Acute Ethanol Withdrawal
Author: Andrew Stolbach, MD

Reviewer:
Suzanne Bentley, MD

Target Audience: Emergency Medicine Residents, Medical Students

Primary Learning Objectives:

1. Recognize clinical signs of alcohol withdrawal
2. Demonstrate the use and titration of benzodiazepines in controlling alcohol withdrawal
3. Demonstrate appropriate treatment of seizures in the setting of a presumed toxicologic condition

Secondary Learning Objectives: detailed technical/behavioral goals, didactic points

1. Demonstrate professionalism and communication skills when consulting the intensive care unit (ICU) and working with the ED nurse
2. Direct proper disposition/appropriate consultation

Critical actions checklist:

1. Protect the patient's airway
2. Start intravenous fluid resuscitation
3. Obtain appropriate diagnostics (BMP, point-of-care glucose)
4. Sedate the patient
5. Order CT head
6. Correct electrolyte derangements
7. Consult Poison Center/Toxicologist
8. Admit to the MICU

Environment:

1. Room Set Up – ED acute care area
    a. Manikin Set Up – Mid or high fidelity simulator, simulated sweat if available
    b. Airway equipment, Sodium Bicarbonate, Nasogastric tube, Activated charcoal, IV fluid. Simulated medications.
2. Distractors – ED noise
3. Actors:
    a. Paramedics are able to provide information about the scene, stating that patient was found at home, appearing disheveled.
    b. Co-worker. This may be an optional person available to provide additional information either in person or via phone. For junior learners, this person can give history of patient being a frequent alcohol drinker at work.
    c. Patient voice is male. Patient is moaning unintelligibly.
    d. ED nurse can start IVs and administer medications/fluids. The nurse does have some medical knowledge base and may cue learners if needed.
    e. Poison control available via "phone consultation."
    f. ICU physician can be available via "phone consultation."

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CRITICAL ACTIONS

1. **Protect the patient's airway**
   Protect the patient's airway. **At a minimum**, this must include assigning continuous evaluation and surveillance of the airway to another team member. Other interventions sufficient for meeting this critical action include endotracheal intubation, end-tidal capnometry (as patient is sedated, or if patient is post-ictal following seizure), or jaw thrust/chin-lift maneuvers. If the patient demonstrates vomiting in the context of altered mental status/sedation, then endotracheal intubation should be performed.
   Cueing Guideline: The nurse can ask if the doctor believes the patient is able to protect his airway.

2. **Start intravenous fluid resuscitation**
   Administer sedatives for agitation. Benzodiazepines are the first line agents in most protocols. Barbiturates or other more novel sedatives (e.g., propofol) may be appropriate depending on institutional preferences of the participant(s). Note that some of these other agents may require advanced airway management.
   Cueing Guideline: The nurse can ask if the doctor would like something to calm the patient and control the patient's agitation.

3. **Obtain appropriate diagnostics (must include the initial point-of-care glucose)**
   Order appropriate diagnostics. **At a minimum**, this must include an initial point-of-care glucose. This should also include a BMP, a serum ethanol level, and other tests as routinely ordered in the participant's institution.
   Cueing Guideline: The nurse can ask if the doctor would like to do order any diagnostic tests.

4. **Sedate the patient**
   Sedate the patient. Benzodiazepines are the first line agents in most protocols. Barbiturates or other more novel sedatives (e.g., propofol) may be appropriate depending on institutional preferences of the participant(s). Note that some of these other agents may require advanced airway management if given in escalating or high doses. Phenothiazines and butyrophenones should be avoided in this patient, as they may precipitate seizures.
   Cueing Guideline: The nurse can ask if the doctor would like something to calm the patient and control the patient's agitation.

5. **Order CT head**
   Order CT head. This critical action should be performed in a patient who demonstrates new-onset seizure without a clear prior history or presumed etiology. A non-contrast enhanced CT head is sufficient to meet this critical action.
   Cueing Guideline: The nurse can ask if the doctor would like any advanced imaging in the context of this patient's symptoms.

6. **Correct electrolyte derangements**
   Correct electrolyte derangements. The derangements most evident in this patient include hypokalemia and hypomagnesemia.
   Cueing Guideline: The nurse can ask if the doctor would like any interventions once the results of the ED diagnostics (BMP, serum magnesium) are provided.

