**International Journal of Clinical Urology**
2021; 5(2): 84-87
http://www.sciencepublishinggroup.com/j/ijcu
doi: 10.11648/j.ijcu.20210502.16
ISSN: 2640-1320 (Print); ISSN: 2640-1355 (Online)

# Endovascular Treatment of Major Vessels Percutaneous Nephrostomy Misplacement

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## To cite this article:

Alicia Lopez-Fernandez, Dario Vazquez-Martul, Daniel Fraga-Manteiga, Daniel Gulias-Soidan, Venancio Chantada Abal. Endovascular Treatment of Major Vessels Percutaneous Nephrostomy Misplacement. *International Journal of Clinical Urology*. Vol. 5, No. 2, 2021, pp. 80-83. doi: 10.11648/j.ijcu.20210502.16

**Received**: August 2, 2021; **Accepted**: August 23, 2021; **Published**: August 31, 2021

**Abstract:** Minimally invasive percutaneous treatment of urological diseases is daily increasing. Puncture, access to renal cavities and dilation the percutaneous tract is not a simple maneuver not free of complications. Percutaneous access of the kidney is sometimes mandatory such as drainage of distally obstructed kidneys in several situations like advanced tumors, stone-related situations and so others. Although the number of surgeries and the grade of specialization are rising, several complications like injuries to in-neighborhood organs, secondary sepsis or kidney bleeding may happen. The kidney is an extremely vascularized organ and this can facilitate vascular damage if some considerations are no taken into account previously. Major vessels (aorta artery and vena cava) damage is exceptional and generally require urgent surgery as in most penetrating injuries. A full endovascular treatment and repair in these situations is uncommon but possible. Initial misplacement of percutaneous nephrostomy tube (PNT) is not a frequent situation and when involving vessels, the small number of publications in literature mainly report catheter misplacement into the renal vessels or inferior vena cava, none affecting the aorta. This article presents two cases of misposition of PNT involving major vessels affecting vena cava and aorta artery. Both of them were successfully managed exclusively with endovascular treatment via femoral access.

**Keywords:** Percutaneous, Nephrostomy, Major Vessels, Kidney

## 1. Introduction

In 1865 Thomas Hiller described percutaneous nephrostomy tube placement (PNT) for therapeutic purposes. After that, Goodwin et al. published their 15 cases-experience in 1955 [1]; since then, several improvements have been carried out with the advancement of technology, new devices and the experience gained with the implementation of this minimally invasive approach [2-4].

Despite the popularization, the kidney has a complex arterial and venous system that predisposes it to any type of vascular damage during percutaneous renal procedures. Hemorrhage is a potential worrying complication of this approach and subsequent techniques [5]. Vascular complications usually occur in the renal parenchyma causing subcapsular or perirenal haematoma, arteriovenous fistula or towards the excretory system and pseudo aneurysms; complications involving major renal vessels are exceptional and generally require major surgery [6, 7].

This article presents two cases of major vessels damage secondary to the attempt to place a percutaneous nephrostomy tube. The first one involves the aorta artery (Ao) and the second one the inferior vena cava (IVC). Both of them were managed exclusively with endovascular treatment.

## 2. Case Reports

### *2.1. Case 1*

Patient 1 is a 64 year old man with history of muscle-invasive bladder carcinoma that required radical

cystectomy (pT2N1) in 2008 with completion of orthotopic ileal neobladder. Later on, right nephroureterectomy for urothelial carcinoma of the right ureter (pT3) was performed. On his evolution the patient had nodal recurrence in progression causing left obstructive uropathy treated by definitive percutaneous nephrostomy (PN). During the replacement of the latter and after introduction of a new 12 French nephrostomy tube, external major bleeding was observed. Computed Tomography (CT) scan confirmed trans-aortic housing of the catheter at the level of infrarenal Ao and retroperitoneal hematoma [Figure 1], which led the patient to be referred to our Centre.

Combining endovascular and percutaneous treatment, occlusion of aortic lumen was carried out using a 46 mm compliant Reliant balloon (Medtronic, Minneapolis, MN) via the retrograde right femoral access with 12F introducer and extrinsic compression by Berenstein 8.5/11.5 mm catheter (Boston Scientific, Watertown, MA) via the preliminary nephrostomy route. Vasoactive drugs administration was required due to the instability of the patient as well as 3 units of red blood cells concentrates. After the operation and checking the hemostasis level of the aortic wall, an external drainage catheter was left per nephrostomy percutaneous route.

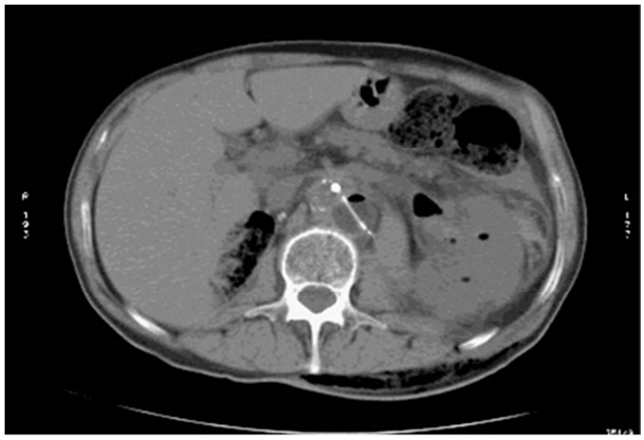

***Figure 1.*** *CT showing intraaortic placement of the catheter.*

On the second postoperative day, progressive anemia without hemodynamic instability was observed. CT scan showed left infrarenal pseudo-aneurysm at the level of the previous injury. Urgent intervention was decided on implanting a ETCF2525C49EE infrarenal aortic cuff (25*25*45 mm) (Medtronic, Minneapolis, MN) and subsequent compression with Reliant balloon, verifying the correct sealing of the aorta. Once the patient was stabilized, PN Percuflex 12 F (Boston Scientific, Watertown, MA) was placed in Valdivia position through the left lower calyx controlled by real time ultrasound and supported by fluoroscopy.

