Case report

**Introduction**

Pigtail catheters and chest tubes are commonly used for effective resolution of pneumothoraces and drainage of simple pleural effusions. Given their small calibers, better flexibility and more ease at the time of insertion, pigtail catheters are associated with lower risks of complications when compared to traditional chest tubes. Commonly reported complications of the pigtail catheters include the higher probability for clogging, kinking, and obstruction. Rare complications as air embolism, penetration of the heart and transection of the lungs are seldom reported in the literature. We present a case of an 81-year-old female presented with covid-19 pneumonia who developed bilateral spontaneous pneumothoraces requiring bilateral pigtail insertion. The patient developed worsening hypoxia and chest imaging revealed that the left pigtail was transected into the lung parenchyma. With this case report, we hope to bring to light a rare complication of pigtail placement.

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**A R T I C L E I N F O**

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**A B S T R A C T**

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1930-0433© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)
port a case of an 81-year-old female who developed bilateral spontaneous pneumothoraxes due to Covid-19 Pneumonia. The patient underwent bilateral pigtail insertion which was complicated with lung parenchyma transection.

Case presentation

An 81-year-old female with a medical history of hypertension presented to our facility with shortness of breath associated with dry cough, watery diarrhea, fatigue and generalized weakness for a week. Upon presentation, the patient was hypoxic on room air requiring non-rebreather mask. Laboratory analysis was significant for elevated inflammatory markers and leukopenia with WBCs of 3200. Chest X-ray exhibited bilateral pulmonary infiltrates, and she was tested positive for Covid-19.

The patient was started on antibiotics, remdesivir, steroids and therapeutic doses of anticoagulants. During the hospital course, the patient was found to have increasing oxygen requirements requiring high-flow nasal cannula. On hospital day 5, the patient continued to have worsening hypoxia and labile mental status, so she was intubated and transferred to the critical care unit.

On hospital day 11, she began to deteriorate clinically. Chest x-ray was done which revealed right subcutaneous emphysema with right pneumothorax and trace pneumothorax in the left apex (Fig. 1). The decision was made to place 14-French pigtail catheter on the right side. After the procedure, she was noted to have worsening hypoxia, hypotension and tachycardia which raised the suspicion that the patient may have developed left-sided tension pneumothorax.

Needle decompression was done, which was followed by a slight improvement of oxygen saturation. A left pigtail catheter was subsequently introduced; however, after the catheter placement, she was noted to have a continuous air leak on the underwater seal raising the suspicion of intraparenchymal placement.

Post-procedure chest x-ray showed resolution of pneumothorax on the right side with persistent pneumothorax on the left side (Fig. 2). The patient was noted to be saturating 78% on 100% FiO2 and with inhalation/exhalation mismatch. 32-F thoracostomy tube was placed (Fig. 3) and the left pigtail was further clamped, which resulted in improvement of oxygen saturation to 92% and resolution of inhalation/exhalation volume mismatch.

During the night, she was found to be tachycardic and tachypneic and labs showed leukocytosis of 29,000 for which
proxemia, metabolic acidosis and renal failure and he passed away. The subsequent autopsy report revealed that the pigtail catheter having traversed the chest wall, entering the ventral surface and exiting the dorsal surface of the right middle lobe [5].

In the case of this neonate, prematurity and pulmonary hypoplasia could have increased the chances of transection; however, similar cases in adults with fully developed lungs had not been reported until recently in the literature.

Transection of the lung with pigtail catheters was observed in adults for the first time in 2018 by Saquib in Staten Island, NY. This was a case of 72-year-old male who presented with dyspnea and decreased breath sounds over the base of the right lung. Chest imaging revealed right-sided moderate pleural effusion in the setting of cancer. Thoracentesis was performed with re-accumulation of fluid requiring 14-French pigtail catheter insertion under ultrasound guidance.

The catheter was accidentally displaced while the patient was moving and another pigtail catheter was placed without using Ultrasound-guided guidance.

On the following day, chest X-ray revealed extensive subcutaneous emphysema, and CT chest showed right pleural catheter with anterior entry point extending posteriorly through the right middle and lower lobes [6].

