**NOCTURIA AND ITS CLINICAL IMPLICATIONS IN OLDER WOMEN**

**Ekrem DUTOGLU1 , Pinar SOYSAL2, Lee Smith3**

**Ferhat ARIK4, Uğur KALAN5, Rumeyza Kazancioglu6, Ahmet Turan ISIK7**

1Kayseri Education and Research Hospital, Department of Geriatric Medicine, Kayseri, Turkey

2 Department of Geriatric Medicine, Bezmialem Vakif University, Faculty of Medicine, Istanbul, Turkey

3The Cambridge Centre for Sport and Exercise Sciences, Anglia Ruskin University, Cambridge, United Kingdom

4Tomarza Yasar Karayel State Hospital, Department of Internal Medicine, Kayseri, Turkey.

5Ermenek State Hospital, Department of Internal Medicine, Karaman, Turkey.

6Department of Nephrology, Bezmialem Vakif University, Faculty of Medicine, Istanbul, Turkey

7Unit for Aging Brain and Dementia, Department of Geriatric Medicine, Faculty of Medicine, Dokuz Eylul University, Izmir, Turkey

**Short Title:** Nocturia and Geriatric Syndromes

**Corresponding Author:** Pinar SOYSAL, Associate Prof

Department of Geriatric Medicine, Bezmialem Vakif University, Faculty of Medicine, Istanbul, Turkey

Full Postal Address: Adnan Menderes Bulvarı (Vatan Street) Postal code: 34093 Fatih , İstanbul, Turkey

E-mail dr.pinarsoysal@hotmail.com; Phone: +90 212 4531700 Fax: +90 212 4531869

**ABSTRACT (244/250)**

The aim of this study is to demonstrate the relationship between nocturia and geriatric syndromes, and comprehensive geriatric assessment parameters (CGA) in older women. 858 older outpatient women were included in this cross-sectional study. For the nocturia variable, the question, ‘‘Generally, during the past 30 days, how many times did you usually urinate after you have gone to sleep at night until the time you got up in the morning?’’ was used. The relationships between nocturia status and common geriatric syndromes, and CGA parameters were determined. The mean age of patients was 74.1±8.0 years. The prevalence of patients who reported average of 0, ≥1, ≥2, ≥3, and ≥4 nocturnal episodes was 14.7%, 85.3%, 66.3%, 42.13%, and 24.1%, respectively. When all the covariates including age, education, Charlson Comorbidities Index score, glomerular filtration rate, antimuscarinic drugs and alpha-blockers use, diabetes mellitus, chronic obstructive pulmonary disease, and incontinence were adjusted, there were higher rates of insomnia, recurrent falls and higher scores of Timed Up-Go test in older women with ≥2 nocturia episodes (p<0.05). There was a significant correlation between ≥ 3 nocturia episodes and lower Instrumental Activities of Daily Living scores and a significant correlation between ≥ 4 nocturnal episodes and frailty and polypharmacy (p<0.05). Nocturia is quite common and associated with insomnia, frailty, polypharmacy, incontinence, falls, lower gait speed, and functionality in older women.Therefore, nocturia is very important for geriatric practice and ≥2 nocturia episodes can be a marker of poor health status in older women.

**Key words:** nocturia; falls; frailty; geriatric syndromes; insomnia; polypharmacy

1. **INTRODUCTION**

Nocturia has been identified as the most bothersome and prevalent lower urinary tract symptoms (Goessaert, Krott, Walle, & Everaert, 2015). It is defined by the International Continence Society (ICS) as the complaint that the individual awakens one or more times to void per night (van Kerrebroeck et al., 2007). However, in many studies, nocturia is defined as two or more waking that is considered to be more clinical outcomes (Goessaert et al., 2015). Because of the differences in definition, mean age, gender, and comorbidities of the individuals participating in the studies, reported nocturia prevalence varies widely (Nakagawa et al., 2010). Overall, all studies have shown that few young adults (<5%) report nocturia, while about half of elderly over 60 years of age report nocturia and about 80% of those older than 80 years are affected (Duffy, Scheuermaier, & Loughlin, 2016). Thus, advancing age is a primary risk factor for the development of nocturia (Varilla, Samala, Galindo, & Ciocon, 2011). Age-related changes in the urinary system include reduced bladder and functional capacity, reduced maximum urinary flow rate, decreased ability to postpone urination and renal ability to concentrate urine, and increased postvoid residual volume (Varilla et al., 2011). Age-related changes in detrusor muscle activity also lead to overactive bladder; which results in nocturia (Varilla et al., 2011). On the other hand, nocturnal polyuria is another important cause of nocturia and may occur due to low levels of antidiuretic hormone at night, which can be attributed to changes in the circadian rhythm in older adults, and to mobilization of fluids in patients with oedema, and autonomic dysfunction (van Doorn & Bosch, 2012). Other biochemical changes, including a decrease in melatonin levels and an increase in plasma natriuretic peptide levels at night, may contribute to nocturia. Another cause of nocturia may be deterioration of brain and spinal cord on micturition in the elderly (Ranson & Saffrey, 2015). Given these age-related changes and the high prevalence of nocturia among older adults, nocturia is often accepted as a natural part of aging.

