Adverse events associated with use of e-cigarettes: a compilation of ~250 published case reports (to 30th April 2024)

– trauma injuries, poisoning, suicides, non-infectious respiratory presentations, cardiovascular incidents and other adverse health effects

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Last updated: *June 2024*

Contents

Introduction

The material that follows is a compilation of case reports where clinicians believed the use of e-cigarettes was a relevant factor, and took time to draft a paper and submit it to a scientific journal for publication. Very few clinicians take time to document cases of interest and reports tend to focus only on previously unknown health effects; few care reports are submitted or published once a phenomenon is already known about. So published reports represent only an extremely small percentage of cases that would be observed.

The compilation does not include information from other sources outside the scientific literature such as discussion in social media fora, reports to manufacturers or health regulators of adverse events, unpublished reports maintained by hospitals, coroner's reports or information from death certificates. Patients have not been routinely asked about vaping in GP consultations or emergency departments so it is possible that many events associated with vaping have occurred that are not recorded anywhere.

These case studies were identified during monthly searches of the scientific literature since 2015 where we downloaded every item containing the expression 'vap* or 'e-cig*' in the title. For the years 2010 to 2014, we undertook additional searches of the PubMed database where the term 'case report' was included in any field.

Instances where it was specified that the e-cigarette contained cannabis are included in this compilation/are not included in this compilation.

Overview articles

Hua M, Alfi M, and Talbot P. Health-related effects reported by electronic cigarette users in online forums. Journal of Medical Internet Research, **2013**; 15(4):e59. Available from: http://www.jmir.org/2013/4/e59/ (Hua, Alfi et al. 2013)

Hua M and Talbot P. Potential health effects of electronic cigarettes: A systematic review of case reports. Preventive Medicine Reports, **2016;** 4:169–78. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27413679(Hua and Talbot 2016)

Langreth R and Etter L. prognosis. Early Signs of Vaping Health Risks Were Missed or Ignored Doctors and researchers scattered around the globe saw problems, but 'nobody put two and two together'. Bloomberg, **2019**; 25 Sep. Available from: https://www.bloomberg.com/news/articles/2019-09-25/vaping-illness-signs-were-missed-or-ignored (Langreth and Etter 2019)

Gulsen, A. and B. Uslu, Health Hazards and Complications Associated with Electronic Cigarettes: A Review. Turk Thorac J, **2020. 21**(3): p. 201-208. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32584238.
Electronic cigarettes (ECs) are devices that vaporize and release a sweetened liquid containing nicotine as a substitute for burning tobacco. EC manufacturers have suggested that "vaping" is a safer alternative to conventional smoking because of the potential reduction of exposure to toxic substances. In 2019, National Youth Tobacco Survey reported that 10.5% and 27.5% of middle and high school students used ECs in the previous 30 days (0.6% and 1.5% in 2011, 3.3% and 11.7% in 2017, and 4.9% and 20.8 in 2018), respectively. Increased EC use among younger individuals is mainly because of the widespread perception that ECs are relatively less harmful than conventional cigarettes as they do not involve smoking tobacco and contain little or no nicotine. This review suggests that ECs may not be completely harmless. There are increasing number of case reports on various complications arising from using ECs, which are especially popular among young individuals and could negatively affect their health. **Reported complications include lipoid pneumonia, acute eosinophilic pneumonia, hypersensitivity pneumonia, organizing pneumonia, diffuse alveolar hemorrhage, multiple reactive pulmonary nodules, subacute bronchiolitis, mouth and tongue injuries, dental injuries, complex facial fractures, thermal injuries, nickel contact allergy, C1 and C2 fractures, and fatal intoxication after ingesting liquids.** Complications that develop directly from the substances in the devices and those resulting from device explosion and burning are being reported with increasing frequency. There is an urgent need for legislation and restriction regarding the sale of these devices considering their increasing frequency of use by younger individuals.

2010

Bennett J. **British factory worker, 57, who died in 2010 after swapping his 20-a-day habi**t for a 'healthier' e-cigarette is **now believed to be the first person in the world to die from lung disease 'linked to vaping'.** Daily Mail - Australia, 2019; 30 September. Available from: https://www.dailymail.co.uk/news/article-7518913/British-factory-worker-57-worlds-person-die-disease-linked-VAPING.html (Bennett 2019)

2011

Langreth R and Etter L. prognosis. Early **Signs of Vaping Health Risks Were Missed or Ignored Doctors and researchers scattered around the globe saw problems, but 'nobody put two and two together'**. Bloomberg, 2019; 25 Sep. Available from: https://www.bloomberg.com/news/articles/2019-09-25/vaping-illness-signs-were-missed-or-ignored

2012

McCauley, L., C. Markin and D. Hosmer, An unexpected consequence of electronic cigarette use. Chest, 2012. **141**(4): p. 1110–3. Available from: http://dx.doi.org/10.1378/chest.11-1334.

A **42-year-old woman was admitted to the hospital with a 7-month history of dyspnea, productive cough, and subjective fevers. She had been seen multiple times in the ED** with similar complaints and had received several courses of antibiotics. …..

2013

Hua, M., M. Alfi and P. Talbot, Health-related effects reported by electronic cigarette users in online forums. Journal of Medical Internet Research, 2013. **15**(4): p. e59. Available from: http://www.jmir.org/2013/4/e59/; http://www.ncbi.nlm.nih.gov/pubmed/23567935.

BACKGROUND: The health effects caused by electronic cigarette (e-cigarette) use are not well understood. OBJECTIVE: Our purpose was to document the positive and negative short-term health effects produced by e-cigarette use through an analysis of original posts from three online e-cigarettes forums. METHODS: Data were collected into Microsoft Access databases and analyzed using Cytoscape association graphics, frequency distributions, and interactomes to determine the number and type of health effects reported, the organ systems affected the frequency of specific effects, and systems interactions. RESULTS: A total of 405 different symptoms due to e-cigarette use were reported from three forums. Of these, 78 were positive, 326 were negative, and one was neutral. While the reported health effects were similar in all three forums, the forum with the most posts was analyzed in detail. Effects, which were reported for 12 organ systems/anatomical regions, occurred most often in the mouth and throat and in the respiratory, neurological, sensory, and digestive systems. Users with negative symptoms often reported more than one symptom, and in these cases interactions were often seen between systems, such as the circulatory and neurological systems. Positive effects usually occurred singly and most frequently affected the respiratory system. CONCLUSIONS: This is the first compilation and analysis of the health effects reported by e-cigarette users in online forums. These data show that e-cigarette use can have wide ranging positive and negative effects and that online forums provide a useful resource for examining how e-cigarette use affects health.

2014

Poisoning

Bartschat, S., K. Mercer-Chalmers-Bender, J. Beike, M.A. Rothschild and M. Jubner, Not only smoking is deadly: fatal ingestion of e-juice-a case report. Int J Legal Med, 2014. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25239221.

A fatal case of nicotine intoxication by oral intake of a nicotine solution, sold via the Internet, is reported. The concentrated nicotine solution (72 mg/mL) is usually diluted with polypropylene, polyethylene glycol or glycerine, respectively, in order to allow the user to

generate their own solution for vaporisation in electronic cigarettes (e-juice). A 34-year-old man was found lifeless by his parents, who reported that their son had been in good health and had shown no hints of suicidal behaviour. The medicolegal autopsy revealed unspecific findings. Toxicological analysis revealed nicotine concentrations of 5.5 mg/L in femoral venous blood, 136 mg/L in heart blood, 12.0 mg/kg in brain tissue, 42.6 mg/kg in kidney tissue, 89.5 mg/kg in lung tissue and a total amount of 3,950 mg in the gastric contents. Cotinine concentrations were 0.9 mg/L in femoral venous blood, 7.6 mg/L in heart blood, 0.4 mg/kg in brain tissue, 0.9 mg/kg in kidney tissue and 0.8 mg/kg in lung tissue. No cotinine was detected in the gastric contents. The nicotine level measured in the femoral blood was in good accordance with the levels reported in other fatal cases caused by oral or patch application of nicotine. Moreover, the high level of nicotine in lung and kidney tissue, compared to that within femoral blood, strikingly emphasises the strong effect of post-mortem redistribution, underlined by the comparably low concentration of nicotine in the brain. The extremely high level of nicotine in the heart blood is more likely due to the high concentration in the gastric contents, due to oral intake, and by accumulation of the basic substance in the acidic gastric contents. This further highlights the effect of post-mortem redistribution. The mother of the deceased later admitted that her son had been suffering from psychosis and that she found a package containing five nicotine solution vials of the brand "Titanium Ice" (of 50 mL each). Three of the vials were empty. The nicotine concentration in the e-juice Titanium Ice was confirmed by HPLC analysis.

Eberlein, C.K., H. Frieling, T. Kohnlein, T. Hillemacher and S. Bleich, **Suicide attempt by poisoning using nicotine liquid for use in electronic cigarettes**. Am J Psychiatry, 2014. **171**(8): p. 891. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25082494.

Respiratory

Spaniard gets pneumonia from e-cigarette abuse. The Local, 2014. Available from: https://www.thelocal.es/20140314/spanish-patient-gets-pneumonia-by-e-cigarettes(2014)

Hureaux, J., M. Drouet and T. Urban, A case report of subacute bronchial toxicity induced by an electronic cigarette. Thorax, 2014. **69**(6): p. 596–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24436327.

Thota, D. and E. Latham, **Case report of electronic cigarettes possibly associated with eosinophilic pneumonitis in a previously healthy active-duty sailor.** J Emerg Med, 2014. **47**(1): p. 15–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24462024. BACKGROUND: Electronic cigarettes (e-cigarettes) are a technology that has been touted as a safe and effective alternative to traditional cigarettes. There is, however, a paucity of literature showing the adverse outcomes of e-cigarettes and a correlation with acute eosinophilic pneumonia (AEP). OBJECTIVE: To present a possible association between e-cigarettes and AEP. CASE REPORT**: A 20-year-old previously healthy man was found to develop AEP after smoking an e-cigarette.** He was treated with antibiotics and steroids and his symptoms improved. CONCLUSION: Though an alternative to traditional cigarettes, e-cigarettes can have unpredictable and potentially serious adverse effects. More research needs to be conducted to determine their safety. If seeing a patient in the ED with pulmonary symptoms after use of e-cigarettes, AEP should be considered in the differential.

2015

Poisoning

Gill, N., G. Sangha, N. Poonai and R. Lim, E-Cigarette Liquid Nicotine Ingestion in a Child: Case Report and Discussion. CJEM, 2015: p. 1–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25892642.
Nicotine poisoning is well described in the pediatric population, and even small oral doses may result in toxic effects. The source of nicotine is usually tobacco products and nicotine replacement products such as gum and patches. With the more frequent use of novel products such as e-cigarettes, concern has arisen regarding liquid nicotine. As there are no regulations regarding childproof bottling and packaging, there may be increased potential for unintentional ingestion of these colorfully and appealingly packaged products by children. We present and discuss a case of this nature, as we feel emergency physicians should be aware of this new mode of poisoning, and public health efforts should be made to minimize such exposures.

Respiratory

Atkins, G. and F. Drescher, Acute Inhalational Lung Injury Related to the Use of Electronic Nicotine Delivery System (ENDS). CHEST, 2015. **148**(4): p. 83A. Available from: https://doi.org/10.1378/chest.2281610.

Modi, S., R. Sangani and A. Alhajhusain, Acute Lipoid Pneumonia Secondary to E-Cigarettes Use: An Unlikely Replacement for Cigarettes. CHEST Journal, 2015. **148**: p. 382A. Available from: https://journal.chestnet.org/article/S0012-3692(16)36283-3/fulltext.

Moore, K., H. Young and M. Ryan, Bilateral Pneumonia and Pleural Effusions Subsequent to Electronic Cigarette Use. Open Journal of Emergency Medicine, 2015. **03**. Available from: http://dx.doi.org/10.4236/ojem.2015.33004.
Electronic nicotine delivery systems also known as electronic cigarettes (or e-cigarettes) are marketed by their manufactures as a safer alternative to tobacco cigarettes because of potentially reduced delivery of toxins. However, the scientific evidence and the long-term health effects of e-cigarettes are limited. We describe a case of a 43-year-old man who had been smoking electronic cigarettes excessively for three days and presented with **acute dyspnea, increased work of breathing and tachycardia. Subsequent chest x-ray revealed bilateral pleural effusions**. In addition, the patient had a new oxygen requirement and was thus admitted with a **diagnosis of pneumonia** and bilateral pleural effusions. The case and the potential harmful effects of electronic cigarettes are discussed herein.

Narang, R., D. Narang, N. Shreya, J. Salman, N. Quyen and G. Udeani, Good, Bad, and Ugly on Vaping, Diffuse Lung Disease Global Case Reports. Chest, 2015. **148**(No. 4_MeetingAbstracts).
SESSION TITLE: Diffuse Lung Disease Global Case Reports
SESSION TYPE: Global Case Report Poster
PRESENTED ON: Tuesday, October 27, 2015 at 01:30 PM - 02:30 PM
INTRODUCTION: INTRODUCTION: E-cigarette usage has become a popular smoking alternative, but its potential adverse health effects are poorly understood. We present a patient with no significant past medical history who developed hypersensitivity pneumonitis due to e-cigarette use
CASE PRESENTATION: A 23-year-old morbidly obese male patient with no significant past medical history presented to the Emergency Department with worsening productive cough with rust colored sputum and shortness of breath. The patient admitted to using an e-cigarette device for the last six months. Vital signs showed the patient to be tachypnic, tachycardic, and febrile. There were crackles heard in the right lung field. The patient's WBC was 9.3 K/µL and his electrolytes and liver

enzymes werewithin normal limits. The patient was started on nebulizer treatments and antibiotics for suspected community acquired pneumonia. Computer tomography (CT) scan of the chest showed countless patchy nodular parenchymal opacities, widely distributed throughout the lungs. Patient underwent fiber optic bronchoscopy; BALF cultures were negative. BAL cell count and differential showed 80% lymphocytes,which is universally noted in most cases of hypersensitivity pneumonitis. Tuberculin skin test, fungal serologies, autoimmune panels, ANCA serologies and HIV titer were also negative. ACE level was normal. Transbronchial biopsy of the left and right lungs exhibited noncaseating epithelioid granulomas. The patient was thus diagnosed with acute hypersensitivity pneumonitis due to e-cigarette aerosol exposure. The patient improved rapidly with cessation of e-cigarette usage and steroid treatment, and was discharged home.
DISCUSSION: Adverse effects associated with e-cigarette usage and aerosol exposure are not wellunderstood. Studies have linked e-cigarette "vaping" sessions to onset of eosinophilic and lipoid pneumonia, as well as sub-acute bronchiolitis. Furthermore, e-cigarette aerosols have been identified as inducing pro-inflammatory mediators in human lung tissue and mouse models. There is paucity of data implicating E-cigarette use with significant lung disease. Patient's flu-like symptoms, atypical radiological findings, bronchoscopic finding and lung biopsy, results were all consistent with hypersensitivity pneumonitis (HP). Patient rapid improvement with cessation of vaping supports the clinical diagnosis. We are unaware of any previous association between HP onset and E-cigarette use.
CONCLUSIONS: E-cigarette use has been increasing rapidly as means to quit smoking. There are many different manufacturers producing many different flavored juices for vaping. FDA does not regulate these products. There have been some confirmed reports of lung disease associated with E-cigarette use. We present a confirmed **case of hypersensitivity pneumonitis associated with vaping**. It's likely that many more cases exist which has not come to clinical attention. There is need for further investigation in the.

Rutledge R. Handful of cases tie e-cigarettes to lung injury, pneumonia The Seattle Times, 2015. Available from: http://www.seattletimes.com/nation-world/handful-of-cases-tie-e-cigarettes-to-lung-injury-pneumonia/ (Rutledge 2015)

CVD

Vannier, S., T. Ronziere, J.C. Ferre, V. Lassalle and M. Verin, **Reversible cerebral vasoconstriction syndrome triggered by an electronic cigarette: case report. Eu**r J Neurol, 2015. **22**(5): p. e64–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25846567.

2016

Trauma injuries

Brooks, J.K., J.W. Kleinman, J.B. Brooks and M.A. Reynolds, Electronic cigarette explosion associated with extensive intraoral injuries. Dent Traumatol, 2016. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27397137.
With the rise in popularity of usage of various electronic smoking devices, there have been increasing reports of explosions, often resulting in complex injuries to the head and neck. To promote the awareness of this new phenomenon, a case report is provided regarding an 18-year-old male who had an electronic cigarette explode in his mouth. He presented with **severe damage to the anterior dentition (fractured teeth, avulsions, luxation), had fractured the premaxilla and anterior nasal spine, and sustained lacerations to the upper lip, labial mucosa, gingivae, tongue, hard palate, and facial skin**.

Cason, D.E., D.E. Morgan and J.A. Pietryga, Injuries From an Exploding E-Cigarette: A Case Report. Ann Intern Med, 2016. **165**(9): p. 678-679. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27802461.

Harrison, R. and D. Hicklin, Jr., Electronic cigarette explosions involving the oral cavity. J Am Dent Assoc, 2016. **147**(11): p. 891-896. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27158079.
BACKGROUND AND OVERVIEW: The use of electronic cigarettes (e-cigarettes) is a rapidly growing trend throughout the United States. E-cigarettes have been linked to the risk of causing explosion and fire. CASE DESCRIPTION: Data are limited on the associated health hazards of e-cigarette use, particularly long-term effects, and available information often presents conflicting conclusions. In addition, an e-cigarette explosion and fire can pose a unique treatment challenge to the dental care provider because the oral cavity may be affected heavily. In this particular case, the **patient's injuries included intraoral burns, luxation injuries, and alveolar fractures.** CONCLUSIONS AND PRACTICAL IMPLICATIONS: This case report aims to help clinicians gain an increased knowledge about e-cigarette design, use, and risks; discuss the risk of spontaneous failure and explosion of e-cigarettes with patients; and understand the treatment challenges posed by an e-cigarette explosion.

Moore, J., G. Mihalache and A. Messahel, "Exploding" electronic cigarette: a case report. Br J Oral Maxillofac Surg, 2016. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27282081.

Nicoll, K.J., A.M. Rose, M.A. Khan, O. Quaba and A.G. Lowrie, Thigh burns from exploding e-cigarette lithium ion batteries: First case series. Burns, 2016. **42**(4): p. e42-6. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27118069.
E-cigarette (EC) use has risen meteorically over the last decade. The majority of these devices are powered by re-chargeable lithium ion batteries, which can represent a fire hazard if damaged, over-heated, over-charged or stored inappropriately. There are currently no reports in the medical literature of lithium ion battery burns related to EC use and no guidance on the appropriate management of lithium ion battery associated injuries. We report two **individual cases of burn resulting from explosion of EC re-chargeable lithium ion batteries. Both patients required in-patient surgical management.** We provide evidence that lithium ion battery explosions can be associated with mixed thermal and alkali chemical burns, resulting from the significant discharge of thermal energy and the dispersal of corrosive lithium ion compounds. We would recommend, as with other elemental metal exposures, caution in exposing lithium ion battery burns to water irrigation. Early and thorough cleaning and debridement of such burns, to remove residual lithium contamination, may limit the risk of burn wound extension and potentially improve outcomes.

Paley, G.L., E. Echalier, T.W. Eck, A.R. Hong, A.V. Farooq, D.G. Gregory, et al., Corneoscleral laceration and ocular burns caused by electronic cigarette explosions. Cornea, 2016. **35**(7): p. 1015-8. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27191672.
PURPOSE: To report cases of acute globe rupture and bilateral corneal burns from electronic cigarette (EC) explosions. METHODS: Case series. RESULTS: We describe **a series of patients with corneal injury caused by EC explosions. Both patients suffered bilateral corneal burns and decreased visual acuity, and one patient sustained a unilateral corneoscleral laceration with prolapsed iris tissue and hyphema.** A review of the scientific literature revealed no prior reported cases of ocular injury secondary to EC explosions; however, multiple media and government agency articles describe fires and explosions involving ECs, including at least 4 with ocular injuries. CONCLUSIONS: Given these cases and the number of recent media reports, ECs pose a significant public health risk. Users should be warned regarding the possibility of severe injury, including sight-threatening ocular injuries ranging from corneal burns to full-thickness corneoscleral laceration.

Poisoning

You, G., J. Rhee, Y. Park and S. Park, Determination of Nicotine, Cotinine and Trans-3'-Hydroxycotinine using LC/MS/MS in Forensic Samples of a Nicotine Fatal Case by Oral Ingestion of e-cigarette Liquid. J Forensic Sci, 2016. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27238766.
Nicotine is a potent neurotoxin alkaloid and is used in e-cigarette liquid. The LC/MS/MS method was linear over 0.01-1.0 mg/L (r2 = 0.992-0.995). Limit of detection and limit of quantitation were 0.001 mg/L (S/N = 3) and 0.003 (S/N = 10). The inaccuracy and imprecision were <13.2%. The recoveries were >99.3%. **A 39-year-old dentist was found dead lying on the floor under the couch in his dental clinic. The concentration of nicotine, cotinine, and trans-3'-hydroxycotinine (heart blood/peripheral blood) was analyzed as follows: 87.2/85.2 mg/L (ratio 1.0), 1.4/1.1 mg/L (ratio 1.3), and 0.012/0.0089 mg/L (ratio 1.3), respectively.** The concentration of nicotine was determined to be 6734.8 mg/kg in gastric contents and 7262.0 mg/L in remaining e-liquid. Only, high concentration of nicotine was detected in the gastric contents as well as the two pieces of evidence collected from the death scene. This fatal case resulted from oral ingestion of e-cigarette liquid. It is estimated that at least 714 mg of nicotine was orally ingested.

Other adverse health effects

Ring Madsen, L., N.H. Vinther Krarup, T.K. Bergmann, S. Baerentzen, S. Neghabat, L. Duval, et al., A Cancer That Went Up in Smoke: Pulmonary Reaction to e-Cigarettes Imitating Metastatic Cancer. Chest, 2016. **149**(3): p. e65–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26965975.
e-Cigarettes have gained worldwide popularity as a substitute for smoking, but concern has been raised regarding the long-term effects associated with their use. We report a case of a 45-year-old female consumer of e-cigarettes who presented with 4 months of abdominal pain and fever. Initial imaging discovered multiple pulmonary nodules and liver lesions suspicious of widespread metastases; however, an extensive evaluation found no evidence of malignancy. **Results of a lung biopsy revealed an area with multinucleated giant cells suggestive of a foreign body reaction to a lipophilic material. Upon cessation of e-cigarette use (known as vaping), the lung nodules disappeared, and the liver lesions regressed. Our case report suggests that vaping can induce an inflammatory reaction mimicking metastatic cancer.**

2017

Trauma inuries

Arnaout, A., H. Khashaba, T. Dobbs, F. Dewi, S. Pope-Jones, A. Sack, et al., The Southwest UK Burns Network (SWUK) experience of electronic cigarette explosions and review of literature. Burns, 2017. **43**(4): p. e1-e6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28412133.
INTRODUCTION: Since the introduction of e-cigarettes to the UK market in 2007 their popularity amongst young adults has significantly increased. These lithium-ion powered devices remain unregulated by the Standards Agency and as a result burns centres across the world have seen an increasing number of patients presenting with significant burns, resulting from poor quality batteries that appear to be liable to explode when over-heated, over-charged or incorrectly stored. METHODS: Retrospective and perspective review of all e-cigarette related burns presenting to the Southwest Burns Network; South Wales Burns Centre (Morriston Hospital) or to Bristol burns centre (Southmead Hospital) between Oct 15-July 16, followed by a review of available literature performed and eligible papers identified using PRISMA 2009 Checklist. RESULTS: South Wales Burns Centre (Morriston Hospital) (N=5), Bristol burns centre (Southmead Hospital) (N=7). **92% of injuries were seen in male patients with a mean age of 34.58 (+/-12.7). The mean TSBA sustained 2.54% of mixed depth, most common anatomical area is the thigh 83% (n=10) with a mean 23.1(+/-5) days to heal with conservative management.** The literature search yielded 3 case series (Colaianni et al., 2016; Kumetz et al., 2016; Nicoll et al., 2016) [8,9,12] and 4 case reports (Jablow and Sexton, 2015; Harrison and Hicklin, 2016; Walsh et al., 2016; Shastry and Langdorf, 2016) [6,7,10,11]. We compare our findings with the published studies. CONCLUSION: The import and sale of e-cigarettes remains unrestricted. This increases the risk of devices being available in the UK market that do not meet the British Standard Specification, potentially increasing their risk of causing fire and exploding. Consumers should be made aware of this risk, and advised of adequate charging and storage procedures. In case lithium ion compounds leak following a breach in the battery, first aid with mineral oil use is advocated to avoid a further chemical reaction.

Foran, I., N.R. Oak and M.J. Meunier, High-Pressure Injection Injury Caused by Electronic Cigarette Explosion: A Case Report. JBJS Case Connect, 2017. **7**(2): p. e36. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29244675.
CASE: Electronic cigarettes are an increasingly popular and poorly regulated alternative to traditional cigarettes that deliver nicotine and other aerosolized substances to the user via a battery-powered atomizer. We report a case in which an **electronic cigarette explosion resulted in a high-pressure injection injury of the finger**. CONCLUSION: Explosions involving electronic cigarettes and similar handheld products should be treated as high-pressure injection injuries until proven otherwise. Radiographs are indispensable in the workup of these injuries. Because the true content of injected material cannot be determined with certainty, we recommend immediate surgical debridement, intravenous antibiotics, and close follow-up to observe the evolution of the injury.

Norii, T. and A. Plate, Electronic cigarette explosion resulting in a C1 and C2 fracture: A case report. J Emerg Med, 2017. **52**(1): p. 86-88. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27712901.
BACKGROUND: Electronic cigarettes have seen a drastic increase in use. A lithium-ion battery is often used as the rechargeable battery of the electronic cigarette device and has recently received much attention in terms of safety. There are several recent case reports in the scientific literature of injuries due to electronic cigarette explosions that involved soft-tissue injuries. CASE REPORT: We report **a significant spinal fracture from an electronic-cigarette explosion in a 27-year-old male. The electronic cigarette exploded during use,**

sending the mouthpiece through the pharynx and into the first cervical vertebra and resulting in fractures of the first and second vertebrae. An x-ray study of the neck showed a foreign body in the neck at the level of C1. A computed tomography scan of the neck showed fractures of C1. The foreign body was removed in the operating room. The patient was discharged home without neurologic sequelae. WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: Our case report is the first case of a cervical spine injury due to the explosion of an electronic cigarette. This case demonstrates that an electronic cigarette explosion can cause potentially serious penetrating neck injury. Emergency physicians should be aware of the potential danger of electronic cigarettes and have a low threshold to obtain radiographic tests and surgical consultation in the case of electronic cigarette explosion in the oral cavity. As the use of electronic cigarettes continue to increase, it is likely that injuries associated with them will also increase.

Ramirez, J.I., C.A. Ridgway, J.G. Lee, B.M. Potenza, S. Sen, T.L. Palmieri, et al., The unrecognized epidemic of electronic cigarette burns. J Burn Care Res, 2017. **38**(4): p. 220-224. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28644205.
Electronic cigarettes (e-cigarettes) are novel battery-operated devices that deliver nicotine as an inhaled aerosol. They originated from China in 2007 and their use has rapidly increased worldwide in the past decade, yet they remain largely unregulated. Reports of injuries associated with their use have appeared as unusual events in the news media and as case reports in the medical literature. This study was undertaken to explore e-cigarettes as a mechanism of burn injury. Referral records to three burn centers from January 2007 to July 2016 were searched to identify patients with injuries caused by e-cigarettes. Data were gathered from the electronic medical records (EMRs) of patients referred within the most recent 18 months. Thirty patients with burns resulting from e-cigarettes were identified. Twenty-nine were referred within the most recent 18 months. Only one was referred in the preceding 8 years. An explosion was identified by the patient as the inciting event in 26 of the 30 injuries (87%). Explosion of an isolated battery while it was carried on personal attire was reported in 10 cases. Explosion of a fully assembled e-cigarette was described in 16 cases. In seven of these 16 cases, the explosion occurred while the device was idle and carried on personal attire. In the other nine cases, the explosion occurred while the device was being operated. No injury occurred while batteries were charging. The mean age of injured patients was 30 years. The mean size of burn was 4% TBSA. **The thighs, hands, and genitalia were the most common sites of injury. Twenty-six patients required hospital admission and nine required surgery. Serious burn injuries from e-cigarettes have recently occurred with greatly increased frequency. The increase in injuries appears out of proportion to the increased popularity of e-cigarettes**. The most common pattern of injury is explosion when either the idle device or its batteries are carried on personal attire.

Satteson, E.S., N.J. Walker, C.J. Tuohy and J.A. Molnar, Extensive Hand Thermal and Blast Injury From Electronic Cigarette Explosion: A Case Report. Hand (N Y), 2017: p. 1558944717744333. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29192506.
BACKGROUND: As the use of electronic cigarettes rises, more reports of injuries related to device explosion are surfacing. METHODS: Presented here is the case of a **35-year-old man sustaining extensive thermal and blast injuries to his hand when the device exploded while he was holding it. He required multiple surgeries involving groin flap coverage, tendon transfer, and nerve grafting to optimize his postinjury function**. RESULTS: While much of his hand function has been restored, he has continued deficits in range of motion and sensation as a result of the incident. CONCLUSIONS: **With increasing numbers of such injuries, hand surgeons must be aware of the blast mechanism involved so as to avoid missing deep soft tissue injury or disruption of deep structures, as demonstrated in this case.**

Treitl, D., R. Solomon, D.L. Davare, R. Sanchez and C. Kiffin, Full and partial thickness burns from spontaneous combustion of e-cigarette lithium-ion batteries with review of literature. J Emerg Med, 2017. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28501385.
BACKGROUND: In recent years, the use of electronic cigarettes (e-cigarettes) has increased worldwide. Most electronic nicotine delivery systems use rechargeable lithium-ion batteries, which are relatively safe, **but in rare cases these batteries can spontaneously combust, leading to serious full and partial thickness burn injuries. Explosions from lithium-ion batteries can cause a flash fire and accelerant-related burn injuries**. CASE REPORT: A retrospective chart review was conducted of 3 patients with lithium-ion battery burns seen at our Level I community-based trauma center. Clinical presentation, management, and outcome are presented. All 3 patients sustained burn injuries (total body surface area range 5-13%) from the spontaneous combustion of lithium-ion batteries used for e-cigarettes. **All patients were treated with debridement and local wound care.** All fully recovered without sequelae. WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: Emergency physicians can expect to treat burn cases due to spontaneous lithium-ion battery combustion as e-cigarette use continues to increase. The cases presented here are intended to bring attention to lithium-ion battery-related burns, prepare physicians for the clinical presentation of this burn mechanism, and facilitate patient education to minimize burn risk.

Poisoning

Noble, M.J., B. Longstreet, R.G. Hendrickson and R. Gerona, Unintentional Pediatric Ingestion of Electronic Cigarette Nicotine Refill Liquid Necessitating Intubation. Ann Emerg Med, 2017. **69**(1): p. 94-97. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27988056.
Liquid nicotine used in electronic cigarette devices is highly concentrated, unreliably packaged, and poorly regulated. **We present a case report of a 6-year-old female who developed severe toxicity and required intubation after an unintentional oral ingestion of approximately 703 mg (35 mg/kg) of liquid nicotine, with accompanying serum and urine concentrations of nicotine and its metabolites.** Analysis of the ingested liquid suggests a nicotine concentration of 140.6 mg/mL in the purchased commercial product, or 234% of its labeled concentration. Clinicians should be aware of these products and the potential severity of toxicity they may incur.

