Self-assessment/CPD answers

Below, you can find the answers to the self-assessment questions published in this chapter.

Answers

Assessment of kidney function in adults

Question 1

Correct answer: A. Blood creatinine concentration reflects release of creatinine from muscle and is related to muscle mass. This changes the usual relationship between creatinine concentration and glomerular filtration rate (GFR) and invalidates most estimates of GFR. Patients with muscle-wasting disorders therefore commonly have a low serum creatinine, and their estimated GFR will be spuriously high. In such patients, an alternative method of assessing GFR should be used. Hyperfiltration is not a usual feature of muscular dystrophy (B). Drug interferences should always be borne in mind but cannabis (C) has never been reported as an interferent in creatinine assays. Errors of analysis (D, E) are a possibility but are less likely than A.

Question 2

Correct answer: B. Urinary albumin:creatinine ratio should be measured to further assess kidney function in view of the duration of the diabetes mellitus and the risk of diabetic nephropathy. Given his equivocal hypertension, the albumin:creatinine ratio should also be used to guide the need for antihypertensive medication. Measurement of 24-hour urine protein (A) would add little in this situation given its poor sensitivity as a test for albuminuria. The HbA_{1c} concentration suggests good glycaemic control, and blood glucose measurement (C) would add little. In the absence of abnormalities of mineral metabolism, there is no value in measuring parathyroid hormone (D). Unless there is a reason to suspect the estimated glomerular filtration rate (GFR) is erroneous, there is no requirement for a more accurate assessment of GFR using inulin clearance studies (E).

Electrolytes and acid–base: common fluid and electrolyte disorders

Question 1

Correct answer: B. Hyponatraemia associated with normal renal function, inappropriate urinary osmolality compared with serum sodium, and urinary sodium >40 mmol/litre are typical of the syndrome of inappropriate antidiuretic hormone secretion. The usual signs of infection can be masked by high-dose corticosteroids. Addison's disease (A) is unlikely after recent corticosteroid administration. The hyperglycaemia (C) is not sufficiently high to have this effect. Normal blood pressure and urinary sodium exclude the presence of severe volume depletion (D). Methylprednisolone is not associated with syndrome of inappropriate antidiuretic hormone secretion (E).

Question 2

Correct answer: E. All these treatments are effective, but calcium salt infusion is first-line treatment in severe hyperkalaemia to protect the heart; the effect is, however, temporary. Gluconate salts are preferred owing to the presence of metabolic acidosis, as can be assumed from the hyperchloraemia. By favouring the intracellular shift, glucose + insulin (B) produce a rapid decrease in K^+ that is longer lasting. Sodium bicarbonate infusion (A) will correct the metabolic acidosis and contribute to potassium correction by intracellular shift. Furosemide (C) administration allows potassium secretion via the urine by impairing reabsorption along the thick ascending limb of Henle, and haemodialysis (D) is helpful in case of anuria or resistance to the above treatments.

Question 3

Correct answer: C. Gitelman's syndrome is most likely in light of the patient's age, the electrolyte panel and the classical onset of the symptoms. Barttler's syndrome (A) is the second most likely diagnosis; this is a tubulopathy that can overlap in phenotype with Gitelman's syndrome, but only rare forms are associated with low serum magnesium concentrations. Vomiting (B) is less likely because of the initial presentation of the symptoms during jogging and the urinary chloride concentration being >10 mmol/litre. Diuretic abuse (D) causing this concentration of potassium is usually associated with lower urinary chloride concentrations at drug withdrawal. This is a metabolic alkalosis not an acidosis (E).

Renal imaging

Question 1

Correct answer C. MR angiography can assess for renal artery stenosis and coarctation of the aorta, and also assess the renal parenchyma and adrenal glands. Ultrasound scan (A) can assess the size of the kidneys. A small kidney may indicate renal artery stenosis.

CT angiogram of the renal arteries (B) will show renal artery stenosis, but will not assess the thoracic aorta to exclude aortic coarctation.

