### 2024 ACMT Board Review Course Interactive Cram Session #5 August 9, 2024

# American College of Medical Toxicology



#ACMTBoardPrep

#### Interactive Cram Session

Today's goal is to be **interactive**, **engaging**, and **educational**:

Introductions 5-min "Key Takeaways" Q&A with Speakers Pop Quiz

Today's session is being recorded and will be accessible on-demand.



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### DISCLAIMER

According to ABEM policy, the planning committee and faculty for this course are not allowed to have intimate knowledge of the exam or write exam questions. The content of this course is based on the expertise of ACMT members, who are specialists in Medical Toxicology.

We do not have direct knowledge of the exam content. ABEM test question writers are prohibited from participating in any board review or preparatory course. The study materials, including the Quiz Bank and pop quiz questions, are based on years of collective experience from the Board Review Course committee, but we do not guarantee that these questions fully represent the exam content.



- Inhalational Toxins & Asphyxiants
- Carcinogenesis
- Reproductive & Developmental Toxicology
- Epidemiology & Population Health
- **Statistical Measures**





## ACMT BOARD REVIEW COURSE

## Inhalational Toxins & Asphyxiants--Review

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## PNEUMOCONIOSES

# Radiographically evaluated by <u>B-readers</u> using ILO classification

<sup>•</sup>CT more sensitive

Fibrogenic to remember: Silica, Berylium, Coal, Asbestos

## WHAT DO YOU SEE IN THIS SLIDE?



## **2 TYPES OF ASBESTOS FIBERS**

- 1. Serpentine ("white asbestos")
  - = chrysotile
  - Fibers tend to be degraded after inhalation
  - Curly shape
- 2. Amphiboles ("brown asbestos")
  - 5 sub-types (most disease assoc. with crocidolite
  - Fibers resist degradation
  - Tendency to migrate
  - Straight shape
  - This is the form that is most closely associated with mesothelioma



## **ASBESTOS – RELATED DISEASES**

- All have long latencies
- 1. Asbestosis
- 2. Malignancies
  - A. Bronchogenic carcinoma
  - B. Mesothelioma
  - C. Larynx
  - D. Ovary
  - Non-malignant pleural disease
  - Does not cause COPD

## **CYANIDE POISONING**

#### Acute

> 10 PPM: toxic effects
> 100 PPM: potentially lethal Metabolic acidosis

Lactic acidosis

Distribution into brain and myocardium

Carotid body stimulation  $\rightarrow$  hyperventilation

Inhibits glutamate decarboxylase  $\rightarrow$ 

↓GABA

Persistent neuro deficits possible

One of the basal ganglia toxins

Basal ganglia toxins (C4M3) = CN<sup>-</sup>, Cu (Wilson's disease), CS<sub>2</sub>, CO, MeOH, Mn, MPTP

### Chronic

 SCN- competes with iodine for uptake into thyroid → goiter & hypothyroidism

## NITROGEN OXIDES

#### $NO_{x} =$

Nitric oxide (NO) Nitrogen dioxide  $(NO_2)$ Nitrogen tetroxide  $(N_2O_4)$ 

#### $NO_2$ has low water solubility

Penetrates deep into resp tract

Causes oxidative injury

Excreted after oxidation as nitrate

Chronic low level exposure can cause  $\uparrow$  airway reactivity and respiratory illnesses

#### NO has low water solubility

Penetrates deeply and is absorbed as NO Very high affinity for Hb  $\rightarrow$  metHB Excreted as urinary nitrate

## High-Yield Carcinogenesis/ Carcinogen Topics

- Linear no-threshold model of carcinogenesis
- Stages of carcinogenicity
- IARC classification system
- Carcinogens
  - Aromatic amines
  - Polycyclic aromatic hydrocarbons
  - Dioxins
  - Agents causing angiosarcoma of the liver
  - Asbestos
  - Metals: chromium, nickel, arsenic
  - Areca nut
  - Radiation: radon, radium, thorium, iodine
  - Hexachlorocyclohexane





## **High-Yield Reprotox Topics**

#### • AGENTS

- DBCP
- First generation antiepileptics
- NSAIDs, ACEs, ARBs
- Thyroid meds
- Warfarin
- Isotretinoin
- Alcohol
- Methyl mercury
- Tobacco smoke
- Pennyroyal oil

#### • TIME PERIODS

- Preimplantation
- Period of organogenesis
- Drugs and Breast Milk
- Neonatal Abstinence Syndrome



## High-Yield Epidemiology and Public Health Topics

- Exposure monitoring and sampling
  - CO
  - Toluene
  - N-hexane
- PPE
- Occupational exposure limits
  - OSHA
  - ACGIH
  - NIOSH
- The 4 components of a risk assessment
- Hierarchy of scientific evidence
- Types of studies
- Roles of governmental agencies



