



## Case report

# Successful nonsurgical management of inferior vena cava penetration as a rare complication of percutaneous nephrostomy



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## ABSTRACT

Inferior vena cava penetration is a rare and life-threatening complication of percutaneous nephrostomy. This report describes our experience of successful nonsurgical management and smooth admission course. No similar case has been reported to our knowledge.

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## 1. Introduction

Percutaneous nephrostomy (PCN) is a common procedure for urinary diversion and maintenance of renal function. The incidence of PCN complication is mainly related to a puncture site and route. Inferior vena cava (IVC) penetration is always a potential complication due to its anatomic relation, although no such complication has been previously reported.

## 2. Case report

A 67-year-old female was a patient of bladder cancer, cT4N2M1, with bilateral hydronephrosis. Her body mass index (BMI) was 19.97 kg/m<sup>2</sup> (height: 155 cm, body weight: 48 kg). Because a left atrophic kidney was noted, right PCN was performed to preserve renal function. She received regular follow-up in the urology outpatient department for right PCN function evaluation and revision. However, an episode of revision difficulty was noted and a resistance was encountered when changing a new pigtail catheter. Thus, a semi-rigid, blunt, plastic tube was used as introducing an inner stent for PCN revision. Unfortunately, bloody drainage from the PCN catheter and mild abdominal pain were noted after the revision procedure. Advanced PCN insertion depth was revealed. Therefore, she was immediately transferred to the emergency

department for further evaluation. Emergent abdominal computed tomography (CT) revealed the tip and the inflated balloon in the IVC (Fig. 1).

After consultation with a cardiovascular specialist, conservative treatment and attempting to remove the PCN catheter were suggested because current stable hemodynamic conditions were noted. Prior to removing the PCN catheter, we set sufficient vital sign monitors. In addition, coagulation parameters checkup, injection of hemostasis agent, and blood transfusion were done for the high risk of massive bleeding. Then, the PCN catheter was withdrawn with direct right abdomen compression by a 500 mL bottle and tight sponge. Ten hours later, abdominal CT for re-evaluation showed neither massive bleeding from the IVC penetrating wound nor direct signs of massive fluid accumulation over the retroperitoneal cavity (Fig. 2). Abdominal compression was released after 12 hours. Her vital sign remained stable. She was then admitted to a general ward for further care including complete bed rest, prophylactic antibiotics, and homeostasis agent usage. An ultrasound-guided right PCN was done smoothly on the second day. The admission course was smooth without any severe consequence. Aggressive intervention or emergent surgery was not needed.

## 3. Discussion

PCN is a common procedure for urinary diversion and maintenance of renal function. Among the variant clinical etiologies, urinary obstruction is the most common condition and is responsible

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**Fig. 1.** Abdominal computed tomography after percutaneous nephrostomy revision shows the tip and the inflated balloon in the lumen of the inferior vena cava.

for approximately 90% of PCNs.<sup>1</sup> The remaining 10% are performed for reasons such as hemorrhagic cystitis, urinary fistulas, antegrade ureteral stent, and access for percutaneous nephrolithotomy. The incidence of PCN complications is mainly related to puncture site and route. Puncture site selection is crucial in minimizing the risk of hemorrhage; generally, aiming at a lower dorsal calyx as target and posterolateral puncture site always reduces the risk of complications. The collecting system can be localized by ultrasonography, fluoroscopy, or computed tomography.<sup>1,2</sup> However, every modality has certain limitations and risks.<sup>1–3</sup>

