

Ethylene Glycol Toxicity

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Procedures: None

LEARNING OBJECTIVES

1. Recognize when an adult has an immediate life-threatening condition
2. Manage an altered patient with unknown ingestion
3. Create a broad differential for a patient with unknown ingestion
4. Order appropriate studies to elucidate the cause of patient's clinical condition
5. Be able to calculate and interpret anion and osmolar gap

CRITICAL ACTIONS

- ✓ Obtain IV access with two large bore peripheral IVs
- ✓ Supplemental oxygen
- ✓ Place patient on monitors with continuous oxygen saturation monitoring
- ✓ Ask for a full set of vital signs including HR, BP, oxygen saturation, and temperature
- ✓ Obtain EKG
- ✓ Ask for and interpret appropriate labs including acetaminophen, salicylate, and toxic alcohols.
- ✓ Administer IV fluids
- ✓ Administer fomepizole IV
- ✓ Reassess patient and vital signs
- ✓ Call appropriate consultations: poison center/toxicology, admitting physician
- ✓ Closed loop communication
- ✓ Synthesis of the case
- ✓ Disclose appropriate information to the patient/family

CASE ONE-LINER

41-year-old male brought in with altered mental status and shortness of breath

PRESENTATION

SETTING	Hospital ED
ADDITIONAL ROLES	Sim operator, sim RN, debrief manager CONSULTANTS: Poison Control/Toxicology, Admitting Physician
PATIENT	41yo male
CHIEF COMPLAINT	Shortness of breath
Hx of PRESENTING ILLNESS	A 41-year-old male is brought to the EC after his co-worker found him breathing rapidly in an auto mechanic shop. EMS REPORT: 41-year-old male who is a recovering alcoholic was found laying on the ground disoriented and short of breath. His co-worker found him on scene with a bottle of something sweet next to him. He has not vomited.
ROS	Unable to obtain due to AMS
PMH/PSH	Schizophrenia
MEDICATIONS	Oxycodone
ALLERGIES	Penicillin - hives
SOCIAL Hx	Alcohol – Former heavy use – three 16-pack of beers daily – stopped 1 month prior Former smoker – 30-pack/year history Former prescription drug abuse – oxycodone – has recently stopped 1 month prior

INITIAL VITAL SIGNS

HR	BP	RR	PULSE OXIMETRY	TEMP	WEIGHT
73	105/68	24	91% on room air	97.8F	85 kg

PHYSICAL EXAM

Items in red need to be verbalized

PRIMARY SURVEY

- **AIRWAY:** Patent, + gag reflex
- **BREATHING:** + Spontaneous respirations, mild tachypnea, no cyanosis
- **CIRCULATION:** 2+ distal pulses, dry skin

GENERAL: AAOXO, distracted, nonsensical statements

HEENT: Normocephalic, atraumatic, PERRL/TM physiologic, no nystagmus, tongue midline, no tongue fasciculations

NECK: No JVD, no crepitus

CV: RRR. Phys S1/S2. No murmurs, rubs, gallops

PULM: Tachypneic, CTAB in all fields

ABD: Soft, nontender/non-distended, +BS

EXT: No edema, moving symmetrically

SKIN: No rashes, warm, dry

NEURO: No clonus, no rigidity; strength and sensation normal

PHASE 1: INITIAL PRESENTATION

TIME	CLINICAL PROMPT	EXPECTED MANAGEMENT	CONSEQUENCES	CRITICAL ACTIONS
00:00-03:00	41-year-old male presents to the EC with altered mental status and shortness of breath	<ul style="list-style-type: none"> Order full set of vital signs, cardiac monitors, continuous pulse oximetry Order large-bore IVs Obtain a focused history and physical examination Start pt on supplemental oxygen Determine that a potentially toxic ingestion has taken place Obtained early fingerstick glucose 	<ul style="list-style-type: none"> RN prompts, “Do you want vitals/patient on the monitor/IV access?” if not requested RN prompts, “Do you want to start supplemental oxygen?” if not conducted RN prompts, “Was he drinking alcohol again? I’ve seen this patient before!” if toxicological ingestion not identified on differential 	<p>Obtained a complete set of vital signs? I P N</p> <p>Obtained a focused history? I P N</p> <p>Performed a focused physical exam? I P N</p> <p>Ordered large bore IVs? I P N</p> <p>Recognized abnormal VS? I P N</p> <p>Initiated supplemental O2? I P N</p> <p>Considered toxidrome on differential diagnosis? I P N</p> <p>Obtained early fingerstick glucose? I P N</p>

PHASE 2: REASSESSMENT AND SECONDARY INTERVENTION

TIME	CLINICAL PROMPT	EXPECTED MANAGEMENT	CONSEQUENCES	CRITICAL ACTIONS
3:01-6:00	<p>Persisten altered mental state</p> <p>Repeat Vital Signs (with NRB and IVF) BP: 123/70 HR: 80 RR: 16 T: 98.3F Pox: 99% on NRB</p>	<ul style="list-style-type: none"> Order STAT labs (must include acetaminophen, salicylate, serum osm, ethanol level, and toxic alcohol panel) Order STAT EKG Order STAT CXR Order IV fluid resuscitation Order thiamine, pyridoxine, magnesium IV Ordered CT head given “found down” 	<ul style="list-style-type: none"> RN to prompt, “Did you want any imaging/labs?” if none ordered. RN to prompt, “Do we need ingestion labs?” if toxidrome labs not ordered 	<p>Ordered appropriate STAT labs? I P N</p> <p>Ordered STAT EKG? I P N</p> <p>Ordered STAT CXR? I P N</p> <p>Ordered IV fluids? I P N</p> <p>Ordered CT head? I P N</p> <p>Ordered thiamine, pyridoxine, magnesium? I P N</p>

