

Length of urethra in the Indian adult male population

Venkatesh Krishnamoorthy, Praveen B. Joshi

Department of Urology, NU Hospitals, Bangalore, Karnataka, India

ABSTRACT

Objective: The urethral length has not been measured in the Indian population. Even the international literature in this arena is very sparse. This paper is an attempt to develop a simple anatomical database for urethral length.

Materials and Methods: Between January 2010 and April 2011, the urethral lengths of 422 adult male patients who required catheterization as part of regular treatment at our hospital, were recorded after obtaining consent from the patients and from the scientific and ethics review boards of the institution. Patients with history of prostatic or urethral abnormalities were excluded. The balloon of a sterile Foley's catheter was inflated using 10 cc of saline. The length from the junction of the balloon to the 'Y' junction of the Foley was measured. The catheter was then passed into the bladder and re-inflated to same volume. The penis was gently straightened and the length of the catheter outside the penis was measured till the premarked point at the 'Y' junction. Subtracting this from the original length gave the length of the urethra.

Results: The mean length of the urethra was 17.55 + 1.42 cm with a range between 14 and 22.5 cm.

Conclusions: Literature in which the length of the normal adult male urethra is recorded for a significant sample size is very scarce. Our data adds to basic anatomic information of the male urethra specific to the Indian population.

Statistical Methods: Descriptive statistical analysis was performed. The non-linear regression analysis was employed to find the normative values of urethral length according to age class.

Key words: Adult urethra, male urethral anatomy, urethral length

INTRODUCTION

In an age where endourology is advancing by leaps and bounds, it is surprising to find that very sparse work has been done to measure the length of the portal for access into the urinary tract, namely, the urethra.

Sir Henry Gray had measured the cadaveric male urethra to be 18–20 cm.^[1] This continues to be a reference standard quoted by most authors. Since then scattered literature from the West has been available but there is no data from India. This paper is an attempt to develop a simple anatomical database for urethral length.

For correspondence: Dr. Venkatesh Krishnamoorthy, C.A. 6, 15th Main, 11th Cross, Padmanabhanagar, Bangalore, Karnataka, India. E-mail: dr.venkatesh@nuhospitals.com

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MATERIALS AND METHODS

All adult men attending our services for some form of urological procedure were considered for the study after obtaining permission from the SAC and ethics review board of the institution. Informed consent was obtained from all participating patients for the procedure and also for using the clinical data for scientific papers and publications. The following inclusion and exclusion criteria were followed.

Inclusion criteria

All adult men attending our services requiring catheterization

Exclusion criteria

1. Urethral abnormalities: congenital or iatrogenic
2. Prior urethral / prostate surgeries
3. Active urethral or prostatic infections
4. Inability to catheterize.
5. Patients having erections under anesthesia

Methodology

All patients were those who required catheterization as a part of their regular treatment in the hospital. A sterile Foley's catheter was taken and the balloon was inflated using 10 cc of saline. The length from the balloon to a premarked spot at the 'Y' junction of the Foley was measured. The catheter was then introduced into the

bladder and the balloon was re-inflated to the same volume.

The penis was then gently straightened to its normal length and the length of the catheter remaining outside the penis was measured up to the same spot at the 'Y' junction. Subtracting this from the original length gave the length of the urethra from the bladder neck to the meatus. With this, the patient did not undergo any unnecessary catheterization, or double catheterization. Care was taken to see that the penis was not being excessively stretched.

RESULTS

Between January 2010 and April 2011 urethral lengths were measured in 422 men aged between 18–94 years (mean 45.56 + 16.42). The mean length of the urethra was 17.55 + 1.42 cm with a range between 14 and 22.5 cm. The maximum mean length of the urethra was in the group between 51–60 years (17.73 + 1.58 cm). The statistical appropriateness of the data is reflected by the normal histogram on the frequency distribution curve [Figure 1]. A comparison between the various age groups suggested an increase in urethral length up to 60 years followed by a slight decline (17.73 cm at 51–60 years vs. 16.76 cm in men > 80 years). Within each age group the difference between the minimum and maximum lengths varied from 5–8.5 cm. The overall standard deviation, however, was only 1.42 cm [Table 1].

DISCUSSION

Literature documenting the length of the normal adult male urethra is very scarce. Considering that establishment of this data would help urology equipment designers to devise suitable instruments and catheters, it would also be helpful to have information on particular sub-populations, making it cost-effective.

While there is paucity of such information in Western literature, there is practically none for the Indian population. We are presently using the devices designed for the Western population, assuming that the urethral length in Indians is the same as in the West. The catheters in the West measure up to 45 cm from end to end, while the commonly available

Indian catheters measure 40 cm. The useful length of the catheter, which is the length from the neck of the inflated balloon to the 'Y' junction, is only 30 cm.

It is also essential to have a good idea of the length of the male urethra, because urologists are still comfortable with calibrating/sounding of the male urethra, to assess the levels of a lesion/obstruction within the urethra. To do this, it is very important to know the normal length, and thereby have an estimate of the location within the urethra.

There are various ways of assessing the urethral length, but none has been proven to be the gold standard. The earliest method employed to measure urethral length was direct measurement during dissection by Sir Henry Gray. This was in the range of 18–20 cm.^[1] While accurate assessments are possible by this method, an obvious drawback is that these are cadaveric measurements.

