



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Pulmonary Lobectomy After COVID-19



Alberto Testori, MD, Gianluca Perroni, MD,
Emanuele Voulaz, MD, Alessandro Crepaldi, MD, and
Marco Alloisio, MD

Humanitas Clinical and Research Center - IRCCS, Thoracic
Surgery Department, Rozzano, Milan, Italy

Concomitant coronavirus disease 19 (COVID-19) is a major risk factor for complications in any type of surgical procedure, especially in thoracic surgery, where the primary organ involved, the lung, is manipulated to perform parenchymal resection. However, it is not clear whether previous infection from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may lead to increased morbidity and mortality for subsequent procedures once radiologic resolution is achieved. We report a young patient with lung cancer who successfully underwent a right upper lobectomy for primary adenocarcinoma by video-assisted thoracoscopic surgery with no complication in the early postoperative phase.

(Ann Thorac Surg 2021;111:e181-2)

© 2021 by The Society of Thoracic Surgeons

Rapid spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) increased the number of patients who presented at emergency departments with respiratory distress related to coronavirus disease 2019 (COVID-19). More chest scans are performed along with nasal swab to correctly diagnose the novel syndrome; therefore, the chances to detect lung nodules increase and management of those patients may be difficult. When concomitant, COVID-19 increases complications of surgical procedures because of subsequent immune impairment. However, no data are available on whether previous infection with COVID-19 generates a persistent risk. We present a case of successful pulmonary lobectomy for lung cancer in a patient with a previous history of COVID-19.

A 46-year-old man with a previous 40 pack-year smoking history came to our emergency department for worsening dyspnea and fever. A chest roentgenogram showed diffuse bilateral opacities with peripheral distribution. A computed tomographic (CT) chest scan revealed peripheral bilateral ground-glass opacity (GGO) with crazy paving appearance plus a 40-mm nodule in the right upper lobe. A nasal swab tested positive for SARS-CoV-2, and the diagnosis of COVID-19 was made.

Overall, the patient's condition was good, and treatment in the intensive care unit was not necessary. The patient was discharged 5 days later. A repeated nasal

swab at 16 days was negative, and a positron emission tomography/CT after 30 days showed a standardized uptake value (SUV) of 9 for the nodule, with slight inflammatory uptake of hilar and mediastinal lymph nodes. Improvement of lung opacities was noted (Figure 1).

A CT-guided biopsy was offered, but the patient refused and preferred up-front operation. His medical history was positive for obstructive sleep apnea syndrome. Pulmonary function was within normal ranges, with forced expiratory volume in 1 second of 3.99 liters (102% of predicted value) and forced vital capacity of 4.98 liters (103%). Diffusion capacity of the lung for carbon monoxide (DLCO) was preserved (99%).

Upon arrival, the chest CT scan and nasal swab were repeated according to our hospital policy, showing, respectively, reduction of GGO and negativity for SARS-CoV-2.¹

A standard right upper lobectomy with lymphadenectomy was performed with video-assisted thoracoscopic surgery after 45 days from the first diagnosis. During the surgical procedure, adhesions between the lung and mediastinal structure were noted (Figure 2). The surgeon experienced some difficulty, describing tissues around the hilum as very firm and tough when cutting, with extremely enlarged lymph nodes (Figure 3). Operative time was 215 minutes with no blood loss. There were no complications in postoperative period, and the patient was discharged after 3 days.

For comparison, we analyzed length of stay and time to completion of the right upper lobectomy from the same surgeon. No difference was present for length of stay, but time to completion was longer (152.5 vs 215 minutes). A 4.3-cm gray lesion was found in the specimen, and histopathologic diagnosis of pT2b N0 adenocarcinoma was made (14 lymph nodes all negative). No alteration was found in the rest of examined lung.

Comment

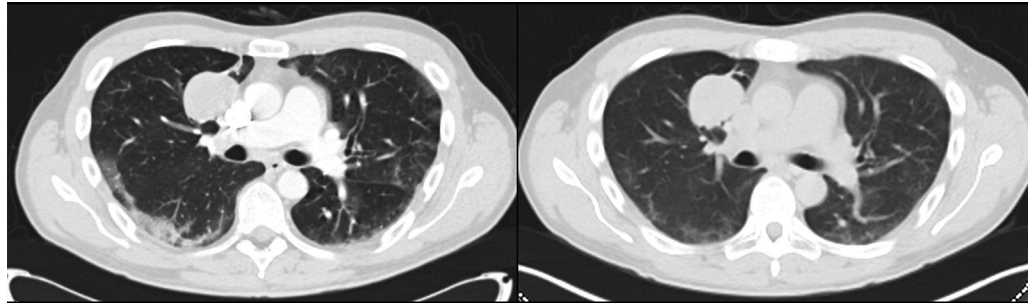
It is well established that COVID-19 that develops in perioperative time is a risk factor for increased length of stay, morbidity, and mortality.² However, no data are available on patients who have recovered from this novel syndrome and been scheduled for elective surgical procedure. Appropriate timing is unclear. Pan and colleagues³ evaluated chest CT scans from 21 patients performed every 4 days after the initial diagnosis, finding maximum peak of lung consolidation at 9 to 13 days, with a reduction after 14 days. Lei and colleagues⁴ observed a 19.5-day interval for real-time polymerase chain reaction conversion with subsequent radiologic improvement.⁴ Delay in operation is an independent risk factor for upstaging and decreased median survival; however, 8 weeks is an acceptable time lapse according to British Thoracic Society Guidelines.⁵

DLCO is a reliable assessing method for postoperative complication risk in thoracic surgery, with 40% as threshold.⁶ Mo and colleagues⁷ tested DLCO in a patient with COVID-19 on the day of or 1 day before discharge,

Accepted for publication Aug 19, 2020.

