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Determination of optimal stent length: a survey of urologic surgeons

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Introduction Ureteral double-J stent length is an important factor affecting stent-related symptoms. Multiple techniques exist to determine ideal stent length for a given patient, however, little is known about what techniques urologists rely on. Our objective was to identify how urologists determine optimal stent length.

Material and methods An online survey was e-mailed in 2019 to all members of the Endourology Society. The survey sought to assess what methods are commonly used to determine choice of stent length, along with frequency of stent placement post ureteroscopy, duration of stenting, availability of different stent lengths and the use of stent tether.

Results 301 urologists (15.1%) responded to our survey. Following ureteroscopy, 84.5% of respondents would stent at least 50% of the time. Following uncomplicated ureteroscopy, most respondents (52.0%) would leave a stent for 2–7 days. Patient height was most commonly ranked first as the method of choice in determining stent length (47.0%), followed by estimation based on experience only (20.6%) and intra-operative direct measurement of ureteric length (19.1%). Most respondents utilized multiple methods in determination of optimal stent length. Most respondents (66.5%) were interested in a simple intra-operative technique utilizing a special ureteral catheter that would help choose the most appropriate stent length.

Conclusions Post-ureteroscopy stent insertion is common and patient height is the most common method of choice used in determining optimal stent length. Most respondents were interested in using a simple, novel ureteral catheter device that would allow them to more accurately select optimal stent length.

Key Words: stent ‹› length ‹› survey

INTRODUCTION

Ureteric stenting was first described in 1967 by Zimskind et al. and has since been a mainstay of urologic practice [1]. Stents are placed at the time of many urologic procedures with the purpose of maintaining ureteral patency and urinary drainage. Such procedures commonly include ureteroscopy, percutaneous nephrolithotomy, endoureterotomy, pyeloplasty and ureteral reimplantation. Stents are also often used as a temporizing measure for patients with ureteral stones or strictures who are awaiting definitive surgical management. While the benefits and indications of stents are clear, stents are unfortunately also associated with symptoms, which have been shown to have a negative impact on patient quality of life [2]. These symptoms include urinary frequency, urgency, dysuria, incomplete emptying, flank and suprapubic pain, incontinence, and hematuria [3].

Ureteric stents are available in a variety of lengths and choice of stent length for a given patient may

have a significant impact on these symptoms since most are directly related to bladder irritation. The Ureteral Stent Symptom Questionnaire (USSQ) is a validated method used to characterize and quantify patient-reported stent symptoms. A 2010 prospective study by Giannarini and colleagues demonstrated that patients in whom the distal stent loop crossed the bladder midline had the highest scores on five of six USSQ domains [4]. Similarly, a randomized trial from 2007 found that urinary urgency, dysuria, and lower quality of life indicators were associated with longer ureteric stent length [5]. Conversely, stents that are too short have a higher rate of migration, which may increase the need for secondary procedures such as stent retrieval or replacement [6, 7]. While the effect of stent length on patient symptomatology has been investigated, there is controversy around what is the best method of determination of the ideal stent length for a given patient. A review of the available literature demonstrates that there are a number of available methods with which to estimate ureteric length and, subsequently, choose the appropriate stent. Previously described methods include use of patient height [8], direct measurement using a guidewire [9] or endocatheter ruler [8], measurement of ureteral length from intravenous pyelogram (IVP) [10], computed tomography (CT), [11, 12] or kidney ureter bladder (KUB) x-ray [13], or simply empiricism based on surgeon experience. Despite all the described methods, we have little understanding as to which method endourologists are using. Patient height is thought to be the most frequently used method to assess ureteric length in daily practice, likely because it is a non-invasive and relatively quick method of predicting ureteric length. However, recent studies, including a study from our unit, have suggested that the correlation between ureteric length and patient height is not as strong as previously believed [6, 11, 12, 14, 15]. Although direct measurement using a graduated ureteral catheter is considered the gold-standard, it is time consuming and often impractical and, therefore, unlikely to be utilized by most urologists in everyday practice. With all the available options and no definitive guidelines, it is unclear how urologists are making the important decision of determining optimal stent length. The objective of our study was to describe practice patterns among urologists around stent insertion. Specifically, we aimed to assess: 1) the demographics of urologists 2) frequency and duration of stent use post-ureteroscopy 3) the method of choice for determining optimal stent length and 4) if urologists would be interested in a new simple, innovative method to more accurately measure appropriate stent length intra-operatively.