7. **Consult the Poison Center/Toxicologist**
   Consult the Poison Center/Toxicologist. The local Poison Center/Toxicologist will provide further management recommendations, if asked (e.g. “did you consider if the patient has electrolyte imbalances or other possible sequela in association with acute ethanol withdrawal?”).
   Cueing Guideline: The nurse can ask the doctor if the Poison Center/Toxicologist has been called yet.

8. **Admit to the MICU**
   Admit to the MICU. The patient with severe acute ethanol withdrawal – with presumed progression to delirium tremens – requires management in the MICU.
   Cueing Guideline: The nurse can ask the doctor if the Intensivist in the MICU has been called yet.

Critical Actions Checklist[1]

Resident Name	
Case Description	

Skills measured **Core competencies: PC** Patient care, **MK** Medical knowledge, **IC** Interpersonal and communication skills **P** Professionalism, **PB** Practice-based learning and improvement **SB** Systems-based practice	**Very Unacceptable**		**Unacceptable**		**Acceptable**		**Very Acceptable**	
Data Acquisition (D) PC MK I	1	2	3	4	5	6	7	8
Problem Solving (S) PC MK PB	1	2	3	4	5	6	7	8
Patient Management (M) PC MK IC P PB SB	1	2	3	4	5	6	7	8
Resource Utilization (R) PC PB SB	1	2	3	4	5	6	7	8
Health Care Provided (H) PC SB	1	2	3	4	5	6	7	8
Interpersonal Relations (I) IC P	1	2	3	4	5	6	7	8
Comprehension of Pathophysiology (P) MK PB	1	2	3	4	5	6	7	8
Clinical Competence (C) PC MK IC P PB SB	1	2	3	4	5	6	7	8

Critical Actions

Yes	No		Comments:
		Protect the patient's airway	
		Start intravenous fluid resuscitation	
		Obtain appropriate diagnostics (BMP, POC glucose)	
		Sedate the patient (benzodiazepines preferred)	
		Order CT head	
		Correct electrolyte derangements	
		Consult Poison Center/Toxicologist	
		Admit to the MICU	

Yes	No	Dangerous actions

[1] Modified ABEM Oral Certification Examination checklist and scoresheet

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HISTORY

This is a 45-year-old man found unresponsive at home. The patient had missed work and was not answering his phone, so work colleagues went to check on him at home. They found him with altered mental status, and immediately called the ambulance. He was brought to the ED for evaluation.

In the ED, the patient is moaning unintelligibly and flailing all extremities. (The Nurse may cue this by stating, “I need some help to control this guy!” “He’s going to fall off the bed!”)

Onset of Symptoms:	Hours
Chief Complaint:	Altered mental status / Unresponsiveness
Past Medical Hx:	Unknown
Past Surgical Hx:	Unknown
Family Med Hx:	Unknown
Social Hx:	Unknown
ROS:	Patient is unable to answer questions appropriately.

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CASE CONTINUATION

Vital Signs: BP: 160/98 mmHg P: 140/minute R: 20/minute T: 37C (98.6F)
POx: 98% (FiO_2= 0.21)

Primary Survey

- Airway – Intact gag reflex
- Breathing – Tachypnea, but not hypoxic (SpO_2 = 98%)
- Circulation – Tachycardia (140's), SBP 160's, brachial and femoral pulses palpable and bounding
- Disability – Will not follow commands, combative and disoriented
- Exposure – Diaphoretic. No trauma. No rashes.

Required Actions Over Time 0-2 Minutes

- Move patient to critical care or acute care area of the Emergency Department
- Establish safety net (IV, oxygen, cardiac monitor, two large bore IVs, draw blood for labs, blood gas)
- A/B – Provide supplemental oxygen. Protect airway (aspiration precautions).
- C – Cardiac monitor; IV crystalloid bolus for presumed volume depletion
- D – Finger stick glucose = 90 mg/dL; consider empiric thiamine 100 mg IV

