# Evidence Search Service Results of your search request

## Incidence, management and outcome of pneumomediastinum and pneumothorax in ICU patients with COVID pneumonitis

**ID of request:** 30498  
**Date of request:** 8th July, 2021  
**Date of completion:** 27th July, 2021

If you would like to request any articles or any further help, please contact:  Lucy Sinclair at [lucy.sinclair1@nhs.net](mailto:lucy.sinclair1@nhs.net)

Please acknowledge this work in any resulting paper or presentation as: Evidence search: Incidence, management and outcome of pneumomediastinum and pneumothorax in ICU patients with COVID pneumonitis. Lucy Sinclair. (27th July, 2021). BRIGHTON, UK: Brighton and Sussex Library and Knowledge Service.

**Sources searched**  
Cochrane Library (0)  
EMBASE (25)  
EUROPE PMC (5)  
Google Scholar (1)  
MEDLINE (40)  
NICE Evidence Search (0)  
TRIP Database (18)  
UpToDate (4)

**Date range used** (5 years, 10 years): 2019-current   
**Limits used** (gender, article/study type, etc.): none   
**Search terms and notes** (full search strategy for database searches below):

Relevant natural language and controlled vocabulary terms were selected and combined. Thesaurus terms were adapted for different databases. Medline and Embase searched on Ovid. Results were reviewed for relevance and de-duplicated in EndNote. Full search strategy below.

**Search terms**

**NICE Evidence search:**

COVID 19 pneumomediastinum

COVID 19 pneumothorax

**Cochrane Library:**

COVID-19 pneumomediastinum

COVID 19 pneumothorax

**UpToDate:**

Coronavirus pneumomediastinum

Coronavirus pneumothorax

**Europe PMC:**

(("COVID-19" or COVID19 or 2019nCoV or "Corona Virus" or Coronavirus or "CoV 2" or CoV2 or COVID or nCoV or SARS2 or SARSCoV or "SARS-CoV") AND ((pneumomediastinum OR pneumothorax OR "collapsed lung"))) AND (SRC:PPR)

**Google Scholar search:**

(("COVID-19" or COVID 19 or 2019 nCoV or "Corona Virus" or Coronavirus or "CoV 2" or CoV2 or COVID or nCoV or SARS 2 or SARS CoV and "SARS-CoV") AND ((pneumomediastinum OR pneumothorax OR "collapsed lung")))

**TRIP Medical database:**

covid-19 pneumomediastinum

covid-19 pneumothorax

For more information about the resources please go to: <https://www.bsuh.nhs.uk/library/>.

## Summary of Results

This evidence search report contains literature about pneumomediastinum and pneumothorax in COVID-19 patients.

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## A. Synopses or Summaries

#### UpToDate

**Pneumothorax in adults: Epidemiology and etiology** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=701b84eb3b682202dcc5d47e321c020a)

MAY BE OF INTEREST: Others — Less common causes of SSP include ankylosing spondylitis, asthma, interstitial lung disease (eg, idiopathic pulmonary fibrosis, silicosis), granulomatous lung diseases (eg, rheumatoid arthritis, granulomatosis with polyangiitis, and sarcoidosis), and inhalation of cocaine [36,72-77]. Several case series have described pneumothorax occurring in patients with coronavirus disease 2019 (COVID-19) in the absence of noninvasive or invasive ventilation [78-80].

## B. Original Research

1. **A case report of pneumomediastinum in a COVID-19 patient treated with high-flow nasal cannula and review of the literature: Is this a "spontaneous" complication?**  
   Cancelliere Anna Clinical Case Reports 2021;9:e04007.

Oxygen support with high-flow nasal cannula (HFNC) is gentler than mechanical ventilation and may provide significant benefits, but more studies are needed to investigate the efficacy and safety of different respiratory supports in patients with COVID-19 pneumonia.Copyright © 2021 The Authors. Clinical Case Reports published by John Wiley & Sons Ltd.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=4d8186842fa5dbc20835247b1f1bd552)

1. **A protocol for COVID-19 associated primary spontaneous tension pneumothorax - a systematic review**  
   Anon. PROSPERO 2021;:No page numbers.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=4425d9b92237b42dc5aa75e9b9896f9f)

1. **Barotrauma and mechanical ventilation in critically ill patients covid-19**  
   Bolivar-Rodriguez Martin Adrian Neumologia y Cirugia de Torax(Mexico) 2021;80:62-67.

Manifestations of SARS-CoV-2 pneumonia can rapidly progress to acute respiratory failure and acute respiratory distress syndrome that should receive timely ventilatory support invasive mechanical ventilation. Barotrauma is a complication that should be considered in this type of patient due to the risk of worsening the clinical course, increasing mortality risk. The mechanism of how barotrauma occurs in COVID-19 patient is related to lung damage associated with mechanical ventilation and structural changes caused by COVID-19 complications. Worldwide evidence on therapeutic management on barotrauma in COVID-19 patient is limited. Clinical evolution should be monitored due to the possibility of cardiovascular and respiratory complications, which must be resolved in a timely manner. The objective of this review is to inform about the current knowledge described in literature of this complication in COVID-19 patients, its incidence, pathophysiology, diagnosis, treatment and prognosis. Conclusion(s): Barotrauma presentation frequency increases in COVID-19 infected patients. Clinical manifestations can be nonspecific, so the diagnosis should have high suspicion. There is little evidence to date of pulmonary sequelae associated with barotrauma in these patients.Copyright © 2021, Instituto Nacional de Enfermedades Respiratorias. All rights reserved.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=aaad24de17e4207271e962c2c9bd8555)

1. **Barotrauma Linked to Coronavirus Disease 2019 Infection in Younger Patients: A Case Series**  
   Ng Thomas G. Cureus 2021;13:e14573.

Patients infected with coronavirus disease 2019 (COVID-19) on invasive mechanical ventilation were found to have high rates of barotrauma. Herein, we present five patients admitted to the intensive care unit between March and April 2020, who developed barotrauma as a complication of COVID-19 pneumonia. This series includes four males and one female with a mean age of 54 years, most without significant chronic comorbidities or former tobacco use. All were intubated for hypoxic respiratory failure due to the COVID-19 infection. The diagnosis of barotrauma was confirmed via radiography showing the presence of pneumothorax, pneumomediastinum, or subcutaneous emphysema on radiographic imaging. At the time, they were evaluated for convalescent plasma infusion, remdesivir, and interleukin-6 inhibitor. Each of the five patient's hospital courses were documented. The average number of days between intubation and subsequent barotrauma was 6.8 days with the mean length of hospital stay being 49 days. Three of the five patients passed away due to complications related to COVID-19. Due to the unknown nature of the virus, our findings add to the growing evidence that those infected, even without significant comorbidities, are at high risk for pulmonary complications and in-hospital mortality. Copyright © 2021, Ng et al.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=48757b613568708e602c00478ec748ad)

1. **Bronchopleural fistula causing persistent pneumothorax in COVID-19 pneumonia patient with no risk factors**  
   Habib Mhd Baraa 2021;:No page numbers.

Although pneumothorax is a well-known complication of COVID-19 pneumonia especially in patients requiring mechanical ventilation, bronchopleural fistula causing persistent pneumothorax in sole COVID-19 pneumonia is extremely rare. In this case, we illustrate that bronchopleural fistula can be found in COVID-19 pneumonia, even with no risk factors nor mechanical ventilation administration.

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1. **Case of pneumothorax on high-flow nasal cannula in COVID-19**  
   Rebello Joslita Indian Journal of Critical Care Medicine 2021;25:S46-S47.

Introduction: High-flow nasal cannula (HFNC) is used as alternative respiratory support in hypoxemic respiratory failure. A study on HFNC has shown a linear relationship between flow and airway pressure and delivers PEEP of 3 to 7 cm H2O. This peep effect can lead to barotrauma with high-flow nasal oxygen. Material(s) and Method(s): A 60-year-old man presented with a 1-week history of cough breathlessness and myalgia. No other significant past medical history SARS-CoV-2 positive status confirmed by a reverse transcriptase-polymerase chain reaction. Initial arterial blood gas showed hypoxic respiratory failure. He was put on HFNC on day 2 with oxygen flows at 40 L/minute gradually increased to 50 L/ minute. Result(s): On day 8 diagnosed with right pneumothorax, a water seal drain was placed. Serial chest radiographs showed resolution of pneumothorax. The water seal drain was removed. The patient was sent to the ward on a face mask. Discussion(s): Spontaneous pneumothorax is a rare complication of COVID-19 pneumonia. In the present case, the pneumothorax is due to positive pressure generated by high-flow nasal cannula therapy combined with underlying lung injury caused by SARS-CoV-2 infection. We successfully removed the water seal drain following the resolution of pneumothorax. Conclusion(s): This case highlights HFNC therapy with high oxygen flow rates can cause pneumothorax in COVID-19 patients with underlying lung inflammation.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=0626510f4cf41c7b7d9182b458b51f04)

1. **Case Report: Massive Spontaneous Pneumothorax-A Rare Form of Presentation for Severe COVID-19 Pneumonia**  
   Marza Adina Maria Medicina (Kaunas, Lithuania) 2021;57:No page numbers.

Background and Objectives: Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is a viral disease that is spreading worldwide and became a pandemic. Although most of the time, the symptoms of the infection are flu like, a percentage of patients develop severe forms, along with severe complications. Many of them are known among front-line health workers, but the number of uncommon presentations and complications has increased. This case report aims to alert healthcare workers on less common forms of presentation, and to introduce this differential diagnosis in the evaluation of patients with COVID-19, given the increasing occurrence of pneumothorax in patients who are not mechanical ventilated. Case presentation: A 57-year-old female patient came to the Emergency Department (ED) by ambulance, with acute respiratory failure. She had SpO2 = 43% on room air at home, and 86% on admission in ED after oxygen delivery (on a reservoir mask). SARS-CoV-2 infection was suspected based on symptoms that started three days ago (fever, dry cough, dyspnea, and fatigability). Blood was taken for lab tests, pharyngeal and nasal swabs for the reverse transcription-PCR (RT-PCR) test, and native computed tomography (CT) was scheduled. The thoracic CT scan showed massive right pneumothorax, partially collapsed lung, multiple bilateral lung infiltrates with a ground glass aspect and the RT-PCR test came back positive for SARS-CoV-2 infection. Despite the prompt diagnosis and treatment of pneumothorax (thoracostomy was performed and the drain tube was placed), the patient died after a long hospitalization in the intensive care unit. Conclusion: Secondary spontaneous pneumothorax (SSP), as a complication in severe forms of COVID-19 pneumonia, especially in female patients without risk factors is rare, and early diagnosis and treatment are essential for increasing the survival chances of these patients.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=a5df3104c49f03852f7876c3c562bb18)

1. **Clinical outcomes of pleural drainage on pneumothorax and hydrothorax in critically ill patients with COVID-19: A case series with literature review**  
   Xu Yuan Heart & lung : the journal of critical care 2021;50:213-219.

BACKGROUND: For patients with COVID-19, pneumothorax and hydrothorax are suggested to be negative prognostic indicators. However, the management of these two conditions has rarely been discussed. We aimed to describe the clinical outcomes of pleural drainage in critically ill patients with COVID-19., METHODS: A total of 17 pleural drainages were performed in 11 critically ill patients with pneumothorax or hydrothorax. Either chest tubes or central venous catheters (CVCs) were used. The clinical outcomes, including respiratory and circulation indicators at 24 h and 1 h before the procedure and 24 h and 48 h after the procedure, were retrospectively recorded., RESULTS: (1) Following pleural drainage, there was a 19.1% improvement in the PaO2/FiO2 ratio from 147.4 mmHg (-1 h) to 175.5 mmHg (24 h), while the mean positive end expiratory pressure (PEEP) decreased from 10.7 cmH2O (-1 h) to 8.9 cmH2O (24 h) and 8.1 cmH2O (48 h). The A-a gradients decreased from 313.3 mmHg (-1 h) to 261.3 mmHg (24 h). (2) The dosage of norepinephrine increased from 0.15 mug/kg/min (-1 h) to 0.40 mug/kg/min (24 h). (3) No haemorrhagic or infectious complications were observed. (4) A total of 41.6% of CVCs were partially or fully obstructed, while no chest tubes were obstructed., CONCLUSION: For critically ill patients with COVID-19, pleural drainage leads to a significant improvement in oxygenation and gas exchange, but the deterioration of circulation is not reversed. It is safe to perform pleural drainage even though anticoagulation therapy and glucocorticoids are widely used. Chest tubes rather than CVCs are recommended. Copyright © 2020 Elsevier Inc. All rights reserved.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=4ceda65c7383460e3de509bd34a107c1)

1. **COVID 19 and Sponthaneous Pneumomediastinum Unrelated to Mechanical Ventilation**  
   Menchaca Davila S. American Journal of Respiratory and Critical Care Medicine 2021;203:No page numbers.

SARS-CoV-2 infection has been responsible for up to 77 million cases reported around the world with up to 1 million and half deaths. Multiple complications have been reported in this patients related mainly to high inflammation markers such as cytokine storm. However there have been several reports regarding spontaneous pneumothorax and pneumomediastinum unrelated to mechanical ventilation. We report the case of a 77 years old woman with clinical history of COPD diagnosed in 2005 without treatment, she denies exacerbations and refers no spirometric control; as well as diabetes type 2 diagnosed in 2015. She had contact with a positive case of SARS-CoV-2. She presents to our emergency department with a one day history of headache, fever, myalgia, arthralgia, dyspnea as well as oxygen saturation of 88 percent with no supplementary oxygen. Simple chest tomography shows high attenuation diffuse ground glass opacities and bronchiectasis with predominance in lower lobes and hospitalization was offered to what she refused and was discharged with outpatient treatment. She received treatment with high dose steroid and supplementary oxygen. In the following week, she presented progressive dyspnea and increasing oxygen requirements and showed to emergency department one week later with dyspnea, tachypnea and desaturation down to 85% with supplementary oxygen. She was admitted and a new tomography showed increased ground glass opacities with septal thickening as well as pneumomediastinum and subcutaneous emphysema with no pneumothorax. Pneumomediastinum is the presence of air in the mediastinum secondary to air leak. COVID-19 has been related to cases of spontaneous air leak with no clear explanation yet. Some authors suggest severe degree of alveolar and interstitial lung architectural damage seen in COVID-19 has a significant effect on alveolar ventilation due to hyaline membranes, fibrin thrombi and infarction. Both ventilation and perfusion are simultaneously affected increasing the degree of hypoxemia and shunt, worsening the perfusion and causing pulmonary tissue ischemic with risk for air leak. Other hypothesis consider viral infiltration of lung parenchyma as well as in visceral and parietal pleura may cause disruption of parenchymal integrity leading to subsequent air leak, related to high inflammation markers as well as an hypercoagulable state. The importance of this case is to be aware of the different complications besides cytokine storm that may affect patients with COVID-19 and not to lose sight on spontaneous events of pneumomediastinum and neumothorax usually associated with adverse outcomes.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=23b6e366019108bc2e24a2e476c14ceb)

1. **COVID-19 pneumonitis and cystic lung disease, pneumothorax and pneumomediastinum**  
   Everden Serenydd Thorax 2021;:No page numbers.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=7c50652adb4d39f8f5872adebb931dc7)

1. **COVID-19 with spontaneous pneumothorax, pneumomediastinum, and subcutaneous emphysema in the intensive care unit: Two case reports**  
   Alharthy Abdulrahman Journal of infection and public health 2021;14:290-292.

Real-Time-reverse-transcription-Polymerase-Chain-Reaction from nasopharyngeal swabs and chest computed tomography (CT) depicting typically bilateral ground-glass opacities with a peripheral and/or posterior distribution are mandatory in the diagnosis of COVID-19. COVID-19 pneumonia may present though with atypical features such as pleural and pericardial effusions, lymphadenopathy, cavitations, and CT halo sign. In these two case-reports, COVID-19 presented as pneumothorax, pneumomediastinum and subcutaneous emphysema in critically ill patients. These disorders may require treatment or can be even self-limiting. Clinicians should be aware of their potential effects on the cardiorespiratory status of critically ill COVID-19 patients. Finally, pneumothorax can be promptly diagnosed by means of lung ultrasound. Although operator dependent, lung ultrasound is a useful bedside diagnostic tool that could alleviate the risk of cross-infection related to COVID-19 patient transport. Copyright © 2020 The Author(s). Published by Elsevier Ltd.. All rights reserved.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=9daef5c9606bcd029b9d055c6db2f916)

1. **Exuberant spontaneous pneumothorax, pneumomediastinum, pneumopericardium and subcutaneous emphysema in COVID-19 pneumonia**  
   Pimenta Ines BMJ Case Reports 2021;14:e243861.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=1625c0d7fe0d83122afd164d879f632a)

1. **Feasibility and safety of bronchoscopy and ultrasonography guided bedside percutaneous dilatational tracheostomy performed by non-intensivists in a community icu**  
   Singh K. American Journal of Respiratory and Critical Care Medicine 2021;203:No page numbers.