Respiratory

Flower, M., L. Nandakumar, M. Singh, D. Wyld, M. Windsor and D. Fielding, Respiratory bronchiolitis-associated interstitial lung disease secondary to electronic nicotine delivery system use confirmed with open lung biopsy. Respirol Case Rep, 2017. **5**(3): p. e00230. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28392919.
As a modern phenomenon, there is currently limited understanding of the possible toxic effects and broader implications of electronic nicotine delivery systems (ENDS). Large volumes of aerosolized particles are inhaled during "vaping" and there are now an increasing number of case reports demonstrating toxic effects of ENDS, as well as human studies demonstrating impaired lung function in users. **This article presents a case of respiratory bronchiolitis interstitial lung disease (RB-ILD) precipitated by vaping in a 33-year-old male with 10 pack years of traditional cigarette and prior treatment for mixed germ cell tumour.** The patient had started vaping 10-15 times per day while continuing to smoke 10 traditional cigarettes per day. After 3 months of exposure to e-cigarette vapour, chest computed tomography demonstrated multiple new poorly defined pulmonary nodules with fluffy parenchyma opacification centred along the terminal bronchovascular units. Video-assisted thoracoscopy with lung biopsy of the right upper and right middle lobes was undertaken. The microscopic findings were overall consistent with RB-ILD. This case demonstrates toxicity with use of ENDS on open lung biopsy with resolution of radiographic findings on cessation. We believe that this is the first case where open lung biopsy has demonstrated this and our findings are consistent with RB-ILD.

Sturek, J. and N. Malik. *Acute Hypoxic Respiratory Failure With* ***Crazy Paving Associated With Electronic Cigarette Use: Affiliate Case Report Poster*****.** in *Chest Annual Meeting*. 2017. Totonto: American College of Chest Physicians. Available from: http://dx.doi.org/10.1016/j.chest.2017.08.776.

Other adverse health effects

Fracol, M., R. Dorfman, L. Janes, S. Kulkarni, K. Bethke, N. Hansen, et al., The Surgical Impact of E-Cigarettes: A Case Report and Review of the Current Literature. Arch Plast Surg, 2017. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29069879.
We report a case of a 51 year old female with a 25 pack year smoking history who underwent bilateral mastectomy and immediate tissue expander reconstruction for newly diagnosed right breast cancer. The patient reported herself as a non-smoker despite significant e-cigarette use, with **resulting significant mastectomy skin flap necrosis and breast reconstruction failure.** Little is known about the physiologic effect of e-cigarettes on wound healing and tissue perfusion. To this end, we provide an updated review of the impact of e-cigarettes on surgical outcomes. PubMed, Ovid MEDLINE, and PRS GO were searched for the terms "e-cigarette", "electronic cigarette", "e-cig", "electronic nicotine delivery system", "vaping", "surgery", "surgical", "peri-operative", "operate", "operative" and "wound healing". Abstract review of all articles was performed. 123 articles returned that contained both variants of e-cigarettes and surgery as keywords. Of those, manual assessment returned three articles which were found to be relevant to e-cigarette use in the surgical patient. No articles were found that compared perioperative complications in e-cigarette versus traditional cigarette users in humans. In conclusion, our case report depicts the potential dangers associated with e-cigarette use in the surgical patient. There is a public misconception that e-cigarettes are healthier than traditional cigarettes and as such their use may go unreported by patients. Early evidence suggests e-cigarettes may induce some of the same physiologic changes as traditional cigarettes, and may have a significant deleterious effect on wound healing.

2018

Trauma injuries

Andresen, N.S., D.J. Lee, C.E. Kowalski and R. Bayon, **Fall with e-cigarette in mouth resulting in pharyngeal and esophageal burns.** JAMA Otolaryngology – Head & Neck Surgery, 2018. **144**(4): p. 385-386. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29494719.

Harshman, J., M. Vojvodic and A.D. Rogers, Burns associated with e-cigarette batteries: A case series and literature review. CJEM, 2018. **20**(S2): p. S20-S28. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28566106.
Electronic cigarettes, often referred to as e-cigarettes, have established a considerable market in North America over the last decade. In parallel to this trend, there has been a surge of e-cigarette battery explosions reported in the general media. Given the growing number of such events, acute care physicians should recognize the associated risks and injury patterns and initiate appropriate treatment. **This report presents two cases of burn injuries from e-cigarette battery explosions requiring surgical management.** The accompanying comprehensive literature review highlights the emerging importance of e-cigarettes as an aetiology of burn injury.

Jones, C.D., W. Ho, E. Gunn, D. Widdowson and H. Bahia, E-cigarette burn injuries: Comprehensive review and management guidelines proposal. Burns, 2018. Available from: https://www.burnsjournal.com/article/S0305-4179(18)30279-1/fulltext.

INTRODUCTION: Electronic cigarettes (EC) have been reported to be associated with burns secondary to explosions of the device or battery, or contact from overheating, resulting in flame, contact or chemical burns. In addition to this, there have also been reported cases of soft tissue and bony trauma with or without associated burns. Using collective evidence, this review aims to summarise all reported burns associated with ECs, and its implications on immediate management with a particular focus on surgical treatment. METHODS: A search was conducted on PubMed, EMBASE and Medline for all case reports, case series and letters to editors published since 2014, using terms "electronic cigarette", "e-cigarette", "vaping" and "burn". The search was repeated by the co-author to avoid bias and a review of the bibliographies of each paper was conducted to ensure all relevant cases were included. The mechanisms, type and severity of burn injury, and management and treatment outcomes of the patients were recorded. Exclusion criteria included non-English articles, explosions with no associated burn and publications with insufficient information. RESULTS: 90 patients from 19 case series or case reports were included. With the exception of one study, gender was recorded with a male predominance (95.6%). **Mean age is 30.1years (range 18-59). The most common type of burn was flame. However, there were reports of chemical burns associated with ECs. The mean total body surface area (TBSA) affected was 4.9% (range 1-27.25%) with the majority of burns being mixed partial and full thickness. 22 patients underwent excision and autologous skin grafting within range of three to 21days. One patient had a full thickness contact burn excised and closed, one patient received a xenograft following debridement and one had biosynthetic skin dressing. 42 patients were managed conservatively with dressings or ointments.** DISCUSSION: In this review over a three-year period (2015-2017), 90 cases of EC related burn injuries were reported, however, this is likely an underestimation of the problem. The suggested mechanism for EC related injuries is battery malfunction. ECs are powered by Lithium ion batteries which are susceptible to "thermal runaway" reactions, which result in device overheating with potential for subsequent explosion. We explain hypothesized triggers for these reactions and mechanisms of other injuries associated with ECs such as chemical burns and blast injury. CONCLUSION: EC-associated burn injury results in combined thermal and chemical burns, which should be managed in tandem. Explosion injuries sustained whilst using the device may result in both facial trauma or inhalation injury and therefore should be reviewed with a high index of clinical suspicion. It is noted that there is no agreed standard for management for such burns by specialist bodies in the UK. We suggested a treatment algorithm to provide guidance for the burn injuries associated with ECs.

McCague, Y., **Ocular chemical burns secondary to accidental administration of e-cigarette liquid.** Advanced Emergency Nursing Journal, 2018. **40**(2): p. 104-109. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29715252.

Chemical burns to the eye represent a true ocular emergency, requiring immediate and proficient attention to preserve visual function. Although there have been very few reports of serious ocular burns secondary to the accidental administration of electronic cigarette liquid, this case report discusses the risk of same because of product confusion between electronic cigarette liquid and ocular preparations. This article presents a patient's case including patient history and management in the emergency department. The significance of chemical burns to the eye and its management is discussed in relation to significance to clinical practice for all nurses, nurse practitioners, and physicians working in the emergency department.

Poisoning

Hughes, A. and R.G. Hendrickson, An epidemiologic and clinical description of e-cigarette toxicity. Clin Toxicol (Phila), 2018: p. 1-7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30306801.

INTRODUCTION: E-cigarettes are battery-powered electronic nicotine delivery systems that simulate smoking by vaporizing nicotine-containing solutions. Systematic published data on e-liquid toxicity and exposures are limited to case reports and retrospective studies.

Prospectively-collected data on the type of exposure, symptomatology, duration of symptoms, and concentration/flavor of e-fluids has not been published. METHODS: This was a prospective observational study over a 42-month period (07/01/2014-12/31/2017). For all calls to a single poison center that involved e-cigarette devices or refill fluid, a data collection instrument was filled out by the specialist in poison information (SPI). RESULTS: **Two hundred sixty-five total cases were identified, including 193 children and 72 adults.** The majority of both pediatric (72%; 139/193) and adult (61%; n = 44/72) exposures involved e-liquid refill containers or fluid. Fifty-six percent (n = 108/193) of pediatric exposures involved ingestion of refill liquid. Though children who ingested e-liquid received only a small amount, initial symptoms were evident in 32% (n = 35/108) of cases. Children who did not ingest or inhale the products were less likely to develop toxicity. Only 2 children who were asymptomatic on initial call became symptomatic on follow-up. Most patients symptoms resolved within 4 hours. Seventy-one specific products/brands were identified with nicotine concentrations ranging from 0 mg/mL to 60 mg/mL with one product containing 3000 mg in a single bottle. A variety of flavors were identified, including several with names that may be attractive to toddlers or adolescents. DISCUSSION: E-cig exposures tend to produce irritant effects from topical exposures and nicotine toxicity from ingestions, as well as some dermal and "sucking" toddler exposures. CONCLUSION: Exposure to e-cig fluid or device frequently causes mild symptoms and rarely may produce systemic nicotine toxicity.

Suicide

Park, E.J. and Y.G. Min, The emerging method of suicide by electronic cigarette liquid: a case report. J Korean Med Sci, 2018. **33**(11): p. e52. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29495133.

Electronic cigarettes (ECs) are a device that aerosolize liquid nicotine by heating a solution of nicotine, glycerol and flavoring agents. The awareness and the usage of ECs has increased in many countries. Due to the online sales and the absence of EC regulations, the prevalence of EC usage is especially high in adolescents and young adults. Due to the large amount and the high nicotine concentration of EC liquid, the ingestion for suicide can lead to cardiac death. **We had two patients, a 27-year-old male who ingested about 23 mg/kg of nicotine and a 17-year-old female who ingested about 30 mg/kg of nicotine. Both patients presented seizure-like movement and cardiac arrest. They had metabolic acidosis and transient cardiomyopathy. They were ultimately discharged with a cerebral performance category of 2 and 4, respectively.** Increasing EC use may produce more cases of medical problems or suicide by nicotine intoxication.

Respiratory

Agustin, M., M. Yamamoto, F. Cabrera and R. Eusebio, Diffuse Alveolar Hemorrhage Induced by Vaping. Case Rep Pulmonol, 2018. **2018**: p. 9724530. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29984031.

There has been a significant increase in electronic cigarette (e-cigarette) use since its introduction in 2007. Ironically, there remains very few published literature on the respiratory complications of e-cigarettes. The use of personalized vaporizers or commonly known as "vaping" has started to overtake standard e-cigarette. Its dynamic vaporizer customization makes it challenging to assess long-term health effects. Case reports on the pulmonary complications of e-cigarettes are limited to bronchiectasis, eosinophilic pneumonia, pleural effusion, and suspected hypersensitivity pneumonitis. Diffuse alveolar hemorrhage (DAH) is bleeding into the alveolar spaces of the lung secondary to disruption of the alveolar-capillary basement membrane. We report a case of young male presenting with subacute respiratory failure. He was later found to have diffuse alveolar hemorrhage syndrome that is likely induced by aggressive vaping. This adds up to the rising concern on the possible serious complications of this innovative technology designed as a safer alternative to traditional cigarettes.

Bitetzakis, C., J. Diaz Leyva, W. Mazalewski and B. Zilka, PLEURAL EFFUSION WITH ELECTRONIC CIGARETTE USE: A NOT-SO-SAFE ALTERNATIVE TO TOBACCO. Journal of Hospital Medicine, 2018. **April 8-11; Orlando, Fla. Abstract 487**. Available from:

https://www.shmabstracts.com/abstract/pleural-effusion-with-electronic-cigarette-use-a-not-so-safe-alternative-to-tobacco/.

Itoh, M., K. Aoshiba, Y. Herai, H. Nakamura and T. Takemura, Lung injury associated with electronic cigarettes inhalation diagnosed by transbronchial lung biopsy. Respirol Case Rep, 2018. **6**(1): p. e00282. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29321926.
A 46-year-old healthy man developed respiratory distress, night sweats, fever, and weight loss after using electronic cigarettes (e-cigs) for approximately 1 month. He presented to the hospital when the symptoms worsened 2 months after onset. The findings of bronchoalveolar lavage (BAL) fluid examination and the following transbronchial lung biopsy examination led to the diagnosis of **acute alveolitis: intra-alveolar fibrosis accompanied with exudate containing abundant lipid-laden macrophages, eosinophils, and neutrophils. Eventually, e-cig-induced acute lung injury was diagnosed.** The symptoms were rapidly alleviated upon e-cig use termination and methylprednisolone pulse therapy, and no subsequent recurrence was observed. There have been only a few reported cases of e-cig-induced lung injury. **In e-cig users presenting with atypical pneumonia, close examination by BAL and biopsy should be performed to verify the presence or absence of lipid-laden macrophages.**

Khan, M.S., F. Khateeb, J. Akhtar, Z. Khan, A. Lal, V. Kholodovych, et al., Organizing pneumonia related to electronic cigarette use: A case report and review of literature. Clin Respir J, 2018. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29392888.
BACKGROUND AND OBJECTIVE: Electronic cigarettes (e cigarettes) are battery operated devices that produce aerosol by heating a solution typically made up of nicotine, propylene glycol, glycerin and flavouring agents. The use of e cigarettes has risen dramatically in recent years especially among adolescents and young adults. These devices have been marketed as safer alternatives to tobacco smoking by their manufactures despite lack of adequate safety data. METHODS: We present a case of **40-year-old female patient who developed significant pulmonary toxicity secondary to e cigarette use and** searched existing literature relevant to the case. RESULTS: To our knowledge this is the **second reported case of organizing pneumonia and tenth reported case of pulmonary toxicity related to e cigarette use. Our patient presented with symptoms of worsening dyspnoea and intermittent chest pain for past 1 month. She reported increased use of e cigarettes during this time period to help her quit smoking. Patient developed acute hypoxemic respiratory failure requiring intubation and mechanical ventilation. She was diagnosed with organizing pneumonia on open lung biopsy and was successfully treated with steroids along with abstinence from e cigarette use**. CONCLUSIONS: As the current data on health effects of e cigarettes is limited, case reports can serve important piece of information in this regard. The use of e cigarettes has increased exponentially in recent years and continue to rise; therefore, physicians should be aware of adverse effects and toxicity related to its use.

Marasco, R.D., D. Loizzi, N.P. Ardo, F.N. Fatone and F. Sollitto, Spontaneous Pneumomediastinum Following Electronic Cigarette Use. Ann Thorac Surg, 2018. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29382507.
Spontaneous pneumomediastinum (SPM) is an uncommon condition typically occurring in young males presenting with pleuritic pain, dyspnea and subcutaneous emphysema. We reported an exceptional case of spontaneous pneumomediastinum following electronic cigarette use in an otherwise healthy young man.

Sommerfeld, C.G., D.J. Weiner, A. Nowalk and A. Larkin, Hypersensitivity Pneumonitis and Acute Respiratory Distress Syndrome From E-Cigarette Use. Pediatrics, 2018. Available from: http://pediatrics.aappublications.org/content/pediatrics/early/2018/05/15/peds.2016-3927.full.pdf.
Electronic cigarette (e-cigarette) use, or “vaping,” is gaining widespread popularity as an alternative to conventional cigarettes among adolescents. Little is known of the health risks

of e-cigarette use, especially in children and adolescents. **We present a Case Report of a previously healthy 18-year-old woman who presented with dyspnea, cough, and pleuritic chest pain after e-cigarette use. She developed respiratory failure with hypoxia and was intubated, and ultimately met diagnostic criteria for acute respiratory distress syndrome. Chest tubes were placed to drain worsening pleural effusions. Computed tomography of the chest revealed dependent opacities in both lung bases, superimposed smooth interlobular septal thickening, and pleural effusions. Bronchoalveolar lavage revealed cellular debris and reactive mononuclear cells, and cell counts were remarkable for elevated mononuclear cells and eosinophilia. After the results of a workup for an infectious etiology came back negative, the patient was diagnosed with hypersensitivity pneumonitis and intravenous methylprednisolone therapy was initiated. After this the patient rapidly improved, was weaned off vasopressor support, and was extubated. This is the first reported case of hypersensitivity pneumonitis and acute respiratory distress syndrome as a risk of e-cigarette use in an adolescent,** and it should prompt pediatricians to discuss the potential harms of vaping with their patients. Hypersensitivity pneumonitis, lipid pneumonia, and eosinophilic pneumonia should be included in the differential diagnosis of patients who exhibit respiratory symptoms after the use of an e-cigarette.

Viswam, D., S. Trotter, P.S. Burge and G.I. Walters, Respiratory failure caused by lipoid pneumonia from vaping e-cigarettes. BMJ Case Rep, 2018. **2018**. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29982176.
A young female vaper presented with insidious onset cough, progressive dyspnoea on exertion, fever, night sweats and was in respiratory failure when admitted to hospital. Clinical examination was unremarkable. Haematological tests revealed only thrombocytopenia, which was long standing, and her biochemical and inflammatory markers were normal. **Chest radiograph and high-resolution CT showed diffuse ground-glass infiltrates with reticulation. She was initially treated with empirical steroids and there was improvement in her oxygenation, which facilitated further tests. Since the bronchoscopy and high-volume lavage was unyielding, a video-assisted thoracoscopicsurgical biopsy was done later and was suggestive of lipoid pneumonia. The only source of lipid was the vegetable glycerine found in e-cigarette (EC). Despite our advice to quit vaping, she continued to use EC with different flavours and there is not much improvement in her clinical and spirometric parameters.**

+ve case study
Miler, J.A. and P. Hajek, Resolution of chronic nasal Staphylococcus aureus infection in a non-smoker who started to use glycerine based e-cigarettes: Antibacterial effects of vaping? Med Hypotheses, 2018. **118**: p. 42-43. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30037613.
BACKGROUND: Smokers who switch to vaping report a decrease in respiratory infections. A previous case report of a non-smoker who started to vape and experienced a resolution of chronic tonsillitis proposed that this could be due to bactericidal effects of propylene glycol. Here were report a similar case where a resolution of chronic nasal infection was associated with using glycerol-based nicotine vaporiser. CASE PRESENTATION: **A never-smoker adopted an e-cigarette that his wife was using and after a few weeks of vaping liquids containing vegetable glycerine with low levels of nicotine (3mg/ml) experienced a complete resolution of chronic nasal Staphylococcus aureus infections.** CONCLUSIONS: The improvements cannot be attributed to smoking cessation or bactericidal effects of propylene glycol. The effect could be a coincidence, but it could also be related to bacteriostatic properties of glycerol, or to antimicrobial properties of nicotine and/or the zinc (II) complex of nicotine. Assessments of effects of e-cigarettes with different humectants and nicotine levels in patients with recurrent bacterial respiratory infections could clarify this issue and possibly generate new treatments.

2019

Trauma injuries

Katz, M.G. and K.W. Russell, Injury from E-Cigarette Explosion. N Engl J Med, 2019. **380**(25): p. 2460. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31216401.

Michael, R., N. Ebraheim, J. Maier, M. Tanios and A. Kouri, Electronic Cigarette Burns: A Case Report and Review of Current Literature. Case Rep Orthop, 2019. **2019**: p. 4231764. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31772801.
Due to the development of electronic cigarettes and their use in our patient population, this article seeks to evaluate the safety and associated morbidity that may result from their use. This article also presents a **patient case regarding an explosion of an electronic cigarette battery and the resultant injury and deformity that occurred.**

Quiroga, L., M. Asif, T. Lagziel, D. Bhat and J. Caffrey, E-Cigarette Battery Explosions: Review of the Acute Management of the Burns and the Impact on Our Population. Cureus, 2019. **11**(8): p. e5355. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31608190.
Electronic cigarettes, also known as e-cigarettes (E-cig), are lithium-battery-powered devices, which became available for sale in the United States in 2017. It has gained significant popularity among younger-generation tobacco smokers due to its advertisement as a non-toxic inhalation property and a potential smoking-cessation aid. The US Food and Drug Administration (FDA) has been regulating e-cigarettes as tobacco products and not as drug-delivery devices, as many medical experts think it should be categorized. In the last few years, the medical community has encountered increasing episodes of burn injuries secondary to e-cigarette battery explosion. Explosions occur through a process known as a "thermal runaway." This process occurs when the battery overheats and the internal battery temperature increases dangerously high, to the point of inner fire and explosion. Overcharge, puncture, external heat, short circuit, amongst others, are conditions that cause a "thermal runaway." **This is a retrospective review and analysis of six patients with superficial, partial, and full-thickness burn injuries related to e-cigarette battery explosions managed at Johns Hopkins Bayview Burn Center over the course of one year.** Lund-Browder diagrams and calculations were used to assess the total body surface area (TBSA) burns. Laser Doppler imaging (LDI) was used to evaluate the indeterminate depth of the burn. Only one of our six patients required tangential excision and skin grafting. The rest of our patients were treated conservatively with complex wound care, which included the mixed combination of topical collagenase and bacitracin, collagenase and mafenide, or silver sulfadiazine as a single-agent treatment with an excellent response. Five patients were discharged home within a week, including the patient who required operative excision and auto-grafting. One patient stayed for eight days for pain control and complex wound care. Our experience with these burns has been similar to what is previously reported. Most of these burns are managed with complex wound care without any surgical interventions. The e-cigarette batteries seem more prone to failure due to an inherent weakness in their structural design. This makes them particularly susceptible to the "thermal runaway." Therefore, we recognized the need to expand the regulation and control of the quality of these devices. Prevention of these burns will require continuing education for the community on the use of E-cig. products and its potential hazardous implications. New efforts should be made to educate the community and healthcare providers regarding the potential hazardous implication of carrying these batteries. Also, there is insufficient data to support or deny the long-term health effects of using e-cigarettes.

Suicide

Maessen, G.C., A.M. Wijnhoven, R.L. Neijzen, M.C. Paulus, D.A.M. van Heel, B.H.A. Bomers, et al., Nicotine intoxication by e-cigarette liquids: a study of case reports and pathophysiology. Clin Toxicol (Phila), 2019: p. 1-8. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31286797.
Background: Electronic cigarettes (e-cigarettes), the smokeless alternative to conventional tobacco cigarettes, have become increasingly popular. E-cigarettes vaporise e-liquid, a solution of highly concentrated nicotine, propylene glycol (PG) and vegetable glycerine (VG). With the popularity of e-cigarettes, e-liquid refills have become easily accessible and several cases of intoxication due to the ingestion of e-liquid have been reported. We provide an overview of these cases, their pathophysiology and patients' characteristics. Methods: We carried out a retrospective evaluation of the scientific literature reporting on cases of liquid nicotine intoxication, using the following inclusion criteria: (1) the article is or contains a case report, (2) describes an intoxication with e-liquid, (3) the substance contains nicotine, and (4) intake is oral, intravenous or subcutaneous**. Results: We found 26 case reports describing a total of 31 patients who suffered from e-liquid intoxication. All intoxications up to the age of six were reported as unintentional, whereas nearly all cases from ages 13 to 53 were due to suicide attempts. The three most prevalent symptoms of e-liquid intoxication were tachycardia, altered mental status and vomiting. Eleven cases resulted in the death of the patient.** In the survivors, the highest plasma concentration of nicotine was 800 microg L(-1), while the lowest concentration in the non-survivors was 1600 microg L(-1). Conclusions: There is a mismatch between the generally accepted lethal oral nicotine dose of 60 mg, resulting in approximately 180 microg L(-1) plasma concentration, and the 4.4- to 8.9-fold higher lethal plasma concentrations we found in cases of e-liquid intoxication. In these severe intoxications, plasma cotinine concentration does not act as a more reliable indicator of nicotine intoxication than nicotine itself. The ages of the patients display a bimodal distribution. In patients above the age of 10, intoxication results mainly from suicide attempts rather than accidental ingestion. The role of PG and VG in e-liquid intoxications is remarkably unclear. However, the similarity across nicotine and PG toxicity symptoms leads us to believe a cumulative effect cannot be excluded.

Respiratory

Aftab, G., M. Ahmad and D. Frenia, Vaping-associated Lung Injury. Cureus, 2019. **11**(11): p. e6216. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31890417.
Many cases related to vaping-associated lung injury have recently been reported to the Center for Disease Control (CDC). **It is, therefore, important for clinicians to be aware of this disease. Here, we present the case of a 46-year-old female patient, who had recently started vaping. She presented to the hospital with dyspnea; since her condition deteriorated quickly, she was mechanically ventilated for acute respiratory failure. When a computed tomography angiography (CTA) chest was performed, patchy alveolar opacities were seen throughout both lungs. The patient's workup for infectious and cardiac etiology was negative. She was diagnosed with vaping-associated lung injury.** Later, she recovered and was discharged to a rehabilitation center.

American College of Chest Physicians, *Vaping is not a safe substitute for smoking and can damage the lungs--a case study of granulomatosis resulting from vaping*, in *Cision PR Newswire*. 2019. Available from: https://www.prnewswire.com/news-releases/vaping-is-not-a-safe-substitute-for-smoking-and-can-damage-the-lungsa-case-study-of-granulomatosis-resulting-from-vaping-300937522.html.

Arter, Z.L., A. Wiggins, C. Hudspath, A. Kisling, D.C. Hostler and J.M. Hostler, Acute eosinophilic pneumonia following electronic cigarette use. Respir Med Case Rep, 2019. **27**: p. 100825. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30963023.

Electronic cigarette (e-cigarette) use, or vaping, is gaining widespread popularity among adults aged 18-35. Vaping is commercially promoted as a safer alternative to traditional cigarette smoking. Previous studies have reported a close relationship between conventional cigarette smoking and acute eosinophilic pneumonia (AEP), but only one case report to date associates vaping with AEP in a male patient**. We present the first case of AEP involving a young female after use of e-cigarettes. Clinicians should consider AEP when evaluating young patients with hypoxic respiratory** failure and a recent history of e-cigarette use. This case highlights the need for more research into the relationship between e-cigarettes and AEP.

Bakre, S.A., T.S. Al-Farra and S. Al-Farra, Diffuse alveolar damage and e-cigarettes: Case report and review of literature. Respir Med Case Rep, 2019. **28**: p. 100935. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31667071.
The prevalence of e-cigarette usage has increased in non-smokers and those who are planning to quit smoking since introduced in 2003. Although the potential long term adverse effects have not been studied in humans, **there have been studies showing that e-cigarette vapor causes release of proinflammatory cytokines leading to cytotoxic damage to alveolar epithelial cells, increase in the release of fibroblast growth factor (FGF) in the alveolar epithelial cells which leads to fibroblastic proliferation, and increased risk of staphylococcus aureus and viral infections which are implicated in the pathogenesis of diffuse alveolar damage. We describe a case of a 47-year-old woman who was diagnosed with histologically confirmed diffuse alveolar damage (DAD). She had no significant medical history and she had been smoking e-cigarettes for 3 years prior to presentation. This case report describes the potential association between e-cigarettes and diffuse alveolar damage** while making reference to relevant associated studies.

Bonilla, A., A.J. Blair, S.M. Alamro, R.A. Ward, M.B. Feldman, R.A. Dutko, et al., Recurrent spontaneous pneumothoraces and vaping in an 18-year-old man: a case report and review of the literature. J Med Case Rep, 2019. **13**(1): p. 283. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31495337.
BACKGROUND: Primary spontaneous pneumothorax is a common disorder occurring in young adults without underlying lung disease. Although tobacco smoking is a well-documented risk factor for spontaneous pneumothorax, an association between electronic **cigarette use (that is, vaping) and spontaneous pneumothorax has not been noted. We report a case of spontaneous pneumothoraces correlated with vaping**. CASE PRESENTATION: An 18-year-old Caucasian man presented twice with recurrent right-sided spontaneous pneumothoraces within 2 weeks. He reported a history of vaping just prior to both episodes. Diagnostic testing was notable for a right-sided spontaneous pneumothorax on chest X-ray and computed tomography scan. His symptoms improved following insertion of a chest tube and drainage of air on each occasion. In the 2-week follow-up visit for the recurrent episode, he was asymptomatic and reported that he was no longer using electronic cigarettes. CONCLUSIONS: Providers and patients should be aware of the potential risk of spontaneous pneumothorax associated with electronic cigarettes.

Bradford, L.E., M.E. Rebuli, B.J. Ring, I. Jaspers, K.E. Clement and C.E. Loughlin, Danger in the vapor? ECMO for adolescents with status asthmaticus after vaping. J Asthma, 2019: p. 1-5. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31352844.
Introduction: Electronic nicotine delivery systems (ENDS) use is on the rise in the adolescent and young adult populations, especially in the wake of sweet flavored ENDS solutions and youth-targeted marketing. While the extent of effect of ENDS use and aerosolized flavorings on airway epithelium is not known, there remains **significant concern that use of ENDS adversely affects airway epithelial function, particularly in populations with asthma**. Case Study: In this case series, we review **two cases of adolescents with history of recent and past ENDS use and asthma who required veno-venous extracorporeal membrane oxygenation (VV-ECMO) for status asthmaticus in the year 2018.** Results: Both patients

experienced hypercarbic respiratory failure requiring VV-ECMO secondary to their status asthmaticus, with slow recovery on extensive bronchodilator and steroid regimens. They both recovered back to respiratory baseline and were counseled extensively on cessation of ENDS use. Conclusion: While direct causation by exposure to ENDS cannot be determined, exposure likely contributed to symptoms. Based on the severity of these cases and their potential relationship with ENDS use, we advocate for increased physician screening of adolescents for ENDS use, patient and parent education on the risks of use, and family cessation counseling.

CDC, *Transcript of August 23, 2019, Telebriefing on Severe Pulmonary Disease Associated with Use of E-cigarettes*, in *Centers for Disease Control and Prevention*. 2019. Available from: https://www.cdc.gov/media/releases/2019/t0823-telebriefing-severe-pulmonary-disease-e-cigarettes.html.

Chand, H.S., T. Muthumalage, W. Maziak and I. Rahman, Pulmonary Toxicity and the Pathophysiology of Electronic Cigarette, or Vaping Product, Use Associated Lung Injury. Front Pharmacol, 2019. **10**: p. 1619. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31992985.
New emerging tobacco products, especially electronic cigarettes (E-Cig) or electronic nicotine delivery systems (ENDS), have gained a huge popularity, particularly in younger populations. The lack of sufficient evidence-based health effect studies has promoted widespread use/abuse with the assumption that E-Cig or ENDS and/or vaping products are safer and less toxic than conventional tobacco smoking. However, the recent escalation in acute lung injuries and their associated fatalities among ENDS or vaping product users has now brought attention to this silent epidemic via investigation into the constituents of ENDS/vaping products and their toxic effects on pulmonary health. Accordingly, CDC has declared an "outbreak" of the e-cigarette or vaping product use associated lung injury (EVALI). EVALI is characterized by sterile exogenous pneumonitis like reaction with substantial involvement of innate immune mechanisms. Vitamin-E acetate (VEA) is found in counterfeit cartridges and bronchoalveolar lavage fluid of EVALI patients. Other reports implicated the presence of aromatic/volatile hydrocarbons and oils consisting of medium-chain triglycerides (MCT oil), including terpenes and mineral oil in tetrahydrocannabinol (THC) containing counterfeit vaping products. These compounds are involved in oxidative stress and inflammatory responses in the lung. Here, we provide the perspectives on the recent case reports on EVALI, etiology, and discuss pulmonary toxicity as well as the mechanisms underlying EVALI susceptibility and lung pathophysiology.

