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Case Presentation

A 34 m/o previously healthy boy was found sleeping on the kitchen floor next to an empty 2 oz bottle of vanilla extract. He was found to be obtunded and had vomited on himself. It was presumed that he ingested the entire bottle of vanilla extract. Upon arrival to the ED, 30 minutes after ingestion, his temperature was found to be 35.8°C, heart rate 182 beats per minute, respiratory rate 10 per minute, and blood pressure 85/40 mmHg. His lungs were clear to auscultation, heart sounds were tachycardic but rhythm normal, abdomen was soft and non-distended, and his skin was flushed and cool. Since he was obtunded and had vomited, he was intubated for airway protection. His blood glucose level upon arrival was 35.

What is going on?



EtOH Intoxication

- Thousands of EtOH exposures in children are reported yearly to poison control
- Household products account for 85-90% of these reports

Item	%ABV
Beer	3.2-14
Wine	8-22
Liquor	20-95
Item	%ABV
Perfumes	25-95
Vanilla Extract	35

Item	%ABV
Cough Medicine	2-25
Cold Medicine	5-16
Hand Sanitizers	60-95

Item	%ABV
Glass Cleaner	10
Mouthwash	15-25

FACTS



- Rarely given by caretaker to quiet infants or as part of physical abuse
- Most EtOH exposure in young children (<6 y/o) involve small amounts of household products and typically do not result in significant toxicity



FACTS

- If peak serum level suspected to be ≥ 50 mg/dL there will be a much higher risk of severe and persistent hypoglycemia
- In kids <6 y/o death due to EtOH ingestion is due to severe hypoglycemia, hypothermia and coma



FACTS

- Children and adolescents make up 11% of total alcoholic beverage consumption in US
- 40% of high school students consume alcohol
 - ¼ binge (>4 drinks)
 - EtOH is most used and abused drug among US adolescents
- Co-morbidities include
 - MVA (2,000 fatal accidents/year involve teenage drivers)
 - ED visits (150,000 yearly)
 - Violence (50% vs 22% in non-drinking teens)
 - Sexual assault (increased risk by 9%)
 - Suicidal (doubles the likelihood from 12% to 24%))
 - Unplanned pregnancy (increased risk of being impregnated or impregnating someone)

QUESTION 1

- If our patient weighed 15 kg, and it was assumed that he drunk all of the vanilla extract (35%ABV), what is the peak serum EtOH concentration? (NB 2 oz = 59 mL)
 - A. 85 mg/dL
 - B. 112 mg/dL
 - C. 146 mg/dL
 - D. 184 mg/dL
 - E. 356 mg/dL

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Blood Ethanol Concentration

$$\text{BEC} = (V)(\text{ABV}\%)(0.8)/(0.6Wt)$$

$$\text{Peak BEC} = (59)(35)(0.8)/(0.6 \times 15) = 183.6 \text{ mg/dL}$$

Specific gravity EtOH = 0.8 mg/dL

Volume of distribution of EtOH = 0.6 mL/kg

****1 toddler's swallow ~ 5 mL**

EtOH Intoxication

- **Infants and young children**
 - Toxic dose 0.4mL/kg of 100% EtOH → **peak BEC 50 mg/dL**
 - Life threatening dose is 4 mL/kg of 100% EtOH → **peak BEC 500 mg/dL**
 - *Fatal hypoglycemia has been reported in peak BEC of <100 mg/dL*

EtOH Intoxication

- **Older Children and adolescents**
 - Develop increasing toxicity with elevation of serum EtOH similar to adults
 - Mostly show signs of inebriation at **BEC of 50-100 mg/dL**
 - Severe toxicity expected with 6mL/kg of 100% EtOH

QUESTION 2

- In our patient what is the minimum and maximum time it will take for serum alcohol to reach 0? (BEC is 184 mg/dL)
 - a) 2 - 10 hours
 - b) 6.5 – 12.8 hours
 - c) 15.2 – 20.5 hours
 - d) 7.4 – 18.4 hours
 - e) > 24 hours

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ELIMINATION

- Constant over time → Zero-order kinetics
- Typically 10-25 mg/dL per hour in non-tolerant
- **Signs of intoxication may wane faster



Our patient:

$$184/25 = 7.36 \text{ hrs}$$

$$184/10 = 18.4 \text{ hrs}$$

EVALUATION

- EtOH vs MetOH and ethylene glycol
 - MetOH and ethylene glycol have a delayed onset but are more severely toxic and will need antidote
- How much?
- What time?
- Co-ingestions (other drugs)
- Trauma? Assault?
- Attempted suicide (adolescents)



EVALUATION

- Co-ingestion causes increased risk of deep coma with respiratory failure
 - GHB, Barbituates, Opioids
 - GHB (date rape drug) often missed; consider if history of agitation with severe short lasting coma
- Symptoms similar to ingestion of other sedative hypnotics
 - Altered behavior
 - Ataxia
 - Slurred speech
 - ↓HR, BP, respirations



EVALUATION

- More differential diagnoses include hypoglycemia, TBI, intoxication with other alcohols (MetOH and ethylene glycol), DKA
 - Ketones
 - Sweet breath
 - Seizures
 - Nystagmus with varying pupil size
 - Dehydration (polyuria/emesis)

EVALUATION

- Ethanol levels
- Check BG rapidly & intervene
- Rapid urine assay for other drugs
- Serum electrolytes
- Arterial/Venous blood gases
- Plasma osmolality
- Acetaminophen levels
- CXR, CT
- Urine pregnancy



MANAGEMENT

- **SUPPORTIVE CARE**

- Airway, Breathing, Circulation
- IV access and BG check immediately if AMS
- Rapid treatment of hypoglycemia
 - IV bolus of dextrose @ 0.25g/kg
 - Maintenance of D5W or D10W with $\frac{1}{4}$ or $\frac{1}{2}$ NS depending on sodium requirements
 - Maintain BG above 60 mg/dL
- Always use isotonic fluids to correct hypovolemia
 - Bolus with 20mL/kg (1 L max) repeat as needed
 - May need potassium supplementation to if hypokalemia
- Heat lamps, radiant warmer, warm blankets

MANAGEMENT

- Thiamine?
- GI decontamination not recommended
 - Rapid absorption, vomiting, doesn't bind to activated charcoal
- Naloxone
- Extracorporeal removal (dialysis)
 - Liver disease
 - >450 mg/dL
- Child protection
- Hospital observation for 12-24 hours

Clinical effects of blood alcohol concentration

Blood alcohol concentration	Clinical effects
20-50 mg/dL (4.4-11 mmol/L)	Diminished fine motor coordination
50-100 mg/dL (11-22 mmol/L)	Impaired judgement; impaired coordination
100-150 mg/dL (22-33 mmol/L)	Difficulty with gait and balance
150-250 mg/dL (33-55 mmol/L)	Lethargy; difficulty sitting upright without assistance
300 mg/dL (66 mmol/L)	Coma in the non-habituated drinker
400 mg/dL (88 mmol/L)	Respiratory depression

Adapted from: Marx JA. Rosen's emergency medicine: concepts and clinical practice, 5th ed, Mosby, Inc., St. Louis 2002. p. 2513. Copyright © 2002 Elsevier.

REFERENCES

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