Introduction: Many ICU's in the United States do not have intensivist coverage and all procedures typically performed by intensivists are done by other specialties. Percutaneous dilatational tracheostomy (PDT) is commonly performed in the intensive care unit (ICU) at bedside for long-term ventilator support. In this study, we aim to describe our experience with PDT with both endoscopic and USG guidance with the primary operator being a hospitalist or internal medicine residents or pulmonary(non critical care) medicine fellow with the supervisor being an intensivist with training in PDT Methods: A total of 26 PDTs were performed using both bronchoscopy and USG guidance. Prior to the procedure, anatomical landmarks, including the thyroid cartilage, crico-thyroid membrane and tracheal rings, were identified using USG. The distance of the trachea from skin was checked and absence of a high innominate artery as well as other vascular anomalies was confirmed with USG. A bronchoscope inserted through the endotracheal tube (ETT) was used to pull the ETT out just distal to the vocal cords. Bronchoscopic visualization was also used to confirm a midline puncture and to avoid puncture of the posterior tracheal wall. After cannulation, the bronchoscope was inserted through the tracheostomy tube to confirm adequate distance from the carina. A post-procedure USG was performed to check for the absence of a pneumothorax. Result(s):The average BMI of patients was 28 with an average age of 72. 2 patients were therapeutically anticoagulated and three patients were on clopidogrel. 5 patients had COVID 19 ARDS. Accidental decannulation was noted in 2 patients early on in the course and the procedure modified to include sutures through the tracheostomy holder along with a tracheostomy tie, following which there were no recurrences. 1 patient had persistent oozing which needed treatment with lidcoaine with epinephrine. No pneumothorax, tracheoinnominate fistula or stenosis post decannulation was noted. There was a 46% in hospital mortality but not related to procedural complications Discussion: Conventional/surgical tracheostomy involves more personnel and increases cost. Bronchoscopy and USG guidance help ensure reduction in major complications described with the procedure when compared to surgical tracheostomies. This pilot feasibility and safety analysis paves the way for teams without full time intensivists to perform more PDTs and collect further data to prove the safety and cost effective performance of PDTs.

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1. **Functional pathophysiology of SARS-CoV-2-induced acute lung injury and clinical implications**  
   Habashi Nader M. Journal of applied physiology (Bethesda, Md. : 1985) 2021;130:877-891.

The worldwide pandemic caused by the SARS-CoV-2 virus has resulted in over 84,407,000 cases, with over 1,800,000 deaths when this paper was submitted, with comorbidities such as gender, race, age, body mass, diabetes, and hypertension greatly exacerbating mortality. This review will analyze the rapidly increasing knowledge of COVID-19-induced lung pathophysiology. Although controversial, the acute respiratory distress syndrome (ARDS) associated with COVID-19 (CARDS) seems to present as two distinct phenotypes: type L and type H. The "L" refers to low elastance, ventilation/perfusion ratio, lung weight, and recruitability, and the "H" refers to high pulmonary elastance, shunt, edema, and recruitability. However, the LUNG-SAFE (Large Observational Study to Understand the Global Impact of Severe Acute Respiratory Failure) and ESICM (European Society of Intensive Care Medicine) Trials Groups have shown that ~13% of the mechanically ventilated non-COVID-19 ARDS patients have the type-L phenotype. Other studies have shown that CARDS and ARDS respiratory mechanics overlap and that standard ventilation strategies apply to these patients. The mechanisms causing alterations in pulmonary perfusion could be caused by some combination of 1) renin-angiotensin system dysregulation, 2) thrombosis caused by loss of endothelial barrier, 3) endothelial dysfunction causing loss of hypoxic pulmonary vasoconstriction perfusion control, and 4) hyperperfusion of collapsed lung tissue that has been directly measured and supported by a computational model. A flowchart has been constructed highlighting the need for personalized and adaptive ventilation strategies, such as the time-controlled adaptive ventilation method, to set and adjust the airway pressure release ventilation mode, which recently was shown to be effective at improving oxygenation and reducing inspiratory fraction of oxygen, vasopressors, and sedation in patients with COVID-19.

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1. **High incidence and mortality of pneumothorax in critically Ill patients with COVID-19**  
   Wang Xiao-Hui Heart & lung : the journal of critical care 2021;50:37-43.

BACKGROUND: The clinical characteristics of the patients with COVID-19 complicated by pneumothorax have not been clarified., OBJECTIVES: To determine the epidemiology and risks of pneumothorax in the critically ill patients with COVID-19., METHODS: Retrospectively collecting and analysing medical records, laboratory findings, chest X-ray and CT images of 5 patients complicated by pneumothorax., RESULTS: The incidence of pneumothorax was 10% (5/49) in patients with ARDS, 24% (5/21) in patients receiving mechanical ventilation, and 56% (5/9) in patients requiring invasive mechanical ventilation, with 80% (4/5) patients died. All the 5 patients were male and aged ranging from 54 to 79 years old. Pneumothorax was most likely to occur 2 weeks after the beginning of dyspnea and associated with reduction of neuromuscular blockers, recruitment maneuver, severe cough, changes of lung structure and function., CONCLUSIONS: Pneumothorax is a frequent and fatal complication of critically ill patients with COVID-19. Copyright © 2020. Published by Elsevier Inc.

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1. **High incidence of barotrauma in critically ill patients with COVID-19**  
   Kahn Michael Critical Care Medicine 2021;49:90.

INTRODUCTION: Intubated patients with acute respiratory distress syndrome are thought to have a 5-12% incidence of barotrauma, even with protective ventilation. However, little is known about the incidence of barotrauma in COVID-19. Due to high rates of observed barotrauma at this center, this retrospective cohort study aims to better characterize the incidence of barotrauma and identify predisposing factors such as inflammatory markers and disease severity indices for this high-mortality complication. METHOD(S): Inclusion criteria were as follows: age over 18 years, positive RT-PCR for SARS-CoV2, admission to the ICU between 03/15/2020 and 06/15/2020, and a score of 5 or higher on the World Health Organization's Ordinal Scale or respiratory rate over 30 breaths per minute on admission. Data were collected for the following categories developed by an internal committee of pulmonary/critical care faculty and housestaff based on similar studies: age, sex, body mass index, ferritin, d-dimer, APACHE II score, SOFA score, blood gas, ventilation mode and settings. Patients with evidence of barotrauma (pneumothorax, pneumomediastinum, pneumopericardium, subcutaneous emphysema) on imaging had additional respiratory data points collected. RESULT(S): 78 patients met inclusion. Among 38 patients who received invasive mechanical ventilation (IMV) 12 had barotrauma (32%). Of 40 patients who did not receive IMV 3 had barotrauma (8%). Of 15 cases of barotrauma, 8 had pneumothorax (2 bilateral, 6 unilateral), 9 had pneumomediastinum, 4 had pneumopericardium, 6 had subcutaneous emphysema. 8 were found incidentally on imaging for non-respiratory indication. Mortality in the barotrauma group was 72% for IMV & 50% for non-IMV (3 patients transferred to other hospital, 3 remain hospitalized) compared to 50% for IMV & 8% for non-IMV in patients without barotrauma. Further analysis pending at submission, data to be finalized prior to presentation. CONCLUSION(S): Barotrauma may be an underappreciated complication of COVID-19, perhaps serving as an independent predictor of disease severity or low lung compliance. Many theories have been presented for the physiology of COVID-19 respiratory failure, but barotrauma could be evidence of or a herald sign for the low compliance phenotype.

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1. **Incidence and outcome of pneumothorax/pneumomediatsinum in COVID-19 patients admitted to an intensive care unit: a systematic review**  
   Anon. PROSPERO 2021;:No page numbers.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=c70c16813fc3f6000bf0cec885cf62dc)

1. **Incidence of barotrauma in COVID19 patients requiring mechanical ventilation: A retrospective study in a community hospital**  
   Mudhar O. American Journal of Respiratory and Critical Care Medicine 2021;203:No page numbers.

Rationale: SARS-CoV-2 causing COVID19 has led to a pandemic with over 70 million cases worldwide as well as more than 18 million cases here in the US. Acute Respiratory Distress Syndrome (ARDS) is a severe complication of this disease and traditional ventilation strategies using ARDSNet protocol, including low tidal volumes, appear to cause barotrauma in COVID19 patients at a higher rate than non-COVID19 ARDS patients. The purpose of our retrospective chart review is to identify the incidence of barotrauma in COVID19 patients with ARDS requiring mechanical ventilation here at SJMC. Method(s): This study was a retrospective chart review of all patients admitted to critical care units at SJMC with COVID19 infection and requiring mechanical ventilation from March 1, 2020-September 30, 2020. The sample included adult patients (over age 18) with ICD 10 Code for COVID19 (U07.1) and patients who were placed on mechanical ventilation for greater than 24 hours, from March 1, 2020 to September 30, 2020. Both ICD 10 codes and a chart search were utilized to determine which ventilated COVID19 patients developed barotrauma. Result(s): 140 COVID19 patients underwent mechanical ventilation for greater than 24 hours from March 1, 2020 to September 30, 2020 at our facility. 26 COVID19 patients (18.6%) met our inclusion criteria, developing barotrauma during their hospital admission, of which 25 (17.9%) underwent mechanical (invasive and/or non-invasive) ventilation. The 1 non-ventilated patient was found to have incidental pneumothorax on chest x-ray after a thoracentesis was performed. 80% of the patients were on non-invasive mechanical ventilation prior to intubation and invasive mechanical ventilation. The categorical breakdown of barotrauma was as follows: Pneumothorax 65.4%, subcutaneous emphysema 61.5%, pneumomediastinum 34.6% and pneumoperitoneum 7.7%. None of these patients had any previous history of documented barotrauma. At the time of barotrauma, 15.4% of patients were on NMB drips, 96.2% were on corticosteroids, 42.3% were undergoing proning and 92.3% were on sedation. Prior to the time of barotrauma, 17 patients were on volume control, 7 were on pressure control and 1 was not on mechanical ventilation. Of the 17 patients on volume control, only 1 patient was above the ARDSNet guideline of 6-8 mL/kg IBW. The 7 patients on pressure control had a PEEP ranging from 8 to 15 and a PIP ranging from 25 to 46. Conclusion(s): Patients with COVID19 who underwent mechanical ventilation developed barotrauma at a higher rate than reported in literature for non-COVID19 patients with ARDS.

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1. **Incidence, risk factors and impact on outcomes of pneumothorax in COVID-19 patients requiring ICU level of care-a single-center retrospective study**  
   Berg B. American Journal of Respiratory and Critical Care Medicine 2021;203:No page numbers.

RATIONALE: Pneumothorax (PTX) incidence, risk factors and impact on outcomes in patients with COVID-19 are unknown. We hypothesized that PTX is associated with a higher rate of mortality and is more likely to occur in patients with severe COVID-19 requiring mechanical ventilation (MV) at higher maximal PEEP and with higher levels of markers of inflammation. METHOD(S): We conducted a retrospective, cohort study of all adult patients (>18 years) with confirmed diagnosed SARS-CoV-19 infection admitted to our medical intensive care units (ICU) between 3/11/2020 and 8/19/2020 at our 2 hospital healthcare system. Exclusion criteria were non-Covid illness resulting in ICU level of care and ICU stay less than 24 hours. Presence or absence of PTX was determined by retrospective review of chest imaging reports. The primary outcome was mortality at discharge. Secondary outcome measures assessed at the p=0.05 level included age, ethnicity, BMI, maximum PEEP on MV and laboratory inflammatory markers (CRP, D-dimer, LDH, Ferritin). RESULT(S): 270 patients with COVID-19 were admitted to the ICU. 11 patients were excluded leaving 259 for analysis. PTX was identified in 16 (6.2%). In the entire group, 9 of 16 (56.2%) patients with PTX died in the hospital compared to 68 of 243 (28%) without PTX (p=0.017). There were no significant differences in age, BMI, highest PEEP, or mortality in the subgroup treated with MV. The rate of PTX was significantly lower in the Black population and higher in the Hispanic population (p=0.01). There were no significant differences in the levels of the inflammatory markers for those patients who developed PTX compared to those who did not (CRP p=0.71; D-dimer p=0.11; Ferritin p=0.36; LDH p=0.41). CONCLUSION(S): PTX occurred in about 6% of COVID-19 patients requiring ICU level of care with most on mechanical ventilation and was significantly associated with a higher rate of mortality for the entire population, but not in the subgroup of patients requiring mechanical ventilation. PTX frequency was significantly lower in the Black population and higher in the Hispanic population. PTX was not associated with higher PEEP values. The absence of an association with PEEP suggests that barotrauma may not be the etiology of pneumothorax in COVID-19. Age, BMI, and the levels of inflammatory markers were not significantly different in these groups.

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1. **Massive emphysema subcutis, pneumothorax, pneumomediastinum and pneumoperitoneum as uncommon complication of covid-19 pneumonia, a rare case**  
   Utomo Sri Andreani Radiology case reports 2021;16:2133-2138.

We should be aware of the uncommon presentation during the pandemic scenario of the Coronavrus disease 2019 (COVID-19). Pneumothorax, pneumomediastinum, pneumoperitoneum, and massive emphysema subcutis are uncommon complications of COVID-19 Pneumonia. The presence of pneumomediastinum and massive emphysema subcutis were rarely reported in the literature. We present a 69-year-old man with COVID-19 Pneumonia with these complications who were managed conservatively and experienced spontaneous resolution of the complications two weeks later. He was admitted to the intensive care unit and was given a ventilator. Pneumonia, massive emphysema subcutis, pneumomediastinum, and pneumothorax are identified from chest X-ray. An Unenhanced thoraco-abdominal computed tomography Scan revealed the presence of a small pneumoperitoneum. However, a computed tomography scan of the abdomen and pelvis did not show any evidence of bowel perforation. It is necessary to detect these complications earlier, so the management can reduce the associated morbidity and mortality. Copyright © 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

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1. **Outcomes of Barotrauma in Critically Ill COVID-19 Patients With Severe Pneumonia**  
   Gazivoda Victor P. Journal of intensive care medicine 2021;:8850666211023360.

BACKGROUND: Pneumomediastinum and pneumothorax are complications which may be associated with barotrauma in mechanically ventilated patients. The current literature demonstrates unclear outcomes regarding barotrauma in critically ill patients with severe COVID-19. The purpose of this study was to examine the incidence of barotrauma in patients with severe COVID-19 pneumonia and its influence on survival., STUDY DESIGN AND METHODS: A retrospective cohort study was performed from March 18, 2020 to May 5, 2020, with follow-up through June 18, 2020, encompassing critically ill intubated patients admitted for COVID-19 pneumonia at an academic tertiary care hospital in Brooklyn, New York. Critically ill patients with pneumomediastinum, pneumothorax, or both (n = 75) were compared to those without evidence of barotrauma (n = 206). Clinical characteristics and short-term patient outcomes were analyzed., RESULTS: Barotrauma occurred in 75/281 (26.7%) of included patients. On multivariable analysis, factors associated with increased 30-day mortality were elevated age (HR 1.015 [95% CI 1.004-1.027], P = 0.006), barotrauma (1.417 [1.040-1.931], P = 0.027), and renal dysfunction (1.602 [1.055-2.432], P = 0.027). Protective factors were administration of remdesivir (0.479 [0.321-0.714], P < 0.001) and receipt of steroids (0.488 [0.370-0.643], P < 0.001)., CONCLUSION: Barotrauma occurred at high rates in intubated critically ill patients with COVID-19 pneumonia and was found to be an independent risk factor for 30-day mortality.

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1. **Pleural complications of Covid-19 pneumonia**  
   Satir Turk Merve Turkish journal of medical sciences 2021;:No page numbers.

Background-aim: As the number of case reports related to the new type of coronavirus (Covid-19) increases, knowledge of and experience with the virus and its complications also increase. Pleural complications are one relevant issue. We aimed in this study to analyse pleural complications, such as pneumothorax, pneumomediastinum, and empyema, in patients hospitalized with the diagnosis of Covid-19 pneumonia., MATERIALS AND METHODS: The files of patients who have pleural complications of Covid-19 pneumonia and were consulted about thoracic surgery between March 2020 and December 2020 were retrospectively reviewed. The data of the patients were analyzed according to age, gender, length of stay, treatment method for pleural complications, mortality, severity of covid-19 pneumonia, tube thoracostomy duration and presence of a mechanical ventilator., RESULTS: A total of 31 patients fulfilled the inclusion criteria were included in the study. There were 11 female (35.5%) and 20 male (65.5%) patients. The most common complication was pneumothorax in 20 patients (65%). The median duration of hospitalization was 22 days and the mortality rate was 71%. Mortality was significantly higher in patients on mechanical ventilation (p=0.04)., CONCLUSION: The mortality rate is very high in patients with pleural complications of Covid-19 pneumonia. Pneumothorax is a fatal complication in critically ill patients with COVID-19 pneumonia.

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1. **Pneumomediastinum as a complication in COVID-19 patients with lung protective mechanical ventilation-a case series**  
   Graaff H. J. American Journal of Respiratory and Critical Care Medicine 2021;203:No page numbers.