Attempts to measure urethral length using retrograde urethrograms and micturating cystourethrograms will be affected by the degree of magnification and the angle at which the X-ray beam focuses on the urethra. An advantage of course is the ability to subdivide the urethra into subsections and measure individual lengths.

Two accurate methods for measuring urethral length appear to be magnetic resonance imaging (MRI) and flexible cystoscopy. On MRI the male urethra has been reported to

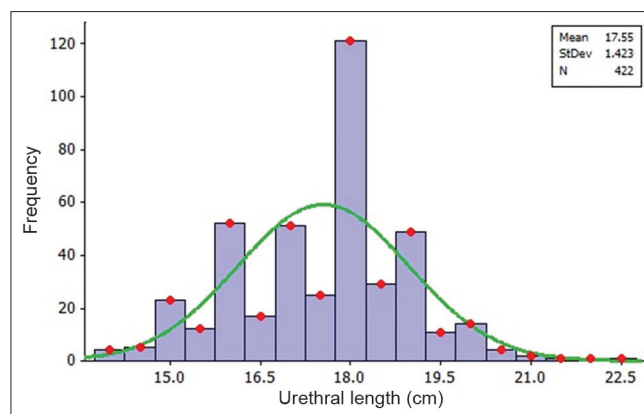


Figure 1: Histogram representing the normal distribution of urethral length

Table 1: Urethral length (cm) according to age

Age in years	Number of patients	Min-Max	Mean	SD	Smoothed mean
18-20	7	15.0-20.0	17.29	1.72	17.23
21-30	86	14.0-20.5	17.36	1.25	17.41
31-40	100	14.0-20.5	17.47	1.36	17.58
41-50	65	14.5-21.5	17.77	1.31	17.70
51-60	83	14.5-22.5	17.86	1.58	17.73
61-70	46	14.0-22.0	17.65	1.43	17.61
71-80	27	15.0-20.5	17.05	1.54	17.31
>80	8	14.2-19.0	16.83	1.87	16.76
Total	422	14.0-22.50	17.55	1.42	-

be approximately 18–20 cm long.^[2] The proximal portions of the prostatic urethra as well as the distal penile urethra are not visualized on MR images unless a Foley catheter is inserted. Kohler *et al.*, had reported the use of flexible cystoscopy to measure urethral length in 30 patients.^[3] The flexible cystoscope was held fixed at the bladder neck with the penis on stretch and the cystoscope was similarly marked with tape at the end of the penis. The cystoscope was then removed and the distance from the mark to the end of the cystoscope was measured. While one can question the accuracy of these methods, they are not only expensive, but also require specialized equipment.

Kohler *et al* measured the length of the urethra in 109 men with normal genitourinary anatomy, as 22.3 cm with a SD of 2.4 cm with the age of the patients ranging between 42 and 89 years.^[3] The length of the penis was measured by two methods. In the first the penis was stretched on the catheter and a mark was made on the catheter at the level of the meatus. The catheter was then removed and the length was measured. In the second method it was measured similarly by performing flexi-urethroscopy.

In our study, 422 subjects with normal urethra, aged more than 18 years were included. The mean urethral length was found to be 17.55 cm + 1.42 cm. The variation in urethral length has been largely attributed to differences in penile and prostatic urethral lengths. Prostatic lengths have been shown to range from 2.5–4.5 cm influenced by both baseline anatomy, and the effect of benign prostatic hyperplasia. As in the study by Tobias *et al.*, our study also excluded those with previous prostatic surgery.

Age-related prostatic hypertrophy would be expected to result in an increase in overall urethral length. Surprisingly, our data suggests a slight decrease in urethral length in men over 60. This may be explained by possible age-related atrophy of periurethral tissues.

As penile urethral lengths vary with the flaccid and erect status, Tobias *et al.*, used the stretched penile length to overcome this limitation.^[4] This may actually overestimate the penile urethral length due to elasticity of the tissues. This has been overcome by measuring the “straightened” penile length in our study.

In our study, we did not put the penis on a stretch. In their study, not only was the penis put on a stretch with no defined limits for the stretch, but it was also performed

at four different centers, by different people, with no standardization. In addition, by putting the penis on a stretch, it is only the penile urethra which is stretched and not the bulbar as well as the posterior urethral region.

Putting the penis on a stretch does not contribute in any way to the actual length of the urethra, as a stretched penis is never the same length as an erect penis, and a stretched penis is never used for urethral reconstruction. The only point where a stretched penis is used is at the time of introduction of an instrument into the urethra, and during a urethrogram. The stretched penis therefore does not contribute any useful information to the length of the urethra. While we acknowledge the minor differences in the urethral lengths due to the elasticity of the catheter and the penis itself, these differences are likely to be negligible.

The length of the catheter currently in use, is at least more than 1½ times the average length of the urethra, indicating a need to perhaps customize the catheter and instruments for our population. The population included in this study comprised the patients who visited our hospital and predominantly belonged to south India.

CONCLUSION

We would like to emphasize that there is hardly any data on this issue. There is a need for assessing the length of the Indian male urethra. This is a simple and basic science work that can add to the database of the urethral length.

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