ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

Original Research Article

A Study of the Urethral Length in the Adult, Indian, Female Population

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ABSTARCT

The indwelling urethral catheter is an important adjunct in modern medical treatment and transurethral endoscopic access is frequent in Urology. In addition, in females, stress urinary incontinence often mandates procedures involving the urethra, and occasionally the bladder neck. Considering these factors, the paucity of published data about the normal female urethral length is surprising. 123 female patients (age 18-80 years) admitted at a tertiary care centre, for any non-Urological indication, between January 2019 and April 2020, who fulfilled the inclusion and exclusion criteria, were included in the study. The urethral length was estimated by measuring the exposed segment of an indwelling Foley catheter and subtracting it from the total catheter length (measured from the base of balloon to the 'Y' junction). The mean urethral length noted was 3.9 cm (2.5-6.5 cm).

INTRODUCTION

The indwelling urethral catheter is an important adjunct in modern medical treatment and transurethral endoscopic access is frequent in Urology. Additionally, there is a significant occurrence of stress incontinence in females, which often mandates procedures involving the urethra, and occasionally the bladder neck. Considering these factors, the paucity of data about the normal female urethral length is surprising. A PubMed search with the terms 'female urethral length' turned up only one paper focused solely on the urethral length in normal, adult females[1] in the first 50 relevant results while other papers were either in the pediatric

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

population[2,3] or in adults with incontinence[4,5]. This paper aims to add to the existing sparse anatomical data.

MATERIALS AND METHODS

123 female patients at a tertiary care center, admitted for any non-Urological indication, between January 2019 and April 2020, who fulfilled the inclusion and exclusion criteria, were included in the study.

Inclusion Criteria:

1. All female patients admitted at a tertiary referral center for any non-urological indication.
2. Only patients who already had an indwelling catheter were included.

Exclusion criteria:

1. Age less than 18 years
2. Any prior history of transurethral, urethral or periurethral surgery.
3. H/o prior traumatic urethral catheterization or instrumentation
4. Any patient where such history was not available could not be elicited or where immobility or altered sensorium precluded weighing or accurate measurements.
5. Any patients with visible orthopedic prosthetic devices like external fixators were also excluded to avoid skewing of the BMI estimation.
6. Any patient having a urethral catheter other than a Foley catheter e.g. Nelaton catheter or infant feeding tube etc.
7. Any patient where examination showed visible congenital anomalies of the external genitalia or urethra like epispadias, or acquired anomalies like labial adhesions or scarring.

No patient was catheterized solely for the purpose of the study. History and informed consent were obtained from the patient and/or an attendant and all the measurements were taken with the subjects in supine posture, with the hips and knees in gentle flexion. The brand of the indwelling catheter was noted. The catheter was then held taut without traction and the catheter was marked at the level of the external urethral meatus using an indelible marker (mark ‘C’). The length of the catheter from the ‘Y’ junction of the catheter (marked ‘B’) to this marking was measured. The length of the urethra was estimated by subtracting the length ‘BC’ from the length ‘AB’.

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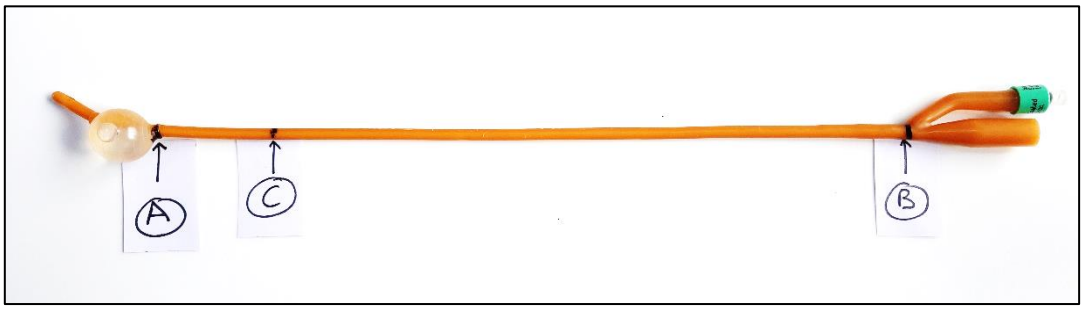
Thereafter, the patients were weighed taking care to see that the urine collecting bags were emptied before doing so and the height was measured in erect posture.

