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ORIGINAL ARTICLE

Ureteral stenting practices following routine ureteroscopy: an international survey

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Abstract

Purpose Stent omission after routine ureteroscopy (rtURS) is accepted by current guidelines and may result in decreased patient morbidity and treatment costs. In a value-based healthcare model, the added morbidity and cost of routine stent placement may be scrutinized. Furthermore, data are limited on urologist cost knowledge and it is effect on ureteral stent placement. As such, we seek to describe ureteral stenting practices and urologist cost knowledge amongst US and non-US-based urologists.

Methods The ureteroscopic practice patterns and cost awareness of members of the Endourological Society were surveyed using an international email listserv. Respondents were grouped by practice location (US vs non-US). Logistic regression was used to evaluate the associations of surgeon practice location with stenting practices.

Results 233 completed responses were received with a response rate of 13.5%. Results revealed that 55% and 71% of respondents reported ureteral stent insertion after rtURS more than 75% of the time for ureteral and renal stones, respectively. Reporting stent insertion following more than 75% of rtURS was more common among US participants for both ureteral and renal stones. Overall, reported cost knowledge was high, but lower among US participants. On multivariable analysis, US respondents were more likely to place ureteral stents after rtURS for ureteral stones more than 75% of the time when compared to those abroad (OR 3.43 $p < 0.01$).

Conclusion Ureteral stenting after rtURS is over utilized in the US compared to other countries. While this phenomenon is multifactorial in nature, cost knowledge may be under recognized as a determinant of ureteral stent placement following rtURS.

Keywords Ureteroscopy · Ureteral stent · Cost · Practice patterns

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Abbreviations

CKS	Cost knowledge score
FSP	Frequent stent placement
IQR	Interquartile range
OR	Odds ratio
URS	Ureteroscopy
US	United States

Introduction

Ureteroscopic laser lithotripsy is utilized by urologists for the management of ureteronephrolithiasis with high success rates, and has become the most common form of surgical stone management in the United States (US) [1, 2]. During ureteroscopy (URS), it has become a parallel practice to place a ureteral stent to prevent ureteral obstruction

and related symptoms. However, ureteral stents have been shown to cause significant side effects including lower urinary tract symptoms, hematuria, pain, sexual dysfunction, and reduced quality of life [3–7]. Subsequent studies have demonstrated that stent omission after routine ureteroscopy can be performed safely and this practice is endorsed by current American Urological Association (AUA) guidelines [8–13]. Despite these recommendations, studies have demonstrated that the rate of ureteral stent placement following URS by American urologists remains excessive and has been reported to be one of the highest in the world [14, 15].

In addition, ureteral stent placement after routine URS has been shown to increase treatment costs [16–19]. As healthcare transitions to a value based model, knowledge of these costs will become a routine part of care. However, data on physician cost knowledge in urology are lacking. As such, we seek to evaluate contemporary ureteral stenting patterns during routine URS and evaluate URS-associated cost knowledge among urologists using an international survey.

Methods

A self-administered web-based survey was designed using DatStat Illume v.4.11 (DatStat Inc., Seattle, WA, USA) and distributed to members of the Endourological Society via e-mail. The survey was administered in the English language and consisted of 61 questions. The survey was distributed in April of 2017 and closed after 12 weeks. Reminders to complete the survey were sent out to the listserv at 4 and 8 weeks following the initial survey invitation. Urologic trainees were excluded, as respondents were limited to urologists who had completed residency and fellowship (if applicable). A copy of the survey can be found in the supplementary materials.

The topics covered by the survey included respondent characteristics, clinical practices, and URS-associated cost knowledge. The respondent characteristics evaluated included number of years in practice, current practice setting (academic, private, or non-academic hospital-based), fellowship training (endourology, other, or none), and percentage of practice dedicated to urolithiasis. The clinical practices evaluated included frequency of ureteral stenting, frequency of stone basketing, and frequency of ureteral access sheath use. These clinical practices were evaluated separately for the treatment of ureteral and renal stones. Respondents' ureteroscopic cost knowledge was evaluated using simple "yes" or "no" questions, as exact costs vary by practice location. Specifically, respondents indicated "yes" or "no" when asked if they were aware of the cost of a ureteral stent, guide wire, access sheath, and procedural cost of in-office ureteral stent removal. A cost knowledge score (CKS) was then formulated by assigning one point for every cost knowledge question answered with "yes", resulting in a minimum score of zero and a maximum score of four.

