



Spontaneous Pneumothorax in COVID-19

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COVID-19

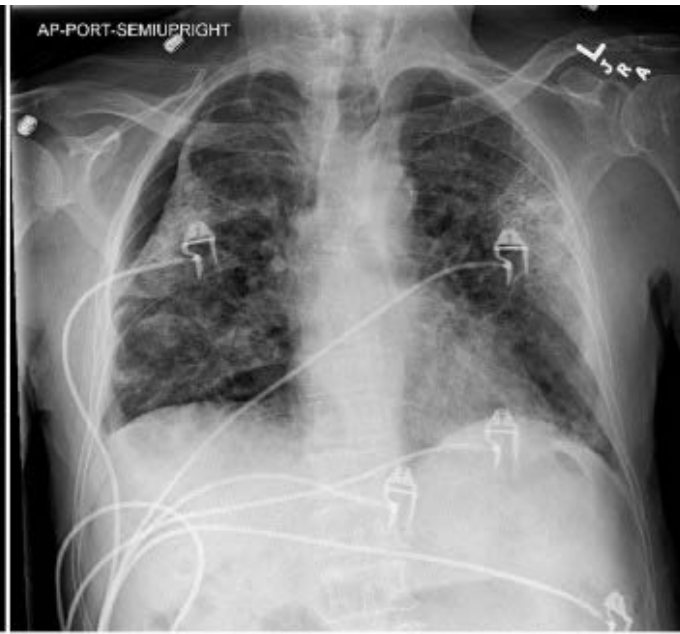
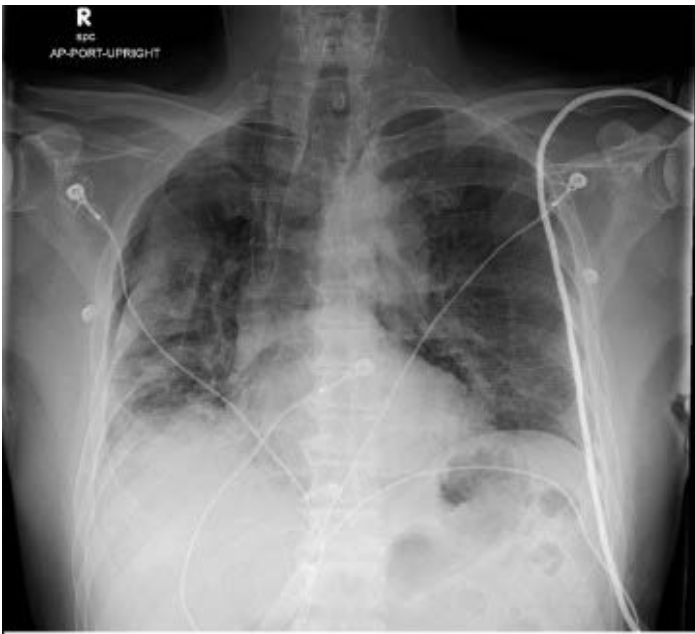
- Coronavirus disease 19 (COVID-19) has been associated with significant morbidity and mortality.
- Our understanding of the clinical spectrum of disease continues to evolve
- Spontaneous pneumothorax has emerged as a concerning complication in patients hospitalized with COVID-19

Epidemiology

- Annual incidence of 0.02% in males and 0.006% in females
- Risk factors
 - Male sex, smoking
 - Subpleural bleb or bulla
- Incidence much higher in ventilated patients
 - Highest incidence in ARDS

COVID-19

- Estimated Incidence of 1-2%
 - Retrospective case reports and case series



“...spontaneous pneumothorax in COVID not on positive pressure. Are people seeing a lot of this? “

Inova Study

- Conducted a retrospective study of patients with COVID-19 admitted at five hospitals within the Inova Health System in Virginia, USA between February and May 2020
- Identified 1619 patients admitted during this time
- 22 patients were diagnosed with spontaneous pneumothorax.

Table 1
Characteristics of 22 patients with COVID-19 and spontaneous pneumothorax.