A dimercaptosuccinic acid scan (D) is used to assess split renal function and to look for renal cortical scars. Micturating cystourethrography (E) can demonstrate vesicourinary reflux.

Question 2

Correct answer: A. Ultrasonography can determine whether there is any hydronephrosis or a distended bladder.

CT angiogram (B) should be avoided as the patient is in renal failure. Similarly an MR angiogram (C) may show the renal arteries, but the priority here is to exclude urinary obstruction. Plain radiograph (D) may show urinary stones, but is not the appropriate test for renal failure. Renal biopsy (E) may eventually be indicated, but not as the first test.

Question 3

Correct answer: C. MR scanning is the best test to assess the renal anatomy and renal artery anatomy before transplantation.

A renal ultrasound scan (A) can assess the size of the kidneys but is not a good test to assess the size and number of the renal arteries. A CT angiogram (B) may be a potential alternative that could give all the information needed for transplantation, but an MR angiogram is better as there is no radiation involved and the MR angiogram can be done without contrast administration. Plain abdominal radiograph (D) is not suitable for transplant assessment. Radioisotope scans(E) can assess the split renal function/urinary obstruction, but not the best test for renal transplant donor assessment.

Genetic renal disorders

Question 1

Correct answer: A. All answers are possible but Alport syndrome is most likely as the patient has renal impairment and there is a family history of early onset end-stage renal disease in a male relative. Polycystic kidney disease (D) is possible but the earlier age of onset of chronic kidney disease in the patient (and end-stage renal disease in the uncle) would be atypical. Immunoglobulin A nephropathy (C) is possible but typically would be associated with hypertension. Thin basement membrane nephropathy (E) and hypercalciuria (B) could both cause haematuria in a young man but are less likely to cause renal impairment in early adulthood.

Question 2

Correct answer: E. All answers are potential renal replacement therapy options. Live donor kidney transplant (E) is associated with optimal long-term survival. If a live donor was not available then deceased donor kidney transplant (B) would be next best option for survival. If a transplant procedure could not be offered then home haemodialysis (C) is preferred as survival on home haemodialysis can almost match deceased donor transplant. Hospital-based haemodialysis (D) offers better long-term survival than peritoneal dialysis (A) mainly due to peritoneal dialysis technique failure in the first 5 years of use.

Question 3

Correct answer: E. Tolvaptan is licensed for progressive renal failure in stage 2 and stage 3 chronic kidney disease (CKD) associated with autosomal dominant progressive kidney disease (ADPKD). Octreotide (B) and sirolimus (C) have been used in clinical trials of ADPKD, but without proven efficacy. Sodium bicarbonate (D) may delay progression of CKD but can cause worsening of hypertension (because of the sodium load). Bisoprolol (D) can be used for hypertension but is unlikely to affect progression of the patient's CKD.

Nephrotoxins and drugs in renal insufficiency

Question 1

Correct answer: B. The clinical and biochemical picture describes acute rhabdomyolysis. Muscle necrosis releases potassium into the circulation resulting in hyperkalaemia. Calcium is sequestrated by damaged muscle exposing calcium binding sites, and as calcium phosphate. The patient has been recently started on high-dose statin therapy, which is the most common cause of drug-induced rhabdomyolysis.

Question 2

Correct answer: E. Gentamicin, particularly in a dosage of three times per day, is the most likely drug to have contributed to the development of the acute kidney injury (AKI) consequently once daily dosing with asiduous monitoring of pre-dose levels is recomended. Diuretics (C) and angiotensin receptor blockers (D) can adversely affect renal blood flow, as can aspirin (A), a non-steroidal anti-inflammatory drug, but at a dose of 75 mg once daily this is likely to be making a negligible contribution. Metformin (E) may be protective against AKI but is commonly perceived as nephrotoxic.

