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Is a 22 cm Ureteric Stent Appropriate for Korean Patients Smaller than 175 cm in Height?

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Purpose: Determining the ideal length of a ureteric stent is important to avoid complications associated with stent placement. Clinically, most urologists usually choose the length of a ureteric stent according to the patient's height. On the basis of a Chinese population study, a 22 cm ureteric stent has been recommended for patients smaller than 175 cm. We evaluated the appropriateness of this recommendation in Korean patients.

Materials and Methods: A total of 70 patients who were smaller than 175 cm and who underwent ureteroscopic lithotripsy and ureteric stent insertion were studied. The appropriateness of the stent length was determined on the basis of plain film findings. Patient discomfort was measured by use of a visual analogue scale (VAS) before the removal of the ureteric stent.

Results: In 29 patients with a 22 cm ureteric stent, 21 patients (72.4%) had an appropriate ureteric stent length and the mean VAS was 4.1. In 36 patients with a 24 cm ureteric stent, 20 patients (55.6%) had an appropriate ureteric stent length and the mean VAS was 4.0. Among 5 patients with a 26 cm ureteric stent, 1 patient (20%) had an appropriate ureteric stent length and the mean VAS was 5.4.

Conclusions: In Korean patients smaller than 175 cm in height, a 22 cm ureteric stent was an appropriate length.

Key Words: *Asian continental ancestry group; Body height; Stents; Ureter*

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INTRODUCTION

The double-pigtail ureteric stent has been widely used to relieve and to prevent ureteral obstruction. However, patients may experience complications such as pain, urinary frequency, hematuria, infection, stent fragmentation, and migration, and many of these complications are related to the ureteric stent length [1-4]. A stent that is too long may cause symptoms of trigonal irritation, and stents that are too short may migrate [5-7]. Therefore, the choice of correct ureteric stent length is very important for reducing stent-associated complications. However, there is no standard method for determining the ideal ureteric stent length [6-9]. Clinically, most urologists use the patient's height to determine the ideal ureteric stent length. However, the methods for choosing the appropriate stent length according to body height are based mostly on data from Caucasians, who are relatively taller [9]. Whether these data are applicable to Asians is unclear. Asians are not as tall and have a relatively longer trunk than do Caucasians [10].

Ho et al reported on Asian findings with regard to body heights and ideal stent length. The appropriate stent length was determined in 408 Chinese patients undergoing ureteroscopic lithotripsy and stent insertion [11]. Their conclusions suggested that the ideal stent length is 22 cm for patients <175 cm. Theoretically, this Asian formula derived for Chinese patients may be more suitable for Korean patients than formulas based on Caucasian data. However, there are no data to support that. Therefore, we tried to verify this in the present study. We applied the Asian formula to Korean patients retrospectively and as-

sessed the outcome.

MATERIALS AND METHODS

Between May 2009 and May 2010, 70 patients who were smaller than 175 cm and undergoing unilateral ureteroscopic lithotripsy and ureteric stent insertion at our hospital were enrolled. All operations were performed in the usual fashion with a 6 French rigid ureteroscope and pneumatic lithotripter. A double-pigtail ureteric stent was inserted at the conclusion of the operation. There were four options for the stent diameter (6, 7, 8, and 10) and three options for the stent length (22, 24, and 26 cm); the choice was up to the operators. All stents were made of polyurethane and were manufactured by Cook Urological (Cook Medical Inc., Bloomington, IN, USA).

The patients' demographic data, including age, gender, height, weight, and duration of indwelling ureteric stent, were reviewed from the information in the medical charts. This information is summarized in Table 1. On the day of ureteric stent removal, a kidney ureter bladder (KUB) film was taken and patients were asked to grade the discomfort and level of pain associated with the ureteric stent by using a 10-point linear visual analogue scale (VAS).

TABLE 1. Patient demographics

Variables	Number (% or range)
No. of patients	70
Mean age (years)	51.4 (22-83)
Mean height (cm)	160.8 (147-175)
Mean weight (kg)	61.5 (45-90)
Mean time of indwelling stent (days)	15.3 (3-40)
Sex	
Male (%)	34 (48.6)
Female (%)	36 (51.4)
Side	
Left (%)	38 (54.3)
Right (%)	32 (45.7)

According to the KUB films, the appropriateness of the stent was defined by the stent location and configuration. It was categorized into three groups: (1) a short stent, with either loop not curled completely; (2) an appropriate stent, with the intravesical loop not across the midline (pubic symphysis) and the intrarenal loop in the middle portion of the kidney shadow; and (3) a stent that was too long, with the intravesical loops across the midline and/or the intrarenal loop in the upper pole.

Data were analyzed by using Predictive analytics software (PASW) Statistics 17 (SPSS Inc., Chicago, IL, USA). Normally distributed continuous variables were analyzed by using the Student's t-test. Categorical variables were compared by using the chi-square test or Fisher's exact test. The correlation between variables was determined by linear regression analysis. A p-value below 0.05 was considered significant.

