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SARS-COV-2 infection in the perioperative of pulmonary lobectomy. About a case

Ricardo Taipe[a,*], Mardonio Euscatigue[a], Fernando Valdivia[a], Brenner Belloso[b], Irene Huaroto[c]

[a] Thorax and Cardiovascular Surgeon, Thoracic Surgery Service of the Guillermo Almenara Hospital, Lima, Peru
[b] Anesthesiology and Intensive Therapy, Anesthesiology and Resuscitation Service of the Guillermo Almenara Hospital, Lima, Peru
[c] Pathological Anatomy, Specialized Pathology Department of the San Bartolome Hospital, Lima, Peru

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ABSTRACT

OBJECTIVE: To describe the form of severe clinical presentation of SARS-COV-2 infection in the early phase, also the timely treatment of COVID-19 pneumonia in postoperative pulmonary lobectomy.
METHOD: Case report where the data were extracted from the clinical history and is in accordance with the SCARE 2018 criteria.
DESCRIPTION OF THE CASE: A 36-year-old man, with no significant history, who presented fever and mucopurulent expectoration of 1 month of evolution, received antibiotics for 4 weeks without response to treatment. Chest tomography shows cystic image with heterogeneous content in the left lower lobe. We decided to opt for surgery, previously 1 PCR in RT and 7 serological tests for COVID-19 were performed, the result of which was non-reactive. In the postoperative period, the patient developed fever and dyspnea on mild exertion, so a new serological test for COVID-19 was performed: IgM/IgG reactive, in addition chest tomography showed both lungs with "*cracy paving*" pattern.
DISCUSSION: The serological tests did not contribute to a timely diagnosis of COVID-19 and generated confusion. We used oxygen therapy, broad spectrum antibiotics since the diagnosis of COVID-19. Likewise, respiratory physiotherapy was intensified even after discharge.
CONCLUSION: The early diagnosis and use of antibiotics at doses of sepsis, associated with corticosteroid pulses and respiratory physiotherapy improve COVID-19 pneumonia in postoperative lung surgery.

1. Introduction

Lung abscess is one of the most common lung infectious diseases in the world and is characterized by purulent collection in the cavity secondary to necrosis of the lung parenchyma. Generally the treatment is based on antibiotic therapy; however, when the lung abscess becomes chronic or presents complications such a hemoptysis, the lung surgery is the most pertinent option. The lobectomy is the surgery of choice for chronic lung abscess; however, postoperative complications are the main cause of postoperative morbidity and mortality; for example, pneumonia has an incidence in the remaining lung that varies from 2 to 22%. In mid-December 2019, the COVID-19 epidemic broke out in Wuhan Hubei province, China. Currently the number of confirmed cases continues to increase rapidly in many countries around the world, especially in Latin America. Although the general mortality rate for this viral infection is around 2–3% in certain population groups (diabetes mellitus, patients undergoing surgery for other indications) it can increase to 50% [1]. In the presence of the COVID-19 pandemic, two scenarios should be considered: the first surgical trauma and stress responses can lead to weakened immune systems that also makes patients susceptible to SARS-COV-2 infection and have a higher risk of death after becoming infected, so we must delve into the preoperative diagnosis of this infection to offer timely treatment. The second, pulmonary pathology can coexist with COVID 19 infection and in this case the risk-benefit of the surgical intervention should be assessed, especially if the patient has low surgical risk and the surgery is considered urgent. Here we report a case that provides experience and lessons for clinical and pathological diagnosis; as well as its timely treatment in the context of SARS-COV-2 pandemic.

Abbreviations: SARS-COV-2, Severe acute respiratory syndrome coronavirus 2; COVID-19, Coronavirus disease-19; RT PCR, Real time polymerase chain reaction; IgM/IgG, Immunoglobulins M and G; AARB, Acid alcohol resistant bacillus; C-RP, C-reactive protein; LDH, Lactate dehydrogenase; SatO2, Oxyhemoglobin saturation; PaO2, Oxygen blood pressure; FiO2, Inspired fraction oxygen; WHO, World Health Organization.

* Corresponding author.
E-mail address: ricardoluis222@hotmail.com (R. Taipe).