Introduction Novel coronavirus 2019 (COVID-19) can cause severe pneumonia requiring endotracheal intubation in 20-25% of all hospitalized patients. High peak pressures, driving pressures and plateau pressures as well as large tidal volumes are known risk factors for ventilator induced lung injury (VILI). Reported mortality rate of pneumomediastinum in COVID-19 is 60%. Therefore, target pressures are a peak pressure and plateau pressure below 30 cmH2O, tidal volumes below 6ml/kg ideal body weight (IBW) and driving pressure below 15 cmH2O. Cases We report two male COVID-19 patients, aged 64 and 65 years, who developed a pneumomediastinum while undergoing mechanical ventilation with lung protective strategies. Medical histories included obesity, hypertension, type 2 diabetes mellitus and were unremarkable for pulmonary disease. Both were hospitalized with respiratory insufficiency. COVID-19 was confirmed by a positive polymerase chain reaction test and CT-scan findings. Within three days, all patients were admitted to the intensive care unit (ICU) and mechanically ventilated in prone position 16-20 hours/day with lung protective strategies and in accordance with the lower positive end expiratory pressure (PEEP) higher FiO2 strategy. Peak pressures ranged 13-33 cmH2O, driving pressure (DP) ranged 10-15 cmH2O, PEEP 5-12 cmH2O, plateau pressure 14-24 cmH2O with tidal volumes 4-7 ml/kg (4-6 ml/kg while on pressure-controlled ventilation). After 7-10 days CT-scans were repeated because of progressive hypoxemia. In both patients CT-scan showed pneumomediastinum with pneumothorax requiring chest tube insertion in one patient and pneumopericardium in one patient (figure 1). Ventilator settings were lowered while allowing permissive hypercapnia to pH 7.20. Pneumomediastinum resorbed in both patients. During follow up, one patient died of progressive lung disease one month after hospitalization and one patient died from pulmonary hemorrhage one month after ICU-admission. Discussion A recent autopsy series in COVID-19 patients showed that alveolar epithelial damage causes loss of lung compliance. Decreased lung compliance combined with high plateau and peak pressures might predispose to VILI, however our case series shows two patients with pneumomediastinum while on lung protective mechanical ventilation. We hypothesize that alveolar epithelial damage predisposes to VILI rather than mechanical ventilation itself. This was confirmed in reports of COVID-19 patients with pneumomediastinum in the absence of mechanical ventilation. Therefore, the recently described mortality rate of 60% is a sign of severe pulmonary disease rather than a result of pneumomediastinum itself. Furthermore, our case series suggests that developing pneumomediastinum while on lung protective mechanical ventilation in COVID-19 patients predisposes to a high mortality rate.

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1. **Pneumomediastinum in a child with severe COVID-19**  
   Carroll Anne G. BJR case reports 2021;7:20200062.

The current global pandemic of the novel coronavirus SARS-CoV2 is a threat to the health and lives of millions of people worldwide. The latest statistics from the World Health Organisation show that there have been 6,515,796 confirmed cases worldwide with 387,298 confirmed deaths (last update 5 June 2020, 10:41 CEST). The majority of critically unwell patients with SARS-CoV2 are adults and the radiological findings associated with them are consistent throughout the literature. However, the reported paediatric cases are few, and as such, there is a limited body of evidence available. More international data is needed, not only on the clinical presentation, but also the radiological findings, so that health-care providers are better able to understand and diagnose this pandemic disease. We describe a case of a previously healthy 9-year-old female who presented to the Emergency Department with symptoms suggestive of raised intracranial pressure. Her CT revealed a medulloblastoma and post-operatively she tested positive for SARS-CoV2. She had a rapid deterioration in her clinical condition and required admission to the intensive care unit (ICU). We provide the supporting radiology along her clinical course in order to demonstrate important insights into this disease in children, including the unusual pnemomediastinum complications which occurred as part of her clinical course. This case is the first reported of its kind. Copyright © 2021 The Authors. Published by the British Institute of Radiology.

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1. **Pneumomediastinum in Mechanically Ventilated Coronavirus Disease 2019 Patients**  
   Suwanwongse Kulachanya Journal of Cardiothoracic and Vascular Anesthesia 2021;35:686-688.

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1. **Pneumomediastinum in patients with SARS-CoV-2 treated with non-invasive ventilation**  
   Niazi Muhammad BMJ Case Reports 2021;14:e241809.

SARS-CoV-2, causing the pandemic COVID-19, has rapidly spread, overwhelming healthcare systems. Non-invasive positive pressure ventilation (NIV) can be used as a bridging therapy to delay invasive mechanical ventilation or as a standalone therapy. Spontaneous pneumomediastinum is rare and self-limiting, but there is an increased incidence documented in COVID-19. Here we document two cases of pneumomediastinum-related prolonged NIV therapy in severe COVID-19. Patient 1, a 64-year-old man, who developed symptoms after NIV therapy was weaned and survived. Patient 2, an 82-year-old woman, failed to improve despite NIV therapy, on investigation was found to have a pneumomediastinum. After review, the patient was placed on best supportive care and died 3 days later. We highlight the importance of recognising less common causes of deterioration in severe COVID-19 treated with NIV. In addition, pneumomediastinum in these cases may not always lead to poor outcomes.Copyright ©

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1. **Pneumothorax and pneumomediastinum in COVID-19**  
   Anon. PROSPERO 2021;:No page numbers.

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1. **Pneumothorax in critically ill patients with COVID-19 infection: Incidence, clinical characteristics and outcomes in a case control multicenter study**  
   Chopra Amit Respiratory medicine 2021;184:106464.

BACKGROUND: The clinical features and outcomes of mechanically ventilated patients with COVID-19 infection who develop a pneumothorax has not been rigorously described or compared to those who do not develop a pneumothorax., PURPOSE: To determine the incidence, clinical characteristics, and outcomes of critically ill patients with COVID-19 infection who developed pneumothorax. In addition, we compared the clinical characteristics and outcomes of mechanically ventilated patients who developed a pneumothorax with those who did not develop a pneumothorax., METHODS: This study was a multicenter retrospective analysis of all adult critically ill patients with COVID-19 infection who were admitted to intensive care units in 4 tertiary care centers in the United States., RESULTS: A total of 842 critically ill patients with COVID-19 infection were analyzed, out of which 594 (71%) were mechanically ventilated. The overall incidence of pneumothorax was 85/842 (10%), and 80/594 (13%) in those who were mechanically ventilated. As compared to mechanically ventilated patients in the non-pneumothorax group, mechanically ventilated patients in the pneumothorax group had worse respiratory parameters at the time of intubation (mean PaO2:FiO2 ratio 105 vs 150, P<0.001 and static respiratory system compliance: 30ml/cmH2O vs 39ml/cmH2O, P = 0.01) and significantly higher in-hospital mortality (63% vs 49%, P = 0.04)., CONCLUSION: The overall incidence of pneumothorax in mechanically ventilated patients with COVID-19 infection was 13%. Mechanically ventilated patients with COVID-19 infection who developed pneumothorax had worse gas exchange and respiratory mechanics at the time of intubation and had a higher mortality compared to those who did not develop pneumothorax. Copyright © 2021 Elsevier Ltd. All rights reserved.

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1. **Pneumothorax in Mechanically Ventilated Patients with COVID-19 Infection**  
   Akdogan Raziye Ecem Case reports in critical care 2021;2021:6657533.

Data on patient-related factors associated with pneumothorax among critically ill patients with COVID-19 pneumonia is limited. Reports of spontaneous pneumothorax in patients with coronavirus disease 2019 (COVID-19) suggest that the COVID-19 infection could itself cause pneumothorax in addition to the ventilator-induced trauma among mechanically ventilated patients. Here, we report a case series of five mechanically ventilated patients with COVID-19 infection who developed pneumothorax. Consecutive cases of intubated patients in the intensive care unit with the diagnosis of COVID-19 pneumonia and pneumothorax were included. Data on their demographics, preexisting risk factors, laboratory workup, imaging findings, treatment, and survival were collected retrospectively between March and July 2020. Four out of five patients (4/5; 80%) had a bilateral pneumothorax, while one had a unilateral pneumothorax. Of the four patients with bilateral pneumothorax, three (3/4; 75%) had secondary bacterial pneumonia, two had pneumomediastinum and massive subcutaneous emphysema, and one of these two had an additional pneumoperitoneum. A surgical chest tube or pigtail catheter was placed for the management of pneumothorax. Three out of five patients with pneumothorax died (3/5; 60%), and all of them had bilateral involvement. The data from these cases suggest that pneumothorax is a potentially fatal complication of COVID-19 infection. Large prospective studies are needed to study the incidence of pneumothorax and its sequelae in patients with COVID-19 infection. Copyright © 2021 Raziye Ecem Akdogan et al.

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1. **Pneumothorax in patients with coronavirus disease 2019 pneumonia with invasive mechanical ventilation**  
   Ozdemir Servet Interactive cardiovascular and thoracic surgery 2021;32:351-355.

OBJECTIVES: Our goal was to evaluate the prevalence of and risk factors for pneumothorax in patients with invasive mechanical ventilation in the intensive care unit (ICU) diagnosed with coronavirus disease 2019 pneumonia., METHODS: The prevalence of pneumothorax was retrospectively reviewed in 107 patients diagnosed with coronavirus disease 2019 pneumonia and treated in an ICU in Turkey between 11 March 2020 and 30 April 2020., RESULTS: The patients were aged 19-92 years; 37 (34.6%) were women. Pneumothorax developed in 8 (7.5%) of the intubated patients. Four (50%) of the patients with pneumothorax and 68 (68.7%) of those without it died. In the univariable logistic regression analysis of the presence of comorbid diseases (P = 0.91), positive end-expiratory pressure (P = 0.18), compliance (P = 0.93), peak pressure (P = 0.41) and the Horowitz index (P = 0.13) did not show statistically significant effects in increasing the risk of pneumothorax., CONCLUSIONS: There was no significant increase or decrease in the risk of pneumothorax in patients treated with invasive mechanical ventilation after the diagnosis of coronavirus disease 2019-related pneumonia/acute respiratory distress syndrome. However, consideration of the risk of pneumothorax in these individuals may have the potential to improve the prognoses in such settings. Copyright © The Author(s) 2020. Published by Oxford University Press on behalf of the European Association for Cardio-Thoracic Surgery. All rights reserved.

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1. **Pneumothorax in Tertiary Intensive Care With COVID-19 is Associated With Increased Mortality**  
   bektaş serife g.ökbulut 2021;:No page numbers.

&lt;h4&gt;Background: &lt;/h4&gt; To examine the laboratory findings with clinical characteristics and treatments of patients who were hospitalized in a tertiary intensive care unit with the diagnosis of COVID-19 and developed pneumothorax and to determine epidemiology and risks of pneumothorax. &lt;h4&gt;Methods: &lt;/h4&gt;: The study was conducted by retrospectively examining the electronic records of 681 COVID-19 patients who were followed up between 1 April 2020 and 1 January 2021 in 3 tertiary care units (each was 24 beds). Patients demographic and clinical characteristics, laboratory findings, mechanical ventilator parameters and chest imaging were collected retrospectively,. &lt;h4&gt;Results: &lt;/h4&gt;: Pneumothorax in 22 (3.2%) of 681 with COVID-19 patients were detected and ARDS in 481 (70.6). All the study patients met ARDS diagnostic criterias. Mortality rates were 43.4% (296/681) in all patients, 52.8% (254/481) in patients with ARDS, and 86.3% (19/22) in patients with pneumothorax. Pneumothorax occurred in the patients within a mean of 17.4 ± 4.8 days. The computed tomographies of patients were observed common ground-glass opacities, heterogenic distribution with patch infiltrates, alveolar exudates, interstitial thickening in the 1 st week of their follow-up. &lt;h4&gt;Conclusion: &lt;/h4&gt; We observed that pneumothorax significantly increased mortality in COVID-19 patients with ARDS. We believe that understanding and preventing the characteristics of pneumothorax will make an important contribution to mortality reduction.

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1. **Pneumothorax with coronavirus disease 2019 in non-ventilated patients: a single-center retrospective case series**  
   kawachi jun 2021;:No page numbers.

Of the 1061 patients of coronavirus disease-2019 admitted to our field hospital, eight patients (0.75%) had pneumothorax. The mean age of incidence was 79.9 years; six of these patients (75%) died. Although pneumothorax is a rare complication of coronavirus disease-2019, it suggests a poor prognosis in elderly patients.

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1. **Predictors of Pneumothorax/Pneumomediastinum in Mechanically Ventilated COVID-19 Patients**  
   Belletti Alessandro Journal of cardiothoracic and vascular anesthesia 2021;:No page numbers.

OBJECTIVE: To determine the incidence, predictors, and outcome of pneumothorax (PNX)/pneumomediastinum (PMD) in coronavirus disease 2019 (COVID-19) acute respiratory distress syndrome (ARDS)., DESIGN: Observational study., SETTING: Tertiary-care university hospital., PARTICIPANTS: One hundred sixteen consecutive critically ill, invasively ventilated patients with COVID-19 ARDS., INTERVENTIONS: The authors collected demographic, mechanical ventilation, imaging, laboratory, and outcome data. Primary outcome was the incidence of PNX/PMD. Multiple logistic regression analyses were performed to identify predictors of PNX/PMD., MEASUREMENTS AND MAIN RESULTS: PNX/PMD occurred in a total of 28 patients (24.1%), with 22 patients developing PNX (19.0%) and 13 developing PMD (11.2%). Mean time to development of PNX/PMD was 14 +/- 11 days from intubation. The authors found no significant difference in mechanical ventilation parameters between patients who developed PNX/PMD and those who did not. Mechanical ventilation parameters were within recommended limits for protective ventilation in both groups. Ninety-five percent of patients with PNX/PMD had the Macklin effect (linear collections of air contiguous to the bronchovascular sheaths) on a baseline computed tomography scan, and tended to have a higher lung involvement at intensive care unit (ICU) admission (Radiographic Assessment of Lung Edema score 32.2 +/- 13.4 v 18.7 +/- 9.8 in patients without PNX/PMD, p=0.08). Time from symptom onset to intubation and time from total bilirubin on day two after ICU admission were the only independent predictors of PNX/PMD. Mortality was 60.7% in patients who developed PNX/PMD versus 38.6% in those who did not (p=0.04)., CONCLUSION: PNX/PMD occurs frequently in COVID-19 patients with ARDS requiring mechanical ventilation, and is associated with increased mortality. Development of PNX/PMD seems to occur despite use of protective mechanical ventilation and has a radiologic predictor sign. Copyright © 2021 Elsevier Inc. All rights reserved.

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1. **Prevalence and risk factors of barotrauma in Covid-19 patients admitted to an intensive care unit in Kuwait; a retrospective cohort study**  
   Elsaaran Hussein Annals of medicine and surgery (2012) 2021;63:102141.

Background: The development of barotrauma has been suggested to complicate the management of mechanically ventilated COVID-19 patients admitted to the intensive care unit (ICU). This study aims to identify potential risk factors associated with the development of barotrauma related complications in COVID-19 patients receiving mechanical ventilation., Methods: A retrospective cohort study was carried out in a single COVID-19 designated center in Kuwait. Three hundred and forty-three confirmed COVID-19 patients transferred and/or admitted to our institution between February 26, 2020 and June 20, 2020 were included in the study. All patients were admitted into the ICU with the majority being mechanically ventilated (81.3%)., Results: Fifty-four (15.4%) patients developed barotrauma, of which 49 (90.7%) presented with pneumothorax, and 14.8% and 3.7% due to pneumomediastinum and pneumopericardium respectively. Of those that developed barotrauma, 52 (96.3%) patients were in acute respiratory distress syndrome (ARDS). Biochemically, the white blood cells (p = 0.001), neutrophil percentage (p = 0.012), lymphocyte percentage (p = 0.014), neutrophil: lymphocyte ratio (NLR) (p=<0.001) and lactate dehydrogenase (LDH) (p = 0.002) were found to be significantly different in patients that developed barotrauma. Intubation due to low level of consciousness (p = 0.007), a high admission COVID-GRAM score (p = 0.042), and a positive-end expiratory pressure (PEEP) higher than the control group (p = 0.016) were identified as potential risk factors for the development of barotrauma., Conclusion: Patients infected with COVID-19 have a significant risk of developing barotrauma when receiving invasive mechanical ventilation. This poses a substantial impact on the hospital course of the patients and clinical outcome, correlating to a higher mortality rate in this cohort of patients. Copyright © 2021 The Authors.

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1. **Pulmonary Barotrauma in COVID-19 Patients With ARDS on Invasive and Non-Invasive Positive Pressure Ventilation**  
   Rajdev Kartikeya Journal of Intensive Care Medicine 2021;:No page numbers.

