Original Article

Int Neurourol J 2023;27(3):217-223
https://doi.org/10.5213/inj.2346116.058
pISSN 2093-4777 · eISSN 2093-6931

INTERNATIONAL NEUROUROLOGY JOURNAL
INJ
OPEN ACCESS

The Effect of Running Water Sound Listened to Patients During Urodynamics on Anxiety and Urodynamic Parameters

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Purpose: This study was conducted to determine the effect of listening to the sound of running water during urodynamics on the patient's anxiety and parameters in the pressure-flow study.
Methods: The population of the study, which was planned in the nonrandomized experimental study design, consisted of patients who will undergo urodynamics in the Urology Department of a city hospital in Istanbul between September 2022 and January 2023, and the sample consisted of 60 patients, 30 of which were in the experimental group and 30 in the control group. During the pressure-flow study, the patients in the experimental group listened to the sound of running water from a smartphone, while the patients in the control group did not undergo any intervention during urodynamics. The level of anxiety in both groups before, during and after urodynamics was evaluated with the visual analogue scale. During the pressure-flow study, it was evaluated whether the patients emptied on command, and the maximum flow rate (Qmax) and the detrusor pressure at the maximum flow rate (PdetQmax) were measured. Bladder outlet obstruction index (PdetQmax–2Qmax) and bladder contractility index (Pdetqmax+5Qmax) were calculated using these values.
Results: During the pressure-flow study, in the experimental group patients who listened to the sound of running water from a smartphone; anxiety level mean scores during and after urodynamics were found to be statistically significantly lower than the control group patients ($P < 0.001$). The mean bladder contractility index score in the experimental group patients was statistically significantly higher than the control group patients ($P < 0.001$), and the cases of urinating with a catheter during the pressure-flow study were statistically significantly higher than the control group patients ($P < 0.001$).
Conclusions: Listening to the sound of running water during urodynamics had a positive effect on reducing anxiety in patients and micturating during pressure-flow study.

Keywords: Urodynamics; Anxiety; Pressure-flow study; Micturition; Bladder contractility

- **Research Ethics:** Research data began to be collected after the ethics committee approval was obtained from the Prof. Dr Cemil Tascıoglu City Hospital Clinical Research Ethics Committee where the research would be conducted (No. 158/2022). Before the data were collected, the individuals to be included in the study were informed about the purpose, content and confidentiality of the research, and their written and verbal consents were obtained in accordance with the principle of voluntariness.
- **Conflict of Interest:** No potential conflict of interest relevant to this article was reported.

INTRODUCTION

Urodynamics is widely used to evaluate lower urinary tract disorders such as urinary incontinence, voiding dysfunction, and neurogenic bladder. Because this differential diagnostic tool includes placement of catheters in the urethra, rectum, or vagina

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Submitted: May 8, 2023 / **Accepted after revision:** July 25, 2023

to measure bladder function and capacity, and in some cases, the placement of a concentric needle electrode in the external urethral sphincter for electromyography, examining intravesical, detrusor, and urethral pressures as the bladder is filled with saline. It is recognized as an invasive diagnostic tool [1,2].

It is used to identify contributing factors to lower urinary tract dysfunction, to predict the consequences of dysfunction on the upper urinary tract, and the outcome of the treatment being considered [3,4]. Uroflowmetry, cystometry, and pressure-flow study are components of urodynamics. The purpose of the uroflowmeter, which is performed without a catheter, is to measure the urine flow rate, which is defined as the amount of urine voided per unit time. Cystometry and pressure-flow study are the stages in which the response of the bladder to the filling process performed by placing the catheter and the relationship between the intrabladder pressure and the urine flow rate while the bladder is emptied are evaluated [5]. During urodynamics, many patients report physical and emotional discomfort such as pain (during catheter insertion), anxiety, and embarrassment [3,4,6,7]. However, although there is no evidence in the literature, it is reported that urination may be affected by anxiety and discomfort, especially during pressure-flow study, and for the patient, anxiety during the procedure may affect the initiation of the voiding reflex due to the detrusor function [8-11].

In infancy, the sound of running water in the sink has been used effectively for toilet training. Although the underlying mechanism is not fully understood, it is speculated that the sound of running water may increase the parasympathetic tone that powers the detrusor muscle and relax the resistant tone of the urethral sphincter, causing an increase in maximum urine flow rate, resulting in easy urination [12-14]. In a study conducted in a New York hospital in the early 1970s, the sound of running water had a positive effect on patients, including the effect on voiding [15]. Many healthy people often feel a strong urge to pee after hearing the sound of running water [14]. In addition, listening to the sound of running water in the care of patients who have difficulty in emptying urine is also applied as a nursing intervention [16].