Chatham-Stephens, K., K. Roguski, Y. Jang, P. Cho, T.C. Jatlaoui, S. Kabbani, et al., Characteristics of Hospitalized and Nonhospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injury - United States, November 2019. MMWR Morb Mortal Wkly Rep, 2019. **68**(46): p. 1076-1080. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31751326.
CDC, the Food and Drug Administration (FDA), state and local health departments, and public health and clinical stakeholders are investigating a nationwide outbreak of e-cigarette, or vaping, product use-associated lung injury (EVALI) (1). As of November 13, 2019, 49 states, the District of Columbia, and two U.S. territories (Puerto Rico and U.S. Virgin Islands) have reported 2,172 EVALI cases to CDC, including 42 (1.9%) EVALI-associated deaths. To inform EVALI surveillance, including during the 2019-20 influenza season, case report information supplied by states for hospitalized and nonhospitalized patients with EVALI were analyzed using data collected as of November 5, 2019. Among 2,016 EVALI patients with available data on hospitalization status, 1,906 (95%) were hospitalized, and 110 (5%) were not hospitalized. Demographic characteristics of hospitalized and nonhospitalized patients were similar; most were male (68% of hospitalized versus 65% of nonhospitalized patients), and most were aged <35 years (78% of hospitalized versus 74% of nonhospitalized patients). These patients also reported similar use of tetrahydrocannabinol

(THC)-containing products (83% of hospitalized versus 84% of nonhospitalized patients). Given the similarity between hospitalized and nonhospitalized EVALI patients, the potential for large numbers of respiratory infections during the emerging 2019-20 influenza season, and the potential difficulty in distinguishing EVALI from respiratory infections, CDC will no longer collect national data on nonhospitalized EVALI patients. Further collection of data on nonhospitalized patients will be at the discretion of individual state, local, and territorial health departments. Candidates for outpatient management of EVALI should have normal oxygen saturation (>/=95% while breathing room air), no respiratory distress, no comorbidities that might compromise pulmonary reserve, reliable access to care, strong social support systems, and should be able to ensure follow-up within 24-48 hours of initial evaluation and to seek medical care promptly if respiratory symptoms worsen. Health care providers should emphasize the importance of annual influenza vaccination for all persons aged >/=6 months, including persons who use e-cigarette, or vaping, products (2,3).

Landman ST, Dhaliwal I, Mackenzie CA, Martinu T, Steel A, et al. Life-threatening bronchiolitis related to electronic cigarette use in a Canadian youth. Canadian Medical Association Journal, 2019; 191(48):E1321-E31. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31753841

Background: Although electronic cigarettes (e-cigarettes) were initially marketed as a potential smoking-cessation aid and a safer alternative to smoking, the long-term health effect of e-cigarette use ("vaping") is unknown. Vaping e-liquids expose the user to several potentially harmful chemicals, including diacetyl, a flavouring compound known to cause bronchiolitis obliterans with inhalational exposure ("popcorn worker's lung").

Case description: We report the case of a 17-year-old male who presented with intractable cough, progressive dyspnea and malaise after vaping flavoured e-liquids and tetrahydrocannabinol intensively. Initial physical examination showed fever, tachycardia, hypoxemia, and bibasilar inspiratory crackles on lung auscultation. Computed tomography of the chest showed diffuse centrilobular "tree-inbud" nodularity, consistent with acute bronchiolitis. Multiple cultures, including from 2 bronchoalveolar lavage samples, and biopsy stains, were negative for infection. He required intubation, invasive mechanical ventilation and venovenous extracorporeal membrane oxygenation (ECMO) for refractory hypercapnia. The patient's condition improved with high-dose corticosteroids. He was weaned off ECMO and mechanical ventilation, and discharged home after 47 days in hospital. Several months after hospital discharge, his exercise tolerance remained limited and pulmonary function tests showed persistent, fixed airflow obstruction with gas trapping. The patient's clinical picture was suggestive of possible bronchiolitis obliterans, thought to be secondary to inhalation of flavouring agents in the e-liquids, although the exact mechanism of injury and causative agent are unknown.

Interpretation: This case of severe acute bronchiolitis, causing near-fatal hypercapnic respiratory failure and chronic airflow obstruction in a previously healthy Canadian youth, may represent vaping-associated bronchiolitis obliterans. This novel pattern of pulmonary disease associated with vaping appears distinct from the type of alveolar injury predominantly reported in the recent outbreak of cases of vaping-associated pulmonary illness in the United States, underscoring the need for further research into all potentially toxic components of e-liquids and tighter regulation of e-cigarettes.

Macedonia, T.V., S.D. Krefft and C.S. Rose, Persistent Severe Fixed Airways Obstruction in a High-Dosing E-cigarette User. J Gen Intern Med, 2019. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31705470.

Electronic Nicotine Delivery Systems (ENDS), commonly referred to as "e-cigs," were first introduced in the United States in 2007. Since then, their use has grown substantially, with the largest market among adolescents and young adults. ENDS are often perceived by the public as safe alternatives to traditional cigarettes and as aids in smoking cessation. Little is known about inhalational hazards of e-cigs. **We describe the case of a 45-year-old man who developed acute respiratory symptoms associated with onset of severe fixed airways obstruction 9 months after he quit traditional cigarettes and began high-dose vaping. Lung biopsy showed respiratory bronchiolitis. Analysis of his heated e-cigarette solution identified a mixture containing vanillin, aldehydes, alcohols and other chemicals, the inhalation effects of which have not been well-studied.** This case report adds to the

growing literature describing potentially severe lung health effects of vaping and provides a framework for taking a clinical vaping history so that the health consequences of e-cigarettes may be better understood.

Ocampo-Gonzalez, F.A. and J.W. Park, Cytologic features of vaping-induced lung injury: A case report. Diagn Cytopathol, 2019. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31714032.
Vaping-induced lung injury is a recently recognized phenomenon owing to the rising popularity of e-cigarette use. A cluster of cases of varying severity, including six deaths, was recently reported in the United States by the Centers for Disease Control. The objective of this report is to highlight the cytologic features suggestive of vaping-induced lung injury. A 20-year-old previously healthy man presented with a 7-day history of progressively worsening respiratory symptoms including dyspnea on exertion, cough, and fever, with no improvement after initiating a course of antibiotics. No relevant travel or occupational history was reported, but patient endorsed daily use of e-cigarette with a fluid containing both tetrahydrocannabinol and nicotine. Radiographic studies demonstrated scattered areas of interlobular septal thickening and diffuse ground-glass opacities in both lungs. Laboratory tests for HIV and influenza were negative. Bronchoscopy and bronchoalveolar lavage were performed, with cytologic study showing clusters of benign bronchial cells and an increase in lipid-laden macrophages by Oil Red O stain. Patient was placed on steroid and steadily improved for the next 2 days. He was discharged on a steroid taper and follow-up with respiratory clinic. Case reports and series have shown a variety of lung injury patterns in previously healthy patients who are frequent users of e-cigarettes and among them features suggestive of lipoid pneumonia with increased lipid-laden macrophages. The clinical utility of this finding is still unclear.

Sharma, M., H. Anjum, C.P. Bulathsinghala, M. Buch and S.R. Surani, A Case Report of Secondary Spontaneous Pneumothorax Induced by Vape. Cureus, 2019. **11**(11): p. e6067. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31827996.
Electronic cigarettes (referred here as E-cigarettes or vapes) are devices that contain heated nicotine/cannabinol vaporized aerosol solution for consumption. While long-term toxicities of E-cigarettes are unknown, the acute adverse events of vaping that have occurred are concerning. There have been variations of pneumonitis presentations so far, however, very few case reports have been shown to have a complication of a pneumothorax. We hereby present a case of a 35-year-old male who presented with spontaneous pneumothorax and pneumonitis due to vaping.

Song, M., S. Cai, H. Luo, Y. Jiang, M. Yang, Y. Zhang, et al., Short-term pulmonary infiltrate with eosinophilia caused by asthma: a phenotype of severe, eosinophilic asthma? Five cases and a review of the literature. Allergy Asthma Clin Immunol, 2019. **15**: p. 48. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31462900.
Background: Asthma is often accompanied by peripheral eosinophilia and eosinophilic airway inflammation. This article explores the relationship between asthma and short-term pulmonary infiltrate with eosinophilia, which results from irregular asthma treatment. Case presentation: We report five unique cases of asthma-induced short-term eosinophilic pneumonia encountered at our pulmonary and critical care centre in Hunan, China, from January 1, 2014, to August 31, 2018. The 5 asthma patients were women with persistent dyspnoea symptoms, an increased peripheral eosinophil count and a high level of exhaled nitric oxide (FeNO). **Chest CT revealed multiple infiltrates and ground-glass opacities in both lung fields in all 5 patients. Four of the 5 patients had increased eosinophils in bronchoalveolar lavage (BAL). Three were positive for reversibility in lung function testing, and two had eosinophil infiltration as revealed by lung biopsy. No antibiotic treatment was given, and after a short period of glucocorticoid therapy and inhaled corticosteroid plus long-acting beta2-agonist (ICS + LABA) treatment, the symptoms of all of the patients disappeared. In addition, their blood eosinophils returned to normal, and their lung**

lesions were quickly absorbed and improved. Conclusion: These cases show a unique association between short-term eosinophilic pneumonia and asthma. The occurrence of eosinophilic pneumonia can prove fatal during a serious asthma attack. Additionally, the presence of peripheral eosinophilia with lung infiltrates poses a diagnostic challenge for clinicians by creating suspicion of pulmonary infiltrate with eosinophilia when present in asthmatic patients.

Spaulding, K.H., P.C. Ng and M.D. April, Idiopathic acute eosinophilic pneumonia: A rare cause of hypoxic respiratory failure. Am J Emerg Med, 2019: p. 158386. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31427164.
Idiopathic Acute Eosinophilic Pneumonia (IAEP) is a life-threatening cause of hypoxic respiratory failure. IAEP is challenging to diagnose as it may mimic infectious pneumonia or acute respiratory distress syndrome. Distinguishing IAEP from these alternatives is important; the mainstay of treatment for IAEP is corticosteroids, a therapy which might not otherwise be indicated. Patients treated appropriately usually experience a full recovery. In this case report we describe the presentation, evaluation, and management of a 19-year old male who presented to the emergency department (ED) in respiratory failure from IAEP. The patient was a military trainee who recently moved to the United States from Saudi Arabia. He also recently began smoking cigarettes for the first time, a known risk factor for IAEP. Upon initial presentation, the patient was in respiratory distress and had an oxygen saturation of 82% on room air. His ED diagnostic workup included chest X-ray showing diffuse interstitial thickening and chest computed tomography that demonstrated diffuse nodular opacification of pulmonary parenchyma. The patient was admitted to the intensive care unit (ICU) where bronchoscopy yielded cytology with 30% eosinophilia. The patient ultimately required 3days of extra corporeal membrane oxygenation (ECMO) due to worsening hypoxic respiratory failure. After both intravenous and outpatient oral steroid treatments, the patient went on to have a full recovery with no ongoing respiratory issues. To our knowledge, this is the first case of IAEP requiring ECMO reported in the emergency medicine literature.

Stubley, P., *Vaping 'linked to 200 health problems in UK including pneumonia'*, in *Independent*. 2019. Available from: https://www.independent.co.uk/news/health/vaping-uk-pneumonia-lung-disease-deaths-us-mhra-e-cigarette-a9125581.html.

Wilhite, R., T. Patel, E. Karle, S. Shankar and A. Krvavac, Diffuse Alveolar Hemorrhage: An Uncommon Manifestation of Vaping-associated Lung Injury. Cureus, 2019. **11**(12): p. e6519. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32025438.
Vaping involves the use of a device to deliver aerosolized nicotine and tetrahydrocannabinol (THC) oils to the lungs. Vaping continues to increase in popularity; however, because it is a novel drug delivery system there is little evidence regarding its safety and long-term consequences. Here, we present a 22-year-old Caucasian male who was admitted with acute hypoxic respiratory failure and massive hemoptysis. Contrasted computed tomography of the chest demonstrated ground glass opacities throughout all lung fields and bilateral pulmonary emboli. Bronchoalveolar lavage revealed increased red blood cell counts in serial aliquots, consistent with the diagnosis of diffuse alveolar hemorrhage (DAH). An extensive workup did not reveal an etiology for the DAH. However, further history was obtained, and the patient divulged daily vaping of THC. E-cigarette, or vaping, product use associated lung injury (EVALI) consists of a myriad of different lung injury patterns. Our case illustrates an uncommon presentation of EVALI with DAH and multiple pulmonary emboli.

Layden JE, Ghinai I, Pray I, Kimball A, Layer M, et al. Pulmonary Illness Related to E-Cigarette Use in Illinois and Wisconsin — Preliminary Report. 2019. Available from: https://www.nejm.org/doi/full/10.1056/NEJMoa1911614(Layden, Ghinai et al. 2019)

Other adverse health effects

Azevedo, A., I. Lobo and M. Selores, Allergic contact dermatitis and electronic cigarettes: Is nickel to blame? Contact Dermatitis, 2019. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30834540.

Okuni-Watanabe, M., K. Kurata and K. Yakushijin, The First Case of E-Cigarette-Induced Polycythemia. Case Rep Hematol, 2019. **2019**: p. 2084325. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31885951.
A 71-year-old male smoker was referred to our hospital because of increased hemoglobin and hematocrit. At initial consultation, his hemoglobin and hematocrit levels were 21.8 g/dl and 64.8%, respectively. Other laboratory data and his cardiopulmonary functions were almost normal, and JAK2 V617F mutation was negative. He had smoked about 25 cigarettes per day for 50 years until the age of 70, when he switched from conventional smoking to electronic cigarettes (e-cigarettes). We requested that he quit e-cigarette use. Thereafter, his hemoglobin and hematocrit gradually decreased and normalized. Here, we report the first case of e-cigarette-induced polycythemia.

Peterson, E., N. Ugonabo, A.G. Franks and K. Lo Sicco, Case report of discoid lupus erythematosus in association with electronic cigarette use. JAAD Case Rep, 2019. **5**(12): p. 1030-1032. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31763427.

Irusa, K.F., B. Vence and T. Donovan, Potential oral health effects of e-cigarettes and vaping: A review and case reports. J Esthet Restor Dent, 2020. **32**(3): p. 260-264. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32243711.
OBJECTIVE: In this article, the potential oral health consequences of vaping are described. While most dentists are likely aware of the potential serious health effects involved with vaping, the aim of this article was to raise awareness on identified oral health consequences. CLINICAL CONSIDERATIONS: Three patients presented to one dental practice with unusual patterns of dental caries, and all three admitted to regular vaping. Vaping components include propylene glycol, glycerin, nicotine, and flavors, which contain sucrose, sucralose, and ethyl maltol. The vapor produced by vaping devices is thick and viscous and much of it is retained on oral tissues. There are over 10 000 different vaping liquids, including some that contain tetrahydrocannabinol (THC) and vitamin E acetate. Vaping clearly has the potential to negatively affect general health, periodontal health, and accelerate the development of caries. There is also evidence that teenagers are being attracted to vaping in astonishing numbers. CONCLUSIONS: The general health consequences of vaping have received considerable attention in the national media. There is much to be learned about the consequences of this behavior. There are also potential serious oral health consequences to vaping. It is likely that the composition of certain vaping solutions may make them more harmful than others CLINICAL SIGNIFICANCE: It is important that dental professionals are made aware of the potential problems related to vaping. Initial reports show that the effect of e-cigarettes on periodontal tissues is similar to that of conventional cigarettes. Some vaping formulations may be highly cariogenic, especially those with sweet flavors, which are used to attract young people. Patients should be routinely questioned about their vaping habits in the medical-dental history.

Trauma injuries

Beining, T., J.R. Thogmartin and W. Kurz, Projectile wound to head from modified electronic cigarette explosion. Journal of Forensic Sciences, 2020. **65**(4): p. 1365-1367. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32202654.
One of the dangers of a rapidly growing technology industry is the risk involved in being intimately close to lithium-ion batteries. When exposed to improper conditions, lithium-ion batteries in a variety of devices have been reported to ignite and, in some cases, explode. With the rise of electronic cigarette use and modifications, the lithium-ion batteries in these devices are subject to a higher risk of malfunction. This is a retrograde analysis of a 38-year-old man who experienced fatal penetrating head trauma while using a modified electronic cigarette device. The findings suggest that the trauma from the explosion was caused by the thermal runaway of the lithium-ion battery in the modified e-cigarette.

Hagarty, S. and J. Luo, E-cigarette "Vape" Device Explosion Causing C Spine Fracture. Plast Reconstr Surg Glob Open, 2020. **8**(4): p. e2745. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32440415.
Electronic cigarette (e-cigarette) use has grown exponentially since its introduction to the US market in 2007.1 Sales went largely unregulated until 2016, when the Food and Drug Administration expanded tobacco laws to encompass the manufacturing, distribution, and marketing of e-cigarette products.2,3 Production safety standards are still being established. Rechargeable lithium batteries used have been reported to combust. The US Fire Administration reported 195 cases of e-cigarette explosions and fires from 2009 to 2016. The proximity of the explosions can cause serious burns and facial trauma to the user.3,4 We present a case report of a 30-year-old woman with oral soft tissue and dental injuries, C1 fracture, and left vertebral artery dissection from an e-cigarette explosion.

Lagasse, L.P., A.S. Grant, M.K.R. Minosa, R.D. Kennedy and J.E. Cohen, Availability and advertising of electronic cigarettes in two Russian cities following implementation of comprehensive tobacco advertising restrictions. Tob Induc Dis, 2020. **18**: p. 04. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31997986.
INTRODUCTION: Electronic cigarettes (e-cigarettes) continue to gain popularity globally. Jurisdictions with comprehensive tobacco control policies, which limit the use and availability of combustible tobacco products but do not regulate e-cigarettes (as in Russia), may be vulnerable to the expansion of the e-cigarette market. METHODS: Using McNemar's test conducted in STATA, this observational study assessed changes between 2014 and 2016 in the availability of e-cigarettes across 239 retail outlets in Moscow and St Petersburg. Also, this study characterized the presence of retail advertising and promotion of e-cigarettes in 2016. RESULTS: Between 2014 and 2016, the availability and display of e-cigarettes increased within traditional tobacco product retail venues (27.6% in 2014 vs 51.9% in 2016; $p<0.01$). CONCLUSIONS: Observations indicate that there has been an increase in the proportion of retailers selling and displaying e-cigarettes.

Yumoto, T., H. Hamaguchi, S. Mae and A. Nakao, Potentially fatal ingestion of heat-not-burn cigarettes successfully treated by gastric lavage. Journal of the American College of Emergency Physicians Open, 2020. **1**(6): p. 1709-1711. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33392579.
Newly introduced heat-not-burn or electronic cigarettes can cause lethal nicotine intoxication if ingested at higher doses. Although routine gastric lavage is not recommended, it should be considered if the amount of intoxicant is lethal. A 59-year-old man with a history of depression was brought to our emergency department after intentional ingestion of 8 heat-not-burn cigarettes, which were estimated to contain a total of 100 mg of nicotine.

Abdominal computed tomography confirmed the gastric contents, detecting multiple stick-like and rod-shaped high-density structures. Gastric lavage was performed to minimize absorption of the potentially lethal nicotine dose. The patient exhibited only mild gastrointestinal symptoms. Emergency physicians should be aware of this novel heat-not-burn cigarette and its toxicity.

Respiratory

Acharya, S., S.I. Ali, S. Anwar and A. Glaser, DO NOT FALL to the VAPE TRAP! Respir Med Case Rep, 2020. **31**: p. 101165. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32685366.
Introduction: Whilst the use of combustible tobacco products continues to decline in the United States, the use of e-cigarettes has seen an explosive rise in recent years. In 2019 an outbreak on EVALI was seen across the country, highlighting the fact that e-cigarettes may not be as harmless as previously perceived. Case description: A 22-year-old male came to the emergency department complaining of vomiting and shortness of breath. Patient reported using a "pod" a day of a "JUUL" e-cigarette. Patient's oxygen requirement continued to increase and was eventually shifted to the intensive care unit and mechanically ventilated. After a course of intravenous glucocorticoids, the patient was successfully weaned off the mechanical ventilation to oral glucocorticoids and discharged. Discussion: Our patient's clinical course can be described as a "classic" case of EVALI. But in contrast to previously reported cases, our patient did not use e-cigarettes known to contain vitamin E acetate or THC two common substances implicated in EVALI. Our patient exclusively used a JUUL e-cigarette at a rate much higher than the typical user. The widespread use of JUUL and e-cigarettes especially amongst the younger demographics is especially concerning. Conclusion: Research efforts must be directed towards the substances utilized in e-cigarettes, and their use should be actively discouraged.

Ahmad, M., G. Aftab, S. Rehman and D. Frenia, Long-term Impact of E-cigarette and Vaping Product Use-associated Lung Injury on Diffusing Capacity for Carbon Monoxide Values: A Case Series. Cureus, 2020. **12**(2): p. e7002. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32206466.
There has been an outbreak of lung injury associated with e-cigarettes and vaping in the United States since early 2019. We present two cases who were admitted to the hospital with shortness of breath and cough. Chest imaging showed they had interstitial changes. They were diagnosed with e-cigarette and vaping product use-associated lung injury (EVALI) and treated with steroids and supportive management. With an improvement in symptoms, they were discharged home. On follow-up in the clinic, both patients were asymptomatic and had complete resolution of radiographic abnormalities. However, pulmonary function testing showed reduced diffusion capacity for carbon monoxide (DLCO). Total lung capacity (TLC), forced vital capacity (FVC), forced expiratory volume in the first one second (FEV-1), and the FEV-1/FVC ratio were normal.

Akkanti, B.H., R. Hussain, M.K. Patel, J.A. Patel, K. Dinh, B. Zhao, et al., Deadly combination of Vaping-Induced lung injury and Influenza: case report. Diagn Pathol, 2020. **15**(1): p. 83. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32646452.
BACKGROUND: E-cigarette and vaping use-associated acute lung injury (EVALI) has been recently recognized as a complication in individuals who use vaping devices. Another consideration is that EVALI may have an adverse influence on the outcome of intercurrent respiratory infections. We document this deadly combination in the case of a young man who had EVALI and simultaneous 41 Influenza-A infection leading to severe Acute Respiratory Distress Syndrome (ARDS). CASE PRESENTATION: A 27-year-old male with a history of tobacco and vaping use was admitted to hospital after two weeks of flu-like symptoms, diarrhea and vomiting. A chest x-ray was consistent with multifocal pneumonia, and microbiological tests were positive for Influenza-A and methicillin-sensitive

Staphalacoccus aureus (MSSA). Bronchoscopy provided evidence of acute inhalational injury. After admission, he acutely decompensated with severe hypoxia and hypotension; he required intubation, sedation and vasopressors. He developed sepsis with acute kidney failure, liver failure, biventricular systolic dysfunction and severe rhabdomyolysis. He was placed on veno-venous (VV) extracorporeal membrane oxygenation (ECMO) initially and later changed to Veno-Arterial (VA) ECMO. Nevertheless, the patient continued to deteriorate, and he expired two weeks after admission. CONCLUSION: This case documents that EVALI can act as a major factor leading a respiratory infection to progress into severe ARDS with a fatal outcome.

Al-Abdouh, A., E. Phillips and M.G. Allison, E-Cigarette or Vaping Product Use-Associated Lung Injury: A Severe Case That Responded to Corticosteroid Treatment. Cureus, 2020. **12**(11): p. e11544. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33365213.
Vaping is associated with an increased risk of lung injury; however, each case of vaping-associated lung injury leads to varying degrees of lung injury, and the response to therapy can be heterogeneous. Corticosteroid use has been suggested as a treatment for lung injuries associated with vaping. We report a case of e-cigarette or vaping product use-associated lung injury (EVALI) that resulted in acute hypoxic respiratory failure. A 20-year-old woman presented with complaints of sore throat, dry cough, shortness of breath, and pleuritic chest pain. The patient admitted to vaping regularly for the past three years. The patient was found to be severely hypoxemic with respiratory distress and was intubated shortly after her arrival at the emergency department. She was treated with a short course of corticosteroids with tapering of the dose based on her response with significant improvement, and she was extubated on the seventh day of her admission. EVALI is a syndrome associated with severe lung injury that results in acute respiratory failure that is clinically indistinguishable from acute respiratory distress syndrome, and it is largely a diagnosis of exclusion. The use of systemic corticosteroids in treating these patients should be considered after excluding an infectious etiology.

Aldy, K., D.J. Cao, S. Hsu, M. McGetrick, D. Willcutts, G. Verbeck, et al., Severe E-cigarette, or Vaping, Product Use Associated Lung Injury Requiring Venovenous Extracorporeal Membrane Oxygenation. Pediatr Crit Care Med, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32150124.
OBJECTIVES: To report a severe case of e-cigarette or vaping product use-associated lung injury with complex course requiring venovenous extracorporeal membrane oxygenation. DESIGN: Case report. SETTING: PICU in an academic medical center. PATIENTS: A 16-year-old girl presenting with gastrointestinal and respiratory symptoms was admitted to our PICU after having progressive respiratory failure and bilateral pulmonary ground-glass opacities on chest CT. INTERVENTIONS: Venovenous extracorporeal membrane oxygenation MEASUREMENTS AND MAIN RESULTS:: After extensive infectious workup was unrevealing, she reported a history of vaping e-cigarette containing either nicotine or delta-9-tetrahydrocannabinol oil prior to symptom onset. She was given a presumptive diagnosis of e-cigarette or vaping product use-associated lung injury. The PICU team in consultation with pulmonology and medical toxicology started high-dose IV methylprednisolone 1 mg/kg bid. Despite initial improvements, she continued to require positive pressure ventilation and developed pneumomediastinum with progression to tension pneumothoraces and a persistent air leak. Unable to maintain her oxygenation, she was placed on venovenous extracorporeal membrane oxygenation for a prolonged course and had a tracheostomy placement. The clinical course, severity, and range of interventions in affected patients around the country have varied widely. Respiratory symptoms have been the most severe, but the constellation of symptoms in e-cigarette or vaping product use-associated lung injury include constitutional symptoms (fevers, weight-loss) and gastrointestinal symptoms (nausea, vomiting, diarrhea). In many cases, steroid use led to rapid clinical improvements. However, other cases with severe illness, like our patient, necessitated high-dose IV steroids, intubation, and venovenous extracorporeal membrane oxygenation. The underlying etiology

and pathophysiology of e-cigarette or vaping product use-associated lung injury remains unknown. The Centers for Disease Control and Prevention in conjunction with state/local health departments and the Food and Drug Administration is actively investigating the outbreak. CONCLUSIONS: Clinicians need to be aware of the current outbreak of e-cigarette or vaping product use-associated lung injury and ask about vaping in patients presenting with gastrointestinal and respiratory symptoms. Treatment options are anecdotal and necessitate a multidisciplinary approach.

Ali, M., K. Khan, M. Buch, M. Ramos-Ramirez, M. Sharma, S. Patel, et al., A Case Series of Vaping-Induced Lung Injury in a Community Hospital Setting. Case Rep Pulmonol, 2020. **2020**: p. 9631916. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32082682.
Acute and subacute injury to the lung parenchyma can be caused by multiple products. Over the past few years, vaping (also known as E-cigarettes) has become a popular trend and has been considered "safer" alternative to smoking cigarettes, especially among young adults. The use of E-cigarettes has rapidly increased, and according to the most recent report by CDC released at the end of December 2019, 2,506 cases and more than 54 associated deaths due to vaping/E-cigarette-associated lung injury were reported. Though vitamin E acetate and tetrahydrocannabinol (THC) have been found in most of the bronchoalveolar lavage samples, there are still small numbers of cases that have not reported to using THC-containing compounds. Research looking into other possible constituents in E-cigarettes that can account for the etiology of disease and effects of vaping as it relates to pulmonary physiology still remains limited and uncertain. We hereby present a case series of 5 patients who were admitted primarily for respiratory symptoms of cough, dyspnea, and fevers and were diagnosed with vaping-induced pulmonary injury.

Antwi-Amoabeng, D. and R. Islam, Vaping Is Not Safe: A Case of Acute Eosinophilic Pneumonia following Cannabis Vapor Inhalation. Case Rep Pulmonol, 2020. **2020**: p. 9496564. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32047695.
There is a well-established association between inhalational exposures and acute eosinophilic pneumonia (AEP). The most reported exposure is cigarette smoking. Here, we present a case of progressive shortness of breath and nonproductive cough in a college student with no significant medical history, approximately 10 days after inhaling cannabis aerosols on two separate occasions. He was started on empiric antibiotics and bronchodilators without improvement. He was diagnosed with AEP based on peripheral eosinophilia and high-resolution CT image results. He made rapid recovery on intravenous glucocorticoids. Vaping has gained popularity among young adults mainly due to the perception that it is a safe alternative to smoking. This case shows that there may be a false sense of security with vaping. Vaping poses a yet-to-be quantified public health threat, which requires further studies.

Armatas C, Heinzerling A and W. JA, *Notes from the Field: E-cigarette, or Vaping, Product Use–Associated Lung Injury Cases During the COVID-19 Response — California*, in *MMWR Morb Mortal Wkly Rep*. 2020. p. 801–802. Available from: https://www.cdc.gov/mmwr/volumes/69/wr/mm6925a5.htm?s_cid=mm6925a5_w#suggestedcitation.

Baxter, R.D., K. Vaquera and T.J. George, Extracorporeal Membrane Oxygenation Support for Vaping-induced Acute Lung Injury. Ann Thorac Surg, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32114044.
Cases of vaporizer-induced acute lung injury are increasing in frequency as the use of these recreational products have become more popular. Such pathology can result in life-threatening conditions for otherwise healthy patients with diagnostic difficulties and complex treatment plans. Presented is a case of severe acute lung injury due to vaporizing substances in a young male requiring extracorporeal membranous oxygenation (ECMO) as a

bridge to recovery. Recovery was successful despite rapid-onset of adult respiratory distress syndrome with prompt utilization of ECMO and appropriate lung-protective strategies.

Bharat, A., N. Jain, B. Sheikh, H.M. Jeelani and M. Shayuk, Vaping-Induced Lung Injury: An Uncharted Territory. Cureus, 2020. **12**(7): p. e8970. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32766012.
Vaping-associated lung injury (VALI) presents with symptoms ranging from lower respiratory tract involvement (shortness of breath, fever, and cough) to gastrointestinal involvement (vomiting and diarrhea). Based on the longitudinal analysis, VALI is associated with increased risk for respiratory disease, making it paramount for medical professionals to understand this disease process and be familiar with its varied presentations. Our case study is a presentation of two relatively young patients with VALI, with a varied clinical course and distinct levels of severity. VALI still remains uncharted territory. Case reports, such as ours, have the potential to invoke randomized controlled clinical trials to better understand the disease etiology, pathology, and management.

Burgwardt, S., A. Huskic, G. Schwartz, D.P. Mason, L. Tapias and E. Podgaetz, Spontaneous pneumomediastinum secondary to electronic cigarette use. Proc (Bayl Univ Med Cent), 2020. **33**(2): p. 229-230. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32313467.
Vaping, the use of electronic cigarettes, involves different mechanics than conventional combustion cigarettes. Consumers who vape tend to overinhale and then forcefully exhale to eliminate the vapor, which is usually produced in much greater quantity than generated by a regular cigarette. Effectively, they are performing an exaggerated Valsalva maneuver. This can increase their risk for developing potential spontaneous pneumomediastinum. Here we present a case of spontaneous pneumomediastinum secondary to electronic cigarette use.

Cano Aguirre, M.D.P., A. Esperanza Barrios, F. Martinez Muniz, S. Alonso Viteri, F. Muniz Gonzalez, R. Segoviano Mateo, et al., Hemoptysis Induced by Vaping. Arch Bronconeumol, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33323302.

