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Loop-tip technique for replacing dislodged catheters

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ABSTRACT

Accidental catheter dislodgement is a common occurrence following placement of drainage and vascular catheters. Several methods have been developed to replace dislodged catheters using existing catheter tracts. We describe a new technique using an adjustable self-centering "Loop-Tip" catheter to facilitate salvage of catheter tracts. The technique may be suitable for re-canalization of a wide variety of catheter tracts and sinus tracts.

Keywords: Dislodged catheter, Loop-Tip catheter, Nephrostomy salvage, Tunneled catheter salvage

INTRODUCTION

Despite the use of various anchoring techniques, drainage catheters and tunneled vascular catheters frequently become dislodged. Options for treating catheter dislodgement include replacing the catheter through the existing tract, inserting a new catheter through a new tract, or leaving the catheter out. Often, the simplest and fastest method of re-establishing catheter access is by salvaging the existing catheter tract. Various methods have been developed to replace dislodged catheters. We describe a new technique using a self-centering "Loop-Tip" catheter to salvage existing catheter tracts. The technique may also be helpful in cannulation of other types of sinus tracts and fistulae.

TECHNIQUE DESCRIPTION

The method used to re-establish access utilizes a novel "Loop-Tip" catheter developed specifically for re-canalization of irregular sinus tracts. The Loop-Tip catheter consists of a hydrophilic 0.018" guidewire (Terumo Glidewire, Somerset, NJ, USA) doubled back on itself within an angled 5 FR catheter (Kumpe Catheter, Angiodynamics, Latham, NY, USA). The guidewire loop protrudes from the tip of the catheter [Figure 1]. The two free ends of the guidewire are secured at the catheter hub by a screw tip torque device (Glidewire Torque Device, Terumo Interventional Systems, Somerset, NJ, USA), [Figure 2]. The size of the loop can be adjusted by pulling on the guidewire ends and re-tightening the torque device. In the instance of a dislodged nephrostomy tube, the catheter tract is opacified with contrast; then, the Loop-Tip catheter is inserted and advanced within the tract to the target. Once the target has been reached, the guidewire loop is pulled back through the catheter, leaving the catheter tip in the target. The 0.018" wire loop is replaced with an 0.035" guidewire (Amplatz guidewire, Boston Scientific, Marlborough, MA, USA) which is then advanced into the target, re-establishing a stable access. A new drainage catheter (Flexima Drainage Catheter, Boston Scientific, Marlborough, MA, USA) is then inserted and positioned using standard technique.

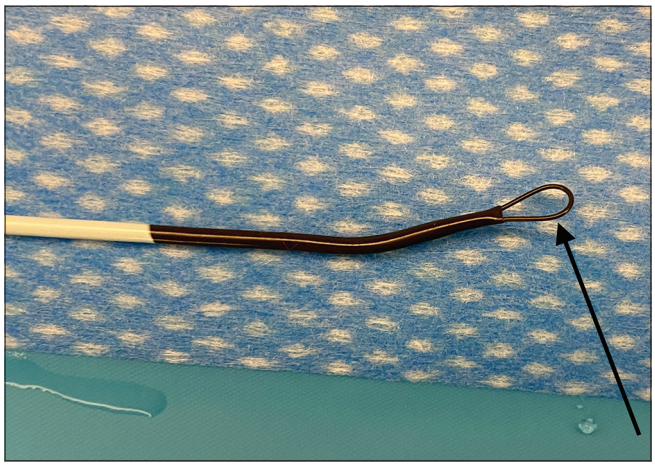

Figure 1: Photograph of Loop-Tip catheter. A hydrophilic wire loop (black arrow) protrudes from the catheter tip.