RESULTS

A total of 70 patients were included in the analysis. Twenty-nine patients (41.4%) had a 22 cm stent, another 36 patients (51.4%) had a 24 cm stent, and the remaining

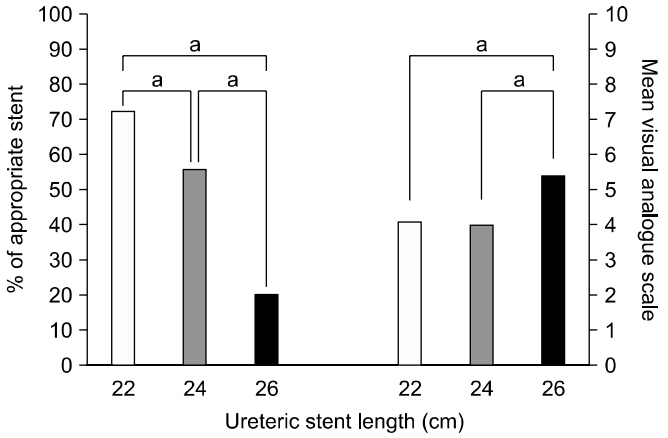

FIG. 1. Percentage of appropriate stents and mean visual analogue scale in each stent length group ([a]: $p < 0.05$).

TABLE 2. Mean visual analogue scale, body height, and percentage of appropriate stents in each stent length group

	Stent length			p-value		
	22 cm	24 cm	26 cm	p (A)[a]	p (B)[b]	p (C)[c]
No. of patients	29	36	5			
Mean height (cm)	155.3 (147-167)	163.8 (148-175)	171.4 (169-174)			
Mean visual analogue scale	4.1 (0-9)	4.0 (0-8)	5.4 (2-9)	0.501	0.010	0.004
Stent configuration						
Short	0	0	0			
Appropriate	21	20	1			
Long	8	16	4			
Appropriate stent percentage (%)	72.4	55.6	20.0	0.048	0.003	0.046

[a]: p (A) compares values between the 22 and the 24 cm stent group, [b]: p (B) compares values between the 22 and the 26 cm stent group, [c]: p (C) compares values between the 24 and the 26 cm stent group

5 patients (7.1%) had a 26 cm stent. The mean VAS was 4.1. Forty-two patients (60.0%) had an appropriate stent length, and 29 patients (40.0%) had stents that were too long. No patients had a stent that was too short.

In the 29 patients with a 22 cm ureteric stent, 21 patients (72.4%) had an appropriate ureteric stent length and the mean VAS was 4.1. In the 36 patients with a 24 cm ureteric stent, 20 patients (55.6%) had an appropriate ureteric stent length and the mean VAS was 4.0. In the 5 patients with a 26 cm ureteric stent length, 1 patient (20.0%) had an appropriate ureteric stent length and the mean VAS was 5.4. The differences in the VAS and appropriate stent ratio among the three groups were statistically significant, except for the VAS between the 22 cm and 24 cm stent groups (Table 2, Fig. 1).

In the 18 patients shorter than 155 cm, 12 patients had a 22 cm stent and 6 patients had a 24 cm stent. A total of 10 patients (55.6%) had an appropriate ureteric stent length and the mean VAS was 3.3. The appropriate stent rate was 58.3% in the 22 cm stent group and 50.0% in the 24 cm stent group. This difference was not statistically significant (p=0.635). The VAS was 3.8 in the 22 cm stent group and 2.5 in the 24 cm stent group. This difference was statistically significant (p=0.004).

In the 31 patients with a height between 156 and 165 cm, 16 patients had a 22 cm stent and 15 patients had a 24 cm stent. A total of 21 patients (66.7%) had an appropriate ureteric stent length and the mean VAS was 4.6. The appropriate stent rate was 81.3% in the 22 cm stent group and 53.3% in the 24 cm stent group. This difference was statistically significant (p=0.019). The VAS was 4.8 in the 22 cm stent group and 4.3 in the 24 cm stent group. This difference was not statistically significant (p=0.092).

