Toxic Stuff: Newest Developments

Bram Dolcourt, MD
Wayne State University

Disclosures

- None

- Only FDA Approved medications will be discussed
Objectives

- Be able to evaluate a patient with a suspected Vape related Lung injury
- Know some of the indications for dialysis associated with toxic ingestions
- Familiarity with reasons for initiating ECMO on intoxicated patients

Electronic-cigarette, or Vaping, product-use Associated Lung Injury (EVALI)
Case for thought

- 16 y/o M
- Progressive DIB plus other symptoms
- Otherwise health athlete
- Interstitial Pneumonia
- Started on antibiotics
- Intubated on hospital day #2
- Significant Vaping history
The beginning…

- July 25, 2019 in Wisconsin
- Aug 1 2019…CDC
- Sept 2019…peak?
- National Syndromic Surveillance Program

Vape Related ED Visits
Epidemiology - CDC

- Jan 8, 2020
- Reported cases: 2602, Michigan 50-99
- Deaths: 57, MI - 3
- < 18 year old: 16%
- 18-24 years old: 38%
- 80% THC use, 35% exclusive THC
- 13% Exclusive Nicotine

Definition

- Diagnosis of exclusion
  - e-cigarette or dabbing 90 days prior
  - pulmonary infiltrate such as opacities on CXR or ground glass on CCT
  - absence of pulmonary infection
  - no alternative plausible diagnoses
Findings

• Dyspnea
• 100% - abnormal imaging
  – Bilateral infiltrates
• Respiratory symptoms
• Low pulse ox in 2/3
  – ½ subtle
• Fever ~30%

Pathology

• Hyaline membranes
• Fibrinous Exudates
• Lipid filled Macrophages

• WTF?
Pathology

• Lipoid Pneumonia?
• Fat in the lungs…

What is in Vape?

• Complex organic aerosol
  – Suspended droplets
  – Pyrolysis components
• THC
• CBD
• Glycerin
• Propylene Glycol
• Turpenes
• Nicotine
What is in vape?

- Flavoring agents
- Diacetyl – “buttery”
- Cinnamaldehyde – Sweet, fruity
- Benzaldehyde and derivatives

What is in vape?

- Oxidation/Degradation products
- Glycoaldehyde
- Acrolein
- Acetaldehyde
- Formic acid
- Formaldehyde
- Acrylamide
Possible cause?

- Vitamin E
  - Associated with most EVALI
  - Gives a good color
- Other chemical/solvent?
  - Less commercial vape juice

approach to possible vaping-induced lung injury in the non-intubated patient

Case highly suggestive for vaping-induced lung injury
- History of vaping (especially concerning if using THC oils or adulterated liquids)
- Bilateral ground-glass opacities on CT scan (without atypical imaging features, such as cavitation or large nodules)
- No immunocompromise
- No exposure to unusual pathogens

Noninvasive diagnostic/therapeutic approach
- Blood cultures ×2
- Sputum gram stain & culture if productive cough
- Urine for legionella & pneumococcus antigens
- Nasal PCR for viruses +/- Influenza
- Nasal PCR for MRSA
- HIV serology
- ESR, C-reactive protein, procalcitonin (if available)

Empiric therapy for pneumonia & VAPI
- Antibiotics (e.g. ceftriaxone plus azithromycin)
- Oxygen support as needed (e.g. high-flow nasal cannula)
- Steroid (e.g. 1 mg/kg prednisone daily)

No clinical improvement
Or labs concerning (e.g. HIV+)
- Consider bronchoscopy
- Additional laboratory studies

Clinical improvement
Diagnostic evaluation unremarkable
Continue treatment
- Gradually wean off steroid
- Discontinue antibiotic (provided infectious evaluation is negative)
Our patient

- Made own THC Juice
- Bought THC/CBD online
- Drug store Vit E
- Craft store glycerine and propylene glycol

Our Patient

- Did not improve...quickly
- ARDS
- ECMO on hospital day #23
- Bilateral pneumothorax
- ECMO day 12: Double Lung transplant
Facing ‘Certain Death,’ Teenager With Vaping Injury Gets Double Lung Transplant

The surgery on the 17-year-old was the first transplant reported in the recent nationwide outbreak of vaping-related lung injuries.