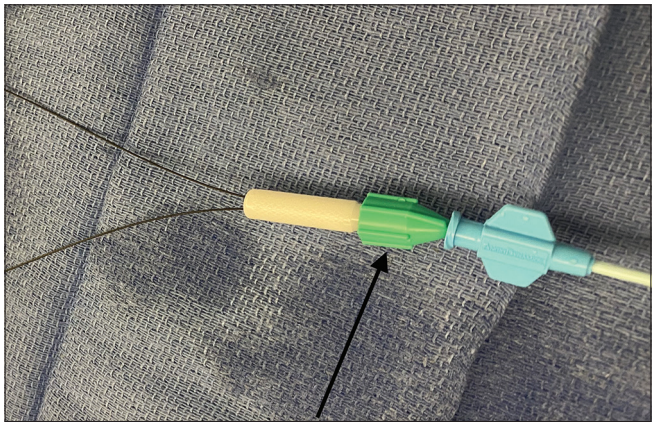

Figure 2: Photograph of Loop-tip catheter and torque device. The torque device (black arrow) secures the free ends of a looped hydrophilic guidewire.

CASE PRESENTATION

An 84-year-old female with chronic bilateral ureteral obstruction presented to the Emergency Department after dislodgement of her left nephrostomy tube. Her previously placed bilateral nephrostomy tubes and bilateral ureteral stents had been functioning well for more than 4 years. She arrived in Interventional Radiology 8 h after left nephrostomy tube dislodgement. The patient was placed in a prone position. Under fluoroscopic guidance, the left nephrostomy sinus tract was opacified with contrast demonstrating a pathway extending from the skin surface toward a lower pole calyx [Figure 3a]. A Loop-Tip catheter was inserted into the tract and easily maneuvered into the lower pole calyx [Figure 3b]. The Loop-Tip catheter was then advanced into the renal pelvis [Figure 3c]. The wire loop was removed, leaving the catheter tip in the renal pelvis [Figure 3d]. An 0.035" guidewire was, then, inserted into the catheter and positioned in the proximal ureter. The loop of a new 8 FR locking pigtail nephrostomy catheter was then positioned within the left renal pelvis [Figure 3e].

OTHER CASES

From July 2018 to June 2021, using the Loop-Tip catheter system, we successfully replaced 15 accidentally dislodged catheters (5 women, 10 men, ranging in age from 47 to 87 years), as shown in Table 1. Types of dislodged catheters included: Six nephrostomy tubes, five suprapubic catheters, two gastrostomy tubes, and two tunneled dialysis catheters. The 15 catheters had been placed a median of 12 months before inadvertent removal (range 3 weeks to 5 years). The catheters had been dislodged an average of 1.1 days before attempted replacement (range 1 day to 3 days). No complications were reported.

DISCUSSION

In an effort to prevent catheter dislodgement, several catheter modifications have been developed to secure catheters. Types of anchoring modifications include locking loops, inflatable balloons, and Dacron cuffs.[1] Despite various anchoring methods, drainage catheters and tunneled central venous catheters frequently become dislodged. Options for treating catheter dislodgement include replacing the catheter through the existing tract, inserting a new catheter through a new tract, or leaving the catheter out.

Several strategies have been proposed to replace dislodged catheters. An early method utilized an occlusive cup to perform a sinogram followed by catheter advancement into the existing catheter tract.[2] Train described a technique to distend the sinus tract by injecting contrast through a curved catheter which could then be advanced within the sinus tract.[3] One frequently used technique is manipulation of a hydrophilic guidewire in the sinus tract followed by insertion of an over-the-wire catheter.[4]

Catheter replacement techniques can also be used within the vascular system. Wang *et al.* described a guidewire looping technique for recanalization of infrapopliteal vessels.[5] The success rate for replacing a dislodged catheter depends on the age of the tract and the length of time between dislodgement and attempted salvage.[6] Collares *et al.* reported an 87% success rate for the catheter/wire technique during salvage of 24 tunneled central venous catheters, 170 gastrostomies/jejunostomies, 25 nephrostomies, five biliary catheters, and one transhepatic central venous catheter.[7] Egglin *et al.* reported replacement of 12/13 dislodged tunneled central venous catheters using catheter/wire technique.[8] A dislodged catheter leaves an immature sinus tract with irregular walls. A mature sinus tract tends to have smoother but still irregular walls. One method of sinus tract cannulation employs the use of conventional 'over-the-wire' technique. However, advancement of an angled hydrophilic guidewire directly into a sinus tract often results in wall irregularities impeding the progress of the

