

BILATERAL SPONTANEOUS PNEUMOTHORAXES ASSOCIATED WITH VAPING

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Background

Electronic cigarette or vaping product use associated lung injury (EVALI) has received increasing attention by the Centers for Disease Control and Prevention (CDC) within the last year due to a recent increase of cases of acute lung injury associated with vaping. The CDC has established criteria for EVALI: 1) the patient must have vaped within 90 days prior to symptom onset; 2) evidence of pulmonary infiltrate on chest radiographs or chest CT; 3) absence of pulmonary infection on initial work-up; 4) no evidence alternative diagnoses[1].

Spontaneous pneumothoraces (SPs) are often idiopathic in nature, classically in tall, thin males between the ages of 15-34 years old, as well as underlying lung or connective tissue diseases[2]. There are few reported cases of SPs in association with vaping or e-cigarette use, with bilateral pneumothoraces being nearly unseen.

Objective

A 26-year-old Caucasian male with past medical history of polysubstance abuse presented to the emergency department with a one-day history of shortness of breath and chest pain. He was an active daily e-cigarette user. On initial evaluation, he was found to be afebrile, tachypneic at 25 breaths/minute, tachycardic to 125 beats/minute, hypotensive to 82/56 mm Hg, and hypoxic on room air with an oxygen saturation of 85% on bedside pulse oximeter. On physical exam, he was diaphoretic and in obvious respiratory distress. Neck exam showed no tracheal deviation or jugular venous distension. Cardiac auscultation revealed tachycardia with no other abnormalities. Pulmonary exam revealed decreased breath sounds in bilateral apical lungs, with no other abnormalities. The rest of the physical exam was unremarkable.

Workup for respiratory virus panel and COVID were negative. CBC and CMP lab values were largely unremarkable, only with lactic acidosis to 4.4 mmol/L. Toxicology was positive for cocaine, THC, and opiates. Pertinent findings of his chest radiograph revealed bilateral small apical pneumothoraces with the left side greater than the right, and multifocal opacities bilaterally, which were greater in the lung apices (Figure 1).

A left sided thoracostomy was performed in the ICU, resulting in resolution of the left sided pneumothorax (Figure 2). Shortly after placement, the patient traumatically removed his thoracostomy tube. 100% oxygen resulted in resolution of the right sided pneumothorax (Figure 3). The patient was downgraded from the ICU and discharged on hospital day three with resolution of symptoms.

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Results

Spontaneous pneumothorax is a potentially life-threatening emergency condition. This patient's concerning presentation with spontaneous bilateral secondary pneumothoraces (SBSP) and multifocal opacities on the chest x-ray in the setting of vape use, without a prior or family history of lung disease, created a concerning clinical picture. EVALI is already a concerning condition. Per the CDC, as of January 14, 2020, there were 2,668 cases of EVALI requiring hospitalization, with 68 cases resulting in mortality [1].

There is increasing evidence that vaping has potentially deleterious short and long term effects, although the weight of evidence currently is strongly indicative of a number of acute issues as a result of vaping, including e-cigarette explosions, respiratory issues, poisonings, allergic complications, and infant complications among other issues reported in medical literature [3]. Contributing factors may be due to a lack of regulation, the ability of users to include potentially harmful additive ingredients, and marketing that has advertised vaping as a safe alternative to smoking [3]. Over the past several years, vaping received considerable attention related to EVALI, with various regulations being put in place in order to help control the rapid increase in vaping related illnesses.

Primary spontaneous pneumothorax has been rarely reported as a complication of vaping. There are several cases where vaping was the only likely risk factor, and at least one where vaping likely induced recurrent pneumothoraces [4]. This case of bilateral spontaneous vape induced pneumothorax is rare, and literature depicting this event was not found in our comprehensive literature review.

The pathophysiologic mechanism of spontaneous pneumothorax in vaping-related lung injuries has not been thoroughly investigated to date. However, it is thought the pathway is similar to the physiologic cascade of marijuana-induced pneumothorax through the inhalation of toxins [5]. The mechanism responsible for a spontaneous pneumothorax in marijuana smokers may involve repeatedly inhaling deeply through an inhalation device with high resistance and as a result, creating a large negative intrathoracic pressure leading to the pneumothorax [6].

Electronic cigarette smoking can also cause direct insults at the cellular level through inhalation of its compounds, including nicotine and non-nicotine compounds such as propylene glycol and glycerol[7]. Vaping can also lead to disruption of mucociliary clearance mechanisms, causing airway obstruction and inflammation, secretion of pro-inflammatory cytokines, leading to microvascular leakage and disturbance of surfactant balance causing an increase in surface tension leading to small-airway collapse and nicotine-induced large airway bronchoconstriction [7].