## **High-Yield Statistical Topics**

- Incidence vs. prevalence
- How to calculate RRs and ORs
- Association vs. causation
- Confidence intervals vs. p-values
- The Hill Criteria
- Bias and confounding
- Type 1 vs. type 2 errors
- Statistical power
- Ho to calculate sensitivity, specificity, positive and negative predictive values





## **POP QUIZ**

#### **10 Qs randomly selected from Quiz Bank**

## Give it your best guess and then we'll discuss the answers!







#### Humans are most typically exposed to radon in what way?

- A. By entry into lower levels of houses from surrounding rock and soil
- B. By working in a coal mine
- C. By working in a uranium mine
- D. From over pressurized houses with positive pressure relative to the outside
- E. From side stream tobacco smoke





## **Question 1 - Answer**

#### Humans are most typically exposed to radon in what way?

- Α. houses from surrounding rock and soil
- B. By working in a coal mine
- C. By working in a uranium mine
- D. From over pressurized houses with positive pressure relative to the outside
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By entry into lower levels of ----> EXPLANATION: Radon is produced by the radioactive decay of radium-226, which is found in uranium ores; phosphate rock; shales; igneous and metamorphic rocks such as granite, gneiss, and schist; and, to a lesser degree, in common rocks such as limestone. Every square mile of surface soil, to a depth of 6 inches (2.6 km2 to a depth of 15 cm), contains approximately 1 gram of radium, which releases radon in small amounts to the atmosphere. Typical domestic exposures are of approximately 100 Bq/m3 indoors. Some level of radon will be found in most homes. Radon enters a home through the lowest level in the home that is in contact with open ground. Typical entry points of radon into homes are cracks in solid foundations, construction joints, cracks in walls, gaps in suspended floors, gaps around service pipes, cavities inside walls, and the water supply.



## **Question 2**

A patient was found unconscious in a car. He had intense conjunctival irritation and several coins in the center console were black. What was the toxin?

- A. Carbon monoxide
- B. Cyanide
- C. Hydrofluoric acid
- D. Hydrogen sulfide
- E. Sodium azide







## **Question 2 - Answer**

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- C. Hydrofluoric acid
- **D. Hydrogen sulfide**

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E. Sodium azide

**EXPLANATION:** This is hydrogen sulfide, a knock down agent, similar in mechanism to cyanide. It is an ETC inhibitor and is commonly seen in suicide attempts.



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According to IARC (The International Agency for Research on Cancer), arsenic has been associated with which of the following cancers?

- A. Bladder
- B. Brain
- C. Gastric
- D. Leukemia
- E. Nasopharyngeal





## **Question 3 - Answer**

According to IARC (The International Agency for Research on Cancer), arsenic has been associated with which of the following cancers?

A. Bladder

- B. Brain
- C. Gastric
- D. Leukemia
- E. Nasopharyngeal

**EXPLANATION:** IARC considers arsenic to be associated with bladder, lung and skin cancer and possibly liver and kidney; but not brain cancer. An association with prostate cancer is debatable.







Asbestos exposure is associated with cancer at multiple sites. Which of the following sites is associated with asbestos-related cancer?

- A. Eye
- B. Kidney
- C. Larynx
- D. Prostate
- E. Skin





### **Question 4 - Answer**

Asbestos exposure is associated with cancer at multiple sites. Which of the following sites is associated with asbestos-related cancer?

A. Eye

- B. Kidney
- C. Larynx -
- D. Prostate

E. Skin

**EXPLANATION:** Asbestos exposure has been associated with cancers of the entire respiratory tract including with larynx and lungs. Asbestos is also associated with mesothelioma of both the pleura and peritoneum. It is not known to be associated with renal or prostate cancer, or with cancers of the skin. IARC cites evidence in support of an association between asbestos exposure and ovarian cancer, as well as cancers of the GI tract (stomach and colorectal cancer).



Which one of the following is the most likely cause of this congenital malformation?

- A. Isotretinoin
- B. Lithium
- C. Methotrexate
- D. Valproic acid
- E. Warfarin







## **Question 5 - Answer**

## Which one of the following is the most likely cause of this congenital malformation?

- A. Isotretinoin
- B. Lithium
- C. Methotrexate
- D. Valproic acid
- E. Warfarin 🗸

#### **EXPLANATION:** Fetal

warfarin syndrome can lead to microcephaly; an abnormally small head, hydrocephaly; increased ventricle size and CSF volume, and agenesis of the corpus callosum.







*In utero* exposure to which of the following drugs of abuse has traditionally been thought to confer a risk of vascular disruptive phenomena (especially limb amputation and stroke)?