MATERIAL AND METHODS

An online-based survey was sent via email in 2019 to all urologists who were members of the Endourological Society (n = 2000). The survey was drafted in the English language by the authors (M.O., J.L.) after numerous expert meetings between the co-authors. Participation in the survey was voluntary and responses to the survey were anonymous. There were no internet provider (IP) address restrictions. The survey was left open for four weeks and one reminder e-mail sent out. Research ethics approval was obtained from the St. Michael's Hospital Institutional Research Ethics Board.

The survey consisted of fourteen items and included questions about physician demographics and practice patterns with respect to ureteric stent placement. The full survey has been included in the supplementary materials (Appendix 1). Specifically, the survey sought to assess what methods are commonly used to determine choice of stent length, along with frequency of stent placement post-ureteroscopy, duration of stenting, availability of different stent lengths, the use of multi-length stents, the use of stent tether/string, and if respondents would be interested in a simple intra-operative technique utilizing a specialized ureteral catheter that would help to choose the most appropriate stent length, replacing the currently used catheter and at a similar cost.

Summary statistics of the demographics of survey respondents and survey questions were reported.

RESULTS

Demographics

Of the 2000 urologists who were contacted, a total of 301 responded to our online survey (15.1%). The majority of urologists were between the ages of 35–44 (34.6%) and 45–54 (32.2%), and the vast majority of respondents were male (94.3%) (Table 1). Most respondents (70.8%) had been in practice for over ten years and 46.0% had an academic practice as opposed to community/private (28.9%) or a mixed model (25.2%). Most respondents practiced in North America (40.9%) followed by Europe (26.2%) and Asia (18.8%) (Figure 1). The majority of respondents (57.1%) completed formal endourology fellowship training. Thirty-seven percent of respondents performed >150 ureteroscopic procedures per year while 30.1% and 21.6% performed 50 to 100 and 100 to 150 procedures per year, respectively.

Practice patterns

Most respondents would frequently leave a stent after performing ureteroscopy for ureteral or renal calculi, with 84.5% of respondents leaving a stent at least 50% of the time (Figure 2). Specifically, 34.8% of respondents reported leaving a stent >90% of the time and 31.08% of respondents leaving a stent 70–90% of the time. For uncomplicated ureteroscopy, considered as a typical case when a stent is being left in-situ, most respondents (52.0%) would leave a stent for two to seven days, followed by seven to fourteen days (32.8%). Only 5.7% of respondents would leave a stent for <48 hours while 9.5% of respondents would leave a stent for >14 days after uncomplicated ureteroscopy. Over 50% of respondents

Table 1. *Survey respondent demographics*

Characteristic	Number of Survey Respondents (%)
Gender	
Female	17 (5.7)
Male	281 (94.3)
Age (y)	
18–24	1 (0.3)
25–34	16 (5.4)
35–44	103 (34.6)
45–54	96 (32.2)
55–64	58 (19.5)
65+	24 (8.1)
Duration of practice	
<5 years	30 (10.1)
5–10 years	57 (19.1)
10–20 years	111 (37.3)
>20 years	100 (33.6)
Type of practice	
Academic	137 (46.0)
Community/private	86 (28.8)
Mixed model	75 (25.2)
Location of practice	
North America	122 (40.9)
South America	24 (8.1)
Central America	3 (1.0)
Europe	78 (26.2)
Asia	56 (18.8)
Australia/New Zealand	8 (2.7)
Africa	7 (2.4)
Endourology fellowship training	
Yes	169 (57.1)
No	127 (42.9)
Number of ureteroscopic procedures per year	
<50	33 (11.2)
50–100	89 (30.1)
100–150	64 (21.6)
>150	110 (37.2)
How often respondents would leave a stent after performing ureteroscopy for ureteral or renal calculi (%)	
<10	6 (2.0)
10–50	40 (13.5)
50–70	55 (18.6)
70–90	92 (31.1)
>90	103 (34.8)
Respondent interest in a simple intra-operative technique utilizing a specialised ureteral catheter that would help choose the most appropriate stent length and would replace the catheter currently used and be of similar cost	
Yes	171 (66.5)
No	86 (34.5)

