

Medical Technology

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American Registry for Diagnostic Medical Sonography (SPI)

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Question: 1

Sonographers should be aware of work-related musculoskeletal disorders. Best practice while scanning is to avoid abducting the arm more than how many degrees?

- A. 50
- B. 90
- C. 30
- D. 40

Answer: C

Explanation:

Sonographers should use correct ergonomics to care for their own bodies to prevent work-related musculoskeletal disorders. Roughly 80% of sonographers report having some sort of work injury. Ergonomics is a combination of setting up the room appropriately so the patient and machine can be reached easily. Properly using equipment that reinforces the desired body mechanics to prevent any injuries is also key. This may be something as simple as adjusting the keyboard or monitor to the correct height. One of the most common complaints that a sonographer makes is pain in the shoulder while scanning. It is imperative that the patient is close enough so that the sonographer's arm does not have to be abducted more than 30 degrees. The other choices would not protect the sonographer because they are all angles that are more than 30 degrees.

Question: 2

Which action demonstrates best practice during ultrasound exams regarding the ALARA principle?

- A. The exposure time should be extended during the exam.
- B. Use the lowest possible output power that provides a diagnostic image.
- C. Use the lowest possible gain.
- D. Ensure that the time gain compensation (TGC) is within acceptable limits.

Answer: B

Explanation:

Sonographers should always consider ways to practice the ALARA principle. ALARA stands for as low as reasonably achievable, and sonographers can achieve this by using the lowest possible output power that enables a diagnostic image. Keeping the exposure time to a minimum is another effective way of practicing ALARA. The gain can change the brightness (or darkness) of the image, but it has no effect on patient exposure, so the power should always be reduced, if possible, before the gain to reduce exposure to the patient. On the other hand, if an image is too dark, it is best to increase the gain because it will not affect exposure to the patient. Time gain compensation (TGC) enables the

sonographer to adjust the amplification of reflections that are located at a greater depth in the body, but it has no effect on the exposure.

Question: 3

Which type of cavitation is the MOST concerning cause of bioeffects?

- A. Transient
- B. Absorption
- C. Stable
- D. Thermal

Answer: A

Explanation:

Cavitation is discussed when bioeffects are considered with the interaction of the ultrasound beam and gas bubbles in the human body. Higher temperatures and pressures may cause the gas bubbles within the body to burst; this is known as transient cavitation, which is extremely concerning for harmful bioeffects. When these gas bubbles expand and contract with fluctuations in pressure without rupturing, it is referred to as stable cavitation. There are only two types of cavitation, so absorption and thermal are not viable answers to this question.

Question: 4

Assuming an unfocused ultrasound beam, the American Institute of Ultrasound in Medicine's "Statement on Mammalian Biological Effects of Ultrasound In Vivo" has confirmed that no bioeffects have been noted when the spatial pulse temporal average (SPTA) intensity is less than which value?

- A. 1 mW/cm²
- B. 100 W/cm²
- C. 1 W/cm²
- D. 100 mW/cm²

Answer: D

Explanation:

The spatial pulse temporal average (SPTA) is linked with the greatest amount of temperature elevation within tissues. Bioeffects have not been noted when the SPTA intensity was less than 100 mW/cm², when the ultrasound beam was unfocused. If the ultrasound beam is focused, then the same principle applies if the intensity is less than 1 W/cm². If there is an inquiry regarding the smallest intensity, the answer would be the spatial average temporal average.

Question: 5

A sonographer notices that the mechanical index (MI) is too high during an ultrasound. What would be the MOST appropriate modification that the sonographer can make?

- A. Decrease receiver gain.
- B. Increase period.
- C. Decrease the output power.
- D. Decrease the frequency of the transducer.

Answer: C

Explanation:

The mechanical index (MI) is a parameter that the user should monitor to help determine if cavitation is expected. If a sonographer notices that the MI is too high during an ultrasound, it is important to decrease the acoustic power of the machine. Another step the sonographer can do to keep the MI lower is to increase the frequency of the transducer. The receiver gain has no effect on patient exposure. The ultrasound operator is not able to adjust the period unless a different transducer is chosen.