Good times
Tox and Hemodialysis

Trying to put science to Voodoo

When to use hemodialysis?

Hemodialysis

Hemodialysis is advisable in patients with the following status: electrolyte imbalance; hepatic failure; and urinary tract infection. The dialysis should be continued until the patient is in a satisfactory condition. It should be continued for at least 24 hours.

Peritoneal dialysis, hemodialysis, and exchange transfusion are three methods of achieving a reduction in serum salicylate levels and clinical improvement. In severe cases of salicylism with serum salicylate levels in excess of 100 mg/dl, coma, renal insufficiency, or a failure to respond to more conservative therapy, these procedures should be considered. Hemodialysis is the most effective means available for lowering the level of serum salicylate, but peritoneal dialysis is a more generally available method. Exchange transfusion may be desirable in a young infant or in the unusual case of congenital salicylism.5
• Aspirin
  – Level of 100 mg/dL (7.2 mmol)
  – Level of 90 mg/dL (6.5) and renal insuff
  – AMS
  – New Hypoxemia

  – 90 mg/dL and failing treatment
  – 80 mg/dL with renal insuff and failing tx
• Lithium
  – Level of 4 mEq/L and renal impairment
  – Decreased LOC, seizures, arrhythmia

  – Level of 5 mEq/L
  – Confusion
  – Time to Li < 1.0 greater than 36hrs

• Valproic Acid
  – Level of 1300 mg/L
  – Shock
  – Cerebral edema

  – 900 mg/L
  – Coma/mechanical ventilation
  – Hyperammonemia
  – pH <7.10
• CBZ/Theophylline
  – Seizures
  – Arrhythmias
  – Shock
  – Coma

  – Elevated levels despite treatment
  – Theophylline level > 60 (50 extremes of age)

• Digoxin
  – Not recommended

• Phenytoin
  – Only for prolonged coma/prolonged incapacitating ataxia
An aside…

• Does Metformin cause acidosis?
• Data isn’t clear…
• 1998 study
  – No difference
• OD reports
  – Non-diabetics develop LA
• Metformin
  – Lactate > 20 mmol/L
  – pH 7.0 or less
  – Shock
  – Decreased LOC
  – Failure of other measures
ECMO/ECLS

- Oxygenates
- Provides Blood pressure
  - ? Perfusion
- Allows Liver/Kidneys to work

- Survival without ~10%

ECMO

Veno-arterial

Veno-venous

Arterio-venous
ECMO – STANDARD FEMORO-FEMORAL

- Femoral vein with tip in right atrium
- Common femoral artery with tip lying in common iliac artery or lower aorta
- Provides full or partial cardiac support
- Risk of differential hypoxia

ECMO/ECLS

- ToxIC Consortium
  - 10 patients
  - Variety ingestions
  - 8 survived

- Caen Hospital, France
  - 17 patients
  - 7 “prolonged CPR”
    - 101+/-55 min
  - 13 discharged without sequelae
  - (but not really, 4 had some significant cognitive issues)
ECMO/ECLS

• Back slide in data quality
• Lots of case reports/heterogenous case series

ECMO/ECLS

• Survival Benefit?
• Reporting bias?
• Patient selection bias?
ECMO/ECLS

• Earlier go too?
  – Case report on caffeine OD
• Feasibility?

Can in be done in the ED?

• ACEP Draft policy exclude EPs
  – Dissention from the ranks…


Emergency Physician-Initiated Resuscitative Extracorporeal Membrane Oxygenation.
Shinar Z1, Plantmason L1, Revnoidu J2, Dembitzky W1, Bellozzo J1, Ho C1, Gasser D1, Adamson R1.
Portable ECMO

http://advancement.jefferson.edu/s/1399/images/gid2/editor/alumni_bulleted/sub13_ecmo_and_helicopter.jpeg

Good times…
Vaping ethanol

• Creating an ethanol vapor by either heating or pouring over dry ice

Questions...