of body weight. Fluid administration should be cautious as volume over load can easily result; smaller amounts are required. Water-soluble drugs attain higher concentrations; so dosing must be lower, especially if the drug is also renally excreted. Likewise recommendations for alcohol intake suggest lower amounts in the old, more so in women (vs. men). Lean body mass is body weight minus fat and includes muscle, bone, and nonfatty tissue. In health, an adult male’s body has 6–24% fat, while a female has 14–31% fat. The fat compartment increases through life to about 30% of body weight by the seventh decade; the lipid compartment is even larger in women (compared to men) at all ages. Even if the total weight remains unchanged, there is a relative decrease in water and increase in fat compartments. Fat soluble hypnotics are relatively avoided in the old as they tend to remain in the fat depots and not leave the body, with consequent adverse effects.

9. Immune system undergoes changes with age. The following are true regarding the administration of vaccines in older adults, with one exception. Which one is it?
A. Reduction in B cell function results in suboptimal antibody production
B. There is a suboptimal antibody response to vaccines such as influenza and pneumococcal vaccine
C. The risks of vaccine administration exceed benefits in older persons
D. Influenza and pneumococcal vaccines must be routinely offered in older adults

Answer: C.

While it is true that the antibody response is suboptimal in the aged and immunosuppressed, nevertheless, the risk–benefit ratio remains favorable to the patient. Vaccine administration for influenza is now universal and pneumococcal vaccine is administered to all adults over the age of 65 years; the only contraindication is allergy to eggs for influenza vaccine, and this needs to be obvious. The younger the patient and the less immune suppressed, the better is the response. Older adult develop some protection through vaccination with lesser likelihood of hospitalizations, morbidity and mortality. Current guidelines recommend vaccinations for influenza, pneumococcal infections, herpes zoster and tetanus/diphtheria/pertussis in older adults.

10. Changes occur in structure and function of the cardiovascular system with age. The alterations predispose to all of the following except:
A. Poorer ability to respond to physical stress with inability to increase the heart rate and cardiac output
B. Increase in hypertension with age, with a higher prevalence of diastolic hypertension
C. Higher prevalence of cardiac dysfunction, with diastolic dysfunction
D. Increase in orthostatic hypotension, with propensity to falls

Answer: B.

Several changes contribute to common cardiovascular conditions in older persons including heart failure with a preserved ejection fraction, systolic hypertension, chronotropic incompetence, and orthostasis. The maximum achievable heart rate is reduced as is the heart rate response to stimulants including beta-agonists. The most widely used formula describing maximal achievable heart rate shows significant interaction with age (HRmax = 220 – age in years for males; 190 – (age in years × 0.8) for females). The sensitivity of the autonomic nervous system declines with age. Carotid baroreceptor and beta-adrenergic receptor function are affected and less so alpha-adrenergic receptor response. Sympathetic activation is blunted and central vagal tone is enhanced. As a result, the body’s ability to compensate for postural change deteriorates, with orthostasis and postprandial hypotension common. Vascular and ventricular stiffening increases the prevalence of isolated systolic hypertension, and hypertensive heart disease, and heart failure with a preserved ejection fraction (CHFpEF). Over half the persons over 60 years and three-quarters of adults over 75 years have systolic hypertension. The majority of older persons with heart failure have CHFpEF.