

## Endourology

## Radiographic hemithorax white-out following percutaneous nephrolithotomy



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## 1. Introduction

Percutaneous nephrolithotomy (PCNL) is a safe and effective treatment for renal stones and is the first-line treatment modality for stone burdens greater than 20mm. Respiratory complications during PCNL are generally associated with surgical technique leading to violation of the lung pleura. However, complications related to repositioning after intubation are still possible. Here, we describe a unique case of a PCNL in the prone position complicated by an endobronchial intubation leading to a collapsed lung.

## 2. Case presentation

A 54-year old female with a history of obesity (BMI 43.6), mild asthma, and multiple previous procedures for nephrolithiasis presented for elective bilateral PCNL. Her pre-operative CT demonstrated multiple bilateral kidney stones as large as 1.6cm on the right and 1.0cm on the left. After intubation, the patient was moved to the prone position. The upper poles were accessed

between the 11th and 12th ribs bilaterally and the procedure was carried out without complication.

Per routine, a chest radiograph obtained in the post-anesthesia care unit demonstrated a possible trace right apical pneumothorax. Apart from mild pain from deep inspiration around the nephrostomy sites, the patient had minimal respiratory complaints. Chest tube placement was deferred. An abdominal and pelvic CT obtained 10 hours following the procedure demonstrated multiple small stones bilaterally and no pneumothorax or hydrothorax. Thus the patient was scheduled to return to the operating room on post-operative day two to clear her stone burden.

The patient was again placed in prone position following intubation and access to the right kidney was obtained using the previously placed nephrostomy tract. Prior to treating the left kidney, the surgeon noticed diminished lung markings on fluoroscopy which were concerning for iatrogenic hydrothorax. It was confirmed the patient was hemodynamically stable, and had normal tidal volumes and bilateral breath sounds. The procedure on the left was completed with flexible and rigid nephroscopy and basketing of small residual stones again using the tract created during the previous procedure.

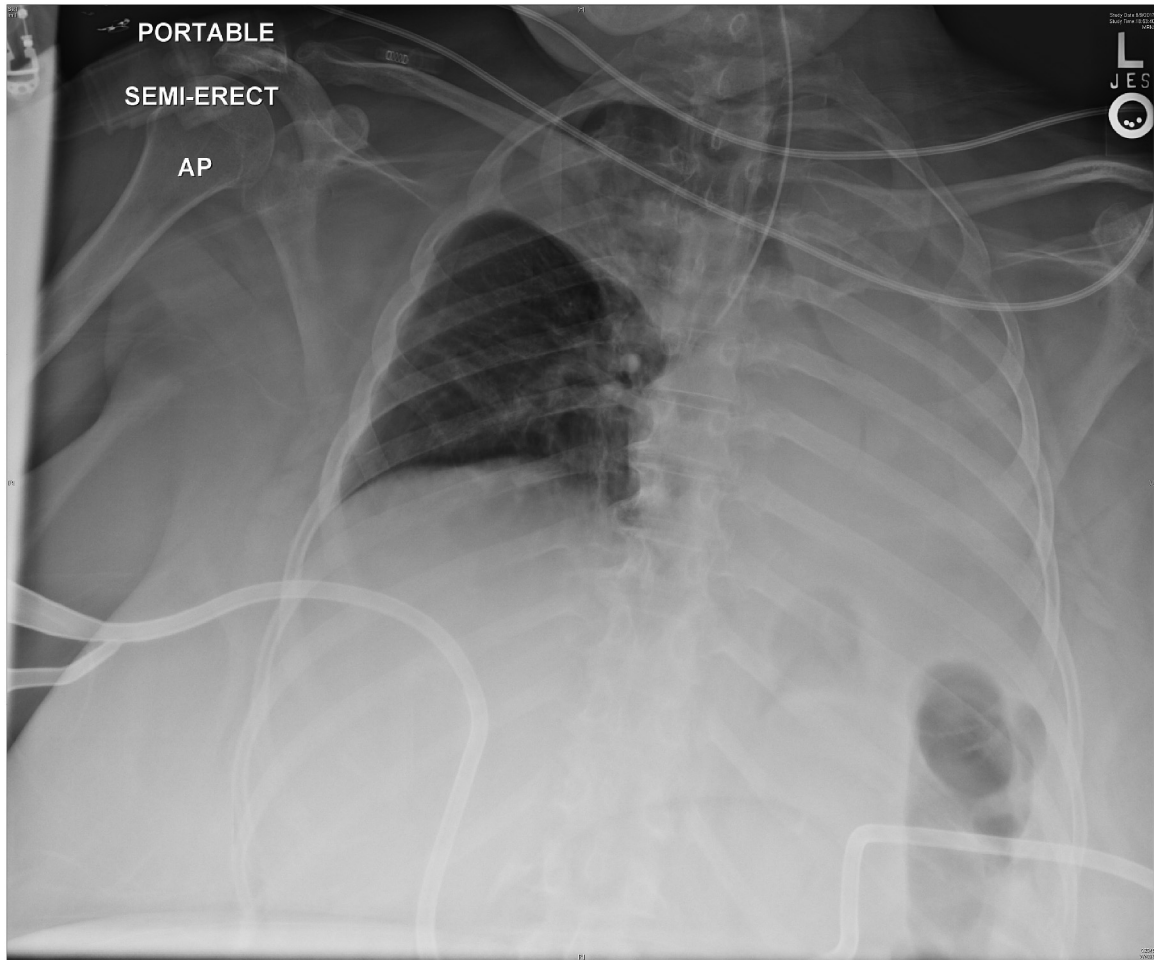
Following replacement of the left nephrostomy, fluoroscopy directed towards the thorax revealed complete white out of the left hemithorax. Again, bilateral breath sounds were confirmed. The patient was moved to the supine position to obtain an upright portable chest radiograph while intubated in case chest tube placement was required. A portable chest radiograph demonstrated complete opacification of the left hemithorax and right upper lobe (Fig. 1). Given the risk of hydrothorax related to the procedure, it was decided to place a left chest tube. However, only minimal fluid was returned despite chest tube repositioning.