Question 3

Correct answer: A. The original description of Chinese herb nephropathy followed the identification of a cohort of Belgian women taking a slimming remedy. The causative agent was later identified as aristolochic acid. Although the heavy metals, arsenic (B), cadmium (C) and lead (E) are all nephrotoxic and can contaminate herbal remedies, but this is less likely and there is no reason to favour one heavy metal over another. The selective serotonin reuptake inhibitor citalopram (D) is metabolized by the liver, and cases of nephrotoxicity have been reported.

Management of hypertension in renal disease

Question 1

Correct answer: A. Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers (ARBs) have been most consistently shown to slow the rate of progression to end stage renal disease including in those with diabetes mellitus and CKD. Whilst better diabetic control is thought to be beneficial the effect is not thought to be as significant. Loop diuretics, β-adrenoceptor blockade and a low-protein diet have not been shown to delay CKD progression.

Question 2

Correct answer: C. Inter dialysis home blood pressure readings have been shown to give a more accurate assessment of blood pressure controls to allow for safe and accurate management. Blood pressure readings on the day of or during dialysis will be confounded by the fluid status before and after dialysis and the effect of dialysis itself. Whilst an echocardiogram may show evidence of hypertensive end organ damage; it will not be able to guide current management.

Question 3

Correct answer: E. The disease which has affected the native kidneys may contribute to hypertension post-transplant. However; this patient had previously had well-controlled blood pressure whilst she was having peritoneal dialysis which would indicate that a recent change such as the commencement of a calcineurin inhibitor (tacrolimus) is the most likely factor contributing to the hypertension. A family history of hypertension in the donor has been shown to increase the risk of post-transplant hypertension.

Renovascular disease

Question 1

Correct answer: C. Computed tomography angiography (D) and gadolinium-enhanced magnetic resonance angiography (MRA) are the current mainstay of diagnostic techniques. They have nearly equivalent accuracy, but MRA has the advantage of avoiding ionizing radiation. Their use is restricted in patients with an estimated glomerular filtration rate <30 ml/minute/1.73 m^2 because of the respective risks of contrast-induced nephropathy and nephrogenic systemic fibrosis. In this patient, therefore, contrast-free MRA (C) would be most appropriate. Duplex ultrasound (E) is potentially another feasible option however it is highly operator dependent and is only available in a few centres so it is not the first choice. Although the gold-standard investigation remains direct intra-arterial angiography, this is an invasive investigation and exposes the patient to the risks of contrast-induced nephropathy and ionizing radiation hence it is not the most appropriate investigation. Renography with captopril provocation (B) is rarely used nowadays as its accuracy is limited in patients with chronic kidney disease or bilateral ARAS and studies have shown an inferior diagnostic performance compared to CTA or MRA.

Question 2

Correct answer: B. The patient meets the criteria for renal revascularization in view of the critical stenosis to a single functioning kidney and poorly controlled blood pressure despite three antihypertensive agents including a diuretic. Studies have shown that percutaneous transluminal renal angioplasty (PTRA) with stenting is superior to PTRA without stenting (C) in atherosclerotic renovascular disease, as re-stenosis rates are high with the latter. The right renal artery is occluded, and intervention is not warranted on this side (A, D) as in these situations the downstream kidney is usually shrunken and irreversibly damaged. This patient has critical stenosis to a single-functioning kidney and repeat imaging in a few months is unlikely to change management. He is more likely to benefit from timely revascularization to prevent irreversible damage occurring in his functioning left kidney hence (E) is incorrect.

Question 3

Correct answer D. This patient does not have a haemodynamically significant degree of stenosis and has no high-risk features, hence she has a similar phenotype to the majority of patients represented by the ASTRAL and CORAL trials. Indeed, in the ASTRAL trial 40% of the study population were found to have low-grade stenosis (50–70%) at angiography while the average degree of angiographic stenosis in CORAL was 67%. These studies have shown that revascularization in these patients does not lead to any improvement in clinical outcomes. An elevated resistive index (>0.8) measured on Doppler ultrasound may have prognostic value by identifying patients who will not gain clinical benefit from revascularization. The resistive index is a reflection of the degree of microvascular injury and is unlikely to benefit from changes in large vessel haemodynamics brought about by revascularization.