For the purposes of this survey, routine URS was defined as a procedure without bleeding, ureteral injury, or renal injury in excess of that which you would normally expect. Questions regarding the frequency with which certain clinical practices were utilized during routine URS were assed using a percentile scale as follows: "less than 25% of the time", "25–50% of the time", "51–75% of the time", and "more than 75% of the time". Frequent utilization was defined as reporting the use of the clinical practice in question "more the 75% of the time". All answer choices included "Other" or "Don't Know/Not Sure" options when applicable. During analysis, all "Other" or "Don't know/Not Sure" responses were changed to missing, and ignored if they represented less than 10% of the responses for that question.

Survey response rate was calculated using the number of eligible respondents reached. Baseline characteristics were summarized using medians, interquartile ranges (IQR), frequency counts, and percentages. These were then compared across groups using ANOVA and Fischer's Exact or Pearson's Chi-squared tests, respectively. Multivariable logistic regression was used to evaluate the associations of surgeon practice location with stenting practices. Effect estimates were summarized using odds ratios (OR) with 95% confidence intervals (95% CI). Models were evaluated for multicollinearity using variance inflation factors. Variance inflation factor was calculated to be below 3.0 for each variable in all models, indicating no evidence of multicollinearity. All statistical analyses were performed using the Stata v. 14.2 statistical package (Stata Corp., College Station, TX, USA).

Results

Demographics

A total of 373 responses were received from members of the Endourological Society on the email listserv utilized. 88 of these were excluded due to incompleteness and 52 were excluded due to ineligibility. Ultimately, 233 valid responses were received from 1722 eligible respondents for a response rate of 13.5%. Eighty (33.4%) respondents reported a practice location in the US, with the remaining respondents representing 49 other countries. 58.4% (136) of survey respondents reported having completed an endourology fellowship, while 7.7% (18) reported completing fellowship training in another urologic subspecialty and 33.9% (79) reported no fellowship training. Respondent demographics are described in further detail in Table 1. A larger percentage of respondents outside of the US reported practicing in a non-academic hospital-based

Table 1 Respondent demographic information

	Overall ($N=233$)	USA ($N=80$)	Rest of world ($N=153$)	p*
Years in practice, median (IQR)	14 (8.23)	12.5 (6.22)	14 (8.23)	0.30[a]
Practice setting				
Academic	59.2 (138)	66.3 (53)	55.6 (85)	< 0.01
Private	21.9 (51)	27.5 (22)	19.0 (29)	
Hospital	18.9 (44)	6.25 (5)	25.5 (39)	
Fellowship training				
None	33.9 (79)	26.3 (21)	37.9 (58)	0.20
Endourology	58.4 (136)	65.0 (52)	54.9 (84)	
Other	7.7 (18)	8.8 (7)	7.2 (11)	
Percentage of practice dedicated to urolithiasis (%)[b]				
< 25	12.1 (28)	15.2 (12)	10.5 (16)	0.34
25–50	35.4 (82)	29.1 (23)	59 (38.6)	
51–75	28.0 (65)	26.6 (21)	28.8 (44)	
> 75	24.6 (57)	29.1 (23)	22.2 (34)	

Figures represent (n)% or median (IQR)

**Pearson's Chi squared unless noted otherwise

[a]Wilcoxon Rank-Sum

[b]Missing values account for less than 10% of responses

practice when compared to those in the US (25.5% vs 6.3%; $p<0.01$). There were no other significant differences between groups with regard to the median number of years in practice, endourology fellowship training, or percentage of practice dedicated to urolithiasis.

Clinical practices during ureteroscopy

Respondents were asked to report their rates of ureteral access sheath use, basket stone extraction, and ureteral stent placement during routine URS for ureteral and renal stones (Table 2). Overall, frequent ("more than 75% of the time") ureteral stent placement was reported by 55.4% of respondents after routine URS for the treatment of a ureteral stone and by 71.0% of respondents following routine URS for the treatment of a renal stone. A larger percentage of US respondents reported frequent stent placement (FSP) following routine URS for both ureteral (77.5% vs 43.8%; $p<0.01$) and renal (81.2% vs 65.5%; $p<0.01$) stones, respectively. Similarly, respondents practicing in the US were more likely to report frequent stone basketing (57.5% vs 35.4%; $p<0.01$) and frequent access sheath use (19.0% vs 8.0%, $p<0.01$) during routine URS for the treatment of a ureteral stone. No significant difference in the frequency of reported stone basketing or access sheath use was noted between groups following routine URS for the treatment of a renal stone.