When a repeat chest radiograph demonstrated no change in airspace opacities, it was noted the endotracheal tube (ET) was too far distal in the right main bronchus. The ET was repositioned and, with the left chest tube on suction, a new chest radiograph showed resolution of the airspace opacities (Fig. 2).

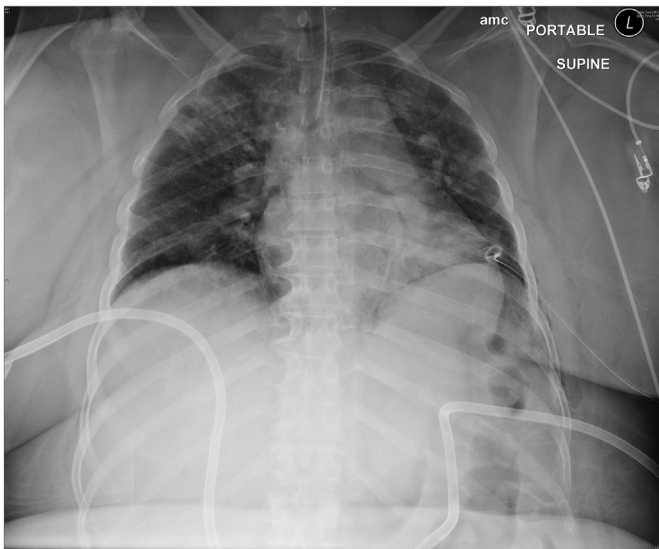
The patient did not have any further respiratory complications. Her chest tube was removed the following day and she was discharged from the hospital two days later. Her nephrostomy tubes were removed five days after surgery and at four-week follow-up she was without complaints.

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**Fig. 1.** Portable chest radiograph following bilateral percutaneous nephrolithotomy demonstrating left hemithorax and right upper lobe opacification.



**Fig. 2.** Portable chest radiograph following bilateral percutaneous nephrolithotomy after repositioning of the endotracheal tube above the carina demonstrating resolution of airspace opacities.

### 3. Discussion

Endobronchial intubation is a rare respiratory complication that most likely occurred in our patient during prone positioning. An ET tube placed in the right bronchus intermedius leads to decreased ventilation of the contralateral lung and the right upper lobe, leading to opacification of the left hemithorax and right upper lobe. This can lead to hypoxemia as well as barotrauma from increased pressures in the ventilated lung spaces.

Although PCNL is safe and effective for most patients, complications can occur due to positioning and the surgical access point. A study of 5803 patients showed PCNL had an overall complication rate of 14.5%. The most common complications were significant bleeding at 7.8%, renal pelvis perforation at 3.4%, and hydrothorax at 1.8%.<sup>1</sup> Other respiratory complications following PCNL include hemothorax, hydropneumothorax, and pleural effusions. Yu et al. showed respiratory complications following PCNL were associated with increased BMI, intraoperative red blood cell transfusion, and intercostal surgical approaches.<sup>2</sup>

Since its introduction, prone positioning for PCNL has been the preferred strategy. However, difficulties with prone positioning have encouraged investigators to examine PCNL in the supine position. Recent studies have suggested using a supine position in

patients with more comorbidities due to slightly decreased complication rates, but the benefits are marginal and more conclusive data is needed.<sup>3</sup>

Risks factors for endobronchial intubation are not well defined. However, one study in critically ill patients demonstrated that 15.5% of ET tubes placed in emergent settings were malpositioned. A statistically significant majority of the malpositioned tubes occurred in women (62%) compared to men (38%), and most of the malpositioned tubes in women occurred with the tip too close to the carina.<sup>4</sup> This suggests women are at higher risk of endobronchial intubation, possibly due to decreased chest lengths.

Endobronchial intubations in the operating room are rare. But when they do occur, they can go undetected on physical exam. In detecting endobronchial intubations, bilateral auscultation may be 65% sensitive, and observation and palpation of symmetrical chest movements may be 43% sensitive. By comparison, measuring insertion depth of the ET tube may be significantly more sensitive at 88%.<sup>5</sup>

An endobronchial intubation in our patient went unnoticed because bilateral breath sounds were auscultated and there was no noticeable change in respiratory status. Intraoperative fluoroscopy incidentally noted the airspace opacities. One future consideration includes using fluoroscopy to assure endotracheal versus endobronchial intubation after prone positioning prior to obtaining renal pelvis access. In addition, the ET insertion depth should always be checked following prone positioning.

#### 4. Conclusion

A patient undergoing bilateral PCNL in the prone position was found to have airspace opacities in the left hemithorax and right upper lobe and underwent chest tube placement. Subsequently, an endobronchial intubation was noted on chest radiograph. While

respiratory complications during PCNL are commonly related to the surgical procedure itself, adverse effects related to prone positioning should always be considered. Following prone positioning, the ET tube insertion depth should be confirmed and fluoroscopy may be used to confirm bilateral airspace ventilation.

#### Consent

No personal or identifiable patient information was included. Consent from the patient was not needed.

#### Conflicts of interest

The authors have no conflicts of interest to disclose.

#### Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.eucr.2017.12.002>.

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