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Case Report

A knotted ureteral stent in patient with renal transplantation: a case report and literature review

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Abstract: With the increased using of ureteral stents in urologic practice, complications secondary to stent placement elevated. Stent knot formation in ureter was reported to be one of the complications with an extraordinarily low incidence. In the present study, we reported a case of knotted stent in a 33-year-old male patient after renal transplantation. A 6F-double J (DJ) stent was inserted due to postoperative ureterovesical anastomotic stricture. At 6 months follow-up, the patient came to the outpatient department to remove the stent, but failed. A computed tomography (CT) scan was performed, which showed a knot formation in the proximal end of the stent. Subsequently, the patient suffered from anuresis with an increased serum creatinine. An endoscopic intervention under spinal anesthesia was eventually performed. By using the holmium laser, the knot was smashed and all remnant stent fragments were cleared. This case highlights that using the holmium laser to undo the stent knot is useful when simple traction fails. It's critical to select a stent with appropriate length in order to avoid the occurrence of stent knotting.

Keywords: Ureteral stent, knot, renal transplantation, urologic complication

Introduction

Ureteral stents are widely used in urologic practice nowadays, including ureteral obstruction, ureteral strictures, urinary diversion, and postoperative drainage. Due to their widespread use, complications secondary to stent placement have also increased dramatically, such as infection, migration, encrustation, stone formation, bladder irritation and hematuria [1, 2].

The stent knot formation in the ureter is an extremely rare complication. Most of these conditions occur in urolithiasis pathology. Although stent extraction is a routine procedure, but extraction of the knotted stent may be complicated and challenging. Several management of this complication has been reported, including simple traction, continuous staged traction, percutaneous removal and open surgery. In this study, we report the use of ureteroscopy with Holmium laser in treating a case of knotted stent in a male patient after renal transplantation.

Case report

A 33-year-old male patient underwent a living-related renal transplantation for end-stage renal disease. The graft was transplanted to the right iliac fossa, and ureterovesical anastomotic stricture was noted 4 months later. A double J (DJ) stent (6 F, 26 cm, Bard) was then placed, and the postoperative computed tomography (CT) showed the upper stent was located at the pelvis with partial coiled (**Figure 1**). At 6 months follow-up, an outpatient surgery using foreign body forceps was performed to remove the DJ stent, but failed. Thus a CT scan was performed, which showed trial of the stent removal failed with tightening of the knot during the attempted extraction (**Figure 2**). Subsequently, the patient encountered anuresis with a serum creatinine increased to 4.92 mg/dl.

The patient was admitted and taken to the operating room. An endoscopic intervention under spinal anesthesia was performed. Initially, removal with gentle traction was attempted,

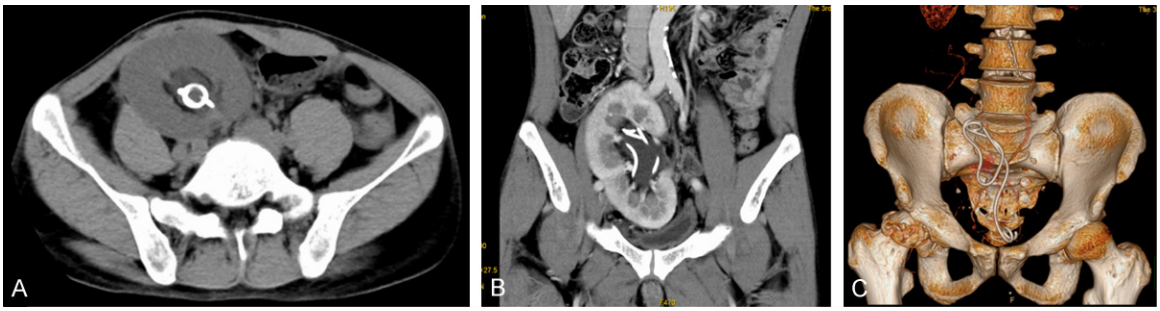

Figure 1. The appearance of computed tomography after the stent was placed. A. Axial CT showed the upper stent was located at the pelvis with partial coiled. B. Coronal CT showed the presence of dilated collecting systems and a coiled stent. C. Reconstructed CT showed the upper stent was partial coiled.

