CLINICAL VIGNETTE

Bong Lung: A Case of Massive Lower Lobe Lung Bullae Associated with Cannabis Smoking

May-Lin Wilgus, MD

Case

A 59-year old man was seen in the pulmonary office for evaluation of dyspnea. He was a light tobacco smoker, about one pack per month, but acknowledged heavy cannabis smoking of about one-eighth ounce marijuana via bong daily for 10 years. Five years prior to presentation he was seen at an outside institution with dyspnea, nocturnal wheezing, and syncope. He was diagnosed with COPD and quit smoking cigarettes and marijuana. He tried homeopathic treatments but had persistent dyspnea. At his initial consult he reported dyspnea on exertion walking ten feet, frequent wheezing, and chest discomfort. He was hospitalized with COPD exacerbation several years prior. He had no history of pneumothorax. Past medical history was otherwise notable for benign prostatic hypertrophy, GERD, and dyslipidemia. There was no family history of lung disease. Exam revealed normal vital signs with oxygen saturation of 96% on room air. He had distant breath sounds with faint expiratory wheezing. There were no extra heart sounds, peripheral edema, cyanosis or clubbing.

Diagnostic testing was scheduled. Spirometry demonstrated severe airflow obstruction with FEV1/FVC ratio 0.43 and FEV1 37% predicted. Lung volumes by plethysmography showed a normal total lung capacity at 116% predicted, and air trapping with a residual volume of 191% predicted. Diffusion capacity was moderately reduced at 46% predicted. High-resolution CT chest showed marked bullous panlobular emphysema of the lower lobes causing upper lobe compressive atelectasis, as well as peribronchial thickening and mucostasis consistent with airways disease (Figure 1). Alpha-1-antitrypsin testing revealed a normal level 136 mg/dL and normal phenotype Pi*MM. He was treated with triple inhaler therapy, inhaled corticosteroids, long acting beta agonist, and long acting anticholinergic and enrolled in pulmonary rehab. He was also referred to thoracic surgery and interventional pulmonary for consideration of bullectomy or bronchoscopic lung volume reduction, however he was lost to follow up after a change in insurance.

Discussion

The incidence of cannabis use is increasing: in 2020 17.9% of individuals over the age of 12 in the US reported using cannabis in the last year, and 5.1% had a cannabis use disorder, defined as the inability to stop using cannabis even though the drug is causing health or social problems.[1] Cannabis smoke includes many of the potentially damaging chemicals that are present in cigarette smoke, with the exception of nicotine, along with the presence of THC and other cannabinoids.[2] Data regarding pathologic effects of cannabis use are limited to observational studies which are frequently confounded by concomitant cigarette smoking in cannabis smokers. Nevertheless, many studies have confirmed an association between cannabis smoking and chronic bronchitis symptoms,[2,3] with corresponding bronchoscopic evidence of airway inflammation and increased secretions,[4] and histopathologic changes including loss of ciliated columnar bronchial epithelial cells and increase in mucus secreting epithelial goblet cells.[5] Studies of airflow obstruction from cannabis smoking are conflicting; some longitudinal studies showed no accelerated decline in FEV1 in cannabis smokers compared to nonsmokers,[6] while one study has shown loss of lung function in those with very heavy marijuana use.[7]

Thoracic CT scan studies have not demonstrated a consistent association between cannabis smoking and macroscopic emphysema. However, case reports have described large bullae in cannabis smokers however, most individuals were also cigarette smokers.[8,9] The association between marijuana use and lung bullae has also been termed "bong lung".[10] These cases are similar to giant bullous emphysema, also termed vanishing lung syndrome, which has been historically described as a young male cigarette smoker with large upper lobe bullae in association with paraseptal emphysema.[11] The radiographic criterion for vanishing lung syndrome are giant bullae in one or both upper lobes occupying at least one-third of the hemithorax, and compressing the surrounding normal lung parenchyma.[11]

Cannabis smoking as compared to cigarette smoking often involves a greater inspiratory volume and breath-hold time,[12] and may utilize Muller or Valsalva maneuvers, increasing risk for barotrauma. Pneumomediastinum and pneumothorax, with or without bullae, have also been described in association with cannabis use.[2] As compared to nonsmokers or cigarette smokers with spontaneous pneumothorax, cannabis smokers with spontaneous pneumothorax have higher incidence of chronic respiratory symptoms, bullous lesions, and tension pneumothorax.[13] Pathology of resected lung tissue obtained during surgical management of pneumothorax in cannabis smokers revealed severe emphysema, inflammation, and heavily pigmented macrophages.[14]