Background: We experienced a high incidence of pulmonary barotrauma among patients with coronavirus disease-2019 (COVID-19) associated acute respiratory distress syndrome (ARDS) at our institution. In current study, we sought to estimate the incidence, clinical outcomes, and characteristics of barotrauma among COVID-19 patients receiving invasive and non-invasive positive pressure ventilation. Methodology: We conducted this retrospective cohort study of adult patients diagnosed with COVID-19 pneumonia and requiring oxygen support or positive airway pressure for ARDS who presented to our tertiary care center from March through November, 2020. Result(s): A total of 353 patients met our inclusion criteria, of which 232patients who required heated high-flow nasal cannula, continuous or bilevel positive airway pressure were assigned to non-invasive group. The remaining 121 patients required invasive mechanical ventilation and were assigned to invasive group. Of the 353 patients, 32 patients (65.6% males) with a mean age of 63 +/- 11 years developed barotrauma in the form of either subcutaneous emphysema, pneumothorax, or pneumomediastinum. The incidence of barotrauma was 4.74% (11/232) and 17.35% (21/121) in non-invasive group and invasive group, respectively. The median length of hospital stay was 22 (15.7 -33.0) days with an overall mortality of 62.5% (n = 20). Conclusion(s): Patients with COVID-19 ARDS have a high incidence rate of barotrauma. Pulmonary barotrauma should be considered in patients with COVID-19 pneumonia who exhibit worsening of their respiratory disease as it is likely associated with a high mortality risk. Utilizing lung-protective ventilation strategies may reduce the risk of barotrauma.Copyright © The Author(s) 2021.

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1. **Pulmonary barotrauma in covid-19 patients: Invasive versus noninvasive positive pressure ventilation**  
   Hamouri Shadi International Journal of General Medicine 2021;14:2017-2032.

Purpose: This study aims to determine the incidence and outcome of COVID-19 patients who required positive pressure ventilation (PPV) and subsequently developed pulmonary barotrauma (PBT). Also, to investigate the risk factors and predictors of these complications to better understand the disease pathogenesis. Patients and Methods: This retrospective analysis enrolled all adult COVID-19 patients admitted through the period from October 1, 2020, to December 31, 2020. All patients who received any form of PPV were included. Patients were then divided into two groups based on PBT development, including subcutaneous emphysema, pneumothorax, and pneumome-diastinum. Medical records of all patients were reviewed. Patients' demographics, laboratory data on admission, respiratory support modes, surgical interventions, and outcomes were collected and analyzed. Result(s): In the specified period, 1095 patients were hospitalized due to COVID-19 illness. A total of 239 (21.8%) of all admitted patients received PPV. PBT accounted for 21.3% (51/ 239) of the study cohort. While both groups were equally exposed to the same modes of PPV, receiving invasive ventilation significantly correlated with decreased PBT odds (OR = 0.891; 95% CI, 0.803-0.988; p=0.029). PBT patients were significantly younger (p<0.001). Diabetes mellitus was found to have a protective effect on developing PBT (OR = 0.867; 95% CI, 0.782-0.962), while PO2/FIO2 ratio was inversely associated with higher odds of developing PBT in both univariate and multivariate analyses (p=0.03 and p=0.019, respectively). Conclusion(s): COVID-19-infected patients are at a higher risk of developing PBT. Invasive positive pressure ventilation was associated with less PBT compared to noninvasive ventilation and delaying intubation does not seem to reduce the risk of pulmonary barotrauma.Copyright © 2021 Hamouri et al.

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1. **Pulmonary barotrauma in mechanically ventilated coronavirus disease 2019 patients: A case series**  
   Edwards Jodi-Ann Annals of Medicine and Surgery 2021;61:24-29.

Background: Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may result in hypoxic respiratory failure necessitating mechanical ventilation. Barotrauma is a well-documented complication of mechanical ventilation. Objective(s): To describe the presentation, characteristics, and management of mechanically ventilated patients with COVID-19 who developed barotrauma. Method(s): Retrospective case series study of 13 adult, mechanically ventilated, laboratory-confirmed COVID-19 positive patients admitted between 3/15/2020 and 4/14/2020 to a community hospital in New York City. Patient demographics, clinical course, ventilatory parameters, and radiographic results were obtained from electronic medical records. Barotrauma was defined as pneumomediastinum, subcutaneous emphysema, and or pneumothorax on chest X-ray. Descriptive analyses and Mann-Whitney U test were performed, where appropriate. Result(s): Of the 574 COVID-19 positive patients, 139 (24.2%) needed mechanical ventilation and 13 (9.4%) of those developed barotrauma. Majority of patients were Black race (92.3%), older than age 65 (56.8%), male (69.2%), and had comorbidities (76.9%). Most common presenting symptoms were cough (84.6%) and dyspnea (76.9%). Barotrauma presentations included 3/13 pneumothoraces and pneumomediastinum, 12/13 pneumomediastinum and subcutaneous emphysema, and 1/13 pneumothorax alone. The average days on ventilator was 3.4, average positive expiratory-end pressure 15.5 cmH2O, dynamic compliance 33.8 mL/cmH2O, and P/F ratio 165. Interventions were 4/13 chest tubes and 2/13 pigtail catheters. Conclusion(s): Barotrauma is a common complication of mechanical ventilation of COVID-19 patients. Despite high ventilatory pressures, tension pneumothorax is rare and barotrauma could potentially be managed conservatively. Further studies are needed to evaluate the indication and outcome of thoracostomies and conservative management.Copyright © 2020 The Authors

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1. **Pulmonary barotrauma resulting from mechanical ventilation in 2 patients with a diagnosis of covid-19 pneumonia**  
   Ezeagu Raphael American Journal of Case Reports 2021;22:1-7.

Objective: Background: Case Reports: Conclusion(s): Unusual clinical course Invasive mechanical ventilation can cause pulmonary barotrauma due to elevated transpulmonary pressure and alveolar rupture. A significant proportion of COVID-19 patients with acute respiratory distress syndrome (ARDS) will require mechanical ventilation. We present 2 interesting cases that demonstrate the possibility of COVID-19-associated ARDS manifesting with pulmonary barotrauma at acceptable ventilatory pressures. The first patient was a 71-year-old man who was intubated and placed on mechanical ventilation due to hy-poxemic respiratory failure from SARS-CoV-2 infection. His partial pressure of O2 to fraction of inspired oxy-gen ratio (PaO2/FiO2) was 156. He developed subcutaneous emphysema (SE) and pneumomediastinum on day 5 of mechanical ventilation at ventilatory settings of positive end-expiratory pressure (PEEP) <=15 cmH2 O, plateau pressure (Pplat) <=25 cmH2 O and pulmonary inspiratory pressure (PIP) <=30 cmH2 O. He was managed with 'blow-hole' incisions, with subsequent clinical resolution of subcutaneous emphysema. The second patient was a 58-year-old woman who was also mechanically ventilated due to hypoxemic respiratory failure from COVID-19, with PaO2/FiO2 of 81. She developed extensive SE with pneumomediastinum and pneumo-thorax while on mechanical ventilation settings PEEP 13 cmH2 O and PIP 28 cmH2 O, Pplat 18 cmH2 O, and FiO2 90%. SE was managed with blow-hole incisions and pneumothorax with chest tube. Clinicians should be aware of pulmonary barotrauma as a possible complication of COVID-19 pulmonary dis-ease, even at low ventilatory pressures.Copyright © Am J Case Rep.

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1. **Radiologic aspects of COVID-19 pneumonia: outcomes and thoracic complications**  
   Parra Gordo M. L. Aspectos radiologicos de la neumonia COVID-19: evolucion y complicaciones toracicas. 2021;63:74-88.

Outcomes vary widely in patients with COVID-19. Whereas some patients have only mild symptoms of short duration, others develop severe disease that leads to acute respiratory distress syndrome requiring prolonged stays in intensive care units. Radiologically, the initial stage is characterized by viral pneumonia with mild expression. In some patients, however, the onset of the immune response results in acute lung damage with organizing pneumonia and diffuse alveolar damage. Moderate-severe disease is associated with a high incidence of pulmonary embolisms, generally peripherally distributed and associated with endothelial damage, prolonged stays in bed, and coagulopathy. Other relatively common complications are spontaneous pneumothorax and pneumomediastinum due to the rupture of alveolar walls and barotrauma in mechanically ventilated patients. Superinfection, generally bacterial and less commonly fungal, is more common in patients with severe disease. Copyright © 2020 SERAM. Publicado por Elsevier Espana, S.L.U. All rights reserved.

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1. **Serious complications in COVID-19 ARDS cases: pneumothorax, pneumomediastinum, subcutaneous emphysema and haemothorax**  
   Guven Bulent Baris Epidemiology and infection 2021;149:e137.

The novel coronavirus identified as severe acute respiratory syndrome-coronavirus-2 causes acute respiratory distress syndrome (ARDS). Our aim in this study is to assess the incidence of life-threatening complications like pneumothorax, haemothorax, pneumomediastinum and subcutaneous emphysema, probable risk factors and effect on mortality in coronavirus disease-2019 (COVID-19) ARDS patients treated with mechanical ventilation (MV). Data from 96 adult patients admitted to the intensive care unit with COVID-19 ARDS diagnosis from 11 March to 31 July 2020 were retrospectively assessed. A total of 75 patients abiding by the study criteria were divided into two groups as the group developing ventilator-related barotrauma (BG) (N = 10) and the group not developing ventilator-related barotrauma (NBG) (N = 65). In 10 patients (13%), barotrauma findings occurred 22 +/- 3.6 days after the onset of symptoms. The mortality rate was 40% in the BG-group, while it was 29% in the NBG-group with no statistical difference identified. The BG-group had longer intensive care admission duration, duration of time in prone position and total MV duration, with higher max positive end-expiratory pressure (PEEP) levels and lower min pO2/FiO2 levels. The peak lactate dehydrogenase levels in blood were higher by statistically significant level in the BG-group (P < 0.05). The contribution of MV to alveolar injury caused by infection in COVID-19 ARDS patients may cause more frequent barotrauma compared to classic ARDS and this situation significantly increases the MV and intensive care admission durations of patients. In terms of reducing mortality and morbidity in these patients, MV treatment should be carefully maintained within the framework of lung-protective strategies and the studies researching barotrauma pathophysiology should be increased.

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1. **Severe pneumomediastinum and subcutaneous emphysema subsequent to prolonged mechanical ventilation**  
   Fidrocki Diana M. IDCases 2021;24:e01090.

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1. **Spontaneous pneumomediastinum unrelated to invasive ventilation in a patient with SARS-CoV-2 (COVID-19): A case report**  
   Maleh Parviz Amri Journal of Cellular and Molecular Anesthesia 2021;6:93-96.

Spontaneous Pneumomediastinum (SP) is a rare complication that has not been reported in patients with coronavirus disease 2019 (COVID-19). In this report, we introduce a patient with COVID-19 with SP unrelated to aggressive ventilation. A 39-year-old woman with COVID-19 with ARDS sign was admitted to the intensive care unit (ICU) of Babol Rouhani Hospital. She died four days after hospitalization with pneumomediastinum with subcutaneous emphysema. According to a chest x-ray and CT scan, the patient had SP before admission and aggressive ventilation. Spontaneous pneumomediastinum could be a complication of acute respiratory syndrome in COVID-19 infected patients with unclear pathogenesis.Copyright © 2021 Journal of Cellular and Molecular Anesthesia. All rights reserved.

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1. **Spontaneous Pneumomediastinum, Pneumothorax, Pneumopericardium and Subcutaneous Emphysema-Not So Uncommon Complications in Patients with COVID-19 Pulmonary Infection-A Series of Cases**  
   Cut Talida Georgiana Journal of clinical medicine 2021;10:No page numbers.

(1) Background: Spontaneous pneumomediastinum (PM), pneumothorax (PT), and pneumopericardium (PP) were recently reported as rare complications in patients with severe COVID-19 pneumonia, and our study aims to follow the evolution of these involvements in 11 cases. The presumed pathophysiological mechanism is air leak due to extensive diffuse alveolar damage followed by alveolar rupture. (2) Methods: We followed the occurrence of PM, PN, PP, and subcutaneous emphysema (SE) in 1648 patients hospitalized during the second outbreak of COVID-19 (October 2020-January 2021) in the main hospital of infectious diseases of our county and recorded their demographic data, laboratory investigations and clinical evolution. (3) Results: Eleven patients (0.66%) developed PM, with eight of them having associated PT, one PP, and seven SE, in the absence of mechanical ventilation. Eight patients (72.72%) died and only three (27.27%) survived. All subjects were nonsmokers, without known pulmonary pathology or risk factors for such complications. (4) Conclusions: pneumomediastinum, pneumothorax, and pneumopericardium are not so uncommon complications of SARS-CoV2 pneumonia, being observed mostly in male patients with severe forms and associated with prolonged hospitalization and poor prognosis. In some cases, with mild forms and reduced pulmonary injury, the outcome is favorable, not requiring surgical procedures, mechanical ventilation, or intensive care stay.

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1. **Spontaneous Pneumothorax in COVID-19 Patients Treated with High-Flow Nasal Cannula outside the ICU: A Case Series**  
   Nalewajska Magdalena International journal of environmental research and public health 2021;18:No page numbers.

The coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a global pandemic and a burden to global health at the turn of 2019 and 2020. No targeted treatment for COVID-19 infection has been identified so far, thus supportive treatment, invasive and non-invasive oxygen support, and corticosteroids remain a common therapy. High-flow nasal cannula (HFNC), a non-invasive oxygen support method, has become a prominent treatment option for respiratory failure during the SARS-CoV-2 pandemic. HFNC reduces the anatomic dead space and increases positive end-expiratory pressure (PEEP), allowing higher concentrations and higher flow of oxygen. Some studies suggest positive effects of HFNC on mortality and avoidance of intubation. Spontaneous pneumothorax has been observed in patients suffering from SARS-CoV-2 pneumonia. Although the viral infection itself contributes to its development, higher PEEP generated by both HFNC and mechanical ventilation is another risk factor for increased alveoli damage and air-leak. Herein, we present three cases of patients with no previous history of lung diseases who were diagnosed with COVID-19 viral pneumonia. All of them were supported with HFNC, and all of them presented spontaneous pneumothorax.

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1. **Subcutaneous emphysema and pneumomediastinum in patients with COVID-19 disease; case series from a tertiary care hospital in Pakistan**  
   Sethi S. M. Epidemiology and infection 2021;149:e37.

Since December 2019, the clinical symptoms of coronavirus disease 2019 (COVID-19) and its complications are evolving. As the number of COVID patients requiring positive pressure ventilation is increasing, so is the incidence of subcutaneous emphysema (SE). We report 10 patients of COVID-19, with SE and pneumomediastinum. The mean age of the patients was 59 +/- 8 years (range, 23-75). Majority of them were men (80%), and common symptoms were dyspnoea (100%), fever (80%) and cough (80%). None of them had any underlying lung disorder. All patients had acute respiratory distress syndrome on admission, with a median PaO2/FiO2 ratio of 122.5. Eight out of ten patients had spontaneous pneumomediastinum on their initial chest x-ray in the emergency department. The median duration of assisted ventilation before the development of SE was 5.5 days (interquartile range, 5-10 days). The highest positive end-expiratory pressure (PEEP) was 10 cmH2O for patients recieving invasive mechanical ventilation, while 8 cmH2O was the average PEEP in patients who had developed subcutaneous emphysema on non-invasive ventilation. All patients received corticosteroids while six also received tocilizumab, and seven received convalescent plasma therapy, respectively. Seven patients died during their hospital stay. All patients either survivor or non-survivor had prolonged hospital stay with an average of 14 days (range 8-25 days). Our findings suggest that it is lung damage secondary to inflammatory response due to COVID-19 triggered by the use of positive pressure ventilation which resulted in this complication. We conclude that the development of spontaneous pneumomediastinum and SE whenever present, is associated with poor outcome in critically ill COVID-19 ARDS patients.

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1. **The incidence, clinical characteristics, and outcomes of pneumothorax in hospitalized COVID-19 patients: A systematic review**  
   Chong Woon H. Heart & lung : the journal of critical care 2021;50:599-608.

BACKGROUND: Pneumothorax has been frequently described as a complication of COVID-19 infections., OBJECTIVE: In this systematic review, we describe the incidence, clinical characteristics, and outcomes of COVID-19-related pneumothorax., METHODS: Studies were identified through MEDLINE, Pubmed, and Google Scholar databases using keywords of "COVID-19," "SARS-CoV-2," "pneumothorax," "pneumomediastinum," and "barotrauma" from January 1st, 2020 to January 30th, 2021., RESULTS: Among the nine observational studies, the incidence of pneumothorax is low at 0.3% in hospitalized COVID-19 patients. However, the incidence of pneumothorax increases to 12.8-23.8% in those requiring invasive mechanical ventilation (IMV) with a high mortality rate up to 100%. COVID-19-related pneumothorax tends to be unilateral and right-sided. Age, pre-existing lung diseases, and active smoking status are not shown to be risk factors. The time to pneumothorax diagnosis is around 9.0-19.6 days from admission and 5.4 days after IMV initiation. COVID-19-related pneumothoraces are associated with prolonged hospitalization, increased likelihood of ICU admission and death, especially among the elderly., CONCLUSION: COVID-19-related pneumothorax likely signify greater disease severity. With the high variability of COVID-19-related pneumothorax incidence described, a well-designed study is required to better assess the significance of COVID-19-related pneumothorax. Copyright © 2021 Elsevier Inc. All rights reserved.

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1. **The Role of High Flow Nasal Cannula in COVID-19 Associated Pneumomediastinum and Pneumothorax**  
   Simioli Francesca Healthcare (Basel, Switzerland) 2021;9:No page numbers.

