Shaheen Shaikh, M.D. Assistant Professor of Anesthesiology, University of Massachusetts Medical center, Worcester, MA.

Shobana Rajan, M.D. Associate Staff Anesthesiologist, Cleveland Clinic, OH

This quiz is being published on behalf of the SNACC Education Commitee
1. A 38-yr-old male with status epilepticus was treated by EMS with IM midazolam. The patient does not appear to be seizing anymore but he is not waking up in the ED. Next step will include ALL except

A. CT Scan
B. Lumbar puncture
C. EEG
D. Reverse midazolam with flumazenil
E. Check blood sugar
A. CT Scan

CT scan may be indicated to diagnose new lesions, subdural or extramural hematoma if seizures resulted in traumatic brain injury or cerebral edema from prolonged seizures. 

B. Lumbar puncture

Lumbar puncture should be performed in patients who are febrile and there is suspicion of central nervous system infection after initial CT scan.
C. EEG

EEG is necessary to diagnose non-convulsive seizures. Prolonged seizures can result in neuronal injury and must be controlled. Hence immediate diagnosis of ongoing electrical seizures must be obtained.
Reversing midazolam effect will be life threatening especially if the patient has ongoing non-convulsive seizures. Respiratory depression may occur secondary to benzodiazepine administration and patients must be closely observed in a monitored setting.
E. Check blood sugar

- Hypoglycemia must be ruled out as soon as possible. Hypoglycemia could be the reason for status epilepticus or the reason the patient is not waking up after termination of seizures with first line therapy (benzodiazepines) and second line therapy (anti-epileptic drugs).

Incorrect

Try again
2. A 55-yr-old male suddenly collapsed at the mall. He was in V-fib cardiac arrest and was rapidly resuscitated with return of spontaneous circulation. Therapeutic hypothermia would be contraindicated in all EXCEPT

A. **Patient had arrested 12 hours ago**

B. **DNR status**

C. **Patient needs coronary angiography and stenting**

D. **Widespread malignancy**

E. **Active bleeding**

Next question
A. Patient had arrested 12 hours ago

- Patients who have suffered cardiac arrest more than 12 hours ago are less likely to benefit from induced therapeutic hypothermia. The patients should however be kept normothermic and fever must be controlled.

Incorrect

Try again

B. DNR status

- DNR status in any patient must be respected and is an absolute contraindication for therapeutic hypothermia after cardiac arrest
C. Patient needs coronary angiogram and stenting

Patients with coronary occlusion may suffer from V-fib arrest. Therapeutic hypothermia is not a contraindication for administration of anti-platelet or anti-coagulant medications. Mild hypothermia does not increase risk of cardiac arrhythmias.

Correct answer

Back to the question next question

D. Widespread malignancy

In patients with widespread malignancy or any illness that precludes meaningful recovery or preclusion to ICU admission, therapeutic hypothermia is contraindicated.
E. Active bleeding

Therapeutic hypothermia post cardiac arrest is contraindicated in the presence of active bleeding, since bleeding may worsen after induction of hypothermia.
3. In a patient with induced therapeutic hypothermia, EEG monitoring is essential before administration of

- A. Midazolam
- B. Magnesium
- C. Neuromuscular blockade
- D. Fentanyl
- E. Propofol
A. Midazolam

Judicious use of sedation is recommended prior to and during therapeutic hypothermia. Inadequate sedation allows the breakthrough of shivering and the patient is unable to attain target temperature. Midazolam is used for sedation when systolic blood pressure is less than 100 mm Hg.
B. Magnesium

Shivering is the most common side effect of therapeutic hypothermia. Magnesium is used to control shivering in addition to sedation, analgesia and paralysis.

Try again

C. Neuromuscular blockade

- Patients may manifest status epilepticus following cardiac arrest. Muscle relaxants obscure seizure activity when used to prevent the shivering response to hypothermia. Continuous EEG monitoring must be used prior to use of neuromuscular blockade to diagnose early non convulsive status epilepticus as part of neurological evaluation

Correct answer

D. Fentanyl

Fentanyl is commonly used to prevent shivering after induction of therapeutic hypothermia following cardiac arrest. In addition to analgesic effects, drugs with opiate properties, suppress shivering
E. Propofol

- Propofol is the drug of choice for sedation in patients who are hemodynamically stable (systolic BP >100) following induction of therapeutic hypothermia after cardiac arrest.

- Propofol is metabolized rapidly and allows for neurological exam after stopping the infusion.


Incorrect

Try again
4. Induction of therapeutic hypothermia after cardiac arrest causes all of the following EXCEPT

A. Hypokalemia
B. Insulin sensitivity
C. Hypophosphatemia
D. Hypomagnesemia
E. Bacterial translocation
A. Hypokalemia

During induction of hypothermia, hypokalemia may occur, secondary to cold diuresis and shift of potassium from extra cellular to intra cellular space.

Incorrect

Try again
B. Insulin sensitivity

Insulin resistance occurs during induced therapeutic hypothermia. Often diabetic patients require large doses of insulin. However during rewarming, insulin sensitivity increases and blood glucose must be monitored closely.

Correct answer

C. Hypophosphatemia

Hypophosphatemia occurs during therapeutic hypothermia due to cold diuresis. Electrolytes must be monitored and repleted continuously.
D. Hypomagnesemia

Hypomagnesemia may occur during induced hypothermia secondary to fold diuresis. Magnesium is often administered during therapeutic hypothermia to prevent shivering. If the patient develops hypomagnesemia, the aim is to raise serum magnesium > 2 mg/dl. If used to prevent shivering, higher serum levels ( > 5 mg/dl) are accepted.
E. Bacterial translocation

Induced hypothermia reduces gastric motility and cause mucosal breakdown. This causes bacterial translocation. Early enteral feeds are recommended early following rewarming.

5. A 25-yr-old athlete who had suffered a V-fib arrest, with successful return of spontaneous circulation is not waking up. He was treated with induced therapeutic hypothermia. His vital signs are HR- 34/min, MAP- 80 mm Hg, temperature 32 deg C. Next step is:

- A. **Atropine**
- B. **Isoproterenol**
- C. **Cardiac pacing**
- D. **Do nothing**
- E. **Discontinue therapeutic hypothermia**
A. Atropine

- Atropine is ineffective for treatment of bradycardia secondary to induced hypothermia

Incorrect

Try again
B. Isoproterenol

- Isoproterenol may be considered for treatment of hypothermia induced bradycardia if the patient is unstable

Incorrect

Try again
C. Cardiac pacing

- Cardiac pacing is not required. The patient is in sinus rhythm and the BP is stable

Incorrect

Try again
D. Do nothing

No treatment is necessary. Normal HR is 34-40 when the patient’s core temperature is 32 Degree C.

Correct answer

Go back to question


End of set
E. Discontinue therapeutic hypothermia

- Therapeutic hypothermia should not be discontinued. The aim is maintain a MAP > 80 mm Hg which is required for adequate cerebral perfusion. Auto regulation is frequently disturbed following cardiac arrest. Bradycardia with HR of 34-40 is normal during induced hypothermia to 32 deg C.

- Incorrect

- Try again