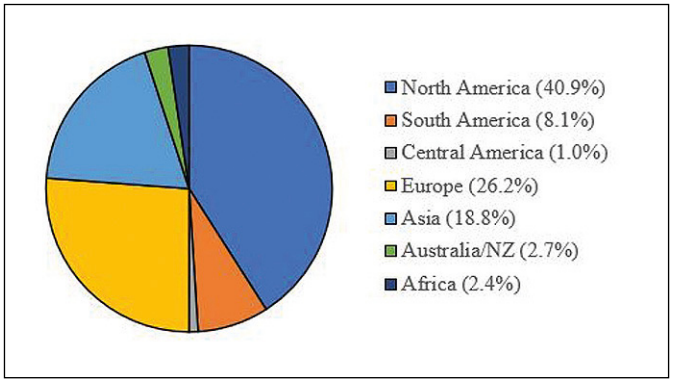

Figure 1. *Practice location.*
NZ – New Zealand

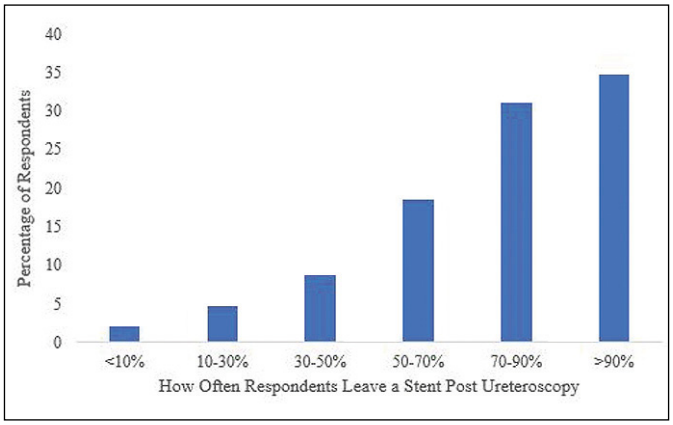

Figure 2. *Frequency of ureteric stent placement after ureteroscopy for ureteral or renal calculi.*

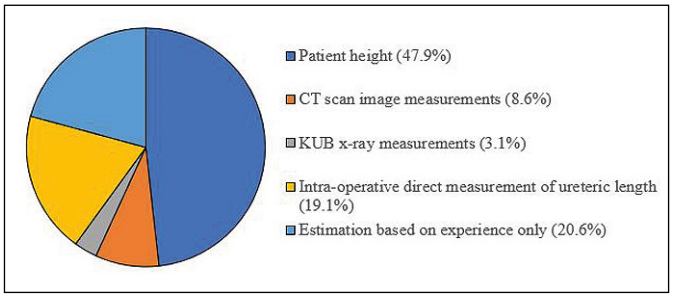

Figure 3. *Most preferred method to determine optimal ureteric stent length.*
CT – computed tomography; KUB – kidney ureter bladder

had access to stents ranging in length from 22 to 28 cm while only 24.15% had access to 20 cm stents and 41.16% had access to multi-length stents. Most respondents did not routinely utilize a tether/string to facilitate removal of stents (58.2%).

When a stent was indicated, the majority of respondents reported determining stent length intraoperatively (79.3%). When asked to rank the method of choice in determining optimal stent length, patient height was most commonly ranked first (47.0%) followed by estimation based on experience only (20.6%) and intra-operative measurement of ureteric length such as with a ureteral catheter (19.1%) (Figure 3). Most respondents utilized multiple methods in determining optimal stent length. Patient height (87.9%), followed by estimation based on experience (81.7%) and intra-operative measurement of ureteric length (74.7%) were included in respondents' repertoire of methods in determining optimal stent length (Figure 4). Interestingly, when respondents were asked if they would be interested in utilizing a simple intra-operative technique utilizing a novel ureteral catheter that helped to choose the most appropriate stent length (which could replace the current ureteral catheter you use and be similar in cost), the majority (66.5%) replied that they would be interested in using such a special catheter.

