Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

insertion location of chest tubes, which may have affected their overall function more than size alone.

In conclusion, in our institutional experience, the incidence of secondary pneumothorax in patients admitted with COVID-19 was 7.4%. The development of a pneumothorax was associated with the need for mechanical ventilation and/or extracorporeal membrane oxygenation. Placement of a large-bore chest tube for pneumothorax was associated with fewer complications than a small-bore tube. Patients with COVID-19-associated pneumothorax had a significantly higher in-hospital mortality rate than COVID-19 patients who did not develop a pneumothorax, which was primarily driven by mortality in patients requiring mechanical ventilation.

REFERENCES

1. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *JAMA*. 2020:3231239-3231242.

2. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *JAMA*. 2020;323:2052-2059.

3. Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary vascular endothelialitis, thrombosis, and angiogenesis in Covid-19. *N Engl J Med*. 2020;383:120-128.

4. Wang XH, Duan J, Han X, et al. High incidence and mortality of pneumothorax in critically Ill patients with COVID-19. *Heart Lung*. 2021;50:37-43.

5. Anzueto A, Frutos-Vivar F, Esteban A, et al. Incidence, risk factors and outcome of barotrauma in mechanically ventilated patients. *Intensive Care Med*. 2004;30:612-619.

6. Gattinoni L, Bombino M, Pelosi P, et al. ARDS: lung structure and function in different stages of severe adult respiratory distress syndrome. *JAMA*. 1994;271:1772-1779.

7. Woodside KJ, vanSonnenberg E, Chon KS, Loran DB, Tocino IM, Zwischenberger JB. Pneumothorax in patients with acute respiratory distress syndrome: pathophysiology, detection, and treatment. *J Intensive Care Med*. 2003;18:9-20.

8. Sihoe ADL, Wong RHL, Lee ATH, et al. Severe acute respiratory syndrome complicated by spontaneous pneumothorax. *Chest*. 2004;125:2345-2351.

9. Máca J, Jor O, Holub M, et al. Past and present ARDS mortality rates: a systematic review. *Respir Care*. 2017;62:113-122.

10. Jones E, Gould A, Pillay TD, et al. Subcutaneous emphysema, pneumomediastinum, and pneumothorax in critically ill patients with coronavirus disease 2019: a retrospective cohort study. *Crit Care Explor*. 2020;2:e0210.

11. Leigh-Smith S, Harris T. Tension pneumothorax—time for a re-think? *Emerg Med J*. 2005;22:8-16.

12. Castiglioni M, Pelosi G, Meroni A, et al. Surgical resections of superinfected pneumatoceles in a COVID-19 patient. *Ann Thorac Surg*. 2021;111:e23-e25.

13. Geraci TC, Narula N, Smith DE, et al. Lobectomy for hemorrhagic lobar infarction in a patient with COVID-19. *Ann Thorac Surg*. 2021;111:e183-e184.

Similar Yet Different: The COVID-19 Pneumothorax

INVITED COMMENTARY:

It's hard to imagine that the COVID-19 pandemic officially began nearly 500 days ago. The pandemic rages on, and therefore we must look back at what has been learned over the previous year. March through April 2020 in New York City was a time of uncertainty. Although there have been a multitude of papers describing the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) itself, there has been less emphasis on secondary complications of the disease, such as pneumothorax.[1] Thoracic surgeons on the front lines will agree that, anecdotally, COVID-19 appears associated with high rates of pneumothorax. But what do the actual data show? In this issue of *The Annals of Thoracic Surgery*, Geraci and coauthors[2] describe the NYU Langone experience with incidence, treatment trends, and recommendations on management.

During the height of the pandemic, Geraci and associates[2] describe 1595 patients admitted to the main Manhattan campus of NYU Langone with COVID-19, of whom 7.4% developed pneumothorax. Although most were mechanically ventilated, almost 20% were not. Median chest tube duration was 12 days—longer than your typical non-COVID pneumothorax.

What have we learned about COVID-19 pneumothoraces? Generally, the air leaks are large and hemodynamic compromise is significant. Geraci and colleagues[2] saw a 21% rate of tension physiology, including 2 cardiopulmonary arrests. Much of this is likely due to the high levels of positive pressure being used to oxygenate COVID-19 patients during this time period. Small-bore chest tubes were rarely effective. Placement of a 14 F or smaller pigtail for management of a routine pneumothorax is now well accepted in the medical community,[3] and, prior to COVID-19, I personally cannot remember the last time I used a large-bore (>24 F) chest tube. With COVID-19, small-bore chest tubes are less likely to lead to full lung reexpansion, and often became obstructed, requiring upsizing. An additional sequela of COVID-19 are pneumatoceles, seen in a minority of patients during initial hospitalization or even months later. These can be treated by minimally invasive marsupialization if infected or related to persistent leak, but are largely asymptomatic and may regress in time.

As we enter yet another COVID surge, it is important to develop treatment algorithms and understand what the latest data show. Go straight to the large-bore chest tube, expect a large air leak, and sit tight on those pneumatoceles.

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REFERENCES

1. Palumbo D, Campochiaro C, Belletti A, et al. Pneumothorax/pneumomediastinum in non-intubated COVID-19 patients: differences between first and second Italian pandemic wave. *Eur J Intern Med*. 2021;88:144-146.

2. Geraci TC, Williams D, Chen S, et al. Incidence, management, and outcomes of patients with COVID-19 and pneumothorax. *Ann Thorac Surg*. 2022;114:401-408.

3. Chang SH, Kang YN, Chiu HY, et al. A systematic review and meta-analysis comparing pigtail catheter and chest tube as the initial treatment for pneumothorax. *Chest*. 2018;153:1201-1212.