ROYAL COLLEGE
OF PHYSICIANS AND SURGEONS OF CANADA
COLLÈGE ROYAL
DES MÉDECINS ET CHIRURGIENS DU CANADA

Sample Written Exam – Occupational Medicine

Question 1

As an occupational physician, you have been retained by a gold mining company which has recently taken over a mine with major stores of arsenic-contaminated waste. Some of this waste has leached into the water supplies used by local farmers and Indigenous Peoples. You realize that you need to rapidly review the toxicology of arsenic.

a. Name **TWO** commonly encountered toxic arsenic compounds.

MODEL ANSWER (2 marks)

- Trivalent - arsenic trioxide, sodium arsenite, arsenic trichloride
- Pentavalent - arsenic pentoxide, arsenic acid, arsenates

b. What is the principal toxic form of inorganic arsenic?

MODEL ANSWER (1 mark)

- Trivalent

c. What is the mechanism of toxicity for arsenic?

MODEL ANSWER (2 marks)

- Inhibits succinic dehydrogenase activity and uncouples oxidative phosphorylation leading to stimulation of mitochondrial ATPase activity - inhibits the energy - linked functions of mitochondria - leads to decreased cellular production of ATP and increased production of hydrogen peroxide - leads to oxidative stress through production of reactive oxygen species.

d. What specimen is usually used for biomonitoring of inorganic arsenic levels?

MODEL ANSWER (1 mark)

- Urine

e. What non-work-related activity may influence the levels of arsenic found in test subjects?

MODEL ANSWER (1 mark)

- Ingestion of arsenic-containing foods - seafood (shellfish, seaweed, kelp)

f. List **THREE** organs or systems that may be affected by chronic arsenic exposure in humans. Identify **ONE** effect on **EACH** organ or system.

MODEL ANSWER (1 mark each, 3 marks total)

- Neurotoxicity - sensory changes - parathesias, muscle tenderness, weakness, peripheral neuropathy, pain
- Liver - jaundice, cirrhosis, ascites, angiosarcoma
- Lung – cancer
- Skin - cancer, hypo/hyperpigmentation, keratosis
- Vascular - distal vasospasm

Question 2

You suspect that your patient's hand-arm vibration syndrome diagnosis is a sentinel event. List **FOUR** workplace engineering or administrative controls that you would suggest to the employer for the prevention of future hand-arm vibration syndrome cases.

MODEL ANSWER (1 mark each, 4 marks total)

- Use ergonomic anti-vibration hand tools
- Ensure that hand tools are properly maintained
- Ensure that hand-arm vibration exposures do not exceed exposure guidelines (e.g. American Conference of Government Industrial Hygienists threshold limit values [ACGIH TLVs])
- Reduce hand-arm vibration exposure through job rotation and increased rest break duration/frequency
- Provide a warm work environment
- Provide worker education and training (i.e. stay warm, grasp tools as lightly as is safe to do so, operate tools at reduced speeds if possible, early recognition of signs and symptoms of hand-arm vibration syndrome, stop smoking)
- Personal protective equipment (PPE) / anti-vibration gloves
- Automation
- Robotics

Question 3

You are the occupational physician for a company manufacturing metal products. The company has recently made some changes to its manufacturing process. Since the introduction of these changes, a number of workers have developed an itchy red rash on their hands. Three hundred and fifty-six (356) people work in the factory. You are asked to try to identify whether this rash may be work-related.

You interview all of the workers in the factory who have a rash and, for every worker with a rash, you select two workers without a rash. You then collect details, including the area where all selected workers have worked for the last 6 months. Of the 30 workers with a rash, 20 currently work in the machine shop and 10 work in the pressing area. Of the 60 workers without a rash, 20 work in the machine shop and 40 work in the pressing area.

a. Calculate an odds ratio for the association between working in the machine shop and development of a rash. Show your calculations.

MODEL ANSWER (2 marks)

- Odds ratio (OR) = (20/10)/(20/40) = 2/0.5 = 4

Also acceptable: Odds ratio (OR) = (20X40)/20X10) = 800/200 = 4

b. How would you categorize this type of study design?

MODEL ANSWER (1 mark)

- Case-control or case-referent

c. Would you accept these results as proof that the machine shop environment had in some way caused the rash? Briefly explain your answer.

MODEL ANSWER (1 mark each, 3 marks total)

- The results would not prove causation.
- It would be important to consider the role of chance - need a *P*-value or 95% confidence interval for the OR.
- It would also be important to consider the possibility of bias and confounding factors.
- May discuss differences between association and causation in terms of Bradford-Hill criteria or other similar.

Question 4

Identify **FIVE** factors to consider when assessing the effect of a medical condition on an individual's fitness to work.

MODEL ANSWER (1 mark each, 5 marks total)

- Natural course of the medical condition (i.e. episodic, transient, reversible, recurrent, chronic, progressive, suddenly incapacitating, etc.)
- Possibility of medical control of the condition through treatment
- Severity of any impairment
- Risk of condition to the safety of the individual or others
- Applicable regulations (e.g. drivers, seafarers, pilots, divers, etc.)
- Bona fide occupational requirements of the job

Question 5

As a medical advisor at a provincial workers' compensation board, you are asked by a claims manager to review a file. A 45-year-old woman with a compensable back injury and an unremarkable past medical history underwent an L5-S1 discectomy, authorized by the claims manager. In the recovery room, she had an arterial crisis involving the left leg. She was found to have a clot in the abdominal aorta and a stent was inserted. An extensive work-up revealed that she has a hereditary hypercoagulable disorder. The treating hematologist has recommended that she take warfarin (Coumadin®) indefinitely.

a. The claims manager is asking whether the vascular complications and treatment should be considered as part of the back injury claim. What is your response and why?

MODEL ANSWER (1 mark each, 2 marks total)

- Yes, since they arose as complications from the surgery for a compensable condition.
- The hypercoagulable disorder does not invalidate the claim, under the 'thin skull principle', i.e. workers are taken as they are.

b. What **TWO KEY** factors must be present for a worker to have a valid workers' compensation claim?

MODEL ANSWER (1 mark each, 2 marks total)

- An injury or disease occurred.
- It arose as a result of and in the course of normal job duties.

c. List and briefly explain **FOUR** of the Meredith principles upon which workers' compensation systems in Canada are based.

MODEL ANSWER (2 marks each, 8 marks total)

- No-fault compensation: Workplace injuries are compensated regardless of fault. The worker and employer waive the right to sue. There is no argument over responsibility or liability for an injury. Fault becomes irrelevant, and providing compensation becomes the focus.
- Collective liability: The total cost of the compensation system is shared by all employers. All employers contribute to a common fund. Financial liability becomes their collective responsibility.
- Security of payment: A fund is established to guarantee that compensation monies will be available. Injured workers are assured of prompt compensation and future benefits.
- Exclusive jurisdiction: All compensation claims are directed solely to the compensation board. The Board is the decision-maker and final authority for all claims. Nor is the Board bound by legal precedent; it has the power and authority to judge each case on its individual merits.
- Independent board: The governing board is both autonomous and non-political. The Board is financially independent of government or any special interest group. The administration of the system is focused on the needs of its employer and labour clients, providing service with efficiency and impartiality.