No points of bleeding, hematuria or urinary leakage were observed in control tests.

### *2.2. Case 2*

Patient 2 is a 93 years old patient with a long record of comorbidities and history of high-risk non-muscle-invasive bladder cancer (high grade pTa) treated in 2019 with transurethral resection of bladder tumor (TURBT). He presented with right obstructive uropathy due to a 9 mm ureteral stone and was managed with a temporary PN 7 Ch. insertion. During the procedure, an important bleeding of venous characteristics was observed. A CT scan was performed showing the catheter positioned in intrahepatic IVC [Figure 2] and a perirenal hematoma. Patient was referred to our center.

The case was consulted with the Intervention Radiology Unit, deciding to withdraw the catheter under fluoroscopic control and a surgical team on standby.

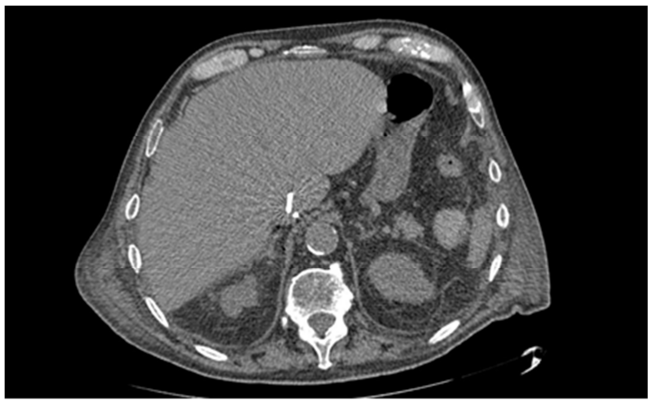

***Figure 2.*** *CT showing catheter placed in IVC.*

A femoral access was performed to catheterize both renal vein and artery. Under fluoroscopic control the catheter was withdrawn. No bleeding or complication was observed but a previous renal vein thrombosis.

In the following days patient was discharged with no need of PN replacement or any other invasive treatment.

## 3. Discussion

Hemorrhagic complications related to percutaneous urological procedures are relatively uncommon and include among others hematoma, active bleeding, arteriovenous fistula and arterial pseudoaneurysm.

Vascular complications usually affect parenchymal vascularity and more rarely the main renal vessels. Bleeding mainly occurs from injury to anterior or posterior segmental arteries [6].

Although relatively uncommon, iatrogenic renovascular injuries have increased due to the raising number of interventional procedures. However, most of these lesions tend to heal spontaneously and only a small percentage requires an endovascular repair, which has become the first-line of treatment for these complications [8].

Subcapsular renal or perinephric hematomas are a very rare hemorrhagic complication. They are mostly diagnosed after performing a radiologic evaluation for another reason and do not usually require any treatment. [9]

Other causes of delayed bleeding are arteriovenous fistulas and arterial pseudoaneurysm. They are seen in 1.2% of cases and the diagnosis is frequently made after the patient is

discharged and reconsult for persistent hematuria. A CT confirms the diagnosis and the treatment is selective embolization [10].

Quality standards of the Society of Cardiovascular and Interventional Radiology and the American College of Radiology make reference to a major hemorrhage in less than 4% of cases [11]. These lesions may occur during kidney puncture, tract dilatation or during endoscopic surgery if performed, and depend on various factors such as the number of routes made, the thickness of renal parenchyma or the presence of Diabetes Mellitus [12, 13].

In order to minimize bleeding complications urologists and radiologists should be advised of kidney vascularization and possible anatomical variation. Puncture must be performed through the avascular line in the renal convexity, also known as Brödel line and acceding upper tract cavities through the calyx papillae, when needed [14]. Real-time ultrasound guided puncture combined with fluoroscopy seem to be the safest approach in order to minimize complications, not only vascular but also damage to in-neighborhood organs such as liver or bowels [15]. It is also important to use ultrasound because fluoroscopy guided puncture may not be an option for cases of obstructive uropathy.

Intravenous misplacement after a percutaneous approach is also an unusual complication. We found less than ten cases reported of misplaced PN in IVC. Most of them were managed by performing the catheter withdrawal in 1 or 2 steps under fluoroscopy or ultrasound. Only some cases required open surgery [16-20].

Although endovascular treatment is a real option for the treatment of blunt traumatic abdominal injury [21-22], in our review we have neither found any case of comprehensive endovascular repair after penetrating trauma in abdominal Ao nor after percutaneous renal treatment.

Therefore, the case presented with penetrating lesion to the Ao not only describes a rare vascular complication in percutaneous urological approaches but also demonstrates the feasibility of minimally invasive treatment by means of an endovascular treatment. It supports the use of these techniques for complications management in percutaneous renal treatments and other well-defined diseases involving large vessels, such as aortic dissection or pseudo-aneurysms [23].

## 4. Conclusion

Ultrasound guided puncture for nephrostomy tube placement and other percutaneous kidney procedures combined with real time fluoroscopy should be the standard approach. Iatrogenic penetrating injuries into the major abdominal vessels are uncommon and usually require surgical treatment, in these two cases we demonstrate the possibility of a full endovascular repair and control.

## Conflict of Interest Statement

The authors have no conflict of interest to declare.

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