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Question: 1828

When preparing a patient for a coronary CTA, which of the following clinical scenarios represents the highest risk for developing contrast-induced acute kidney injury (CI-AKI)?

- A. A 65-year-old patient with NYHA Class III heart failure and an estimated GFR of $35 \text{ mL/min/1.73m}^2$
- B. A 70-year-old patient with stable chronic obstructive pulmonary disease and a creatinine of 1.2 mg/dL
- C. A 50-year-old patient with well-controlled type 2 diabetes and an estimated GFR of $65 \text{ mL/min/1.73m}^2$
- D. A 45-year-old patient with essential hypertension and a body mass index of 32 kg/m^2

Answer: A

Explanation: The risk of CI-AKI is highest in patients with pre-existing renal impairment ($\text{eGFR} < 45 \text{ mL/min/1.73m}^2$), especially when combined with other risk factors such as congestive heart failure, dehydration, or advanced age. Heart failure reduces renal perfusion, making the kidneys more susceptible to the toxic effects of contrast media. While diabetes is a risk factor, it is primarily significant when renal function is already impaired.

Question: 1829

A CCTA identifies a "myocardial bridge" in the mid-LAD. What is the most important CT feature to report to determine if this is clinically significant?

- A. The presence of plaque in the bridge
- B. The presence of plaque proximal to it
- C. The total calcium score of the LAD
- D. The depth and length of the segment

Answer: D

Explanation: While myocardial bridging is common and often benign, significant systolic compression can occur if the bridge is deep (>2 mm) and long (>15 mm). CT can accurately measure these dimensions and also detect the characteristic "step-down" and "step-up" course of the vessel.

Question: 1830

A 60-year-old male with a history of coronary artery bypass grafting and subsequent left ventricular assist device implantation undergoes cardiac computed tomography to evaluate driveline position and left ventricular apical cannulation site. Into which specific cardiac chamber is the inflow cannula of a continuous-flow left ventricular assist device typically inserted?

- A. Left ventricular apex directed toward the mitral valve plane
- B. Right ventricular free wall directed toward the pulmonic valve
- C. Ascending aorta directed retrograde toward the aortic valve
- D. Left atrium positioned near the entrance of the pulmonary veins

Answer: A

Explanation: The inflow cannula of a continuous-flow left ventricular assist device is surgically implanted directly into the left ventricular apex through a sewing ring and coring procedure, positioned so that blood is continuously drawn from the left ventricular cavity and expelled into the systemic arterial circulation via an outflow graft anastomosed to the ascending aorta. Cardiac computed tomography plays an essential role in postoperative assessment by verifying the exact alignment of the apical cannula, ruling out ventricular wall micro-aneurysms, and detecting any thrombus formation within the pump pocket.

Question: 1831

A 61-year-old man with stable angina undergoes coronary computed tomography angiography to evaluate a chronic total occlusion in the right coronary artery. Which morphological feature on computed tomography is most favorable for successful percutaneous revascularization of a chronic total occlusion?

- A. Tapering proximal stump with a clear entry point and side branch marker
- B. Long segment occlusion measuring greater than 40 mm in total length
- C. Severe heavy circumferential calcification spanning the entire occluded length
- D. Blunt proximal stump with no recognizable side branch at the occlusion site

Answer: A

Explanation: A tapering proximal stump pointing toward the occluded segment and the presence of a side branch near the entry point are favorable computed tomography predictors for successful percutaneous coronary intervention of chronic total occlusions. Blunt stumps, long occlusion lengths, and heavy circumferential calcification are independent predictors of procedural failure and increased technical difficulty.

Question: 1832

A 78-year-old female evaluated for transcatheter aortic valve replacement undergoes cardiac computed tomography. The scan demonstrates a bicuspid aortic valve morphology (Sievers Type 1 with fusion of the left and right coronary cusps) with massive, asymmetric calcium distribution extending into the sinotubular junction. What is the primary implication of bicuspid valve morphology on CT-based procedural planning?