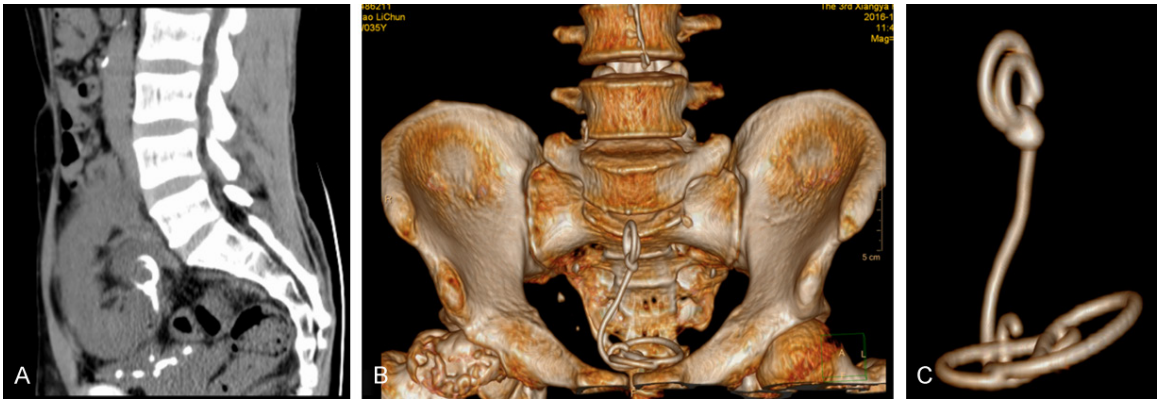

Figure 2. The appearance of computed tomography after the simple traction was failed. A. Sagittal CT showed the stent was knotted. B and C. Reconstructed CT showed a stent knot formation in the proximal end of the stent.

but resistance was experienced. Then a 6-French ureteroscope was used, the scope was advanced into the ureter and a knot was seen in the proximal end of the stent. Finally, a 2100 nm holmium laser was used to smash the knot with a setting of 10 Hz and 0.8 J. The knot broke into three parts and all remnant stent fragments were cleared by stone basket extractor.

The postoperative period was uneventful and no postoperative complications happened. The serum creatinine recovered to 0.95 mg/dl and the patient was discharged 3 days after the surgery. No hydronephrosis and ureterectasis was detected, and the patient recovered to a normal serum creatinine of 0.93 mg/dl at the 6-month follow-up.

Discussion

Ureteral stent knot, first reported by Groeneveld et al [3] in 1989, is one of the less commonly reported complications associated with stent inserting. To our knowledge, only 19 cases including the present study have been reported in literature (summarized in **Table 1**). Among the 19 cases, the median age was 47 years with a range of 4-82 years. These ureteral stent knots formed in the proximal, mid or distal ureter, while most of the knots located in the proximal ureter (n = 16, 84.2%). The sizes of the knotted stents varied from 4.7 F to 7 F with an equally distribution. When took the stent style as consideration, it seems that the use of double j stent increased the probability of knot formation.

The majority of patients were admitted to remove the ureteral stent without symptoms, and the knotted stents were found when resistance was encountered during stent traction. Four patients were detected with hydronephrosis [4-7]. In a case of a 32-year-old male with solitary left functioning kidney, the knotted stent resulted in an obstructive acute renal fail-