A second case was also reported in 2019 by Garcia de Alencar in University of Sao Paulo where transection of lung with pigtail catheter was seen in a 92-year-old man who required placement of a pigtail catheter for management of pneumothorax. The patient had good lung expansion and the chest radiograph showed a well-positioned catheter; however, the pigtail catheter was still observed on the CT chest within the pulmonary parenchyma with a residual pneumothorax [7].

In all of these 3 cases, we believe the pathophysiology of lung transection was similar to the one found in our case, where the transection occurred following the introduction of the needle and air evacuation. After needle introduction, it is possible that the lung re-expanded against the sharp introducer needle prior to needle retrieval creating a puncture site in the lung parenchyma; after that, the pigtail catheter was wired through and introduced. The straightened appearance of left pigtail catheter on chest x-ray (Figs. 2 and 3) as compared to more curled appearance of right pigtail catheter most likely is sign that the catheter penetrated through lung parenchyma, a solid structure, versus having been positioned in pleural space composed of either fluid or air, the latter in this case. CT chest obtained on hospital day 12 also reveals a straightened appearance of left pigtail through lung tissue.

Although the transection of the lung with pigtail catheter is rare, it is important to keep this complication in mind in order to minimize the harm.

Many recommendations have been proposed to lower the risk of parenchymal transection. These recommendations include the use of ultrasound before and after insertion, placing the catheter in the right anatomical landmark between the fourth to sixth intercostal space of the midaxillary line, as well as using modified Seldinger method,

antibiotics and antifungal coverage was expanded. CT chest was ordered to evaluate for the position of the left chest tube, which revealed the left-sided pigtail chest tube catheter traversing the left lung with the tip in the trachea at the carina. It also showed left trace pneumothorax, large pneumomediastinum and subcutaneous emphysema (Fig. 4).

On hospital day 12, the patient continued to deteriorate, and she was found to have dilated fixed pupils on her neurological exam. CT head revealed new marked cerebral edema suggestive of diffuse anoxic brain injury and tonsillar herniation. After extensive discussion with her family, they decided against pursuing any aggressive intervention and the patient was transitioned to comfort care and passed away.

Discussion

Pigtail catheters continue to be used as a safer alternative to traditional chest tubes for resolution of pneumothoraces and drainage of simple pleural effusions. Although minor complications such as blockage, kinking, tubal dislodgement, small pneumothoraces, pain and infection can be seen with the use of pigtail catheters, more serious complications like hemothorax, pneumothoraces, rupture of diaphragm, and damage to other organs are more commonly observed with large-bore chest tubes than with pigtail catheters [2]. However, rare complications associated with the use of pigtail catheters such as cerebral air embolus and systemic air embolus in addition to 3 cases of parenchymal lung injury following catheters insertion have been documented in the literature [3,4].

To our knowledge, one of the first reported cases of parenchymal lung transection occurred to a neonate who was born prematurely at 32 weeks and developed right-sided pneumothorax for which a pigtail catheter was inserted. One day later, he was found to develop hypotension, hypoxemia, metabolic acidosis and renal failure and he passed away. The subsequent autopsy report revealed that the pigtail catheter having traversed the chest wall, entering the ventral surface and exiting the dorsal surface of the right middle lobe [5].

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Many recommendations have been proposed to lower the risk of parenchymal transection. These recommendations include the use of ultrasound before and after insertion, placing the catheter in the right anatomical landmark between the fourth to sixth intercostal space of the midaxillary line, as well as using modified Seldinger method,
which entails the using of soft angiocatheter and a J-tip guidewire rather than a hard puncture needle and a straight guidewire [5].

Conclusion

In conclusion, transection of the lung following pigtail catheter insertion is rare; however, it’s serious and can be fatal. Hence, a high level of clinical suspicion concerning the association between pigtail catheter insertion and clinical deterioration is important for prompt diagnosis. This highlights the need for refinements of the methods used in catheter placement and imaging localization. Proper care should always be taken when placing pigtail catheters.

Patient consent

No patient consent required for images since patient diseased and images have no patient identifiers.

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