

HOW DOES THE URINARY FLOW CLEAN THE URETHRA DURING THE MICTURITION? THE ROLE OF LOW URINARY FLOW ON BLADDER OUTLET OBSTRUCTED PATIENTS.

Hypothesis / aims of study:

Studies regarding the urinary sample's collecting technique have addressed issues such as the first or mid stream clean catching, urethral catheterization and cleaning the perineal area and urethral meatus. However, at our knowledge, there is no study addressing the importance of the urinary flow and how it could clean or avoid urine contamination. In this study, we evaluate the role of the urinary stream on the urethral urinary contamination and how the urinary flow washes the urethra during the micturition, which could justify the need to collect the midstream on urinary testing.

Study design, materials and methods:

To determine how the urinary flow could interfere on the bacterial urethral contamination, the distal urethra of male patients with indication for urodynamic study (UDS) was scrub using a sterile cotton swab just after the patient had urinated to perform the initial fluxometry. Patients that urinated less than 150 ml or had detrusor hypocontractile were excluded. The swabs were sent to laboratory bacteriological culture tests. After the UDS have been accomplished, the patients were evaluated according to the urinary flow, presence of bladder outlet obstruction (BOO) and swab culture results. Patients were considered obstructed when classified as grade II or greater on Schafer pressure flow classification.

To evaluate how the urinary flow washes the urethra during the micturition, we developed an apparatus capable to automatically aliquot the urinary stream in 40 different samples and concomitantly determine the urinary flow and volume. The device was created using a circumferential acrylic plate, which fitted 40 tubes of 50 ml covering the entire external edge. To collect the samples, the subject urinated into a funnel that drove the urine toward the tubes. As the patient urinated, the acrylic plate along with the tubes rotated at a constant speed, which allowed calculating the urinary flow based on the volume collected in each tube. The volume and the number of leukocytes in all 40 tubes were evaluated for all subjects. Using this apparatus, we study the kinetic of leukocyte urinary elimination of 38 asymptomatic volunteers. To evaluate the effect of the urinary stream on the urethral washing, we create a curve of leukocyte elimination during the micturition and compared the number of leukocyte/ml on the first 100 ml with the leukocyte elimination on the left over micturition.

Results

In table 1, it is outlined the data related to the urethral cultures. Patients without BOO had greater urinary flow ($p=0.003$) and lower incidence of positive urethral bacteriological culture ($p=0.02$) than their counterparts.

Thirty eight asymptomatic male medical students with mean age of 20.2 ± 1.3 years old were evaluated regarding the leukocyte elimination. Out of them, 10 subjects presented a urinated volume < 100 ml and 28 subjects presented a volume > 100 ml (table 1). Subjects that eliminated less than 100 ml had lower ($p < 0.000$) urinary flow than their counterparts (table 1). The 28 young asymptomatic males that urinated more than 100 ml presented a pattern of leukocytes elimination during the micturition (figure 1), unlike those that urinated less than 100 ml (figure 2). Analyzing the 28 subjects that urinated a volume > 100 ml, we observed that the first 100 ml of micturition had a higher (1439.1 leukocytes/ml) mean leukocytes' concentration than the subsequent micturition (404.7 leukocytes/ml; $p < 0.000$).

Interpretation of results

In this study, we address the importance of urinary flow on urethral washing during the micturition. This variable, intuitively, has a role on the urethral cleaning, urinary tract infection prevention and may be an influence on the urinary tests results. However, there is a lack of studies to evaluate it. We choose to study the leukocyte urinary elimination on health subjects, which had a normal urinary flow, because leukocyte could demonstrate better than any other urinary component how the flow washes the urethra. Leukocytes are present in the urine and in the urethra. The pattern of leukocytes elimination clearly demonstrated how the

the first 100 ml of micturition washes the urethral leukocytes and then stabilizes at a constant concentration during the micturition on subjects with normal urinary flow. In addition, we demonstrated that patients without BOO and normal urinary flow have a lower bacterial contamination on the urethral meatus after micturition, which could be related to the higher incidence of lower urinary tract infection on patients with BOO. The persistent urethral contamination, even after micturition on patients with BOO should be considered as a possible contamination factor, even when it is performed midstream urinary collection. Further studies should be accomplished to evaluate the patron of leukocytes elimination on those patients with some sort of bladder emptying disturbs.

Concluding message

To our knowledge, it is the first time in the literature that it is described the kinetic of leukocyte urinary elimination in asymptomatic health subjects. These results confirm the importance of midstream urinary collecting to perform urinary test, because the first 100 ml of micturition is highly contaminated with urethral leukocytes and may be with bacteria. In addition, we presented the importance of the urinary flow on the urethral bacterial washing. Therefore, we recommend, when it is possible, to collect urinary samples of patients with more than 100 ml in the bladder and instruct patients to urinate at least 100 ml before collect the sample. Patients with BOO may present higher urinary contamination by the urethra, as the low urinary flow did not allow a good urethral washing.

Table 1- Comparison of patients with and without BOO.

	N	Age (mean+/- S.D.)	Mean Urinary Flow (mean+/- S.D.)	Positive urethral culture N (%)
With BOO	15	56.7+/-14.4	6.36+/-4.9	14 (93.3%)
Without BOO	8	49.4+/-16.1	13.5+/-5.4	4 (50%)

Table 2- Comparison of patients that urinated volumes < or > than 100 ml.

	N	Age (mean+/- S.D.)	Mean Urinated Volume	Mean Urinary Flow (mean+/- S.D.)	Mean Max. Urinary Flow
< 100 ml	10	20.2+/-1.5	86.8	11.8 +/-5.1	18.4
> 100 ml	28	20.2+/-1.3	206.7	5.0+/-3.1	11.0

Figure 1- Patron of mean urinary leukocytes elimination of asymptomatic subjects that urinated more than 100 ml.

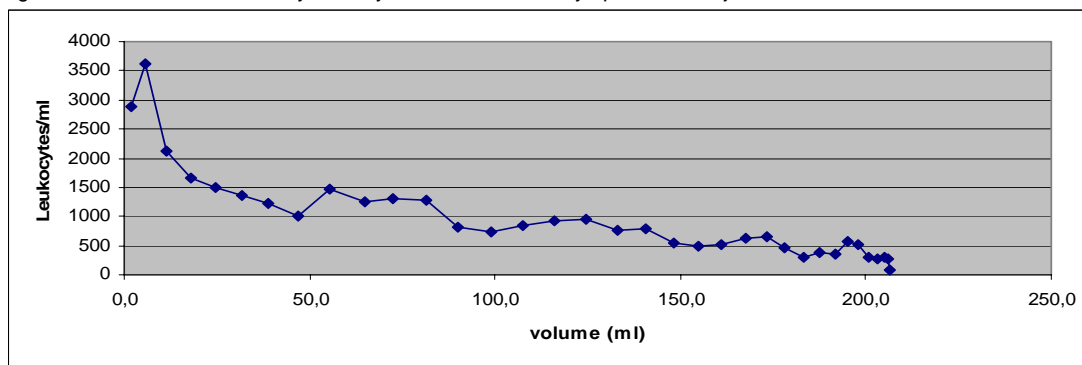


Figure 2- Patron of mean urinary leukocytes elimination of asymptomatic subjects that urinated less than 100 ml.