BACKGROUND: Pneumomediastinum, subcutaneous emphysema and pneumothorax are not rarely observed during the COVID-19 pandemic. Such complications can worsen gas exchange and the overall prognosis in critical patients. The aim of this study is to investigate what predisposing factors are related to pneumomediastinum and pneumothorax in SARS-CoV2-Acute Respiratory Distress Syndrome (ARDS), what symptoms may predict a severe and potentially fatal complication and what therapeutical approach may provide a better outcome., METHODS: In this single center cohort study, we recorded data from 45 critically ill COVID-19 patients who developed one or more complicating events among pneumomediastinum, subcutaneous emphysema and pneumothorax. All patients showed ARDS and underwent non-invasive ventilation (NIV) at baseline. Patients with mild to moderate ARDS and pneumomediastinum/pneumothorax (n = 25) received High Flow Nasal Cannula (HFNC), while patients with severe ARDS and pneumomediastinum/pneumothorax underwent HFNC (n = 10) or invasive mechanical ventilation (IMV) (n = 10)., RESULTS: Pneumomediastinum/pneumothorax developed in 10.5% of subjects affected by SARS-coV2-ARDS. Dyspnea affected 40% and cough affected 37% of subjects. High resolution computed tomography of the chest showed bilateral diffuse ground glass opacities (GGO) in 100% of subjects. Traction bronchiolectasis, reticulation, crazy paving and distortion were observed in 64%. Furthermore, 36% showed subcutaneous emphysema. Non-severe ARDS cases received HFNC, and 76% patients recovered from pneumomediastinum/pneumothorax over a median follow up of 5 days. Among severe ARDS cases the recovery rate of pneumomediastinum/pneumothorax was 70% with the HFNC approach, and 10% with IMV., CONCLUSION: HFNC is a safe and effective ventilatory approach for critical COVID-19 and has a positive role in associated complications such as pneumomediastinum and pneumothorax.

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1. **Ventilator-induced barotrauma in critically ill patients with COVID-19: a retrospective observational study**  
   Sah Anuraag Journal of community hospital internal medicine perspectives 2021;11:304-310.

Background: Ventilator-induced Barotrauma is a complication of intubation that is associated with high driving pressures and positive end-expiratory pressure use. We attempt to determine the incidence of barotrauma in intubated patients with SARS-CoV-2 infection. Methods: Retrospective observation case series of patients with SARS-CoV-2 infection who were intubated in the ICU. Data were collected for a total of 3 months from electronic health records on patient's age, sex, BMI, incidence of barotrauma, total length of intubation and outcome. Results: Ninteen out of the 100 included patients developed barotrauma as defined by radiographic evidence of pneumothorax, pneumomediastinum or subcutaneous emphysema. The average BMI of patients with barotrauma was 32.06 kg/m2 with an average age of 56.84 years and 9 patients being classified as obese (BMI >=30 kg/m2). Fourteen out of 19 patients (73%) with barotrauma were intubated for 10 or more days with a median of 16.52 days. The overall mortality rate was noted to be 92% amongst intubated patients. Conclusion: Rate of barotrauma in COVID-19 intubated patients was noted to be 19% in our study, which is on par with the rate of ventilator-induced barotrauma with the previous SARS virus-associated ARDS, and higher than that of the general population with ARDS. Patients who developed barotrauma were also noted to be intubated for a significantly longer duration (16.52 days) as compared to their non-barotrauma counterparts. These findings suggest a need for more data and randomized studies to establish appropriate ventilator management strategies for patients with lung injury associated with COVID-19. Copyright © 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group on behalf of Greater Baltimore Medical Center.

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1. **A Cyclodextrin-Stabilized Spermine-Tagged Drug Triplex that Targets Theophylline to the Lungs Selectively in Respiratory Emergency**  
   Sofian Zarif M. Advanced therapeutics 2020;:2000153.

Ion-pairing a lifesaving drug such as theophylline with a targeting moiety could have a significant impact on medical emergencies such as status asthmaticus or COVID-19 induced pneumomediastinum. However, to achieve rapid drug targeting in vivo the ion-pair must be protected against breakdown before the entry into the target tissue. This study aims to investigate if inserting theophylline, when ion-paired to the polyamine transporter substrate spermine, into a cyclodextrin (CD), to form a triplex, could direct the bronchodilator to the lungs selectively after intravenous administration. NMR demonstrates that upon the formation of the triplex spermine protruded from the CD cavity and this results in energy-dependent uptake in A549 cells (1.8-fold enhancement), which persists for more than 20 min. In vivo, the triplex produces a 2.4-fold and 2.2-fold increase in theophylline in the lungs 20 min after injection in rats and mice, respectively (p < 0.05). The lung targeting is selective with no increase in uptake into the brain or the heart where the side-effects of theophylline are treatment-limiting. Selectively doubling the concentration of theophylline in the lungs could improve the benefit-risk ratio of this narrow therapeutic index medicine, which continues to be important in critical care. Copyright © 2020 The Authors. Published by Wiley-VCH GmbH.

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1. **A rare case of Pneumopericardium secondary to COVID-19**  
   Anon. Heart & Lung 2020;49:679-680.

A rare case of Pneumopericardium secondary to COVID-19. Coronavirus disease 2019 (COVID-19) has posed an unparalleled challenge to the medical communities and patients worldwide. This is the third coronavirus pandemic of the decade and worst so far in terms of the number of patients affected and related deaths. Although COVID-19 is a systemic illness, the respiratory system is obvious to be involved first, and takes most of the brunt of SARS-CoV-2 infection. Common upper and lower respiratory presentations could be sore throat, consolidation, ground glass opacities, and acute respiratory distress syndrome in severe cases. Pneumothorax, pneumomediastinum are uncommon clinical findings in association with COVID-19. We hereby report a rare case of spontaneous pneumomediastinum with a synchronous pneumopericardium.Copyright © 2020 Elsevier Inc. All rights reserved.

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1. **Bilateral spontaneous pneumothorax in SARS-CoV-2 infection: A very rare, life-threatening complication**  
   Anon. American Journal of Emergency Medicine 2020;:No page numbers.

Bilateral spontaneous pneumothorax in SARS-CoV-2 infection: A very rare, life-threatening complication. In the coronavirus disease 2019 (COVID-19) era, the presence of acute respiratory failure is generally associated with acute respiratory distress syndrome; however, it is essential to consider other differential diagnoses that require different, and urgent, therapeutic approaches. Herein we describe a COVID-19 case complicated with bilateral spontaneous pneumothorax. A previously healthy 45-year-old man was admitted to our emergency department with sudden-onset chest pain and progressive shortness of breath 17 days after diagnosis with uncomplicated COVID-19 infection. He was tachypneic and presented severe hypoxemia (75% percutaneous oxygen saturation). Breath sounds were diminished bilaterally on auscultation. A chest X-ray revealed the presence of a large bilateral pneumothorax. A thoracic computed tomography (CT) scan confirmed the large bilateral pneumothorax, with findings consistent with severe COVID-19 infection. Chest tubes were inserted, with immediate clinical improvement. Follow-up chest CT scan revealed resolution of bilateral pneumothorax, reduction of parenchymal consolidation, and formation of large bilateral pneumatoceles. The patient remained under observation and was then discharged home. Bilateral spontaneous pneumothorax is a very rare, potentially life-threatening complication in patients with COVID-19. This case highlights the importance of recognizing this complication early to prevent potentially fatal consequences.Copyright © 2020 Elsevier Inc. All rights reserved.

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1. **Broadening the differential: pneumomediastinum and COVID-19 infection**  
   Pooni Rajan BMJ case reports 2020;13:No page numbers.

The novel coronavirus (COVID-19) has emerged as a new pathogen responsible for an atypical viral pneumonia, with severe cases progressing to an acute respiratory distress syndrome. In our practice, we have observed patients admitted with COVID-19 pneumonia developing worsening hypoxaemic respiratory failure prompting the need for urgent endotracheal intubation. Here, we present a case of a patient admitted with severe COVID-19 pneumonia who required continuous positive airway pressure support following acute deterioration. However, with the patient requiring an increasing fraction of inspired oxygen (FiO2), a prompt CT pulmonary angiogram scan was performed to exclude an acute pulmonary embolism. Surprisingly, this revealed a pneumomediastinum. Following a brief admission to the intensive care unit, the patient made a full recovery and was discharged 18 days post admission. Copyright © BMJ Publishing Group Limited 2020. No commercial re-use. See rights and permissions. Published by BMJ.

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1. **Case report of sequential bilateral spontaneous pneumothorax in a never-ventilated, lung-healthy COVID-19-patient**  
   Caviezel Claudio International Journal of Surgery Case Reports 2020;75:441-445.

Introduction: Patients with COVID-19 infection and severe lung parenchyma alterations may need mechanical ventilation with subsequent pneumothorax and eventually persistent air leak in case of pre-existing lung disease. Presentation of case: This report presents the case of a never-ventilated 58 years old male patient without pre-existing, underlying lung disease demonstrating severe lung parenchyma changes due to COVID-19-pneumonia. He suffered from recurrent bilateral spontaneous pneumothoraces, which were successfully treated with bilateral thoracoscopy and resections of the destroyed lung areas. Notably, he has already been under treatment with anticoagulation due to portal thrombosis 8 years ago. Discussion(s): Although especially know from patients under mechanical ventilation, this patient suffered from spontaneous pneumothorax without ever been ventilated. Probably due to the severe vascular inflammatory changes and focal endothelitis like also seen in other organs of COVID-19 patients, the pneumothorax may lead to a prolonged air leak, which needs surgical therapy. The patients pre-existing anticoagulation therapy may prevented him from a mere severe course. Conclusion(s): Early surgical therapy may be considered in COVID-19 patients with persistent air leak, even if not mechanically ventilated. Simultaneously, the role of early anticoagulation needs further investigation.Copyright © 2020 The Author(s)

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1. **Case Report: Pneumothorax and Pneumomediastinum as Uncommon Complications of COVID-19 Pneumonia—Literature Review**  
   2020;:1170–1176.

As the COVID-19 pandemic progresses, awareness of uncommon presentations of the disease increases. Such is the case with pneumothorax and pneumomediastinum. Recent evidence suggested that these can occur in the context of COVID-19 pneumonia, even in the absence of mechanical ventilation–related barotrauma. We present two patients with COVID-19 pneumonia complicated by pneumomediastinum. The first patient was a 55-year-old woman who developed COVID-19 pneumonia. Her clinical course was complicated by pneumothorax and pneumomediastinum, and, unfortunately, she died 2 days following the admission. The second patient was a 31-year-old man who developed a small pneumomediastinum and was managed conservatively. He had a spontaneous resolution of the pneumomediastinum and was discharged 19 days later. None of our patients required invasive or noninvasive positive pressure ventilation. We performed a literature review of COVID-19 pneumonia cases that developed pneumothorax, pneumomediastinum, or both. The analysis showed that the latter had high mortality (60%). Thus, it is necessary to pay attention to these complications as early identification and management can reduce the associated morbidity and mortality.

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1. **Case Report: Sublingual Microcirculatory Alterations in a Covid-19 Patient With Subcutaneous Emphysema, Venous Thrombosis, and Pneumomediastinum**  
   Grewal Sanjeev Frontiers in medicine 2020;7:624695.

The Corona virus disease 2019 (Covid-19) has brought a wide range of challenges in intensive care medicine. Understanding of the pathophysiology of Covid-19 relies on interpreting of its impact on the vascular, particularly microcirculatory system. Herein we report on the first use of the latest generation hand-held vital microscope to evaluate the sublingual microcirculation in a Covid-19 patient with subcutaneous emphysema, venous thrombosis and pneumomediastinum. Remarkably, microcirculatory parameters of the patient were increased during the exacerbation period, which is not a usual finding in critically ill patients mostly presenting with a loss of hemodynamic coherence. In contrast, recovery from the disease led to a subsequent amelioration of these parameters. This report clearly shows the importance of microcirculatory monitoring for evaluating the course and the adequacy of therapy in Covid-19 patients. Copyright © 2021 Grewal, Harjo, Aykut, Ergin, Nowitzky, Ince and Akin.

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1. **Coronavirus Disease 2019 (COVID-19): A Systematic Review of Imaging Findings in 919 Patients**  
   Salehi Sana AJR. American journal of roentgenology 2020;215:87-93.

OBJECTIVE. Available information on CT features of the 2019 novel coronavirus disease (COVID-19) is scattered in different publications, and a cohesive literature review has yet to be compiled. MATERIALS AND METHODS. This article includes a systematic literature search of PubMed, Embase (Elsevier), Google Scholar, and the World Health Organization database. RESULTS. Known features of COVID-19 on initial CT include bilateral multilobar ground-glass opacification (GGO) with a peripheral or posterior distribution, mainly in the lower lobes and less frequently within the right middle lobe. Atypical initial imaging presentation of consolidative opacities superimposed on GGO may be found in a smaller number of cases, mainly in the elderly population. Septal thickening, bronchiectasis, pleural thickening, and subpleural involvement are some of the less common findings, mainly in the later stages of the disease. Pleural effusion, pericardial effusion, lymphadenopathy, cavitation, CT halo sign, and pneumothorax are uncommon but may be seen with disease progression. Follow-up CT in the intermediate stage of disease shows an increase in the number and size of GGOs and progressive transformation of GGO into multifocal consolidative opacities, septal thickening, and development of a crazy paving pattern, with the greatest severity of CT findings visible around day 10 after the symptom onset. Acute respiratory distress syndrome is the most common indication for transferring patients with COVID-19 to the ICU and the major cause of death in this patient population. Imaging patterns corresponding to clinical improvement usually occur after week 2 of the disease and include gradual resolution of consolidative opacities and decrease in the number of lesions and involved lobes. CONCLUSION. This systematic review of current literature on COVID-19 provides insight into the initial and follow-up CT characteristics of the disease.

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1. **COVID-19 and Pneumothorax: A Multicentre Retrospective Case Series**  
   Anon. European Respiratory Journal 2020;:No page numbers.

COVID-19 and Pneumothorax: A Multicentre Retrospective Case Series. Pneumothorax and pneumomediastinum have both been noted to complicate cases of COVID-19 requiring hospital admission. We report the largest case series yet described of patients with both these pathologies that includes non-ventilated patients.Cases were collected retrospectively from UK hospitals with inclusion criteria limited to a diagnosis of COVID-19 and the presence of either pneumothorax or pneumomediastinum. Patients included in the study presented between March and June 2020. Details obtained from the medical record included demographics, radiology, laboratory investigations, clinical management and survival.Seventy-one patients from 16 centres were included in the study, of whom 60 patients had pneumothoraces (six also with pneumomediastinum), whilst 11 patients had pneumomediastinum alone. Two of these patients had two distinct episodes of pneumothorax, occurring bilaterally in sequential fashion, bringing the total number of pneumothoraces included to 62. Clinical scenarios included patients who had presented to hospital with pneumothorax, patients who had developed pneumothorax or pneumomediastinum during their inpatient admission with COVID-19 and patients who developed their complication whilst intubated and ventilated, either with or without concurrent extracorporeal membrane oxygenation. Survival at 28 days was not significantly different following pneumothorax (63.1%±6.5%) or isolated pneumomediastinum (53.0%±18.7%; p=0.854). The incidence of pneumothorax was higher in males. The 28-day survival was not different between the sexes (males 62.5%±7.7% versus females 68.4%±10.7%; p=0.619). Patients above the age of 70 had a significantly lower 28-day survival than younger individuals (≥70 years 41.7%±13.5% survival versus <70 years 70.9%±6.8% survival; p=0.018 log-rank).These cases suggest that pneumothorax is a complication of COVID-19. Pneumothorax does not seem to be an independent marker of poor prognosis and we encourage active treatment to be continued where clinically possible.Copyright ©ERS 2020.

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1. **COVID-19 pneumonia and pneumothorax: case series**  
   Talan Leyla COVID-19 pnomonisi ve pnomotoraks: olgu serisi. 2020;68:437-443.

Barotrauma is a commonly reported complication in critically ill patients with ARDS caused by different etiologies, it's rate is reported to be around %10. Pneumothorax/pneumomediastinum in COVID-19 patients seem to be more common and have different clinical characteristics. Here we report 9 patients who had pneumothorax and/or pneumomediastinum during their stay in the ICU. Patients who were admitted to ICU between March 2020 and December 2020, were reviewed for presence of pneumothorax, pneumomediastinum and subcutaneous emphysema during their ICU stay. Demographic characteristics, mechanical ventilation settings, documented ventilation parameters, outcomes were studied. A total of 161 patients were admitted to ICU during the study period, 96 were invasively ventilated. Nine patients had developed pneumothorax, pneumomediastinum and/or subcutaneous emphysema during their admission. Five of them were men and median age was 66.6 years. All patients were intubated and mechanically ventilated. All patients were managed conservatively. One patient was discharged from ICU, the others were lost due to other complications related to COVID-19. Upon detection of pneumothorax and/or mediastinum all patients were managed conservatively by limiting their PEEP and maximum inspiratory pressures and were followed by daily chest X-rays (CXR) for detection of any progress. None of the patients showed increase in size of their pneumothorax and/or pneumomediastinum. Hemodynamically instability due to pneumothorax and/or pneumomediastinum was not observed in any of the patients. Tension pneumothorax was not observed in any of the patients. Most common reason for death was sepsis due to secondary bacterial infections. Acute deterioration with rapid oxygen desaturation or palpation of crepitation over thorax and neck in a COVID-19 patient should prompt a search for pneumothorax or pneumomediastinum. Conservative management may be an option as long as the patients are stable.