Cost knowledge

Overall, 88.4, 81.1, 85.8, and 80.3% of respondents possessed knowledge of the costs of a ureteral stent, guide wire, access sheath, and an in-office ureteral stent removal, respectively. Urologists practicing in the US were less likely to possess knowledge of each of these costs (Table 3), though a significant difference was only noted for ureteral stent (80.0 vs 92.8; $p<0.01$) or access sheath (72.5% vs 85.6%; $p=0.02$) cost knowledge. The CKS was also calculated as described above, with an overall mean CKS of 3.36. Notably, a significantly lower mean CKS was seen among US respondents when compared to non-US urologists (3.09 vs 3.49; $p=0.02$).

Univariable and multivariable analyses were performed to evaluate factors predicting positive cost knowledge. Univariable results are presented in Table 4a. Our multivariable model adjusted for practice location, number of years in practice, practice setting, fellowship training, and reported practice stone volume. Analysis revealed that a practice location in the US was independently associated with a decreased odds of reporting ureteral stent (OR 0.33, $p=0.02$) and access sheath (OR 0.46, $p=0.046$) cost knowledge. Each additional reported year in practice was also found to be independently associated with an increased odds of reporting ureteral stent (OR 1.06; $p=0.03$) and ureteral stent removal (OR 1.04; $p=0.03$) cost knowledge. It was also demonstrated that compared to no fellowship training, completion of a non-endourology fellowship was independently associated with a lower odds of reporting guide wire (OR 0.25, $p=0.04$) cost knowledge.

Predicting frequent stent placement

Univariable and multivariable analyses of the survey data were performed to identify factors that predict FSP after routine URS. Results of the univariable analysis are presented in Table 5. Our multivariable model accounted for practice location, number of years in practice, practice setting, fellowship training, percentage of practice dedicated to urolithiasis, frequency of stone basketing, frequency of ureteral access sheath use, and cost knowledge score. Compared to respondents practicing outside of the US, a practice location in the US was independently associated with having 3.43 times of the odds of reporting FSP following routine URS for the treatment of a ureteral stone ($p<0.01$). No other factors were shown to have a statistically significant association with FSP following routine URS for the treatment of a ureteral stone (Table 5a). Analysis of FSP following routine URS for treatment of a renal stone identified frequent stone basketing as being independently associated with having 5.19 times the odds of FSP following routine URS for a renal stone, compared to those who reported stone

Table 2 Practices during routine ureteroscopy for the treatment of ureteral stones (a) or renal stones (b), by practice location

	Overall ($N=233$)	USA ($N=80$)	Rest of world ($N=153$)	p*
(a) *Ureteral stones*				
Frequency of ureteral stenting (%)				
< 25	15.0 (35)	3.8 (3)	21.0 (32)	< 0.01[a]
25–50	9.4 (22)	6.25 (5)	11.1 (17)	
51–75	20.2 (47)	12.5 (10)	24.2 (37)	
> 75	55.4 (129)	77.5 (62)	43.8 (67)	
Frequency of stone basketing (%)[b]				
< 25	28.1 (65)	18.8 (15)	33.1 (50)	< 0.01
25–50	15.2 (35)	11.3 (9)	17.2 (26)	
51–75	14.3 (33)	12.5 (10)	15.2 (23)	
> 75	42.2 (98)	57.5 (46)	35.4 (52)	
Frequency of ureteral access sheath use (%)[b]				
< 25	60.7 (139)	46.8 (37)	68.0 (102)	< 0.01
25–50	14.4 (33)	19.0 (15)	12.0 (18)	
51–75	13.1 (30)	15.2 (12)	12.0 (18)	
> 75	11.8 (27)	19.0 (15)	8.0 (12)	
(b) *Renal stones*				
Frequency of ureteral stenting (%)[b]				
< 25	6.5 (15)	1.25 (1)	9.3 (14)	0.03[a]
25–50	7.4 (17)	6.3 (5)	8.0 (12)	
51–75	15.2 (35)	11.3 (9)	17.2 (26)	
> 75	71.0 (164)	81.2 (65)	65.6 (99)	
Frequency of stone basketing (%)[b]				
< 25	24.5 (56)	20.0 (16)	26.9 (40)	0.10
25–50	16.2 (37)	12.5 (10)	18.1 (27)	
51–75	17.9 (41)	15.0 (12)	19.5 (29)	
> 75	41.5 (95)	52.5 (42)	35.6 (53)	
Frequency of ureteral access sheath use (%)[b]				
< 25	14.9 (34)	16.3 (13)	14.1 (21)	0.81
25–50	10.5 (24)	12.5 (10)	9.4 (14)	
51–75	18.3 (42)	18.8 (15)	18.1 (27)	
> 75	56.3 (129)	52.5 (42)	58.4 (87)	