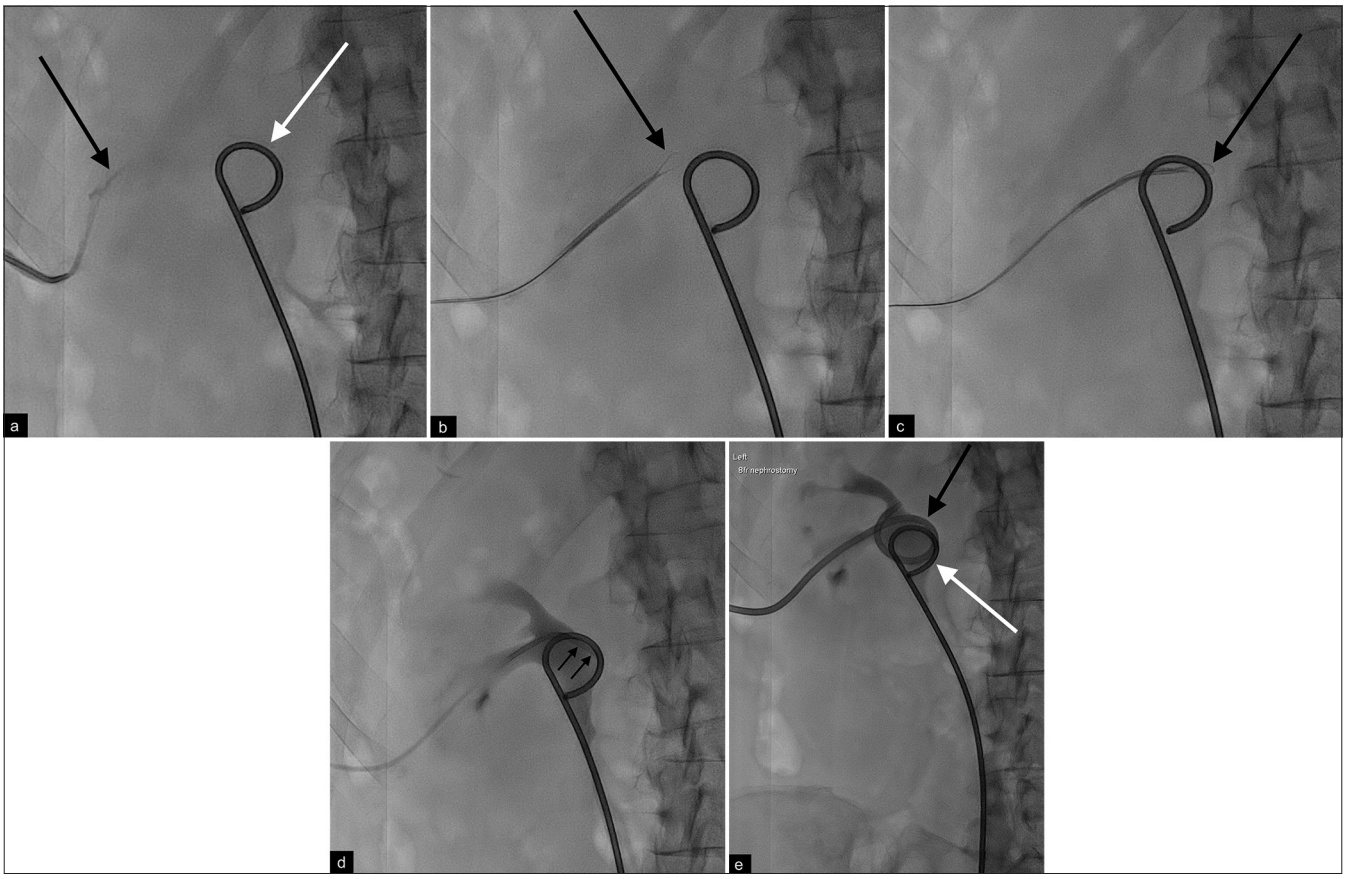

Figure 3: A 82-year-old female with chronic ureteral obstruction and a history of bilateral nephrostomy tubes and bilateral ureteral stents presents with dislodgement of her left nephrostomy tube. Replacement of the left nephrostomy tube was aided by the use of a Loop-Tip catheter. (a) Fluoroscopic image obtained after catheter dislodgement shows contrast opacification of the left nephrostomy tract (black arrow), and pre-existing left ureteral stent (white arrow). (b) Fluoroscopic image shows Loop-Tip catheter entering lower pole calyx (black arrow). (c) Fluoroscopic image shows Loop-Tip catheter entering renal pelvis (black arrow). (d) Fluoroscopic image shows removal of wire loop leaving catheter tip in renal pelvis (black arrows). (e) Fluoroscopic image shows final placement of new nephrostomy tube (black arrow), and pre-existing ureteral stent (white arrow).

Table 1: Patients presenting with dislodged catheters.

Pt	Age	Sex	Diagnosis	Catheter Type	Tract Age	Catheter Out
1	61 years	M	Head and neck cancer	Gastrostomy	6 months	3 day
2	58 years	F	Cervical cancer, CRF	Nephrostomy	2 years	1 day