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1. **Covid-19 Pneumonia and Ventilation-induced Lung Injury: A Case Report**  
   van Gastel Lieke H. A. Romanian journal of anaesthesia and intensive care 2020;27:80-82.

We present the case of a 67-year-old male patient, who was admitted to the intensive care unit for hypoxemic respiratory failure due to severe COVID-19 pneumonitis, requiring mechanical ventilation. Despite close monitoring using transpulmonary pressure measurements and interventions to pursue lung-protective ventilation, the patient developed extensive barotrauma including a right-sided pneumothorax, subcutaneous emphysema and pneumomediastinum while on pressure support ventilation. We hypothesize that the high respiratory drive that COVID-19 patients seem to exhibit, combined with diffuse alveolar injury and increased alveolar pressure, resulted in gross barotrauma., Conclusion: The respiratory characteristics that COVID-19 patients seem to exhibit might expose those on mechanical ventilation to an increased risk of developing ventilation-induced lung injury. This case emphasizes that caution should be taken in the respiratory treatment of patients with COVID-19 pneumonitis. Copyright © 2020 Lieke H.A. van Gastel, MD et al. published by Sciendo.

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1. **COVID-19 ventilator barotrauma management: Less is more**  
   Housman Brian Annals of Translational Medicine 2020;8:1575.

Background: COVID-19 patients requiring mechanical ventilation may develop significant pneumomediastinum and sub-cutaneous emphysema without associated pneumothorax (SWAP). Prophylactic chest tube placement or sub-fascial "blowholes" are usually recommended to prevent tension pneumothorax and clinical decline. Risk of iatrogenic lung injury and release of virus into the environment is high. Incidence and conservative management data of such barotraumatic complications during the COVID-19 pandemic are lacking. Method(s): All patients with mediastinal air and SWAP evaluated by the department of Thoracic Surgery at the Mount Sinai Hospital between March 30 and April 10, 2020 were identified. All patients without pneumothorax were treated conservatively with daily chest x-ray and observation. Three patients had prophylactic chest tube placement prior to the study period without thoracic surgery consultation. Result(s): There were 29 cases of mediastinal air with SWAP out of 171 COVID positive intubated patients (17.0%) who were treated conservatively. Patients were intubated for an average of 2.4 days before SWAP was identified. 12 patients (41%) had improvement or resolution without intervention. Two patients progressed to pneumothorax 3 and 8 days following initial presentation. Both had chest tubes placed without incident before there were any changes in oxygenation, hemodynamics, supportive medications, or ventilator settings. There were 3 patients who had percutaneous tubes placed before the study period all of whom had significant worsening of their sub-cutaneous air and air leak. Conclusion(s): Conservative management of massive sub-cutaneous emphysema without pneumothorax in COVID-19 patients is safe and limits viral exposure to healthcare workers. Placement of chest tubes is discouraged unless a definite sizable pneumothorax develops.Copyright © Annals of Translational Medicine. All rights reserved.

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1. **Critical Care Management for Novel 2019 SARS-CoV-2 and HCoV-NL63 Coinfection in a Young Immunocompromised Patient: A Chicago Experience**  
   Sanchez-Nadales Alejandro Case reports in critical care 2020;2020:8877641.

Background: SARS-CoV-2 is a newly emerged virus that has spread rapidly, exhibiting tremendous morbidity and mortality. Some potential pharmaceutical targets have been identified but are still lacking proper validation. Case Presentation. We describe the case of a young, immunosuppressed and critically ill patient with previous Influenza B infection, requiring extracorporeal membrane oxygenation, which was then followed, in the succeeding months, by SARS-CoV-2 infection complicated by severe adult respiratory distress syndrome. Her clinical course exhibited complications, including pulmonary embolism, acute kidney injury, pneumothorax, pneumomediastinum, multiple cardiac arrests, and eventually death., Conclusion: Coinfection with other respiratory pathogens and opportunistic infections are possible. Copyright © 2020 Alejandro Sanchez-Nadales et al.

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1. **Efficacy and Safety Data of Treatments for Novel Coronavirus Pneumonia (SARS-Cov-2): A Systematic Review and Network Meta-Analysis of Randomized Trials**  
   Anon. Journal of Infectious Diseases and Epidemiology 2020;:No page numbers.

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1. **High incidence of barotrauma in patients with COVID-19 pneumonia during invasive mechanical ventilation**  
   Udi J. Critical Care 2020;24:No page numbers.

Introduction: COVID-19 can cause pulmonary failure and even acute respiratory distress syndrome (ARDS) requiring prolonged mechanical ventilation (MV). It is known that MV by itself comes with complications like superinfections and barotrauma. Since it has been proposed by Gattinoni et al that COVID-19 pneumonia may have two phenotypes [1], an early one presenting with low elastance and recruitability and the later one with features of ARDS, we evaluated all COVID-19 patients on MV for barotrauma. Method(s): All patients with COVID-19 pneumonia on MV treated at our intensive care unit (university hospital, ARDS and ECMO reference center) between March and April 2020 were included. Characteristics of MV during the last 24 hours (h) before any complication were recorded. This retrospective registry is covered by an ethics approval (file 234-20). Result(s): A total of 20 patients with COVID-19 pneumonia were included (median age: 61 years, 6 female, duration of MV 22 days, 55% on venovenous extracorporeal membrane oxygenation (vv-ECMO). Of these, 8 patients (median age: 62 years, 3 female, 4 on vv-ECMO) developed barotrauma (40%) including pneumothorax (n=5), pneumomediastinum (n=5) and subcutaneous emphysema (n=2) under MV (Figure 1). Only 1 patient had a predisposing lung disease (chronic obstructive lung disease). Median MV duration before complication occurs was 18 days (range: 1-32). Median MV parameters from all 8 patients during the last 24 h before barotrauma, were: inspiratory oxygen fraction (FiO2) 55% (range: 45-70) peak inspiratory pressure 27 mbar (range: 20-29), positive end-expiratory pressure (PEEP) 12 mbar (range: 5-16), tidal volume (VT) 453 ml (range: 41-775), and respiratory frequency (RF) 22/min (range: 15-30), 63% spontaneous breathing, 50% prone positioning. Conclusion(s): In our experience, barotrauma is a frequent complication in the late phase of COVID-19 induced ARDS. Preliminary data suggest that barotrauma in COVID-19 may occur even when following recommendations for lung protective MV in ARDS.

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1. **HIGH INCIDENCE OF SPONTANEOUS PNEUMOTHORAX IN CRITICALLY ILL PATIENTS WITH SARS-COV-2**  
   Reddy Renuka Chest 2020;158:A1191.

SESSION TITLE: Disorders of the Pleura Posters SESSION TYPE: Original Investigation Posters PRESENTED ON: October 18-21, 2020 PURPOSE: Spontaneous pneumothorax is a relatively common complication in critically ill patients with severe acute respiratory distress syndrome (ARDS). Limited data exists regarding pneumothorax in severe acute respiratory coronavirus 2 (SARS-CoV-2) patients. This study depicts cases of spontaneous pneumothorax in critically ill SARS-CoV-2 patients and explores the potential underlying mechanisms. METHOD(S): This is a retrospective cohort study of SARS-CoV-2 patients with severe ARDS admitted to a tertiary care center between March 9, 2020 to April 5, 2020. SARS-CoV-2 was diagnosed via polymerase chain reaction. Only patients on mechanical ventilation were analyzed. RESULT(S): A total of 22 patients with confirmed SARS-CoV-2 infection on mechanical ventilation were identified and analyzed. Out of these, 7 patients developed a spontaneous pneumothorax. The patients were predominantly male (86%) with an age range between 67 and 82 years old. Cough (100%) and shortness of breath (71%) were the most common presenting symptoms. Chronic obstructive pulmonary disease was not present in any of the patients. Pneumothoraxes were diagnosed 6 to 33 days after hospital admission. All 7 patients had subclavian central lines that were placed by 4 different providers with more than 15 years of critical care experience. All 7 patients had right sided pneumothoraxes of varying sizes but only 42% had right-sided lines. Remarkably, the mean peak inspiratory pressure (Ppeak) for these patients was 25 cm H2O and the mean positive end expiratory pressure (PEEP) was 11 cm H2O. Prone positioning was utilized in 57% of patients and 42% of patients received convalescent plasma. The mortality rate was 71% and the 2 patients who survived were discharged to long term acute care hospitals. CONCLUSION(S): Traditionally, ventilator associated pneumothorax is associated with a Ppeak greater than 40 cm H2O, which contrasts with the mean Ppeak of 25 cm H2O observed in this study. While iatrogenic pneumothoraces are common following subclavian central line placement, the majority of the pneumothoraces in this study occurred on the opposite side of the procedure. ARDS secondary to SARS-CoV-2 infection appears to have a completely different pathophysiology than that of traditional ARDS, which is typically managed with low PEEP and Ppeak. Utilizing the ARDSnet protocol in patients with ARDS secondary to SARS-CoV-2 may be deleterious. Further investigation is needed to evaluate this hypothesis. CLINICAL IMPLICATIONS: ARDS secondary to SARS-CoV-2 appears to be distinct from ARDS caused by other disease processes and may have a different risk of pneumothorax development. As elderly, critically ill SARS-CoV-2 patients with ARDS have been found to have increased risk of death, identifying modifiable risks associated with the development of a spontaneous pneumothorax could help mitigate morbidity and mortality in this population. DISCLOSURES: No relevant relationships by Andres Chacon Martinez, source=Web Response No relevant relationships by robert chait, source=Web Response No relevant relationships by Kai Chen, source=Web Response No relevant relationships by Nakeya Dewaswala, source=Web Response No relevant relationships by Katherine Hodgin, source=Web Response no disclosure on file for Jesus Pino; No relevant relationships by Fergie Ramos Tuarez, source=Web Response No relevant relationships by Renuka Reddy, source=Web ResponseCopyright © 2020 American College of Chest Physicians

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1. **Hyperbaric oxygen therapy may be effective to improve hypoxemia in patients with severe COVID-2019 pneumonia: two case reports**  
   Guo Dazhi Undersea & hyperbaric medicine : journal of the Undersea and Hyperbaric Medical Society, Inc 2020;47:181-187.

Objectives: To determine whether hyperbaric oxygen (HBO2) therapy be effective to improve hypoxemia for severe COVID-19 pneumonia patients., Methods: Two male patients ages 57 and 64 years old were treated. Each met at least one of the following criteria: shortness of breath; respiratory rate (RR) >=30 breaths/minute; finger pulse oxygen saturation (SpO2) <=93% at rest; and oxygen index (P/F ratio: PaO2/FiO2 <=300 mmHg). Each case excluded any combination with pneumothorax, pulmonary bullae or other absolute contraindications to HBO2. Patients were treated with 1.5 atmospheres absolute HBO2 with an oxygen concentration of more than 95% for 60 minutes per treatment, once a day for one week. Patients' self-reported symptoms, daily mean SpO2 (SO2), arterial blood gas analysis, D-dimer, lymphocyte, cholinesterase (che) and chest CT were conducted and measured., Results: For both patients, dyspnea and shortness of breath were immediately alleviated after the first HBO2 treatment and remarkably relieved after seven days of HBO2 therapy. The RR also decreased daily. Neither patient became critically ill. The decreasing trend of SO2 and P/F ratio was immediately reversed and increased day by day. The lymphocyte count and ratio corresponding to immune function gradually recovered. D-dimer corresponding to peripheral circulation disorders and serum cholinesterase, reflecting liver function had improved. Follow-up chest CT showed that the pulmonary inflammation had clearly subsided., Conclusion: Our preliminary uncontrolled case reports suggest that HBO2 therapy may promptly improve the progressive hypoxemia of patients with COVID-2019 pneumonia. However, the limited sample size and study design preclude a definitive statement about the potential effectiveness of HBO2 therapy to COVID-2019 pneumonia. It requires evaluation in randomized clinical trials in future. Copyright© Undersea and Hyperbaric Medical Society.

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1. **Incidence of pneumothorax and pneumomediastinum in Covid-19 critically ill patients**  
   Gandini L. Intensive Care Medicine Experimental 2020;8:No page numbers.

Introduction: Barotrauma, including both pneumothorax and pneumomediastinum, is a well-known complication of prolonged non-invasive ventilation (NIV) [1]. Vigorous respiratory efforts lead to increased transpulmonary pressure and to patient self induced lung injury [2]. In Coronavirus Disease 2019 (Covid-19), correct timing to declare failure of NIV and proceed to intubation and invasive ventilation is unknown. We tested the hypothesis that in Covid-19 prolonged NIV is associated with barotrauma. Objective(s): To describe incidence of barotrauma in Covid-19 and its onset time from hospital admission. To evaluate association between barotrauma and duration of NIV in Covid-19. Method(s): We retrospectively enrolled 104 consecutive Covid-19 patients, admitted to our ICU from February 22nd to March 22nd, requiring intubation after failure of NIV. Age, sex and SOFA score were collected at ICU admission. Diagnosis of barotrauma was confirmed by radiological evidence (ultrasound/chest x-ray, chest CT) during the first 2 weeks from ICU admission. Different time intervals (from hospital admission to intubation (T1) and from beginning of NIV to intubation (T2)) were compared between patients with barotrauma and controls, using the Mann-Withney test. We then identified a subgroup of barotrauma patients, defined "early", characterized by occurrence of barotrauma before or within the first 24 hours after intubation. We compared this group with controls with the Mann-Whitney test. Result(s): Mean age was 61+/-10, 84 (80.7%) were male and median SOFA score was 6 (range 4-8). Barotrauma occurred in 15 patients (14%), at a median time of 8 days (IQR 6-12) from hospital admission. No differences were found either in T1 (median days 3, IQR 2-5.5 vs 5, IQR 2-9, p ns), or in T2 (median days 2, IQR 1-4 vs 3, IQR 2-6, p ns) between controls and patients with barotrauma. However 6 patients had an early barotrauma; in this subgroup, T2 was longer in patients who developed early barotrauma compared to controls (Table). Conclusion(s): In Covid-19 barotrauma had an incidence similar to other forms of acute respiratory failure. However, early barotrauma was associated with prolonged use of NIV. (Table Presented).

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1. **Late-onset pneumothorax in a COVID-19 patient treated with ventilation and ECMO: A case report and literature review**  
   Horii Toshihiro Radiology Case Reports 2020;15:2560-2564.

Coronavirus disease 2019 (COVID-19) has become a major threat to public health since the outbreak in Wuhan in 2019. Chest computed tomography is recommended for COVID-19 cases for evaluation and follow up of pneumonia and related complication. We report the case of a 66-year-old man with underlying hypertension and a history of smoking 76 packs a year; he was frequently monitored by computed tomography for pulmonary changes during the period from early symptom onset to death. Furthermore, he developed a pneumothorax during the course. The occurrence of pneumothorax in COVID-19 patients is not common, and there have been only a few previous reports. This is a valuable case of pneumothorax in a patient with COVID-19 treated with a ventilator and extracorporeal membrane oxygenation. This case and previous reports suggest that pneumothorax occurs in COVID-19 with a relatively late onset (3-8 weeks). Long-term pneumonia morbidity, steroid therapy, positive pressure ventilation, and extracorporeal membrane oxygenation can cause pneumothorax, leading to capillary and alveolar damage.Copyright © 2020

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1. **MANAGEMENT OF PERSISTENT PNEUMOTHORAX WITH THORACOSCOPY AND BLEBS RESECTION IN COVID-19 PATIENTS**  
   Anon. Annals of Thoracic Surgery 2020;:No page numbers.

MANAGEMENT OF PERSISTENT PNEUMOTHORAX WITH THORACOSCOPY AND BLEBS RESECTION IN COVID-19 PATIENTS. Several studies have been published describing the clinical and radiographic findings on the novel coronavirus (COVID-19) pneumonia. Therefore, there is currently a lack of pathologic data about its effects in intubated patients. Pneumothorax may occur rarely and results from a combination of fibrotic parenchyma with prolonged high-pressure ventilation. Chest drain represent the first line treatment. However, in case of persistent pneumothorax, thoracoscopy and bleb resection may be a feasible option to reduce air leak and improve ventilation. We report the cases of two COVID-19 patients successfully treated with thoracoscopy, bleb resection, and pleurectomy for persistent pneumothorax.Copyright © 2020. Published by Elsevier Inc.

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1. **Management of pneumothorax in mechanically ventilated COVID-19 patients: early experience**  
   Hussain Azhar Interactive cardiovascular and thoracic surgery 2020;31:540-543.

A significant proportion of patients infected with the novel coronavirus, now termed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), require intensive care admission and subsequent mechanical ventilation. Pneumothorax, a potential fatal complication of mechanical ventilation, can further complicate the management of COVID-19 patients, whilst chest drain insertion may increase the risk of transmission of attending staff. We present a case series and a suggested best-practice protocol for how to manage and treat pneumothoraces in COVID-19 patients in an intensive care unit setting. Copyright © The Author(s) 2020. Published by Oxford University Press on behalf of the European Association for Cardio-Thoracic Surgery. All rights reserved.