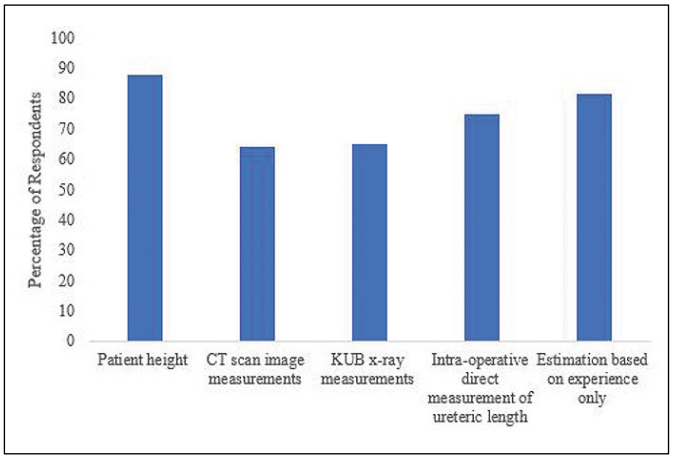

Figure 4. *Techniques used to determine optimal stent length.*
CT – computed tomography; KUB – kidney ureter bladder

DISCUSSION

While there are multiple methods to determine proper stent length, there is no consensus on the best method. Previously described methods include use of patient height [8], direct measurement [8, 9], preoperative imaging [10–13], or surgeon experience. In the pediatric population, Palmer and Palmer determined that simply adding 10 to patient age served as a reliable and accurate rule of thumb to determine ureteric stent length [16]. There are no established guidelines for determining ureteric stent length in adults or children. To our knowledge, this is the first study to evaluate preferred techniques amongst urologists for determining optimal stent length.

It has been claimed that empiricism based on surgeon experience is the most common method for

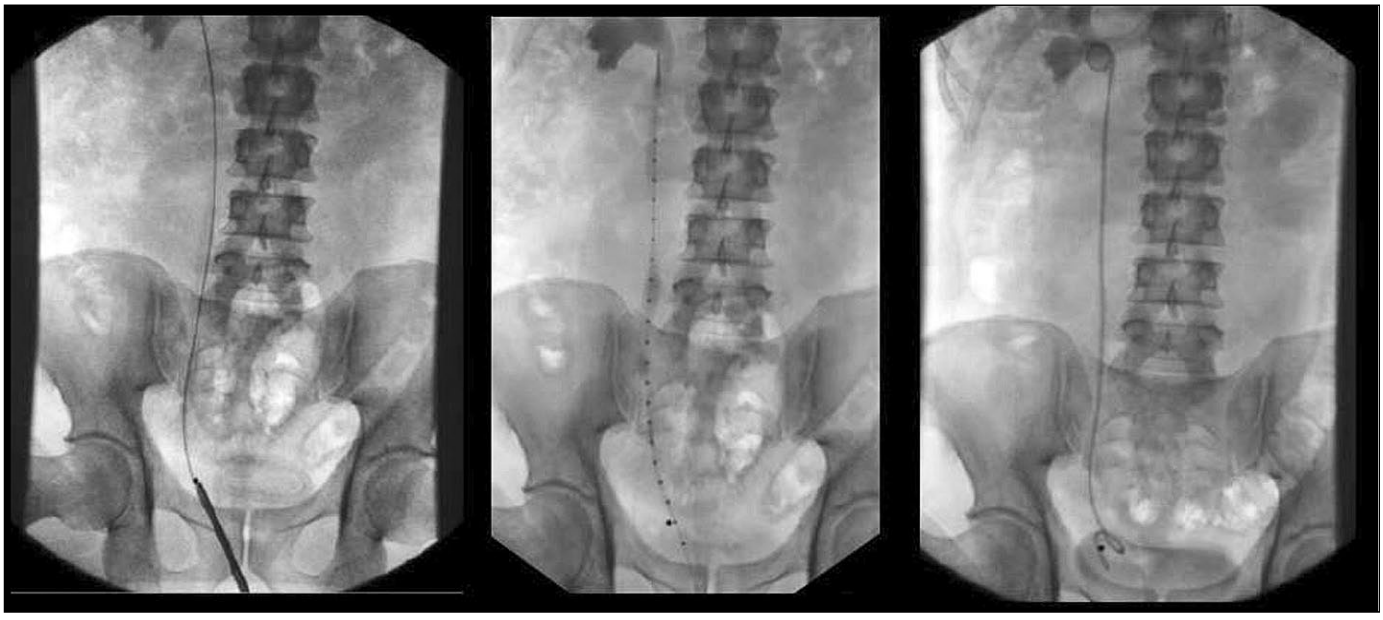

Figure 5. *Novel intra-operative technique to determine ureteral length utilizing an angiographic catheter with radiopaque markings adapted from Barrett et al. [20].*