Although some risk factors such as lifestyle,, obstructive sleep apnea, hypertension, and medications are common to both sexes, gender differences can also be effective (Varilla et al., 2011). Even though nocturia is traditionally thought to be a male condition that presents as a sign of benign prostatic hyperplasia, prostate cancer, testosterone deficiency or prostatectomy, nocturia in women may develop due to parity, postmenopausal hormonal changes and hysterectomy, and is as frequent as in men (Mobley & Baum, 2014). Moreover, in studies comparing both genders, it was shown that nocturnal risk factors and their relationship with comorbid conditions were different in men and women. For example, nocturia was associated with overactive bladder, diabetes mellitus, and coronary artery disease in women, but not in men (Tikkinen et al., 2009). Because hormonal differences between men and women are important contributors to the development of nocturia; the present study was conducted among only older women (Varilla et al., 2011).

 Furthermore, there are many negative outcomes related to nocturia such as sleep disorders, falls, hip fractures, decreased quality of life, depression, death, which are seen more frequently in patients who have more nocturia episodes (Varilla et al., 2011). Nevertheless, to the best of our knowledge, there are no studies on the relationship between geriatric syndromes/comprehensive geriatric assessment parameters and nocturia/nocturia frequency.Thus, the aim of this study is to determine clinical importance of nocturia in geriatric practice.

1. **Methods**
	1. **Patients**

A total of 858 elder outpatient women, who were admitted to a geriatric center between December 2016 and April 2018, were included in this study. The investigation conformed to the Declaration of Helsinki and was approved by our local ethics committee. Informed consent was provided by each participant or a legal guardian before participating in the study.

Patients who have severe illness that may impair general health status, such as acute cerebrovascular event, sepsis, acute renal failure, acute coronary syndrome, and acute respiratory failure; patients under 65 years of age and were men; patients who did not agree to undergo the CGA; patients who had active malignancy and a history of urinary tract cancers such as renal, pelvis, and bladder cancer even if they were in complete remission; and patients who had urinary catheters; patients who had lower urinary tract infections symptoms such as fever, lower abdomen discomfort, frequent and painful urination or who had uropathologic condition such as urinary stones were excluded. Patients with moderate and severe dementia were also ruled out because self-reports based on their memory might be unreliable for nocturia questions.

* 1. **Patients’ Characteristics:**

Patients’ age, gender, and education level were recorded. Those with hypertension, ischemic heart disease, congestive heart failure, diabetes mellitus, peripheral arterial disease, chronic obstructive pulmonary disease (COPD), osteoporosis, cerebrovascular disease, or constipation were identified by their or caregivers’ self-reports. In addition, comorbidity status of the patients was evaluated using the Charlson Comorbidity Index (CCI).

* 1. **Comprehensive Geriatric Assessment**

All the participants underwent the CGA including Mini-Mental State Examination, Geriatric Depression Scale-15 for neurocognitive evaluation, Basic and Instrumental Activities of Daily Living (BADL and IADL) for functional evaluation, Tinetti Performance-Oriented Assessment of Mobility, and Timed Up and Go Test (TUG) for mobility evaluation, and MNA for nutritional evaluation. If the total MNA score was <17, it was accepted that there was malnutrition (Vellas et al., 1999).

The drugs, drug groups, and number of drugs that the patients used were recorded. Using five or more drugs was considered polypharmacy (Unutmaz, Soysal, Tuven, & Isik, 2018). Dementia and depression were diagnosed according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, criteria.  Urinary incontinence was defined as involuntary urinary leakage at the last 3 months except for urinary tract infection (Ates Bulut, Soysal, & Isik, 2018; Gajewski et al., 2018).Recurrent falls was considered positive if the patient had fallen at least two times in the previous year except for tripping on a rug and slipping on wet floor (Ku et al., 2013). Pain was evaluated by the individual’s response to the questions ‘Do you hurt anywhere?’ or ‘What is stopping you from doing what you want to do?(Schofield, 2018).

Handgrip test of the dominant hand (mean of 3 measurements) was measured by a Jamar hand dynamometer. Dynapenia was defined as handgrip strength <20 kg and the diagnosis of sarcopenia was defined according to the criteria of the European Working Group on Sarcopenia in Older People (Ates Bulut et al., 2018). Frailty status was defined based on 5 dimensions of frailty phenotype, including shrinking, exhaustion, low levels of physical activity, weakness, and slowness. People with 0 criteria were considered robust, 1-2 prefrail, and ≥ 3 frail (Fried et al., 2001). All patients were administered the Insomnia Severity Index (ISI), and insomnia was accepted if ISI scores were ≥ 8 (Wong et al., 2017).