Cedano, J., A. Sah, R. Cedeno-Mendoza, H. Fish and C. Remolina, Confirmed E-cigarette or vaping product use associated lung injury (EVALI) with lung biopsy; A case report and literature review. Respir Med Case Rep, 2020. **30**: p. 101122. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32577363.
Background: E-cigarette or vaping has become an increasingly popular alternative to smoking tobacco. In September 2019 multiple cases of confirmed E-cigarette or vaping product use associated lung injury were published. However, there is limited knowledge regarding the pathologic mechanism of this condition. Methods: We performed a systematic literature review in PubMed and EMBASE aiming to obtain additional clinical data on confirmed E-cigarette or vaping product use associated lung injury cases with lung biopsy results. With this information we hope to determine whether this condition is related to a histopathological pattern of acute lung injury instead of lipid deposits. Results: Seven articles were reviewed and a total of 27 cases were included. Imaging findings predominantly showed presence of diffuse bilateral ground glass opacities. A majority of patients had complete resolution of the disease. The most common histopathological pattern was organizing pneumonia present in almost half of the patients. Other frequently occurring patterns included diffuse alveolar damage and acute fibrinous pneumonitis; lipoid pneumonia was found in one case. Conclusion: The underlying pathophysiological mechanism in E-cigarette or vaping product use associated lung injury is most likely acute lung injury related to direct inhalant-mediated parenchymal inflammation.

Chawla, H. and T. Weiler, E-cigarette or Vaping Product Use-Associated Lung Injury Presenting as Sub-Acute Hypoxemia Without Increased Work of Breathing. Cureus, 2020. **12**(8): p. e9855. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32963897.

A 15-year-old male with a history of mild intermittent asthma presented with fatigue, coughing, vomiting and anorexia which was progressive in nature over the past month. The patient was found to have evolving chest x-ray infiltrates bilaterally, and hypoxemia without accessory muscle use. The patient was placed on non-invasive continuous positive airway pressure (CPAP) for hypoxemia. A CT scan showed bilateral infiltrates in a pattern consistent with E-cigarette or Vaping product use-Associated Lung Injury (EVALI). Upon further history taking, the patient admitted to electronic cigarette (e-cigarette) use with a new tetrahydrocannabinol (THC) cartridge prior to the onset of symptoms. The patient was started on methylprednisolone after which his oxygen requirement improved. This case highlights the need to continue to be diligent regarding the use of e-cigarettes in the pediatric population, and be aware of the constitutional symptoms that are associated with their use.

Chen, J., S. English, J.A. Ogilvie, M.K.M. Siu, A. Tammara and C.J. Haas, All up in smoke: vaping-associated lung injury. J Community Hosp Intern Med Perspect, 2020. **10**(6): p. 571-578. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33194132.
The electronic cigarette (EC), was initially introduced as a safe alternative to conventional cigarette smoking While initially seemingly innocuous, over 2800 E-cigarette, or Vaping, product use-associated lung injury (EVALI) cases have been reported in the USA, with a spectrum of clinical severity ranging from mild dyspnea to overt respiratory failure In this report we highlight three EVALI cases whom presented with dyspnea and a variety of non-specific symptoms. Diagnostic imaging demonstrated bilateral reticular infiltrates and ground-glass opacities with lymphadenopathy. Clinically, patients failed to respond to empiric antibiotics but improved after initiating steroids. Consistent with prior case series, our patients reported exposure to EC liquids containing tetrahydrocannabinol (THC)/cannabidiols (CBD) additives, suggesting Vitamin E acetate as the potentially harmful constituent. In this case series and review, we not only summarize prior clinical studies that have evaluated the effects of vaping on cardiopulmonary function as well as case reports on EVALI, but also discuss the pathophysiology of vaping and EVALI. It remains unclear not only why some individuals develop EVALI, but why the clinical and pathological presentations vary. EVALI remains a significant public health concern and clinicians must maintain a high index of suspicion for this novel phenomenon.

Choe, J., P. Chen, J.A. Falk, L. Nguyen, D. Ng, T. Parimon, et al., A Case Series of Vaping-Associated Lung Injury Requiring Mechanical Ventilation. Crit Care Explor, 2020. **2**(1): p. e0079. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32166299.
Objectives: Vaping-associated lung injury has rapidly become a nationwide epidemic and a threat to public health. In this case series, we describe unique clinical features of severe vaping-associated lung injury, defined as respiratory failure due to vaping that requires mechanical ventilation. Data Sources: Clinical observation of four patients. Study Selection: Case series. Data Extraction: Data and images were extract from medical records after approval was obtained from the institutional review board. Data Synthesis: Four patients were admitted to the ICU with severe manifestation of vaping-associated lung injury. Although every case required mechanical ventilatory support (venovenous extracorporeal membrane oxygenation in one patient), all patients survived and were discharged without supplemental oxygen. Systemic corticosteroids were administered in three patients and N-acetyl cysteine in one. A postdischarge pulmonary function test in one patient was normal except for mildly decreased diffusing capacity. Conclusions: Based on our experience, prognosis of severe vaping-associated lung injury appears favorable with aggressive supportive care, although there is evidence from existing literature that mortality rate might rise with increasing disease severity. Underlying mechanism of lung injury might be similar between vaping-associated lung injury and amiodarone pneumonitis. Foamy or lipid-laden macrophages, seen in both conditions, might be a marker of cytotoxicity from substances contained in e-cigarettes, such as vitamin E acetate. Systemic corticosteroids, and possibly N-acetyl cysteine, could be considered as therapeutic adjuncts in vaping-associated lung

injury. Serial pulmonary function tests should be obtained in these patients to monitor for potential long-term complications. The primary limitations of this case series are its small sample and lack of longitudinal follow-up data.

Darmawan, D.O., K. Gwal, B.D. Goudy, S. Jhawar and K. Nandalike, Vaping in today's pandemic: E-cigarette, or vaping, product use-associated lung injury mimicking COVID-19 in teenagers presenting with respiratory distress. SAGE Open Med Case Rep, 2020. **8**: p. 2050313X20969590. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33194204.
The clinical presentation of children and adolescents infected with severe acute respiratory syndrome coronavirus 2 can range from asymptomatic to mild or moderate manifestations. We present a case series of three adolescents who presented during the coronavirus disease 2019 (COVID-19) pandemic with symptoms concerning for COVID-19, including fever, abdominal symptoms, cough, respiratory distress, and hypoxemia. Their laboratory results showed elevated inflammatory markers that are also commonly seen in COVID-19. The chest imaging studies mimicked COVID-19 with non-specific ground glass opacities and interstitial prominence patterns. However, severe acute respiratory syndrome coronavirus 2 testing was negative and further questioning of these adolescents and their parents revealed a history of vaping marijuana-related products leading to the eventual diagnosis of e-cigarette, or vaping, product use-associated lung injury. Our patients were successfully treated with corticosteroids. The providers caring for pediatric patients, especially adolescents, should continue to have a high index of suspicion for e-cigarette, or vaping, product use-associated lung injury in patients presenting with unexplained respiratory failure, while ruling out COVID-19.

Davis Health, *Breathing problems in teens: COVID-19 or lung injury due to vaping?*, in *Science Daily*. 2020, University of California. Available from: https://www.sciencedaily.com/releases/2020/11/201119141708.htm.

DeCarli, K., M. Arabiat, C. Ward, A. Levinson and G. Carino, A Case of Vaping-Associated Lung Injury in Rhode Island. R I Med J (2013), 2020. **103**(1): p. 38-41. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32013304.
The Centers for Disease Control and Prevention (CDC) is currently investigating a nationwide outbreak of e- cigarette, or vaping, associated lung injury (EVALI). The objective of this case report is to review a suspected case of EVALI in Rhode Island and discuss how to identify and manage this condition.

Deliwala, S., S. Sundus, T. Haykal, N. Theophilus and G. Bachuwa, E-cigarette, or Vaping, Product Use-associated Lung Injury (EVALI): Acute Lung Illness within Hours of Switching from Traditional to E-cigarettes. Cureus, 2020. **12**(4): p. e7513. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32373415.
2019 has been a landmark year in the world of electronic nicotine delivery systems (ENDS), specifically e-cigarette and vaping. Numerous state health departments across the United States have voiced their concerns in the growing number of lung injury cases from e-cigarettes and vaping. Over the past few decades, many agencies have brought into light the harmful effects of smoking cigarettes, and despite popular belief, a growing movement has started to recognize the harmful effects of ENDS. The Centers for Disease Control and Prevention have released recommendations and provided health practitioners a methodology to identify and diagnose e-cigarette, or vaping, product use-associated lung injury (EVALI). EVALI is a diagnosis of exclusion and comprises a variety of respiratory illnesses, with intubation rates nearing 32%. The most critical risk factor remains product use in the preceding 90 days, although a timeline on the development of symptoms or notable structural changes remains unknown. We present a case of acute lung injury in a traditional cigarette smoker that evolved within hours of switching to e-cigarettes.

Di Cicco, M., M. Sepich, V. Ragazzo, D.G. Peroni and P. Comberiati, Potential effects of E-cigarettes and vaping in pediatric asthma. Minerva Pediatr, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32686924.
INTRODUCTION: Asthma is the most common chronic disease in childhood and exposure to tobacco smoke has been long recognized as a risk factor for its onset as well as for exacerbations and poor disease control. Since the early 2000s, electronic cigarettes have been marketed worldwide as a non-harmful electronic alternative to combustible cigarettes and as a device likely to help stop smoking, and their use is continuously rising, particularly among adolescents. However, several studies have shown that vape contains many different well-known toxicants, causing significant cytotoxic and pro-inflammatory effects on the airways in-vitro and in animal models. In humans, a variety of harmful lung effects related to vaping, ranging from bronchoconstriction to severe respiratory distress has been already reported. EVIDENCE ACQUISITION: To investigate the potential effects of vaping in pediatric asthma, we searched relevant published studies in the MEDLINE/PubMed database by combining the adequate Medical Subject Headings terms and keywords. EVIDENCE SYNTHESIS: At the end of our study selection process, 5 cross-sectional studies focusing on electronic cigarettes use in adolescents and self-reported asthma and/or other respiratory symptoms, 1 study focusing on the effects of electronic cigarettes second-hand exposure and 1 case report were retrieved. These preliminary data support a likely detrimental effect of vaping in asthmatic adolescents. CONCLUSIONS: Currently available evidence supports that electronic cigarettes are a potential threat to respiratory health, particularly in adolescents with asthma. High-quality studies on larger population assessing the long-term effects of vape exposure, are urgently needed.

Drabkin, M.J. and B. Heyligers, Vaping-associated pulmonary disease (VAPD): An unusual pattern of CT findings. Radiol Case Rep, 2020. **15**(2): p. 154-155. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31827663.
There has been a recent increase in vaping which has been accompanied by an increase in otherwise unexplained acute pulmonary disease in young people. Case series and expert opinion suggest there is a correlation. This case involves "Vaping-Associated Pulmonary Disease" in a man who vapes and has no other medical history. The patient improved with steroids, similar to other recent cases. However, CT findings demonstrated a different pattern than those described in the literature.

Eddy, R.L., H. Serajeddini, D. Knipping, S.T. Landman, K.J. Bosma, C.A. Mackenzie, et al., Pulmonary Functional MRI and CT in a Survivor of Bronchiolitis and Respiratory Failure Due to E-cigarette Use. Chest, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32544490.
Whilst nearly 3,000 e-cigarette-related hospitalizations have been reported in North America, the long-term outcomes in these patients have not been described. We followed an 18-year-old male who survived acute critical illness and respiratory failure related to five-months of e-cigarette use. Chronic irreversible airflow obstruction and markedly abnormal (129)Xe magnetic resonance imaging (MRI) ventilation heterogeneity was observed and persisted 8-months post-hospital discharge, despite improvement in quality-of-life and chest computed tomography findings. Lung clearance index and oscillometry measures were also highly abnormal at 8-months post-discharge. Although (129)Xe MRI ventilation abnormalities were dominant in the lung apices and central lung regions, the pattern of ventilation defects was dissimilar to ventilation heterogeneity observed in patients with obstructive lung disease, such as asthma and COPD. Our findings underscore the long-term functional impacts of e-cigarette-related lung injury in survivors of critical illness; longitudinal evaluations may shed light on the pathophysiologic mechanisms that drive e-cigarette-related lung disease.

Edmonds, P.J., C. Copeland, A. Conger and B.W. Richmond, Vaping-induced diffuse alveolar hemorrhage. Respir Med Case Rep, 2020. **29**: p. 100996. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31956478.
There are growing reports of adverse health effects from e-cigarette use or vaping. The U.S. Centers for Disease Control and Prevention has reported 2409 cases and 52 deaths associated with e-cigarette use as of December 10, 2019. Vaping has been associated with acute eosinophilic pneumonia, organizing pneumonia, lipoid pneumonia, diffuse alveolar damage, acute respiratory distress syndrome, hypersensitivity pneumonia, and giant cell interstitial pneumonitis. Here we present a case of vaping-associated diffuse alveolar hemorrhage.

Essa, A., J. Macaraeg, N. Jagan, D. Kwon, S. Randhawa, M. Kruse, et al., Review of Cases of E-Cigarette or Vaping Product Use-Associated Lung Injury (EVALI) and Brief Review of the Literature. Case Rep Pulmonol, 2020. **2020**: p. 1090629. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32607271.
Since the appearance of the E-Cigarette in the early 2000s, its industry, popularity, and prevalence have risen dramatically. In the past, E-Cigarette use with the vaping of nicotine or cannabis products had been associated with a few reported cases of lung injury. However, in 2019, thousands of cases of E-Cigarette or vaping product use-associated lung injury (EVALI) were reported in the United States. Evidence linked this outbreak with vaping of tetrahydrocannabinol (THC). We report two confirmed cases of EVALI and their associated clinical, radiologic, and pathologic features. This report supports the growing body of information regarding EVALI. It also discusses various substances, particularly vitamin E acetate, which has been suggested as a causative agent.

Fathima, S. and H. Zhang, Histologic patterns of lung injury in patients using e-cigarettes. Proc (Bayl Univ Med Cent), 2020. **33**(4): p. 619-620. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33100546.
In recent years, e-cigarette use has become more popular. Until recently, it was considered safer than smoking. We report two cases of acute pulmonary illness associated with vaping, focusing on their histologic patterns.

Freathy, S., N. Kondapalli, S. Patlolla, A. Mora and C. Trimmer, Acute lung injury secondary to e-cigarettes or vaping. Proc (Bayl Univ Med Cent), 2020. **33**(2): p. 227-228. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32313466.
As of October 2019, 1299 cases of "e-cigarette, or vaping, product use associated lung injury" (EVALI) have been reported in the USA, with 26 deaths. Multiple patterns of lung injury have been reported, including lipoid pneumonia, organizing pneumonia, and acute eosinophilic pneumonia, with radiographic findings including diffuse pulmonary infiltrates. We report a case of lipoid pneumonia secondary to EVALI. Physicians should be alert to recognizing these patterns of lung injury, as well as emphasizing to patients the importance of e-cigarette cessation.

Fryman, C., B. Lou, A.G. Weber, H.N. Steinberg, S. Khanijo, A. Iakovou, et al., Acute Respiratory Failure Associated With Vaping. Chest, 2020. **157**(3): p. e63-e68. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32145818.
The use of e-cigarettes to deliver aerosolized nicotine has gained popularity in recent years. Numerous reports have cited the development of acute pulmonary disease linked to vaping nicotine as well as marijuana-based products. As cultural attitudes evolve and policies shift toward the legalization of marijuana, its use has become more prevalent. Given the increased prevalence of marijuana consumption and e-cigarette usage, better insight into its potential to cause lung toxicity is warranted. The clinical, radiographic, and histopathologic characteristics of lung injury associated with vaping, particularly with marijuana-based products, have yet to be well described in the literature. We present eight patients, most of whom were admitted recently to our institution with acute respiratory failure following

vaping. The majority of patients were young, with a median age of 31.5 years (range, 24-62 years) and with no known underlying lung disease. This case series highlights common clinical findings as well as the varied radiographic and histopathologic features of acute respiratory failure associated with vaping predominantly marijuana-based products. As more cases of vaping-associated pulmonary injury unfold, data will be available to further characterize this emerging disease entity. Improved understanding of disease pathogenesis and its clinical course will help clinicians determine optimal management and follow-up strategies for this patient population.

Galo, J., D. Celli, D. Gross, G. Holt and M. Campos, A presentation of E-Cigarette vaping associated lung injury (EVALI) caused by THC-Containing electronic smoking device. Respir Med Case Rep, 2020. **31**: p. 101154. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32690998.
Several cases have recently been reported concerning the development of a syndrome of acute lung injury associated with the use of electronic cigarettes, leading to respiratory failure and several deaths. We present a case of a young veteran who presented with e-cigarette vaping associated lung injury (EVALI) to a primary care clinic and who required subsequent inpatient admission and home oxygen therapy after discharge. The patient afterwards improved after a three-month course of steroids and cessation of THC-containing electronic cigarettes, consistent with previously reported cases. Furthermore, evidence on bronchoscopy and biopsy demonstrated intracellular lipid droplets in the patient's macrophages. This outpatient case of EVALI prompts primary care providers to raise suspicion of this condition, and enquire about the use of e-cigarettes, particularly THC-containing vaping products. Furthermore, in the setting of the COVID-19 pandemic, similar clinical and radiographic presentations between COVID-19 and EVALI can be seen.

Gay, B., Z. Field, S. Patel, R.M. Alvarez, W. Nasser, M. Madruga, et al., Vaping-Induced Lung Injury: A Case of Lipoid Pneumonia Associated with E-Cigarettes Containing Cannabis. Case Rep Pulmonol, 2020. **2020**: p. 7151834. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32309002.
Electronic cigarette, or vaping product use-associated lung injury (EVALI), is a group of lung disorders associated with vaping and e-cigarette products that has previously been categorized as a diagnosis of exclusion and best described as an exogenous lipoid pneumonia or chemical pneumonitis. Here, we describe the onset of an exogenous cause of lipoid pneumonia in an otherwise healthy patient using cannabis-containing electronic cigarettes. We explore similarities in the clinical case, define a common clinical presentation with progression of disease, characteristic radiographic findings along with pathological diagnosis and management.

Girvin, F. and D. Naidich, CT features of electronic-cigarette or vaping-associated lung injury (EVALI); our experience during the recent outbreak. BJR Case Rep, 2020. **6**(3): p. 20200027. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32922848.
As an emerging clinical syndrome, our knowledge of the clinical, pathologic and radiologic features of electronic-cigarette or vaping-associated lung injury is evolving. CT appearances are described in six cases imaged at our institution (NYU Langone Health, New York) in the cluster of 2019.

Gordon, S., *'Necrotizing Pneumonia' May Be New Vaping Hazard*, in *WebMD*. 2020. Available from: https://www.webmd.com/lung/news/20200304/necrotizing-pneumonia-may-be-new-vaping-hazard#1.

Gutsche, J., R. Pasternak, D. Campbell, J.L. Schili, P.J. Boyle and P. Tilney, A 19-Year-Old Man With Vaping-Associated Lung Injury. Air Med J, 2020. **39**(1): p. 6-8. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32044072.

Hage, R., V. Fretz and M.M. Schuurmans, Electronic cigarettes and vaping associated pulmonary illness (VAPI): A narrative review. Pulmonology, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32553826.
BACKGROUND: Electronic (e-) cigarettes are used to heat liquids producing aerosols for inhalation. Recently there have been reports of a large number of adverse outcomes relating to e-cigarette consumption (vaping), which has been referred to as "vaping associated pulmonary illness" (VAPI). AIM: This review provides an overview of clinical, radiological and pathological features of VAPI in the literature. We also describe a case of VAPI, presenting with symptoms of bronchiolitis, responding well to azithromycin in addition to the usual treatments provided for such cases. METHODS: We searched original papers, observational studies, case reports, and meta-analyses published between 2000 and 2019 in English in PubMed database using the keywords: e-cigarette, "vaping associated pulmonary illness", VAPI, EVALI, vaping AND "lung injury". We also used data of the Centers of Disease Control (CDC) website. RESULTS: From an initial search of PubMed, 62 potential articles were identified, and another 9 studies were identified from the bibliographies of retrieved articles. In this search we found 7 case series and 16 case reports, which were included in the review. In this search we also found 4 review articles. CONCLUSION: VAPI is a syndrome presenting with isolated pulmonary or combined pulmonary, gastrointestinal and constitutional symptoms and can be rapidly progressive, leading to respiratory failure, often requiring invasive respiratory support. There is an urgent need for more research on VAPI especially relating to etiology, treatment and prevention.

Hassoun, A., K. Brady, R. Arefi, I. Trifonova and K. Tsirilakis, Vaping-Associated Lung Injury During COVID-19 Multisystem Inflammatory Syndrome Outbreak. J Emerg Med, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33483200.
BACKGROUND: E-cigarette or vaping product use-associated lung injury (EVALI) is a complex inflammatory syndrome predominantly seen in adolescents and young adults. The clinical and laboratory profile can easily mimic infectious and noninfectious conditions. The exclusion of these conditions is essential to establish the diagnosis. Recently, the novel coronavirus disease 2019 (COVID-19) pandemic introduced the multisystem inflammatory syndrome in children (MIS-C). MIS-C knowledge is evolving. The current criteria to establish the diagnosis are not specific and have overlapping features with EVALI, making the accurate diagnosis a clinical challenge during continued COVID-19 transmission within the community. CASE REPORT: Three young adults evaluated at our emergency department for prolonged fever and gastrointestinal and respiratory symptoms were initially assessed for possible MIS-C due to epidemiologic links to COVID-19 and were eventually diagnosed with EVALI. The clinical, laboratory, and radiologic characteristics of both entities are explored, as well as the appropriate medical management. WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: Physician awareness of overlapping and differentiating EVALI and MIS-C features is essential to direct appropriate diagnostic evaluation and medical management of adolescents and young adults presenting with systemic inflammatory response during the unfolding pandemic of COVID-19.

Jankharia, B., S. Rajan and B. Angirish, Vaping associated lung injury (EVALI) as an organizing pneumonia pattern- A case report. Lung India, 2020. **37**(6): p. 533-535. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33154217.
Electronic cigarettes use or vaping is popular but has not been proven to be an innocuous substitute for traditional smoking. Several patterns of vaping-associated lung injuries have been reported. We report a case of a 43-year-old female patient, who presented with productive cough and an organizing pneumonia pattern on computed tomography (CT) scan. Recognizing the various CT scan patterns of vaping-associated lung injury is important to make a diagnosis because the cessation of vaping is an important step in the treatment.

Jonas, A.M. and R. Raj, Vaping-related Acute Parenchymal Lung Injury: A Systematic Review. Chest, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32442559.

The ongoing U.S. outbreak of vaping-related acute lung injury, recently named EVALI (E-cigarette or vaping product use associated acute lung injury), has reignited concerns about the health effects of vaping. Initial case reports of vaping-related lung injury date back to 2012, but the ongoing outbreak of EVALI began in the summer of 2019 and has been implicated in 2,807 cases and 68 deaths as of this writing. Review of the scientific literature reveals 216 patient cases spanning 41 reports of parenchymal lung injury attributed to vaping. In this review, we detail the clinical, radiographic, pathologic patterns of lung injury attributable to vaping, as well as provide an overview of the scientific literature to date on the effects of vaping on respiratory health. Tetrahydrocannabinol was the most common vaped substance and Vitamin E acetate was found in bronchoalveolar lavage specimens from many affected individuals, however no specific component or contaminant has conclusively been identified as the cause for the injury to date. Patients present with cough, dyspnea, constitutional symptoms, and gastrointestinal symptoms. Radiology and histopathology demonstrate a spectrum of nonspecific acute injury patterns. A high index of suspicion combined with a good history are the key to an accurate diagnosis. Treatment is supportive, mortality is low, and most patients recover. Corticosteroids have been used with apparent success in patients with severe disease but more rigorous studies are needed to clarify their role in treating vaping related lung injury.

Khiatah, B., A. Murdoch, C. Hubeny, C. Constantine and A. Frugoli, Vaping-induced lung injury: brief report for the practicing clinician. Oxf Med Case Reports, 2020. **2020**(8): p. omaa060. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32793364.
The USA is witnessing an outbreak of vaping-induced lung injuries associated with the drastic rise in e-cigarette use, especially among teenagers and young adults. Our understanding of the harmful effects of these products is expanding as an increasing amount of consumers seek medical care for lung-related illnesses. The knowledge of the long-term sequelae of e-cigarette use is limited due to their novelty, but a growing association exists between use and acute lung injury. We describe a case vignette of vaping-induced lung injury to increase physician awareness and discuss the applicability of preliminary diagnostic criteria.

Kooragayalu, S., S. El-Zarif and S. Jariwala, Vaping Associated Pulmonary Injury (VAPI) with superimposed Mycoplasma pneumoniae infection. Respir Med Case Rep, 2020. **29**: p. 100997. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32042584.
There is growing evidence that vaping has the potential to cause adverse health effects. Vaping is affecting the younger and healthier population which is a public concern. Mycoplasma pneumoniae pneumonia is a benign condition and is usually underdiagnosed and is managed in an outpatient setting. Here we present a case of fulminant MPP in a young adult probably associated with VAPI. A 24-year-old woman presented to our hospital for severe hypoxic respiratory failure needing intubation and intensive care unit admission. She had a history for vaping for 2 years prior to presentation. She had fever and an elevated white count. Her Chest X-Ray and CT scan of the chest were consistent with bilateral predominantly lower lobe patchy opacities. She had mildly elevated serum LDH and Urine toxicology screen was positive for THC. Serum IgM Mycoplasma level was positive and her BAL fluid analysis showed lipid-laden macrophages. She was diagnosed as a probable case of VAPI per CDC guidelines with superimposed fulminant MPP. Vaping is known to increase the risk of viral and bacterial pneumonia by compromising the respiratory local immune response. Vaping also causes lipoid pneumonia where the alveoli are filled with lipid-laden macrophages with surrounding inflammation. We hypothesize that this patient had fulminant MPP in the setting of background VAPI. The association between vaping and MPP infection has not been established in the literature and this is the first documented report to establish a link between e-cigarettes and fulminant MPP. Further research is needed to confirm this association.

Krishnan, S., G.S. Thind, M. Soliman, L. Tolle, E. Mireles-Cabodevila, A. Adi, et al., A case of vaping-induced acute respiratory distress syndrome requiring extracorporeal life support.

Perfusion, 2020: p. 267659120925634. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32650708.
INTRODUCTION: An upsurge of e-cigarette, or vaping, product use-associated lung injury has been reported in the United States. The potential role of extracorporeal life support in e-cigarette, or vaping, product use-associated lung injury merits consideration. CASE REPORT: We present a case of vaping-induced severe acute respiratory distress syndrome that was salvaged with extracorporeal life support and had excellent recovery. DISCUSSION: The mechanistic reasons for the sudden outbreak of e-cigarette, or vaping, product use-associated lung injury are under active investigation. A predominantly diffuse, bilateral pattern of lung injury has been reported, with some cases meeting the criteria for severe acute respiratory distress syndrome. To date, 68 deaths from e-cigarette, or vaping, product use-associated lung injury have been confirmed by the centers of disease control. However, resolution of lung injury has been reported in most cases, thereby justifying candidacy for extracorporeal life support, if required. CONCLUSION: Extracorporeal life support can be successfully utilized as a bridge to recovery in vaping-induced severe acute respiratory distress syndrome.

Lin, C., V. Arrossi, R. Yadav and H. Choi, Vaping-related pulmonary granulomatous disease. Respir Med Case Rep, 2020. **31**: p. 101179. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32775194.
The use of electronic cigarettes, or "vaping," has garnered significant popularity and attention in recent years. Its pulmonary and systemic effects have yet to be fully studied and quantified, and recent reports of vaping-related illnesses and deaths have brought the clinical consequences of vaping into the public spotlight. This report describes the case of a 34 year old woman who presented to clinic with new-onset cough and dyspnea, shortly after beginning to use electronic cigarettes. Imaging demonstrated new micronodular opacities and mediastinal lymphadenopathy, while pathology confirmed granulomatous disease. After she received counseling and successfully quit vaping, her symptoms resolved and repeat imaging demonstrated resolution of parenchymal findings and lymphadenopathy. This case report therefore presents a longitudinal narrative of reversible vaping-related pulmonary granulomatous disease.

MacMurdo, M., C. Lin, M.B. Saeedan, E.E. Doxtader, S. Mukhopadhyay, V. Arrossi, et al., e-Cigarette or Vaping Product Use-Associated Lung Injury: Clinical, Radiologic, and Pathologic Findings of 15 Cases. Chest, 2020. **157**(6): p. e181-e187. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32505323.
Since mid-2019, > 2,000 cases of e-cigarette or vaping product use-associated lung injury (EVALI) have been reported. Although initial reports suggested that this entity may be a form of inhalation-related lipoid pneumonia, subsequent studies indicate that EVALI represents various patterns of acute lung injury. Cases of EVALI continue to be reported, and public awareness of the epidemic is increasingly high. However, evidence surrounding optimal management of EVALI remains limited. In this case series, we report 15 cases of EVALI across a spectrum of severity, highlighting key radiologic, pathologic, and cytologic findings, and discuss management implications. In line with national findings, most patients with EVALI in the series vaped liquids containing tetrahydrocannabinol. Our imaging and pathologic findings support the notion that EVALI is a form of acute lung injury.

Marliere, C., J. De Greef, S. Gohy, D. Hoton, P. Wallemacq, L.M. Jacquet, et al., Fatal e-cigarette or vaping associated lung injury (EVALI): a first case report in Europe. Eur Respir J, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32217651.

Miskoff, J.A. and M. Chaudhri, E-cigarette or Vaping Product Use-associated Lung Injury: A Case of an Adult Female Leading to Hospitalization. Cureus, 2020. **12**(1): p. e6765. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32140332.

E-cigarette or vaping is an alternative to traditional cigarette use with potentially devastating consequences. The most recent update from the Centers for Disease Control and Prevention reports a total of 2,561 cases of vaping associated pulmonary injury as of December 27, 2019. This case described a 41-year-old female who presented with a clinical picture suggesting of bronchitis; however, a diagnosis of e-cigarette or vaping product use-associated lung injury was made.

Mittal, A., A. Baig, R. Zulfikar and S. Sharma, Chronic Vaping Related Tracheomalacia (TM): A Case of Vaping Induced Altered Innate Immunity that Culminated in Severe TM. Cureus, 2020. **12**(4): p. e7571. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32391220.
Tracheomalacia (TM) is a weakness of the trachea either due to impaired cartilage integrity or atrophy of muscular elastic fibers. We present the first-ever case of chronic vaping induced altered immunological defenses that led to frequent pulmonary infections, ultimately culminating in severe TM which we successfully treated with positive airway pressure (PAP) therapy. A 53-year-old male presented with hypoxia and pneumonia refractory to outpatient antibiotics and steroids. He underwent bronchoscopy which showed severe TM, prompting transfer to our institution. He started vaping seven years ago and noted frequent bronchitis requiring antibiotics and steroids along with 10 life-time surgeries. He underwent repeat bronchoscopy noting TM, worst 3 cm above the carina and extending 4 cm proximally. The lesion was deemed not suitable for stenting, so PAP therapy was initiated. Bronchoalveolar lavage (BAL) confirmed 40% alveolar macrophages positive for lipid in Oil-O-Red stain consistent with EVALI. He tolerated PAP therapy with significant improvement in his ground glass opacities (GGO) and TM on subsequent imaging. TM is generally defined as >50% narrowing in the sagittal diameter. It is often further characterized into primary (congenital) or secondary (acquired) causes. Notable secondary causes include postintubation, chronic infection/bronchitis, chronic inflammation, and frequent steroid exposure -- all present in this case. Furthermore, there is existing literature that chronic inflammation due to irritants like cigarette smoke may be an important contributor to the development of TM. However, such data are lacking for EVALI. Our patient started experiencing repeated bronchitis episodes after he started vaping, leading to chronic inflammation and frequent antibiotics/steroids. Given his additional risk factor of multiple surgeries, this case not only presents a perfect storm for TM, but also a novel manifestation of EVALI. This case, to our knowledge, is the first-ever manifestation of EVALI presenting with TM. Management with PAP therapy helped avoid major surgery.