Branch Point

- **IF NO INTERVENTIONS ARE PERFORMED,** then the patient becomes more hypertensive, tachycardic (140/minute), confused and agitated. **IF TWO MINUTES OF TOTAL CASE TIME HAVE ELAPSED WITHOUT SEDATIVES, THEN THE PATIENT WILL SEIZE.**
- **IF A SINGLE DOSE OF SEDATIVE (E.G., BENZODIAZEPINE) IS PROVIDED FOR THE PATIENT'S AGITATION,** then the patient's agitation will improve and abnormal vital signs will trend toward more normal levels.
- **IF MULTIPLE DOSES OF SEDATIVES (E.G., BENZODIAZEPINE) ARE PROVIDED,** then the patient's agitation will improve even more, and abnormal vital signs will move even quicker toward normal levels.
- **IF BUTYROPHENONES (E.G., HALOPERIDOL) ARE USED AS A SOLE AGENT TO SEDATE THE PATIENT,** then the patient will **SEIZE ONE MINUTE FOLLOWING ITS ADMINISTRATION.**

CASE CONTINUATION

General Appearance: Disoriented, agitated man, with an intact gag reflex

Vital Signs: BP: 197/120 mmHg P: 125/minute R: 24/minute T: 38.3C (100.4F)
POx: 94% (FiO_2= 0.21)

Head: Normocephalic and atraumatic

Eyes: PERRL, pupils 7 mm bilaterally

Ears: TM's normal.

Mouth: Dry mucous membranes, intact gag reflex

Neck: Trachea midline, supple

Skin: Warm, diaphoretic, no rashes or lesions **(If your mannequin is not capable of diaphoresis, this can be simulated by spraying the mannequin with water prior to starting the scenario or nurse providing cue to how "sweaty the patient looks")**

Chest: No trauma. Good chest rise

Lungs: Clear, equal bilaterally

Heart: Tachycardic, S1 S2, no murmurs

Back: Normal

Abdomen: Soft, non-tender, no signs of trauma, no rebound/guarding

Extremities: No signs of trauma, no edema, radial pulses weak, central pulses strong

Rectal: Normal tone, guaiac negative

Neurological: Moaning unintelligibly. Flailing all extremities. Spontaneously opens eyes. Intact gag reflex. If prior to sedation administration, moans and groans to painful stimuli, pushes examiner away. Moves all 4 extremities though follows commands poorly.

Required Actions within the First Two Minutes

- Peripheral IV access should be achieved by this time
- Diagnostic serum (e.g., BMP) and other testing (e.g., ECG) should be ordered at this time
- Point-of-care serum glucose should be performed by this time
- Patient should receive at least one dose of a sedative (benzodiazepine) by this time
- Further resuscitation with IV NS 20 mL/kg boluses should be started at this time
- Non-contrast head CT may be ordered at this time, but this intervention cannot be performed until patient is more stable and less combative

Branch Points

- **IF NO INTERVENTIONS ARE PERFORMED,** then the patient becomes more hypertensive, tachycardic (140/minute), confused and agitated. **IF THE PATIENT HAS NOT BEEN PROVIDED A SEDATIVE BY THIS TIME, THEN THE PATIENT WILL HAVE A TONIC-CLONIC SEIZURE.**
- **IF MULTIPLE DOSES OF SEDATIVES (E.G., BENZODIAZEPINE) ARE PROVIDED,** then the patient's agitation will improve even more, and abnormal vital signs will move even more quickly toward normal levels.
- **IF BUTYROPHENONES (E.G., HALOPERIDOL) ARE USED AS A SOLE AGENT TO SEDATE THE PATIENT,** then the patient will **SEIZE ONE MINUTE FOLLOWING ITS ADMINISTRATION.**

Required Actions over the Next 2 Minutes

- ED diagnostics – if ordered – should return by this time
- Vital signs should be improving if sedatives have been provided
- Participant should recognize the likelihood of acute alcohol withdrawal (delirium tremens) at this time
- Participant may consider alternative diagnoses as causes for patient's symptoms (e.g., infection, other toxic exposures [sympathomimetic toxicity, serotonin syndrome, or equivalent] and sympathetic conditions such as thyrotoxicosis or pheochromocytoma)
- Non-contrast head CT may be ordered at this time, but this intervention cannot be performed until patient is more stable and less combative
- Electrolyte correction (magnesium administration) should be considered at this time