Figures represent (*n*)%

*Pearson's Chi-squared unless noted otherwise

[a]Fischer's exact

[b]Missing values account for less than 10% of responses

basketing in less than 25% of cases. It was also noted that respondents who reported use of a ureteral access sheath in 25–50% of cases had 0.12 times the odds of reporting FSP following treatment of a renal stone when compared to those who reported access sheath use in less than 25% of routine URS for the treatment of a renal stone and adjusted for the features in the multivariable model. While multivariable analysis demonstrated that respondents reporting a practice location in the US were also found to have 2.19 times the odds of reporting FSP following routine URS for a renal stone when compared to respondents outside of the US, this association did not reach statistical significance ($p=0.06$).

Discussion

In this international survey of Endourological Society members, we were able to investigate common practices during URS. We found that FSP was common, with 55.4% and 71% of respondents reporting FSP following routine URS for renal and ureteral stones, respectively. Closer examination of our data revealed that FSP following routine URS following the treatment of both renal (81.2% vs 65.5%, $p<0.01$) and ureteral (77.5% vs 43.8%, $p<0.01$) stones was much more prominent among respondents practicing in the US when compared to respondents practicing elsewhere.

Table 3 Respondent knowledge of costs associated with ureteroscopy, by practice location

	Overall ($N=233$)	Practice location		p*
		USA ($N=80$)	Rest of world ($N=153$)	
Ureteral stent cost	88.4 (206)	80.0 (64)	92.8 (142)	< 0.01
Cost of in-office ureteral stent removal	80.3 (187)	76.3 (61)	82.4 (126)	0.27
Guide wire cost	85.8 (200)	80.0 (64)	88.9 (136)	0.07
Ureteral access sheath cost	81.1 (189)	72.5 (58)	85.6 (131)	0.02
Cost knowledge score (mean)	3.36	3.09	3.49	0.02[b]

Figures represent %(n)

*Pearson's Chi-square test unless otherwise noted

[a]Composite cost score assigned based on the number of items for which a respondent reported possessing cost knowledge, ranging from 0 to 4

[b]Welch t test

Multivariable analysis identified practice location in the US as the only independent predictor of FSP following routine URS for the treatment of a ureteral stone, with US respondents found to be three times more likely to report FSP in this setting than other respondents. A similar multivariable analysis of renal stone treatment identified frequent stone basketing as an independent predictor of FSP, with respondents reporting frequent stone basketing to be nearly five times more likely to report FSP. Respondents located in the US were also noted to be twice as likely to report FSP, though this association did not reach statistical significance.

These data suggest that while FSP following routine URS for the treatment of renal stones is largely driven by the use of stone basketing, FSP following routine URS of ureteral stones is largely driven by practice location in this cohort. Several studies have demonstrated the safety of stent omission following routine URS for the treatment of ureteral stones, but evidence for stent omission in the setting of renal stone treatment is sparse [9–12]. Application of this evidence in clinical practice amongst non-US based respondents is demonstrated in our results as a much lower rate of reported FSP following ureteral stone treatment was seen when compared to reported rates of FSP following renal stone treatment (43.8% vs 65.5%). Conversely, reported rates of FSP following routine URS amongst US respondents were similar for both ureteral and renal stone treatment (77.5% vs 81%).

