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Chylothorax as a Complication of Percutaneous Nephrolithotomy

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Abstract Percutaneous nephrolithotomy is a minimally invasive procedure to remove large renal calculi. Complications can range from infection to bowel damage but only rarely does the procedure result in pulmonary injury. We present the first case of chylothorax secondary to percutaneous nephrolithotomy for removal of a large renal calculus. The patient was treated with a decortication procedure and discharged to rehab shortly thereafter.

Keywords: *percutaneous nephrolithotomy, chylothorax, hemithorax*

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1. Introduction

Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure used to remove kidney stones from the renal calyces. This technique is indicated for large or complex calculi and is generally preferred to open renal surgery due to similar efficacy but shortened hospitalization time. Pleural injury is a rare but serious complication of PCNL. We report a case of persistent chylothorax immediately after percutaneous nephrolithotomy. To our knowledge, this is the first reported case to date.

2. Case

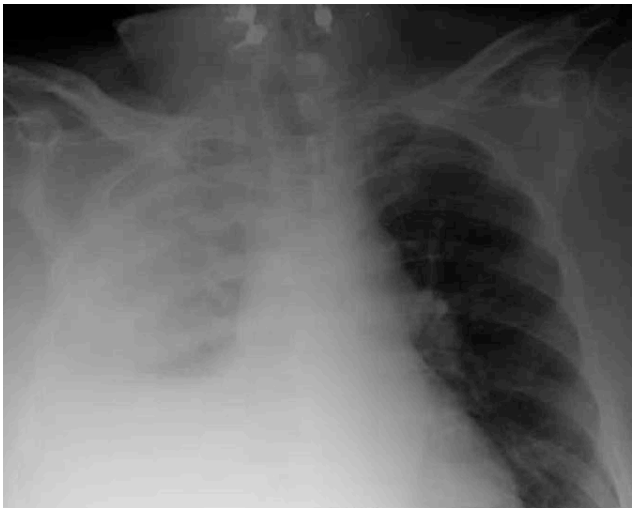

Figure 1. Opacification of the right hemithorax

A 66-year-old male presented to the emergency room (ER) complaining of progressively worsening shortness of breath. He had undergone PCNL due to a large calculus in the right renal pelvis one week prior to presentation. He denied any previous respiratory symptoms prior to the procedure but began feeling short of breath one day after the procedure. He was discharged home but his shortness of breath continued to worsen and he decided to return to the hospital. On arrival to the ER, he was afebrile and his white count was within normal limits. Chest x-ray revealed near complete opacification of the right hemithorax (Figure 1).

Follow-up computed tomography (CT) of the chest without contrast revealed a large partially loculated right-sided pleural effusion with lung consolidation (Figure 2).

Figure 2. Large right-sided partially loculated pleural effusion

The PCNL entry point was visualized above the 12th rib (Figure 3).

Figure 3. PCNL entry point above the 12th rib

An ultrasound-guided thoracentesis was performed and 20 mL of fluid was removed from the right lung. Analysis of the pleural fluid revealed an LDH of 902 units/L, total protein of 5.1 g/dL, triglycerides of 117 mg/dL, glucose was 42 mg/dL, amylase 31 units/L, and pH 8.0. Serum total protein was 7.1 gm/dL and LDH was 153 u/L. Using Light's criteria, the fluid was determined to be exudative. Initial gram stain showed no organisms and culture revealed no growth over the next 5 days. Thoracic surgery was consulted and a decortication procedure was performed with minimal resolution on follow-up chest x-ray (Figure 4).

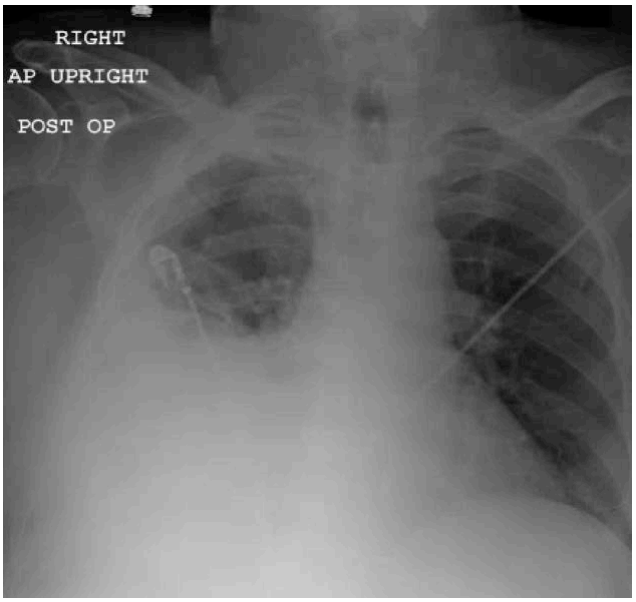

Figure 4. Minimal resolution after thoracentesis

Samples of the pleural fluid during the decortication procedure also revealed no organisms. Additionally, cytology was negative for malignant cells. Based on the elevated triglyceride level (>110) and lack of bacterial growth, it was determined that the fluid was chylous in nature. The patient was stabilized with oxygen delivered by nasal cannula and albuterol/ipratroprium nebulizer treatments as needed. When he was able to tolerate room air, he was transferred to a rehabilitation facility where treatment was aimed at improving lung function with deep breathing exercises and incentive spirometry. At 2-week follow-up, there was moderate improvement in his shortness of breath but x-ray showed continued opacification of the inferior aspect of the right hemithorax.