- A. It requires specialized sizing algorithms that account for elliptical annular geometry
- B. It guarantees that balloon-expandable valves will expand with absolute geometric symmetry
- C. It eliminates the possibility of paravalvular regurgitation post-procedure
- D. It simplifies device sizing because bicuspid annuli are perfectly circular and uniform

Answer: A

Explanation: Bicuspid aortic valves present unique anatomical challenges for transcatheter aortic valve replacement due to elliptical annulus shapes, heavy asymmetric calcium distribution, and often enlarged ascending aortas or fused raphe. Standard sizing based solely on circular assumptions can lead to under-expansion, severe paravalvular leak, or annular rupture. Pre-procedural cardiac computed tomography is mandatory to thoroughly characterize the bicuspid phenotype, measure perimeter and area dimensions across multiple levels, and guide appropriate prosthesis selection.

Question: 1833

When calculating body mass index during pre-exam anthropometric assessment for cardiac computed tomography protocol selection, what primary technical parameter is directly influenced?

- A. Patient breath-hold duration instructions and timing.
- B. Sublingual nitroglycerin absorption pharmacokinetic rates.
- C. Target heart rate threshold for beta-blockade success.
- D. Automated tube current and voltage modulation settings.

Answer: D

Explanation: Patient body mass and habitus directly determine X-ray attenuation. Pre-exam entry of weight and height enables automated tube current and tube voltage modulation software to optimize radiation dose while maintaining diagnostic image noise levels. Breath-holding, drug absorption, and target heart rates are physiological parameters rather than direct anthropometric calculation outputs.

Question: 1834

During pre-procedural cardiac computed tomography evaluation for pulmonary vein isolation, an interpreting physician measures the diameters of all pulmonary vein ostia in a 58-year-old female. Which imaging plane or post-processing technique is optimal for obtaining accurate ostial dimensions?

- A. Standard axial slice thickness measurements without reconstruction
- B. Sagittal oblique projection parallel to the descending thoracic aorta

- C. Coronal maximum intensity projection images at standard window levels
- D. Three-dimensional multi-planar reformation perpendicular to the long axis

Answer: D

Initializing proper measurement methodology requires generating multi-planar reformation planes strictly perpendicular to the long axis of each individual pulmonary vein as it approaches the left atrium. This perpendicular alignment prevents overestimation of ostial diameters caused by elliptical cross-sections or oblique slicing angles, ensuring reliable sizing data for ablation catheter selection and pre-procedural planning.

Question: 1835

A patient undergoing a cardiac CT scan for suspected coronary artery disease is found to have a well-circumscribed posterior mediastinal mass originating from the sympathetic chain, featuring heterogeneous enhancement and neural foraminal extension. What is the most likely diagnosis?

- A. Foregut duplication cyst located within the paravertebral sulcus and spinal canal
- B. Pleuropericardial cyst displaced posteriorly by cardiomegaly and chamber dilation
- C. Neurogenic tumor such as a schwannoma or ganglioneuroma in the posterior mediastinum
- D. Extramedullary hematopoietic tumor associated with chronic severe hemolytic anemia

Answer: C

Explanation: The vast majority of posterior mediastinal masses in adults are neurogenic tumors arising from the intercostal nerves or sympathetic chain, such as

schwannomas, neurofibromas, or ganglioneuromas, which can occasionally show dumbbell extension through neural foramina.

Question: 1836

When processing and analyzing a coronary artery calcium dataset, the automated scoring software highlights multiple distinct high attenuation foci within the left anterior descending artery. What are the specific minimum volumetric threshold criteria required for a contiguous lesion to be classified and quantified as a true calcified plaque?

