CASE REPORT

Non-surgical treatment of bilateral persistent air leak secondary to severe coronavirus disease (COVID-19) related macklin effect

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SUMMARY

Autologous blood patch pleurodesis (ABPP) as a treatment in COVID-19-related secondary spontaneous pneumothorax is scarce and only limited to a few case reports. A 71-year-old gentleman without any medical illness was admitted for severe COVID-19 pneumonia. However, he had persistent respiratory failure even after 2 weeks of illness. A high-resolution computed tomography (HRCT) demonstrated bilateral ground-glass opacities, bilateral pneumothoraces and pneumomediastinum. Left pneumothorax was drained successfully via an ambulatory device. However, he had recurrent right pneumothorax with persistent air leak. We performed ABPP up to three times for him and his lungs were fully expanded afterwards. Meanwhile, he underwent intensive physiotherapy and pulmonary rehabilitation. He was discharged well after a prolonged hospitalisation.

INTRODUCTION

The incidence of persistent air leak (PAL) from secondary spontaneous pneumothorax in coronavirus disease 2019 (COVID-19) is not uncommon in mechanical ventilated patients. The Macklin effect describes cyclical rapid changes in transpulmonary pressure during respiration, which could account for the COVID-19 associated spontaneous pneumomediastinum and pneumothoraces.[1] Treatment of PAL in COVID-19 patients can be challenging. Autologous blood patch pleurodesis (ABPP) as a treatment for COVID-19-related PAL is scarce. We herein presented a case of recurrent bilateral pneumothoraces with PAL in post severe COVID-19 infection which was successfully treated with ABPP and an ambulatory device.

CASE REPORT

A 71-year-old gentleman with not known medical illness presented with shortness of breath, fever and cough for 1 week. He was tachypnoeic on arrival with a respiratory rate of 28 breaths per minute. His blood pressure, heart rate, and percutaneous oxygen saturation (SpO2) under room air were 146/87mmHg, 95 beats per minute and 86%, respectively. Lung examination demonstrated bilateral lower zone crepitation. Other system was unremarkable. COVID-19 polymerase chain reaction (PCR) was detected from naso- and oropharyngeal swab with CT value of 21.18 upon admission. He was admitted to intensive care unit (ICU) and was started on high flow nasal cannula (HFNC). His initial investigation was shown in Table I. He was then commenced on intravenous dexamethasone, parental anticoagulant and proton pump inhibitor.

He had been relying on HFNC with a fraction of inspired oxygen (FiO2) of 40-50% despite standard treatment and supportive management given to him. On day 38 of admission, further imaging demonstrated bilateral ground-glass opacities with extensive bilateral pneumothoraces and pneumomediastinum without any bronchopleural fistula. Pulmonary embolism was excluded. As the patient was not a surgical candidate, the left pneumothorax was treated with drainage but complicated with PAL. It was later successfully treated with an ambulatory device (Pneumostat). However, he also had recurrent right pneumothorax with PAL on tube drainage. ABPP was repeated three times (on two alternate days) until successful. We ensured anticoagulant was withheld and no signs or symptoms of infection prior to the procedure. We then inserted a cannula (18 gauge) over his right femoral vein, followed by instilling 80-100ml (Equivalent to 1-2 ml/kg) of his whole blood into the right chest tube (18 Fr). We instilled 20 cc of blood each time then followed by 10 cc of normal saline to prevent a blood clot within the chest tube. Finally, we hung the tube to the drip stand for four hours to ensure no back flow or clot in the chest tube (Figure 1). Full chest expansion was observed on day 7 post-ABPP. He improved clinically with reduced oxygen requirement to maintain SpO2 of > 92% and radiologically as shown in Figure 2. Meanwhile, he underwent intensive physiotherapy and pulmonary rehabilitation. Subsequently, he was discharged without oxygenation support after 104 days of admission. He remained well even after 2 months of discharge.

DISCUSSION

ABPP was first introduced by Robinson in 1987.[2] This procedure is done by withdrawing patient's own blood, followed by injecting it into a pleural cavity under aseptic technique. It is not an uncommon practice at present with increasing number of studies showing its efficacy, not only in post thoracic surgical patients, but interstitial lung disease also-related pneumothorax as well as in pneumothorax complicating acute respiratory distress syndrome.[3,4]

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Table I: Laboratory markers upon admission

Laboratory markers	Results
Haemoglobin	16.6 g/L
White cell counts	7.2 x 10^9/L
Platelet counts	137 x 10^9/L
Lymphocytes count	220 cells/μL
Neutrophils count	6700 cells/μL
C-reactive protein	195 mg/L
Serum ferritin	3249 ug/L

Fig. 1: The patient's blood was infused into the chest tube for autologous blood patch pleurodesis. The chest tube was elevated, and the patient was placed in Trendelenburg position for at least 15 minutes