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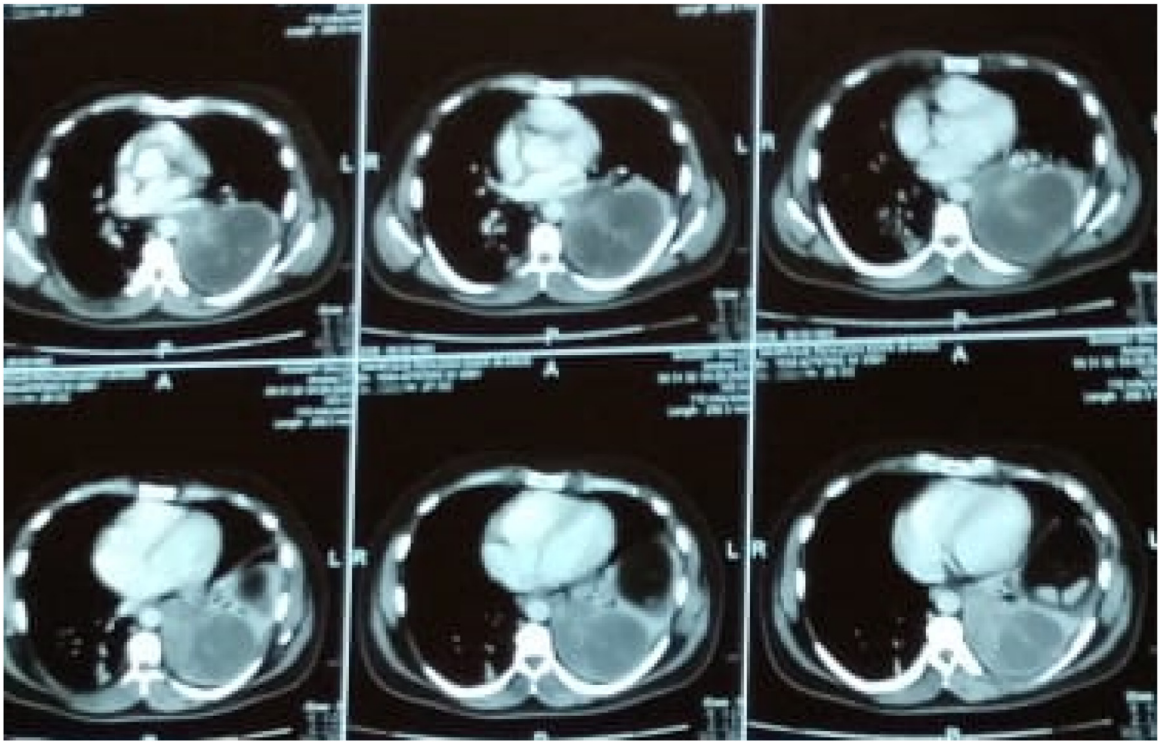


Fig. 1. Preoperative chest tomography shows a cystic image with heterogeneous content and a thickened wall that compromises the lower left lobe.

Fig. 2. Preoperative chest tomography showing the lower third of the lung showing signs of hepatization.

2. Methodology

The data consigned in this case report were extracted from the clinical history, pathological report and operative report of the patient, who underwent pulmonary surgery for lung abscess complicated with hemoptysis and presented severe form of COVID-19 in the postoperative period. Likewise, the patient authorized and consented to the publication of this case. Likewise, this case report is in accordance with the SCARE 2018 criteria [12].

3. Case report

Male patient, 36 years old, from Cañete - Peru. Presents illness time of 1 month, associated with symptoms such as general malaise, productive cough and fever. In the chest X-ray: it presents homogeneous radiopacity, defined edges 8 cm in diameter in the lower third of the left hemithorax. At the beginning, he was treated with ciprofloxacin + cephalosporins, without remitting symptoms, so he underwent a chest tomography in the third week of illness, which revealed a "cystic" image with heterogeneous content in the left lower lobe, suggestive of lung abscess versus Complicated pulmonary hydatid cyst (*see* Figs. 1 and 2). Therefore, it is treated with vancomycin and intravenous meropenem. Despite antibiotic treatment, symptoms of fever persist and chest pain and hemoptysis of 50–100cc in volume were added, 1 week before surgery. In the context of the COVID-19 pandemic in Peru, 6 serological tests were performed to discard SARS-COV-2 and 1 real time PCR at Cañete Hospital, which were non-reactive. Patient is referred from Cañete hospital to a clinic in Lima for surgical intervention; in this establishment, a novo serological test to discard COVID-19 was performed, the result was non-reactive. Therefore, the surgery is performed under strict biosecurity measures: N95 masks, personal protective equipment for all participants. The approach was performed by left vertical axillary thoracotomy, general anesthesia, and one-lung ventilation. The surgery performed: lower left lung lobectomy; the findings were: pleuroparenchymal adhesions and the lower lobe of the left lung was "hepatized" (*see* Figs. 3 and 4); bleeding approximately 100cc so it was not necessary transfusion of blood components. During the surgical procedure, the patient proceeds without intercurrences, tolerates surgery without com-