2.1. Discussion

Percutaneous nephrolithotomy (PCNL) is indicated for removal of large or multiple renal calculi and provides the highest stone free rate after one session. Despite low morbidity overall complications may include bleeding, infection, or in less than 2% of cases pulmonary complications [1]. Pleural injury is a rare and serious complication. Although the risk increases if the puncture site is above the 12th rib [2] PCNL performed through the 10th and 11th intercostal spaces using fluoroscopy is considered a safe procedure that rarely has thoracic complications directly related to the procedure [3]. One study revealed 8 percent of percutaneous nephrolithotomy procedures resulted in post-operative pulmonary complications [4]. Pneumothorax and atelectasis with pleural effusion constituted a majority of these complications and are associated with a longer hospitalization [5]. Using a search of Google Scholar and Pubmed, until now, no cases of chylothorax post-PCNL have been reported to date.

Chylothorax is defined as pleural fluid triglyceride level >110 mg/dL. In fact, one study revealed that triglyceride levels greater than 110 mg/dL had a 99% specificity for chylothorax [6]. The etiology of chylothorax can be classified as traumatic or non-traumatic in nature. Traumatic chylothorax can be further sub-classified into iatrogenic and non-iatrogenic [7]. The thoracic duct begins as the cisterna chyli and enters the thorax accompanying the aorta through the aortic hiatus of the diaphragm [8]. It arises along the right side of the thoracic vertebrae but between the 3rd, 4th [9], and 5th [8] thoracic vertebrae it turns left behind the aortic arch and terminates in the subclavian vein. This anatomy, although not universal [9], can assist in identifying the injury site as lesions below the 5th thoracic vertebrae result in right-sided chylothorax while lesions above the same level often result in a left-sided chylothorax [8]. Given the entry point above the 12th rib and development of chyle leak immediately post-PCNL, this patient's condition can be classified as a traumatic iatrogenic chylothorax. Unfortunately, during the decortication procedure, the surgeon was unable to identify the source of the chyle leak. In cases of complicated or loculated chylothorax, the source of the leak may be difficult to identify [7]. When the source of the chyle leak is not easy visualized, extensive surgical dissection is discouraged in order to minimize further trauma to the lymphatic system [7]. Based on the anatomical site of entry, the injury point to the lymphatic system was likely the thoracic duct directly superior to the cisterna chyli.

Chylothorax presents symptomatically, as do all pleural effusions, with dyspnea, chest pain, and cough [9] but notably has a mortality rate as high as 75% [8]. Histories of either trauma to the chest (i.e. knife wound, forceful cough, thoracic surgery) or disease states with known associations (i.e. sarcoiosis, filariasis, amyloidosis) are often present [9]. Diagnosis can be first established by plain films; seen as a simple pleural effusion or unilateral opacification. The primary four etiologies comprising the

differential for hemithorax opacification include atelectasis, consolidation, post-pneumonectomy, and pleural effusion [10]. Thoracentesis with pleural fluid collection allows for examination of fluid. As chylothorax is generally exudative in nature [11], distinction must be made from empyema thoracis. Grossly, chylothorax and empyema both may appear milky. Therefore, laboratory evaluation is necessary for definitive diagnosis. A sensitive exam begins with cytological analysis of fluid with Sudan III stain which demonstrates chylomicrons, although this not specific. This test is not always necessary as diagnosis of chylothorax can reliably and readily be made with pleural fluid triglyceride level >110mg/dl and cholesterol <200mg/dl [9]. A fluid cholesterol to triglyceride ratio of <1 is also diagnostic [8].

Treatment for chylothorax begins with addressing treatable underlying causes with further management organized into conservative and surgical approaches. Notably, thoracic duct leaks close spontaneously in nearly half of patients and conservative management should be considered in all patients that are able to tolerate this approach [8]. Conservative treatment begins with respiratory support and placing a chest tube to drain large chylothoraces, as well as replacing nutrients lost in chyle. Augmenting the patient's dietary status can reduce the flow through the thoracic duct and lead to spontaneous resolution. This is done by placing the patient on a nothing by mouth (NPO) diet or administering low fat medium chain triglyerides by mouth. Escalating dietary care includes total parental feeding to further reduce chyle flow. Monitoring nutritional status during this time is also necessary. Under the umbrella of conservative management includes medications, such as somatostatin and octreotide. Both act similarly to dietary manipulations by decreasing volume through the thoracic duct. Surgical therapy is recommended in anyone with a rapid decline in nutritional status or when the patient drains > 1.5 L/day in an adult, >100 ml/kg body weight/day in a child, chyle leak at a rate >1L/day for 5 days, or persistence of a leak for >2 weeks. If the thoracic duct is suspected to have been injured surgically, management may consist of either surgical ligation or pleurodesis,. If the patient is unfit for surgery, a pleuroperitoneal shunt may be placed.

2.1.1. Conclusion

All surgeries carry the risk of post-operative pulmonary complications, with atelectasis and pneumonia being the most common manifestations. PCNL is generally a safe procedure with minimal complications. In addition to the pulmonary complications seen in any surgery, direct injury to the pleural space should be considered in patients who develop shortness of breath after PCNL. These injuries can manifest as pneumothorax, pleural effusion, empyema, or in this case, chylothorax. Initial management includes maintenance of oxygenation followed by chest x-ray. If a large effusion is present, diagnostic thoracentesis with fluid analysis should be performed to characterize the fluid. Depending on the severity of symptoms and volume of the chyle leak, conservative or surgical management can be considered. Although injury to the lymphatic system is an exceedingly rare complication of PCNL, expeditious diagnosis is key to initiating the proper management and ultimately leads to better outcomes.

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