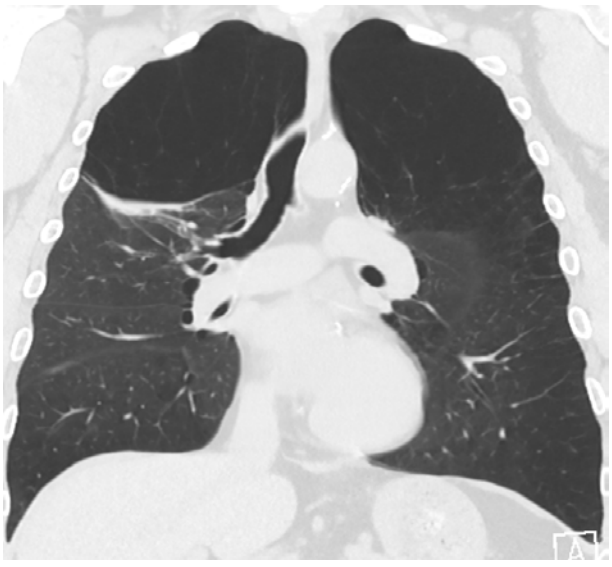
Our patient notably had lower lobe bullae (although so massively hyperinflated as to occupy the upper thorax and compress the upper lobes) and panlobular rather than paraseptal emphysema. Lower lobe panlobular emphysema is characteristic of alpha-1-antitrypsin deficiency, which was excluded in this patient. Panlobular emphysema is associated with greater severity of airflow obstruction and more severe COPD symptoms.[15] It is unclear if the pathogenesis of panlobular emphysema differs from centrilobular emphysema, which is highly associated with cigarette smoking. An association between cannabis use and panlobular emphysema has not been previously described.

Severe COPD results in excess dead space ventilation with loss of elastic recoil, air trapping, and VQ mismatch. Surgical treatment of COPD by lung volume reduction surgery, or bullectomy in the case of large lung bullae, can reduce air trapping, improve diaphragm function and respiratory mechanics, and improve VQ matching.[16] Surgery is indicated for massive lung bullae occupying more than one-third of the lung and compressing normal lung tissue.[11] Mortality after bullectomy is 0 to 2.5%; morbidity is related to prolonged air leak (53%), atrial fibrillation, post-operative mechanical ventilation, and pneumonia.[11] Bronchoscopic methods are now being used for lung volume reduction. Although consensus recommendations advise against bronchoscopic lung volume reduction for large bullae,[17] bronchoscopic bullectomy has been successfully reported in case reports.[18]

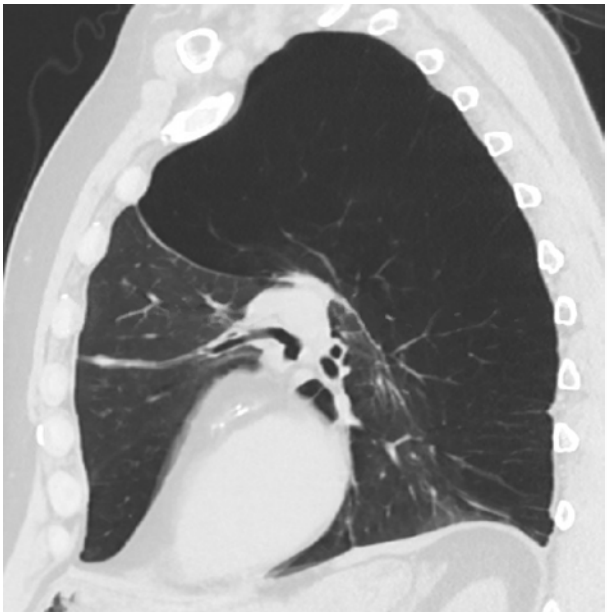
The unique features of this case include the lower lobe location of bullae, panlobular rather than paraseptal emphysema, and severe airflow obstruction. While cigarette smoking may have contributed to this patient's lung disease, his history of very heavy daily cannabis consumption using bong maneuvers likely caused this presentation of severe emphysema.

Figure 1. CT chest with marked lower lobe bullous emphysema causing upper lobe compressive atelectasis. Coronal (A) and sagittal (B) CT images.

A.



B.