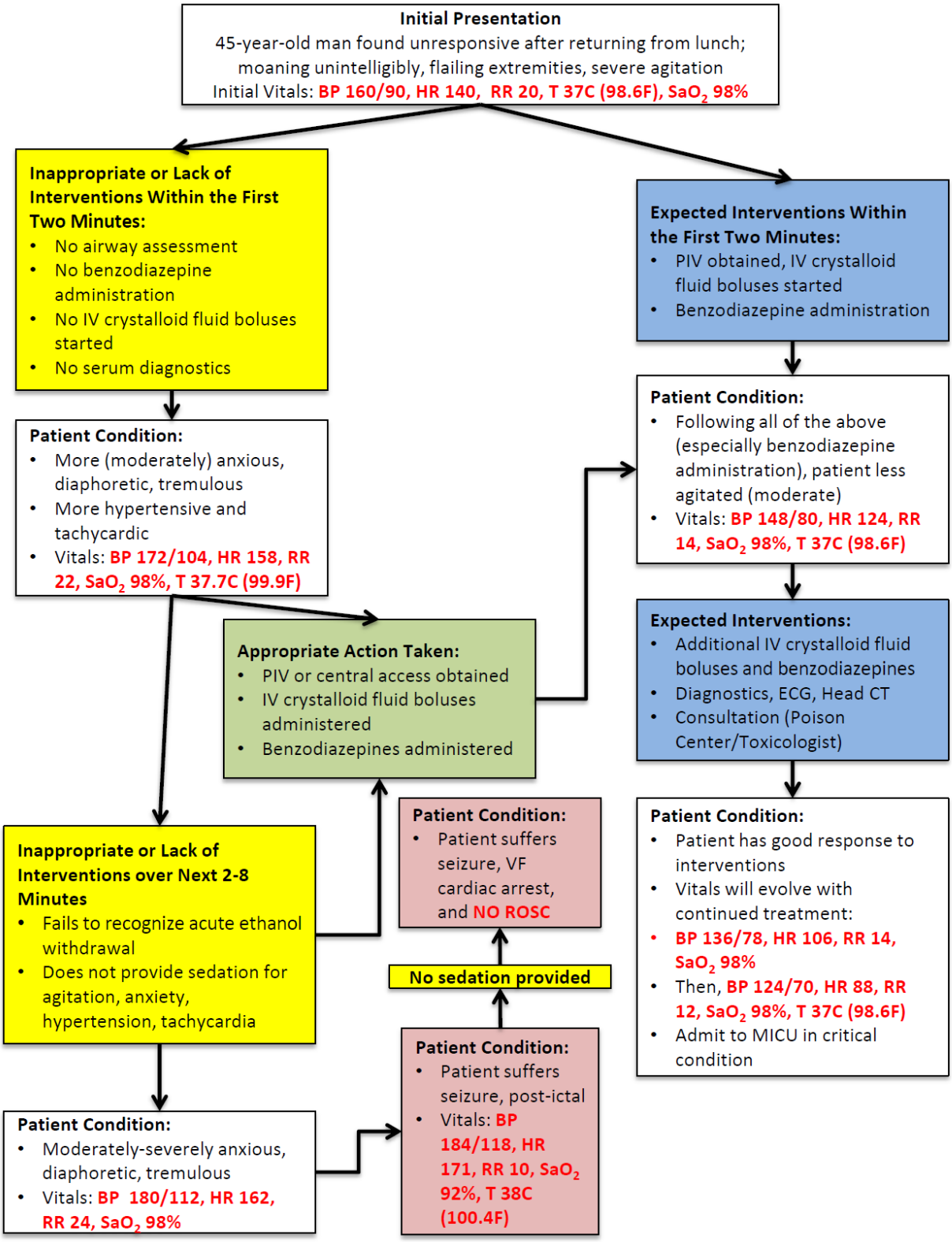
Branch Points

- **IF OTHER INTERVENTIONS ARE PROVIDED FOR ALTERNATIVE DIAGNOSES (E.G., THYROTOXICOSIS, PHEOCHROMOCYTOMA, INFECTIONS, ETC.),** these will have no impact on the patient's condition during the period of case play.

