Urol Res (2012) 40:763–767
DOI 10.1007/s00240-012-0500-4

ORIGINAL PAPER

Changing to a loop-type ureteral stent decreases patients' stent-related symptoms

Takashi Kawahara · Hiroki Ito · Hideyuki Terao · Takehiko Ogawa · Hiroji Uemura · Yoshinobu Kubota · Junichi Matsuzaki

Received: 4 May 2012 / Accepted: 2 August 2012 / Published online: 17 August 2012

Abstract The first indwelling ureteral splint was described in 1967. A ureteral stent can cause unpleasant side effects, such as urinary frequency, urgency, incontinence, hematuria, bladder pain and flank pain, which have a negative impact on a patient's quality of life. It is necessary to minimize the amount of material in the bladder in order to decrease stent-related symptoms. This study investigated the stent-related symptoms after changing from a double pigtail to a loop-type ureteral stent in the same patient group. This study followed 25 patients who underwent ureteral stent exchange from double pigtail to loop-type ureteral stent between September 2009 and February 2010. Ureteral stents were exchanged using topical, conscious sedation and general anesthesia for the various procedures including stent exchange, before/after shock wave lithotripsy and before/after ureteroscopy. The stent length was selected to be the same as whole ureteral length and the caliber based on the previous stent. A self-administered stent-related symptom questionnaire was used to assess stent-related symptoms in comparison to the previous double-pigtail stents. A total of 25 patients with a median age of 56.5 years underwent ureteral stent exchange. All patients had stone disease except two patients who had ureteral stricture. Almost all of stent-related symptoms without nocturia showed a significantly lower score with the loop-type ureteral stent than in double-pigtail stent. None of the patients experienced urinary tract infection either before or after undergoing ureteral stent exchange. Changing to loop-type ureteral stent significantly decreased ureteral stent-related symptoms.

Keywords Ureteral stent · Stent-related symptom · Loop-type ureteral stent

T. Kawahara · H. Ito · H. Terao · T. Ogawa · J. Matsuzaki (✉)
Department of Urology, Ohguchi Higashi General Hospital, 2-19-1, Irie, Kanagawa-ku, Yokohama, Kanagawa, Japan
e-mail: j_matsuzaki@kamakura-medical.com; junmatukd5@yahoo.co.jp

T. Kawahara · H. Ito · T. Ogawa · H. Uemura · Y. Kubota
Department of Urology, Yokohama City University Graduate School of Medicine, Yokohama, Japan

Purpose

The first indwelling ureteral splint was described by Zimskind et al. in 1967 [18]. A ureteral stent is now a fundamental part of many urological procedures for obstructing ureteral calculi, ureteral stricture, ureteropelvic junction obstruction, retroperitoneal tumor or fibrosis, or that developing after open or endoscopic ureteral surgery [1, 2, 11, 12]. A longer stent can result in unpleasant side effects, such as urinary frequency, urgency, incontinence, hematuria, bladder pain and flank pain, which have a negative impact on a patient's quality of life [7, 9, 11, 13, 17].

Urinary stents contain various materials, and are available with different sizes, coatings and shapes to avoid unpleasant urinary symptoms and discomfort [4, 8, 15]. It is necessary to minimize the amount material in the bladder in order to decrease stent-related symptoms [15]. Therefore, the Tail Stent® (Boston Scientific, USA) was developed with a 7 Fr proximal pigtail at the proximal end and 7 Fr shaft which tapers to a lumenless straight 3 Fr tail at the distal end [5]. Dunn et al. showed that the 7 Fr tail loop stent produced significantly less irritating symptoms than the standard 7 Fr double-pigtail stent. Lingeman et al. described stent-related symptoms using a self-administered questionnaire for various types of ureteral stent. The loop-type ureteral stent showed a lower stent-related symptom score than in the standard double stent, but not significantly [15].

This study investigated the stent-related symptoms after changing from a double-pigtail stent to a loop-type ureteral stent in the same patient group.

Materials and methods

This study enrolled 25 patients (25 stents) that underwent ureteral stent exchange between September 2009 and February 2010. The Institutional Review Board of Ohguchi Higashi General Hospital approved this study. Informed consent for this study was obtained before the ureteral stent was inserted.