Mughal, M.S., D.L.V. Dalmacion, H.M. Mirza, I.P. Kaur, M.A. Dela Cruz and V.E. Kramer, E-cigarette or vaping product use associated lung injury, (EVALI) - A diagnosis of exclusion. Respir Med Case Rep, 2020. **31**: p. 101174. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32775191.
Inhalation of aerosolized products generated by different electronic devices is called vaping. E-cigarettes or Vaping product use Associated Lung Injury (EVALI) outbreak peaked in August-September 2019 and gradually declined. EVALI remains a diagnosis of exclusion which presents as an acute lung injury in the vaping population. Vitamin E acetate and its products are implicated as one of the cytotoxic agents causing airway centered pneumonitis. Lipid laden macrophages are found in samples of BAL fluid but their role in cytopathology of the disease remains unclear. We present a 57 years old man who came to the emergency department at Monmouth Medical Center, New Jersey in fall, 2019. Reportedly he has been vaping THC about 100g every day for past three days. At initial presentation, he had fever, shortness of breath and hypoxia requiring supplemental oxygen. He was empirically treated with levofloxacin 500 mg for five days without a significant improvement in his symptoms. Non-contrast chest CT scan showed bilateral ground-glass opacities, indicative of diffuse alveolar damage. He underwent flexible bronchoscopy to rule out infective pneumonia followed by auto-immune work-up that was non-conclusive. He was given 1 mg/kg methylprednisolone with a quick taper of oral steroids leading to the resolution of

symptoms. At six months follow-up, imaging showed near resolution of ground-glass opacities.

Nemeh, H., V. Coba, M. Chulkov, A. Gupta, N. Yeldo, T. Chamogeorgakis, et al., Lung Transplantation for the Treatment of Vaping Induced, Irreversible, End Stage Lung Injury. Ann Thorac Surg, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33130115.
Recently, there has been a rise in the incidence of E-cigarettes/Vaping Associated Lung Injury (EVALI) in the United States mostly involving Tetrahydrocannabinol (THC)(1). Present treatment strategies for EVALI are aimed at controlling the inflammatory and infectious etiologies in addition to supportive care(2). While most patients improve with supportive measures(3,4) the long-term pulmonary effects of this illness are still not well defined. In this report, we describe a case of EVALI resulting in progressive, irreversible destruction of the lung parenchyma that was treated with double lung transplantation.

Pajak, A., S. Bascoy, J.C. Li, M. Benninghoff and A. Deitchman, E-cigarette or Vaping Product Use Associated Lung Injury Among Three Young Adults: A Retrospective Case Series From Delaware. Cureus, 2020. **12**(10): p. e11031. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33224641.
BACKGROUND: E-cigarette or vaping associated lung injury (EVALI) is a lung disease associated with an inflammatory response to the vaping fluid. Currently, diagnosis remains elusive without definitive biomarkers. CASE PRESENTATION: Herein, we describe three cases of EVALI among 18- to 21-year-old patients ranging from mild to severe. All cases presented with a combination of respiratory, gastrointestinal, and constitutional symptoms. Oxygen support and level of medical care varied based on disease severity. Bilateral pulmonary opacities were observed on chest imaging in each case. Additionally, each case had markedly elevated inflammatory markers, specifically C-reactive protein (CRP). None of these patients improved with intravenous (IV) antibiotics and all required IV corticosteroid therapy to achieve clinical improvement. CONCLUSION: EVALI should be suspected among young, otherwise healthy patients who present with new-onset hypoxia, non-specific gastrointestinal symptoms, and endorse a history of vaping. Though considered a diagnosis of exclusion, diagnosing EVALI requires thorough history taking. Inflammatory studies, CRP, and erythrocyte sedimentation rate (ESR) should be considered adjunctive biomarkers to aid clinicians when the diagnosis remains unclear. Corticosteroids are the mainstay of treatment and patients should have close follow-up whether or not they require hospitalization.

Phung, B. and A. Lam, Pediatric Acute Respiratory Distress Syndrome and Hypersensitivity Pneumonitis Related to E-cigarette Vaping. J Pediatr Intensive Care, 2020. **9**(2): p. 128-134. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32351768.
In recent years, electronic cigarettes (e-cigs) have been falsely advertised as safe alternatives to conventional smoking. We report a case involving a 16-year-old female who presented with fever, nonproductive cough, and shortness of breath after vaping e-cig/tetrahydrocannabinol dab pen. Her symptoms rapidly deteriorated and met diagnostic criteria for pediatric acute respiratory distress syndrome. Chest radiograph revealed extensive patchy airspace disease and computed tomography scan showed bilateral ground glass opacities. Bronchoalveolar lavage fluid revealed increased neutrophils, lymphocytosis, but absent eosinophilia. After the results of a comprehensive workup for infectious etiology returned negative, she was diagnosed with hypersensitivity pneumonitis and started on systemic corticosteroids.

Priemer, D.S., C. Gravenmier, A. Batouli and J.E. Hooper, Overview of Pathologic Findings of Vaping in the Context of an Autopsy Patient With Chronic Injury. Arch Pathol Lab Med, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32383974.
CONTEXT.-: Electronic cigarettes are handheld devices that heat an inner liquid containing chemicals to be aerosolized and inhaled, and have become a popular alternative to conventional cigarettes. Their use, termed vaping, has been linked to severe injury, with

2711 cases of associated lung injury and 60 deaths reported to the Centers for Disease Control and Prevention at time of writing. Published case reports and series have emerged detailing clinical and imaging characteristics of vaping-induced lung injury. However, the pathologic characteristics of these induced injuries are still being established, particularly findings occurring over time. OBJECTIVE.-: To illustrate the autopsy findings of an older patient who died of vaping-induced injury after prolonged symptomology and to provide a review of the most recent literature regarding the basic science, epidemiology, clinical presentation, imaging characteristics, and pathology of vaping-induced lung injury. DATA SOURCES.-: Autopsy case and peer-reviewed literature. CONCLUSIONS.-: Vaping-induced lung injury has emerged as a public health issue, and this case represents a rare opportunity to evaluate this issue at autopsy. Most commonly, the injury has been attributed to tetrahydrocannabinol product use as opposed to nicotine. This case demonstrates that as today's young and relatively healthy vapers grow older and develop the comorbidities that come with advanced age, there is serious risk of chronic lung damage from vaping that could result in death. Further observations and studies, particularly autopsy evidence, are clearly important to understand the possible outcomes.

Puebla Neira, D., S. Tambra, V. Bhasin, R. Nawgiri and A.G. Duarte, Discordant bilateral bronchoalveolar lavage findings in a patient with acute eosinophilic pneumonia associated with counterfeit tetrahydrocannabinol oil vaping. Respir Med Case Rep, 2020. **29**: p. 101015. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32071854.
Vaping has emerged as a popular alternative form of inhalation of nicotine and marihuana derivates (including Tetrahydrocannabinol, THC) in part due to the avoidance of combustion byproducts. Unfortunately, THC oil (especially that produced by unregulated individuals) may contain dilutants such as propylene glycol, vitamin E, and flavoring ingredients that can lead to adverse respiratory effects. Acute eosinophilic pneumonia (AEP) has been described in association with e-cigarette and vaping associated lung injury (EVALI) but the majority of bronchoalveolar lavage (BAL) samples reported in the literature do not show eosinophils as the predominant cell lineage. Only two other cases of AEP have been published, and here we present the first case reported in the literature of a patient with EVALI with AEP pattern associated with counterfeit tetrahydrocannabinol (THC) oil vaping and discordant bilateral BAL cell count differential.

Rodriguez, J.A., A.A. Roa and J.C. Lemos-Ramirez, E-Cigarette or Vaping Product Use-Associated Lung Injury (EVALI) Mimicking COVID-19 Disease. Case Rep Pulmonol, 2020. **2020**: p. 8821289. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33204563.
Background: Coronavirus 2 (SARS-CoV-2) is the virus associated with the coronavirus disease (COVID-19) causing a pandemic worldwide in 2020. There are other noninfectious diseases that can present exactly as COVID-19, and the management and approach are completely different, hence the importance of understanding and having a wide differential in patients presenting with similar characteristics. Case Report. A 23-year-old male, with a history of childhood asthma, presented to the Emergency Department in a hospital in south Florida in the USA with complaints of a 2-day duration of subjective fever, chills, dry cough, dyspnea, and myalgia. His vital signs were blood pressure 135/65 mmHg, temperature 39 degrees C, pulse 134 bpm, respiratory rate 22 breaths per minute, and saturation of oxygen 96% in room air. Laboratory analysis was significant for white blood cells 15.3 x 10(3)/muL, ALT 69 U/L, AST 66 U/L, ferritin 375.6 ng/mL, C-reactive protein 27.70 mg/dL, and procalcitonin 1.43 ng/mL. A respiratory pathogen panel (RPP) and a SARS-CoV-2 test were both negative. The patient was given empiric antibiotic treatment and hydroxychloroquine. Two more tests for SARS-CoV-2 were negative, and the patient reported that he smoked marijuana through an e-cigarette. The patient was started on high-dose steroids, and symptoms improved. Conclusion: COVID-19 is an emergent lung disease that is affecting the population worldwide; many other noninfectious diseases can mimic its presentations and laboratory characteristics; the importance of having a broad differential diagnosis especially in causing

confusion during pandemic times is valuable in the management of patients with such presentations, such as EVALI, and glucocorticoids will be indicated in this circumstances.

Ronald, A.A., D. Defta, J. Wright and B. Rothstein, Extensive pneumorrhachis associated with vaping-induced lung injury. World Neurosurg, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32473332.
BACKGROUND: Pneumorrhachis, or air within the spinal canal, is most commonly associated with traumatic spinal injuries or spine surgery. Literature exists which has also demonstrated a link with pneumorrhachis and certain pulmonary diseases such as asthma, however, there are no previous reports of pneumorrhachis secondary to vaping-induced lung injury. CASE DESCRIPTION: A 15-year-old male with vaping-induced lung injury experienced acute respiratory decompensation after straining. Computed tomography (CT) of the chest revealed bilateral pneumothoraces, extensive pneumomediastinum, and pneumorrhachis. Extensive air was seen in the spinal canal from the cervical spine down to the level of the T8 vertebrae. CONCLUSIONS: The emerging condition of vaping-induced lung injury may place patients at risk for serious complications of extra-pulmonary air including pneumorrhachis, and to our knowledge this is the first such report.

S acci, P., A. Au and M. Hutchinson, E-cigarette or vaping product use-associated lung injury (EVALI) characterized by pulmonary ultrasound. J Am Coll Emerg Physicians Open, 2020. **1**(5): p. 1101-1103. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33145564.
Pulmonary ultrasound is a useful tool in the diagnosis and resuscitation of emergency department (ED) patients with dyspnea. We present the case of a patient who was diagnosed with E-cigarette or vaping product use-associated lung injury (EVALI) using pulmonary ultrasound. Many of these cases are diagnosed using x-ray, computerized tomography, or bronchoscopy and to our knowledge this is the first published case that demonstrates utility of ultrasound in diagnosing EVALI. While more investigation is needed on the use of this technique, the patient in this case was diagnosed with EVALI based on positive history, presence of normal cardiac function, non-cardiogenic pulmonary edema on ultrasound, and absence of pulmonary infection.

Shehata, M. and T. Kocher, Vaping-associated diffuse alveolar hemorrhage - A case report. Respir Med Case Rep, 2020. **30**: p. 101038. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32257790.
"Vaping" is a rapidly growing habit seen worldwide, especially amongst the younger population. Several aspects of vaping have made it more appealing than cigarettes and have lead to the conversion of many smokers. Appeal resides in the belief that it is a healthier alternative to cigarettes. It also has the ability to interchange flavors and type of oil used. The focus of advertisement for vaporized products is its use as a smoking cessation aid. Systematic reviews have failed to display evidence of harmful processes other than exposure to nicotine (Bullen et al., 2013; Burstyn, 2013) [1,2]. We report a clinical case of a woman who suffered diffuse alveolar hemorrhage correlated with e-cigarette usage due to history and negative findings of extensive rheumatologic and infectious disease workup. Her presentation, clinical course, and effective therapy are outlined here.

Singh, A., Q. Tan, N.M. Saccone and D.H. Lindner, A Case of Vaping TCH Oil Leading to Vaping Associated Pulmonary Injury: Our Approach to Its Diagnosis, Management, and Recommendations. Case Rep Pulmonol, 2020. **2020**: p. 6138083. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31976113.
Vaping's popularity has grown exponentially since its introduction to the US market in 2003. Its use has sky-rocketed since the unveiling of the vaping pods in 2017 which may account for the advent of the vaping related illnesses we are now seeing. Substances such as nicotine solution, tetrahydrocannabinol (THC) oil, cannabidiol (CBD) oil, and butane hash oil (BHC) packaged in cartridges available in various flavors and concentrations are aerosolized by the heating of metal coils in the e-cigarette/vaping devices. Cases from all over the country have

recently been coming to light in which vaping has led to severe acute pulmonary disease or vaping-associated-pulmonary-injury (VAPI). A vast majority of the presenting patients in the reported cases have required hospitalization and intensive care, needing supplemental oxygen and even endotracheal intubation and mechanical ventilation. 98% of patients present with respiratory symptoms (dyspnea, hypoxia, chest pain, cough, hemoptysis), 81% of patients have gastrointestinal symptoms (nausea, vomiting, diarrhea, and abdominal pain), and 100% of patients have constitutional symptoms such as fever, chills, and fatigue/malaise on presentation. Although based on history and clinical presentation it is reasonable to have a high suspicion for VAPI, diagnostic workup to rule out alternative underlying causes such as infection, malignancy, or autoimmune process should be performed before establishing the diagnosis. Computed Tomography (CT) scans of the chest have predominantly shown ground-glass opacity in the lungs, often with areas of lobular or subpleural sparing. Although lung biopsies have been performed on a relatively low number of cases, lung injury patterns so far have shown acute fibrinous pneumonitis, diffuse alveolar hemorrhage, or organizing pneumonia, usually bronchiolocentric, and accompanied by bronchiolitis. Treatment plans that have led to clinical improvement in the reported cases center around high-dose systemic steroids, although there are a lack of data regarding the best regimen and the absolute need for corticosteroids. The role of antibiotics appears to be limited once infection has definitively been ruled out. We present the case of a young male who vaped THC oil and developed severe acute pulmonary injury requiring mechanical ventilation and showed a remarkable response to high dose steroid therapy with improvement in clinical symptoms and resolution of diffuse ground glass opacity on repeat HRCT scan.

Smith, E., R. Cherian and B. McGillen, A Case of E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI) in a Previously Healthy Patient: Case Report and Literature Review. J Gen Intern Med, 2020. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32440996.

Suhling, H., T. Welte and T. Fuehner, Three Patients With Acute Pulmonary Damage Following the Use of E-Cigarettes-A Case Series. Dtsch Arztebl Int, 2020. **117**(11): p. 177-182. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32327029.
BACKGROUND: The use of e-cigarettes is on the rise around the world. Many case reports of acute lung injury due to e-cigarette use have been published in recent months in the USA, but no comparable cases have emerged in Germany up to the present report. The use of e-cigarettes has risen very rapidly in the USA in recent years, simultaneously with the legalization of marijuana sale in many American states. Most of the cases described there involved the use, not only of nicotine, but of tetrahydrocannabinol (THC, the psychoactive ingredient in marijuana) as well, though some of the patients had indeed not used additives (e.g. THC). METHODS: We report three cases in Germany of acute pulmonary illness that we consider to have been caused by the use of e-cigarettes. RESULTS: All three patients were hospitalized for acute shortness of breath. Two displayed partial respiratory insufficiency and bilateral pulmonary infiltrates. All three stated that they had used ordinary, commercially available e-cigarettes every day for at least the past three months. In the first patient, a 48-year-old man, the complete blood count and bronchial lavage findings indicated eosinophilic inflammation. The second patient, a 22-year-old man, developed multiple episodes of hemoptysis, with computed tomography (CT) showing diffuse alveolar bleeding; his complete blood count also revealed eosinophilic inflammation. The third patient, a 34-year-old man, displayed acute ground-glass lung opacities as well as fibrosing changes on CT corresponding to pulmonary sarcoidosis. All three recovered on high-dose systemic corticosteroid treatment and were discharged from the hospital in 2 to 12 days. CONCLUSION: In the first two cases, acute pulmonary injury was very likely due to e-cigarette consumption, as all other possible causes were ruled out. A possible link to e-cigarette use was present in the third case. We thus describe the first three suspected cases of acute lung disease due to e-cigarette use in Germany. These patients do not share any

common, typical clinical picture; rather, their symptoms represent different components of the wide spectrum of interstitial lung disease. A uniform national registry should be established to improve our understanding of the adverse effects of e-cigarettes and the resulting acute and chronic changes in the lungs.

Temas, D. and A. Meyer, E-Cigarette- and Vaping-Related Lung Injury (EVALI) at a Regional Hospital System in South Carolina. Case Rep Pulmonol, 2020. **2020**: p. 5370606. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32509369.
We report on four cases of severe lung injury and respiratory failure attributed to E-cigarette use that presented between July and August, 2019. The patients described were relatively healthy without clinically significant history of lung disease. Each developed severe acute respiratory distress shortly following E-cigarette use. In each case, the patients initially presented with considerable hypoxia and infectious-appearing pattern with elevated inflammatory markers on laboratory values. Imaging studies demonstrated a consistent pattern of widespread bilateral interstitial infiltrates with a medial distribution. All but one of the cases involved the admitted use of THC oil in E-cigarettes. There was rapid progression of illness requiring increased supplemental oxygen and in two cases, requiring urgent intubation and mechanical ventilation. No infectious organism was isolated in any case, and patients improved rapidly with the initiation of steroids. These are among the first cases reported in South Carolina and are consistent with similar cases that have been reported around the country.

Tzortzi, A., M. Kapetanstrataki, V. Evangelopoulou and P. Beghrakis, A Systematic Literature Review of E-Cigarette-Related Illness and Injury: Not Just for the Respirologist. Int J Environ Res Public Health, 2020. **17**(7). Available from: https://www.ncbi.nlm.nih.gov/pubmed/32230711.
Following the recent electronic cigarette (e-cigarette) illness outbreak, the current review aimed to collect all related clinical cases for study and analysis and provide a critical synopsis of the proposed injury mechanism. Adhering to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) guidelines, e-cigarette-related clinical cases were identified via Google Scholar and PubMed databases. Additionally, references of published case reports and previous review papers were manually searched, revealing 159 publications presenting e-cigarette-related case reports and 19 reports by the Centers for Disease Control and Prevention. 238 individual cases were identified; 53% traumatic injuries due to e-cigarette explosion or self-combustion, 24% respiratory cases, and 12% poisonings. Additional cases pertained to oral, cardiovascular, immunologic, hematologic, allergic reactions, infant complications, and altered medication levels. Case reports were mainly published between 2016-2019 (78%). The oldest case, a lipoid pneumonia, was published in 2012. The current review showed that e-cigarette-related health effects extend beyond the acute lung injury syndrome, including traumatic, thermal injuries and acute intoxications. Physicians should be aware of the distinct clinical presentations and be trained to respond and treat effectively. Regulators and public health authorities should address the regulatory gap regarding electronic nicotine delivery systems (ENDS) and novel tobacco products.

Wolf, M. and J. Richards, Acute Eosinophilic Pneumonia Due to Vaping-Associated Lung Injury. J Crit Care Med (Targu Mures), 2020. **6**(4): p. 259-262. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33200099.
A case is described of a 29-year-old female who presented with acute hypoxic respiratory failure due to acute eosinophilic pneumonia, associated with the use of electronic cigarettes to vape tetrahydrocannabinol (THC), together with the contemporary clinical understanding of the syndrome of electronic-cigarette associated lung injury (EVALI). Attention is drawn to acute eosinophilic pneumonia as a potential consequence of vaping-associated lung injury to understand the diagnostic evaluations and therapeutic interventions for acute eosinophilic pneumonia associated with vaping THC.

Works, K. and L. Stack, E-cigarette or vaping product-use-associated lung injury (EVALI): A case report of a pneumonia mimic with severe leukocytosis and weight loss. J Am Coll Emerg Physicians Open, 2020. **1**(1): p. 46-48. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33000013.
E-cigarette or vaping product-use-associated lung injury is a disease process obtained from smoke inhalation with electronic delivery systems and typically presents with shortness of breath, cough, and fever, not unlike pneumonia. Our patient presented with similar symptoms, and his case went unrecognized through several emergency department visits. The pathophysiology is similar to chemical pneumonitis and can cause significant morbidity and mortality, particularly when it goes unrecognized. It often presents with a pneumonia-like picture and may be treated as such. The distinguishing and controversial treatment for this disease is systemic glucocorticoids, which are not often given in pneumonia. This case is unique for the significant leukocytosis found on laboratory testing and profound weight loss associated with his course of illness. Emergency medicine providers should be vigilant in recognizing this illness to prevent progression of this disease.

Cardiovascular

McClelland, M. and S. McClelland, Case of a 21-year-old man with persistent lung collapse leading to a pericardectomy linked to vape use. Heart Lung, 2020. **50**(2): p. 262-267. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33373941.
This case report describes multiple organ failure in a young man with illicit vape use which he did not initially disclose to his health care providers. His symptoms were not readily diagnosed until he experienced lung collapse and significant heart failure. Treatment plan recommendations varied among health care providers leading to increased anxiety for the patient and his family. It was ultimately determined that illicit vape use along with chronic substance abuse contributed to a respiratory virus causing pulmonary collapse. The pulmonary virus migrated to the patient's heart causing severe restrictive pericarditis ultimately requiring a pericardectomy. Assessment, interventions, and follow-up care occurred during the global Corona-19 pandemic of 2020.

Jessri, M., A.S. Sultan, E. Magdy, N. Hynes and S. Sultan, Nicotine e-vaping and cardiovascular consequences: a case series and literature review. Eur Heart J Case Rep, 2020. **4**(6): p. 1-7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33437920.
Background: Cardiovascular toxicity as a consequence of nicotine from conventional tobacco cigarette smoking is well documented. However, little is known about the cardiovascular consequences of nicotine e-vaping. We review the literature and report a case series of three cases of major adverse cardiovascular clinical effects post nicotine e-vaping. Case summary: Three patients with known peripheral arterial disease who switched from heavy cigarette smoking consumption to a high-intensity dose of nicotine e-vaping all developed further arterial complications within 6-30 months. Discussion: With the recent epidemic of e-vaping in young individuals and the national outbreak of e-vaping use-associated lung injury (EVALI), the dangers of e-vaping are now coming to light. The pulmonary effects are now well described, and this paper highlights three new cases of cardiovascular toxicity associated with e-vaping. The potential role of nicotine e-vaping and the risk of coronavirus disease-2019 (COVID-19) will also be discussed.

Sakhamuri, S., S. Goji and S. Teelucksingh, Case Report: Flavored Vaping-Associated Hypokalemia. Am Fam Physician, 2020. **102**(2): p. 74-76. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32667173.

Shea, J.B., M. Aguilar, W.H. Sauer and U. Tedrow, Unintentional magnet reversion of an implanted cardiac defibrillator by an electronic cigarette. HeartRhythm Case Rep, 2020. **6**(3): p. 121-123. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32195116.

Other adverse health effects

Irusa, K.F., B. Vence and T. Donovan, Potential oral health effects of e-cigarettes and vaping: A review and case reports. J Esthet Restor Dent, 2020. **32**(3): p. 260-264. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32243711.
OBJECTIVE: In this article, the potential oral health consequences of vaping are described. While most dentists are likely aware of the potential serious health effects involved with vaping, the aim of this article was to raise awareness on identified oral health consequences. CLINICAL CONSIDERATIONS: Three patients presented to one dental practice with unusual patterns of dental caries, and all three admitted to regular vaping. Vaping components include propylene glycol, glycerin, nicotine, and flavors, which contain sucrose, sucralose, and ethyl maltol. The vapor produced by vaping devices is thick and viscous and much of it is retained on oral tissues. There are over 10 000 different vaping liquids, including some that contain tetrahydrocannabinol (THC) and vitamin E acetate. Vaping clearly has the potential to negatively affect general health, periodontal health, and accelerate the development of caries. There is also evidence that teenagers are being attracted to vaping in astonishing numbers. CONCLUSIONS: The general health consequences of vaping have received considerable attention in the national media. There is much to be learned about the consequences of this behavior. There are also potential serious oral health consequences to vaping. It is likely that the composition of certain vaping solutions may make them more harmful than others CLINICAL SIGNIFICANCE: It is important that dental professionals are made aware of the potential problems related to vaping. Initial reports show that the effect of e-cigarettes on periodontal tissues is similar to that of conventional cigarettes. Some vaping formulations may be highly cariogenic, especially those with sweet flavors, which are used to attract young people. Patients should be routinely questioned about their vaping habits in the medical-dental history.

Krishna, A., W. Mathieu, E. Mull and J.D. Tobias, Perioperative Implications of Vaping. J Med Cases, 2020. **11**(5): p. 129-134. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34434382.
Over the past 10 - 15 years, there has been a significant increase in the use of electronic cigarettes. These devices are generally used to deliver nicotine through inhalation by aerosolization. While the long-term risk of lung cancer is yet to be known, the chemicals and impurities in the solutions may have other acute and chronic effects on the respiratory system including respiratory failure from adult respiratory distress syndrome. Recent concerns have been raised regarding the potential for significant acute and chronic health care risks of these devices including pneumonitis, airway reactivity and respiratory failure. Given that many of the acute effects are related to the respiratory system, anesthetic care may be required during diagnostic procedures including bronchoscopy to investigate the etiology of acute respiratory symptomatology. We present an adolescent who presented to the operating room for bronchoscopy and bronchoalveolar lavage to investigate the etiology of respiratory involvement following an episode of vaping. The healthcare and end-organ effects of nicotine, tobacco smoke and vaping are discussed, and potential anesthetic implications are presented.

Makurina HI, Makarchuk OI, Dmytrenko IP, Holovkin AV, Sokolovska IA and C. AS., Verrucous leukoplakia of the red border caused by the use of IQOS heated tobacco product (a case report). Zaporozhye Medical Journal, 2020. **22**(6). Available from: http://zmj.zsmu.edu.ua/article/view/218477/218770.

Shields, C.L., M. Kim, S.E. Lally, P. Chevez-Barrios and J.A. Shields, Eye cancer in a young male with a vaping history. Indian J Ophthalmol, 2020. **68**(8): p. 1699-1701. Available from: https://www.ncbi.nlm.nih.gov/pubmed/32709829.

We report a new observation of conjunctival intraepithelial neoplasia (CIN) in a young man following years of electronic cigarette use. A 22-year-old man with a 5-year electronic cigarette use (vaping) developed painless unilateral blurred vision in the right eye from mild superficial corneal opacification, unresponsive to topical antiviral therapy. Corneal scraping documented no infectious etiology. The abnormality persisted for 1 year and superficial keratectomy revealed high-grade CIN with enlarged pleomorphic and dyskeratotic cells. Interferon-alpha-2b was instituted. In this case, chronic exposure to electronic cigarette vapors (vaping) could have been associated with CIN in this young patient.

2021

Trauma injuries

Dekhou, A., N. Oska, B. Partiali, J. Johnson, M.T. Chung and A. Folbe, E-cigarette burns and explosions: What are the patterns of oromaxillofacial injury? Journal of Oral and Maxillofacial Surgery, 2021. **79**(8): p. 1723-1730. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33974919.
PURPOSE: With the recent increase in popularity of electronic cigarette use in the United States, its harmful effects are not only limited to smoke inhalation, but also to the possibility of e-cigarette device malfunction. The purpose of this review is to characterize oromaxillofacial trauma secondary to electronic cigarette device explosion. METHODS: For this systematic review, PubMed and Embase were searched in October 2019 using the following search terms: e-cigarette burns, e-cigarette injury, and e-cigarette explosions, which yielded 400 studies. Basic science research, animal studies, non-English studies, and reports of non-oromaxillofacial injuries were excluded. Study subject demographics, mechanism of trauma, injury type, treatment, and sequelae were recorded and analyzed. RESULTS: Of all studies, 20 studies met inclusion criteria, including 14 case reports and 6 case series, with a total of 21 study subjects. For cases that reported sex, 100% were male (20) with a mean age of 29.5 years. Most common lacerations and/or burns involved the lips (10/21), tongue (8/21), soft palate and/or hard palate (4/21), and nose (5/21). Thirteen subjects underwent surgeries including oral-maxillofacial surgery or dental implants (7/13), bone graft repair (3/13), open reduction and internal fixation for preservation of sinus outflow tracts (2/13), foreign body removal from the cervical spine (1/13), and iridectomy (1/13). Reported complications included bone loss secondary to traumatic fracture, tinnitus and hearing loss, lip paralysis secondary to persistent edema, major depressive disorder/ post-traumatic stress disorder, persistent sinusitis, photophobia, and bilateral axillary and hand contractures. CONCLUSIONS: Electronic cigarette device malfunction and explosion carries great risk for acute oromaxillofacial trauma that may be disfiguring. With the increasing popularity of electronic cigarette use, clinicians and patients should be advised regarding dangers of electronic cigarette use.

Respiratory

Adhikari, R., T. Koritala, R. Gotur, S.V. Malayala and N.K. Jain, EVALI - E-Cigarette or Vaping Product Use-Associated Lung Injury: A Case Report. Cureus, 2021. **13**(2): p. e13541. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33815967.
The use of electronic cigarettes among the young adult and adolescent population has increased over the past decade. Vaping is the process of inhaling an aerosol that is produced by heating a liquid or wax containing substances, such as nicotine, cannabinoids (e.g., tetrahydrocannabinol (THC), cannabidiol), flavoring, and additives (e.g., glycerol, propylene glycol) using an e-cigarette. A multistate epidemic associated with vaping prompted the Centers for Disease Control and Prevention (CDC) to issue an official health advisory on e-cigarette or vaping product use-associated lung injury (EVALI). EVALI is a diagnosis of exclusion with no specific diagnostic test. We present a case of EVALI before the COVID-19 pandemic time in a 23-year-old immunocompetent male student with an eight-year history of vaping. He presented to the emergency department with fever, shortness of breath, tachypnea, nausea, and diarrhea. The patient had no past medical history. The patient denied illicit drug abuse or known drug allergies. The patient was admitted with a diagnosis of sepsis and pneumonia. The patient's urine drug screen was positive for cannabinoids with a history of vaping. Community-acquired pneumonia due to Legionella, Pneumococcal, Mycoplasma bacteria was ruled out. Influenza A/B, Parainfluenza, Rhino, and Adenoviruses were negative. A computed tomographyscan of the chest showed bilateral infiltrates. He was treated with high dose steroids, empiric antibiotics, high flow oxygen and managed in

ICU for seven days. The patient was discharged on tapering doses of steroid and counseled to quit vaping. EVALI outbreak is strongly linked to vitamin E acetate in vaping products. EVALI is a diagnosis of exclusion with a history of vaping and responds well to steroids.