PHASE 3: REASSESSMENT, TERTIARY INTERVENTION, RESULTS, RESOLUTION

TIME	CLINICAL PROMPT	EXPECTED MANAGEMENT	CONSEQUENCES	CRITICAL ACTIONS
6:01-10:00	Patient still disoriented	<ul style="list-style-type: none"> • Calculate anion gap • Calculate osmolar gap • Order IV fomepizole • Call consultant • Formulate differential including: toxic alcohol ingestion, intracranial process, neurologic, infectious, metabolic, etc. • Either poison control or toxicology called • MICU called for admit 	<ul style="list-style-type: none"> • Labs result at 6:30 • RN to prompt, "Do we have any reversal meds?" if no interventions • RN to prompt, "What did the imaging/labs show?" if no interpretation shared • RN to prompt, "Who's admitting this patient?" if no consult called 	<p>Calculated anion gap? I P N</p> <p>Calculated osmolar gap? I P N</p> <p>Ordered appropriate IV meds? I P N</p> <p>Called consultant? I P N</p> <p>Presented case to specialist succinctly and directly? I P N</p> <p>Formulated broad DDx? I P N</p> <p>Interpreted test results accurately? I P N</p> <p>Appropriate disposition? I P N</p>

PHASE 4: CONCLUSION & DEBRIEFING

TIME	ACTIONS
10:00-20:00	<p>Debrief</p> <p>Q&A Session/Teaching</p> <p>Evaluations</p>

DEBRIEFING POINTS

GENERAL POINTS	SCENARIO-SPECIFIC POINTS
<ul style="list-style-type: none"> • What went well? • What are some opportunities for improvement? • Did you identify any gaps in knowledge? • Was there any delay in treatment? • How was communication between team members? 	<ul style="list-style-type: none"> • Indications for hemodialysis • Pharmacologic management of ethylene glycol toxicity • Differential diagnosis in the disoriented ingestion patient • Calculation of anion gap and osmolar gap

ORAL BOARDS PEARLS

- Have a format for how you would like to approach each case
- Make sure you consider alternate causes of AMS
- Make sure you order co-ingestion workup
- Remember to administer the co-factors along with the antidote
- Remember to make the patient NPO, re-assess the vital signs, re-assess after each intervention, and follow up on any studies
- Remember to explain to the patient/family the same way you would in real life
- If the examiner attempts to cue you or ask "anything else", take a moment to synthesize what has been done to help organize your thoughts (this may be your final chance to correct something you forgot!) and ensure the examiner recorded all of your intended actions

SCENARIO STIMULI

Complete Blood Count		Coagulation Profile	
WBC	10.0 (Normal 5.0 - 14.5 x 10 ³ /mL)	PT	12 (Normal 11-13.5 seconds)
Hemoglobin	12.5 (Normal 11.5-15.5 gm/dL)	PTT	27 (Normal 25-35 seconds)
HCT	38 (Normal 35%-45%)	INR	1.0 (Normal 0.8-1.1)
Platelets	150 (Normal 150-450 x 10 ³ /mL)		
MCV	84 (Normal 76-90 fL/red)		
Basic Metabolic Panel		VBG	
Sodium	132 (Normal 136-145 mEQ/L)	pH	7.29
Potassium	4.0 (Normal 3.5-5.5 mEQ/L)	pCO ₂	63
Chloride	87 (Normal 95-105 mEQ/L)	pO ₂	60
CO ₂	28 (Normal 17-29 mEQ/L)	Lactate	2.5
BUN	40 (Normal 5-20 mg/dL)	Liver Function Tests	
Creatinine	0.9 (Normal 0.5-1.1 mg/dL)	ALT	50 (Normal 10-130 U/L)
Glucose	80 (Normal 70-110 mg/dL)	AST	58 (Normal 10-34)
Posm	310	Alk Phos	130 (Normal 24-147 U/L)
UDS		Bilirubin	0.2 (Normal 0-0.8 mg/dL)
THC	Negative	Albumin	2.5 (Normal 2.4-4 g/dL)
Cocaine	Negative	Additional	
Opioids	Positive	Acetaminophen	Undetectable
Amphetamines	Negative	Salicylate	Undetectable
PCP	Negative	Ethanol	Undetectable
Urinalysis		Toxic Alcohol Panel	
Color	Yellow	Methanol	Undetectable
Clarity	Hazy	Isopropyl alcohol	Undetectable
Specific grav	1.008	Ethylene glycol	65 mg/dL
pH	7.0		
Leukoesterase	Negative		
Nitrates	Negative		
Protein	0		
Glucose	0		
Ketones	Negative		
Urobilinogen	Negative		
Bilirubin	Negative		
Hemoglobin	Negative		
WBC	0		
RBC	0		
Bacteria	Not seen		
Squam epi cells	Not seen		
Other	+ Envelope crystals, UV fluorescent urine		

IMAGING

Representative EKG