determining stent length [16]. However, our study found that patient height is the most common method for determining stent length with 47% of respondents ranking patient height as their most preferred method for determining stent length and 87.9% of respondents considering patient height as part of their repertoire of determining stent length. There have been different ways that height has been used to determine stent length. Described formulas include length = 1.125 x body height + 0.5 cm or the vertical distance from the second lumbar vertebrae to the pubic symphysis minus 2 [17]. The distance between the xyphoid process to the pubic symphysis as well as the distance between the acromium process to head of ulna has also been used to predict stent length [18]. Ho et al. prospectively evaluated 87 patients and their stent-related symptoms and found that a 22 cm stent would be most appropriate for those between 149.5 to 178.5 cm in height [19]. Despite the widespread use of patient height in determining stent length, multiple studies have found that patient height does not correlate well with ureteral length [6, 11, 14, 15]. This was confirmed by Barrett et al. who found a poor correlation between patient height and directly measured ureteral length, and also between lumbar vertebral height and directly measured ureteral length [20]. Interestingly, this same study also found that surgeon estimate of ureteric length also did not correlate with directly measured ureteral length, which is not surprising as surgeons may estimate ureteral length based on patient height. Despite opposing evidence, patient height may remain a commonly used method to determine stent length because it is convenient, low cost, and non-invasive.

There is thought that ureteral stents are overused in contemporary urologic practice [3]. A prior survey study by Auge et al. in 2007 found that two-thirds of responders would place a stent more than 50% of the time and 13% would always place a stent following ureteroscopy, despite the fact that stent intolerance was the most significant problem addressed by patients (98%) [21]. In our study, we found that 84.5% of respondents would leave a stent at least 50% of the time, and surprisingly, 34.8% would leave a stent >90% of the time (Figure 2). For uncomplicated ureteroscopies when a stent is being left in situ, 52.03% of respondents would still leave a stent for two to seven days. These results suggest that stent insertion following ureteroscopy remains a common practice and in fact may be even more common now than before. Prior randomized prospective trials have questioned stent placement following uncomplicated ureteroscopy and the American Urological Association (AUA) Guideline on Surgical Management of Stones recommends a selective approach to stent placement [22]. The AUA guideline indicates that clinicians may omit ureteral stenting in patients meeting all of the following criteria: those without suspected ureteric injury during ureteroscopy, those without evidence of ureteral stricture or other anatomical impediments to stone fragment clearance, those with normal contralateral kidney, those without renal functional impairment, and those in whom a secondary ureteroscopy is not planned.

With respect to placement of a tether/string to facilitate stent removal, 58.2% of respondents would not leave a tether. The decision on whether to leave a tether may be affected by surgeon access to resources, surgeon preference, and perceived risks of leaving a tether including increased urinary symptoms from string irritation, stent dislodgement, and patients forgetting to remove stents. A systematic review by Oliver et al. in 2018 found that patients with tethered stents had no overall difference in pain scores or urinary symptoms compared to non-tethered stents [23]. Tethered stents were found to have a shorter dwell time, which has implications on patient morbidity and burden on the healthcare system. However, nearly 10% of patients with tethered stents suffered from dislodgement. There are currently no guidelines on placement of tethered versus non-tethered stents.

