CASE REPORTS
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Incidental misplacement of a percutaneous nephrostomy tube in the inferior vena cava

Incidentalni neadekvatni plasman perkutanog nefrostomskog katetera u venu kavu inferior

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Abstract

Introduction. An isolated renal pelvis rupture is a rare type of blunt renal trauma that can occur mostly in patients with pre-existing hydronephrosis due to different causes. We presented a patient with the misplacement of a percutaneous nephrostomy tube during the treatment of isolated renal pelvis rupture in a patient with pre-existing hydronephrosis caused by post-irradiation ureteral stricture. **Case report.** A 36-year-old woman was referred to our institution by her gynaecologist for the treatment of a retroperitoneal urinoma. She had completed the irradiation treatment with concurrent cisplatin chemotherapy for a uterine malignancy one year ago. A computed tomography scan showed an isolated rupture of the left renal pelvis with the pre-existing hydronephrosis. A nephrostomy catheter was misplaced in the inferior vena cava during the percutaneous urinary drainage attempt. The patient underwent a laparotomy, renal pelvis suture and ureteroneocystostomy with an indwelling double pigtail stent. The percutaneous nephrostomy was removed during the same surgical procedure. **Conclusion.** Inadvertent injury of vascular structures is a possible complication of percutaneous nephrostomy under ultrasound guidance. It may have been possible to avoid the reported complication if the dilation of the nephrostomy tract over the guidewire had been performed under contrast-enhanced X-ray fluoroscopy.

Key words:
hydronephrosis; intraoperative complications; nephrostomy, percutaneous; tomography, x-ray computed; urologic surgical procedures; vena cava, inferior.

Apstrakt

Uvod. Izolovana ruptura pijelokaliksnog sistema je redak tip tupe traume tog sistema koja se može pojaviti kod bolesnika sa preegzistentnom hidronefozom izazvanom različitim uzrocima. Prikazali smo bolesnicu sa preegzistentnom hidronefrozom izazvanom postiradijacionom stenozom uretera sa neadekvatnim plasmanom nefrostomskog katetera prilikom tretmana izolovane rupture pijelokaliksnog sistema. **Prikaz bolesnika.** Bolesnica, stara 36 godina, upućena je u našu instituciju od strane ginekologa radi lečenja retroperitonealnog urinoma. Godinu dana ranije završena je kombinovana zračna terapija i primena hemioterapije cisplatinom zbog ginekološkog maligniteta. Kompijuterizovanom tomografijom utvrđena je izolovana ruptura pijelokaliksnog sistema levog bubrega sa preegzistentnom hidronefrozom. Nefrostomski kateter je nehotično plasiran u venu kavu inferior prilikom pokušaja preliminarne perkutane drenaže. Bolesnici je urađena laparotomija, sutura pijelokaliksnog sistema i ureterocistoneostomija sa postavljanjem dvostrukog *pigtail* katetera. Nefrostomski kateter je uklonjen u toku iste procedure. **Zaključak.** Incidentalna povreda vaskularnih struktura je moguća kod ultrazučno vođenog plasmana nefrostomskog katetera. Navedena komplikacija bi možda bila izbegnuta da je dilatacija nefrostomskog trakta preko žice vodilje rađena pod kontrastnom radiološkom fluoroskopijom.

Ključne reči:
hidronefroza; intraoperativne komplikacije; nefrostoma, perkutana; tomografija, kompjuterizovana, rendgenska; hirurgija, urološka, procedure; v. cava inferior.

Introduction

Ureteral stricture is a common complication of irradiation treatment for uterine cervical malignancies. An overall incidence of ureteral stricture with consecutive hydronephrosis in patients following irradiation treatment varies between 1% and 2.5% [1]. An isolated renal pelvis rupture is a rare type of blunt renal trauma which occurs most frequently in patients with

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pre-existing hydronephrosis due to ureteral stones, tumours, retroperitoneal fibrosis, pelvic masses or congenital anomalies, such as stenosis of the ureteropelvic junction or vesicoureteral reflux [2]. In such cases, the formation of urinoma and consequent abscess formation can occur. Percutaneous nephrostomy (PCN) is a safe and efficient procedure for temporary urinary diversion and is rarely associated with serious complications [3].

We present a single case who represents a simultaneous appearance of a rare injury and an unusual complication of the treatment.