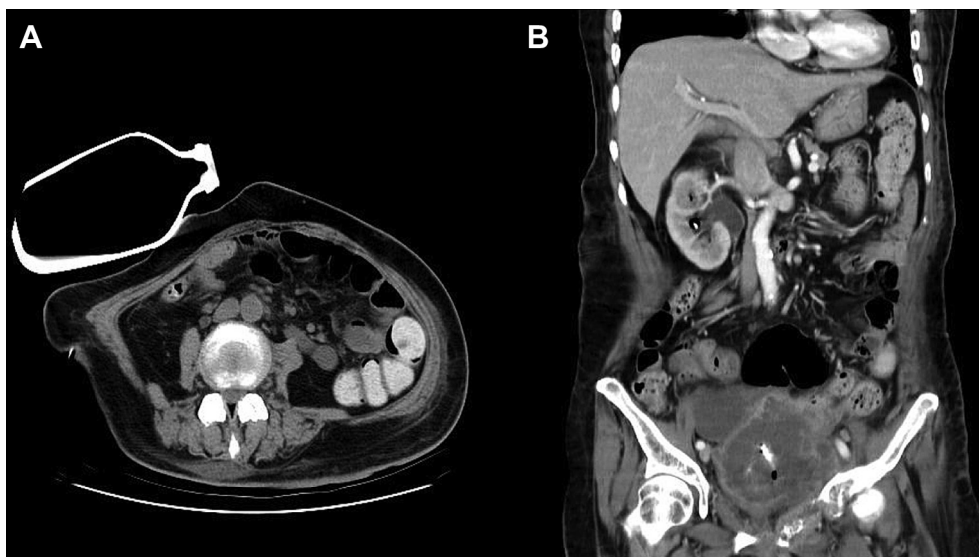
Unusual major complications have been reported such as splenic injury, lumbar artery bleeding, pseudoaneurysm, arteriovenous fistula, and intramural dissection of the renal collecting

system.<sup>4–6</sup> However, to our knowledge, this is the first case of IVC injury as a rare complication during PCN with a successful experience of PCN removal without exploratory operation.

The IVC is formed by the anastomoses of the left and right common iliac veins. It is posterior to the abdominal cavity and runs along the right side of the vertebral column. Furthermore, the IVC lies along the transverse rotation axis of the right kidney hilum, which is the target of PCN puncture. As a result, the risk of IVC injury should also be kept in mind due to the close anatomical relationship of the right kidney and IVC. Abnormal resistance during tube revision, unusual advanced PCN tube depth, and consecutive bloody drainage can give us the hints of this threatening complication; thus, we should consider an alternative PCN revision method, such as PCN revision under fluoroscopy.

To date, injuries to the IVC remain highly fatal, with mortality rates conventionally higher than 50%, particularly for the less accessible segments (such as retrohepatic, suprarenal, IVC, and iliac bifurcation).<sup>7–9</sup> Generally, direct compression above and below the injury section during IVC exposure should be done via surgical approach; principally, repair and ligation are the predominant technical options for such penetrated infrarenal IVC injury.<sup>8</sup>

In this case, we observed bloody drainage from PCN catheter with an advanced PCN depth and abdominal pain after PCN revision, and emergent abdominal CT showed the IVC injury. Although no sharp needle or blade was used during this revision procedure, such a rare life-threatening complication could occur. No previous experience has been reported in the literature. However, taking the stable hemodynamic status, old age, and terminal stage of malignancy into considerations, we used a 500 mL bottle and tight sponge for simulation of direct pressure over the IVC wound instead of emergent venorrhaphy. After the PCN catheter removal, repeated abdominal CT revealed no severe bleeding consequence. Possible explanations for this successful result may be the relatively low-pressure nature of IVC in a closed retroperitoneal cavity and satisfactorily direct compression effects by external devices. This patient's lean body may be one element contributing to this uneventful result (BMI: 19.97 kg/m<sup>2</sup>); however, there is no definite body weight, waist measurement, or BMI defined as the threshold for conservative compression therapy.



**Fig. 2.** Abdominal computed tomography after supportive treatment. (A) A 500 mL bottle and tight sponge usage as direct compression is noted. (B) No further bleeding or hematoma is noted in the retroperitoneum after percutaneous nephrostomy catheter removal.

Taking this case as an experience, conservative treatment might be indicated for blunt caval injury in selective cases. However, further experience is clearly needed for determining the role of conservative treatment for penetrating caval injury during PCN revision.<sup>8,10</sup> We should view the emergent vascular repair as the last but essential strategy when conservative treatment cannot maintain the stable hemodynamic status.

In conclusion, IVC penetration during PCN revision is rare; however, this complication could occur and may lead to a life-threatening consequence. This case provided a successful experience of PCN catheter removal with conservative treatment. However, further experience of similar cases is essential to clarify the roles of both conservative approach and emergent surgery for such a rare complication of PCN revision.

#### Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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