Table 1. Review of knotted ureteral stents in literature

Reference/year	Age	Sex	Pathology	Side	Stent style	Stent size	Knot location	Complications	Treatment
Groeneveld (1989) [3]	UA	UA	Renal stone	UA	Double-j stent	UA	Proximal	None	Simple traction
Das et al (1990) [14]	45	M	Renal stone	R	Single-j stent	UA	Distal	None	Simple traction
Braslis et al (1992) [15]	37	F	Renal stone	R	Multilength ureteric stent	4.7 F	Proximal	None	Percutaneous removal
Kundargi et al (1994) [16]	53	M	Renal stone	L	Multi-coil stent	6 F	Proximal	None	Percutaneous removal
Flam et al (1995) [17]	86	M	Ureteral stone	L	Double-j stent	6 F	Proximal	None	Placement of a double-j stent and one week later the knot was untied via ureteroscopy
Baldwinn et al (1998) [18]	73	M	Transitional cell carcinoma	L	Multilength stent	7 F	Proximal	None	Untie the knot with an amplatz super stiff guide wire
Quek et al (2002) [13]	66	F	Ureteropelvic junction stone	R	Double-j stent	7 F	Mid	None	Simple traction
Sighinolfi et al (2005) [19]	48	M	Renal stone	R	Double-j stent	5 F	Proximal	None	Three days of continuous slight traction
Kondo et al (2005) [20]	37	M	Renal stone	L	Multilength stent	6 F	Proximal	None	Ureterotomy
Corbett et al (2005) [4]	4	UA	Obstructed mega-ureter	L	Multilength ureteric stent	4.7 F	Proximal	Hydronephroureter	Simple traction
Eisner et al (2006) [21]	82	F	Renal stone	L	Kwart Retro Inject stent	6 F	Proximal	None	Simple traction
Picozzi et al (2010) [22]	41	F	Endometriosis	R	Double-j stent	7 F	Proximal	None	Simple traction
Richards et al (2011) [10]	67	M	Ureteral stone	L	Double-j stent	UA	Proximal	None	Ureteroscopy and laser smash the knot
Bhirud et al (2012) [6]	41	M	Renal stone	R	Double-j stent	UA	Mid	Hydronephrosis	Percutaneous removal
Nettle et al (2012) [11]	43	M	None	R	Double-j stent	6 F	Proximal	None	Ureteroscopy and laser smash the knot
Karagüzel et al (2012) [12]	53	M	Ureteral stone	R	Double-j stent	4.7 F	Proximal	None	Renoscopy
Moufid et al (2012) [7]	32	M	Ureteral stone	L	Double-j stent	UA	Proximal	ARF and hydronephrosis	Placement of a double-j stent and 3 days later the knot was tracted via ureteroscopy
Present	33	M	Renal transplantion	R	Double-j stent	6 F	Proximal	Anuresis and an increased serum creatinine	Ureteroscopy and laser smash the knot

ARF = acute renal failure, UA = unavailable.

ure [7]. As described in our report, the patient had a history of renal transplantation due to end-stage renal disease, and the patient suffered from anuresis after the stent knot formed. An increase in serum creatinine was noted, it returned to normal after the knotted stent was removed. Hence, it should be aware that the stent knot might be hard to detect and could cause unexpected troubles.

The ureteral stent knot formation may occur during the implantation or removal processes. Since removing the knotted stent means a treatment challenge, several techniques have been talked about. Simple traction could be easily performed, but as described in our case, it could also result in tightening the knot. Other treatments including retrograde ureteroscopy, percutaneous removal, and open surgery were used for those attempting in simple traction without success. Holmium laser has been applied in fragmenting the foreign body in urinary tract [8, 9]. As reported by Richards et al [10] and Nettle et al [11], they successfully transected the stent knot using holmium laser and removed the stent fragments. Similarly, in the present report, simple traction was unsuccessful. We then untied the knot via ureteroscopy with holmium laser. Therefore, using the holmium laser to undo the knot may be an appropriate alternative when simple traction fails.

Among the published 19 cases of knotted stent, most of the cases occurred with a pathology of renal or ureteral stone. To our best knowledge, this was the first case presenting a knotted DJ stent in a transplanted kidney. Excessive length of the stent had been considered as a facilitating factor for stent knotting [12, 13]. As the transplanted kidney is usually placed in a lower position, thus selecting a stent with appropriate length and controlling the length of the stent in the ureter are important.

In summary, we present a rare case of a knotted ureteral stent in patient with renal transplantation. The stent knot may be hard to detect, leading to serious consequences. Thus, we should be mindful of the probability of knot formation, especially when resistance was encountered during stent traction. Using the holmium laser to undo the knot is useful when simple traction fails. To avoid the occurrence of stent knotting, selecting a stent with appropriate length and controlling the length of the stent in the ureter are important.

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Disclosure of conflict of interest

None.

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