All of the patients received ureteral stent exchange from double-pigtail ureteral stents (Inlay® and Inlay optima®, BARD, NJ, USA. Polaris®, Boston Scientific, MA, USA) to loop-type ureteral stents (Polaris Loop®, Boston Scientific, MA, USA). All pre- and post-ureteral stents were made of hydrogel-coated stent. The ureteral stents were exchanged using topical, conscious sedation and general anesthesia for the various procedures including stent exchange, before/after shock wave lithotripsy (SWL) and before/after ureteroscopy (URS). There were four options for the stent diameter (5, 6, 7, and 8 Fr) and four options for the stent length (20, 22, 24, and 26 cm). The stent's length was selected to be the same as the whole ureteral length and the caliber was based on the previous stent. The stent lengths described by the manufacturer were the length of the shaft, not the whole length. The length of the whole ureteral stent length was selected, most of which were about 2.0 cm shorter than the previous stent length that the manufacturer described. (e.g. a 26 cm double-pigtail ureteral stent has roughly the same overall stent length as a 24 cm loop-type ureteral stent). We usually exchange a ureteral stent with a stent that has a similar diameter, but this was not possible in all patients because we did not always have a stent of the same diameter with the selected ureteral stent length. Therefore, the ureteral stent length, rather than the ureteral stent caliber for two ureteral stents was the priority for this investigation of the ureteral stent-related symptoms.

A kidney–ureter–bladder (KUB) film was taken on the day before the procedure and on postoperative day 1 to confirm the presence of the stent configuration. The appropriateness of a stent was defined by the stent location observed in the KUB films [13]. Ho et al. classified the ureteral position into 3 groups: (1) a short stent, with either pigtail not curled completely; (2) an appropriate stent, with the intravesical pigtail not across the midline (pubic symphysis) and the intrarenal pigtail in the middle portion of the kidney shadow; and (3) an overlong stent, with the intravesical pigtail across the midline [7]. The loop-type stents were divided into three groups as in the previous report: (1) a short stent, distal loop position closed less than 1 cm in the bladder; (2) an appropriate stent, distal loop position open more than 1 cm and less than 5 cm in the bladder; (3) an overlong stent, distal loop position more than 5 cm in the bladder (Fig. 1) [10, 13].

Stent-related complications including migration, difficulty or impossibility of removable with cystoscopy, and fever after inserting the ureteral stent were observed at the time of ureteral stent removal.

A Japanese-translation of the self-administered stent-related symptom questionnaire originally reported by Lingeman et al. [14] was used to assess stent-related symptoms in comparison to the previous double-pigtail stents. Eight questions addressed urinary tract symptom rating, including incomplete emptying, frequency, intermittency, urgency, weak stream, straining, nocturia and incontinence. Pain was assessed by four questions including pain in the flank or lower back side area, pain in the abdominal area, pain in the bladder or pelvic area and pain in the urethral area.