Nurses perform their roles as educators and practitioners while informing the patient before urodynamics, giving the patient the appropriate position during the procedure, and making the necessary directions for the patient to express their feelings about voiding [17]. For urodynamics to give reliable results, it is important that the patient feels as comfortable and safe as possible during the procedure with a multidisciplinary approach. During urodynamics, many different methods (listening to music, applying hot pads, lavender aromatherapy, etc.) were used to reduce the discomfort and anxiety of the patients [1,4,18,19]. However, when the literature is examined, no study has been found that examines the effect of reducing anxiety in patients by listening to the sound of running water during urodynamics and the effect on urine flow rate during pressure-flow study. Therefore, this study was planned to determine the effect of listening to the sound of running water during urodynamics on the patient's anxiety and parameters in the pressure-flow study.

Hypothesis(s) of the Research

H0: There was no significant difference in anxiety levels between the group that listened to the sound of running water and the group that was not.

H1: There is a significant difference in anxiety levels between the group that listened to the flowing sound and the group that was not.

$H0^1$: There was no significant difference between the group that listened to the flowing sound and the group that was not listened to in terms of pressure-flow study.

$H1^1$: There is a significant difference between the group that listened to the flowing sound and the group that was not listened to in terms of pressure-flow study.

MATERIALS AND METHODS

Study Design

This study was planned as a nonrandomized experimental study to determine the effect of listening to the sound of running water during urodynamics on the parameters of the patient's anxiety and pressure-flow study.

Sample

The population of the study consisted of patients who would undergo urodynamics in the Urology Polyclinic of a city hospital in Istanbul between September 2022 and January 2023. The sample calculation was determined using power analysis based on a previous study [9]. The sample size of the study was calculated as at least 28 patients for each group meeting the sampling criteria, by accepting 80% power value and 5% type I error. The study was completed with 60 patients. Patients over the age of 18 with urodynamic indication were included in the study. Patients who required urodynamics due to urinary retention and

patients who refused to participate in the study were excluded from the study.

Data Collection Forms

Data were collected via structured information form and visual analogue scale (VAS).

Structured information form

This form, which was prepared by the researchers in line with the literature [3,11], aimed at the socio-demographic characteristics of the patients; It consists of questions about age, gender, marital status and identifying problems related to urinary excretion. The form also used uroflowmetry to determine the urine flow rate during the pressure-flow study.

Visual analogue scale

It is used to convert some values that cannot be measured numerically. Anxiety was measured by using a 10-cm VAS, where zero was representation and of the absence of anxiety and 10 equated to the excess of anxiety. The test has no language and its ease of implementation is an important advantage [20].

Procedure

The first 30 patients to whom urodynamics would be applied to prevent the patients from being affected by each other in the outpatient setting formed the control group. The urodynamic procedure was conducted in the urodynamic room, which is an environment suitable for the privacy of the patient and where the toilet is located. After completing the sample size in the control group, 30 patients formed the experimental group. The level of anxiety felt by the patients in the control group before, during and after urodynamics was evaluated by the researcher nurse with VAS. The patients in the control group did not undergo any intervention during urodynamics. The level of anxiety felt by the patients in the experimental group before, during and after urodynamics was evaluated by the nurse with VAS. Unlike the control group, the patients in the experimental group listened to the sound of running water from a smartphone during the pressure-flow study.

During the pressure-flow study, it was evaluated whether the patients in both groups micked on command, and the maximum flow rate (Qmax) and the detrusor pressure at the maximum flow rate (pdetQmax) were measured by the investigator. Bladder outlet obstruction index (PdetQmax–2Qmax) and bladder contractility index (PdetQmax+5Qmax) were calculated using these values.

Statistical Analysis

All data will be analyzed using IBM SPSS Statistics ver. 25.0 (IBM Co., Armonk, NY, USA) while evaluating the study data, in addition to descriptive statistical methods (mean, standard deviation, frequency, ratio, minimum, maximum) in the comparison of quantitative data, Student t-test was used to compare 2 groups of normally distributed variables; Pearson chi-square test, Mann-Whitney U-test, Fisher exact test will be used to compare qualitative data. Significance was evaluated at the $P < 0.05$ level.

