Medical Technology

ARRT-CT
Computer Tomography (CT) exam

Latest Version: 6.0

Question: 1

What technical factor adapts the mA to the beam attenuation as a function of the projection angle allowing the current to be more efficient, thus reducing patient dose?

A. mA modulation
B. kVp
C. Filtration
D. Collimation

Answer: A

Explanation:
Traditionally, the mA in CT is kept constant throughout the exam. This is technically simple, but it is an inefficient method of utilizing mA. Tube current modulation adapts the tube current to the beam attenuation from the localizers or real time scans. It allows the available x-ray power to be utilized more efficiently. Patient dose can be greatly reduced using mA modulation without affecting image quality.

Question: 2

What is considered the most effective way to reduce the population dose from CT radiation exposure?

A. Newer CT scanners
B. Decrease the number of CT studies ordered
C. Eliminate pediatric CT scans
D. Iodine supplements

Answer: B

Explanation:
When a CT scan is justified by medical necessity, the radiation risk is small relative to the diagnostic results obtained. However, there are a significant number of CT exams that are not justified by medical need. Children are often irradiated without convincing medical need. Patients and physicians need to be educated on the radiation risks versus the benefits. This will help control the overall population radiation dose from medical ionizing radiation.

Question: 3

What are the two scanner-based radiation patient dose estimates displayed on the

operator's console after the completion of a CT exam?

A. mAsand kVp
B. MSADand DLP
C. CTDI and DLP
D. mAs and DLP

Answer: C

Explanation:
CT dose index (CTDI) and dose length product (DLP) are two related measures of CT radiation dose available on CT consoles. CT DI is the primary dose measurement in CT. It denotes the average absorbed dose, along the z axis, from a series of contiguous exposures. It is measured from one axial CT scan (one rotation of the x-ray tube), and is calculated by dividing the absorbed dose by the total beam width. Several variations of the CTDI have been defined over the years. DLP is the CTDI multiplied by the scan length (slice thickness x number of slices) in centimeters. DLP is independent of what is actually scanned. The reported DLP is the same whether a small infant or a large child is scanned if the scan length and other scan parameters are the same. DLP is only an approximation of dose.

Question: 4

CTDIvol (CT dose index volume) is a modified patient dose accounting for which technical parameter?

A. Pitch
B. Slice thickness
C. Slice increment
D. Filtration

Answer: A

Explanation:
CTDI is a measurement interpreted as dose from the one scanned slice that would result from an entire procedure with continuous slices. CT DI is used by the FDA and CT manufacturers. CTDIw is a weighted average of CTDI as a standard single number descriptor of patient radiation dose from a CT scan. Helical scan capabilities required another method of calculation and technical factors to consider (such as the z axis). CTDIvol accounts for the pitch. CTDIw represents the average absorbed radiation dose over the x and y directions, and CTDIvol represents the average absorbed radiation dose over the x, y and z directions. Pitch is the most important parameter in helical scanning, and it determines the volume covered, image quality, and radiation exposure to the patient. CTDIv01 = CTDIw/Pitch

Question: 5

Efforts and measures to reduce patient dose should be initiated by and are the

responsibility of all of the following except:

A. Ordering physicians
B. Patient
C. CT manufacturers
D. Clinical radiology staff

Answer: B

Explanation:
It is the ordering physician's responsibility to make sure their patients' symptoms necessitate a CT exam. The clinical radiology staff is responsible for selecting the proper protocol based on the patient's individual history and the appropriate technical factors to get the best possible images and the least possible dose (ALARA principle). The manufacturers of CT equipment are responsible for developing dose-efficient systems together with special technical measures.

Question: 6

Color-coded weight-based CT protocols have been developed for what population to help reduce patient dose?

A. Geriatric
B. Adult
C. Pediatric
D. Low-income

Answer: C

Explanation:
The pediatric population is the most sensitive to the effects of ionizing radiation. CT manufacturers and radiology professionals developed color-coded weight-based protocol selections to help reduce the pediatric population radiation dose per CT exam. These color-coded protocols will help the technologist select a protocol with tailored technical parameters for a patients size/weight.

Question: 7

What process reduces the longest wavelength photons creating a more monochromatic beam and reducing patient radiation dose?

A. Filtration
B. Detector collimation
C. Slip rings
D. Beam hardening

Answer: A

Explanation:
Filtration helps a polychromatic beam become monochromatic. It reduces the longest wavelengths or lower energy wavelengths. Thus, the radiation dose to the patient is reduced without a significant decrease in the measured signal. The remaining x-rays are less prone to beam hardening and artifacts caused by beam hardening.