Markings were as follows:

A (notional): The base of the Foley catheter balloon (which rests at the bladder neck)



B (actual): The 'Y' junction of the Foley catheter

C (actual): The marking on the catheter at the level of the external urethral meatus

Thus, the urethral length was calculated as follows:

AB - BC = AC (Estimated Urethral length)

Where AB is the distance from the bladder neck to the 'Y' junction of the catheter, BC is the distance from the 'Y' junction until the external meatus and AC is the estimated distance from the bladder neck until the external urethral meatus (the urethral length).

Figure 1: Foley catheter

The data were tabulated, basic statistics derived and statistical analysis done for correlation between the various measurements.

RESULTS

Table 1: Basic Statistics

Basic statistics among Females				
Parameter	**Median**	**Mean**	**Min**	**Max**
AGE	35	38.4	18	80
HEIGHT (CM)	156	155.3	130	168
WEIGHT IN KGS	56	55.8	35	78
BMI	22.8	23.2	16.8	38.5
CATHETER SIZE(FR)	14	14.4	12	18
LENGTH OF URETHRA(CM))	4	3.9	2.5	6.5

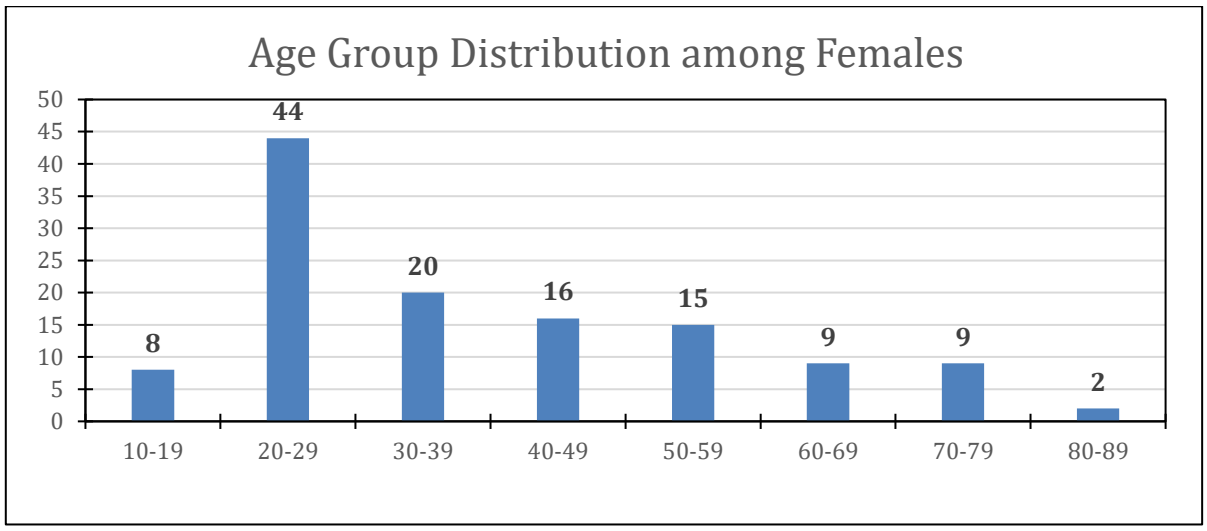


Figure 2: Age Distribution (X-axis: age in years, Y-axis: number of subjects)

