



Endourology

Acute Abdominal Compartment Syndrome as a Complication of Percutaneous Nephrolithotomy: Two Cases Reports and Literature Review



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ABSTRACT

Percutaneous nephrolithotomy (PCNL) is a technique commonly used to remove large or multiple kidney stones and stones in the inferior calyx, with the advantages of lower morbidity rates, decrease in post-operative pain with faster recovery. Intra-abdominal irrigation fluid extravasation which leads to abdominal hypertension is a rare complication of PCNL with little reports. Early detection of intra-abdominal extravasation is very important to prevent morbidity and mortality. We present two cases and review the literature.

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Introduction

Percutaneous nephrolithotomy (PCNL) is a technique commonly used to remove large or multiple kidney stones and stones in the inferior calyx, with the advantages of lower morbidity rates, decrease in post-operative pain and faster recovery. However, it is associated with multiple complications including bleeding, septicemia and injury to adjacent organs. Intra-abdominal irrigation fluid extravasation which leads to abdominal hypertension is a rare complication of PCNL with few reports. Here, we present two cases and review the literature.

Case 1

A 63-year old man was admitted in our hospital complaining of soreness of the waist. The CT scan and IVU (Fig. 1) detected right kidney staghorn calculi and atrophy of left kidney. Pre-operative laboratory date showed creatinine: 178 $\mu\text{mol/L}$ and others were normal. He was scheduled for PCNL under general anesthesia in the prone position. It was difficult to break the stone as it was big and hard. Airway pressure was found to be elevated at 37 $\text{cm H}_2\text{O}$ after

2 h. The operation was soon stopped and the patient was turned from the prone to the supine position. The abdomen was markedly distended and stony hard, and ultrasonography examination revealed fluid accumulated in hepatorenal recess and inferior abdominal cavity. A drain was punctured through McBurney point and soon 100 mL of colorless liquid was drained. The patient was then sent to the ICU and accepted synchronized intermittent mandatory ventilation (SIMV). It was detected that the abdominal pressure reached 39 $\text{cm H}_2\text{O}$. A drainage tube was inserted into the right upper abdomen under the guidance of ultrasonography and diuretic was used as supplementary. The drainage flow and the urine volume were 1000 mL and 6000 mL respectively on operative day. The abdominal pressure dropped at 20 $\text{cm H}_2\text{O}$ and he was observed and extubated next day. The patient recovered well without further complications.

Case 2

A 77-year old male patient was admitted to the hospital for left lumbodynia for 4 months. IVU (Fig. 2) revealed left kidney staghorn calculi. The patient was scheduled for PCNL under general anesthesia in the prone position. It took 1.5 h to complete the operation and the airway pressure elevated to 35 $\text{cm H}_2\text{O}$ in the end. A distended abdomen was observed when turned to the supine position (Fig. 3). The patient was soon sent to ICU. Abdominal pressure got to 39 $\text{cm H}_2\text{O}$ and massive effusion was detected in

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Figure 1. IVU revealed multiple large right kidney staghorn calculi.



Figure 2. IVU detected left kidney staghorn calculi.

hepatorenal recess. A drainage tube was inserted into the right upper abdomen under the guidance of ultrasonography and soon massive colorless fluid flowed out. Diuretic was also prescribed to the patient. Abdominal pressure decreased to 18 cm H₂O and he was extubated the next day. Post-operative KUB showed that the stone was cleared well. However, the patient suffered sudden gasp and tremble in wee hours after two weeks. His oxygen saturation dropped down to 72%. He got cyanosis of lips and lower breath sound in the right lower lung. Bedside chest film revealed right lower part pulmonary atelectasis and it was highly suspected pulmonary infarction. Laboratory test showed D-dimer reached 40.01 mg/L. Urgent pulmonary angiography proved pulmonary artery embolism and right lower part pulmonary atelectasis. He accepted thrombolysis with alteplase and was fully recovered after one month.

Discussion

Extravasation is a common incident during PCNL, which can potentially lead to untoward consequences. Intra-abdominal irrigation fluid extravasation which leads to abdominal hypertension is a rare complication with few reports. Abdominal hypertension is defined as intra-abdominal pressure of 12 mm Hg or more, which could result in abdominal compartment syndrome (ACS). ACS developed when IAP elevated over 20 mm Hg stably and resulted in abdominal distension, respiratory insufficiency, increased central venous pressure and decreased urine out.¹ Abdominal hypertension or ACS may develop due to iatrogenic etiologies, such as laparoscopy, intra-abdominal bleeding, intestinal edema, or massive fluid resuscitation. Early detection and treatment may prevent morbidity and mortality.

How intra-abdominal irrigation fluid extravasation developed? In our two cases, some common factors existed. Firstly, as the stones were big and hard, both of the operation time lasted more than 1 h. And some renal pelvis mucosa was teared, which could lead to intravascular absorption. In order to clear operative field, the irrigation volume was very large. Some researchers thought that intra-abdominal irrigation was caused by a technical error in placing the dilator inside the abdomen.² While Etemadian et al reported that they performed laparotomy and revealed intact intraperitoneal viscera.³ We placed the dilator successfully for both patients without loss of channel in the operation.

Early detection of intra-abdominal extravasation is very important to prevent morbidity and mortality. Hemodynamics changes are important index for intra-abdominal extravasation. Abdomen distention is an obvious physical sign. However, it is also easy to be overlooked as the prone position. Airway pressure is a



Figure 3. The abdomen was markedly distended and stony hard after operation.

key observation index, with the guard line at 30 cm H₂O. The increase of airway pressure may have been due to dislocation of the endotracheal tube toward the bronchi, secretions, bronchospasm and pneumothorax, which can happen during this type of procedures. Normal breathing sounds, no secretions and normal SpO₂ may indicate intra-abdominal extravagation.² Koroğlu et al established that there were no clinically significant changes in fluid-electrolyte balance when 0.9% NaCl was used in PCNL.⁴ Electrolyte imbalance was not observed in our cases, because 0.9% NaCl was used during PCNL.

Diuretic was effective for slightly intra-abdominal extravagation. However, as to severe extravagation, especially when fluid could be detected by ultrasonography, a drainage tube is essential to alleviate the compartment of the abdomen. The drainage tap should be placed in the hepatorenal recess as it is lowest of the abdomen cavity of the supine position. We could even suck fluid through the drainage tube to decompress the abdomen quickly. In addition, we should prevent other untoward complications like disseminated intravascular coagulation (DIC). For the second case, the reason why the patient suffered pulmonary infarction may be long-term bedridden. In addition, PCNL in the oblique supine lithotomy position was superior to PCNL in the prone position regarding effects on respiratory and cardiovascular status, making it more comfortable for patients and anesthesiologists.⁵ It is also easy to monitor the abdomen sign of abdominal hypertension.

Conclusion

Irrigation fluid extravasation during PCNL can be life-threatening. Keep continuous vigilance during operation. Timely treatment may prevent morbidity and mortality if early detected.

Conflicts of interest

None.

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