Case report

A thirty-six-year-old woman was referred to our institution by her gynaecologist to treat a retroperitoneal urinoma. It was found during a routine computed tomography (CT) scan (Figure 1a), scheduled as part of a check-up visit following the irradiation treatment for a uterine cervical malignancy (FIGO stage 2b). The previous year, the patient had completed combined irradiation treatment (at a total dose of 74 Gy) delivered by conformal external beam radiation treatment and brachytherapy with concurrent cisplatin chemotherapy. Preceding follow-up monitoring had revealed no sign of the recurrence of the disease. However, the patient's recent history reported moderate pain in the left flank following an accidental fall in the bathroom, although she did not seek medical attention at the time. On admission she reported urological complaints and haematuria. A physical examination revealed mild tenderness, located predominantly in the upper left region of the abdomen and flank. The laboratory findings were unremarkable. Intravenous urography (IVU) revealed contrast extravasation in the left retroperitoneum, mild hydronephrosis and stricture of the distal third of the left ureter (Figure 1b).

The initial treatment plan was to place a PCN catheter under ultrasound guidance. The patient was positioned in the supine position. A Chiba needle was inserted in the posterior lower calix under ultrasound guidance (Acuson X500, C6-2 transducer, Siemens, Erlangen, Germany). The intervention proceeded with the placement of the flexible tip guidewire and dilation of the nephrostomy tract over a guidewire. Following the placement of the nephrostomy catheter (8 French Bard, Becton, Dickinson and Company, United States), unusual blood drainage was noticed. The PCN was closed and the patient underwent a CT scan immediately, which revealed that the pigtail nephrostomy tube had passed through the left renal vein into the inferior cava vein (Figures 2a and b). Under intensive

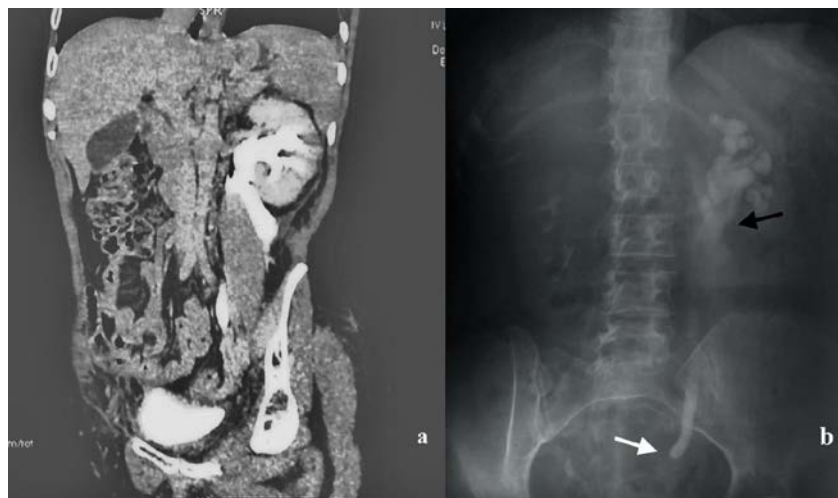

Fig. 1 – a) Computed tomography after trauma – contrast extravasation around the psoas muscle. No injuries to the kidney; b) On urography retroperitoneal extravasation (black arrow indicating) and stenotic distal ureter (white arrow indicating) are visible.

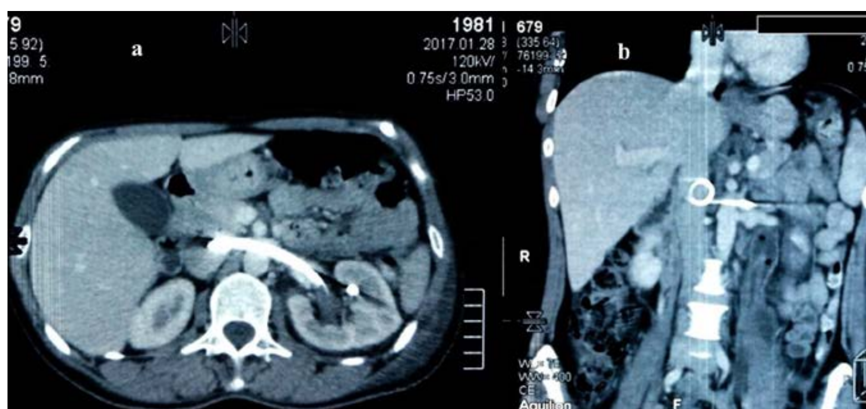

Fig. 2 – a) Percutaneous nephrostomy in the renal vein; b) Tip of the nephrostomy pigtail in the vena cava

care unit monitoring, the patient had stable haemodynamic parameters and showed no symptoms. The patient's haemoglobin blood levels were stable, excluding significant blood loss.