3	69 years	F	Ulcerative colitis, CRF	Tunneled dialysis catheter	4 years	1 day
4	87 years	M	Chronic bladder outlet obstruction, BPH	Suprapubic	>2 years	1 day
5	76 years	M	Chronic bladder outlet obstruction	Suprapubic	3 years	1 day
6	68 years	M	Chronic bladder outlet obstruction, CRF	Suprapubic	2 years	1 day
7	73 years	M	Prostate cancer	Suprapubic	2 years	1 day
8	70 years	M	Chronic bladder outlet obstruction	Suprapubic	>1year	1 day
9	84 years	F	Chronic ureteral obstruction	Nephrostomy	>4 years	1 day
10	66 years	F	Multiple sclerosis	Suprapubic	>1 year	1 day
11	80 years	M	Urologic cancer	Nephrostomy	1 month	1 day
12	65 years	M	Head and neck cancer	Gastrostomy	>2 months	1 day
13	47 years	F	Endometrial cancer, chronic ureteral stricture	Nephrostomy	>18 days	1 day
14	81 years	M	Prostate cancer	Nephrostomy	6 months	1 day
15	51 years	M	CRF	Tunneled dialysis catheter	3 weeks	1 day

CRF: Chronic renal failure, BPH: Benign prostatic hypertrophy, M: Male, F: Female

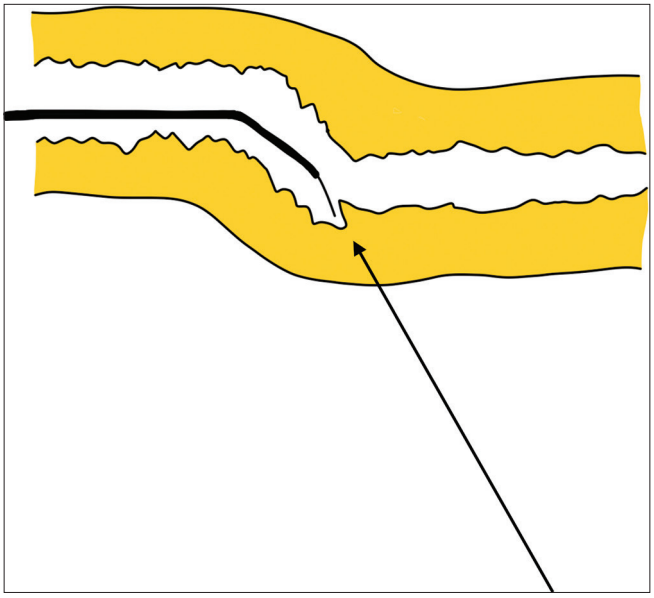

Figure 4: Image of sinus tract irregularity hindering guidewire tip (black arrow).