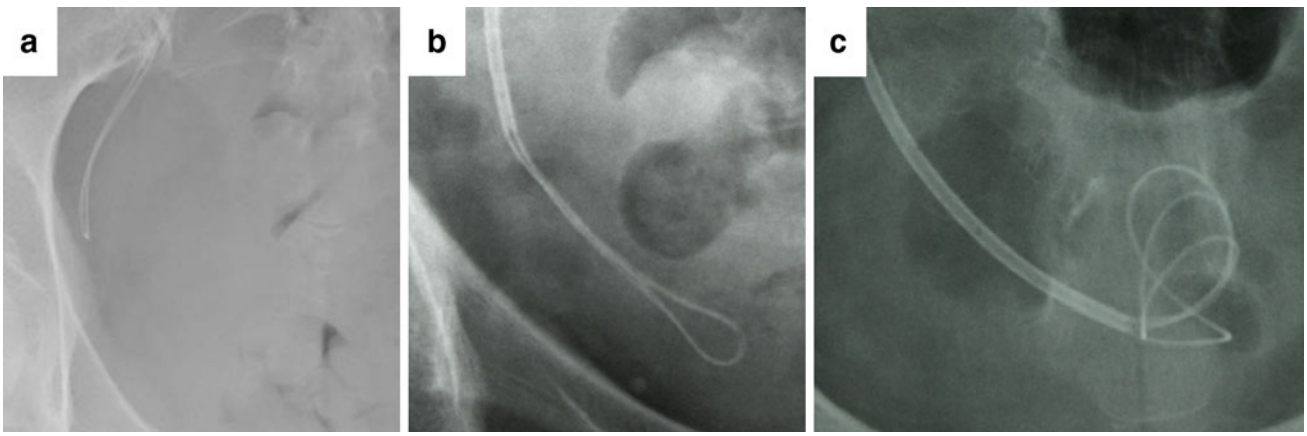

Fig. 1 Ureteral stent position at the distal end. **a** Migrated: the distal end of the stent in the ureter. **b** Appropriate: the distal end of the stent is in both the ureter and the bladder. *White arrow* the distal end of the loop in the ureter. **c** Overlong: the stent shaft is in the bladder

Table 1 Patient characteristics

Variables	Number (%) or median (mean ± SD)		*P* value
	Double pigtail	Loop	
No. of patients	25		
Median age (years)	56.5 (52.9 ± 12.2)		
Sex			
Male	16 (64.0 %)		
Female	9 (36.0 %)		
Side			
Right	15 (60.0 %)		
Left	10 (40.0 %)		
Indication for stenting			
Stone disease	23 (92.0 %)		
Ureteral stricture	2 (8.0 %)		
Procedure			
Ureteroscopy	22 (88.0 %)		
Ureteral stent exchange	3 (12.0 %)		
Stent caliber (Fr)	6.0 (4.7–8)	6.1 (6–8)	NS
Stent length (cm)	25.9 (24–28)	23.9 (22–26)	<0.001

Statistical analysis

All continuous variables are expressed as the mean ± SD. The numerical data were compared by either Student's *t* test or the paired *t* test. A *P* value of 0.05 or less was considered to be significant.

Results

A total of 25 patients with a median age of 56.5 years (52.9 ± 12.2 years) underwent ureteral stent exchange. The patients' age, gender, side of stenting, indication for stenting, procedure of ureteral stent exchange, stent caliber and stent length are shown in Table 1. All patients had stone disease, except two patients who had ureteral stricture.

None of the stents had migrated, 19 stents (76.0 %) were in the appropriate position and 6 stents (24.0 %) were overlong double-pigtail ureteral stents. No stents were in the short position, 20 stents (80.0 %) were in the appropriate position and 5 stents (20.0 %) were overlong in loop-type ureteral stent. No ureteral stent migrated in to the ureter in any of the cases. We confirmed that there was no injury to the trigone when either ureteral stent exchange or ureteral stent retrieval was performed in all cases.

Stent-related symptoms in each question are shown in Tables 2 and 3. Almost all of stent-related symptoms other than nocturia showed significantly lower scores in loop-type ureteral stents than in double-pigtail stents. We thought that the decreasing flank pain was due to urinary reflux to the ureter because stent irritation to the bladder results in bladder contraction. One patient (4.0 %) came to the hospital for gross hematuria in the double-pigtail stent. None of the patients experienced urinary tract infection either before or after ureteral stent exchange.

Both the double-pigtail and loop-type ureteral stents showed a lower total of stent-related symptoms with stents in an appropriate position in comparison to an overlong position, but the difference was not significant.

Discussion

The placement of a ureteral stent is a fundamental part of many urological procedures for obstructing ureteral calculi, ureteral stricture, ureteropelvic junction obstruction,

Table 2 Urinary tract symptom rating in double pigtail (pre.) and loop-type (post.) ureteral stents