Adhikari, R., D. Manduva, S.V. Malayala, R. Singh, N.K. Jain, K. Deepika, et al., A Rare Case of Vaping-Induced Spontaneous Pneumomediastinum. Cureus, 2021. **13**(8): p. e17166. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34532191.
Vaping is the process of inhaling an aerosol produced by heating a liquid or wax containing substances such as nicotine, cannabinoids (e.g., tetrahydrocannabinol, cannabidiol), flavoring, and additives (e.g., glycerol, propylene glycol). The presence of air or gas in the mediastinum is pneumomediastinum. We present a rare case of vaping-induced spontaneous pneumomediastinum. A young 20-year-old female patient with a history of vaping and no past medical history presented with acute chest pain to an emergency room. The urine drug screen was positive for cannabinoids. Imaging studies - chest x-ray and computed tomography of the chest - showed pneumomediastinum. The patient was discharged after a day of observation and counseling to quit vaping.

Alam, M.D.U., K. Hussain, S. Garedew and M. Imtiaz, Vaping and Commitment Flu-B Infection Is a Deadly Combination for Spontaneous Pneumomediastinum. Case Rep Pulmonol, 2021. **2021**: p. 9944491. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34239752.
Vaping or E-cigarettes were created to deliver nicotine-containing aerosol to users with a flavoring agent without agents such as tars, oxidant gases, and carbon monoxide smoke found in traditional tobacco cigarettes. The use of E-cigarettes is steadily increasing in the United States, especially among the young population. Electronic cigarettes seem capable of causing various injury patterns in the lungs, collectively called E-cigarettes or vaping-associated lung injury (EVALI). Spontaneous pneumomediastinum (SPM) is a rare finding in EVALI. Here, we report a case of spontaneous pneumomediastinum secondary to vaping in a young man with no past medical history except for daily vaping and a recent untreated influenza infection.

Ashraf, O., A. Nasrullah, R. Karna and A. Alhajhusain, Vaping associated spontaneous pneumothorax - A case series of an enigmatic entity! Respir Med Case Rep, 2021. **34**: p. 101535. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34745871.
The use of electronic nicotine delivery devices (ENDDs) has risen to an epidemic level among high schoolers and people aged 18-34. To our knowledge there are only 7 reported cases of spontaneous pneumothorax (SP-PTX) associated with vaping, and herein we describe 4 additional cases. We propose identifying this disease process as a novel entity, Vaping-Associated Spontaneous Pneumothorax (VASP). VASP requires early interventional treatment and has a high recurrence rate, and we suggest that vaping cessation and early interventional treatment including tube thoracostomy and surgical treatment is necessary in most cases to prevent recurrences.
Ayoub, M., M. Quamme, A.K. Abdel-Reheem and P. Lwin, COVID or Not COVID? A Great Mimicker Behind the Smoke Screen. Cureus, 2021. **13**(11): p. e19480. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34912621.
Vaping is becoming increasingly popular as an alternative to cigarettes. However, vaping does not come without risks; electronic cigarette (e-cigarette) and vaping-associated lung injury (EVALI) is one of the most severe consequences. Coronavirus disease 2019 (COVID-19) and bacterial pneumonia cases often present with almost identical features. We present a case of a young man who presented with pneumonia that was initially thought to be related to COVID-19 infection but later diagnosed as EVALI. Clinicians should have a high suspicion of EVALI in patients who present with hypoxemia and negative infectious workup, particularly during the COVID-19 era. Administration of corticosteroids has shown remarkable efficacy in improving hypoxemia; however, many patients may have chronic lung injury and may require oxygen long-term. Cases of EVALI should continue to be reported and followed up long term for monitoring disease outcomes.

Barnes, J.M. and M. Ali, E-Cigarette or Vaping Associated Lung Injury: Evolving Threat to Healthy Teens. S D Med, 2021. **74**(7): p. 318-321. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34449994.
Vaping quickly rose in popularity once introduced to the market in 2003. Devices heat liquid to produce an aerosol that is inhaled by the user, an aerosol that can contain nicotine, heavy metals, volatile organic compounds, ultrafine particles, cancer-causing chemicals, and flavoring. Teenagers commonly use these products to smoke cannabinoids including delta-9-tetrahydrocannabinol (THC), cannabidiol (CBD), and butane hash oil (BHO). Liquids placed in the devices can be commercial or homemade. As popularity increased, more cases of vaping-related lung injury have been reported. We report a case of a 17-year-old female patient with delayed diagnosis of e-cigarette or vaping associated lung injury.

Borchert, D.H., H. Kelm, M. Morean and A. Tannapfel, Reporting of pneumothorax in association with vaping devices and electronic cigarettes. BMJ Case Rep, 2021. **14**(12). Available from: https://www.ncbi.nlm.nih.gov/pubmed/34920999.
Vaping may lead to spontaneous pneumothorax, but there are few published reports on this phenomenon. We present a case of vaping-related pneumothorax and make recommendations for structured reporting of this emerging cause for pneumothorax. A normal-weight 34-year-old male presented to our emergency department with dyspnoea and back pain increasing over 24 hours. Chest X-ray showed a large right-sided pneumothorax. Three years ago, he had quit smoking cigarettes and switched to vaping. CT scan revealed bullae, and the patient received apical lung resection. Histology revealed mild alveolitis. Vaping is an emerging cause of lung injury. This report demonstrates a potential association between vaping and pneumothorax. However, structured reporting and future research are needed to establish a definitive (or causal) relationship between vaping and pneumothorax.

Cano Aguirre, M.D.P., A. Esperanza Barrios, F. Martinez Muniz, S. Alonso Viteri, F. Muniz Gonzalez, R. Segoviano Mateo, et al., Hemoptysis induced by vaping. Arch Bronconeumol, 2021. **57**(7): p. 505-506. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35698965.

Chua, T.H., A. Takano, Y.J. Yao, S.Y. Chow, A. Devanand and C.K. Tay, Autoimmune pulmonary alveolar proteinosis with a history of vaping and vitamin E-positive bronchoalveolar lavage. Respirol Case Rep, 2021. **9**(11): p. e0864. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34703611.
Pulmonary alveolar proteinosis (PAP) can be due to primary autoimmune and secondary causes, including e-cigarette, or vaping, product use-associated lung injury. We present a 33-year-old male presenting with PAP and a history of vaping. Serum anti-granulocyte-macrophage colony-stimulating factor antibodies were present. Vitamin E (VE), but not VE acetate, was detected in bronchoalveolar lavage. This is the first report of potential association between vaping and autoimmune PAP.

Glenski, T.A., C.E. Dorris, G.M. Patel, C.M. Taylor and N.M. Doyle, Vaping Associated Cardiac Arrest at School in a Teenager with Anomalous Left Coronary Artery. Mo Med, 2021. **118**(5): p. 450-452. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34658439.
The prevalence of electronic cigarette use is increasing at an astonishing pace, particularly in the teenage population. While at school, a healthy 13-year-old male experienced a sudden cardiac arrest after vaping multiple times throughout the day. Workup revealed an anomalous left coronary artery originating from the right sinus of Valsalva. Given this patient's underlying anomalous left coronary artery, we suspect that sympathoexcitatory and arrhythmogenic effects of high dose nicotine from vaping led to his cardiovascular collapse. This is the first published case report of a vaping associated cardiac arrest in a patient of this age.

Gouse, B.M., A. Nieves-Archibald, I. Trutzer, M. Rezvani, M. Srinath, A. Chang, et al., Pediatric Malignant Catatonia Associated With Vaporized Cannabis Use: A Case Series. J Acad Consult Liaison Psychiatry, 2021. **62**(4): p. 445-448. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34210403.

Harada, H.A., J. Liu, J.D. Shortell and S.J. Beesley, A 20-Year-Old Man with e-Cigarette or Vaping Product Use-Associated Lung Injury (EVALI) and Thrombotic Coagulopathy. Am J Case Rep, 2021. **22**: p. e929915. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33854029.
BACKGROUND In 2019, the US Centers for Disease Control and Prevention (CDC) described the criteria for the diagnosis of e-cigarette or vaping product use-associated lung injury (EVALI), which may be caused by contamination of delta-9-tetrahydrocannabinoid (THC) e-liquids with vitamin E acetate. This report describes a case of a 20-year-old man with a history of recreational drug use that included vaping, who presented with EVALI and a coagulopathy associated with thrombotic events. CASE REPORT We present a 20-year-old patient who worked at a cannabidiol (CBD) manufacturing facility with a history of e-cigarette use and polysubstance abuse in remission who presented with respiratory and gastrointestinal symptoms accompanied by 50-pound weight loss over 6 months. The patient had been vaping with nicotine and THC-containing e-cigarettes multiple times per day for 1.5 years. He met the CDC surveillance criteria for EVALI, consisting of respiratory symptoms and infiltrates on imaging within 90 days of vaping, and was found to have eosinophilic pneumonia secondary to THC-containing e-cigarette use. Additionally, thrombi were detected in the pulmonary arteries, right saphenous vein, and right ventricle. A segmental infarct was noted in the inferior pole of the left kidney. CONCLUSIONS We present the second case report potentially linking e-cigarette use with clinically significant thrombogenesis, the first with both arterial and venous thromboses. This report demonstrates the importance of taking a history of e-cigarette use in patients presenting with lung injury. Although EVALI and the diagnostic criteria have only recently been described, systemic effects, including coagulopathy, are now being reported.

Ismail, A.S., T. Imaduddeen and W.H. Ibrahim, Electronic Cigarette or Vaping Product Use-Associated Lung Injury in a Previously Healthy Young Male. Cureus, 2021. **13**(9): p. e18269. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34722048.
Vaping (i.e., the use of electronic cigarettes) has been gaining popularity among people for the past few years, perhaps due to the misconception that its use is less harmful than traditional cigarettes. Although the long-term effects of these products are still unknown, it has been shown that they can be implicated in acute lung injury in healthy people. In 2019, an epidemic of severe acute lung injury was reported in the United States, and it was linked to vaping or electronic cigarette use and was referred to as e-cigarette or vaping product use-associated lung injury (EVALI). Here, we present the first case of EVALI in the state of Qatar.

Kalantary, A., B. Abdelazeem, N. Shams, R. Pratiti and I. Al-Sanouri, Coagulopathy and Acute Respiratory Distress Syndrome: Dual Complications of E-Cigarette-Associated Lung Injury. Cureus, 2021. **13**(2): p. e13531. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33786238.
E-cigarette-associated lung injury (EVALI) is related to the usage of e-cigarettes or a related product (e.g., "vaping" or "dabbing"). It presents mainly with constitutional, respiratory, or gastrointestinal symptoms, and EVALI is currently a diagnosis of exclusion. EVALI patients are more prone to rapid clinical decline requiring close monitoring, with some requiring intensive care unit (ICU) level of care or intubation. Mortality occurs in rare cases. We are presenting an interesting case of a male in his mid-60s who presented to the emergency department with worsening dyspnea and cough for two weeks, preceded by a one-week history of fever, nausea, and diarrhea. He was diagnosed with bilateral pneumonia based on computed tomography (CT) findings. Subsequent CT of the chest showed worsening bilateral

diffuse ground-glass opacities (GGOs) correlating with acute respiratory distress syndrome (ARDS). Laboratory workup showed leukocytosis and lactic acidosis. The rest of the laboratory workup was normal. The patient was intubated due to ARDS, developed multiorgan failure, and passed away subsequently.

Kaslow, J.A., C. Rosas-Salazar and P.E. Moore, E-cigarette and vaping product use-associated lung injury in the pediatric population: A critical review of the current literature. Pediatr Pulmonol, 2021. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33821574.
Use of electronic nicotine delivery systems (ENDS), also known as e-cigarettes, in the adolescent population has significantly increased over the past several years. This rise led to an outbreak of e-cigarette or vaping product use-associated lung injury (EVALI) in the summer of 2019. Since that time, numerous case reports and case series on vaping and EVALI have been published but the majority of literature highlights the adult population with few articles focusing on pediatric patients. Given the addictive nature of these products and the lack of full understanding of the human health effects, there is concern that use of ENDS may have lasting impacts on users, especially adolescents and young adults. The goal of this review is to critically assess published data on ENDS use in children, report our institutional experience, discuss the reasons why the use of ENDS have increased among young individuals, outline the current understanding of EVALI as it pertains to the pediatric population, and discuss future opportunities for health policy implementation.

Kubbara, A., F. Hawari and J. Johnkoski, Diffuse alveolar haemorrhage secondary to haemophilus influenzae in a vaping patient. BMJ Case Rep, 2021. **14**(6). Available from: https://www.ncbi.nlm.nih.gov/pubmed/34130979.
Diffuse alveolar haemorrhage (DAH) is known to occur from several infectious and non-infectious aetiologies. Among the infectious aetiologies, Haemophilus influenzae, an organism known to cause community-acquired pneumonia, has not been reported in association with DAH prior to this case. On the other hand, vaping, an evolving epidemic concern, has been linked to various types of lung injury, including DAH. However, DAH related to vaping is only limited to several case reports. Our case describes H. influenzae pneumonia with DAH in a patient known to have vaped until the night prior to elective lobectomy for lung cancer and developed DAH within 24 hours of hospitalisation. He subsequently recovered with treatment. DAH requires immediate recognition, and healthcare providers need to be aware that neither haemoptysis nor decrease in haemoglobin level is necessarily associated. Prior to diagnosis, empirical treatment with intravenous steroids and antibiotics can be life-saving.

Kupelian, C., A. Kim and V. Vijayan, E-cigarette or Vaping Product Use-Associated Lung Injury Complicated by Pulmonary Aspergillosis. Cureus, 2021. **13**(12): p. e20075. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34987937.
Since the initial reports regarding the nationwide outbreak of e-cigarette or vaping product use-associated lung injury (EVALI) in August 2019 by the Centers for Disease Control and Prevention, a clear link has been established between EVALI and tetrahydrocannabinol (THC)-containing product use. We report a case of invasive pulmonary aspergillosis (IPA) as a complication of EVALI in an immunocompetent adolescent that resulted in a fatal outcome. We encourage physicians that are considering the diagnosis of EVALI be cognizant of the increased use of THC and other potential contaminants in vaping cartridges. IPA can be a fatal disease and early aggressive treatment is necessary.

Lee, M.H., C.D. Cool and J.P. Maloney, Histopathological Correlation of Acute on Chronic Eosinophilic Pneumonitis Caused by Vaporized Cannabis Oil Inhalation. Chest, 2021. **159**(3): p. e137-e139. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33678280.
Whether eosinophilic pneumonitis represents a true manifestation of e-cigarette, or vaping, product use-associated lung injury remains uncertain, and this ambiguity stems from a lack of histopathological data. We present a previously healthy young woman whose asthma-like

symptoms and histopathologic finding of eosinophilic pneumonitis were caused by inhalation of vaporized cannabis hash oil concentrates. This report provides compelling evidence that eosinophilic pneumonitis can result from cannabis hash oil inhalation.

Lilley, J., S. Kravitz, Z. Haynes, T. Church, S. McKay and A. Mertz, E-cigarette, or vaping, product use associated lung injury and the risks and benefits of a thorough infectious work-up. Respir Med Case Rep, 2021. **33**: p. 101465. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34401301.
As of February 2020, over 2800 cases of lung injury associated with vapes have been reported in all 50 states (Cullen et al., 2019) [1]. This case is about a 29-year-old female with a five-year history of vaping tetrahydrocannabinol (THC) who presented with symptoms consistent with e-cigarette, or vaping, product-use associated lung injury (EVALI). This case report is unique because this patient clinically improved on a lower dose of corticosteroids compared to other reported cases of EVALI. Additionally, this case report highlights the importance and difficulty of excluding other disease processes prior to treating patients for EVALI, particularly during the coronavirus disease 2019 (COVID-19) global pandemic.

Lim, J., B.D. Nam, J.H. Hwang, Y.K. Kim, E. Oh and E.J. Lee, Electronic Cigarette or Vaping Product Use-Associated Lung Injury: A Case Report. Taehan Yongsang Uihakhoe Chi, 2021. **82**(6): p. 1581-1588. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36238876.
Electronic cigarette (e-cigarette) or vaping product use-associated lung injury (EVALI) has emerged as a social issue as e-cigarette use is rapidly increasing worldwide and is related to many deaths in the United States. To our knowledge, this is the first case report of EVALI in South Korea of a 24-year-old man with acute respiratory symptoms and a history of e-cigarette use. Chest CT revealed diffuse bilateral ground-glass opacities with subpleural sparing, airspace consolidation, and centrilobular micronodules as typical patterns of EVALI with organizing pneumonia and diffuse alveolar damage. Infection was excluded with meticulous laboratory examinations, and the patients' illnesses were not attributed to other causes. EVALI was diagnosed by meeting the diagnostic criteria with consistent clinico-radiologic findings through a multidisciplinary approach. Radiologists should have good knowledge of EVALI radiologic findings and play a cardinal role in the proper diagnosis and management of EVALI.

Lucero, A., N. Eriksson, C. Nichta and K. Sokol, A 23-year-old man with acute lung injury after using a tetrahydrocannabinol-containing vaping device: a case report. J Med Case Rep, 2021. **15**(1): p. 70. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33573662.
BACKGROUND: Vaping-associated lung injury is a newly emerging disease process with the potential for serious health implications and high mortality, even despite the lack of underlying lung disease. We present a case of a young, otherwise healthy patient with tetrahydrocannabinol vaping-associated lung injury. CASE PRESENTATION: A 23-year-old Caucasian man with a past history of tetrahydrocannabinol vaping and benzodiazepine and methamphetamine abuse presented to the emergency department of our institution with a complaint of "feeling malnourished" over the past 5 days, along with associated fevers, cough, and vomiting. His past medical, surgical, family, and social histories were significant only for the recent use of marijuana vaping pens. Upon initial presentation, the patient appeared to be in significant respiratory distress. A computed tomographic scan of his chest demonstrated diffuse central predominant interstitial opacities, and he was admitted to the medical intensive care unit, where he was eventually intubated for hypoxic respiratory failure. No other cause of his respiratory failure was found, and it was ultimately believed that the patient had sustained a vaping-associated lung injury. CONCLUSION: Tetrahydrocannabinol-containing vaping-associated lung injury is still poorly understood overall and is currently being investigated by the Centers for Disease Control and Prevention. In the meantime, physicians should consider vaping to be a public health emergency. We summarize the appropriate history, physical examination, appropriate

workup, and therapies that physicians should be aware of in order to appropriately manage and treat patients presenting with suspected vaping-associated lung injury.

Munagala, R., A. Ullah, C. Sharma, A.N. Bhatt and J. Keshavamurthy, Smoky Diagnosis: Importance of Patient History in Vaping Associated Lung Injury. Cureus, 2021. **13**(11): p. e19596. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34926065.
E-cigarette or vaping use associated lung injury (EVALI) recently became a common cause of respiratory illness. The pathophysiology of EVALI is relatively unknown, and thus the disease remains a diagnosis of exclusion. There are no specific tests or markers that exist, although there is some belief that Vitamin E acetate is strongly linked to the increase in EVALI cases. Immediate recognition of EVALI patients is critical in order to reducing severe outcomes. For these cases, the importance of a complete patient interview is emphasized and necessary for diagnosis. We present a case of a young patient presenting with hypoxic respiratory failure due to EVALI, in which diagnosis was delayed due to incomplete patient history.

Pasricha, T.S. and B. Kochar, Vaping-associated esophagitis. BMC Gastroenterol, 2021. **21**(1): p. 106. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33663409.
BACKGROUND: Vaping, or e-cigarettes, heat nicotine and other chemicals to create a vapor that is inhaled. The practice has gained rapid popularity with 41 million people globally reporting regular or occasional use. Although tobacco smoking is well-known to increase esophageal acid exposure by augmenting the number of reflux events, the effects of vaping on the gastrointestinal tract have not yet been elucidated. Our objective is to report a case of severe esophagitis associated with vaping, which is the first in the literature to our knowledge. CASE PRESENTATION: A 25-year-old male with a history of well-controlled gastro-esophageal reflux disease presented to the emergency room for evaluation of one week of severe odynophagia. He had been treated with a proton-pump inhibitor for several years with good effect. Approximately two months prior to presentation, he started vaping tetrahydrocannabinol and nicotine with recent heavy daily use. He denied any alcohol or non-steroidal anti-inflammatory drug use. We performed esophagogastroduodenoscopy that revealed Los Angeles Grade C esophagitis (involving >/= 1 mucosal breaks continuous between tops of >/= 2 mucosal folds, < 75% circumferential). Histopathological analysis of esophageal biopsies demonstrated granulation tissue with acute and chronic inflammation. Periodic acid-Schiff-diastase staining was negative and immunohistochemical stains for herpes simplex virus and cytomegalovirus were negative. There was no evidence of eosinophilic esophagitis. We treated him with intravenous PPI and analgesics until he was able to tolerate oral intake. He was counseled extensively on vaping cessation and reported complete resolution of symptoms after 2 months. CONCLUSION: This patient's presentation illustrates a serious gastrointestinal consequence of vaping, the long-term consequences of which warrant additional studies. Like smoking, the mechanism of injury in vaping may be, at least in part, due to the effects of nicotine. As prevalence of vaping continues to rise, clinicians should be aware of this complication and carefully solicit a patient's vaping history as a simple denial of "smoking" can be misleading.

Patil, S.M., P.P. Beck, T.P. Patel, R. Dale Swaney, D. Dandachi and A. Krvavac, Electronic Vaping-Induced Methicillin-Sensitive Staphylococcus Aureus Pneumonia and Empyema. Case Rep Infect Dis, 2021. **2021**: p. 6651430. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33747579.
Pneumonia is a severe acute inflammation of the lower respiratory tract due to infectious pathogens. Pathogens responsible include bacteria, viruses, fungi, and parasites. Pneumonia categorizations include community-acquired pneumonia (CAP), hospital-acquired pneumonia, and ventilator-associated pneumonia. It is the single most common cause of infection-related mortality in the United States. Among the typical bacterial CAP causes, Staphylococcus aureus (S. aureus) is responsible for less than 5% of all cases. Among the S. aureus, methicillin-susceptible S. aureus (MSSA) is slightly more common than the methicillin-resistant S. aureus (MRSA). CAP caused by S. aureus is associated with worse

clinical outcomes compared to streptococcal pneumoniae. Although S. aureus CAP occurs throughout the year, it is less common except during the influenza season when there is a spike. Multiple studies have stratified risk factors for MRSA infection. MSSA pneumonia in immunocompetent young patients is uncommon due to healthy host defense mechanisms. However, certain individual risk factors promote infection, such as intravenous drug abuse. Recent multiple research studies implicate increased virulence of S. aureus in colonized patients after exposure to electronic cigarette vapor exposure (ECVE), resulting in pneumonia. A PubMed search revealed no MSSA community-acquired bacterial pneumonia due to ECVE. We report a 38-year-old female who developed acute MSSA pneumonia, which was complicated by left empyema due to ECVE from JUUL device with third-party compatible cannabidiol pods. The patient completed treatment successfully with a chest tube placement followed by fibrinolysis and intravenous antibiotics.

Roberts, J., J. Chow and K. Trivedi, Adult-Onset Asthma Associated With E-Cigarette Use. Cureus, 2021. **13**(11): p. e19190. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34873530.
Electronic cigarettes (e-cigarettes) are being increasingly used as a "safer" alternative to regular cigarettes as a method of de-addiction or a bridge to nicotine cessation. However, a multitude of pulmonary pathologies have been described associated with its use and have been clubbed under the category of e-cigarette or vaping use-associated lung injury (EVALI). This case describes a patient who started e-cigarette smoking in order to quit combustible cigarette smoking and developed adult-onset severe asthma. The clinical effect was initially reversible but later developed into persistent symptoms requiring inhaled and systemic therapy.

Sarel, E., D.R. Hoppenstein, M. Lahav, N. Ifrach, F. Fanadka and B.D. Fredman, Respiratory Failure Induced by Vaping-Associated Pulmonary Injury: Case Report of a New Entity. Isr Med Assoc J, 2021. **23**(1): p. 59-60. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33443347.

Schafer, M., M. Steindor, F. Stehling and C. Dohna-Schwake, EVALI (E-cigarette or vaping product use associated lung injury): First case report of an adolescent in Europe. Pediatr Pulmonol, 2021. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33497507.

Shiralkar, S., J. Fletcher and M. Balasubramaniam, An Unusual Complication of Electronic Cigarette Use: Missed Inhaled Foreign Body Causing Acute Respiratory Failure. Cureus, 2021. **13**(6): p. e15731. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34285842.
We present a case of a young woman who was admitted to the hospital with persistent pneumonia and cough productive of purulent green sputum. She was admitted to the intensive care unit due to type 1 respiratory failure. Chest computerised tomography (CT) showed a large right-sided hydropneumothorax, for which a right-sided chest drain was inserted. Despite intubation, oxygenation continued to deteriorate and the patient was commenced on veno-venous extracorporeal membrane oxygenation (ECMO) and transferred to the regional ECMO centre. Bronchoscopy revealed a plastic coil from an electronic cigarette at the entrance to the right lower lobe. Following its removal, the patient's condition rapidly improved and she was successfully weaned from ECMO and discharged from the cardiothoracic critical care unit. There are very few reports of tracheobronchial foreign body (FB) aspiration secondary to electronic cigarette use, and tracheobronchial FB aspiration in adults requiring veno-venous ECMO to treat respiratory failure is uncommon. This case highlights the importance of considering tracheobronchial FB aspiration as a potential diagnosis in patients who present with more than two weeks of pneumonia not responding to treatment.

Sood, S.B., A.J. Weatherly, A.H. Smith, M.A. Murphy, S.J. Conrad and D.P. Bichell, Vaping Contributing to Post-operative Acute Respiratory Distress Syndrome. Ann Thorac Surg, 2021. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33497668.
We report the case of an 18-year-old male with a history of bicuspid aortic valve with severe aortic insufficiency who had undergone a Ross procedure one year prior, but subsequently developed stenosis of the pulmonary homograft necessitating conduit replacement. His post-operative course was complicated by Acute Respiratory Distress Syndrome (ARDS). Bronchoscopy revealed significant mucus plugging without identification of contributing pathogen. Further evaluation revealed a history of e-cigarette use not identified pre-operatively and thought to be largely contributory to his post-operative complications. This case highlights the importance of screening pre-operatively for e-cigarette use and counseling on cessation prior to surgical procedures.

Sussman, M.A., VAPIng into ARDS: Acute respiratory distress syndrome and cardiopulmonary failure. Pharmacol Ther, 2021: p. 108006. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34582836.
"Modern" vaping involving battery-operated electronic devices began approximately one dozen years and has quickly evolved into a multibillion dollar industry providing products to an estimated 50 million users worldwide. Originally developed as an alternative to traditional cigarette smoking, vaping now appeals to a diverse demographic including substantial involvement of young people who often have never used cigarettes. The rapid rise of vaping fueled by multiple factors has understandably outpaced understanding of biological effects, made even more challenging due to wide ranging individual user habits and preferences. Consequently while vaping-related research gathers momentum, vaping-associated pathological injury (VAPI) has been established by clinical case reports with severe cases manifesting as acute respiratory distress syndrome (ARDS) with examples of right ventricular cardiac failure. Therefore, basic scientific studies are desperately needed to understand the impact of vaping upon the lungs as well as cardiopulmonary structure and function. Experimental models that capture fundamental characteristics of vaping-induced ARDS are essential to study pathogenesis and formulate recommendations to mitigate harmful effects attributable to ingredients or equipment. So too, treatment strategies to promote recovery from vaping-associated damage require development and testing at the preclinical level. This review summarizes the back story of vaping leading to present day conundrums with particular emphasis upon VAPI-associated ARDS and prioritization of research goals.

Threadcraft, M.A. and R. Case, Jr., Vape-Associated Pulmonary Injury (VAPI) Presenting With a "Miliary" Pattern on Imaging. Cureus, 2021. **13**(2): p. e13385. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33754108.
Electronic (E)-cigarette use or vaping is associated with pulmonary injury. Users can present with wide-ranging symptoms, varying degrees of pulmonary injury, and respiratory distress. Lung injury secondary to vaping is associated with a variety of patterns on pulmonary imaging. Typical radiographic findings are consistent with bilateral, basilar ground-glass opacities and or consolidation with septal thickening. We present a case of vape-associated pulmonary injury (VAPI) in a previously healthy adult who was found to have atypical radiographic findings. A 34-year-old male presented with a chief complaint of a two-week history of malaise, nausea, cough, and worsening shortness of breath. A chest CT scan without contrast revealed diffuse nodules in a miliary pattern. The patient reported a six-month history of tetrahydrocannabinol (THC) vape use. Bronchoscopy with cytologic analysis confirmed findings consistent with the VAPI. To our knowledge, this is the first report of a "miliary" pattern of infiltrates and nodules in a patient with VAPI. This pattern on CT imaging led to increased suspicion for other possible etiologies, including tuberculosis. Thus, moving forward, we believe that VAPI needs to be considered in the differential diagnosis if a patient presents with radiographic findings consistent with a miliary or diffuse micronodular pattern.

Wang, Y., Y.Q. Tong, W. Zhou, Z.L. Tian, N.N. Li, X.X. Lyu, et al., [Electronic cigarette use-associated lung injury: a case report and literature review]. Zhonghua Jie He He Hu Xi Za Zhi, 2021. **44**(5): p. 481-487. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34865370.
Objective: To improve the clinical recognition of electronic cigarette or vaping product use-associated lung injury. Methods: A 67 year old patient with lung injury induced by e-cigarette was reported. The concentrations of vitamin E acetate (VEA) and tetrahydrocannabinol (Delta9-THC) in BALF were measured by UHPLC-MS/MS. A literature review was performed with"Vaping-Associated Lung Injury""vape","e-cigarette","electronic cigarette","EVALI","electronic nicotine device","lung","injury","case"as Mesh terms in PubMed. Results: There were 208 cases reported in the literature, 71.6% of whom were male, and 28.4% were female, with a median age of 27 years (17-67 years), while 2 patients (1%) were over 60 years old. The median time of using e-cigarette was 90 days (2 weeks-3 years). Of the 208 patients, the most common symptoms were dyspnea, fever, chest pain, hemoptysis, and gastrointestinal symptoms such as nausea, abdominal pain or diarrhea. The most common manifestation of chest CT was bilateral ground glass opacity (n=119, 57.2%). A total of 70 patients received bronchoscopy and BALF, which showed that the ratio of macrophages was (49.5+/-29.8)%, neutrophil (34.7+/-28.7)%, lymphocytes (10.1+/-7.4)%, and eosinophils (2.4+/-3.6)%. The "foamy" alveolar macrophages were positive in 65 cases (92.9%).A total of 132 patients (63.5%) were treated with antibiotics, and 162 patients (77.9%) were treated with glucocorticoids. The initial dose of methylprednisolone was 40 mg and the maximum was 500 mg. 48 patients (23.1%) were mechanically ventilated and 10 patients (4.8%) were treated with extracorporeal membrane oxygenation (ECMO). Of the 208 patients, 202(97.1%) patients improved and 6 (2.9%) died. Conclusion: Our case and reported cases should alert physicians to the clinical presentation of vaping-associated lung injury for early diagnosis and prompt management. It is suggested that the standardized management of e-cigarette should be strengthened to avoid similar situation of e-cigarette-related lung injury in China. Additional work is needed to characterize the pathophysiology of this disease.

Wieckowska, J., U. Assaad and M. Aboudan, Pneumothorax secondary to vaping. Respir Med Case Rep, 2021. **33**: p. 101421. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34401268.
Pneumothorax is the presence of air in the pleural space that can result in the partial or complete collapse of a lung. Cigarette and cannabis smoking are also well-known risk factors. Vaping, on the other hand, is not as well-established as little is known about the impact electronic cigarettes have on the development of pneumothoraces despite their use rapidly increasing over the past decade. While the long-term adverse health effects of vaping are still unknown, the acute adverse events of vaping that have occurred are concerning. Pneumothoraces due to electronic cigarettes have been rarely reported so far but the body of literature illustrating an association is growing. We hope to contribute to it by presenting a case of a 19-year-old male who presented with an e-cigarette induced pneumothorax. It is our hope that this case brings more evidence to the dangers of e-cigarette use.