Figures

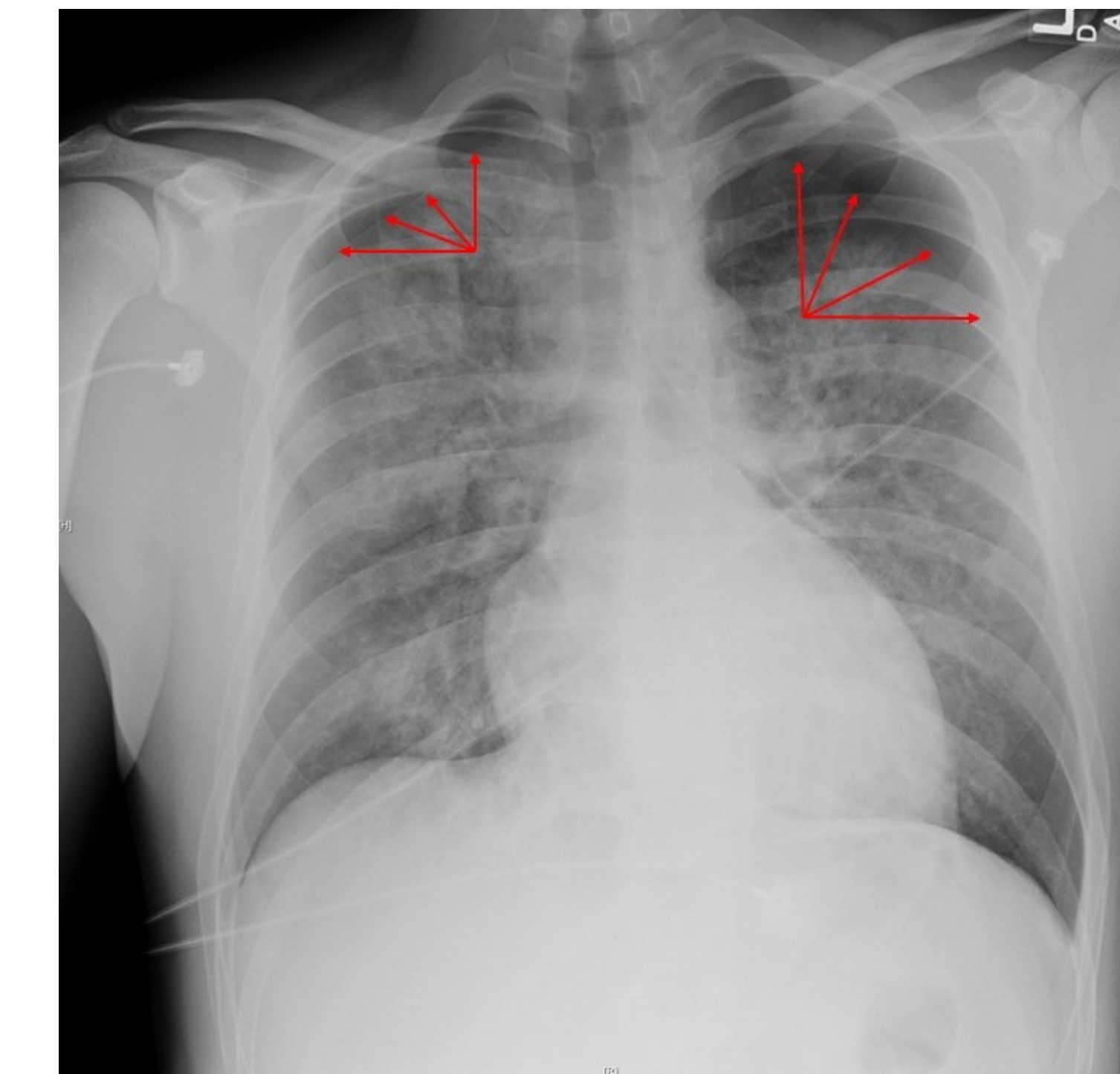


Figure 1 – Admission Radiograph demonstrating bilateral pneumothoraces

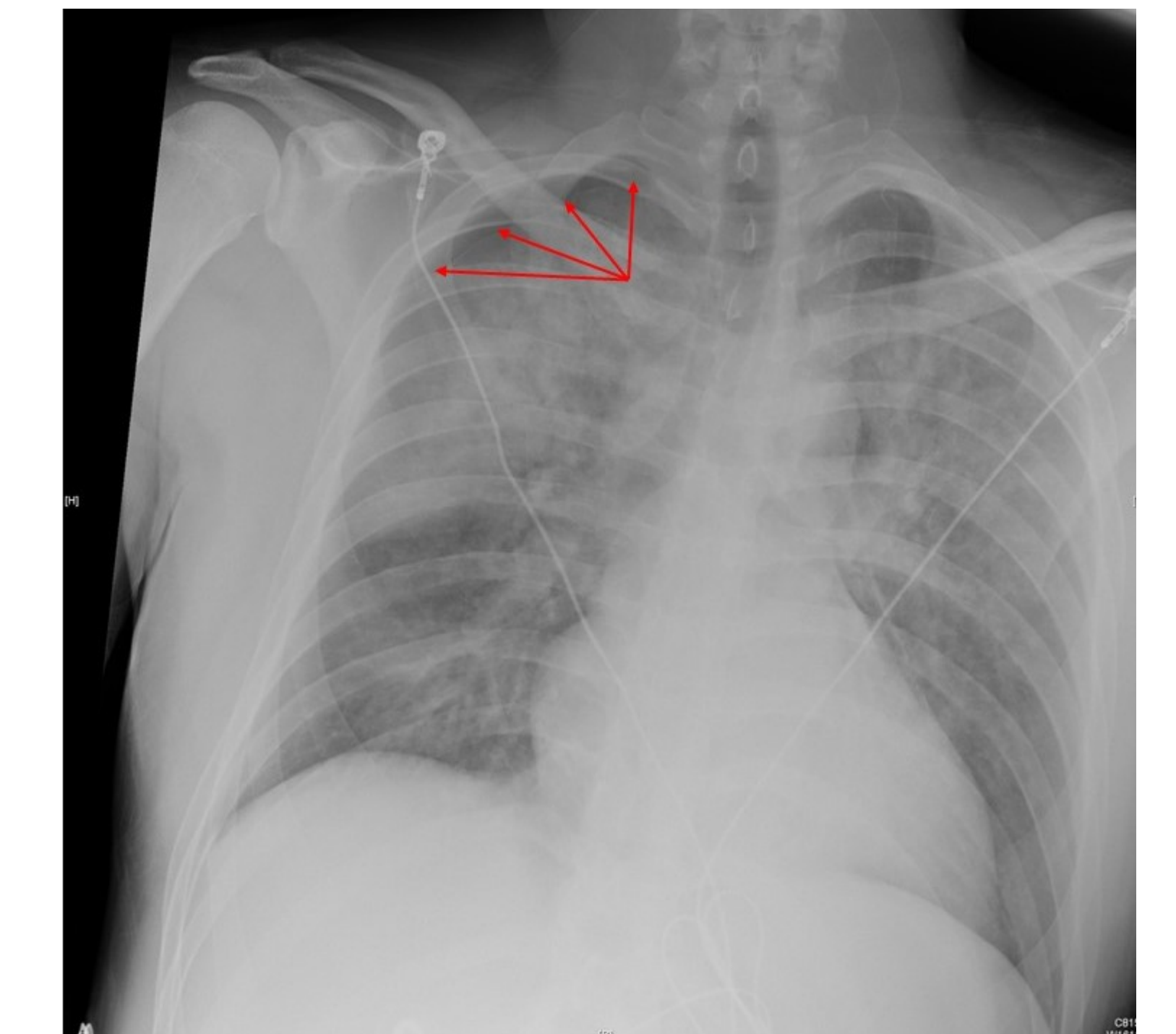


Figure 2 – Resolution of the left sided pneumothorax

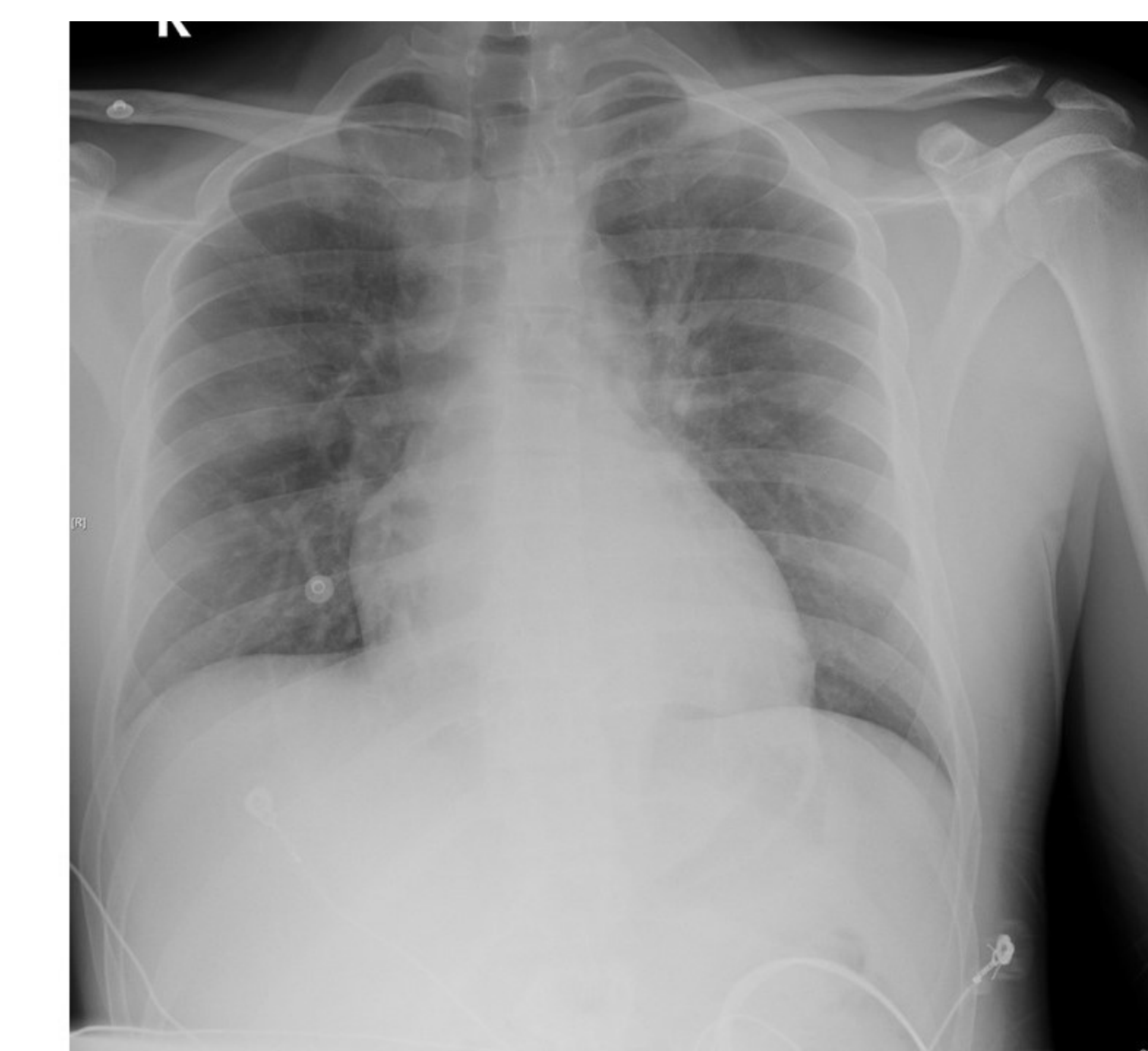


Figure 3 – Resolution of both pneumothoraces

References

1. Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html.
2. Graf-Deuel E, Knoblauch A: Simultaneous bilateral spontaneous pneumothorax. *Chest*. 1994, 105:1142-1146. 10.1378/chest.105.4.1142
3. Kalra SS, Pais F, Harman E, Urbine D: Rapid development of bullous lung disease: a complication of electronic cigarette use. *Thorax*. 2020, 75:359. 10.1136/thoraxjnl-2019-214333
4. Sahn SA, Heffner JE: Spontaneous pneumothorax. *N Engl J Med*. 2000, 342:868-874. 10.1056/NEJM200003233421207
5. Bonilla A, Blair AJ, Alamro SM, 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), 283-2019. 10.1186/s13256-019-2215-4
6. Hazouard E, Koninck JC, Attucci S, Fauchier-Rolland F, Brunereau L, Diot P: Pneumothorax and pneumomediastinum caused by repeated Müller's maneuvers: complications of marijuana smoking. *Ann Emerg Med*. 2001, 38:694-697. 10.1067/mem.2001.1180168.
7. Chaumont M, van de Borne P, Bernard A, et al.: Fourth generation e-cigarette vaping induces transient lung inflammation and gas exchange disturbances: results from two randomized clinical trials. *Am J Physiol Lung Cell Mol Physiol*. 2019, 316:705-719. 10.1152/ajplung.00492.2018