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1. **PNEUMOMEDIASTINUM AND PNEUMOTHORAX DUE TO NONINVASIVE POSITIVE PRESSURE VENTILATION IN COVID-19 PNEUMONIA**  
   Thetford Jay Chest 2020;158:A1284.

SESSION TITLE: Medical Student/Resident Disorders of the Pleura Posters SESSION TYPE: Med Student/Res Case Rep Postr PRESENTED ON: October 18-21, 2020 INTRODUCTION: Barotrauma as a consequence of high alveolar pressures is well described in invasive mechanically ventilated (IMV) patients with pneumonia or pneumonitis. Limited data exists on the incidence of barotrauma in patients with Coronavirus Disease 19 pneumonia (COVID-19). We present a case of barotrauma occurring in a non-intubated patient with COVID-19 receiving noninvasive positive pressure ventilation (NPPV). CASE PRESENTATION: A 43-year-old male with obesity presented with 2 days of cough and dyspnea. Polymerase chain reaction (PCR) testing confirmed COVID-19. He initially required 5L of oxygen (O2) per minute by nasal cannula. Due to worsening hypoxemic respiratory failure (HRF) on day 3, the patient was placed on high-flow nasal cannula (HFNC) at 90% FiO2 at a flow rate of 30 L/min. By day 7, the patient had worsening HRF and increased work of breathing. He was transitioned to continuous positive airway pressure (CPAP) at 100% FiO2 with continuous pressure set at 12 cm H2O. On day 13, he developed tachycardia and desaturation. Chest CT found gas dissecting along the axial interstitium resulting in pneumomediastinum, bilateral pneumothoraces, and extensive subcutaneous emphysema. The lung parenchyma exhibited coarse ground glass opacities and early evidence of fibrotic changes. Chest tubes were placed in each hemithorax with resolution of his pnemothoraces after 5 days. His O2 requirements decreased, and he was transferred to a rehabilitation hospital on 10 L/min O2 by facemask on day 25. DISCUSSION: Barotrauma leading to pneumomediastinum and pneumothoraces are a well-documented complication of mechanical ventilation.1 In an effort to mitigate the morbidity and mortality associated with mechanical ventilation, many clinicians have shifted toward using NPPV in HRF in COVID-19, however NPPV may not necessarily protect patients against a complication more commonly associated with IMV.2,3 Progressive and cumulative alveolar injury may predispose COVID-19 patients to barotrauma regardless of mode of ventilation.3 CONCLUSION(S): Due to the mortality associated with IMV in COVID-19, many clinicians have shifted toward using NPPV to manage HRF. However, patients receiving NPPV may still be subject to complications such as barotrauma. Additionally, given our evolving understanding of COVID-19 and the pulmonary parenchymal distortion seen in many patients, a deterioration in respiratory status should prompt clinicians to search for evidence of barotrauma, even in patients receiving NPPV. Reference #1: Mentzer SJ, Tsuda A, Loring SH. Pleural mechanics and the pathophysiology of air leaks. J Thorac Cardiovasc Surg. 2018;155(5):2182-2189. Reference #2: Xu XP, Zhang XC, Hu SL, et al. Noninvasive Ventilation in Acute Hypoxemic Nonhypercapnic Respiratory Failure: A Systematic Review and Meta-Analysis. Crit Care Med. 2017;45(7):e727-e733. Reference #3: Sun R, Liu H, Wang X. Mediastinal Emphysema, Giant Bulla, and Pneumothorax Developed during the Course of COVID-19 Pneumonia. Korean J Radiol. 2020;21(5):541-544. DISCLOSURES: no disclosure on file for Nikhil Barot; No relevant relationships by Michael Kahn, source=Web Response No relevant relationships by Nader Kamangar, source=Web Response No relevant relationships by Jay Thetford, source=Web ResponseCopyright © 2020 American College of Chest Physicians

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1. **Pneumomediastinum and subcutaneous emphysema in COVID-19: barotrauma or lung frailty?**  
   Lemmers Daniel H. L. ERJ open research 2020;6:No page numbers.

Background: In mechanically ventilated acute respiratory distress syndrome (ARDS) patients infected with the novel coronavirus disease (COVID-19), we frequently recognised the development of pneumomediastinum and/or subcutaneous emphysema despite employing a protective mechanical ventilation strategy. The purpose of this study was to determine if the incidence of pneumomediastinum/subcutaneous emphysema in COVID-19 patients was higher than in ARDS patients without COVID-19 and if this difference could be attributed to barotrauma or to lung frailty., Methods: We identified both a cohort of patients with ARDS and COVID-19 (CoV-ARDS), and a cohort of patients with ARDS from other causes (noCoV-ARDS). Patients with CoV-ARDS were admitted to an intensive care unit (ICU) during the COVID-19 pandemic and had microbiologically confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. NoCoV-ARDS was identified by an ARDS diagnosis in the 5 years before the COVID-19 pandemic period., Results: Pneumomediastinum/subcutaneous emphysema occurred in 23 out of 169 (13.6%) patients with CoV-ARDS and in three out of 163 (1.9%) patients with noCoV-ARDS (p<0.001). Mortality was 56.5% in CoV-ARDS patients with pneumomediastinum/subcutaneous emphysema and 50% in patients without pneumomediastinum (p=0.46). CoV-ARDS patients had a high incidence of pneumomediastinum/subcutaneous emphysema despite the use of low tidal volume (5.9+/-0.8 mL.kg-1 ideal body weight) and low airway pressure (plateau pressure 23+/-4 cmH2O)., Conclusions: We observed a seven-fold increase in pneumomediastinum/subcutaneous emphysema in CoV-ARDS. An increased lung frailty in CoV-ARDS could explain this finding more than barotrauma, which, according to its etymology, refers to high transpulmonary pressure. Copyright ©ERS 2020.

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1. **Pneumomediastinum following intubation in COVID-19 patients: a case series**  
   Wali A. Anaesthesia 2020;75:1076-1081.

The number of patients requiring tracheal intubation rose dramatically in March and April 2020 with the COVID-19 outbreak. Our thoracic surgery department has seen an increased incidence of severe pneumomediastinum referred for surgical opinion in intubated patients with COVID-19 pneumonitis. Here we present a series of five patients with severe pneumomediastinum requiring decompression therapy over a 7-day period in the current COVID-19 outbreak. We hypothesise that the mechanism for this is the aggressive disease pathophysiology with an increased risk of alveolar damage and tracheobronchial injury, along with the use of larger-bore tracheal tubes and higher ventilation pressures. We present this case series in order to highlight the increased risk of this potentially life-threatening complication among the COVID-19 patient cohort and offer guidance for its management to critical care physicians. Copyright © 2020 Association of Anaesthetists.

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1. **PNEUMOMEDIASTINUM IN A CRITICALLY ILL CORONAVIRUS DISEASE 2019 (COVID-19) PATIENT**  
   Hayrabedian Moses Chest 2020;158:A765.

SESSION TITLE: Fellows Critical Care Posters SESSION TYPE: Fellow Case Report Posters PRESENTED ON: October 18-21, 2020 INTRODUCTION: The Coronavirus Disease 2019 (COVID-19) pandemic has displayed heterogeneity in disease manifestations and complications; cardiac, renal, neurological complications and coagulopathy are reported. We present a case of COVID-19 with pneumomediastinum. CASE PRESENTATION: A 59-year-old male was admitted after a reverse transcriptase polymerase chain reaction (RT-PCR) test- confirmed COVID19. He was confused and was intubated for hypoxia. Laboratory investigation showed white blood cells of 2.8x1000/mm3 (normal: 3.4-9.4x1000/ mm3) [differential: 59%(normal: 47-67%) neutrophils and 39% ( normal: 25-45%) lymphocytes], aspartate aminotransferase 1174 IU/l(normal:13-39IU/l), alanine aminotransferase 598 IU/l(normal:7-52IU/l), ferritin > 7500 ng/ml (normal: 20-200 ng/ml), C reactive protein 306.1 mg/l (normal: 0-5 mg/l) and D-dimer 10 mcg/ml (normal: 0-0.50 mcg/ml). Arterial blood gases showed pH 7.14 (normal: 7.35-7.45), PCO2 59 mmHg (normal: 34-46 mmHg) and PO2 54 mmHg (normal: 80-97 mmHg) on 100% oxygen. Computed tomography of the chest (CT chest) showed diffuse groundglass opacities. Diagnosis of acute respiratory distress syndrome (ARDS) was made. On day 5, given low lung compliance (static compliance 13.5 ml/CmH2O), mode was switched to airway pressure release ventilation(APRV). On day 8, subcutaneous emphysema was noted with worsening hemodynamics. CT chest showed pneumomediastinum, pneumopericardium and subcutaneous air without pneumothorax. APRV was changed to conventional mode and infraclavicular incisions completed. Patient's status continued to decline; he died on the 13th day of admission. DISCUSSION: COVID-19 causes pulmonary involvement ranging from atypical pneumonia to ARDS. Few cases of COVID-19-associated pneumomediastinum are reported in the literature. Barotrauma from mechanical ventilation accounts for one third cases of pneumomediastinum. Although, large tidal volumes are thought to predispose to barotrauma, these associations are related to the severity of lung disease. ARDS is most associated and is the only independent risk factor for barotrauma[1]. APRV does not demonstrate any difference regarding the onset of barotrauma when compared to conventional modes used in ARDS[2]. Different pathological patterns ranging from interstitial lymphocytic infiltrates to organizing pneumonia to diffuse alveolar damage are reported in COVID-19[3]. These possibly define the spectrum of COVID-19 and hence the increasing rate of severe complications with worsening injury. CONCLUSION(S): COVID-19 patients display diverse complications; pneumomediastinum is an emerging one. Further research is needed to study COVID-19 and barotrauma within the clinical and pathological phenotypes of the disease. Reference #1: Airway pressures and early barotrauma in patients with acute lung injury and acute respiratory distress. Eisner MD, Thompson BT, Schoenfeld D, et al. Am J Respir Crit Care Med. 165:978-982 2002. Reference #2: Airway pressure release ventilation during acute hypoxemic respiratory failure: a systematic review and meta-analysis of randomized controlled trials. Carsetti et al. Ann. Intensive Care (2019) 9:44. Reference #3: Time to consider histologic pattern of lung injury to treat critically ill patients with COVID-19 infection. Marie-Christine Copin, Erika Parmentier, [...], and The Lille COVID-19 ICU and Anatomopathology Group. Intensive Care Med. 2020 Apr 23 :1-3. DISCLOSURES: No relevant relationships by Moses Hayrabedian, source=Web Response No relevant relationships by Faraaz Nayeemuddin, source=Web Response No relevant relationships by Rajagopal Sreedhar, source=Admin inputCopyright © 2020 American College of Chest Physicians

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1. **Pneumomediastinum in critically ill adult with COVID-19**  
   Collercandy N. Medicina intensiva 2020;:No page numbers.

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1. **Pneumothorax and pneumomediastinum secondary to COVID-19 disease unrelated to mechanical ventilation**  
   Tucker Lara Case Reports in Critical Care 2020;2020:6655428.

In the recent worldwide coronavirus 2019 pandemic, a notable rise in pneumomediastinum and pneumothorax complications has been witnessed in numerous mechanically ventilated patients infected with severe acute respiratory syndrome coronavirus 2. Most cases have reported these complications as barotrauma from mechanical ventilation with COVID-19 disease. We aim to report three polymerase chain reaction-confirmed COVID-19 patients who developed pneumomediastinum and pneumothorax unrelated to mechanical ventilation. We originally analyzed 800 patients with COVID-19 disease at Orlando Regional Medical Center from March 1, 2020, to July 31, 2020, of which 12 patients developed pneumomediastinum and pneumothorax in their hospital course. Interestingly, three patients developed pneumomediastinum on chest imaging prior to intubation. We present these three patients, one female and two males, ages of 42, 64, and 65, respectively, who were diagnosed with COVID-19 disease through nasopharyngeal sampling tests with acute respiratory distress syndrome. Spontaneous pneumomediastinum and pneumothorax are potential complications of COVID-19 disease in the lungs unrelated to mechanical ventilation. This is similar to previous outbreaks of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) diseases. Further investigation is needed to define the causality of pneumomediastinum in nonintubated COVID-19 patients to define the incidence of disease.Copyright © 2020 Lara Tucker et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

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1. **Pneumothorax as an ominous side effect in COVID-19 patients under mechanical ventilation: Report of seven patients**  
   Tofigh Arash Mohammadi Journal of Cellular and Molecular Anesthesia 2020;5:202-205.

Today, due to the pandemic of novel coronavirus 2019 (COVID-19), extensive information over all parts of the world is spreading rapidly. We present seven cases of COVID-19 patients with pneumothorax as one of the ominous side effects of the disease and a strong predictor of death which is a new challenge in controlling the transmission and distribution of the disease.Copyright © Shahid Beheshti University of Medical Sciences, Anesthesiology Research Center.

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1. **Pneumothorax in COVID-19 Acute Respiratory Distress Syndrome: Case Series**  
   Wong Kelvin Cureus 2020;12:e11749.

Objective The study aims to describe the clinical characteristics and outcomes of patients with COVID-19 related acute respiratory distress syndrome (ARDS) who developed pneumothorax. Design and setting A retrospective chart review was performed of the electronic medical record. Patients were included if they were identified as having confirmed COVID-19 as well as pneumothorax from March 16, 2020 to May 31, 2020. Patients' demographic and clinical characteristics, mechanical ventilator parameters, lung compliance measurements and outcomes during hospitalization were collected. This case series was conducted in intensive care units at two large tertiary care centers within the Northwell Health System, located in New York State. Patients A total of 75 patients were identified who were predominantly male (73.3%) with an average age of 62.8 years. Thirty (40%) were Hispanic, 20 (26.7%) were White, 16 (21.3%) were Asian, and nine (12%) were Black. Common comorbid conditions were hypertension (52%), diabetes mellitus (26.7%), hyperlipidemia (32.0%), and chronic pulmonary disease (8, 10.7%). Measurements and main results Most of the patients were diagnosed with pneumothorax while on mechanical ventilation (92%) despite overall adherence with lung-protective ventilation strategies. Average tidal volume was 6.66 mL/kg) of ideal body weight. The average positive end-expiratory pressure (PEEP) was 10.83 (cm) H2O. Lung compliance was poor, with average peak and plateau pressures of 41.9 cm H2O and 35.2 cm H2O, respectively. Inpatient mortality was high in these patients (76%). Conservative management with initial observation had a success rate (73.3%) with similar mortality and shorter length of stay (LOS) on average. Significant factors in the conservatively managed group included lack of tension physiology, the smaller size of pneumothorax, lack of underlying diabetes, presence of pneumomediastinum, and not being on mechanical ventilation during diagnosis. Conclusion Despite overall adherence to best practice ventilator management in ARDS, we observed a large number of pneumothoraces during the COVID-19 pandemic. Conservative management may be appropriate if there are no clinical signs or symptoms of tension physiology and pneumothorax size is small. Copyright © 2020, Wong et al.

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1. **Pneumothorax in COVID-19 disease- incidence and clinical characteristics**  
   Anon. Respiratory research 2020;21:236.

Pneumothorax in COVID-19 disease- incidence and clinical characteristics. Spontaneous pneumothorax is an uncommon complication of COVID-19 viral pneumonia. The exact incidence and risk factors are still unknown. Herein we review the incidence and outcomes of pneumothorax in over 3000 patients admitted to our institution for suspected COVID-19 pneumonia.We performed a retrospective review of COVID-19 cases admitted to our hospital. Patients who were diagnosed with a spontaneous pneumothorax were identified to calculate the incidence of this event. Their clinical characteristics were thoroughly documented. Data regarding their clinical outcomes were gathered. Each case was presented as a brief synopsis.Three thousand three hundred sixty-eight patients were admitted to our institution between March 1st, 2020 and June 8th, 2020 for suspected COVID 19 pneumonia, 902 patients were nasopharyngeal swab positive. Six cases of COVID-19 patients who developed spontaneous pneumothorax were identified (0.66%). Their baseline imaging showed diffuse bilateral ground-glass opacities and consolidations, mostly in the posterior and peripheral lung regions. 4/6 cases were associated with mechanical ventilation. All patients required placement of a chest tube. In all cases, mortality (66.6%) was not directly related to the pneumothorax.Spontaneous pneumothorax is a rare complication of COVID-19 viral pneumonia and may occur in the absence of mechanical ventilation. Clinicians should be vigilant about the diagnosis and treatment of this complication.

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1. **PNEUMOTHORAX IN SEVERE ILL PATIENTS ADMITTED DUE TO SARS-COV-2**  
   Uribe Juan Pablo Chest 2020;158:A324.