Fig. 3. Postlobectomy surgical specimen shows hepatized left lower lobe.

Fig. 4. Resected left lower lobe shows lung abscess with signs of vascular thrombosis and edematous lung parenchyma that compromises its entire extension.

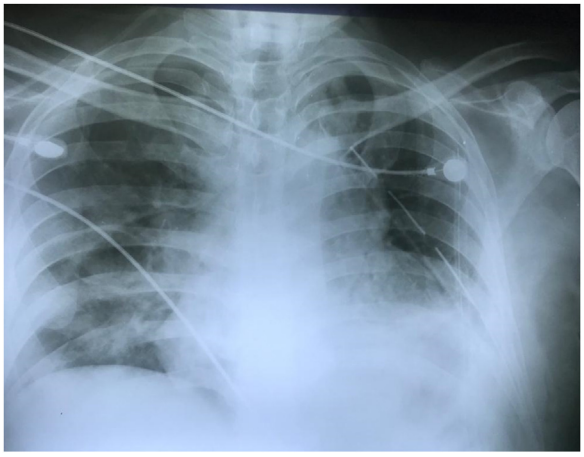


Fig. 5. Chest X-ray on the second postoperative day shows left lung reexpansion, no signs of pneumonia in the lung parenchyma, chest drainage directed towards the lung dome.

plications, goes to recovery room with oxygen therapy: 3 L/min by binasal cannula. On the first postoperative day, he presented tachycardia and tachypnea. In addition, chest radiograph shows atelectasis of the left upper lobe (*see* Fig. 5); therefore, it is intensified in respiratory physiotherapy. Regarding chest drainage: the first day: 150 cc of serohematic fluid.

On the second postoperative day, he persisted with fever of 38.5 °C, tachycardia and tachypnea, therefore we started vancomycin 1 g every 12 h and meropenem 1 g every 8 h, in addition,

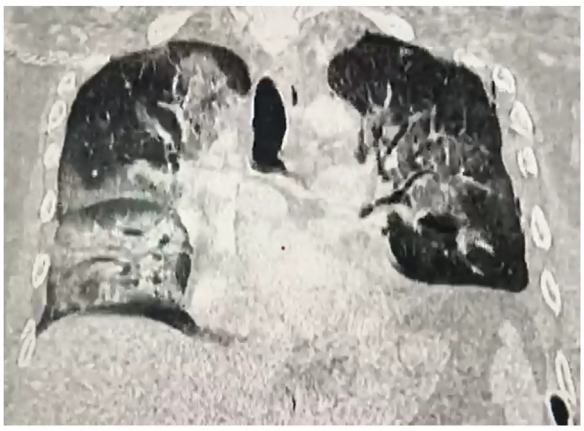


Fig. 6. Tomography of the chest on the fourth postoperative day shows a ground glass pattern, compatible with SARS-COV-2 pneumonia. Note the involvement of both lungs, but predominantly the right lung.

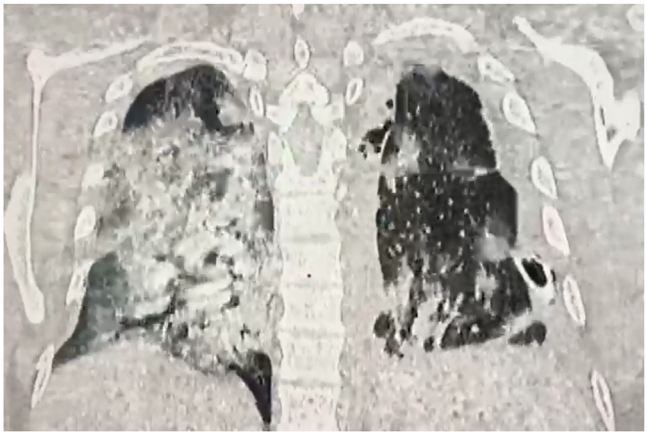


Fig. 7. Chest tomography on the fourth postoperative day shows a "crazy paving" pattern of SARS-COV-2, especially of the right lung. Note the re-expansion of the left upper lobe after surgery.