- A. Benzodiazepines
- B. Cocaine
- C. GHB
- D. Opioids
- E. THC





## **Question 6 - Answer**

*In utero* exposure to which of the following drugs of abuse has traditionally been thought to confer a risk of vascular disruptive phenomena (especially limb amputation and stroke)?

- A. Benzodiazepines
- B. Cocaine –
- C. GHB
- D. Opioids
- E. THC

**EXPLANATION:** Although the effects are controversial with confounding in many studies, cocaine results in fetal vascular disruptive effects because of decreased uterine blood flow and fetal vascular effects from the first trimester through the end of pregnancy. While highly publicized, absolute risk for major disruptive effects is seemingly low (approximately 1% of pregnant Americans use cocaine at some point during their pregnancy, and a large population-based study found no significant increase in the incidence of malformations).



During which period of fetal gestation is the fetus most vulnerable to teratogens?

- A. Weeks 1-2
- B. Weeks 3 8
- C. Weeks 9 16
- D. Weeks 20 24
- E. Weeks 28 32





## **Question 7 - Answer**

During which period of fetal gestation is the fetus most vulnerable to teratogens?

- A. Weeks 1-2
- B. Weeks 3 8 -
- C. Weeks 9 16
- D. Weeks 20 24
- E. Weeks 28 32

**EXPLANATION:** The fertilized ovum is generally thought to be resistant to toxic insult before implantation; however, toxic insults can prevent the ovum from being implanted. Organogenesis occurs between days 18 and 60 of gestation. As such, the fetus is more vulnerable to teratogens from weeks 3-8 than weeks 1-2.





#### Which of the following is true regarding risk assessment?

- A. Cancer and non-cancer endpoints are calculated similarly
- B. Inter-individual or intraspecies variability is very minimal
- C. It is an exact science that uses definitive calculations
- D. It is important not to extrapolate from animal data
- E. Uncertainty factors are necessary due to gaps in the data





## **Question 8 - Answer**

#### Which of the following is true regarding risk assessment?

- A. Cancer and non-cancer endpoints are calculated similarly
- B. Inter-individual or intraspecies variability is very minimal
- C. It is an exact science that uses definitive calculations
- D. It is important not to extrapolate from animal data
- E. Uncertainty factors are necessary due to gaps in the data

**EXPLANATION:** The factors are intended to account for (1) variation in susceptibility among the members of the human population (i.e., inter-individual or intraspecies variability); (2) uncertainty in extrapolating animal data to humans (i.e. interspecies uncertainty), (3) uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure (i.e., extrapolating from subchronic to chronic exposure); (4) uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) uncertainty associated with extrapolation when the database is incomplete.

(http://www.epa.gov/risk\_assessment/glossary.htm#u)



#### Which one of the following is true when a clinical test has a 100% sensitivity?

- A. False negative is 0
- B. False positive is 0
- C. Positive predictive value is 100%
- D. True negative is 0
- E. True positive is 0





## **Question 9 - Answer**

Which one of the following is true when a clinical test has a 100% sensitivity?

#### A. False negative is 0

- B. False positive is 0
- C. Positive predictive value is 100%
- D. True negative is 0
- E. True positive is 0

#### **EXPLANATION:**

Sensitivity = True Positive/(True Positive + False Negative)



## **Question 10**

Given 110 patients, 37 ingested a button battery and 73 did not. Abdominal ultrasonography imaging identified button battery in 29 patients who ingested button battery and in 3 patients who did not ingested button battery. What is the sensitivity of abdominal ultrasonography imaging in detection of ingested button battery?

- A. 78.38%
- B. 89.74%
- C. 90%
- D. 90.63%
- E. 95.89%





Given 110 patients, 37 ingested a button battery and 73 did not. Abdominal ultrasonography imaging identified button battery in 29 patients who ingested button battery and in 3 patients who did not ingested button battery. What is the sensitivity of abdominal ultrasonography imaging in detection of ingested button battery?

A. 78.38%
B. 89.74%
C. 90%
D. 90.63%
EXPLANATION: Sensitivity = True Positive/(True Positive + False Negative): 29/29 + 8 = 29/37 = 78.38%

E. 95.89%





### FEEDBACK SURVEY

Before you leave, please fill out the feedback survey.

This survey should appear in your browser when the meeting ends.

Let us know how we can improve the next interactive cram session!





### **COMING UP!** Interactive Cram Session #6 August 23, 2024

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## CRAM SESSION TOPICS | FRI. AUG 23, 2024

- Metals & Metalloids
- **Terrestrial Toxicity**
- Hematology
- Antimicrobials
- **Drugs of Abuse & Withdrawal**





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