SESSION TITLE: Chest Infections Posters SESSION TYPE: Original Investigation Posters PRESENTED ON: October 18-21, 2020 PURPOSE: Approximately 1% of patients admitted for SARS-CoV-2 may develop pneumothorax (PTX) during the hospitalization. Currently there is no literature available regarding the development of pneumothorax during SARS-CoV-2 infection neither the characteristics nor clinical outcomes of these patients. We present a single center review of 11 subjects who developed PTX during the course of hospitalization for SARS-CoV-2. METHOD(S): Retrospective medical records review of patients diagnosed with PTX and SARS-CoV-2 between January 1, 2020 and May 8, 2020 at Beth Israel Deaconess Medical Center in Boston, MA. Patients were identified from our institutional database (Clinical Query 2). Demographics, baseline comorbidities, hospital stay, ICU stay, interventions and crude mortality are presented. RESULT(S): A total of 11 inpatients with SARS-CoV-2 and PTX were included (mean age 66.45 years [SD 13.28]; 81.82% [n=9] males; 72.73% PTX on the right side). The mean hospital stay until discharge or death was 25.91 days (SD 11.61), with a mean time from admission to PTX of 13.81 days (SD 12.27). Nine (81.82%) of PTX were secondary spontaneous and 2 (18.18%) iatrogenic. The most common comorbid conditions found were hypertension (54.55%) followed by hyperlipidemia (45.45%), malignancy (27.27%) and congestive heart failure (27.27%). Nine (81.81%) subjects were on the ICU when the event occurred with a mean ICU stay of 15.11 days (SD 8.89). Seven (63.64%) patients were under mechanical ventilation with a mean intubation time of 19.86 days (SD 10.17). Ten (90.91%) subjects required chest tube insertion with 54.54% (n=6) requiring chest tube size > 14 Fr. Two (18.18%) patients ended up having tracheostomy and 5 (45.45%) died before discharge. CONCLUSION(S): We found that secondary and iatrogenic PTX may be an infrequent complication of patients admitted for the treatment of SARS-CoV-2. This entity may be implicated in acute clinical deterioration with rapid oxygen desaturation in critically ill patients. CLINICAL IMPLICATIONS: Pneumothorax may be may be implicated in acute clinical deterioration with rapid oxygen desaturation in critically ill patients SARS-CoV-2. DISCLOSURES: No relevant relationships by Alvaro Ayala, source=Web Response No relevant relationships by Alex Chee, source=Web Response No relevant relationships by Fayez Kheir, source=Web Response Consultant relationship with Boston Scientific Please note: $1001 - $5000 by Adnan Majid, source=Web Response, value=Consulting fee Consultant relationship with olympus Please note: $5001 - $20000 by Adnan Majid, source=Web Response, value=Consulting fee Consultant relationship with pinacle biologics Please note: $1001 - $5000 by Adnan Majid, source=Web Response, value=Consulting fee Consultant relationship with cook medical Please note: $1001 - $5000 by Adnan Majid, source=Web Response, value=Consulting fee No relevant relationships by Mihir Parikh, source=Web Response No relevant relationships by Juan Pablo Uribe, source=Web ResponseCopyright © 2020 American College of Chest Physicians

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1. **Rapidly developing large pneumatocele and spontaneous pneumothorax in SARS-CoV-2 infection**  
   Sanivarapu Raghavendra R. Respiratory Medicine Case Reports 2020;31:101303.

1. **Recurrent Pneumothorax in a Critically Ill Ventilated COVID-19 Patient**  
   Rehnberg Lucas Case reports in critical care 2020;2020:8896923.

We present this case of a young woman with SARS-CoV-2 viral infection resulting in coronavirus 2019 (COVID-19) lung disease complicated by a complex hydropneumothorax, recurrent pneumothorax, and pneumatoceles. A 33-year-old woman presented to the hospital with a one-week history of cough, shortness of breath, and myalgia, with no other significant past medical history. She tested positive for COVID-19 and subsequently, her respiratory function rapidly deteriorated, necessitating endotracheal intubation and mechanical ventilation. She had severe hypoxic respiratory failure requiring a protracted period on the mechanical ventilator with different ventilation strategies and multiple cycles of prone positioning. During her proning, after two weeks on the intensive care unit, she developed tension pneumothorax that required bilateral intercostal chest drains (ICD) to stabilise her. After 24 days, she had a percutaneous tracheostomy and began her respiratory wean; however, this was limited due to the ongoing infection. Thorax CT demonstrated a left-sided pneumothorax, with bilateral pneumatoceles and a sizeable, complex hydropneumothorax. Despite the insertion of ICDs, the hydropneumothorax persisted over months and initially progressed in size on serial scans needing multiple ICDs. She was too ill for surgical interventions initially, opting for conservative management. After 60 days, she successfully underwent a video-assisted thoracoscopic surgery (VATS) for a washout and placement of further ICDs. She was successfully decannulated after 109 days on the intensive care unit and was discharged to a rehabilitation unit after 116 days of being an inpatient, with her last thorax CT showing some residual pneumatoceles but significant improvement. Late changes may mean patients recovering from the COVID-19 infection are at increased risk of pneumothoracies. Clinicians need to be alert to this, especially as bullous rupture may not present as a classical pneumothorax. Copyright © 2020 Lucas Rehnberg et al.

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1. **SARS-CoV-2 Associated With Pneumothorax: A Case Report and Literature Review**  
   Younes Islam Cureus 2020;12:e12191.

SARS-CoV-2 has created universal disarray since its outbreak in 2019. Emergent measures were taken worldwide to mitigate the morbid outcomes of the pandemic. Multiple organ systems have been shown to be negatively impacted secondary to the heightened inflammatory response to the novel virus. In this report, we focus on the respiratory system. The novel virus impact on the respiratory system has been well documented, leading to acute respiratory distress syndrome. Here, we present a case of a patient with no risk factors for pneumothorax (smoking, underlying lung disease, prior history of pneumothorax, age, family history) who was found to be SARS-CoV-2 positive and developed a significant pneumothorax requiring transfer to the intensive care unit. Copyright © 2020, Younes et al.

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1. **SARS-CoV-2 pneumonia with subcutaneous emphysema, mediastinal emphysema, and pneumothorax: A case report**  
   Xiang Chunlin Medicine 2020;99:e20208.

INTRODUCTION: Since the end of 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has affected more than 1,000,000 population in the world. Subcutaneous emphysema and pneumothorax are uncommon complications of SARS-CoV-2 pneumonia. Herein, we describe a fatal case of SARS-CoV-2 pneumonia with subcutaneous emphysema and pneumothorax., PATIENT CONCERNS: Subcutaneous emphysema was found in neck, bilateral chest walls, abdomen wall, groin area, and scrotum of a 67-year-old man. Extensive air-space opacities, subcutaneous emphysema and a small amount of pneumothorax were found in his chest X-ray scan. Echocardiography showed left ventricular enlargement with ejection fraction 20%., DIAGNOSIS: This resident of Wuhan with laboratory-confirmed SARS-CoV-2 infection had chronic pulmonary and cardiac diseases. Liver dysfunction, myocardial injury, and coagulation disorder were suggested by laboratory findings. Pneumonia, subcutaneous emphysema, and pneumothorax were confirmed with chest X-ray. Heart failure was revealed by echocardiography., INTERVENTIONS: He was transferred to intensive care unit, where invasive ventilation was used for him during the whole hospitalization. Prone position ventilation, vasoconstrictor, antibacteria, and antiviral therapy were given., OUTCOMES: He died on the twelfth day after admission., CONCLUSIONS: Subcutaneous emphysema and pneumothorax may occur in patients with SARS-CoV-2 pneumonia and chronic pulmonary disease. Chronic cardiac disease might be aggravated by SARS-CoV-2 infection, and develop heart failure.

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1. **Spontaneous pneumomediastinum in a male adult with COVID-19 pneumonia**  
   Anon. American Journal of Emergency Medicine 2020;:No page numbers.

Spontaneous pneumomediastinum in a male adult with COVID-19 pneumonia. Spontaneous pneumomediastinum is a rare complication of viral pneumonia. Here we report a case of a 52 year old male who presented with a spontaneous pneumomediastinum in COVID-19 pneumonia, followed by a severe course of disease. We discuss the pathophysiological mechanisms underlying this association as well as its possible clinical implications as a marker of disease severity in COVID-19.Copyright © 2020 Elsevier Inc. All rights reserved.

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1. **Spontaneous pneumomediastinum in COVID-19**  
   2020;:e236519.

A 49-year-old man presented to the emergency room with 3 days of increasing cough and shortness of breath, both at rest and with minimal exertion, associated with decreased appetite and anosmia. He denied fevers, chills, chest pains, nausea or vomiting. He did suspect recent coronavirus exposure. His medical history was significant for hypertension and type 2 diabetes. He denied tobacco, alcohol or drug use.

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1. **Spontaneous pneumothorax and subcutaneous emphysema in COVID-19 patient: Case report**  
   2020;:887–889.

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome virus coronavirus 2 (SARS-CoV-2). As known, COVID-19 has become a global pandemic and serious health problem. Disease mainly affects lungs and common findings are fever cough and shortness of breath. Computerized tomography (CT) has an important role in initial evaluation and follow up of COVID-19. Main (CT) finding of the disease is bilateral extensive ground-glass opacification (GGO) with a peripheral or posterior distribution, mainly involving the lower lobes. In this case report, we present a pneumothorax and subcutaneous emphysema case in a patient with COVID-19. To the best of authors’ knowledge, it is the first illustrated case of pneumothorax accompanying COVID-19 pneumonia.

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1. **Spontaneous Subcutaneous Emphysema and Pneumomediastinum in COVID-19 Patients: An Indicator of Poor Prognosis?**  
   Al-Azzawi Mohammed The American journal of case reports 2020;21:e925557.

BACKGROUND Novel Coronavirus 2019 (COVID-19) has been in the spotlight since the first cases were reported in December 2019. COVID-19 has been found to cause severe acute respiratory distress syndrome and, more uncommonly, subcutaneous emphysema and pneumomediastinum. We present a case series of 3 patients with COVID-19 infection managed in the Intensive Care Unit and found to have subcutaneous emphysema and pneumomediastinum on chest imaging. CASE REPORT We present a case series of 3 men, ages 36, 47, and 78 years, diagnosed with COVID-19 via RT-PCR, found to have severe acute respiratory distress syndrome, and managed in the Intensive Care Unit. Two patients described in this case series were mechanically ventilated on low positive end-expiratory pressures and developed subcutaneous emphysema and pneumomediastinum on chest imaging, and 1 patient developed subcutaneous emphysema prior to intubation. Each of these patients had a more eventful hospital course and worse outcomes than most COVID-19 infected patients. CONCLUSIONS Subcutaneous emphysema and pneumomediastinum in COVID-19 patients have been rarely reported and is poorly understood. In our institution, we have found the diagnosis of subcutaneous emphysema and pneumomediastinum in COVID-19 patients is associated with unfavorable outcomes and worse prognosis.

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1. **Subcutaneous Emphysema in Patients With COVID-19 Infection: A Report of Three Cases**  
   Toquica Gahona Christian C. Cureus 2020;12:e10559.

Subcutaneous emphysema is a rare complication of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia that should prompt immediate attention to find its cause. Herein, we describe three patients with SARS-CoV-2 pneumonia who were admitted to the ICU and developed subcutaneous emphysema and one with a concomitant pneumothorax. Three patients with diagnosis of SARS-CoV-2 pneumonia admitted to the ICU developed subcutaneous emphysema during the hospital admission. One of them who had concomitant pneumothorax required thoracostomy tube for treatment and the other two were monitored clinically without additional interventions. Two patients died during the first two to three weeks of their hospital course. One patient survived and was discharged after 63 days in the hospital. Subcutaneous emphysema is considered a non-life-threatening condition and is usually self-limited requiring supportive treatment in mild cases. For such cases, observation is appropriate. Patients with newly discovered SE life-threatening pathology, such as pneumothorax, esophageal rupture, and necrotizing infections, should be investigated depending on the clinical setting. This is one of the first paper that shows the development of subcutaneous emphysema in patients with SARS-CoV-2 pneumonia. This may represent a rare complication of the infection as well as may be attributable to other factors such as increased cough and mechanical ventilation. There is a need for studies on the clinical characteristics of a disease with still many unknown features and a wide clinical spectrum that is still being defined. Copyright © 2020, Toquica Gahona et al.

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1. **Subcutaneous Emphysema, Pneumomediastinum, and Pneumothorax in Critically Ill Patients With Coronavirus Disease 2019: A Retrospective Cohort Study**  
   Jones Eben Critical care explorations 2020;2:e0210.

Importance: Management of severe coronavirus disease 2019 relies on advanced respiratory support modalities including invasive mechanical ventilation, continuous positive airway pressure, and noninvasive ventilation, all of which are associated with the development of subcutaneous emphysema, pneumomediastinum, and pneumothorax (herein collectively termed barotrauma)., Objectives: To assess the occurrence rate of barotrauma in severe coronavirus disease 2019 and to explore possible associated factors., Design Setting and Participants: A retrospective, single-center cohort study with nested case series, conducted at University Hospital Lewisham: a 450-bed general hospital in London, United Kingdom. All patients with confirmed coronavirus disease 2019 admitted to the critical care department from March 12, to April 12, 2020, were included., Main Outcomes and Measures: Patients were retrospectively screened for radiological evidence of barotrauma. Admission characteristics, modalities of respiratory support, and outcomes were compared between barotrauma and nonbarotrauma groups. Respiratory parameters in the period preceding barotrauma identification were recorded., Results: Of 83 admissions with coronavirus disease 2019, eight suffered barotrauma (occurrence rate 9.6%; 95% CI 4.3%-18.1%). Barotrauma cases had longer illness duration prior to critical care admission (10 vs 7 d; interquartile range, 8-14 and 6-10, respectively; p = 0.073) and were more often treated with continuous positive airway pressure or noninvasive ventilation as the initial modality of advanced respiratory support (87.5% vs 36.0%; p = 0.007). Patients managed with continuous positive airway pressure or noninvasive ventilation prior to the development of barotrauma had median minute ventilation of 16.2-19.9 and 21.3-22.7 L/min, respectively. Compared with the nonbarotrauma group, a higher proportion of patients with barotrauma had died (62.5% vs 43.2%), and a lower proportion of patients had been discharged (25.0% vs 53.3%) at 3-month follow-up., Conclusions and Relevance: Barotrauma appears to be a common complication of severe coronavirus disease 2019. Determining whether high minute ventilation while using continuous positive airway pressure or noninvasive ventilation predisposes patients to barotrauma requires further investigation. Copyright © 2020 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of the Society of Critical Care Medicine.

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1. **The coronavirus diseases 2019 (COVID-19) pneumonia with spontaneous pneumothorax: a case report**  
   Anon. BMC Infectious Diseases 2020;20:662.

The coronavirus diseases 2019 (COVID-19) pneumonia with spontaneous pneumothorax: a case report. The outbreak of the novel coronavirus (COVID-19) that was firstly reported in Wuhan, China, with cases now confirmed in more than 100 countries. However, COVID-19 pneumonia with spontaneous pneumothorax is unknown.We reported a case of 66-year-old man infected with COVID-19, presenting with fever, cough and myalgia; The patient received supportive and empirical treatment including antiviral treatment, anti-inflammatory treatment, oxygen supply and inhalation therapy; The symptoms, CT images, laboratory results got improved after the treatments, and a throat swab was negative for COVID-19 PCR test; However, on the hospital day 30, the patient presented with a sudden chest pain and dyspnea. CT showed a 30-40% left-sided pneumothorax. Immediate thoracic closed drainage was performed and his dyspnea was rapidly improved. With five more times negative PCR tests for SARS-CoV-2 virus, the patient was discharged and home quarantine.This case highlights the importance for clinicians to pay attention to the appearance of spontaneous pneumothorax, especially patients with severe pulmonary damage for a long course, as well as the need for early image diagnose CT and effective treatment once pneumothorax occurs.

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1. **The Use of POCUS to Manage ICU Patients With COVID-19**  
   Schrift David Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine 2020;:No page numbers.

Since the advent of SARS-CoV-2, the virus that causes COVID-19, clinicians have had to modify how they provide high-value care while mitigating the risk of viral spread. Routine imaging studies have been discouraged due to elevated transmission risk. Patients who have been diagnosed with COVID-19 often have a protracted hospital course with progression of disease. Given the need for close follow-up of patients, we recommend the use of ultrasonography, particularly point-of-care ultrasound (POCUS), to manage patients with COVID-19 through their entire ICU course. POCUS will allow a clinician to evaluate and monitor cardiac and pulmonary function, as well as evaluate for thromboembolic disease, place an endotracheal tube, confirm central venous catheter placement, and rule out a pneumothorax. If a patient improves sufficiently to perform weaning trials, POCUS can also help evaluate readiness for ventilator liberation. Copyright © 2020 American Institute of Ultrasound in Medicine.

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1. **Unusual presentations of COVID-19 pneumonia on CT scans with spontaneous pneumomediastinum and loculated pneumothorax: A report of two cases and a review of the literature**  
   Anon. Heart & Lung 2020;:No page numbers.

Unusual presentations of COVID-19 pneumonia on CT scans with spontaneous pneumomediastinum and loculated pneumothorax: A report of two cases and a review of the literature. Spontaneous pneumomediastinum (SPM) and Loculated pneumothorax (LPNX) are both generally rare clinical and radiological conditions associated with Coronavirus Disease 2019 (COVID-19). We report for the first time clinical data and radiological chest CT imaging of two patients affected by COVID-pneumonia associated with early radiological findings of SPM and LPNX.Copyright © 2020 Elsevier Inc. All rights reserved.

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## C. Search History

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