he continued with oxygen therapy by binasal cannula 2 L/min (SatO2 = 96%). On the third postoperative day, he presents 2 fever peaks of 39 °C, for which the dose of meropenem is increased to 2 g every 8 h. Likewise, the oxygen requirement increases since he presents sudden desaturation (Sat O2 = 82%), for which we change to high-flow oxygen therapy by reservoir mask at 10 L/min. Despite supplemental oxygen, oximetry ranged from 94 to 95%. Thoracic drains in 200 cc serous fluid. No air leak. Hemogram: leukocytes 11, 200 and hemoglobin: 10 g/dl.

On the fourth postoperative day, the fever partially subsided, but persisted with an oxygen requirement of up to 15 L/min per mask with a reservoir. The oximetry ranged between 89–90% with this therapy. Patient presents poor general condition, tachycardia and polypneic. Due to a torpid evolution, we requested a chest CT scan with contrast. In this examination, the right lung presents a ground glass image in the three lobes associated with areas of multiple consolidation compatible with the Crazy Paving pattern of SARS-COV-2 (see Figs. 6 and 7). In the mediastinal view there are no signs of pulmonary thromboembolism. Left upper lobe is shown with almost complete expansion and minimal left pleural effusion. Consequently, a serological test for COVID-19 is repeated, which has a reactive result (IgM/IgG).

During the fifth to seventh postoperative day, the patient presented polypnea, fever, sweatiness and tachycardia despite pain management with ketorolac and tramadol. He was evaluated by infectiology who suggested blood cultures due to the

Table 1
Evolution of vital functions in the perioperative period.

V. F.	PO1	PO3	PO4	PO5	PO7	PO8	PO9	PO10	PO13	PO14	PO15	PO16
T (°C)	38,5	39	38,2	39	38	38	37,5	36,8	37	36	36,5	36
HR (bpm)	95	118	116	92	100	105	94	90	92	84	86	80
SatO2 (%)	97	93	90	86	90	88	90	93	94	96	97	98

V. F.: Vital functions, T: Temperature, HR: Heart rate, SatO2: Oximetry, PO: postoperative day, bpm: beats per minute, °C: degrees Celsius.

suspicion of added bacterial infection and search for AARB (acid-alcohol resistant bacillus). Patient persists with poor evolution, severe hypoxemia despite supplemental high-flow oxygen therapy (reservoir mask). Consequently, due to the severe SARS-COV-2 pneumonia, it is proposed to refer the patient to a center with a mechanical ventilator and an intensive care unit. However, despite the efforts to refer him to a more complex center, there was no success due to the spread of the coronavirus infection in our country. Therefore, it was decided to maintain high-flow oxygen therapy, respiratory physiotherapy, conscious pronation, and absolute rest.

The blood counts, C-reactive protein, LDH, D-dimer, serum ferritin are requested and antibiotic coverage is changed to meropenem 2 g intravenously every 8 h. NSAIDs and nebulizations are suspended while enoxaparin is started at a dose of 60 mg subcutaneous every 12 h, likewise, Ivermectin 6 mg/dL is administered at a dose of 60 drops per day, for two consecutive days.

During the eighth to the twelfth postoperative day, the patient presents elevated acute phase reactants, associated with a torpid evolution and poor ventilatory dynamics despite oxygen support and the indicated therapy, within the framework of the so-called "cytokine storm" of SARS-COV-2. Consequently, at this stage it is decided to start pulses of hydrocortisone; in addition, the oxygen flow as administered at 100% and the oxygen saturation ranged between 88–90%. On the other hand, the pathological anatomy results of the surgical specimen showed: left lower lobe, findings compatible with chronic lung abscess associated with bronchiectasis, surrounding lung parenchyma with signs of acute infection.