Wu, C.H., T.Y. Liao, Y.H. Chen and P.H. Kuo, Treatment of electronic cigarette or vaping product use-associated lung injury (EVALI) by corticosteroid and low-dose pirfenidone: Report of a case. Respirol Case Rep, 2021. **9**(10): p. e0845. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34584727.
Electronic (e)-cigarette or vaping product use-associated lung injury (EVALI) is a novel and potentially lethal disease first reported in the United States. We report the case of a 56-year-old man who presented to our hospital with dyspnoea and cough lasting for 2 months after using an e-cigarette for approximately 50 puffs over 2 weeks. Physical examination revealed crackles in the left lower lung. High-resolution computed tomography (HRCT) showed consolidation and ground-glass opacities in both lungs. The baseline forced vital capacity

(FVC) and diffusion capacity for carbon monoxide (DLCO) were 65.7% and 63.9% of the predicted, respectively. Lung biopsy revealed organizing pneumonia with focal fibrosis. In addition to prednisolone, he was treated with a low-dose pirfenidone (200 mg three times per day) due to the persistence of a mild cough, exertional dyspnoea and basal crackles after discharge. His symptoms and FVC significantly improved, but the recovery of the DLCO was slow. The follow-up HRCT demonstrated only minimal fibrotic changes. To our knowledge, this was the first reported case of EVALI successfully treated with a combination of corticosteroid and antifibrotic agents.

Xantus, G., V. Anna Gyarmathy, C.A. Johnson, P. Sanghera, L. Zavori and P.L. Kanizsai, The role of vitamin E acetate (VEA) and its derivatives in the vaping associated lung injury: systematic review of evidence. Crit Rev Toxicol, 2021: p. 1-13. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33432848.
Small scale observational evidence suggested that Vitamin E (VE) might play beneficial role in human and animal respiratory conditions of various origin by stabilizing surfactant functions. The intra-aleveolar VE level is directly proportionate to the lung's response to inflammation. Electronic cigarette or vaping associated lung injury was a dominantly respiratory syndrome in the United States with seemingly strong association between potential Vitamin E acetate inhalation exposure and the onset of symptoms. This systematic review intended to assess if there was previous evidence of any potential respiratory/gastrointestinal toxicity associated with Vitamin E acetate or any of its derivatives. A systematic review was constructed and prospectively registered at PROSPERO to search important clinical databases between 2000 and 2020 for full text human articles investigating the effect of VEA or any of its derivatives administered via any route (oral/parenteral/aerosolised) in adults with any respiratory conditions. Out of 363 records investigating the effect of VEA and/or its derivatives/isomers in (any) lung injury (inflammatory, oxidative, infective, asthma/COPD) seven articles qualified. The papers reported various surrogate outcomes (APACHEII score, spirometry, etc) with equivocal results. There was one case report of harmful exposure to both Vitamin E (intramuscular) and Vitamin E acetate (topical). The present review found evidence of neither harm nor any significant clinical improvement associated with the administration of VEA or any derivatives via any route in adult inflammatory lung conditions however, the articles were of low-level evidence. Further studies are needed to correct flaws in research to explore the role of Vitamin E in pulmonology.

Other health effects

Alzahrani, A.M., J.H. Basalelah, M.S. Alarifi and S.S. Alsuhaibani, Electronic Cigarettes as a Cause of Stuttering Priapism: A Case Report. Am J Case Rep, 2021. **22**: p. e935716. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34966166.
BACKGROUND **Having painful intermittent penile erections that last less than 4 h is known as stuttering priapism.** Sickle cell disease is a well-known risk for stuttering priapism; although, other causes could be related to this disorder. To date, no study has examined the relationship between stuttering priapism and electronic cigarettes (e-cigarettes). CASE REPORT We present a case of a 31-year-old man who came to our clinic with recurrent stuttering priapism. He had no chronic medical illnesses. He had smoked half a pack of cigarettes per day for the past 6 years but had shifted to vaping e-cigarettes for which he used several e-fluids and brands. His stuttering priapism started approximately 1 week after he began vaping. **A detailed history and physical examination were unremarkable. Laboratory results showed a normal complete blood count and** metabolic panel along with a normal testosterone level and negative sickle cell screening test. The chest X-ray and abdominal and pelvic ultrasound were normal. Initially, we reassured the patient; however, his condition persisted with no significant changes in his general health or lifestyle. **We asked him to stop using e-cigarettes, and after he stopped, his stuttering priapism surprisingly completely resolved.** He has not experienced a single episode of stuttering

priapism in the 3 months since the cessation of e-cigarettes use. CONCLUSIONS The relationship between stuttering priapism and e-cigarettes remains largely unexplored in the literature. Whether e-cigarettes and e-fluids represent a risk factor for priapism in novice e-cigarette smokers warrants further investigation.

Lechien, J.R., J.F. Papon, C. Pouliquen and S. **Hans, E-Cigarette Vaping-Related Vocal Fold Injury:** A Case Report. J Voice, 2021. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34389219.

Montville, D.J., J.M. Lindsey and J.G. Leung, Fluctuation between cigarette smoking and use of electronic nicotine delivery systems: Impact on clozapine concentrations and clinical effect. Ment Health Clin, 2021. **11**(6): p. 365-368. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34824961.
Unlike with smoking cigarettes, electronic nicotine delivery systems do not cause CYP450 1A2 induction as there is a lack of combustion and polycyclic aromatic hydrocarbon production. Changing to the use of an electronic nicotine delivery system from cigarettes can result in the deinduction of CYP450 1A2 and the increase of certain medication serum concentrations, including clozapine. A case is reported in which the switch from smoking to an electronic nicotine delivery system resulted in increased clozapine serum concentration and constipation, necessitating pharmacologic management. The patient ultimately transitioned back to cigarettes, which resulted in the emergence of psychiatric symptoms. An evaluation of longitudinal serum concentrations and clinical correlation is provided. It is important that patients and health care professionals have knowledge not only about the impact of smoking cigarettes on clozapine metabolism, but also the effects of switching to or from an electronic nicotine delivery system.

Oster, J.M., P. Tatum, C. Monigan and J. Kryzanski, **Seizures Noted by Responsive Neurostimulation From e-Cigarette Use** (Vaping). J Clin Neurophysiol, 2021. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34049366.
SUMMARY: The health consequences of e-cigarette use (vaping) have recently garnered significant attention, most notably from reports of pulmonary pathologic examination although there are scattered case reports of vape-induced seizures, but thus far, there have been little objective data or rigorous study supporting this association with definitive quantification.

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Poisoning

Ayesha, A., A review of electronic cigarettes and liquid nicotine poisoning exposure cases in the United States. Journal of Pharmacy & Pharmaceutical Sciences, 2022. **25**: p. 354-368. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36423643.
PURPOSE: In 2007, electronic cigarettes (e-cigarette) were introduced as a smoking cessation device. Since then, its sale and marketing has been expanded annually. Concomitantly, there is an increase in the electronic cigarette (e-cigarette) and liquid nicotine exposure cases reported to the United States (US) poison control centers. The purpose of this review is to assess the exposure cases reported to US poison control centers to characterize the adverse health effects of e-cigarette and liquid nicotine use. METHODS: The PubMed database was searched for e-cigarette and e-liquid exposure reports since 2010. The qualitative analysis was conducted to depict the characteristics related to the incident cases and health outcomes of e-cigarette and e-liquid exposure to support public awareness. RESULTS: Since 2010, there was an increase in e-cigarette exposure incidents with ingestion, inhalation, ocular and dermal identified as the commonly reported routes of exposure in both children and adults. The clinical symptoms were well characterized based upon the specific route of exposure. The exposure incidents were categorized into age, sex, type of exposure, symptoms, management site and medical outcome. The children less than 5 years of age were unintentionally exposed followed by both unintentional and intentional exposure in adults. The reported medical outcomes have a range from minor effects exhibiting symptoms that were not bothersome to major effects with life-threatening symptoms, and death. The short-term or acute exposure was mostly associated with mishandling or misuse of the e-cigarette device or e-liquid. **The case reports of young adult males who are linked to intensive use of e-cigarettes show lung injury**. CONCLUSION: E-liquid and e-cigarette use continue to pose a serious health risk for both adults and children. There is accumulating data of incidents associated with short-term e-cigarette use or intensive use of e-cigarettes. However, monitoring of the long-term health effect of e-cigarettes is needed in order to raise public awareness among young adults.

Sellner, J., L. Hauer, F. Rinaldi, M. Covi, F. Brigo, S. Pikija, et al., Embolic Stroke Following Ingestion of Liquid Nicotine Refill Solution. Neurohospitalist, 2022. **12**(4): p. 693-696. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36147756.
The use of e-cigarettes is gaining popularity despite knowing about cardiovascular health risks. Cases of intentional or accidental intoxication following ingestion of the refill solution are also a growing concern. Most of these cases were fatal and related to cardiac arrest and hypoxic brain injury. We report the case of a 54-year-old woman who developed bilateral acute ischemic stroke in the anterior and posterior cerebral circulation following intentional oral intake of e-liquid nicotine refill solution. The diagnostic work-up concluded an etiology of embolic stroke of undetermined source, most likely of cardiac origin. We assume that sympathetic overactivation lead to temporary cardiac arrhythmia and subsequent thrombi formation. Moreover, we discuss several additional pathogenic aspects of oral intake of e-liquid refill solution for the development of central nervous system pathology. This case expands the clinical spectrum of health hazards associated with the introduction of e-cigarettes and raises awareness of the need for preventive measures.

Respiratory

Atkin, M., *Autopsy finds man most likely died as a result of vaping*, in *ABC News*. 2022. Available from: https://www.abc.net.au/news/2022-02-21/autopsy-finds-man-most-likely-died-as-a-result-of-vaping/100800004.

Baker, M.M., T.D. Procter, L. Belzak and S. Ogunnaike-Cooke, Vaping-associated lung illness (VALI) in Canada: a descriptive analysis of VALI cases reported from September 2019 to December 2020. Health Promot Chronic Dis Prev Can, 2022. **42**(1): p. 37-44. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35044143.
INTRODUCTION: The aim of this study was to explore demographic and clinical characteristics of vaping-associated lung illness (VALI) cases reported in Canada from September 2019 to December 2020; compare the epidemiology of VALI cases in Canada to e-cigarette or vaping product use-associated lung injury (EVALI) cases in the US; and examine possible explanations for differences between the two countries. METHODS: A federal/provincial/territorial task group developed a national outbreak definition, minimum dataset and case report form for identification and surveillance of VALI cases in Canada. Descriptive analysis explored the characteristics and epidemiology of reported VALI cases. RESULTS: Of the 20 VALI cases reported, none resulted in a death. Of all cases, 5 (25%) involved youth aged 15 to 19 years, 10 (50%) adults aged 20 to 49 years and 5 (25%) aged 50 years and older. Sixty percent of patients were men. Half (50%) required breathing assistance. Three-quarters (75%) reported using nicotine-containing vaping products, and 40% reported use of cannabis-containing vaping products; of those who reported frequency of vaping, most (71%) reported vaping daily. VALI cases were reported at a lower prevalence (0.9 per million) than EVALI (8.5 per million). Demographics and vaping behaviour also differed. CONCLUSION: VALI cases were reported in Canada between September 2019 and December 2020; however, there was a much lower prevalence and they may have been caused by different factors from the EVALI outbreak in the US. The factors influencing VALI in Canada are complex and multifactorial. Research is needed to understand the short- and long-term health effects of nicotine and cannabis vaping.
In Canada, the use of e-cigarettes has been increasing, particularly among youth. Between September 2019 and December 2020, 20 cases of vaping-associated lung illness (VALI) were reported in Canada. Canada experienced a lower perpopulation prevalence of VALI compared to e-cigarette or vaping product use-associated lung injury (EVALI) in the US; differences in patient demographics and products used were also found.

Casamento Tumeo, C., A. Schiavino, M.G. Paglietti, F. Petreschi, A. Ottavianelli, A. Onofri, et al., E-cigarette or Vaping product use Associated Lung Injury (EVALI) in a 15 year old female patient - case report. Ital J Pediatr, 2022. **48**(1): p. 119. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35854320.
BACKGROUND: E-cigarettes are devices which allow to aerosolize liquids containing nicotine or other substances. Ever since they were released on the market in 2006, the number of users have been constantly increasing, especially among adolescents, ranging from 7,6% to 9,3% in the age group 18-24 years old from 2014 to 2019. Hand in hand with the spread of E-cigarettes many have been the efforts to understand their impact on health. EVALI (E-cigarette or Vaping product use Associated Lung Injury) is an emerging condition with a heterogeneous presentation with several reported cases worldwide. We mean to report a case of EVALI in a 15-year-old female Caucasian patient, who's currently attending her clinic follow-up at Bambino Gesu Pediatric Hospital in Rome. CASE PRESENTATION: The patient was admitted to the Emergency Room due to acute respiratory failure in November 2020. At admittance, she was severely dyspneic (HR 120 bpm, SatO2 75%). As she was hospitalized amid the COVID-19 pandemics, she underwent a nasopharyngeal swab for SARS-CoV2, which turned out negative, and a chest CT scan. Chest CT scan showed a central ground grass pattern with peripheral sparing. At the anamnestic recall, it was disclosed she was an e-cigarette smoker and occasional marijuana user. The microbiological work-up proved only positive for Rhinovirus. Her clinical and radiological case was discussed with our radiologist who suspected EVALI. She was assisted through HFNC, antibiotical therapy and corticosteroids with a dramatic recovery within the first 48 h. CONCLUSIONS: EVALI started being recognized a specifically nosological entity in summer 2019, with increasing cases being reported. No diagnostic criteria have been agreed upon yet, but its usual presentation

includes respiratory, gastrointestinal and systemic symptoms of different degree and the diagnosis can be hypothesised in case the patient has an evocative clinical and radiological presentation and has been an E-cigarette smoker in previous 90 days. Due to the novelty of the condition and its heterogeneous presentation it is of interest to report the cases in which EVALI is identified to raise awareness about this emerging new-age disease.

Choudhry, H. and P. Duplan, Vaping-Induced Lung Injury With Superimposed Mycoplasma Pneumonia Leading to Acute Respiratory Failure. Cureus, 2022. **14**(7): p. e26755. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35967184.
Electronic cigarettes (e-cigarettes) contain solvents, nicotine, and other chemicals which are vaporized with heat and inhaled into the lungs during a process known as vaping. Vaping has significantly increased in popularity in the US, especially among youth and young adults. E-cigarette, or vaping, product use-associated lung injury (EVALI) is a syndrome of lung disease associated with vaping or e-cigarette products--which is well discussed in the current medical literature. However, the mechanisms by which lung injury occurs remain to be fully understood. We hypothesize that vaping damages lung defenses, allowing bacterial or viral organisms to infect the lungs and further exacerbate lung function. Furthermore, chemicals found in e-cigarettes alter lung structures, leading to an exaggerated response to an infectious insult. A combination of these two mechanisms may lead to acute respiratory failure. Here we discuss a case report about a 27-year-old patient who presented with acute respiratory failure due to vaping-induced lung injury with superimposed mycoplasma pneumonia.

Deskins, S.J., S.K. Luketich and S. Al-Qatarneh, Recurrent spontaneous pneumothorax in a 15-year-old female associated with electronic cigarettes. Pediatr Pulmonol, 2022. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35856236.
Pneumothorax as a sequela of vaping is a relatively recent complication being described in the literature. Smoking has classically been associated with an increased risk of pneumothorax, and emerging evidence is showing that electronic cigarettes (e-cigarettes) likely carry some of the same risks. Since e-cigarettes increased in popularity, especially among the adolescent population, there has been a reported increased incidence of lung injury, including pneumothorax. We present a case of a 15-year-old female with a history of e-cigarette use admitted for recurrent pneumothorax with failure to re-expand requiring surgical intervention.

Garrido Marquez, I., A. Sanchez Torrente and E. Perez Cuenca, Pulmonary Disease Due to the Use of Electronic Cigarettes (EVALI): About a Case. Arch Bronconeumol, 2022. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36609111.

Jansen, J.H., S. Roumpf and J.L. Welch, Reprint of: Vaping associated pulmonary injury (VAPI): Electronic cigarettes are not harmless. Dis Mon, 2022: p. 101414. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35644663.

Kang, B.H., D.H. Lee, M.S. Roh, S.J. Um and I. Kim, Acute eosinophilic pneumonia after combined use of conventional and heat-not-burn cigarettes: A case report. Medicina (Kaunas), 2022. **58**(11). Available from: https://www.ncbi.nlm.nih.gov/pubmed/36363483.
Background: Acute eosinophilic pneumonia (AEP) is a rare acute respiratory disease accompanied by fever, shortness of breath, and cough. Although the pathogenesis of the disease is not yet established, the patient's condition improves with a rapid therapeutic response to systemic corticosteroids. Conventional cigarettes or heat-not-burn cigarettes are the most common cause of AEP among young people. Case Presentation: A 22-year-old woman with dyspnea, cough, and fever did not improve after visiting the local medical center and was admitted to the emergency room. The patient denied having any recent travel history or insect bites. She was treated with appropriate antibiotics according to the

community acquired pneumonia, but there was no improvement. Chest radiography showed bilateral patches of pulmonary infiltration, and chest computed tomography revealed bilateral multifocal patchy consolidations with multiple small nodular ground-glass opacities and interlobular septal thickening. The bronchoalveolar lavage result was dominantly eosinophilic. The patient's condition improved rapidly after the use of intravenous methylprednisolone and then a change to oral methylprednisolone. Finally, the patient was hospitalized for 9 days, and the duration of use of methylprednisolone including outpatient visits was 14 days. Results: The early treatment of AEP yields a good prognosis, but since the symptoms of AEP are similar to those of infectious diseases such as community-acquired pneumonia, physicians should be meticulous in differentiating AEP from other diseases. Conclusions: Since AEP shows a good response to steroids, early detection using an appropriate diagnostic method is recommended. In addition, there should be strong education against smoking in any form.

Khan, T., A.B. Huda, M. Al-Jibury and Z. Tin, A case of acute lung injury due to an e-cigarette. Clin Med (Lond), 2022. **22**(Suppl 4): p. 16-17. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36220243.

Lim, W., M. Suhail and K. Diaz, A Case of E-cigarette or Vaping Product Use-Associated Lung Injury Mimicking Miliary Tuberculosis. Cureus, 2022. **14**(2): p. e22406. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35345753.
E-cigarette usage or vaping is becoming more popular as an alternative option to cigarette smoking. Vaping is associated with a wide degree of pulmonary injuries such as asthma, chronic obstructive pulmonary disease or E-cigarette or vaping product use-associated lung injury (EVALI). E-cigarette or vaping product use-associated lung injury is an acute or subacute respiratory illness that can be severe and life-threatening. Miliary tuberculosis, on the other hand, is a rare form of tuberculosis that results from hematogenous dissemination of Mycobacterium tuberculosis, affecting multiple organs and systems. It is characterized by the presence of small, firm white nodules resembling millet seeds. We report a case of a young patient presenting to the hospital with features suggestive of miliary tuberculosis in the CT scan of the chest. Diagnosis of EVALI was reached after extensive diagnostic workup including tuberculosis revealed negative.

Malik, B., A. Kalantary, A. Ghatol and A. Kunadi, Vaping-Induced Sepsis and Rapidly Evolving Pleural Effusion in a Young, Otherwise Healthy Male. Cureus, 2022. **14**(5): p. e25327. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35651984.
There have been increasing reports of electronic cigarette (e-cigarette) or vaping use-associated lung injury (EVALI), and the evolving literature demonstrates that the solvents used to dissolve flavors, including vitamin E, may be responsible, at least in part, for the injuries associated with this form of smoking. We present the case of a 26-year-old, otherwise healthy, African American male with a history of heavy use-cigarette use who presented with pleuritic chest pain. He was found to be septic and developed a rapidly accumulating pleural effusion with loculations during his hospitalization. He eventually underwent a thoracotomy due to his deteriorating respiratory status. This case highlights the importance of physician awareness regarding the growing evidence base suggesting that electronic cigarettes and vaporized tobacco products are not as safe as they have been perceived to be. Physicians should screen for and advise patients regarding the risks associated with the use of such products.

Mandal, G., A. Lale and R. Greco, E-vape and E-Cigarettes-Associated Lung Injury (EVALI) in the COVID-19 Pandemic: A Diagnostic Dilemma and Therapeutic Challenge. Cureus, 2022. **14**(6): p. e26200. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35754440.
E-vape and e-cigarettes-associated lung injury (EVALI) is a diagnostic dilemma and even more obscure during the coronavirus disease 2019 (COVID-19) pandemic. A rise was seen in EVALI cases at the beginning of the COVID-19 pandemic. Still, the non-specific presentation,

or the overlapping symptoms of COVID-19 and EVALI, can negate the possible diagnosis of EVALI because of a clinician's predisposition toward infectious etiologies, and it becomes even more challenging during a viral pandemic. The patient's social history remains the key distinctive point in diagnosing EVALI. Systemic steroids are generally used along with supportive care to treat patients with EVALI. This case report demonstrates the dilemma in diagnosing EVALI in a 19-year-old female during the COVID-19 pandemic.

Marrocco, A., D. Singh, D.C. Christiani and P. Demokritou, E-cigarette vaping associated acute lung injury (EVALI): state of science and future research needs. Critical Reviews in Toxicology, 2022: p. 1-33. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35822508.
"E-Cigarette (e-cig) Vaping-Associated Acute Lung Injury" (EVALI) has been linked to vitamin-E-acetate (VEA) and Delta-9-tetrahydrocannabinol (THC), due to their presence in patients' e-cigs and biological samples. Lacking standardized methodologies for patients' data collection and comprehensive physicochemical/toxicological studies using real-world-vapor exposures, very little data are available, thus the underlying pathophysiological mechanism of EVALI is still unknown. This review aims to provide a comprehensive and critical appraisal of existing literature on clinical/epidemiological features and physicochemical-toxicological characterization of vaping emissions associated with EVALI. The literature review of 161 medical case reports revealed that the predominant demographic pattern was healthy white male, adolescent, or young adult, vaping illicit/informal THC-containing e-cigs. The main histopathologic pattern consisted of diffuse alveolar damage with bilateral ground-glass-opacities at chest radiograph/CT, and increased number of macrophages or neutrophils and foamy-macrophages in the bronchoalveolar lavage. The chemical analysis of THC/VEA e-cig vapors showed a chemical difference between THC/VEA and the single THC or VEA. The chemical characterization of vapors from counterfeit THC-based e-cigs or in-house-prepared e-liquids using either cannabidiol (CBD), VEA, or medium-chain triglycerides (MCT), identified many toxicants, such as carbonyls, volatile organic compounds, terpenes, silicon compounds, hydrocarbons, heavy metals, pesticides and various industrial/manufacturing/automotive-related chemicals. There is very scarce published toxicological data on emissions from THC/VEA e-liquids. However, CBD, MCT, and VEA emissions exert varying degrees of cytotoxicity, inflammation, and lung damage, depending on puffing topography and cell line. Major knowledge gaps were identified, including the need for more systematic-standardized epidemiological surveys, comprehensive physicochemical characterization of real-world e-cig emissions, and mechanistic studies linking emission properties to specific toxicological outcomes.

Pourshahid, S., S. Khademolhosseini, S. Hussain, S.R. Ie, M.D.M. Cirino-Marcano, S. Aziz, et al., A Case Series of E-cigarette or Vaping-Associated Lung Injury With a Review of Pathological and Radiological Findings. Cureus, 2022. **14**(5): p. e24822. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35693362.
There has been a recent outbreak of e-cigarette or vaping-associated lung injury (EVALI) but the exact pathophysiology remains unknown. Tetrahydrocannabinol (THC) and vitamin E derivates are the major components in vaping-generated aerosols that are associated with EVALI. So far, there is no standard treatment for EVALI. Most cases are treated with antibiotics and steroids. Counseling for smoking cessation is an integral part of care for EVALI patients. Referral to addiction medicine may be beneficial. Considering the nonspecific presenting symptoms and the growing popularity of vaping devices, providers need to consider EVALI in the differential diagnosis of bilateral patchy ground-glass opacities with respiratory, constitutional, or gastrointestinal symptoms in patients using e-cigarettes. Here, we present four EVALI cases and review the pertinent imaging and pathological findings.

Ruttenberg, M., D. Armstrong, D. Mellinger, J. Carroll and A. Ashare, The Impact of Chronic Electronic Cigarette Use on Alveolar Macrophage Lipid Content: Case Report. Arch Clin Med

Case Rep, 2022. **6**(5): p. 689-692. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36465982.
BACKGROUND: While acute respiratory distress following electronic cigarette (e-cig) use has been described, the effects of chronic e-cig use on lung health are currently unknown. Acute e-cigarette/vaping product use-associated lung injury (EVALI) has been highlighted recently in numerous cases across the United States. Numerous EVALI case reports highlight alterations in alveolar macrophages, justifying investigation of this key immune sentinel of the lung in habitual e-cig users. CASE PRESENTATION: After informed consent, we performed a bronchoscopy on a 25 year asymptomatic woman who reported daily e-cig use. To evaluate for evidence of abnormal lipid homeostasis, we performed histologic and Oil Red O stain evaluation of alveolar macrophages obtained from bronchoalveolar lavage fluid. Our analyses demonstrate a prevalence of cells with high lipid accumulation in multiple, discrete cytoplasmic foci. We found a high lipid laden macrophage index within alveolar macrophages isolated from a chronic e-cig user. At the ultrastructural level, we found membrane-bound compartments filled with material of various densities segregated along curved phase separation lines reminiscent of suspensions of immiscible fluids. CONCLUSIONS: We found a unique ultrastructural pattern in alveolar macrophages isolated from a chronic e-cig user that is unlike any other previously reported in aspiration syndromes and may represent a defining diagnostic feature of chronic e-cig use.

Schekochikhina, N., R. Meister and K. Trivedi, E-cigarette or Vaping Product Associated Lung Injury (EVALI) Presenting As Cardiac Arrest. Cureus, 2022. **14**(5): p. e25010. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35719811.
E-cigarettes or vaping products became available in the market in 2004. Since then, their use has rapidly increased in all sections of society. They have been increasingly used as a "safer" alternative for combustible cigarettes and as an aid toward smoking cessation. Over time, the acceptability of e-cigarettes in public spaces increased. Lack of regulatory control also led to a rapid rise in the rate of e-cigarette/vaping product users. We report a case of a 35-year-old female who recently switched from conventional cigarettes to e-cigarette usage, and who presented to the emergency department after an out-of-hospital cardiac arrest. She was found to have bilateral extensive nodular ground-glass opacities on a CT angiogram of the chest. She needed non-invasive ventilation and was initially started on broad-spectrum antibiotic treatment for possible pneumonia. **Due to a worsening clinical status, e-cigarette or vaping product associated lung injury (EVALI) diagnosis was considered, and she was started on parenteral steroid therapy, leading to rapid recovery in respiratory status. With a tapering course of steroid therapy and cessation of e-cigarette use, there was complete clinical and radiological recovery.** This case highlights that EVALI can have varied clinical presentations, and the diagnosis should be considered in anyone who presents with an acute cardio-pulmonary decline and a concomitant history of e-cigarette use.

Shin, Y.M., D.P. Hunt and J. Akwe, An Epidemic Supplanted by a Pandemic: Vaping-Related Illness and COVID-19. South Med J, 2022. **115**(1): p. 8-12. Available from: https://www.ncbi.nlm.nih.gov/pubmed/34964053.
Before the coronavirus disease 2019 (COVID-19) pandemic, vaping-related illness was the prevailing public health concern. **The incidence of vaping-related illnesses-mainly e-cigarette, or vaping, product use-associated lung injury (EVALI)-went from a peak in September 2019 to a low in February 2020, and the Centers for Disease Control and Prevention decided to discontinue the collection of EVALI case reports**. Despite the decrease in EVALI with the arrival of COVID-19, EVALI should still be considered a differential diagnosis for people with COVID-19 for reasons outlined in this review. This narrative review describes vaping devices, summarizes the adverse health effects of vaping on the lungs and other systems, considers the potential interplay between vaping and COVID-19, and highlights gaps in knowledge about vaping that warrant further research.

Soybel, A., V. DeJaco, A. Ellison-Barnes and P. Galiatsatos, Sarcoidosis Associated With Electronic Cigarette Use in an Adult: A Case Report. J Med Cases, 2022. **13**(3): p. 95-98. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35356391.
The clinical recognition of acute lung disease caused by electronic cigarette (e-cigarette) usage has continued to grow. The identified pulmonary pathologies each include some degree of injury and/or inflammation. Electronic cigarettes contain chemicals that hold potential for acute pulmonary toxicity, including, but not limited to, nicotine, volatile organic compounds, and aldehydes. However, the development of chronic pulmonary diseases with more insidious symptoms has gained more recognition. Some chronic pulmonary diseases, such as sarcoidosis, have not yet been causally linked to electronic cigarette use. **We present a case of a patient who developed sarcoidosis after using electronic cigarettes,** discussing clinical outcomes and management of both the patient's electronic cigarette addiction and sarcoidosis development.

Takigawa, Y., K. Sato, A. Inoue, M. Nagae, T. Inoue, K. Onishi, et al., Acute eosinophilic pneumonia caused by nicotine-free vaping in an adolescent patient: A case report. Respirol Case Rep, 2022. **10**(6): p. e0961. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35592268.
An 18-year-old man was admitted to our hospital with pneumonia 4 days after he initiated vaping. The patient did not show improvement after ceftriaxone and azithromycin treatment. The cell count of the bronchoalveolar lavage fluid (BALF) revealed 64% eosinophils and 18% lymphocytes. Based on the BALF **findings, the patient met the current diagnostic criteria and was diagnosed with vaping-induced acute eosinophilic pneumonia (AEP). AEP caused by nicotine-free vaping is rare in Japan.** Thus, in cases of AEP, the patient's history of cigarette smoking as well as vaping should be considered.

Tuck, N., K. Gichohi and T. Moore, **Bilateral Upper Lobe Collapse Secondary to Vaping.** Kans J Med, 2022. **15**: p. 253-254. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35899065.

Cardiovascular

Grech, A.K., D.T. Keating, D.J. Garner and M.T. Naughton, A case of extreme carboxyhaemoglominemia due to vaping. Respirol Case Rep, 2022. **10**(5): p. e0942. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35433009.
Acute carbon monoxide (CO) poisoning is known to cause neurological, metabolic and cardiorespiratory sequalae. However, data on chronic CO exposure are scant, particularly in the context of vaping, which recent literature suggests may be a greater source of CO than tobacco cigarette smoking. **During a series of admissions at the time of vaping, our patient repeatedly presented with significant CO poisoning and developed pulmonary arterial hypertension with resultant high-output right heart failure. On each occasion, our patient's levels of carboxyhaemoglobin were both higher and took longer to resolve than 12 smokers who underwent arterial blood gas testing at two time points. Our observation may reveal an association between vaping, chronic carboxyhaemoglobinemia and the development of cardiorespiratory disease.** Thus, further studies into the safety of vaping and chronic CO exposure are urged.