The patient underwent immediate surgery following the median laparotomy with a vascular surgeon present. Strict vascular control of the pigtail in the cava vein and unfolding conducted by the vascular surgeon allowed for the removal of the PCN by a urologist. There was no bleeding or haematoma formation after the removal of the PCN. A simultaneous renal pelvis suture and ureteroneocystostomy (a psoas hitch and a double pigtail stenting of the ureter) was performed. The procedure was completed, a drain inserted and the wound closed.

Thromboprophylaxis (nadroparin potassium, 0.3 mL) was introduced on the day of surgery, as well as third-generation cephalosporines (ceftriaxone 2 g/day), and continued during the seven days while the patient remained in hospital. The patient was discharged with a double pigtail catheter in the left renal unit and a urinary catheter. The drain was removed on postoperative day 2 and the urinary catheter on postoperative day 10. The double pigtail catheter was removed on postoperative day 14 during an outpatient follow-up appointment. The patient's postoperative recovery was uneventful.

A controlled IVU revealed the patient's left kidney functional, complete healing of the renal pelvis, patent ureteroneocystostomy and persistent hydronephrosis (Figure 3).

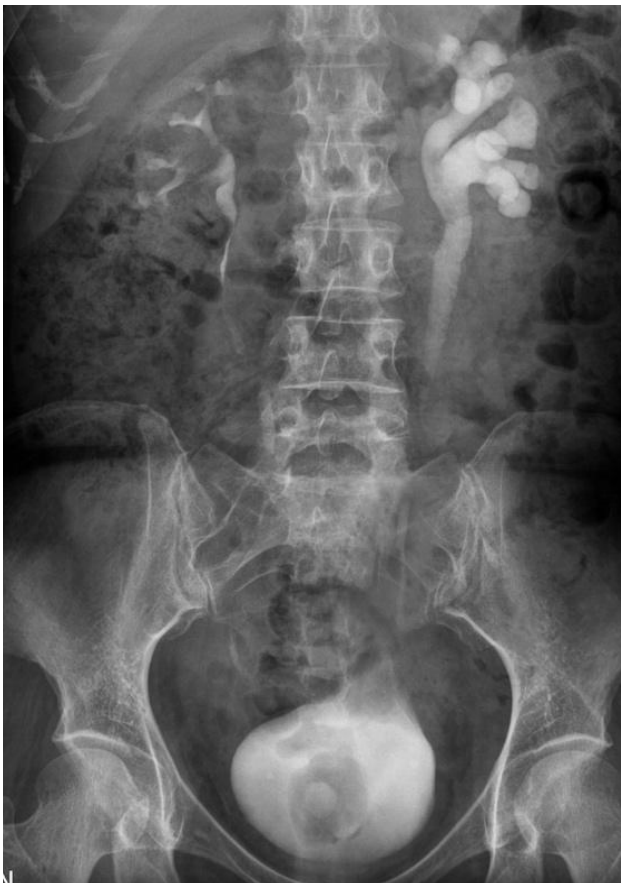

Fig. 3 – Postoperative control intravenous urography.

Discussion

Isolated ruptures of the renal collecting system are more common in cases with pre-existing hydronephrosis. To the best of our knowledge, there have been no previous reports of isolated renal pelvis rupture in patients with hydronephrosis as a result of postirradiation stricture of the distal part of the ureter.

Although the CT scan is considered a standard of care for renal trauma, IVU remains a useful method for the reliable diagnosis of urinary extravasation [4, 5]. Injuries of the renal collecting system remain a challenging issue in CT diagnostics. Extravasation of contrast will not occur during the early phases of CT scanning. Delayed CT scans are required to diagnose significant injury of renal pelvis or ureters. Contrast extravasation may be confirmed by additional IVU exposures at 30 minutes or later after intravenous contrast administration [6].

The majority of cases including an isolated injury of the renal collecting system require an active approach: a placement of a PCN or double pigtail stent, or even an open surgery [6]. Although spontaneous healing of the injury was reported, drainage should be advised for cases with persisting or increasing urinoma after five to seven days [7]. The surgical approach is indicated in cases with pre-existing ureteral obstruction.