From the third week after surgery, the patient begins to show clinical improvement; that is, the fever resolved and the flow of oxygen decreased to 50% (FiO2 = 0.50). Also we continue with respiratory physiotherapy antibiotic coverage. Likewise, acute phase reactants began to decrease and ventilatory and hemodynamic parameters began to improve. During the fourth week, the patient improved oximetry to 94–95% with FiO2 = 0.30 and improved general condition, as well as his appetite.

Consequently, at the end of the third to fourth week after surgery, our patient was discharged from the hospital, spontaneously ventilating with antibiotic coverage, low-dose corticosteroids, and a high-protein diet; in addition, he continued with his respiratory rehabilitation therapy and incentive inspirometry.

4. Discussion of results

The disease caused by the new coronavirus-19 (COVID-19) appeared in December 2019 in China and spread to the entire world in two months, causing a pandemic and thousands of deaths from severe acute respiratory syndrome 2 (SARS-COV-2). This coronavirus is an enveloped RNA virus and is highly infectious (subgenus sarbecvirus, subfamily Orthocoronavirinae). The main mode of transmission through droplets of the respiratory tract (aerosols) and also by direct contact. The incubation period for this virus is generally 4–8 days and the most common symptoms of COVID-19 are fever and cough and some cases dyspnea. On the other hand, pneumonia is known to be the most common complication after surgical lung resection. However, there are several studies in the literature that report on the perioperative clinical course of COVID-19 pneumonia in patients who underwent lung resection for lung cancer, such as lobectomy or pneumonectomy (1). Most patients present with the asymptomatic or mild form of the disease, but approximately 15–20% fall into the severity group, which means that they require oxygen support as part of the treatment. This group has a high mortality rate and is associated with advanced age, underlying disease such as diabetes mellitus, or medical procedures (surgical intervention for other indications), as in our case [2]. The patient presented persistent fever from the first post-operative day, accompanied by cough, dyspnea, and tachycardia. Although these symptoms are typical of COVID-19, they are also common symptoms in postoperative lung surgery patients. Therefore, it was a great challenge for us to distinguish between COVID-19 and nonspecific pneumonia in the context of lung surgery, especially because the patient had 7 serological tests (so-called rapid) for detection of anti-COVID-19 antibodies: negative. In this case, the computed tomography of the chest was decisive for the diagnosis of this disease, since it showed an image of bronchopneumonia with a wide distribution, a c̈razy pavingp̈attern, both in the operated lung and the non-operated lung; however the right lung (not operated) was the most affected [3] (See Table 1).

Bacterial and fungal superinfections have been described after COVID-19 pneumonia; There are even reported cases of lung abscess post-infection by COVID 19, up to 1 month after the viral infection. Likewise, the reports presented in the medical literature do not specify whether this complication is a direct consequence of the specific toxicity related to COVID-19 [4]. The remarkable thing about this case is that the lung abscess had already been present since 1 month before the symptoms of COVID-19 pneumonia, so the possibility that the abscess is directly due to COVID-19 is unknown. In addition, this case teaches us that we must be aware of the complications of COVID-19 and that serological tests to detect anti-COVID-19 antibodies have many false negatives. The case reported accidentally represents a COVID-19 lung sample, since the surgery performed was due to a chronic lung abscess complicated with hemoptysis.

However, the literature reports that the incubation period until the appearance of symptoms after exposure to SARS-COV-2 is on average 4–5 days and this period can be extended up to 14 days, so our patient probably already the infection was present before the scheduled surgery but it was in an early phase not detected by serological tests (incubation period). Likewise, the initial symptoms, which appeared after 2 days, such as fever, cough and dyspnea could have been confused with postoperative complications of chest surgery. However, dyspnea and the high flow oxygen requirement, together with the tomographic findings, were key for the diagnosis of severe COVID-19 pneumonia; Since according to clinical, radiological and laboratory criteria, the patient had to enter the intensive care room; However, it was not achieved because at that time the hospitals and clinics in our country were collapsed (See Table 2).

The biomedical literature refers that a critical factor is early diagnosis, since late diagnosis is associated with high mortality. Likewise, some authors refer that lymphopenia is due to the redistribution of lymphocytes to the tissues of the affected target organ, another possibility is that the SARS-COV-2 virus produces myelosuppression [7]. Consequently, due to a timely diagnosis, our patient was managed with strict monitoring and high-flow oxygen

Table 2
Evolution of arterial gases in the perioperative period.