Variables	Median (mean ± SD)		*P* value
	Double pigtail	Loop	
Incomplete emptying	2.5 (2.4 ± 1.9)	1 (1.2 ± 1.3)	0.003
Frequency	4 (3.5 ± 1.5)	2 (2.2 ± 1.8)	0.001
Intermittency	2 (2.2 ± 1.8)	0 (0.9 ± 1.2)	0.015
Urgency	3 (2.7 ± 0.4)	1 (1.4 ± 1.3)	<0.001
Weak stream	3 (2.1 ± 1.6)	0 (1.0 ± 1.4)	0.001
Straining	0 (1.1 ± 1.4)	0 (0.4 ± 0.8)	0.005
Nocturia	2 (2.2 ± 1.2)	2 (2.3 ± 1.4)	0.771
Incontinence	0.5 (1.4 ± 1.9)	0 (1.0 ± 1.7)	0.005
Total score	15 (15.0 ± 5.7)	9 (9.1 ± 6.6)	<0.001

Table 3 Pain rating in double pigtail (pre.) and loop-type (post.) ureteral stents

Variables	Median (mean ± SD)		*P* value
	Double pigtail	Loop	
Pain in the urethral area			
At rest	4 (4.4 ± 3.4)	1 (1.7 ± 1.9)	<0.001
During urination	5.5 (5.2 ± 3.3)	1 (1.4 ± 1.8)	<0.001
Pain in the flank area			
At rest	1.5 (2.5 ± 2.6)	1 (0.9 ± 1.3)	0.003
During urination	1 (2.0 ± 2.6)	0.5 (1.1 ± 1.6)	0.042
Pain in the bladder or pelvis area			
At rest	1 (1.8 ± 2.1)	1 (0.9 ± 1.4)	0.233
During urination	1.5 (2.3 ± 2.4)	1 (1.2 ± 1.7)	0.045
Whole area and time	3 (3.9 ± 3.3)	2 (2.2 ± 2.1)	0.002
Total score	24 (22.2 ± 15.8)	9 (9.5 ± 10.5)	<0.001

retroperitoneal tumor or fibrosis, or that developing after open or endoscopic ureteral surgery [2, 11–13, 18].

Various forms, caliber, and materials have been developed and used to avoid urinary irritation [3, 6, 8, 15, 16]. However, placing a ureteral stent in an appropriate position and selecting an appropriate length of the ureteral stent are the most important factors to avoid such irritation [4, 13].

It is necessary to minimize the amount material in the bladder in order to decrease stent-related symptoms [15]. Therefore, Tail Stent® (Boston Scientific, USA) was developed with a 7 Fr proximal pigtail and 7 Fr shaft which tapers to a lumenless straight 3 Fr tail [5]. Dunn et al. showed that the 7 Fr Tail stent produced significantly less irritating symptoms than that the standard 7 Fr double-pigtail stent. Lingeman et al. [15] found similar results with a 5 or 7 cm loop tail stent using ureteral stent symptom questionnaire (USSQ), but the reduction in symptoms was not significant. There is no Japanese validated USSQ presently available. Therefore, a validated Japanese USSQ is needed in order to perform future stent-related studies in Japan.

This study is the first report of assessing ureteral stent symptoms in the different types of ureteral stent in the same patients group. Our institute is the third referral stone disease center in Japan. Therefore, patients that are resistant to ESWL and patients with large stones and ureteral stents are often referred to our department for further treatment. We limit the stent indwelling time to 3 months. Some of the patients had to undergo ureteral stent exchange to avoid a long stent indwelling time. The symptom scores in the loop-type stent group were significantly lower than in the double-pigtail stent. The symptom score was differentiated by stent position in the distal end. The symptom score was higher when the shaft of stent with a caliber of 6–8 Fr was across the midline, than when the shaft was fully in the ureter. Therefore, it is important to select the appropriate length of a ureteral stent.

A longer stent may protrude into the bladder and cause the patient irritation. Therefore, the surgeons in this institute selected a stent length based on the direct measurement of ureteral length using a 5 Fr ureteral catheter. [13]

The major limitation of this study is that we only changed from a double-pigtail to a loop-type ureteral stent. The symptom score after changing from a loop-type ureteral stent to a double pigtail stent may therefore be important information. The patients with a long stent indwelling time tend to demonstrate stent-related symptoms. A stent-related questionnaire was administered just before ureteral stent exchange to avoid the development of symptoms. However, a investigation of the results after changing from a double pigtail to a loop-type ureteral stent would be useful, and our findings should thus be confirmed in a larger number of patients.