RESULTS

When the characteristics of the patients included in the study were examined; more than half (55%) of them were women, their mean age was 57.93 ± 14.38 years. 76.7% of the patients had a chronic disease (20 patients with Diabetes Mellitus, 14 patients with Hypertension, 12 patients with cerebrovascular disease), 31.7% were using a clean intermittent catheter to empty their urine, 55% had difficulty micturation, 76.7% had urinary incontinence, and the average number of nocturia of the patients was 2.72 ± 2.56 (Table 1).

The patients in the control group had an anxiety score of before urodynamics 6.30 ± 1.78, during urodynamics 4.93 ± 1.84, and after urodynamics 5.03 ± 2.03. It was seen that the patients in the experimental group had an average anxiety score of before urodynamics 5.13 ± 3.66, during urodynamics 1.83 ± 2.77, and after urodynamics 1.43 ± 2.65 (Table 2). During the pressure-flow study, in the experimental group patients who listened to the sound of running water from a smartphone; anxiety level mean scores during and after urodynamics were found to be statistically significantly lower than the control group patients ($P < 0.001$) (Table 3).

The mean Qmax score of the patients in the control group was 5.20 ± 7.13, the mean PdetQmax score was 17.47 ± 24.84, the bladder outlet obstruction index mean score was 7.06 ± 19.85, the bladder contractility index mean score was 43.47 ± 54.33 (Table 2). The mean Qmax score of the patients in the experimental group is 8.27 ± 7.76, the mean PdetQmax score is 29.63 ± 24.57, the mean bladder outlet obstruction index score is 13.10 ± 25.02, the bladder contractility index mean score is 70.97 ± 51.53 (Table 2). It was observed that the mean bladder contractility index score in the experimental group patients was

Table 1. Individual characteristics (N = 60)

Characteristic	Value
Age (yr)	57.93 ± 14.38 (23–88)
Sex	
Female	33 (55)
Male	27 (45)
Chronic disease	
Yes	46 (76.7)
No	14 (23.3)
Use of clean intermittent catheters	
Yes	19 (31.7)
No	41 (68.3)
Difficulty micturation	
Yes	33 (55)
No	27 (45)
Urinary Incontinence	
Yes	14 (23.3)
No	46 (76.7)
Nocturia number	
Possibility of micturating with a catheter	
Yes	36 (60)
No	24 (40)
Qmax	6.73 ± 7.55 (0–25)
PdetQmax	23.55 ± 25.25 (0–96)
Bladder outlet obstruction index	10.08 ± 22.60 (0–92)
Bladder contractility index	57.22 ± 54.29 (0–180)

Values are presented as mean ± standard deviation (range) or number (%).
Qmax, maximum flow rate; PdetQmax, detrusor pressure at the maximum flow rate.

statistically significantly higher than the control group patients (P < 0.001). The cases of micturating with a catheter during the pressure-flow study were found to be statistically significantly higher in the experimental group patients than in the control group patients (P < 0.001) (Table 3).

Table 3. Comparison of individual characteristics between groups

Characteristic	Control group (n = 30)	Experimental group (n = 30)	P-value
Sex			0.299
Female	19	14	
Male	11	16	
Chronic disease			0.619
Yes	23	23	
No	7	7	
Use of clean intermittent catheters			0.238
Yes	13	6	
No	17	24	
Difficulty micturation			0.795
Yes	17	16	
No	13	14	
Urinary incontinence			0.063
Yes	4	10	
No	26	20	
Nocturia number	1.40 ± 1.04	4.03 ± 2.95	< 0.001*

Values are presented as number or mean ± standard deviation.
Chi-square test.
*P < 0.05, statistically significant differences, independent sample t-test.

Table 2. Comparison of anxiety levels between groups and parameters in the pressure-flow study

Characteristic	Control group (n = 30)	Experimental group (n = 30)	P-value
Age (yr)	57.67 ± 14.89	58.20 ± 14.83	0.89
Anxiety before the procedure	6.30 ± 1.78	5.13 ± 3.66	0.122
Anxiety during the procedure	4.93 ± 1.84	1.83 ± 2.77	< 0.001*
Postprocedure anxiety	5.03 ± 2.03	1.43 ± 2.65	< 0.001*
Qmax	5.20 ± 7.13	8.27 ± 7.76	0.116
PdetQmax	17.47 ± 24.84	29.63 ± 24.57	0.061
Bladder outlet obstruction index	7.06 ± 19.85	13.10 ± 25.02	0.305
Bladder contractility index	43.47 ± 54.33	70.97 ± 51.53	0.049*
Possibility of micturating with a catheter, yes:no	17:13	24:6	0.001*,†

Values are presented as mean ± standard deviation or number.
*P < 0.05, statistically significant differences, independent group t-test. †Chi-square test.