- A. An area threshold of four contiguous pixels combined with a minimum density threshold of four hundred Hounsfield units
- B. An area threshold of two contiguous pixels combined with a minimum density threshold of two hundred Hounsfield units
- C. An area threshold of three contiguous pixels combined with a minimum density threshold of three hundred Hounsfield units
- D. An area threshold of one contiguous pixel combined with a minimum density threshold of one hundred thirty Hounsfield units

Answer: D

Explanation: The standard Agatston scoring methodology defines a calcified lesion as an area of at least one contiguous pixel with a computed tomography density greater than or equal to 130 Hounsfield units. Utilizing a single pixel threshold ensures high sensitivity for detecting early microcalcifications, while the 130 HU threshold reliably separates true calcium from surrounding soft tissue and fibrous plaque elements. Higher density or area thresholds would underestimate the total calcium burden and alter prognostic risk stratification categories.

Question: 1837

During an automated bolus tracking acquisition for a coronary computed tomography angiogram, the region of interest is incorrectly placed in the inferior vena cava instead of the ascending aorta. What immediate troubleshooting consequence occurs?

- A. The automatic tube current modulation system will fail to adjust output based on patient attenuation profiles
- B. The scanner will lock out further exposures due to safety limits on total iodine injection volume per procedure
- C. The scan will trigger prematurely before the contrast bolus reaches the left-sided cardiac chambers and coronary arteries
- D. Severe streak artifacts will appear across the right ventricular outflow tract due to localized hyper-concentration

Answer: C

Explanation: Placing the bolus tracking region of interest in the venous system rather than the arterial system results in premature triggering of the scan before the contrast media has traversed the pulmonary circulation and entered the left ventricle and coronary arteries.

Question: 1838

A patient presents for a coronary computed tomography angiography with an estimated glomerular filtration rate of 55 mL/min/1.73m² and no other risk factors.

According to contrast media safety guidelines, what pre-exam intravenous fluid recommendation applies?

- A. Administration of high-dose systemic loop diuretics.
- B. Immediate hemodialysis session scheduled post-exam.
- C. Mandatory hospital admission for overnight hydration.
- D. Routine outpatient oral hydration with water is sufficient.

Answer: D

Explanation: For patients with mild renal impairment (eGFR 45 to 59 mL/min/1.73m²) without other risk factors like diabetes or heart failure, routine oral hydration is generally adequate, and complex intravenous hydration protocols or hospital admissions are unnecessary. Dialysis is reserved for severe end-stage renal disease, and diuretics would worsen hydration status.

Question: 1839

What is the effect of increasing the detector collimation (e.g., from 64×0.6 mm to 128×0.6 mm) on the scan time?

- A. It doubles the total time
- B. It increases the scan time
- C. It has no effect on time
- D. It reduces the total time

Answer: D

Explanation: Increasing the detector collimation means the X-ray beam is wider and

covers more anatomy in a single rotation. This allows the scanner to cover the entire heart in fewer rotations, which significantly shortens the total acquisition time.

Question: 1840

A patient undergoing a cardiac computed tomography scan exhibits a sudden sustained ventricular tachycardia lasting longer than thirty seconds on the monitoring scope. Which of the following is the immediate protocol response?

- A. Continue the contrast injection to complete.
- B. Administer oral beta-blocker tablets via.
- C. Instruct the patient to perform deep breathing.
- D. Stop the scan immediately and activate.

Answer: D

Explanation: Sustained ventricular tachycardia is a life-threatening medical emergency that requires immediate cessation of scanning, entry into the room, and activation of advanced cardiac life support protocols. Patient safety supersedes diagnostic image acquisition under unstable hemodynamic conditions.

Question: 1841

When using a 64-slice MDCT scanner for coronary imaging, what is the primary limitation of using a high pitch (e.g., 1.5) during a retrospectively gated acquisition?