Required Actions over the Remainder of the Case

- Arrange for MICU admission
- Contact Poison Control/Toxicologist for further recommendations

Timeline and Branch Points for This Case



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STIMULUS INVENTORY

#1	Complete blood count
#2	Basic metabolic panel
#3	Urinalysis
#4	Liver function tests
#5	Venous blood gas
#6	Point-of-care glucose
#7	Toxicology
#8	Initial CXR
#9	CT Head
#10	Abdominal XR
#11	ECG
#12	Serum magnesium

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LAB DATA & IMAGING RESULTS

Stimulus #1	
Complete Blood Count (CBC)	
WBC	14,400/mm^3
Hemoglobin	15.2 g/dL
Hematocrit	46%
Platelets	279,000/mm^3
Differential	
PMNLs	45%
Lymphocytes	55%
Monocytes	2%
Eosinophils	1%

Stimulus #2	
Basic Metabolic Profile (BMP)	
Sodium	142 mEq/L
Potassium	3.1 mEq/L
Chloride	108 mEq/L
Bicarbonate	12 mEq/L
Glucose	90 mg/dL
BUN	28 mg/dL
Creatinine	1.2 mg/dL
Calcium	9 mg/dL

Stimulus #3	
Urinalysis	
Color	Yellow
Specific gravity	1.030
Glucose	Negative
Protein	Negative
Ketones	1+
Leuk. Esterase	Negative
Nitrites	Negative
WBC	0/hpf
RBC	0/hpf

Stimulus #4	
Liver Function Tests	
AST	57 U/L
ALT	48 U/L
Alk Phos	110 U/L
Total Bilirubin	1.1 mg/dL
Direct Bilirubin	0.2 mg/dL
Albumin	3.2 mg/dL
Protein	7 g/dL

Stimulus #5	
Initial Venous Blood Gas	
pH	7.35
pCO_2	24 mm Hg
pO_2	52 mm Hg
HCO_3	14 mEq/L
Lactate	6 mmol/L

Stimulus #6	
Point-of-care Glucose	
Value	90 mg/dL

Stimulus #7	
Toxicology	
Salicylate	Undetectable
Acetaminophen	Undetectable
Ethanol	Undetectable
Urine drug screen	
Amphetamines	Negative
Benzodiazepines	Negative
Cocaine	Negative
Opiates	Negative
TCAs	Negative
THC	Negative

Stimulus #8	
CXR	Normal

Stimulus #9	
CT head	Normal

Stimulus #10	
Abdominal XR	Normal

Stimulus #11	
ECG	Sinus tachycardia

Stimulus #12	
Serum Magnesium	1.5 mEq/L

Stimulus #1

Complete Blood Count (CBC)

WBC	14,400/mm^3
Hemoglobin	15.2 g/dL
Hematocrit	46%
Platelets	279,000/mm^3
Differential	
PMNLs	45%
Lymphocytes	55%
Monocytes	2%
Eosinophils	1%

Stimulus #2

Basic Metabolic Profile (BMP)

Sodium	142 mEq/L
Potassium	3.1 mEq/L
Chloride	108 mEq/L
Bicarbonate	12 mEq/L
Glucose	90 mg/dL
BUN	28 mg/dL
Creatinine	1.2 mg/dL
Calcium	9 mg/dL

Stimulus #3

Urinalysis

Color	Yellow
Specific gravity	1.030
Glucose	Negative
Protein	Negative
Ketones	1+
Leuk. Esterase	Negative
Nitrites	Negative
WBC	0/hpf
RBC	0/hpf
Microscopic	Calcium oxalate crystals

Stimulus #4

Liver Function Tests

AST	57 U/L
ALT	48 U/L
Alk Phos	110 U/L
Total Bilirubin	1.1 mg/dL
Direct Bilirubin	0.2 mg/dL
Albumin	2.9 mg/dL
Protein	7 g/dL

Stimulus #5

Venous Blood Gas

pH	7.35
pCO_2	24 mm Hg
pO_2	52 mm Hg
HCO_3	14 mEq/L
Lactate	6 mmol/L

Stimulus #6

Point-of-care Glucose

Value	90 mg/dL

Stimulus #7

Toxicology

Salicylate	Undetectable
Acetaminophen	Undetectable
Ethanol	Undetectable

Urine drug screen

Amphetamines	Negative
Benzodiazepines	Negative
Cocaine	Negative
Opiates	Negative
TCAs	Negative
THC	Negative