A 2007 survey of ureteral stenting practices following routine URS reported that approximately two-thirds of respondents in an overwhelmingly American-based cohort reported placing a ureteral stent more than 50% of the time [14]. These results differ greatly from those of the current study, where 90% or 86% of US respondent reporting placing a ureteral stent following more than 50% of the time for renal or ureteral stones, respectively. While the survey methods and respondent cohorts vary substantially between these studies, this is may suggest that ureteral stenting during routine URS in the US has increased over the past decade. As the utilization of URS also increases, the total number of stents placed during routine URS will exponentially increase.

Evidence of frequent ureteral stenting following URS in the US was also demonstrated by a recent study which examined 10,000 cases from an international cohort [15]. While this study was not limited to routine URS, they observed that a ureteral stent was placed in 91.6% of cases from the US, one of the highest stenting rates noted among the countries studied. This study also identified several factors that were associated with an increased likelihood of ureteral stent placement. Most of these factors, however, would indicate that the procedure was not routine URS (i.e., intraoperative complication, stone impaction, and prolonged operative time), thus limiting their utility in predicting stent placement during routine URS. Unlike the current study, they did not asses the influence of practice location or cost knowledge on ureteral stenting practices. The reasons for increased ureteral stent use amongst US urologists in clinical practice are likely multifactorial and may include differences in determinants such as the US healthcare system, instrument or supply availability, reimbursement structure, patient-specific factors, or even personal experience.

To our knowledge, this study represents the first survey of physician cost knowledge in endourology. We demonstrated that the level of cost knowledge amongst respondents was high overall (Table 2). However, the ureteral stent cost knowledge rates, access sheath cost knowledge rates, and mean CKS were all significantly lower amongst US respondents. We also observed that the likelihood of possessing cost knowledge in several domains tested increased with the reported number of years in practice, but decreased with a reported practice location in the US. Given the other findings in our study, this would indicate that US-based respondents were more likely to stent during routine URS and less likely to know the costs associated with ureteral stenting. While

Table 4 Univariable (a) and multivariable (b) analyses of the association of respondent demographic features on reporting positive cost knowledge of the indicated domains

	Ureteral stent cost, OR (95% CI)	*p* value	Ureteral access sheath cost, OR (95% CI)	*p* value	Stent removal cost, OR (95% CI)	*p* value	Guide wire cost, OR (95% CI)	*p* value
(a) *Univariable analysis*								
Practice location in USA	0.33 (0.14, 0.81)	0.02	0.46 (0.22, 0.99)	0.046	0.64 (0.31, 1.31)	0.22	0.53 (0.23, 1.22)	0.14
Time in practice (years)	1.06 (1.01, 1.12)	0.03	1.06 (1.01, 1.11)	0.01	1.04 (1.00, 1.09)	0.03	1.01 (0.97, 1.05)	0.71
Practice setting								
Academic	–	–	–	–	–	–	–	–
Private	1.17 (0.39, 3.52)	0.77	0.63 (0.25, 1.55)	0.31	3.02 (1.09, 8.35)	0.03	1.40 (0.48, 4.09)	0.54
Hospital	1.79 (0.44, 7.23)	0.41	0.60 (0.83, 9.86)	0.10	1.73 (0.67, 4.49)	0.26	1.77 (0.53, 5.96)	0.36
Fellowship training								
None	–	–	–	–	–	–	–	–
Endourology	0.71 (0.23, 2.25)	0.56	0.78 (0.32, 1.92)	0.59	1.75 (0.78, 3.90)	0.17	0.97 (0.36, 2.60)	0.95
Other	0.59 (0.11, 3.10)	0.53	0.34 (0.09, 1.26)	0.11	2.67 (0.95, 10.12)	0.19	0.25 (0.07, 0.95)	0.04
Percentage of practice dedicated to urolithiasis (%)[a]								
< 25	–	–	–	–	–	–	–	–
25–50	1.01 (0.28, 3.56)	0.99	1.47 (0.52, 4.17)	0.47	1.27 (0.46, 3.53)	0.65	1.21 (0.40, 3.61)	0.74
51–75	1.52 (0.39, 5.97)	0.55	2.03 (0.65, 6.29)	0.10	2.29 (0.74, 7.04)	0.15	4.12 (1.03, 16.5)	0.46
> 75	3.34 (0.71, 15.71)	0.13	2.86 (0.83, 9.86)	0.11	3.11 (0.95, 10.12)	0.06	2.39 (0.64, 8.89)	0.19
(b) *Multivariable analysis*								
Practice location in USA	0.31 (0.14, 0.71)	0.01	0.44 (0.23, 0.86)	0.02	0.69 (0.35, 1.33)	0.27	0.5 (0.24, 1.05)	0.07
Time in practice (years)	1.07 (1.02, 1.13)	0.01	1.06 (1.02, 1.10)	0.01	1.04 (1.00, 1.07)	0.048	1.01 (0.97, 1.05)	0.66
Practice setting								
Academic	–	–	–	–	–	–	–	–
Private	1.13 (0.42, 3.01)	0.82	0.65 (0.30, 1.43)	0.28	2.26 (0.89, 5.79)	0.09	1.19 (0.48, 2.99)	0.71
Hospital	2.05 (0.57, 7.32)	0.27	0.78 (0.33, 1.84)	0.57	1.36 (0.57, 3.22)	0.49	1.90 (0.62, 5.84)	0.27
Fellowship training								
None	–	–	–	–	–	–	–	–
Endourology	0.42 (0.15, 1.16)	0.09	0.59 (0.27, 1.28)	0.18	1.03 (0.51, 2.05)	0.94	0.79 (0.32, 1.92)	0.60
Other	0.34 (0.07, 1.57)	0.17	0.23 (0.07, 0.72)	0.01	1.27 (0.33, 4.93)	0.73	0.14 (0.04, 0.46)	< 0.01
Percentage of practice dedicated to urolithiasis (%)[a]								
< 25	–		–	–	–	–	–	–
25–50	1.40 (0.44, 4.46)	0.57	1.81 (0.70, 4.71)	0.22	1.33 (0.50, 3.49)	0.57	1.49 (0.54, 4.14)	0.45
51–75	1.80 (0.52, 6.26)	0.35	2.61 (0.92, 10.37)	0.07	2.20 (0.76, 6.36)	0.15	5.08 (1.35, 19.12)	0.02
> 75	2.88 (0.71, 11.71)	0.14	3.38 (1.10, 10.37)	0.14	2.13 (0.72, 6.32)	0.17	2.83 (0.85, 9.44)	0.09