Conclusions

Changing to a loop-type ureteral stent significantly decreases the occurrence of ureteral stent-related symptoms.

References

1. Auge BK, Pietrow PK, Lallas CD, Raj GV, Santa-Cruz RW, Preminger GM (2004) Ureteral access sheath provides protection against elevated renal pressures during routine flexible ureteroscopic stone manipulation. J Endourol 18:33–36
2. Borboroglu PG, Kane CJ (2000) Current management of severely encrusted ureteral stents with a large associated stone burden. J Urol 164:648–650
3. Damiano R, Autorino R, De Sio M, Cantiello F, Quarto G, Perdona S, Sacco R, D' Armiento M (2005) Does the size of ureteral stent impact urinary symptoms and quality of life? A prospective randomized study. Eur Urol 48:673–678
4. Dellis A, Joshi HB, Timoney AG, Keeley FX Jr (2010) Relief of stent related symptoms: review of engineering and pharmacological solutions. J Urol 184:1267–1272
5. Dunn MD, Portis AJ, Kahn SA, Yan Y, Shalhav AL, Elbahnasy AM, Bercowsky E, Hoenig DM, Wolf JS Jr, McDougall EM, Clayman RV (2000) Clinical effectiveness of new stent design: randomized single-blind comparison of tail and double-pigtail stents. J Endourol 14:195–202
6. Hendlin K, Vedula K, Horn C, Monga M (2006) In vitro evaluation of ureteral stent compression. Urology 67:679–682
7. Ho CH, Huang KH, Chen SC, Pu YS, Liu SP, Yu HJ (2009) Choosing the ideal length of a double-pigtail ureteral stent according to body height: study based on a Chinese population. Urol Int 83:70–74
8. Joshi HB, Chitale SV, Nagarajan M, Irving SO, Browning AJ, Biyani CS, Burgess NA (2005) A prospective randomized single-blind comparison of ureteral stents composed of firm and soft polymer. J Urol 174:2303–2306
9. Joshi HB, Stainthorpe A, MacDonagh RP, Keeley FX Jr, Timoney AG, Barry MJ (2003) Indwelling ureteral stents: evaluation of symptoms, quality of life and utility. J Urol 169:1065–1069 (discussion 1069)
10. Kawahara T, Ito H, Terao H, Yamagishi T, Ogawa T, Uemura H, Kubota Y, Matsuzaki J (2012) Ureteral stent retrieval using the crochet hook technique in females. PLoS ONE 7:e29292
11. Kawahara T, Ito H, Terao H, Yoshida M, Matsuzaki J (2011) Ureteral stent encrustation. Incrustation, and coloring: morbidity related to indwelling times. J Endourol 26:178–182
12. Kawahara T, Ito H, Terao H, Yoshida M, Ogawa T, Uemura H, Kubota Y, Matsuzaki J (2012) Ureteroscopy assisted retrograde nephrostomy: a new technique for percutaneous nephrolithotomy (PCNL). BJU Int 110:588–590
13. Kawahara T, Ito H, Terao H, Yoshida M, Ogawa T, Uemura H, Kubota Y, Matsuzaki J (2012) Choosing an appropriate length of loop type ureteral stent using direct ureteral length measurement. Urol Int 88:48–53
14. Lingeman JE, Preminger GM, Berger Y, Denstedt JD, Goldstone L, Segura JW, Auge BK, Watterson JD, Kuo RL (2003) Use of a temporary ureteral drainage stent after uncomplicated ureteroscopy: results from a phase II clinical trial. J Urol 169:1682–1688
15. Lingeman JE, Preminger GM, Goldfischer ER, Krambeck AE (2009) Assessing the impact of ureteral stent design on patient comfort. J Urol 181:2581–2587

16. Pedro RN, Hendlin K, Kriedberg C, Monga M (2007) Wire-based ureteral stents: impact on tensile strength and compression. Urology 70:1057–1059
17. Pollard SG, Macfarlane R (1988) Symptoms arising from Double-J ureteral stents. J Urol 139:37–38
18. Zimskind PD, Fetter TR, Wilkerson JL (1967) Clinical use of long-term indwelling silicone rubber ureteral splints inserted cystoscopically. J Urol 97:840–844