Following a proper puncture of the pelvicalyceal system, flexible-tip guidewire problems can occur under ultrasound guidance. A standard set guidewire was placed in our patient. The protrusion of the Chiba needle deep into the collecting system of the kidney and inadvertent movements of the needle during the insertion of the guidewire may have resulted in direct cannulation of the vein. Therefore, Chiba needle tips should be inserted minimally and carefully controlled during the introduction of the guidewire. A lack of space needed for a flexible guidewire tip to wrap and secure the position for dilation may be another problem. In some reported cases the guidewire curled within the calyx itself, resulting in a vein puncture following the dilation of the tract [8]. The placement of the PCN in the renal vein and vena cava is an uncommon complication, with a total of 10 cases reported in the literature to date (Table 1) [8–15]. The majority of these 10 cases occurred in patients intended for percutaneous nephrolithotomy treatment; only two of the affected patients were scheduled for preliminary drainage. The majority of the misplacements involved the left renal vein. Large dilation tracts were reported in the majority of cases and all catheters were withdrawn without open surgery.

Possible PCN placement in the renal vein and vena cava can occur because of the existence of an anastomotic collar of veins around the calyceal infundibulum with significant antero-posterior connections and a close relationship to the renal vein. An accidental peri-infundibular vein puncture could occur in cases without permanent radiographic control and in patients without a clear distension of the calyceal infundibulum. A guidewire will follow the puncture route

Table 1

Demographic, clinical and operative data of previously published cases of misplacements of percutaneous nephrostomy (PCN) catheter within the inferior cava vein

Age/ gender	Medical history	Catheter size	Side	Location	Catheter withdrawal	Original operation	Definitive operation	Ref.
42/M	NA	14F	left	renal vein, IVC	2-step under CT	PCNL	late PCNL	8
38/F	right ureterolithotomy	14F	left	renal vein, IVC	2-step under fluoroscopy	PCNL	PCNL	8
48/M	right nephrectomy	14F	left	renal vein	1-step under ultrasound	PCNL	late ureterolithotomy	8
63/F	UCM, EBRT	12F	left	renal vein, IVC	1-step under fluoroscopy	PCN	PCN	9
54/M	left nephrectomy cystectomy	14F	right	renal vein	2-step under fluoroscopy	PCNL	laparotomy late PCNL	10
NA	NA	10F	NA	IVC	1-step under fluoroscopy	NA	NA	11
52/M	right nephrectomy	14F	left	renal vein	1-step removal	PCNL	NA	12
35/F	right nephrectomy	12F	left	renal vein, IVC	2-step under fluoroscopy	PCNL	NA	13
32/F	left lithotomy	14F	left	renal vein, IVC	2-step under ultrasound	PCNL	NA	14
50/M	left PCNL	8F	left	renal vein, IVC	1-step pyelotomy	PCN	pyelotomy	15

NA – not available; IVC – inferior vena cava; PCNL – percutaneous nephrolithotomy; PCN – percutaneous nephrostomy; UCM –uterine cervical malignancy; EBRT – external beam radiotherapy.

through the vein, and after dilation the PCN will be eventually placed through the renal vein into the lumen of the inferior vena cava [8, 16].

Chen et al. [8] suggested that another possible mechanism involved is an injury to the infundibular vein with the large dilatators of nephrostomy tract during percutaneous stone treatment. In this case, a calyceal fornix is strictly advised as a PCN puncture site [16].

Closure of the nephrostomy tube is the first-line manoeuvre after noticing blood flow draining through the PCN. Subsequent removal of the PCN can be performed in one or two stages, in the operating room or under CT or fluoroscopy control and with a surgical team on standby [8]. An intravenous balloon tamponade was recently reported as a successful treatment [17]. In the described case, ureteral implantation was necessary anyway, so the active approach was the primary choice, including ureteral reimplantation with the placement of a double pigtail stent after the removal of the PCN and renal pelvis suture in the operating room.

Thromboprophylaxis was introduced on the day of surgery during the hospital stay, as well as antibiotic support. Thromboembolic complications are rare and long-time prophylaxis is not obligatory in the absence of other reasons [8]. Communication of the urinary and vascular systems through a nephrostomy tube suggests obligatory antibiotic use in order to prevent systemic inflammatory complications, especially in cases of an infected kidney [8]. This complication seems to be preventable. The authors suggest regularly checking the position of the Chiba needle and guidewire during dilation of nephrostomy tract, using X-ray fluoroscopy with contrast medium.

Conclusion

Inadvertent injury of vascular structures is a possible complication of percutaneous nephrostomy under ultrasound guidance. It may have been possible to avoid the reported complication if the dilation of the nephrostomy tract over the guidewire had been performed under contrast-enhanced X-ray fluoroscopy.

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Conflict of interest

Authors have nothing to declare.

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