DISCUSSION

As a result of this study, the effect of listening to the sound of running water during urodynamics on the parameters of the patient's anxiety and pressure-flow study was determined. Due to the placement of urethral and rectal catheters during urodynamics, many patients experience discomfort and anxiety during urodynamics. In addition, the anxiety of not protecting privacy during urodynamics and lack of knowledge about the application may also cause anxiety in patients [4,21,22]. As intimacy declines, even individuals without paruresis report mild difficulty initiating urination [10]. In this context, some patients fail to void during urodynamics, and this failure leads to feelings of anxiety and embarrassment. Herd [23] states that most of the patients undergoing urodynamics experience serious anxiety and discomfort due to voiding. However, it has been reported in the literature that urination may be affected by anxiety and discomfort, especially during pressure-flow study, and anxiety may affect the initiation of the voiding reflex due to its detrusor function [8-11]. Zelikovsky et al. [24] states that it is important to reduce the distress of patients and encourage urination with different applications during procedures such as urodynamics. In the literature, it is stated that listening to music during invasive procedures such as bronchoscopy, colonoscopy and cystoscopy helps patients experience less pain and anxiety [25]. It has been reported that listening to music during urological interventions (cystoscopy, prostate biopsy) is effective in reducing the anxiety and discomfort levels of patients [19,25-27]. In this study, like the literature, the mean scores of anxiety level during and after urodynamics in the experimental group patients who listened to the sound of running water from a smartphone during the pressure-flow study were lower than the control group patients.

The Qmax values and PdetQmax values of the patients in the experimental group were found to be higher during the pressure-flow study. Parasympathetic tone increases with the sound of running water, resulting in stronger detrusor contractions [28]. In addition, it was observed that Qmax values increased with the relaxation in the external urethral sphincter [29]. Kwon et al. [14] had patients listen to the sound of running water using a mobile phone application during urodynamics and an increase in peak flow rate was observed in this group. It is thought that the running water sound listened to in the study has a positive effect on the detrusor muscle and increases the maximum urination speed by reducing the anxiety caused by an invasive procedure such as urodynamics.

It has been revealed in previous studies that the urge to urinate is felt with the sound of water [14]. A Pavlovian mechanism brings the feeling of urination, as in the watering of the mouth reflex, when a dog understands that food will come when he hears the bell. In this study, the sound of running water was not listened to during the filling cystometry by paying attention to this situation. After the patients declared that they had reached the maximum cystometric capacity, the sound of running water was listened to when the pressure-flow study was started.

The study has some limitations. The first of these is that the experimental group was evaluated only with the sound of running water. No evaluation was made with other music genres. However, the fact that the sound of water was not heard during the free uroflowmeter is another limitation. Symptom questionnaires (such as International Prostate Symptom Score, International Consultation on Incontinence Questionnaire-Short Form, etc.) were not filled in because the preprocedural symptoms of the patients between the groups were similar. The lack of randomized control of the study is also among the limitations.

In conclusion, listening to the sound of running water during urodynamics had a positive effect on reducing anxiety in patients and micturating during pressure-flow study. In order for urodynamics to give reliable results and for the patient to feel as comfortable and safe as possible during the procedure, it is important to inform the patient before urodynamics, to give the patient the appropriate position during the procedure, and to provide necessary guidance during the procedure. However, the implementation of different practices that will reduce the distress of the patients and encourage urination during pressure-flow study requires a multidisciplinary approach. The obtained data will shed light on future randomized controlled studies with large number of patients.

AUTHOR CONTRIBUTION STATEMENT

- Conceptualization: *YC, ESA, MGC*
- Data curation: *YC, ESA, MGC*
- Formal analysis: *YC, MGC*
- Methodology: *YC, ESA, MGC*
- Project administration: *YC, ESA, MGC*
- Visualization: *YC, ESA, MGC*
- Writing-original draft: *YC, ESA, MGC*
- Writing-review & editing: *YC, MGC*

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