Characteristics	Total (N = 22)	Alive (N = 14)	Deceased (N = 8)
Median Age (IQR)- yr	60 (47–67)	59 (39–63)	63 (58–78)
BMI (IQR)	25.4 (21.9–32.1)	23.7 (21.7–30.2)	28.3 (24.3–33.5)
Male Sex- no. (%)	18 (82)	11 (79)	7(88)
Ethnicity			
Hispanic	21(95)	14(100)	7(87.5)
Unavailable	1(5)	0	1 (12.5)
Risk Factors- no. (%)			
Hypertension	12(56)	6(43)	6(75)
Diabetes Mellitus	7(32)	3(21)	4(50)
Smoker	3(14)	2(14)	1(13)
Asthma	3(14)	2(14)	1(12.5)
Chronic Obstructive Pulmonary Disease	1(5)	1(7)	0
Idiopathic Pulmonary Fibrosis	0	0	0
Inflammatory disorder*	4(18)	2(14)	2(25)
Congestive Heart Failure	2(9)	0	2(25)
Malignancy	2(9)	1(7)	1(12.5)
Cirrhosis	2(9)	1(7)	1(12.5)
Home medications- no. (%)			
Aspirin	2(9)	1(7)	1(12.5)
Statin	7(32)	4(18)	3(37.5)
Inhaled Corticosteroids	2(9)	1(7)	1(12.5)
Long Acting Beta Agonists	2(9)	1(7)	1(12.5)
Long Acting Muscarinic Antagonists	2(9)	1(7)	1(12.5)
Montelukast	2(9)	1(7)	1(12.5)
Oral Steroids	3(14)	2(14)	1(12.5)
Admission symptoms- no.(%)			
Cough	7(32)	2(14)	5(62.5)
Shortness of Breath	19(86)	13(93)	6(75)
Fever	9(41)	4(29)	5(62.5)
Chills	1(5)	1(7)	0
Chest tightness	1(5)	0	1(12.5)
Altered Mental Status	1(5)	0	1(12.5)

Median Peak Inflammatory Markers. (IQR)

Troponin I - ng/ml	0.02 (0.01–0.09)	0.02 (0.01–0.08)	0.03 (0.02–0.10)	
D-Dimer – ug/ml	4.0 (3.0–10.5)	4.0 (3.0–10.7)	4.09 (3.1–10.1)	
Ferritin – ng/ml	2345 (1031–3361)	2116 (952–5399)	2792 (1431–3178)	←
C-Reactive protein – mg/dL	28.0 (18.4–36.6)	27.7 (18.2–31.8)	33.5 (22.7–40.8)	←
Fibrinogen – mg/dL	812 (680–941)	740 (694–904)	873 (666–941)	←
LDH – U/L	723 (507–1077)	840 (559–1071)	687 (511–891)	

Median Inflammatory Markers at time of pneumothorax diagnosis (IQR)

Troponin- ng/ml	0.01(0.01–0.03)	0.01 (0.01–0.03)	0.02 (0.01–0.07)	
D-dimer- ug/ml	2.6 (2.3–3.6)	2.6 (2.1–3.5)	2.9 (2.5–4.9)	
Ferritin – mg/dL	1166 (697–2147)	979 (652–1680)	1857 (1222–2588)	}
C-Reactive protein – mg/dL	11.8(8.0–27.1)	8.7 (2.2–12.1)	27.1 (15.4–34.2)	
Fibrinogen – mg/dL	659(559–725)	643 (464–706)	740 (615–866)	
LDH – U/L	650 (455- 853)	658 (445–920)	624 (511–681)	

Respiratory Support at time of diagnosis of pneumothorax- no. (%)

Nasal Cannula	4(18)	3(21)	1(12.5)	}
HFNC	5(23)	4(29)	1(12.5)	
CPAP	0	0	0	
BIPAP	2(9)	1(7)	1(12.5)	
Ventilator	9(41)	4(29)	5(62.5)	
ECMO+Ventilator	2(9)	2(14)	0	

Treatment strategy- no. (%)

Close Monitoring	6(27)	4(29)	2(25)
Chest tube placement	16(73)	10(71)	6(75)
Days until resolution	4	5	N/A

Median Duration of hospitalization (days)