- A. Gaps in the reconstructed data volume
- B. Prolonged breath-hold requirements for the patient

- C. Inability to perform multiplanar reformats later
- D. Excessive radiation dose to the patient

Answer: A

Explanation: In cardiac CT, the pitch must be low (typically 0.2 to 0.4) to ensure that every part of the heart is imaged during every phase of the cardiac cycle. If the pitch is too high, there will be "data gaps" where certain anatomical sections were not captured during the required phase of the EKG, making it impossible to reconstruct a complete, motion-free image of the heart.

Question: 1842

During a computed tomography evaluation of a patient with a left internal mammary artery graft and a radial artery graft, the reader notes complete non-visualization of the radial artery graft from its aortic root origin. What term describes this specific imaging finding?

- A. Graft atresia with congenital absence of the vascular conduit structure
- B. Graft occlusion demonstrated by complete absence of luminal contrast opacification
- C. Severe vasospasm causing temporary constriction of the proximal conduit
- D. Competitive flow artifact resulting in stagnant non-enhanced blood pooling

Answer: B

Explanation: Complete absence of contrast opacification throughout a bypass conduit on a diagnostic computed tomography angiogram with adequate peak arterial enhancement indicates graft occlusion. While radial artery grafts are

susceptible to spasm, complete lack of visualization typically represents established thrombotic occlusion.

Question: 1843

A 52-year-old male smoker undergoes a screening calcium score. The Agatston score is 0, but a non-calcified 7 mm spiculated nodule is identified in the right upper lobe. Which of the following is the most appropriate management based on current Fleischner Society guidelines?

- A. Order a positron emission tomography scan for further workup
- B. Provide reassurance that the current calcium score is zero
- C. Obtain a follow-up computed tomography in six to twelve months
- D. Perform a transthoracic needle biopsy of the pulmonary nodule

Answer: C

Explanation: For a solid, spiculated nodule between 6 mm and 8 mm in a high-risk patient (smoker), the Fleischner Society recommends a follow-up CT at 6–12 months. Spiculation increases the probability of malignancy, making reassurance based on a zero calcium score inappropriate. PET scans are generally reserved for nodules larger than 8 mm due to spatial resolution limits and the risk of false negatives in smaller lesions. Biopsy is typically reserved for larger or growing nodules where the suspicion of malignancy is higher.

Question: 1844

Which of the following is a primary disadvantage of using a "large" focal spot size during CCTA acquisition?

- A. Increased heat loading on the X-ray tube, leading to longer cooling times between scans.
- B. Reduced spatial resolution due to increased geometric blurring (penumbra).
- C. Reduced temporal resolution because the gantry must rotate more slowly.
- D. Increased radiation dose to the patient due to a wider X-ray beam geometry.

Answer: B

Explanation: The size of the focal spot on the X-ray tube anode affects the spatial resolution of the CT system. A smaller focal spot produces a sharper image with less geometric blurring (penumbra). A large focal spot, while able to handle higher tube currents (mA), results in decreased spatial resolution, which can limit the ability to visualize small coronary branches or fine details within a plaque.

Question: 1845

A cardiac computed tomography angiogram reveals a rare coronary anomaly where the left main coronary artery arises from the pulmonary trunk (anomalous left coronary artery from the pulmonary artery, or ALCAPA syndrome). The patient is an adult presenting with mild dyspnea and continuous murmur. What is the clinical and therapeutic significance of this anomaly?

- A. Benign incidental variant that resolves spontaneously with aging and collateral growth
- B. Absolute contraindication to any surgical intervention due to high operative mortality

- C. Low-risk anomaly managed conservatively with oral beta-blockers and outpatient observation
- D. Severe congenital anomaly causing coronary steal and ischemia, requiring surgical repair

Answer: D

Explanation: Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a rare and life-threatening congenital anomaly. Because the pulmonary artery pressure and oxygen saturation drop shortly after birth, blood flows retrograde from the high-pressure right coronary system through collaterals into the left coronary system and drains into the low-pressure pulmonary artery (coronary steal phenomenon). This results in severe myocardial ischemia, mitral regurgitation, and heart failure, necessitating prompt surgical reestablishment of a dual-coronary supply system.