Question: 6

Select the technique that will generate the LEAST amount of exposure to the patient.

- A. Spectral Doppler
- B. Color flow Doppler
- C. Grayscale
- D. M-mode

Answer: C

Explanation:

The lowest level of tissue heating occurs when the output intensity of the equipment being used is at its lowest numerical value. Generally, grayscale imaging is the method in which tissue heating will be the lowest. It is typically the highest when pulsed Doppler is being used. M-mode and color flow Doppler tend to fall in the middle of these intensities.

Ultrasound should be used only for clinical exams in which the benefits outweigh the risks. One risk during an exam is an elevation of temperature in tissues exposed to the ultrasound beam. The thermal index (TI) will be highest during an exam with a high-frequency, high-intensity beam. This heating depends on the exposure time and the temperature. Typically, the greatest increase in temperature is witnessed with spectral Doppler exams.

Question: 7

When a vibrating string or fluid pump is used to test system performance, what parameter is being tested?

- A. Dead zone
- B. Doppler velocities

- C. Contrast resolution
- D. Grayscale sensitivity

Answer: B

Explanation:

A vibrating string or fluid pump is used to test Doppler velocities of an ultrasound system. These Doppler phantoms enable the evaluation of particles in motion that mimic blood flowing through blood vessels to determine the accuracy of velocities as well as the resolution at various depths. The dead zone is the region within the first centimeter of the transducer. Contrast resolution and grayscale sensitivity can both be evaluated with a tissue-equivalent phantom.

Question: 8

A tissue-equivalent phantom is used to ensure the efficiency of the ultrasound machine. Choose the resolution that is NOT tested with this phantom.

- A. Temporal
- B. Contrast
- C. Axial
- D. Horizontal

Answer: A

Explanation:

A tissue-equivalent phantom (also referred to as a grayscale or tissue-mimicking phantom) is important because it evaluates the sensitivity of the system's grayscale capabilities. This type of phantom can distinguish between shades of gray that are even marginally different, such as in contrast resolution. Axial resolution can also be evaluated with a tissue-equivalent phantom because separate structures that are parallel to the ultrasound wave can be seen individually as one in front of the other. Horizontal resolution is the ability to determine that reflectors are in the proper locations when they are perpendicular and in a horizontal position in relation to the ultrasound beam. Horizontal resolution can also be assessed in a tissue-equivalent phantom. Temporal resolution depends on the frame rate and is not tested with a tissue-equivalent phantom.

Question: 9

Which performance check describes the ability of the ultrasound machine to correctly visualize signals that are weaker than others?

- A. Accuracy
- B. Specificity
- C. Reliability
- D. Sensitivity

Answer: D

Explanation:

Sensitivity refers to the ability of an ultrasound machine to demonstrate weaker signals. Accuracy is the ability of an exam to diagnose outcomes that are positive and negative. Specificity is when an imaging exam can correctly diagnose results that are normal. Reliability refers to the ability of an exam to produce results that are dependable and consistent.

Question: 10

What is the name of the recent technological advancement that is used on tissues such as the liver, breast, prostate, and thyroid to assess the stiffness of tissue or to better assess lesions?

- A. Contrast-enhanced ultrasound
- B. Fusion imaging
- C. Elastography
- D. Harmonics

Answer: C

Explanation:

Elastography is a recent ultrasound technology that uses sound waves to test the stiffness of tissue or lesions that are being evaluated. Elastography is used most often when evaluating the liver, breast, or prostate or for thyroid disease. Contrast-enhanced ultrasound involves injecting (or giving orally) contrast to help visualize tumors or to evaluate blood vessels. Fusion imaging involves concurrent ultrasound imaging with a previous computed tomography or magnetic resonance imaging scan on a split screen to enhance diagnostic confidence that an area previously mentioned is the same area being evaluated. This can be extremely helpful during ultrasound-guided biopsies. Harmonics are signals that are produced by the patient's body (not the ultrasound system). This technology has been in use for several years.

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