AGA	V. N.	Postoperative 4	Postoperative 7	Postoperative 10	Postoperative 14
pH	7.37–7.45	7,2	7,1	7.4	7.5
pO2	71–104	60	54	56	62
pCO2	35–46	50	51	34	36
HCO3	21–26	20	18	23	29
Sat O2	94–100%	91	88	90	93
FIO2		0,4	0,5	0,6	0.32

AAG: Analysis of arterial gases, N. V.: Normal values.

Table 3
Results of acute phase reactants and requested tests.

Exam	Preoperative	Posoperative 4	Postoperative 7	Postoperative 10	Postoperative 14
Red blood cells	4430000	3810000	3410000	3740000	3520000
Leukocytes	9890	19600	23200	12850	10800
Segmented	89%	85	89	80	80
Stocked	0%	1	2	0	0
Lymphocytes	20%	6%	3%	4%	18%
Platelets	309000				
Hemoglobin	13.6	13	12,8	11,6	10.6
Creatinine	0,35	0,34	0,34	0.26	
Ferritin		1350	3809	1715	780
DHL		1050	1143	1067	910
Proteina C		90	144	63	23
D-dimer		17	17		8

DHL: Lactate dehydrogenase, N.V.: Normal values.

therapy, associated with full anticoagulation and broad-spectrum antibiotic therapy. Other authors have reported that the degree of decrease in the number of lymphocytes after lung surgery is closely related to the progression of COVID-19 [8], in the case of our patient there was a progressive decrease in the initial lymphocyte count (value absolute) and remained so during 2 weeks of treatment (See Table 3).

Likewise, typical COVID-19 chest tomography images are characterized by: g̈round glassp̈attern (indicator of the early exudative phase), reticular pattern and consolidation (indicator of progressive disease) [5,9]; in our case, the patient developed a severe "ground glass" pattern called c̈razy pavingp̈attern that affected 70% of the right lung (not operated) and 20% of the remaining lung lobe. The involvement of the left upper lobe (remnant) was minor and was probably due to the surgery performed (lobectomy). It is worth mentioning that our patient was requested a chest tomography 5 days before surgery, where the lungs did not show radiological signs of COVID-19. On the other hand, our patient has over-aggregated bacterial infection, either due to colonization, atelectasis or bacteremia, so the COVID-19 pneumonia that the patient developed was aggressive with marked elevation of ferritin, D-dimer, lactate dehydrogenase (LDH), protein C-reactive (PCR), among others (see Table 3).

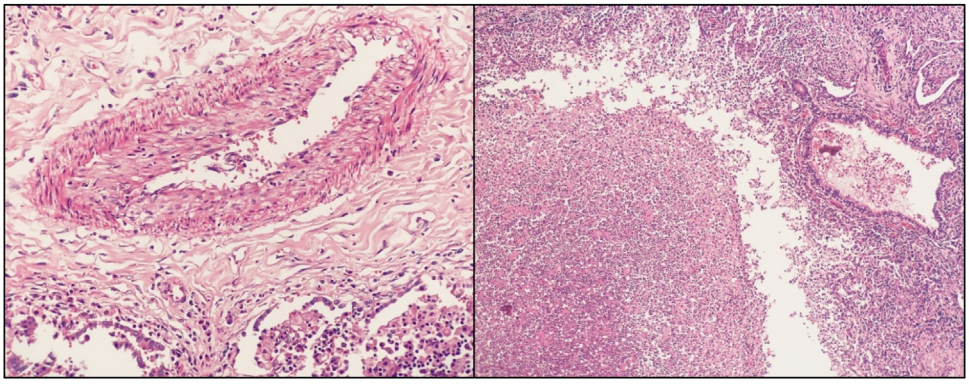
Therefore, during the pandemic, even in asymptomatic patients, we recommend being evaluated with at least one chest X-ray before surgery to reduce the risk of infection. The main pathological result of the surgical specimen was lung abscess; however, non-typical abscess signs and patterns are observed in the periphery of the lung parenchyma; thus, they are thought to be histopathological signs of an early COVID-19 infection (see Figs. 8 and 9). There are not many pathological studies performed on the basis of autopsies or biopsies in COVID-19. This is due to the aggressiveness of the epidemic, hospital collapse due to the volume of hospitalized patients, as in the case of Peru, and the high rate of transmission, which makes invasive diagnostic procedures not a clinical priority [6].