18.5	21.5	11
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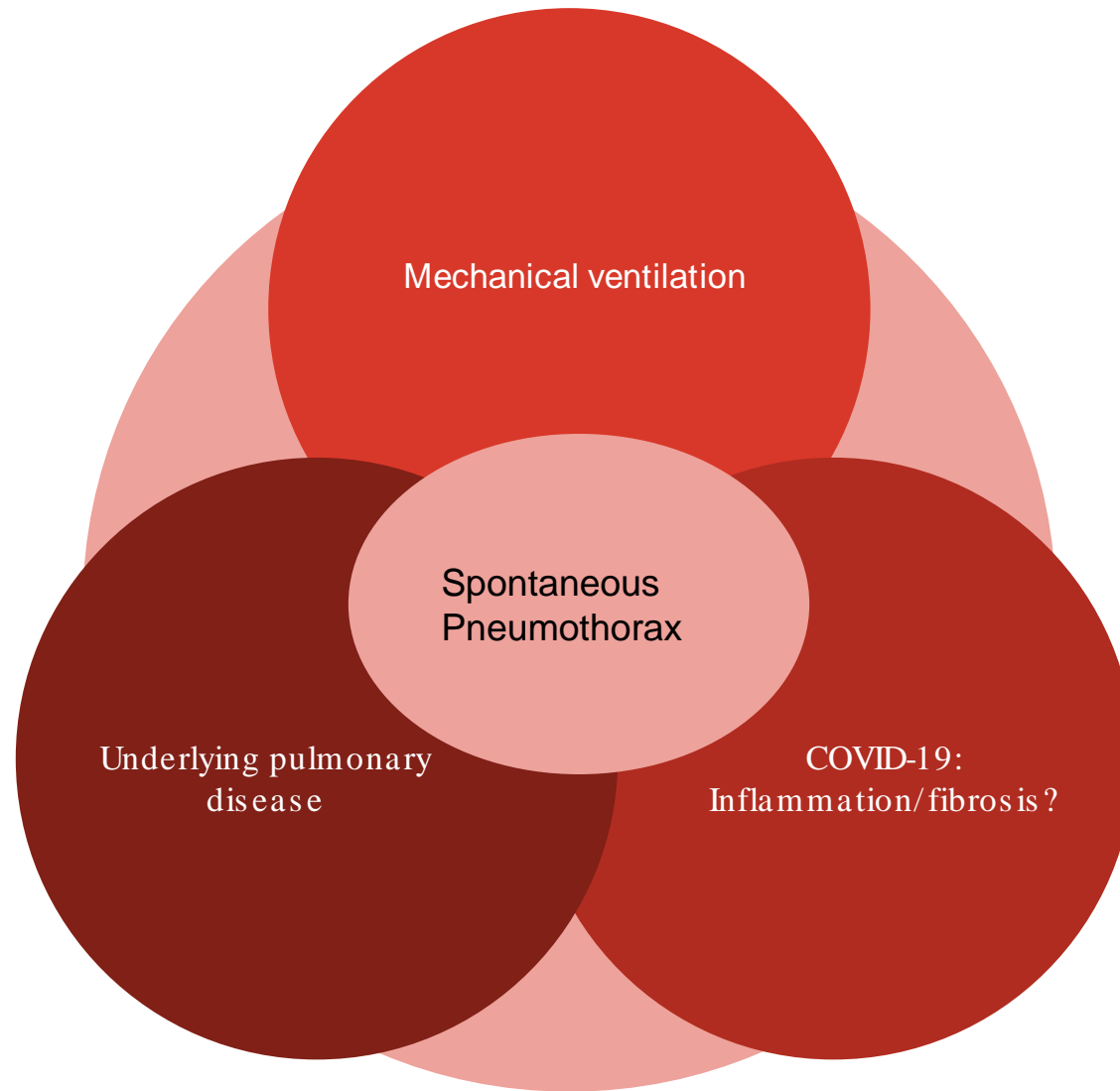
Inova Study

- Incidence of spontaneous pneumothorax was 1.4%
- Mortality rate of 36%
 - Crude mortality rate of all patients admitted with COVID-19 PNA during this time span was 15.8%
- Deceased patients were more likely to be older, overweight, increased inflammatory markers, with higher prevalence of HTN, DM and CHF
- Hypothesize that marked inflammatory response, fibrosis, and need for positive pressure ventilation are contributory to the development of pneumothorax

Pneumothorax in COVID-19

- Miro et al conducted a case control study in 61 spanish emergency departments (71,904 COVID-19 patients vs 1.3 million non COVID pts) comparing the characteristics of patients with and without COVID-19 who developed pneumothoraces and patients with COVID-19 who did not develop pneumothoraces
 - COVID-19 patients with pneumothoraces had increased leukocyte count, lymphopenia and increased hospital death compared to the other two groups
- Wong et al published case series identifying 75 patients (13.7%) with COVID-19 ARDS and pneumothorax
 - 92% while ventilated despite lung protective strategies
 - Most patients classified as severe ARDS
 - 76% inpatient mortality

Wong, Kelvin, et al. "Pneumothorax in COVID-19 Acute Respiratory Distress Syndrome: Case Series." *Cureus* 12.11 (2020).



Mechanical ventilation

Spontaneous
Pneumothorax

Underlying pulmonary
disease

COVID-19:
Inflammation/fibrosis?