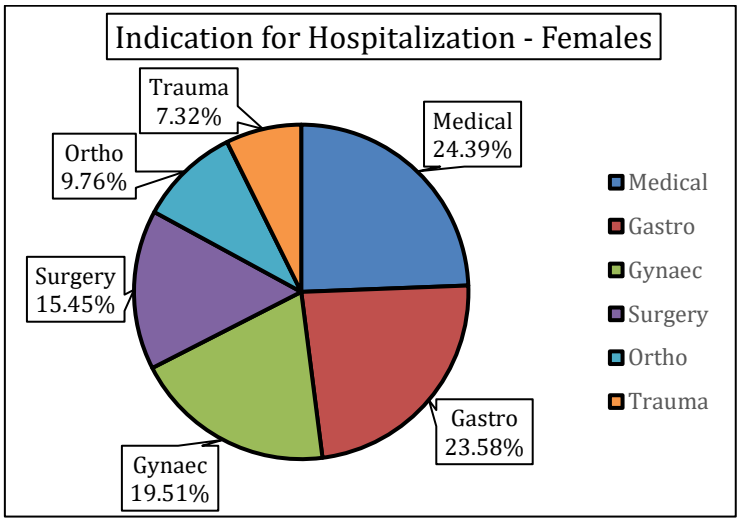


Figure 3: Indication for Hospitalization

Ortho: Orthopedics, Trauma: Any non-urological trauma, Medical: Any medical illness, Gastro: Any medical or surgical gastrointestinal or hepatobiliary pathology, Surgery: Any general surgical procedure

Table 2: Statistical Analysis

	BMI vs UL	
R	0.03	3.45%
R^2	0.00	0.12%
Coeff Alienation(K)	1.00	99.88%
t	0.56	
p value	0.58	57.68%

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

Std Error (SE)	0.06	
Probable Error (PE)	0.04	
R/PE	0.83	

BMI: Body mass Index, UL: Estimated Urethral length

Correlation of BMI and urethral length (UL) – No Correlation, Not significant.

Table 3: Comparative Analysis

Parameter	Pomian[1]	Halleran[2]	Hirdes[3]	Fontaine[9]	Our study
n=	927	91	121	57	123
Age range (years)	Adults	6 months to 3 years	0-15	23-55	18-80
Technique	Perineal Ultrasound	VCUG	Perineal Ultrasound	Perineal Ultrasound	Indwelling catheter
Mean urethral length (cm)		2.31	2.6		3.9
Urethral Length range (cm)	1.9-4.5		1.2-4.0	3.03 +/- 0.34	2.5-6.5

VCUG: Voiding Cystourethrogram, 3D TVUS: 3 Dimensional Transvaginal Ultrasound

DISCUSSION

VCUG[2], perineal ultrasound[3, 4], MRI[5, 6] and 3-D transvaginal ultrasound[7], have been used to study urethral anatomy and have the advantage of being minimally or non-invasive and

identifying supporting ligaments[6], and urethral sphincter volume[8], but these are operator and software dependent. The urethral length measured by ultrasound has been found to be equally reliable as that by direct catheter technique[9]. However, while the measurement by ultrasound can be affected by inadequate bladder filling[1], this does not hamper direct measurement by catheter.

The advantage of our technique was that neither was any patient catheterized for the sole purpose of the study, nor did the measurement require removal of any indwelling catheter. Hence, patient inconvenience was minimal and so was the risk of introducing infection due to repeated catheterization. While due diligence was done during data collection and all the data were collected by the same investigator, the measurements could have been affected by body habitus and the amount of labial fat.

Longer urethral length has been reported in obese persons[1] but no correlation was found in this series. Increasing number of vaginal deliveries has been reported to be associated with shorter urethral length[1]. However, this parameter was not studied in this series.

Nulliparous women in the age range of 45 to 60 years have been reported to have longer urethral lengths than those who are less than 30 years old[10]. Since the parity status of subjects was not noted in our series, there cannot be a direct comparison of the results. However, a similar age-based correlation was not evident in our series.

In addition, we have not taken into consideration the duration of hospital stay at the time of the study which may have had some effect on the weight, and hence the BMI. Similarly, we have also not taken into account the effect on weight of any debilitating illnesses or malignancies, which the patients may have been suffering from. However, since the total number of patients falling into these categories was miniscule, we presume that these did not have a significant bearing on the results.

CONCLUSIONS

Our data adds to the existing scant information about the female urethral length available in the literature. The same may be applied to optimizing the size of urethral catheters and potentially help in planning tape or sling placement for treating stress urinary incontinence in the Indian population.

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