Other adverse health effects

Liu-Zarzuela, J.A. and R. Sun, Three Seizures Provoked by E-cigarette Use in a Five-Year Period: A Case Report. Cureus, 2022. **14**(8): p. e27616. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36059307.
We report a case of three seizures provoked by e-cigarette use (vaping) within the time span of five years from youth to young adult. At presentation, the neurological exam was unremarkable. Computerized tomography (CT) of the head, magnetic resonance image (MRI)

of the brain, electroencephalograms (EEG), electrocardiogram (EKG), and transthoracic echocardiogram (TTE) were normal. **Multiple toxicology screens were normal as well. Each seizure occurred within minutes of vaping, thereby suggesting a temporal association and a possible causal relationship between e-cigarettes and seizures.**

Balinski, A.M., R.N. Harvey, R.B. Ko, M.M. Smalley, N.E. Cutler and M.T. Siddiqi, Vaping-Related Clotting Phenomena Presenting As Central Retinal Vein Occlusion. Cureus, 2022. **14**(8): p. e27700. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36081966.
Central retinal vein occlusion (CRVO) typically manifests as unilateral vision loss from thrombosis and occlusion of the central retinal vein in patients with thrombophilic risk factors. **Here we report a case of a 23-year-old male with three weeks of intermittent left-sided eye pressure and vision loss, who was found to have decreased visual acuity, retinal hemorrhages, and an impending CRVO in his left eye**. Upon further evaluation, infectious disease and autoimmune labs were normal, but he had mildly increased right heart pressures and hypercoagulable changes in the right middle cerebral artery. He denied any personal or family history of clotting disorders but noted a four-year history of vaping. He was started on anticoagulation and discharged. Outpatient genetic testing for Factor V Leiden, protein C, protein S, and prothrombin G20210 was normal. His visual acuity returned to normal in the left eye and the retinal hemorrhages resolved. After the exclusion of organic causes, significant vaping history was considered the likely etiology of his hypercoagulable state and resultant CRVO. Vaping-related clotting phenomena may explain the etiology of an otherwise unexplained CRVO, but further investigation of the long-term health consequences of electronic cigarette use is still needed.

Corazza, M., C. Bocchi, P. Zedde, N. Schettini, E. Marzola and A. Borghi, A Case of **Facial Contact Dermatitis Due to E-Cigarette Flavored Liquids.** Dermatitis, 2022. **33**(3): p. e29-e31. Available from: https://www.ncbi.nlm.nih.gov/pubmed/35594458.

Trauma injuries

HTPs: Higashi, K., Y. Koike, Y. Sato, S. Yamashita, Y. Nagano, T. Shimura, et al., Extraction of a metallic susceptor after accidental ingestion of the heated tobaccostick TEREA: a case report. BMC Pediatrics, 2023. **23**(1): p. 452. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37689624.
BACKGROUND: Tobacco ingestion is widely known to cause nicotine toxicity, which may result in severe symptoms. Two heated tobacco sticks, called TEREA and SENTIA, were launched in 2021 by Philip Morris International (New York, NY, USA), and their ingestion is associated with a risk of bowel injury because they contain a partially pointed metallic susceptor. However, this risk is not well known to the general public or healthcare providers. To increase awareness of this risk, we herein report a case involving extraction of a metallic susceptor after ingestion of the heated tobacco stick TEREA. CASE PRESENTATION: A 7-month-old girl presented to the emergency department of a nearby hospital because she was suspected to have accidentally swallowed heated tobacco. **Although she presented with no symptoms related to nicotine poisoning, abdominal X-ray examination revealed a metal object in her stomach. According to a statement released by the Japan Poison Information Center, the TEREA heated tobacco stick contains a metallic susceptor with a rectangular shape and sharp corners.** The patient was transferred to our department because of the risk of bowel injury, and upper gastrointestinal endoscopy was performed. No cigarettes were found by endoscopic observation; however, a metallic susceptor was located in the second part of the duodenum. We grasped it with biopsy forceps and carefully removed it using an endoscope with a cap attached to the tip. The post-endoscopic course was uneventful. CONCLUSIONS: Some patients who ingest heated tobacco sticks might be exposed not only to the effects of nicotine but also to physical damage caused by a metallic susceptor. Infants and toddlers especially could swallow these sticks, therefore tobacco companies need to make the problem more public. Clinicians also should alert the problem, and pay attention to this risk in the clinical setting.

Sahni, V., E-cigarette explosion injuries in the oral and maxillofacial region and a protocol for their management. Evid Based Dent, 2023. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37731046.
DATA SOURCES: MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Central Register of Controlled Trials, Embase and Web of Science along with the reference lists from select articles. STUDY SELECTION: Retrospective or prospective cohort studies, randomised controlled trials, case series, case-control studies and case reports on e-cigarette explosion-related facial injuries published in the English language were included. Review articles, nonclinical studies, commentaries, published abstracts and editorials were excluded. Also were excluded, those studies which did not specify injury location or if the injury did not pertain to the maxillofacial region. DATA EXTRACTION AND SYNTHESIS: Data pertaining to bibliographic information, device characteristics, patient details, facial injuries, factors precipitating explosion, complications at follow-up, management and other injuries were extracted. An association between the predictor variables of injury type and location with outcomes of surgical management and intubation was determined by utilising a Chi-squared analysis. RESULTS: **A total of 28 studies met the inclusion criteria. A total of 105 facial injuries in 32 patients from 32 e-cigarette explosions were recorded. 73.3% of the injuries were projectile in nature with 26.7% being characterised by burns. 43.8% of all patients suffered both burn and projectile injuries. The eye (10.7%), oral cavity (25%) and face (64.3%) were involved with burn injuries. Projectile injuries mostly involved the lower third of the face (81.8%). 62.5% of patients suffered from a tooth or bone fracture.** A 44.4% rate of complications was reported amongst the studies which reported on follow-ups. Surgical management or intubation were found to

have no statistically significant relationship with explosive oral injuries. No other statistically significant associations were observed between outcomes and other injury types. CONCLUSIONS: There is a risk of spontaneous combustion with e-cigarettes, which can cause injuries of a serious nature to the oral and maxillofacial region, specially the lower third of the face, commonly necessitating surgical management. Increased regulation along with user education are required in order to improve the safety profile of these devices.

Tran, V., M. Mian, S. Sreedharan, R. Robertson, A. Saha, S.K. Tadakamadla, et al., Oral and Maxillofacial Injuries Associated With E-Cigarette Explosions: A Systematic Review and Management Guidelines Proposal. J Oral Maxillofac Surg, 2023. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36806607.
PURPOSE: E-cigarettes have become increasingly popular devices used to consume nicotine in recent years. There is a growing body of evidence regarding the risk of spontaneous explosion of these devices causing burn and projectile injuries. The primary purpose of this review was to summarize all injuries to the oral and maxillofacial region secondary to explosion of e-cigarettes. The secondary purpose was to propose an initial management algorithm for such injuries based on the findings in the literature. This review also aims to test the hypothesis that e-cigarette explosive injuries to the oral region were associated with an increased risk of intubation and surgery and examine whether any other injury pattern was associated with an increased risk of intubation or surgery. METHODS: A cohort study based on identifying cases in the literature was conducted to summarize injuries to oral and maxillofacial region and examine the associations between injury types and location and management. A literature search of the major biomedical databases was conducted in September 2022 using terms such as e-cigarette, explosion, blast, trauma, and burn, among others, which yielded 922 studies. Nonclinical studies, review articles, and studies without injuries to the facial region were excluded. Study subjects were recorded for demographics, device characteristics, injury mechanism, injury location, management, and complications. Chi-squared analysis was used to determine if the predictor variables of type of injury (burn or projectile) and its associated location (ocular, facial, or intraoral for burns and facial thirds for projectile) were associated with the outcomes of intubation and surgical management. The collected data were then used as a guide to propose an initial management algorithm for these injuries. RESULTS: Twenty eight studies, including 20 case reports and 8 case series met the inclusion criteria. A total of 32 explosions of e-cigarettes to 32 patients caused 105 recorded injuries to the facial region. Projectile injuries made up 73.3% (n = 77) of all facial injuries, while burn injuries made up of 26.7% (n = 28). There were 14 (43.8%) patients who suffered both projectile and burn injuries. Burn injuries mostly involved the face (64.3%, n = 18), oral cavity (25%, n = 7), and eye (10.7%, n = 7). **The majority (81.8%, n = 63) of projectile injuries occurred in the lower facial third. There were 20 (62.5%) patients who suffered a bone or tooth fracture. Management of injuries involved surgery in 62.5% (n = 20) of patients, which included open reduction and internal fixation of fractures, dental extraction, bone and skin grafts, and ocular surgery. A complication rate of 44.4% (n = 8) was observed across studies that reported on follow-up.** There was no statistically significant association between explosive injury to the oral region and intubation or surgical management. There was also no other statistically significant association between any other injury type and location with intubation or surgical management. CONCLUSIONS: E-cigarettes are at risk of spontaneous combustion that can cause serious oral and maxillofacial injuries, particularly to the lower facial third and commonly requiring surgical management. Safety of these devices should be improved through increased user education and regulation.

Poisoning

Becam, J., E. Martin, G. Pouradier, N. Doudka, C. Solas, R. Guilhaumou, et al., Transdermal Nicotine Poisoning: A Rare Case Report of Occupational Exposure. Toxics, 2023. **11**(5). Available from: https://www.ncbi.nlm.nih.gov/pubmed/37235278.

We report a case of accidental nicotine intoxication following transdermal exposure in a 22-year-old man with no medical history, who worked in a company manufacturing e-liquids for electronic cigarettes. He accidentally spilled 300 mL of pure nicotine solution (>99%) on his right leg without wearing protective clothing or a mask. Less than a minute later, he experienced dizziness, nausea, and headaches, followed by painful burning sensations in the affected area. He immediately removed his pants and washed his leg thoroughly with water. He presented to the emergency department two hours later, where he exhibited a respiratory rate of 25 cpm, a heart rate of 70 bpm, headaches, abdominal pain, pallor, and vomiting. He recovered without specific treatment five hours post-intoxication. Plasma levels of nicotine, cotinine, and hydroxycotinine were measured five hours after exposure using liquid chromatography-mass spectrometry. The concentrations found were 447 ng/mL for nicotine, 1254 ng/mL for cotinine, and 197 ng/mL for hydroxycotinine. Nicotine is an alkaloid that can be highly toxic, with doses of 30-60 mg being potentially fatal. Transdermal intoxication is rare, with very few cases reported in the literature. This case highlights the risk of acute intoxication through cutaneous exposure to nicotine-containing liquid products and the need for protective clothing when handling such products in a professional context.

Respiratory

Chuang, A., L. Bacon and A. Lucero, Electronic Cigarette or Vaping-Associated Lung Injury Case Report. J Educ Teach Emerg Med, 2023. **8**(1): p. V22-V27. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37465034.
Electronic cigarette (e-cigarette) or vaping associated lung injury (EVALI) cases have increased with the popularity of e-cigarettes in the mostly young, healthy population. Some common symptoms associated with EVALI include shortness of breath and chest pain, and the most common diagnostic imaging findings are organizing pneumonia and diffuse alveolar damage seen on computed tomography (CT). Pneumomediastinum is a known sequela of EVALI.1 In the setting of pneumomediastinum in EVALI, EVALI is a diagnosis of exclusion, so other sources of pneumomediastinum need to be evaluated. EVALI has diverse presentations, and this case is a unique representation of a disease process that is becoming more commonplace with the increase in popularity of vaping. It is important to be aware of the clinical symptoms of EVALI, which can be nonspecific and can include gastrointestinal symptoms along with respiratory symptoms. It is equally important to recognize the diverse image findings of EVALI, which can include subcutaneous emphysema and pneumomediastinum**. In this case, pneumomediastinum is seen in EVALI, and the patient was successfully treated with empiric antibiotic coverage, steroids, and conservative measures- making sure to limit any coughing or increases in intrathoracic pressure that can cause worsening of pneumomediastinum.** TOPICS: EVALI, vaping, pneumomediastinum, E-cigarette, ground-glass opacity.

Dudiki, N., V.M. Ganipisetti, S. Kolli and S.S. Thapa, A Large Lung Abscess in an Electronic Cigarette User: To Drain or Not to Drain. Cureus, 2023. **15**(4): p. e37690. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37091491.
A lung abscess is a walled necrotizing infection involving the lung parenchyma, characterized by a cavitary lesion filled with fluid. It is usually caused by microbial infection with aspiration of oropharyngeal contents being the most common mechanism for primary lung abscesses. Secondary lung abscesses occur in the presence of predisposing lung conditions like bronchial obstruction, vascular or septic emboli or impaired host defenses. **Lung abscesses caused by electronic cigarette use have gained relevance in the recent years since the outbreak of EVALI, that is, e-cigarette or vaping product use-associated lung injury, in 2019.** First-line therapy involves prompt initiation of antibiotics given their success rate in the treatment of lung abscess in the current potent antibiotic era. Percutaneous aspiration and catheter drainage is considered a second line approach due to concerns for potential complications including catheter blockage necessitating repeat procedures, pneumothorax,

hemothorax, hemoptysis, need for surgical intervention, infection of pleural space and bronchopleural fistula**. We describe a case of a 21-year-old female with a history of electronic cigarette use presenting with a large left upper lobe lung abscess** (14.5 x 8.5 x 13.3 cm) treated successfully with broad-spectrum antibiotics alone resulting in clinical and radiologic improvement.

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Kwack, T.J., C. Kim, S.H. Hwang, H.S. Yong, Y.W. Oh and E.Y. Kang, Electronic Cigarette or Vaping-Associated Lung Injury Manifested as Acute Eosinophilic Pneumonia: A Case Report. J Korean Soc Radiol, 2023. **84**(1): p. 298-303. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36818711.
Electronic cigarette or vaping-associated lung injury (EVALI) is a disease defined by lung injuries caused by e-cigarette use. It predominantly manifests in forms of organized pneumonia or diffuse alveolar damage but rarely as acute eosinophilic pneumonia (AEP). **This report describes a 34-year-old male with acute respiratory symptoms and a vaping history of only nicotine. Chest CT revealed peripheral distributing multiple patchy consolidations and ground-glass opacities dominant in both lower lobes, bilateral diffuse interlobular septal thickening, and bilateral pleural effusion without cardiomegaly. Bronchoalveolar lavage fluids showed increased eosinophilia levels, while infectious laboratory results were all negative, enabling the diagnosis of both AEP and EVALI**. Herein, we report a rare case of only-nicotine vaping EVALI manifested as AEP.

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Rachid, C., O. Fikri and L. Amro, E-cigarette and Vaping-Induced Lung Injury (EVALI) Long Taken for Miliary Tuberculosis: A Rare Cause of Interstitial Lung Disease. Cureus, 2023. **15**(10): p. e47948. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37908698.
Electronic cigarettes, a recent and burgeoning product, are gaining traction among the general population. However, despite their growing popularity, there is a lack of comprehensive research on their potential health risks. A prominent concern is EVALI (electronic cigarette or vaping product use-associated lung injury), a newly recognized condition currently under intense investigation. **Here, we report the case of a 24-year-old male with a history of chronic smoking e-cigarettes and vaping products heavily over the past year. He sought urgent care at the emergency room due to symptoms that had been present for seven days before seeking medical attention. These symptoms included a sudden onset of difficulty breathing at rest, an intermittent dry cough producing a small amount of greenish sputum, and occasional episodes of mild hemoptysis**. Chest radiograph showed bilateral diffuse infiltrates including almost innumerable tiny interstitial nodules. Multiple lobes of the lungs were affected by consolidations and patches of ground-glass opacities in the chest high-resolution computed tomography (HRCT) image. Throughout the following week, the patient's health showed gradual improvement with the aid of supportive measures and corticosteroid treatment. As part of the recovery plan, the patient was released with a gradually reducing regimen of oral corticosteroids and was scheduled for regular outpatient monitoring. The progression of the recovery was notable through enhancements in clinical symptoms, biological markers, and radiological findings.

Stein, J., H.E. Kay, J. Sites, A. Pirzadeh, B.L. Joyner, Jr., T. Darville, et al., Electronic cigarette, or vaping, product use-associated lung injury (EVALI) in a patient with testicular cancer: A case report. Tumori, 2023: p. 3008916231172806. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37165581.
Electronic cigarette, or vaping, product use-associated lung injury (EVALI) is an increasingly recognized entity with the potential for severe pulmonary toxicity. **We present the case of a young man first evaluated at a tertiary care center in the United States in 2019 with newly diagnosed testicular cancer with acute respiratory failure, which was initially attributed to possible metastatic disease but eventually determined to be related to EVALI.** This case highlights the clinical features of EVALI, the potential diagnostic dilemma that can arise with EVALI when occurring in the setting of malignancy and the importance of inquiring about vaping use among patients with malignancy, especially in adolescents and young adults.

Sund, L.J., P.I. Dargan, J.R.H. Archer and D.M. Wood, E-cigarette or vaping-associated lung injury (EVALI): a review of international case reports from outside the United States of America. Clin Toxicol (Phila), 2023: p. 1-7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/36636876.

INTRODUCTION: E-cigarette or vaping-associated lung injury has been reported extensively throughout the United States without a corresponding number of international cases. Cannabinoid-based products have been implicated in the majority of cases. OBJECTIVES: To collate published reports of E-cigarette or vaping-associated lung injury outside the United States and to identify the reasons behind the discrepancy in reported cases between the United States and the international community. METHODS: PubMed and Healthcare Databases Advanced Search were used to identify published case reports of E-cigarette or vaping-associated lung injury prior to February 2021 using the search terms "e-cigarette", "e-cigarettes", "vaping", "vape" and, "lung injury", "pulmonary", "respiratory". Cases occurring in the United States were excluded. Non-United States case reports were excluded if they did not meet the Centers for Disease Control and Prevention "probable case" criteria. This requires use of a vaping device within 90 days of symptom onset, the presence of pulmonary infiltrates on plain film chest radiography or ground glass opacities on computerised tomography, clinical suspicion that infection was not the underlying cause of lung injury, and the absence of other plausible medical processes to account for the presentation. Patient demographics, nature of exposure, symptomatology and outcome were compared to 125 cases from three regional United States based case series, which were chosen on the basis of having complete data for these comparative factors. RESULTS: Seventeen international cases from 13 countries were identified for analysis. There was a male predominance in both non-United States and United States cohorts (76% vs 58-83%), with a marginally higher median patient age in non-United States cases (31 vs 27, 19, 27 years). Reported use of nicotine/flavoured e-liquids was more common in non-United States cases (100% vs 58-67%), and use of cannabinoid-based products was less common (24% vs 78-92%). The most common symptoms across all cohorts were shortness of breath (76% vs 85-91%), cough (59% vs 78-83%) and fever (47% vs 78-83%). The majority of patients were hypoxic (76% vs 69-86%) and required hospital admission (88% vs 90-94%). Fewer of the non-United States patients required intensive care admission (24% vs 55-67%) though their median length of stay was longer (15 days vs 5, 6, 7 days). DISCUSSION: **Uniformity amongst non-United States cases in regards to nicotine based and/or flavoured e-liquid exposure may underestimate the role of these substances in e-cigarette or vaping-associated lung injury**. This is consistent with prior United States based research demonstrating increased presentations to emergency departments prior to the recognised "outbreak" of e-cigarette or vaping-associated lung injury at a time of increased nicotine based e-liquid uptake. A longer length of hospital stay, lower rate of intensive care admission and a higher rate of bronchoscopy in the non-United States cohort could be indicative of clinician inexperience internationally. It is unclear why the non-United States cases also had a lower incidence of gastrointestinal symptoms however this may also be explained by poorer diagnostic awareness. CONCLUSIONS: **E-cigarette or vaping-associated lung injury is not limited to cannabinoid-based products. Apparent similarities in patient demographics, clinical features, and clinical course between non-United States and United States cases raise concern for underreporting of E-cigarette or vaping- associated lung injury internationally**.

CVD

Tran Duc, M., Y. Nguyen, D. Nguyen Hung, L. Truong Hoai and P. Nguyen Xuan, Acute Pericarditis After Use of Electronic Cigarettes: A Case Report. Cureus, 2023. **15**(12): p. e49810. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38164324.

Acute pericarditis is the most common pericardial disease in clinical practice and frequently in young and middle-aged people. The past decade has dramatically increased electronic cigarettes or vapes in developing countries. However, there are no case reports describing

vaping-induced acute pericarditis**. This report describes a case of a 27-year-old male who presented with acute onset chest pain after using an electronic cigarette. His ECG showed typical pericarditis with diffuse ST-segment elevation and downsloping TP segment. The patient responded to the medical therapies of non-steroidal anti-inflammatory drugs (NSAIDs) and colchicine, but serum troponin T went up.** In this case report, the authors have shared their opinions on how to handle this situation.

Other adverse health effects

Gospodaru, S., G. Bordeniuc, V. Fala, T.B. Casale and R. Polosa, **Generalized urticaria following the use of e-cigarette: a case reported during a switching trial**. Ann Allergy Asthma Immunol, 2023. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37676229.

Girish, G., B. Xiang and L.L. Hsu, A 21-Year-Old Woman with Sickle Cell Disease and Vaso-Occlusive Pain Associated with Using an Electronic Nicotine Dispensing System (E-Cigarette or Vape) - a Case Report. Am J Case Rep, 2023. **24**: p. e941268. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37990483.
BACKGROUND Sickle cell disease is an inherited blood disorder that leads to multisystem complications. The heterogeneous course of sickle cell disease is due to both genetic modifiers and environmental factors. Cigarette smoking is a strong risk factor for sickle cell complications and even secondhand exposure to tobacco smoke can be detrimental for individuals with sickle cell disease. However, no prior reports have associated e-cigarettes and sickle cell vaso-occlusive pain. **CASE REPORT A 21 year old woman presented with sickle cell disease SS complicated by frequent pain, multiple acute chest syndrome episodes, sickle cell nephropathy, and avascular necrosis of the left hip, plus mild intermittent asthma. She developed pain in the ribs and back after her first use of e-cigarettes. After 4 days of home pain management, she came to the Emergency Department. She was mildly hypoxic and received supplemental oxygen. Chest radiograph did not show airspace consolidation, and the sites of pain were consistent with her prior pain episodes, so the diagnosis was sickle cell vaso-occlusive pain.** Her hemoglobin was more than 2 g/dL below baseline and she received a red blood cell transfusion on hospital day 2. Overall, this was among her more severe pain episodes. CONCLUSIONS The rising popularity of e-cigarettes, also known as vapes or Electronic Nicotine Delivery Systems (ENDS), is partly due to the misconception that they are safer than traditional cigarettes. Although firm conclusions will depend on studies designed to provide rigorous evidence, this case suggests that the acute adverse effects of ENDS might trigger complications of sickle cell disease, especially with asthma as a comorbidity.

Fadeyi, O., A. Randhawa, A. Shankar, C. Garabetian, H. Singh and A. Topacio, Thromboembolism Triggered by a Combination of Electronic Cigarettes and Oral Contraceptives: A Case Report and Review of Literature. J Investig Med High Impact Case Rep, 2023. **11**: p. 23247096231181072. Available from: https://www.ncbi.nlm.nih.gov/pubmed/37314028.
Genetic predisposition, **oral contraceptive (OCP)** use, tobacco smoking, cancers, and trauma are well-known triggers for hypercoagulability and thromboembolism. Multiple reports have been published on the health risk of combining OCP and traditional cigarettes smoking in the context of thromboembolism. However, limited information is available on the health consequences of combining OCP use with electronic cigarettes**. Here, we report a case of a young female patient with a past medical history of ovarian cysts and electronic cigarettes use who came into the hospital with a complaint of "recurrent seizures" and tachycardia. This patient was subsequently diagnosed with bilateral pulmonary emboli, subacute cerebrovascular accident (CVA), and possible patent foramen ovale. Therapeutic Lovenox was initiated. R**easons to educate young females on the risks of combining OCP and electronic cigarettes use were explained.

Trauma injuries heated tobacco sticks

Doi, H., T. Kakiuchi, M. Nishino and M. Yoshiura, Natural excretion of a metallic susceptor originating from an ingested heated tobacco stick. Clin Case Rep, 2024. **12**(4): p. e8756. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38595963.
KEY CLINICAL MESSAGE: Clinicians should not only consider the presence of metallic foreign bodies within the digestive tract but also contemplate the possibility of nicotine poisoning during the diagnostic process. ABSTRACT: **When clinicians encounter cases of accidental ingestion of some types of heated tobacco, they must consider not only nicotine poisoning but also the possibility of a metallic foreign body within the digestive tract during diagnosis. In children, even sharp or relatively large ingested foreign bodies can spontaneously pass below the esophagus.** Considering that this 12-mm metal piece is small, natural excretion may be considered rather than endoscopic removal.

Frino-Garcia, A., E.N. Perez Rodas, F. Hernandez-Gonzalez, X. Alsina-Restoy, P. Kette-Aguilera, C. Jimenez Ruiz, et al., Everyone was Fooled, it Burns: Simple Diy Proof of the Falsity of Heat-Not-Burn Tobacco. Arch Bronconeumol, 2024. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38429133.

Schicchi, A., D. Lonati, A. Papotto, A. Ippolito, S. Piana and S. Grasso, Ingestion of heated tobacco sticks containing a micro-blade by children: the importance of performing a radiograph. Clin Toxicol (Phila), 2024. **62**(2): p. 129-130. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38477964.
INTRODUCTION: Some tobacco sticks, such as TEREA heat sticks for IQOS ILUMA, contain a blade. **Both the nicotine part of the device and the micro-blade can be ingested by children. CASE SUMMARIES: We report two children, an 18-month-old boy and a 10-month-old girl, who ingested a heat stick containing a micro-blade.** IMAGES: Radiography revealed the micro-blade to be in the child's mouth in the first case and the stomach in the second. Endoscopy was performed on the second child, confirming the presence of the blade in the stomach. CONCLUSION: We recommend performing a radiograph on all children who ingest tobacco sticks containing a micro-blade. If a metallic object is present, we recommend endoscopic removal to avoid traumatic lesions from the sharp edges.

Poisoning

Motomura, A., H. Inoue, N. Ishii, K. Horioka, K. Okaba, C. Moue, et al., A suicide case of liquid nicotine intoxication. Leg Med (Tokyo), 2024. **68**: p. 102400. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38237272.
A man in his 50 s, who was found vomiting and in a disturbed state when the emergency medical team arrived, then went into cardiopulmonary arrest during transport and died without responding to resuscitation. The hospital initially suspected that the death may have been caused by internal causes, but since the deceased had previously been transported to the hospital in a suicide attempt, the hospital called police regarding suspicions of unnatural death. The police investigation revealed two empty bottles of nicotine liquid for e-cigarettes in his house and a search history of "nicotine suicide" on his cellphone. In a forensic autopsy, he was found to be highly obese, and abundant fat deposits were observed in his organs. A stent was placed in the aorta, but no abnormality was found. There was no obvious stenosis or obstruction in the coronary arteries. Drug screening using liquid chromatography tandem mass spectrometry (LC-MS/MS) was performed on cardiac blood, urine, and stomach contents collected at autopsy, which revealed the presence of some medical products such as aripiprazole, nicotine, and cotinine. Further quantitative

testing revealed high concentrations of nicotine in all samples. The left and right femoral venous blood concentrations were above the lethal dose, suggesting that arrhythmia or respiratory failure due to nicotine intoxication was the cause of death. With the widespread use of e-cigarettes, high concentrations of nicotine are readily available, and case reports of serious nicotine addiction are increasing. It is important to always consider addiction when conducting forensic evaluations in the medical field.

Respiratory

Vess, K.B., N. Ivan and J. Boscia, E-cigarette-/Vape-Associated Lung Injury as a Cause of Interstitial Lung Disease. Cureus, 2024. **16**(4): p. e58199. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38741809.
E-cigarette-/vape-associated lung injury (EVALI) refers to damage to lung tissue occurring as a result of e-cigarette utilization or via vaping of inhaled nicotine products. Vaping refers to the practice of inhaling an aerosol derived from heating a liquid or gas containing substances such as nicotine, cannabinoids, flavoring, or additives. Battery-operated e-cigarettes or vape pens are the vessels commonly used in this practice. EVALI, first described in the literature in 2019, has a non-specific course, presenting initially with cough and dyspnea. It can progress, however, to interstitial lung disease or result in damage to the lung parenchyma with concomitant inflammation and fibrosis. Imaging findings reflect the development of this inflammation and fibrosis, often visualized as ground-glass opacities on computed tomography (CT) scans. Formal biopsies are not required to make the diagnosis of EVALI, and thus, a gap exists in the scientific literature with regard to the pathology of lungs exposed to non-tetrahydrocannabinol (THC) e-cigarettes. The following case details the clinical course of a 62-year-old male who presented to the outpatient pulmonology office with symptomology and exposure history consistent with EVALI, unique in presentation due to the timeline of his disease development. The patient initially presented to the clinic for the evaluation of a non-productive cough and exertional dyspnea beginning one year ago, with an associated new home oxygen requirement of 2 liters via nasal cannula. The patient's past medical history was relevant for diffuse large B-cell lymphoma treated with the chemotherapeutic regimen that consists of etoposide phosphate, prednisone, vincristine sulfate (Oncovin), cyclophosphamide, doxorubicin hydrochloride (hydroxydaunorubicin), and rituximab, commonly known as EPOCH-R, as well as a social history relevant for a 35-pack-year smoking history. On further questioning, the patient revealed that following cessation of cigarette smoking, he began using non-THC e-cigarettes daily and had been doing so for 10 years prior to symptom onset. Imaging and biopsy findings consisted of a CT of the chest demonstrating concern for interstitial lung disease and an open lung biopsy demonstrating diffuse alveolar damage with eosinophilia. Given the patient's history, clinical symptoms, and imaging findings, a diagnosis of EVALI was established. This case was documented not only to increase awareness of the rising incidence of EVALI as the use of e-cigarettes and vapes becomes increasingly popular but also to further understand the inhalational injury sustained from non-THC e-cigarettes and other inhalational practices.

CVD

Fernandez, M.I.C., M.F. Co, J.B.M. Rafael, R.C. Mag-Usara, V. Ediza, R.L. Gavino, et al., Acute myocardial infarction with e-cigarette or vaping-use associated lung injury in a young Filipino vape user. Respirol Case Rep, 2024. **12**(4): p. e01353. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38633225.
Electronic cigarettes (or e-cigarettes) and vape products have multisystemic adverse effects despite being advertised as a safer smoking alternative and cessation device. We present a 22-year-old Filipino male with sudden chest pain. He had no known comorbidities but had a two-year history of daily vape use. Work-up revealed elevated cardiac markers, anteroseptal ST-elevation myocardial infarction, hypokinesia of the anterior wall and interventricular septum, and an ejection fraction of 30%. **Chest radiography showed consolidation pneumonia but culture studies and Biofire Pneumonia Panel were negative for microbial detection. Coronary angiography revealed chronic total obstruction of the mid-left anterior descending (LAD) and right coronary arteries (RCA). Percutaneous coronary angioplasty of the LAD was done. The patient eventually required mechanical ventilation for progressive respiratory distress <u>but expired after three hospital days despite medical</u>**

management. This case highlights a possible association between vape use and the development of both acute lung injury and myocardial infarction.

Other adverse health effects

Van Roey, G., W. Goos, C. Claessens, A. Hoorens, W. Verlinden and J. Schouten, Acute grade IV toxic hepatitis due to the e-cigarette. Acta Gastroenterol Belg, 2024. **87**(1): p. 44-47. Available from: https://www.ncbi.nlm.nih.gov/pubmed/38431791.

A 46-year-old woman presented at the emergency department because of acute hepatitis with jaundice. After hepatological work-up including liver biopsy, drug induced liver disease (DILI) was suspected. Patient recovered completely within a few months. One year later she presented again with jaundice due to acute hepatitis. Vaping was the only agent that could be identified as causative agent for DILI. After VAPING cessation, the hepatitis resolved completely. Calculated RUCAM score was 10, making the diagnosis of toxic hepatitis very likely. During follow-up liver tests remained normal. This is the first report of severe DILI secondary to the use of e-cigarettes. In future vaping can be included in the differential diagnosis of DILI.

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