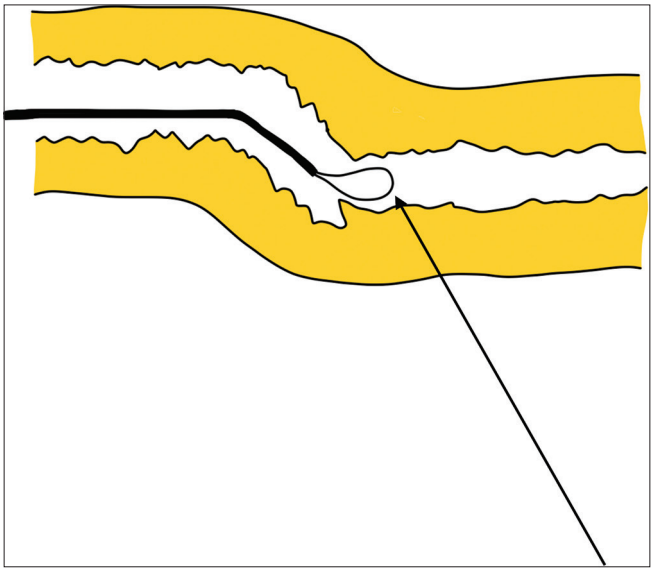

Figure 5: Image of self-centering wire loop within irregular sinus tract (black arrow).

guidewire [Figure 4], or the guidewire creating a false lumen. Another conventional technique allows the guidewire tip to form a 'U-shape' which is then pushed through the obstruction. This technique has the disadvantage of limited control over the size of the U-shape and diminished torque control.

The Loop-Tip design represents a modification of conventional catheter/wire techniques. The Loop-Tip device allows greater torque control, gives better maneuverability, and provides the ability to match the size of the loop to the diameter of the sinus tract. In addition, the hydrophilic loop at the tip of the catheter is inherently self-centering [Figure 5]. The size of the loop can be adjusted to accommodate sinus tracts of various diameters. We have found that smaller loops perform better in smaller diameter tracts, while larger loops work better in larger diameter tracts. The angled shape of the guiding catheter tip affords additional maneuverability.

The Loop-Tip catheter also works well when cannulating a partially epithelialized skin opening. With a small amount of forward pressure, the relatively stiff loop easily passes into the skin opening compared to a conventional catheter/guidewire combination which tends to "pop out" of the skin opening during manipulation.

Conventional catheter/wire techniques are successful about 90% of the time in regaining access after catheter dislodgement. When these techniques fail, Loop-Tip technique offers another option for tract salvage utilizing equipment commonly found in most Interventional Radiology suites. As with conventional methods, the Loop-Tip catheter may have limitations when treating completely epithelialized skin openings which resist penetration, or immature tracts which can deflect the wire loop outside of the tract lumen.

We have successfully used the Loop-Tip catheter to replace 15 dislodged catheters including: 6 nephrostomy tubes, 5 suprapubic catheters, 2 gastrostomy tubes, and 2 tunneled dialysis catheters. As with other catheter replacement techniques, mature tracts do better than fresh tracts, and early replacement is better than long delays after dislodgement.[9]

One potential complication of replacing a catheter using the existing tract is infection. For replacement of tunneled vascular catheters, Saad found that infection rates for tunneled catheter replacement using existing tracts are similar compared to de-novo catheter placement.[9]

The Loop-Tip technique can be used for recanalization of most catheter tracts, sinus tracts, and fistulae. Possible future indications for use of the Loop-Tip catheter might include: endocervical canal obstruction, urethral stricture, ureteral stricture, abscess drainage tube dislodgement, biliary drainage tube dislodgement, cutaneous fistulae, arterial and venous stenoses, difficult nasogastric tube placement, and complicated feeding tube placement.

CONCLUSION

Accidental catheter dislodgment is a common occurrence following placement of drainage and vascular catheters. Replacement of a catheter using the existing catheter tract is preferable to inserting a new catheter using a new puncture site. We describe a novel technique using an adjustable self-centering Loop-Tip catheter to facilitate salvage of dislodged catheters. The technique can be helpful when conventional catheter/wire techniques fail to re-establish

access. The technique may be suitable for canalization of a wide variety of catheter tracts, sinus tracts, and fistulae.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The author certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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