

Hydrothorax as a Complication of Percutaneous Access to the Renal Pelvis

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The use of percutaneous techniques to remove stones and tumors from the renal pelvis has increased over the past decade. We report an unusual life-threatening complication of this procedure that also highlights the importance of routine monitoring of peak airway pressure in the operating room.

Case Report

A 55-yr-old, 53-kg female with a history of previous bladder cancer was rehospitalized with new onset hematuria. Magnetic resonance imaging revealed a right pelvic mass that was subsequently biopsied and found positive for renal cell carcinoma. She presented to the operating room for a percutaneous endoscopic resection of the right renal pelvis tumor.

Her past medical history included prior vaginal hysterectomy, right mastectomy, and an allergy to sulfa. Physical examination, except for the previous surgery, was normal. There was no evidence of scoliosis. Blood urea nitrogen and serum creatinine levels were 47 mg/dL and 2.7 mg/dL, respectively. All other laboratory study results were normal.

The patient was brought to the operating room, and routine monitors were applied. Anesthesia was induced with intravenous fentanyl and thiopental. After succinylcholine, a 7.0 oral endotracheal tube was placed atraumatically, with confirmation of tube placement by visualization of the vocal cords, positive end-tidal carbon dioxide, symmetrical movement of the chest, and the presence of equal breath sounds bilaterally. The tube was secured at 22 cm at the teeth, and the patient was safely turned prone. Breath sounds were again confirmed to be equal. Muscle relaxation was maintained with pancuronium and monitored with a nerve stimulator.

A narcotic technique with low flow isoflurane was used to maintain anesthesia. The endoscope was placed with the patient disconnected from the ventilator circuit using a posterior intercostal approach. The trocar was inserted below the right twelfth rib without obvious problem.

The operative course was uneventful until approximately 2½ h into the procedure, when the peak inspiratory pressure

increased from 26 to 40 cm of water over several minutes. Common causes of increased airway pressure (e.g., change in tube position, light anesthesia, bronchospasm, inadequate neuromuscular block) were ruled out. Within 1–2 min of the noted increase in airway pressure, the oscillometric measured arterial blood pressure (Critikon, Inc., West Chester, PA) became unobtainable. Although the pulse oximeter continued to detect arterial pulsations, the carotid pulse was weak. Breath sounds could not be heard over the right posterior chest, and a presumptive diagnosis of tension pneumothorax was made. Oxygen saturation decreased from 100% to 84%, and heart rate slowed to 55 bpm. With the patient still prone, a 16-gauge angiocatheter was inserted in the right midaxillary line in the sixth intercostal space. Airflow was not noted, but aspiration through the needle with a 60-mL syringe yielded clear fluid. A No. 32 chest tube was then placed by the surgery team with the patient still prone. Upon entering the pleural space, 1–2 L of glycerol irrigation fluid exited the chest under pressure. Blood pressure returned to normal promptly after drainage of the hydrothorax, and the next cycle of the oscillometer indicated a pressure of 120/62 mm Hg. The pulse oximeter showed return of oxygen saturation to 99% almost immediately.

Surgery was rapidly completed, and the patient was transported to the intensive care unit. Postoperatively, vital signs and arterial blood gases were normal. A chest radiograph on admission to the intensive care unit showed no residual fluid; however, the serum sodium concentration was 112 mEq/L. The patient had an unremarkable postoperative course, and her sodium level normalized over 36 h.

Discussion

This report of tension hydrothorax occurring during percutaneous renal pelvis surgery highlights a potentially lethal complication of this surgery. The posterior intercostal approach is commonly used for percutaneous access to the kidney (1–6). Hopper and Yakes (1) evaluated the safety of this approach using computed tomographic imaging studies to examine the path of insertion during both maximum inspiration and expiration. They concluded that, even when the needle was inserted after expiration, the path of the needle could cause injury to the right and left lung in 28% and 14% of patients, respectively. During maximum inspiration, the lung was in the path of the needle in most

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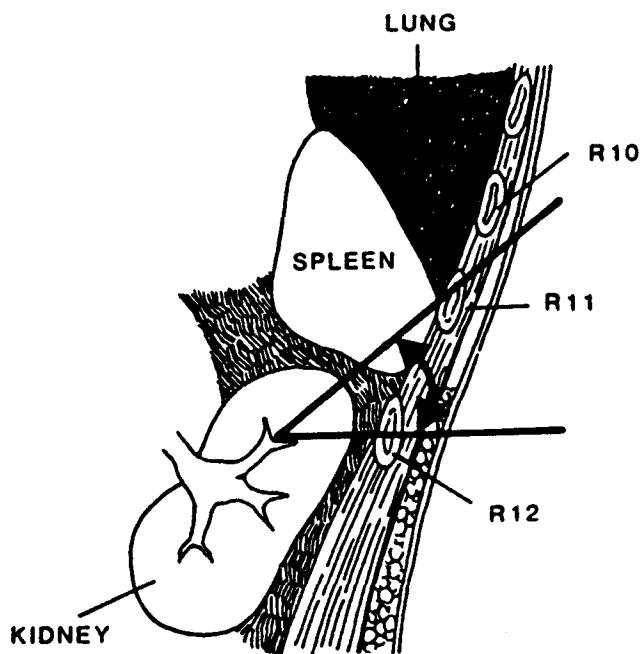


Figure 1. Relationship between trocar path to lung and other structures at end-expiration. [Reprinted with permission from Hopper and Yakes (1)].

patients. Risk of lung injury increased when a high intercostal approach (10th–11th rib) was used. Figure 1 demonstrates the usual path of the trocar when insertion is attempted at end-expiration. Lee et al. (7) noted a 4% incidence of complications in 582 patients undergoing percutaneous nephrolithotomy. Injuries to lung and pleura, resulting in pneumothorax and hydrothorax, occurred most often; the incidence of these injuries increased with insertion of the trocar above the 12th rib. In another large series, Moskowitz et al. (4) reported a complication rate of 3.5%, pneumothorax and hemothorax again being the most commonly encountered problems. A chest tube was the only therapy required for treatment, and all patients recovered without sequelae. Thus, the literature suggests that the pleural cavity is entered with some frequency when this approach is used. As our case illustrates, these complications can occur in normal, thin patients without identifiable factors suggesting an increased risk. The development of life-threatening hemodynamic compromise from tension hydrothorax has not, to our knowledge, been reported previously. In addition, the delay in development of the hydrothorax and the accompanying dilutional hyponatremia are unusual aspects of this case.

Physicians caring for patients undergoing percutaneous renal pelvis surgery should be aware that life-threatening complications can occur and must be prepared to intervene quickly should the need arise. The 2.5-hour delay in the development of the hydrothorax in our patient is atypical and has not been noted in prior reports of complications with this procedure. The late development of hydrothorax may have been due to unrecognized repositioning of the scope or to a late perforation of the renal pelvis that permitted fluid to enter the pleural space through a diaphragm injury incurred at the time of scope insertion. The timing of this complication increased the probability of a considerable delay in recognition of the cause of hemodynamic collapse. Since the patient was in the prone position, which precludes effective cardiopulmonary resuscitation, such a delay in diagnosis could have adversely affected outcome. We attribute the prompt institution of appropriate therapy to the early warning provided by the increase in peak airway pressure; the limited differential diagnosis of hypotension associated with a marked increase in peak airway pressure suggested the presence of a pneumothorax or hydrothorax and led to appropriate and timely intervention. This case emphasizes the value of monitoring peak airway pressures and using this information to evaluate physiologic perturbations.

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