According to our review, there are reports of patients who underwent pulmonary lobectomy for adenocarcinoma and COVID-19 infection was found retrospectively at the time of surgery. The results of the histopathological study showed: edema and proteinaceous exudate associated with focal hyperplasia of pneumocytes II and irregular inflammatory infiltration of multinucleated giant cells [7,9]. In other pathological studies published in China, in addition to these findings, epithelial hyperplasia and fibroblastic proliferation (fibroblast plugs) were reported [10]. The results of the pathological anatomy of the case in question showed: edema and proteinaceous exudate, vascular congestion (*see* Figs. 10 and 11), fibrinoid material, multinucleated giant cells, prominent lymphoplasmacytic infiltration (see Figs. 12 and 13). It should be noted that the histopathological findings found in our case preceded the development of clinical symptoms of COVID-19 and probably represent an early phase of the disease (see Figs. 14 and 15).

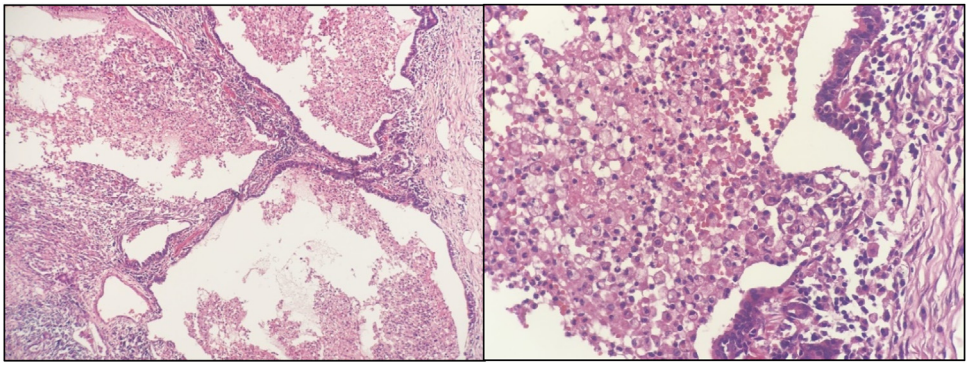
Regarding the treatment for COVID-19, the biomedical literature mentions that there is no antiviral therapy or specific vaccine, therefore the treatment is symptomatic. In severe cases, oxygen therapy is used, and when supplemental oxygen fails, mechanical ventilation may be chosen. WHO recommends high-flow oxygen therapy by binasal cannula or reservoir mask; In addition, it defines severe disease as: respiratory rate> 30/min, blood oxygen saturation (SatO2) <93%, PaO2/FiO2 ratio <300, and pulmonary infiltrates> 50% in 24–48 h [11]. In the case of our patient, on the third and fourth days he began to present symptoms and signs of severity due to the SARS-COV-2 infection, for which he received high-flow oxygen therapy by reservoir mask.

On the seventh postoperative day he required a mechanical ventilator; since high-flow oxygen therapy was insufficient and PaO2/FiO2 decreased to less than 100. Despite efforts in the search for a mechanical ventilator, we could not get it because we were facing a collapse of hospitals and clinics throughout our country due to the pandemic. However, the timely use of systemic corticosteroid associated with oxygen therapy and respiratory physiotherapy gave support to our patient, so it was possible to maintain oximetry at around 90%. For a cost issue, we do not use antivirals, such as remdesivir or IgG1 monoclonal antibodies such as tocilizumab. Instead, we use broad-spectrum antibiotics such as high-dose meropenem to treat secondary bacterial infection; in addition, ivermectin 200mug/kg for two days from the onset of symptoms.