Question: 1846

A patient undergoing structural heart evaluation has a cardiac CT scan that demonstrates a persistent left superior vena cava draining directly into the coronary sinus, resulting in marked dilation of the coronary sinus measuring 28 mm in diameter. The right superior vena cava is also present. How does this finding impact subsequent invasive catheterization and transcatheter procedures?

- A. It prevents safe placement of temporary transvenous pacing wires from the right femoral vein
- B. It serves as a definitive contraindication for iodinated contrast administration during cardiac CT protocols
- C. It causes severe systemic arterial desaturation by creating an absolute right-to-left intracardiac shunt

D. It alters coronary sinus anatomy and can complicate procedures requiring coronary sinus cannulation

Answer: D

Explanation: Persistent left superior vena cava draining into a dilated coronary sinus is a relatively common congenital venous anomaly easily identified on cardiac computed tomography. While isolated persistence does not typically cause an intracardiac shunt or hemodynamic compromise, the markedly enlarged coronary sinus alters local right atrial anatomy. This anatomical variation can significantly complicate interventional procedures that require trans-septal punctures near the fossa ovalis, right-sided electrophysiology mapping, retrograde cardioplegia delivery, or left-sided device placement that navigates through the coronary sinus.

Question: 1847

A 45-year-old female with a body mass index of 34 kg/m^2 undergoes a 64-slice coronary CT angiography. The images exhibit a generalized grainy appearance, significantly reducing the signal-to-noise ratio and limiting the assessment of small side branches. Which parameter should be increased to improve image quality?

- A. The window width of the viewing software
- B. The tube current-time product (mAs)
- C. The rotation speed of the gantry system
- D. The pitch of the helical scan acquisition

Answer: B

Explanation: A grainy appearance in CT imaging is the hallmark of quantum mottle

or photon starvation, which occurs when an insufficient number of X-ray photons reach the detectors. In patients with a high body mass index, the X-ray beam is more attenuated. Increasing the tube current-time product (mAs) or the tube voltage (kVp) increases the number of photons, thereby reducing noise and improving the signal-to-noise ratio.

Question: 1848

A 61-year-old male is scheduled for coronary computed tomography angiography to evaluate chest pain. His medical history includes severe chronic obstructive pulmonary disease requiring continuous home oxygen therapy and regular bronchodilator use. Which of the following pre-exam medication considerations is most critical?

- A. Avoid beta-blocker therapy due to potential bronchospastic precipitation risks.
- B. Avoid beta-blocker therapy due to potential bronchospastic precipitation risks.
- C. Avoid beta-blocker therapy due to potential bronchospastic precipitation risks.
- D. Avoid beta-blocker therapy due to potential bronchospastic precipitation risks.

Answer: A

Explanation: Non-selective beta-blockers can precipitate severe bronchospasm in patients with reactive airway disease or severe chronic obstructive pulmonary disease by blocking beta-2 adrenergic receptors in the bronchial smooth muscle. Even cardioselective beta-blockers lose their selectivity at higher doses. In patients with significant pulmonary disease, alternative rate-controlling agents such as non-dihydropyridine calcium channel blockers or ivabradine should be considered during the pre-exam review phase to maintain patient safety.

Question: 1849

A patient with suspected "Scimitar Syndrome" undergoes CT. What is the characteristic finding of this condition?

- A. Anomalous left pulmonary vein to SVC
- B. Anomalous right pulmonary vein to IVC
- C. Pulmonary sequestration of lower lobe
- D. Persistent left superior vena cava

Answer: B

Explanation: Scimitar syndrome is a form of partial anomalous pulmonary venous return (PAPVR) where the right pulmonary veins drain into the inferior vena cava (IVC). The anomalous vein often has a curved shape resembling a Turkish sword (scimitar) on imaging. It is often associated with right lung hypoplasia.

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