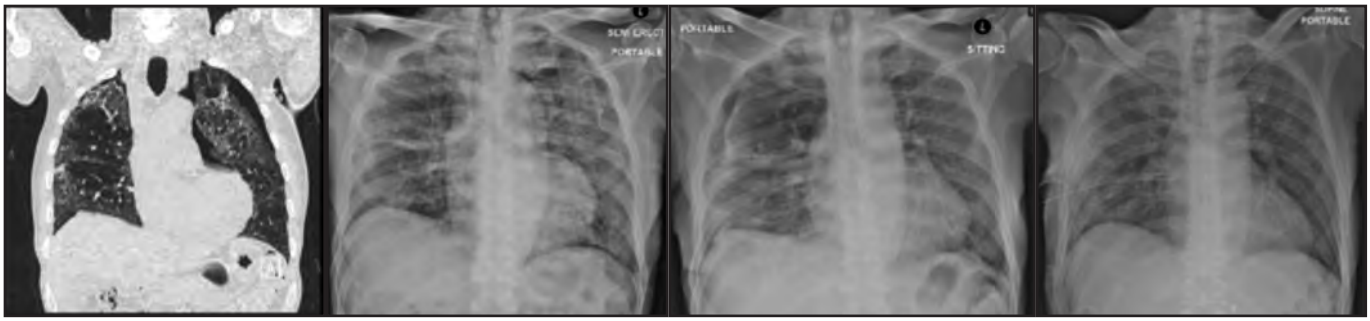

Fig. 2: Serial imaging (left to right): Day 38 of illness which showed bilateral pneumothorax and pneumomediastinum (HRCT and CXR), day 81 of illness which showed PAL of right lung, and day 88 of illness which showed fully expanded right lungs

Few authors suggest at least 28 French of chest tube and 18 Gauge of cannula for peripheral blood withdrawal in preventing blood clotting.[5,6] Meanwhile, the volume of blood is controversial. In the past, 50ml of blood was recommended in light of blood as a good medium for bacteria growth and pleural effusion as a likely complication of the procedure. Nonetheless, a randomised controlled trial by Andreetti et al. indicated that a volume of 100ml blood infused may produce a higher success rate.[7] Hence we use 100 ml of autologous blood each time. The success rate of ABPP within 48 hours is up to 83.7%.[8] Most studies suggest not more than three attempts whereby Ng BH et al. proposed further instillation after resting for one week.[6] Our patient achieved successful ABPP only after the third attempt. The risk of complication is also relatively lower compared to other approaches such as surgical intervention, chemical pleurodesis and prolonged chest drainage with only 1.5% of empyema, 8.6% of fever and 0-29% of recurrence rate. Prolonged effusion and tension pneumothorax were also reported in case studies.[8]

We did not subject him to surgical repair in view of his fragility with poor lung reserve after severe COVID-19 infection although surgical intervention is recommended according to British Thoracic Society (BTS) guidelines.[9] Chemical pleurodesis was not a choice as there was no apposition and there is a risk of worsening lung function. We treated the left PAL with an ambulatory device instead of ABPP as he developed fever at that point. On the whole, ABPP

is generally a safe procedure which is cheap, readily available and painless with high success rate. Pulmonary rehabilitation is equally important in post severe COVID-19 patients.

CONCLUSION

ABPP is a safe option for severe COVID-19 related PAL from secondary spontaneous pneumothorax.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

REFERENCES

1. Charles C. Macklin. Transport of Air Along Sheaths of Pulmonic Blood Vessels from Alveoli to Mediastinum. Arch Intern Med 1939; 64(5): 913-26.
2. CLN R. Autologous blood for pleurodesis in recurrent and chronic spontaneous pneumothorax. Can J Surg 1987; 30: 428-9.
3. Aihara K, Handa T, Nagai S, Tanizawa K, Watanabe K, Harada Y, et al. Efficacy of blood-patch pleurodesis for secondary spontaneous pneumothorax in interstitial lung disease. Intern Med 2011; 50(11): 1157-62.
4. Campisi A, Dell'Amore A, Gabryel P, Ciarrocchi AP, Sielewicz M, Zhang Y, et al. Autologous blood patch pleurodesis: a large retrospective multicenter cohort study. Ann Thorac Surg 2021; 2021.06.089
5. Cobanoglu U, Melek M, Edirne Y. Autologous blood pleurodesis: A good choice in patients with persistent air leak. Ann Thorac Med 2009; 4(4): 182-6.
6. Ng BH, Tan JK, Ban YLA, Hamid MFA. Intra-pleural instillation of autologous blood - fine-tuning techniques for better success rate: Two case reports. Med J Malaysia 2020; 75(2): 181-3.
7. Andreetti C, Venuta F, Anile M, De Giacomo T, Diso D, Di Stasio M, et al. Pleurodesis with an autologous blood patch to prevent persistent air leaks after lobectomy. J Thorac Cardiovasc Surg 2007; 133(3): 759-62.
8. Karampinis I, Galata C, Arani A, Grilli M, Hetjens S, Shackcloth M, et al. Autologous blood pleurodesis for the treatment of postoperative air leaks. A systematic review and meta-analysis. Thorac Cancer 2021; 2648-54.
9. MacDuff A, Arnold A, Harvey J. Management of spontaneous pneumothorax: British Thoracic Society pleural disease guideline 2010. Thorax 2010; 65(Suppl. 2): ii18-31.