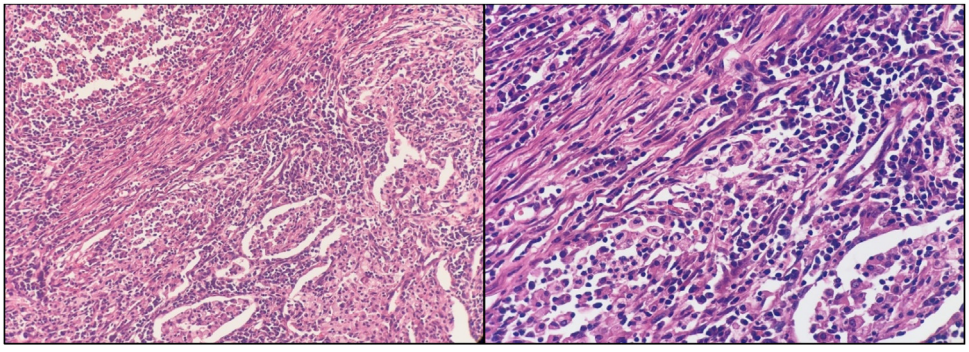
Fortunately, our patient begins to improve between on the tenth and fourteenth days, respiratory physiotherapy was intensified at



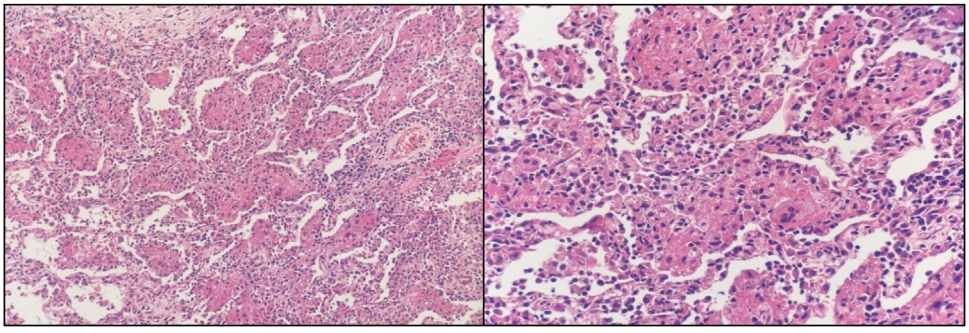
Figs. 8 and 9. H and E (20×) Concentric vascular hypertrophy of the middle muscular layer (left side), Microabscess zone (right side).



Figs. 10 and 11. HyE (10×, 40×) Bronchiectasis with mixed inflammatory exudate and macrophages; partial destruction of the epithelium.



Figs. 12 and 13. H and E (20×, 40×) Interstitium with the presence of lymphohistioplasmacytic inflammatory infiltrate and fibroblastic proliferation.



Figs. 14 and 15. (20×, 40×) Fibrin deposits, mixed inflammatory infiltrate and intraalveolar multinucleated giant cells.

this stage. At the time of preparing this article there are not many reports on pulmonary rehabilitation in COVID-19 patients during the acute stage; therefore, we believe that under strict biosafety measures, this type of treatment can be offered, especially in post-operative lung surgery patients.

5. Conclusions

This case teaches us that patients with non-COVID-19 lung pathology who have an indication for lung resection, despite the risks posed by SARS-COV-2, should undergo surgery to reduce the risk of death and even when the infection appears in perioperative period. For this reason, we recommend considering for the diagnosis of SARS-COV-2 infection, in addition to PCR in RT or serological tests, to consider performing a chest tomography before surgery to investigate lung infiltration or other radiological changes that precede the onset of symptoms so that the patient receives early treatment and health personnel have the appropriate biosafety equipment. We recommend employing early treatment with the medications and therapies (respiratory physiotherapy) available at that time for the management of COVID-19 pneumonia. Likewise, we consider that COVID-19 serological tests are of no use in early diagnosis and, on the contrary, confuse decision-making, therefore we do not recommend their use in the preoperative period of patients who require lung surgery.

Conflicts of interest

The authors of this case report declare have not conflict of interests with any entity or medical laboratory.

Sources of funding

Our case report has not sponsors. Likewise, we don't have an agent to finance the publication of this case report.

Ethical approval

Does not apply.

Consent

We, the authors, declare: Ẅritten informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editor-in-chief of this magazine on request.

Author contribution

Ricardo Taipe: Primary author. writing of the article, discussion of the case and conclusions.

Mardonio Euscatigue: Review of the bibliography and radiological images.

Fernando Valdivia: Review of the bibliography and radiological images.

Brenner Belloso: Review of the bibliography and radiological images.

Irene Huaroto: Slide review and histopathological study

Registration of research studies

N/A.

Guarantor

I, Ricardo Taipe, cardiothoracic surgeon, declare myself responsible for this case report.

Provenance and peer review

Not commissioned, externally peer-reviewed.

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