This survey has highlighted areas of improvement and topics to debate. Most notably, our survey results show that urologists are commonly using a non-validated method, patient height, to determine stent length. In addition, despite evidence and AUA recommendations to place stents selectively, stent placement appears to be increasing in frequency compared to prior survey data. Using an accurate and uniform measure to determine stent length and also reserving stent placement for select complicated cases would not only have implications in patient quality of life, but could also result in potential cost-savings from reduced emergency department visits, secondary procedures, office visits and medication usage, such as antispasmodics and alpha blockers to treat bladder spasms and stent-colic. Our survey identified that a majority of urologists (66.5%) are interested in a simple intra-operative technique utilizing a special ureteral catheter that would help choose the most appropriate stent length, which suggests that surgical innovation in this realm would be beneficial. Barrett et al. described a novel intraoperative technique to measure ureteral length and found that this technique strongly correlated with directly measured ureteral length with a ureteral catheter ($r = 0.873$, $p < 0.01$) and resulted in good stent position in 92% of cases [20]. In this study,

25 ureters from 23 patients were included. This novel technique was compared with patient height and CT measurement, which resulted in poor and moderate correlation with directly measured ureteral length, respectively. In this novel technique, a radiographic measurement was performed by using a radiographic nipple marker affixed to the skin over the ureteral orifice and an angiographic catheter with radiopaque markings at 1 cm intervals (Cook Urological) (Figure 5, adapted from Barrett et al.) [20]. The ureteral length was the distance between the ureteropelvic junction (UPJ) to the marker at the ureteric orifice, measured using the catheter markers. The authors are currently working with the appropriate industry to discuss product development.

To our knowledge, this is the first study of its kind to characterize how urologists determine optimal stent length utilizing data from academic and community urologists on an international scale. An understanding of current demographics and practice patterns provides a platform for future research and development. The results of our study must be interpreted within the context of our study limitations. This was a survey study of endourologists who are part of the Endourological Society and as a result, may reflect a subgroup of urologists who tend to perform more complicated endourological cases. We also did not stratify survey respondents based on their degree of expertise (i.e. resident versus consultant) which may have affected results. In addition, our survey did not have IP address restrictions so a responder may have completed the survey more than once. In our survey question 9, in reference to uncomplicated ureteroscopy describing a typical case when a stent is being left in-situ, different urologists may have different criteria as to what they consider to be an uncomplicated ureteroscopy which may have biased results. The survey was also disseminated in 2019 and practice patterns change over time. As a survey study, our results are also susceptible to sampling and recall bias.

CONCLUSIONS

The results from this survey demonstrate that ureteric stent use post-ureteroscopy is common, that patient height is the most frequently used method to determine optimal stent length and that urologists are interested in an intra-operative technique utilizing a special ureteral catheter that would help choose the most appropriate stent length.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

Appendix 1

Survey questions

1. Age:

2. Gender:

3. Years in practice
   a) <5 years
   b) 5–10 years
   c) 10–20 years
   d) >20 years

4. Primary practice location (select continent)
   a) North America
   b) South America
   c) Europe
   d) Asia
   e) Australia
   f) Africa

5. Type of practice
   a) Academic hospital
   b) Community hospital/private practice

6. Did you complete training in an endourology fellowship?
   a) Yes
   b) No

7. How many ureteroscopic procedures do you perform per year?
   a) <50
   b) 50–100
   c) 100–150
   d) >150

8. How often do leave a stent after performing ureteroscopy for ureteral or renal calculi?
   a) <10%
   b) 10–50%
   c) 50–70%
   d) 70–90%
   e) >90%

9. For a typical case when a stent is being left in-situ, how long do you leave a stent in place following ureteroscopy?
   a) <7 days
   b) 7–10 days
   c) 10–14 days
   d) >14 days

10. What stent length options are available at your institution? Select all that apply.
    a) 20 cm
    b) 22 cm
    c) 24 cm
    d) 26 cm
    e) 28 cm
    f) Multi-length

11. Do you routinely utilize the tether/string on the stent to facilitate removal?
    a) Yes
    b) No

12. Do you determine stent length pre- or intra-operatively?
    a) Yes
    b) No
    c) N/A – I use multi-length stent

13. Which techniques do you use to determine optimal stent length? (1–4, most to least frequent?)
    a) Patient height
    b) CT scan
    c) KUB x-ray
    d) Intra-operative measurement of ureteric length with ureteral catheter
    e) Estimation based on experience

14. If there were a simple intra-operative technique utilizing a specialized ureteral catheter that would help you to choose the most appropriate stent length and would replace the catheter you now use and be of similar cost, would you be interested in using it?
    a) Yes
    b) No

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