Question: 8

What component located within the CT gantry measures transmitted photons that pass completely through the patient?

A. Filters
B. Detectors
C. Collimators
D. Slip rings

Answer: B

Explanation:
Detectors are located within the gantry of the CT unit. They measure the transmitted photons that pass completely through the patient from the x-ray tube. They convert the photons to electrical signals by measuring attenuation. For an x-ray photon to generate a signal, it must enter the detector, collide with the detector atom, and produce a measurable event of electricity or light. The measurable light or energy from the detectors is a very small electrical signal that must be processed through the data acquisition system (DAS) to be amplified and made into an actual CT image. First-generation CT scanners contain a single detector. Second-generation scanners contain a linear detector array or a group of detectors in a straight line. The third-generation scanners contain a multiple detector array along a curve with complete circular rotation of detectors. Fourth-generation scanners contain a rotating fan beam within a stationary ring of detectors. The development of multi-row detector scanners or MDCT provided the ability to collect information from multiple anatomical slices for each tube rotation. This allowed for faster scans, increased anatomical coverage, and thinner slices. MDCT utilizes Third-generation technology with multiple parallel detector arrays.

Question: 9

What is the most efficient and most common type of detector utilized today?

A. Xenon gas detectors
B. Stationary detectors
C. Solid state crystalline detectors
D. Single detectors

Answer: C

Explanation:
The most common and efficient type of detectors are the solid state crystalline. The photon passes through the patient and strikes the crystalline detector. The crystals change the energy to light, and the light is converted to an electrical signal. The other type of detector is the xenon gas detectors. These are not commonly used today and they are inefficient. When the xenon gas detector is hit with an x-ray, the gas is ionized. The ions migrate to a positive charge, charge plates, and create the electrical energy. All multi-row detectors in the past and all new detector systems have been built with the crystalline detectors.

Question: 10

During image reconstruction in the data acquisition system, what system reconstructs the amplified digitized raw data into the CT images?

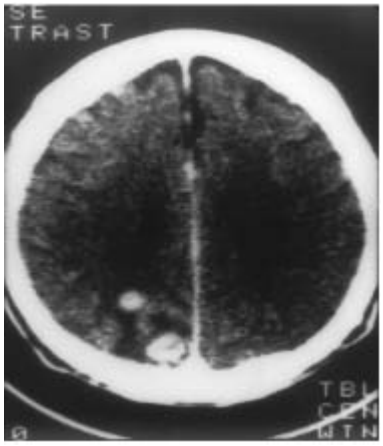
A. Amplifier
B. Analogue-to-digital converter (ADC)
C. Array processor
D. Operator's console

Answer: C

Explanation:
The data acquisition system is a crucial process for image reconstruction. In short, the DAS measures the number of photons that strike the detectors, converts the information to a digital signal, and sends the signal to the computer. The measurable light or energy from the detectors is a very small signal that must pass through an amplifier in the gantry. Once the attenuation information has been amplified, it is sent to the computer system. The amplified signal is an analogue signal that must be digitized before it can be processed and stored on a computer. The ADC (analogue-to-digital converter) converts the analogue attenuation data into digital form. The now amplified digitized signal is sent as raw data to temporary storage to be reconstructed into an image by the array processor. The array processor reconstructs raw data into CT images. The data is sorted and goes through filtered back projection and convolution to produce a CT image viewed at the operator's console.

Question: 11

What imaging plane is displayed in the below brain CT?

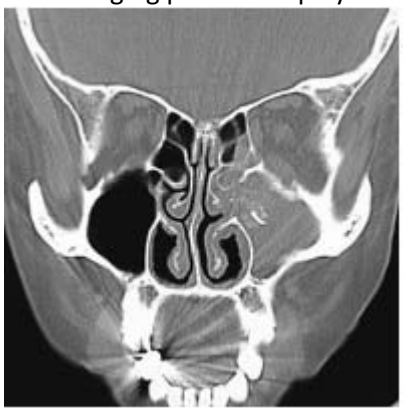


A. Sagittal
B. Axial
C. Coronal
D. Oblique

Answer: B

Question: 12

What imaging plane is displayed on the below sinus CT image?



A. Sagittal
B. Axial
C. Coronal
D. Oblique

Answer: C

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