Multivariable model adjusted for practice location, number of years in practice, practice setting, fellowship training, and percentage of practice dedicated to urolithiasis

[a]Missing values account for less than 10% of responses

no significant association between CKS and FSP was noted on multivariable analysis, cost knowledge has been shown to decrease operating room supply costs in general surgery [20]. Data regarding cost knowledge in Urology is limited, and as the US health care systems transitions to value based care, efforts should be made to further improve cost knowledge amongst American urologists.

While this study provides unique insight into ureteral stenting practices and cost knowledge among members of the Endourology Society, the generalizability of our findings to general urologists is limited by the low response rate and large proportion of fellowship trained endourologists in our respondent pool. In addition, by limiting respondents to members of the Endourology Society, there may be biases inherent to these groups that are not identified in this discussion. It is also important to note that due to the low response rate and study design, our results may be subject to sampling and non-response biases. Furthermore, the use of an unvalidated survey instrument makes it is difficult to predict the reproducibility of this study. Finally, we acknowledge that the costs associated with ureteroscopy and ureteral stent placement extends beyond equipment or procedural costs.

Table 5 Univariable and multivariable analyses of the association of respondent features on reporting frequent stent placement following routine ureteroscopy for the treatment of a ureteral or renal stone

	Univariable, OR (95% CI)	*p* value	Multivariable, OR (95% CI)[a]	*p* value
(a) *Ureteral stone*				
Practice location in USA	4.42 (2.39, 8.17)	< 0.01	3.43 (1.72, 6.84)	< 0.01
Time in practice (years)	0.98 (0.95, 1.0)	0.15	0.99 (0.96, 1.02)	0.59
Practice setting				
Academic	–	–	–	
Private	1.50 (0.77,2.91)	0.24	1.53 (0.69, 3.37)	0.30
Hospital	0.68 (0.34, 1.34)	0.27	0.89 (0.40, 2.01)	0.78
Fellowship training				
None	–	–	–	–
Endourology	1.44 (0.82, 2.51)	0.20	1.08 (0.53, 2.20)	0.82
Other	0.78 (0.28, 2.18)	0.64	0.50 (0.13, 1.89)	0.31
Percentage of practice dedicated to urolithiasis (%)[a]				
< 25	–	–	–	
25–50	0.40 (0.16, 1.01)	0.053	0.42 (0.14, 1.23)	0.12
51–75	0.44 (0.17, 1.14)	0.09	0.43 (0.14, 1.32)	0.14
> 75	0.55 (0.21, 1.46)	0.23	0.44 (0.14, 1.41)	0.17
Cost Knowlege Score (mean)	0.75 (0.58, 0.97)	0.03	0.90 (0.66, 1.21)	0.48
Frequency of stone basketing (%)[a]				
< 25	–	–	–	–
25–50	0.73 (0.32, 1.68)	0.59	0.77 (0.30, 1.99)	0.59
51–75	1.03 (0.45, 2.39)	0.94	0.89 (0.36, 2.22)	0.80