REFERENCES

1. **National Institute on Drug Abuse**. What is the scope of cannabis (marijuana) use in the United States? [Internet] Available at: https://nida.nih.gov/publications/research-reports/marijuana/what-scope-marijuana-use-in-united-states.
2. **Tashkin DP**. Marijuana and Lung Disease. *Chest*. 2018 Sep;154(3):653-663. doi: 10.1016/j.chest.2018.05.005. Epub 2018 May 17. PMID: 29778658.
3. **Tashkin DP, Simmons MS, Tseng CH**. Impact of changes in regular use of marijuana and/or tobacco on chronic bronchitis. *COPD*. 2012 Aug;9(4):367-74. doi: 10.3109/15412555.2012.671868. Epub 2012 Apr 12. PMID: 22497563.
4. **Roth MD, Arora A, Barsky SH, Kleerup EC, Simmons M, Tashkin DP**. Airway inflammation in young marijuana and tobacco smokers. *Am J Respir Crit Care Med*. 1998 Mar;157(3 Pt 1):928-37. doi: 10.1164/ajrccm.157.3.9701026. PMID: 9517614.
5. **Fligiel SE, Roth MD, Kleerup EC, Barsky SH, Simmons MS, Tashkin DP**. Tracheobronchial histopathology in habitual smokers of cocaine, marijuana, and/or tobacco. *Chest*. 1997 Aug;112(2):319-26. doi: 10.1378/chest.112.2.319. PMID: 9266864.
6. **Tashkin DP, Simmons MS, Sherrill DL, Coulson AH**. Heavy habitual marijuana smoking does not cause an accelerated decline in FEV1 with age. *Am J Respir Crit Care Med*. 1997 Jan;155(1):141-8. doi: 10.1164/ajrccm.155.1.9001303. PMID: 9001303.
7. **Pletcher MJ, Vittinghoff E, Kalhan R, Richman J, Safford M, Sidney S, Lin F, Kertesz S**. Association between marijuana exposure and pulmonary function over 20 years. *JAMA*. 2012 Jan 11;307(2):173-81. doi: 10.1001/jama.2011.1961. PMID: 22235088; PMCID: PMC3840897.

8. **Johnson MK, Smith RP, Morrison D, Laszlo G, White RJ**. Large lung bullae in marijuana smokers. *Thorax*. 2000 Apr;55(4):340-2. doi: 10.1136/thorax.55.4.340. PMID: 10722775; PMCID: PMC1745720.
9. **Fiorello A, Vicidomini G, Santini M**. Marijuana smokers and lung bullae. *Eur J Cardiothorac Surg*. 2008 Sep;34(3):706-7; author reply 707. doi: 10.1016/j.ejcts.2008.06.033. Epub 2008 Jul 26. PMID: 18657985.
10. **Gao Z, Wood-Baker R, Harle R, Muller K, Hauser J, Reid DW**. "Bong lung" in cystic fibrosis: a case report. *J Med Case Rep*. 2010 Nov 19;4:371. doi: 10.1186/1752-1947-4-371. PMID: 21092085; PMCID: PMC2998526.
11. **Van Bael K, La Meir M, Vanoverbeke H**. Video-assisted Thoracoscopic Resection of a Giant Bulla in Vanishing Lung Syndrome: case report and a short literature review. *J Cardiothorac Surg*. 2014 Jan 5;9:4. doi: 10.1186/1749-8090-9-4. PMID: 24387696; PMCID: PMC3904682.
12. **Wu TC, Tashkin DP, Djahed B, Rose JE**. Pulmonary hazards of smoking marijuana as compared with tobacco. *N Engl J Med*. 1988 Feb 11;318(6):347-51. doi: 10.1056/NEJM198802113180603. PMID: 3340105.
13. **Stefani A, Aramini B, Baraldi C, Pellesi L, Della Casa G, Morandi U, Guerzoni S**. Secondary spontaneous pneumothorax and bullous lung disease in cannabis and tobacco smokers: A case-control study. *PLoS One*. 2020 Mar 30;15(3):e0230419. doi: 10.1371/journal.pone.0230419. PMID: 32226050; PMCID: PMC7105102.
14. **Beshay M, Kaiser H, Niedhart D, Reymond MA, Schmid RA**. Emphysema and secondary pneumothorax in young adults smoking cannabis. *Eur J Cardiothorac Surg*. 2007 Dec;32(6):834-8. doi: 10.1016/j.ejcts.2007.07.039. Epub 2007 Oct 10. PMID: 17931876.
15. **Wilgus ML, Abtin F, Markovic D, Tashkin DP, Phillips JE, Buhr RG, Flynn MJ, Dembek M, Cooper CB, Barjaktarevic I**. Panlobular emphysema is associated with COPD disease severity: A study of emphysema subtype by computed tomography. *Respir Med*. 2022 Feb;192:106717. doi: 10.1016/j.rmed.2021.106717. Epub 2021 Dec 14. PMID: 35026616.
16. **Mulhall P, Criner G**. Non-pharmacological treatments for COPD. *Respirology*. 2016 Jul;21(5):791-809. doi: 10.1111/resp.12782. Epub 2016 Apr 21. PMID: 27099216.
17. **Slebos DJ, Ten Hacken NH, Hetzel M, Herth FJF, Shah PL**. Endobronchial Coils for Endoscopic Lung Volume Reduction: Best Practice Recommendations from an Expert Panel. *Respiration*. 2018;96(1):1-11. doi: 10.1159/000490193. Epub 2018 Jul 10. PMID: 29991060; PMCID: PMC6530543.
18. **Hou G, Wang W, Wang QY, Kang J**. Bronchoscopic bullectomy with a one-way endobronchial valve to treat a giant bulla in an emphysematic lung: a case report. *Clin Respir J*. 2016 Sep;10(5):657-60. doi: 10.1111/crj.12257. Epub 2015 Jan 27. PMID: 25516237.