In the 21 patients with a height between 166 and 175 cm, 1 patient had a 22 cm stent, 15 patients had a 24 cm stent, and 5 patients had a 26 cm stent. A total of 11 patients (52.4%) had an appropriate ureteric stent length and the mean VAS was 4.7. The appropriate stent rate was 100.0% in the 22 cm stent group, 60.0% in the 24 cm stent group, and 20.0% in the 26 cm stent group. The VAS was 8.0 in the 22 cm stent group, 4.3 in the 24 cm stent group, and 5.4 in the 26 cm stent group. There were no statistically significant differences except in the VAS between the 24 cm

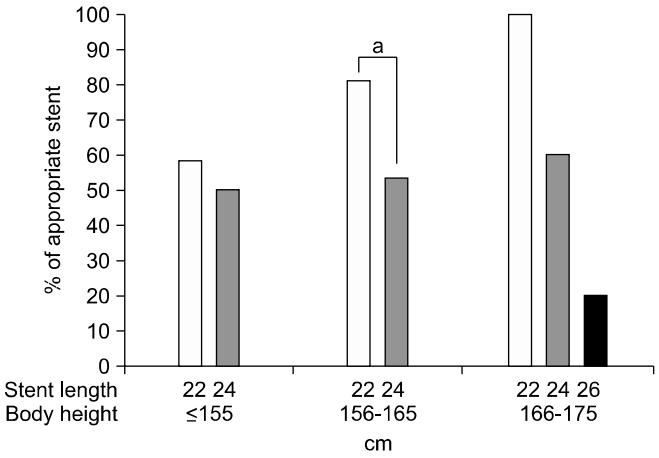

FIG. 2. Percentage of appropriate stents and stent length in each body height group ([a]: $p < 0.05$).

TABLE 3. Mean visual analogue scale and percentage of appropriate stents and stent length in each body height group

	Stent length			p-value		
	22 cm	24 cm	26 cm	p (A)[a]	p (B)[b]	p (C)[c]
No. of patients	29	36	5			
Height ≤155 cm group						
No. of patients	12	6	0			
Stent configuration						
Short/appropriate/long	0/7/5	0/3/3				
Appropriate stent percentage (%)	58.3	50.0		0.635		
Mean visual analogue scale	3.8	2.5		0.004		
Height 155-165 cm group						
No. of patients	16	15				
Stent configuration						
Short/appropriate/long	0/13/3	0/8/7				
Appropriate stent percentage (%)	81.3	53.3		0.019		
Mean visual analogue scale	4.8	4.3		0.092		
Height 166-175 cm group						
No. of patients	1	15	5			
Stent configuration						
Short/appropriate/long	0/1/0	0/9/6	0/1/4			
Appropriate stent percentage (%)	100	60.0	20.0	0.516	0.091	0.065
Mean visual analogue scale	8.0	4.3	5.4	0.494	0.187	0.042

[a]: p (A) compares values between the 22 and the 24 cm stent group, [b]: p (B) compares values between the 22 and the 26 cm stent group, [c]: p (C) compares values between the 24 and the 26 cm stent group

stent group and the 26 cm stent group (p=0.042) (Table 3, Fig. 2).

The appropriateness of the stent and the VAS has a statistically significant association. However, patient age, gender, height, weight, stent diameter, stent side, and duration of time for the indwelling ureteric stent did not have a statistically significant association with the VAS or with appropriate stent length.

DISCUSSION

Choosing the correct ureteric stent length is important to ensure trouble-free drainage. Therefore, selection of the ureteric stent length must be individualized on the basis of the patient's ureteral length. The ureteral length for each patient has been calculated by use of three different methods according to previous reports: (1) direct measurement of the ureter itself by use of a guidewire [12,13], (2) measurement of the distance from the ureteropelvic junction to the ureterovesical junction either by retrograde or intravenous pyelography [14], and (3) estimation from a formula based on the patient's height [9,11]. Of these methods, direct measurement with a guidewire is an ideal method theoretically. However, the guidewire used for the measurement makes a highly curved ureter straight and the ureteral length is underestimated. None of the standard methods used are considered the correct measurement method for ureter length. Measurement by retrograde or intravenous pyelography is another theoretically ideal method. However, tracing the curved ureter viewed on a retrograde or intravenous pyelography film is difficult. Radiographic magnification also can make it difficult to measure the correct ureteral length. In addition, retrograde and intravenous pyelography have been mostly replaced by computerized tomography (CT).

A formula based on body height is much easier than the other methods mentioned above [9,11]. Whether body height can predict the ureteral length and the subsequent ideal stent length has been investigated; the results have been controversial. Jeon et al reported that determination of stent length according to patient height does not correlate well with the length needed for endoscopic procedures [12]. Direct measurement of the ureteral length is easy and minimizes stent-associated complications and stent migration. By contrast, Hruby et al reported that body height can be used to predict ureteral length [15]. More studies on the relationship of height with ureteral length are needed. However, currently, body height is the most practical method used for determining the correct ureteric stent length.

The commonly used formula based on body height is the one reported by Pilcher and Patel: for a height <178 cm, the stent length should be 22 cm; for 178-193 cm, 24 cm; and for >193 cm, 26 cm [9]. However, these formulas are based on data from Caucasians. This height-based formula does not take into account racial differences. Asians, including Koreans, are shorter and have a relatively longer trunk than do Caucasians [10,11]. Therefore, Asians might have a longer ureter than Caucasians for a given height. Therefore, most Korean urologists use this formula with modifications. However, there is no standard modification used.