Address correspondence to Dr Testori, Humanitas Clinical and Research Center - IRCCS, Thoracic Surgery Department, Via Manzoni 56, 20089 Rozzano, Milan, Italy; email: alberto.testori@humanitas.it.

Figure 1. Chest computed tomography scans (left) before and (right) 30 days after coronavirus disease 2019 (COVID-19). An almost complete resolution of peripheral opacities is visible.



finding a greater reduction in those with severe pneumonia and critically ill. Whether the reduction is persistent or transient is not clear, and further studies are needed.

Changes in the lung structure during the early phases of COVID-19 were previously described by Tian and colleagues,¹ with alveolar edema, type II pneumocyte hyperplasia, and multinucleated giant cells. In a more recent report, autptic examination of 7 lungs from COVID-19 patients confirmed findings of diffuse alveolar damage, with more prominent endothelial injury, intussusceptive angiogenesis, and capillary microthrombi compared with specimens from patients who died of acute respiratory distress syndrome or influenza A (H1N1).⁸

In the examined specimen from our patient, no alteration from the previous infection was found, thus meaning a complete restoration is possible in some cases, but further studies are mandatory. However, abnormal inflammation may negatively affect nearby structures (eg, visceral and parietal pleura, lymph nodes), which can cause adhesions and nodal swelling.

In conclusion, lobectomy after COVID-19 was safe, with no increase in length of stay. The mean operative time was longer due to presence of thickened tissues, adhesions, and enlarged lymph nodes, but no major complication occurred. In our experience, improvement of radiologic features along with a good DLCO were useful in predicting a good outcome; however, defining

appropriate timing for surgical procedure may be hard. Due to an increased risk of upstaging, we recommend not to exceed 8 weeks from the diagnosis.

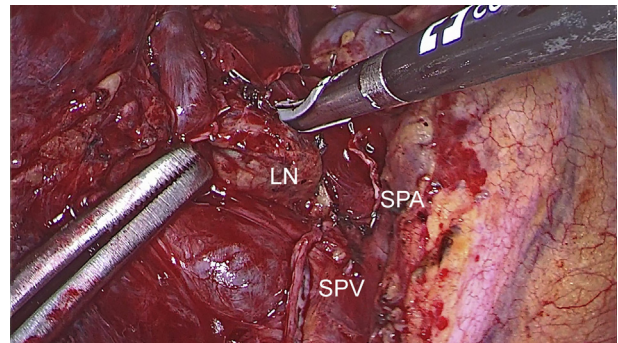


Figure 3. After closure and section of the superior pulmonary artery (SPA) and superior pulmonary vein (SPV), an enlarged lymph node (LN) blocking the passage to right upper bronchus is present.

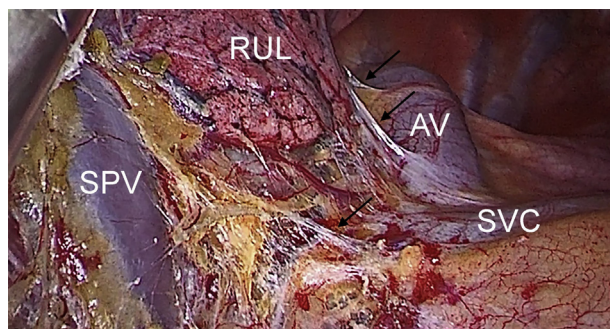


Figure 2. Initial dissection during lobectomy. From left to right: superior pulmonary vein (SPV), right upper lobe (RUL), Azygos vein (AV), and superior vena cava (SVC). The arrows indicate adhesions between lung and hilar structures.

References

1. Testori A, Alloisio M, Errico V, Perroni G, Gatzemeier W, Tinterri C. Extraordinary emergency measures set up by a breast unit to prevent COVID-19: report of our experience. *Breast J.* 2020;26:1611-1612.
2. Tian S, Hu W, Niu L, Liu H, Xu H, Xiao SY. Pulmonary pathology of early-phase 2019 novel coronavirus (COVID-19) pneumonia in two patients with lung cancer. *J Thorac Oncol.* 2020;15:700-704.
3. Pan F, Ye T, Sun P, Zhang GJ. Time course of lung changes at chest CT during recovery from coronavirus disease 2019 (COVID-19). *Radiology.* 2020;295:715-721.
4. Lei S, Jiang F, Su W, Zhang GJ. The clinical dynamics of 18 cases of COVID-19 outside of Wuhan. *Eur Respir J.* 2020;55:2000398.
5. BTS recommendations to respiratory physicians for organising the care of patients with lung cancer. The Lung Cancer Working Party of the British Thoracic Society Standards of Care Committee. *Thorax.* 1998;53(Suppl 1):S1-S8.
6. Lim E, Baldwin D, Beckles M, et al. Guidelines on the radical management of patients with lung cancer. *Thorax.* 2010;65(Suppl 3):iii1-iii27.
7. Mo X, Jian W, Su Z, et al. Abnormal pulmonary function in COVID-19 patients at time of hospital discharge. *Eur Respir J.* 2020;55:2001217.
8. 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.