Stimulus #8

CXR	Normal

Stimulus #9

CT head	Normal

Stimulus #10

Abdominal XR	Normal

Stimulus #11

ECG	Sinus tachycardia

Stimulus #12

Serum Magnesium	1.5 mEq/L

Debriefing Materials – Acute Ethanol Withdrawal

Educational Goals: review the key principles of managing acute ethanol withdrawal

Debriefing Approach:

I. Decompress – "How do you feel it went?" (not asking for details; just a chance for the resident to decompress, decrease anxiety/energy level to be more open to learning/retaining knowledge)

II. Core Medical Knowledge (instructor covers details of scenario and objectives)

III. Advocacy/Inquiry
   a. As an instructor, "advocate" for your point of view/observations of resident actions
   b. Inquire with an open mind to see why the resident acted the way they did – use this response as a springboard to determine what exactly to teach (e.g., was the resident's poor performance due to missing core medical knowledge or is it a lack of communication skills with the rest of the team?)

IV. Plus/Delta
   a. Plus – Tell the resident what went well
   b. Delta – Tell the resident what she could change for next time

Pathophysiology

Ethanol is a CNS and respiratory depressant that acts by increasing inhibitory tone (GABA) or decreasing excitatory tone (glutamate, or NMDA). GABA opens the chloride channel on the GABA receptor and hyperpolarizes the cell, making it less likely to depolarize or fire. Chronic ethanol consumption leads to tolerance. The brain responds by decreasing the number of GABA receptors (down regulation) to reduce the sedative effects. In addition, EtOH reduces glutamate-induced stimulation at the NMDA receptor. The brain responds to this suppression by upregulating the number of channels on the NMDA receptors. Then, in the absence of EtOH, the decreased number of chloride channels on the GABA receptor, and the increased number of excitatory calcium channels on the NMDA receptors, result in excessive neuronal activity/firing. Seizures result.

Four syndromes of EtOH withdrawal exist.

1. Tremulousness. (Early w/d). Excess catecholamines cause HTN, tachycardia, hyperthermia, diaphoresis, tremor, agitation, fasciculations, and altered mental status. Symptoms may begin by 6-12 hours.
2. Alcohol withdrawal seizures. These can be single or multiple and occur within 24 hours of the last drink. Approximately 1/3 of untreated patients will develop delirium tremens.
3. Alcoholic hallucinosis. Tactile (formication), visual, and auditory hallucinations develop within hours of the last drink.
4. Delirium tremens. This is the most severe presentation and entails all of the above, along with altered mental status/delirium. If untreated, mortality is 15-20% and results from fluid/electrolyte abnormalities, infection, and seizures. It develops about 72 hours after the last drink.

Treatment

1. Rapid sedation, fluid/electrolyte correction, and treating infections are the mainstays of therapy. Benzodiazepines are the first-line medications and are usually required in large doses, but barbiturates are synergistic. Address airway problems as they develop.
2. IV benzodiazepines include diazepam (10mg IV q5-15 min), lorazepam (2-4mg IV q5-15 min), and midazolam (2-5mg IV). Diazepam has active metabolites and is preferred for severe withdrawal. Lorazepam has no active metabolites (so it is good in patients with liver disease) and also has a slower onset of action compared to diazepam. There is no theoretical maximum dose of diazepam, but if the patient fails to respond after 400mg, try another agent.
3. Barbiturates such as phenobarbital directly open the GABA chloride channel and are effective. However, they have a greater tendency to cause hypotension and respiratory depression.
4. Propofol is a GABA agonist and NMDA antagonist with a rapid onset/offset.
5. Magnesium 1-2 grams IV may help since hypomagnesemia may appear like acute alcohol withdrawal.
6. Finally, avoid phenothiazines and butyrophenones (e.g., haloperidol or droperidol) because they may lower the seizure threshold and increase death.

Take-Home Points

1. Use large doses of benzodiazepines and redose frequently to achieve sedation.
2. Chronic alcohol users have a high incidence of infection and trauma, so don't attribute altered mental status to EtOH alone.

Tintinalli, JE et al. Emergency Medicine, A Comprehensive Study Guide.

Marx, J et al. Rosen's Emergency Medicine, Concepts and Clinical Practice