> 75	2.49 (1.30, 4.76)	0.01	1.92 (0.92, 4.00)	0.08
Frequency of ureteral access sheath use (%)[a]				
< 25	–	–	–	–
25–50	1.58 (0.72, 3.46)	0.25	1.28 (0.52, 3.12)	0.59
51–75	0.69 (0.31, 1.53)	0.36	0.56 (0.23,1.38)	0.21
> 75	2.58 (1.03, 6.50)	0.04	1.35 (0.48, 3.79)	0.57
(b) *Renal stone*				
Practice location in USA	2.36 (1.23, 4.54)	0.01	2.19 (0.96, 4.96)	0.06
Time in practice (years)	1.00 (0.97, 1.03)	0.73	1.01 (0.97, 1.05)	0.51
Practice setting				
Academic	–	–	–	–
Private	1.37 (0.65, 2.89)	0.40	1.83 (0.66, 5.10)	0.66
Hospital	0.74 (0.36, 1.51)	0.41	0.88 (0.36, 2.18)	0.79
Fellowship training				
None	–	–	–	–
Endourology	1.17 (0.63, 2.15)	0.62	1.06 (0.46, 2.43)	0.88
Other	0.55 (0.19, 1.55)	0.26	0.62 (0.15, 2.65)	0.52
Percentage of practice dedicated to urolithiasis (%)[a]				
< 25	–	–	–	–
25–50	0.42 (0.14, 1.22)	0.11	0.50 (0.14, 1.73)	0.27
51–75	0.72 (0.23, 2.23)	0.58	0.88 (0.24, 3.26)	0.85
> 75	0.40 (0.13, 1.22)	0.11	0.40 (0.11, 1.51)	0.18
Cost knowledge score	0.78 (0.58, 1.04)	0.09	0.77 (0.53, 1.13)	0.18
Frequency of stone basketing (%)[a]				
< 25	–	–	–	–
25–50	0.68 (0.30, 1.58)	0.37	1.00 (0.36, 2.77)	1.00
51–75	1.25 (0.54, 2.89)	0.61	1.46 (0.54, 3.97)	0.46
> 75	4.48 (1.99, 10.05)	<0.01	5.19 (1.78, 15.08)	< 0.01
Frequency of ureteral access sheath use (%)[a]				
< 25	–	–	–	–

Table 5 (continued)

	Univariable, OR (95% CI)	*p* value	Multivariable, OR (95% CI)[a]	*p* value
25–50	0.17 (0.05, 0.54)	<0.01	0.12 (0.03, 0.47)	< 0.01
51–75	0.61 (0.23, 1.60)	0.32	0.34 (0.10, 1.10)	0.07
> 75	2.03 (0.85, 4.83)	0.11	1.14 (0.40, 3.23)	0.80

Multivariable model adjusted for practice location, number of years in practice, practice setting, fellowship training, percentage of practice dedicated to urolithiasis, frequency of stone basketing, frequency of ureteral access sheath use, and cost knowledge score

[a]Missing values account for less than 10% of responses

Supplementary costs (i.e., cost of additional medication, lost wages, or secondary procedures) are not accounted for in this analysis and warrant further investigation.

Conclusions

Ureteral stenting after routine URS is utilized significantly more often in the US when compared to abroad. Furthermore, urologists in the US may be less likely to know the costs associated with ureteral stenting. While a multitude of factors influences ureteral stenting practices, we have demonstrated that cost knowledge may be an under recognized determinant of ureteral stent placement following routine URS. This information can be used by urologists and policy makers alike to guide further research into the impact of frequent ureteral stent placement following routine URS on treatment costs and patient morbidity.

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