Ho et al reported an Asian study based on a Chinese population performed to determine the ideal stent length according to body height [11]. They evaluated the stent length according to plain films in 408 patients undergoing ureteroscopic lithotripsy and stent insertion. Based on the Chinese population studied, a 22 cm stent length was appropriate for patients <175 cm. A longer, 24 or 26 cm stent may be suitable for those >175 cm. The goal of this study was to apply this formula to Korean patients and to determine whether it was more appropriate in Koreans than the Caucasian-based formula.

The results of this study showed that the formula reported by Ho et al based on Chinese population data were also appropriate in the Korean cohort [11]. However, our results did not confirm that their formula was superior to other formulas based on Caucasian data. Additional comparative studies are needed for such confirmation.

During the study period, a total of 75 patients underwent unilateral ureteroscopic lithotripsy and ureteric stent insertion at our hospital. Seventy patients (93.3%) who were smaller than 175 cm were enrolled in this study. Because the number of patients (5 patients) taller than 175 cm was small, we did not include these data in the study analysis. All of these patients had a 26 cm stent. Three patients (60%) had appropriate ureteric stent length and two patients had stent lengths that were too long. The mean VAS was 4.2 (58.6% appropriateness and mean VAS 4.1 in 70 patients under 175 cm in height).

The limitations of this study include the following. First, the number of study patients was small. Second, the formula was confirmed only in patients smaller than 175 cm. Third, there were significant height differences among each of the stent length groups. The mean height was 155.3 cm in the 22 cm stent group, 163.8 cm in the 24 cm group, and 171.4 cm in the 26 cm stent group (Table 2). In addition, this was a retrospective study.

However, this is the first study to determine the ideal length of a ureteric stent by body height for Korean patients. The results support the formula based on Chinese population data. However, further study is needed to confirm the findings.

CONCLUSIONS

A 22 cm ureteric stent was appropriate for Korean patients smaller than 175 cm in height. However, in some cases, a 24 cm stent might be recommended. The Asian formula derived for Chinese patients may be used for Korean patients.

Conflicts of Interest
The authors have nothing to disclose.

REFERENCES

1. Pollard SG, Macfarlane R. Symptoms arising from Double-J ureteral stents. J Urol 1988;139:37-8.
2. Joshi HB, Okeke A, Newns N, Keeley FX Jr, Timoney AG. Characterization of urinary symptoms in patients with ureteral stents. Urology 2002;59:511-6.
3. Lee JW, Park SC, Seo IY. The clinical characteristics of malignant ureteral obstruction secondary to non-genitourinary malignancy. Korean J Urol 2008;49:49-54.
4. Han CH, Ha US, Park DJ, Kim SH, Lee YS, Kang SH. Change of symptom characteristics with time in patients with indwelling double-J ureteral stents. Korean J Urol 2005;46:1137-40.
5. Rane A, Saleemi A, Cahill D, Sriprasad S, Shrotri N, Tiptaft R. Have stent-related symptoms anything to do with placement technique? J Endourol 2001;15:741-5.
6. Slaton JW, Kropp KA. Proximal ureteral stent migration: an avoidable complication? J Urol 1996;155:58-61.
7. Breau RH, Norman RW. Optimal prevention and management of proximal ureteral stent migration and remigration. J Urol 2001;166:890-3.
8. Wills MI, Gilbert HW, Chadwick DJ, Harrison SC. Which ureteric stent length? Br J Urol 1991;68:440.
9. Pilcher JM, Patel U. Choosing the correct length of ureteric stent: a formula based on the patient's height compared with direct ureteric measurement. Clin Radiol 2002;57:59-62.
10. Bhudhikanok GS, Wang MC, Eckert K, Matkin C, Marcus R, Bachrach LK. Differences in bone mineral in young Asian and Caucasian Americans may reflect differences in bone size. J Bone Miner Res 1996;11:1545-56.
11. Ho CH, Huang KH, Chen SC, Pu YS, Liu SP, Yu HJ. Choosing the ideal length of a double-pigtail ureteral stent according to body height: study based on a Chinese population. Urol Int 2009;83:70-4.
12. Jeon SS, Choi YS, Hong JH. Determination of ideal stent length for endourologic surgery. J Endourol 2007;21:906-10.
13. Shah J, Kulkarni RP. Height does not predict ureteric length. Clin Radiol 2005;60:812-4.
14. Paick SH, Park HK, Byun SS, Oh SJ, Kim HH. Direct ureteric length measurement from intravenous pyelography: Does height represent ureteric length? Urol Res 2005;33:199-202.
15. Hruby GW, Ames CD, Yan Y, Monga M, Landman J. Correlation of ureteric length with anthropometric variables of surface body habitus. BJU Int 2007;99:1119-22.