* 1. **Assessment of Nocturia**

For the nocturia variable, the question, ‘‘Generally, during the past 30 days, how many times do you usually urinate after you have gone to sleep at night until the time you got up in the morning?’’ was used. The wording of the question shows strong agreement with the (ICS) definition of nocturia (van Kerrebroeck et al., 2007). Response options included choices ranging from 0 to 3, or 4 or more per night.

* 1. **Laboratory Findings**

Laboratory tests performed to assess biochemical, metabolic, and nutritional status of the patients included measurements of complete blood count, kidney and liver functions, cholesterol levels, thyroid stimulating hormone, HbA1c, and levels of vitamin B12, folic acid, and vitamin D. The Glomerular Filtration Rate (GFR) was calculated using Modification of Diet in Renal Disease All these biochemical tests were performed using the Diagnostic Modular Systems auto analyser (Roche E170 and P-800). Although urinalysis and urine cultures should not be performed for asymptomatic residents, we have also taken urinalysis to investigate the relationship between urinalysis findings and nocturia (Ali & Snape, 2004).

* 1. **Statistical Analyses**

Data were analysed using SPSS, version 22. Descriptive statistics are shown as mean±standard deviation for variables with normal distribution, median (minimum to maximum) for non-normal distributions, and number of cases and percentage for nominal variables. When the group number was 2, the significance of differences between the groups in terms of averages was investigated by t test, and if in median values it was investigated by Mann-Whitney test. When the number of groups was more than 2, the significance was investigated by analysis of variance and the Kruskal-Wallis test for averages and medians, respectively. Nominal variables were assessed by the Pearson chi-square or Fisher exact test. Variances in more than 2 groups were assessed by post hoc Tukey tests. Logistic regression were used to assess the association between nocturia groups with regard to the number of urinate and CGA parameters. For P <0.05, results were considered statistically significant. The sample size needed was calculated to be at least 322 patients with an acceptable error of 5% and a 95% confidence level.

1. **RESULTS**

The mean age of 858 patients was 74.1 ±8.2. At first, nocturia was categorized as 1, 2, 3, or 4 or more times per night. The prevalence of patients without nocturia was 14.7%. The prevalence of patients who report average of one, two, three, and four or more times nocturia episodes was 19.0%, 24.2%, 18.4%, and 24.1%, respectively. The patients’ characteristics, comorbidities, and geriatric syndromes, and drug groups summarized in Table 1. There was a significant difference between groups in terms of age, education, CCI, presence of insomnia, recurrent falls, polypharmacy, frailty, diabetes mellitus, COPD, and urge type incontinence (p< 0.05). Only antimuscarinic drugs used for overactive bladder and alpha blockers (eg, doxazosin) were significantly higher in patients with four or more nocturia episodes (p<0.05) (certain drugs that are probably associated with nocturia are shown in table 1). There was no difference between the groups in terms of urinary and blood laboratory findings exception of GFR (p>0.05).

The 5 groups were compared with respect to CGA parameters, and lower scores of MMSE, Tinetti balance and gait test, BADL and IADL scores and hand grip strength; and higher scores of TUG, ISI and Fried frailty scores were detected in patients with 2, 3 and 4 or more nocturia episodes compared to the patients with 0 or 1 nocturia (p<0.05). When groups were adjusted for age, education level, CCI, GFR, diabetes mellitus, COPD, and antimuscarinic drugs and alpha blockers as well as urge incontinence, the significant differences between frailty, insomnia, recurrent falls, polypharmacy, TUG, ISI, Fried frailty scores, IADL scores and nocturia persisted (p<0.05).

Nocturia was also dichotomized into ≥1, ≥2, ≥3, and ≥4 nocturia and compared with no nocturia, ≤1, ≤2, and ≤3, respectively. The prevalence of patients with ≥1, ≥2, ≥3 and ≥4 nocturia was 85.3%, 66.3%, 42.13%, and 24.1%, respectively. The relations between the CGA parameters and nocturia groups were investigated usinglogistic regression analysis adjusting for all the covariates. Results showed that there was a statistically significant relationship between the risk for geriatric syndromes, including recurrent falls, frailty, polypharmacy, incontinence and CGA parameters, including higher number of drugs, Fried frailty and ISI scores, lower TUG, and IADL and dichotomized nocturia groups (p<0.05). Their odd ratios are shown in Table 2.

1. **DISCUSSION**

In this study, it was found that nocturia was quite common in older women and there was a correlation between some geriatric syndromes and CGA parameters depending on the frequency of nocturia. In older women, ≥ 2 nocturia was associated with recurrent falls, polypharmacy, insomnia, decreased TUG score, while ≥3 nocturia was found to be associated with decreased Instrumental Activities of Daily Living and ≥ 4 nocturia was related to frailty. Urinary incontinence was the most strongly associated parameter /condition with nocturia.

Up to now, when literature review of lower urinary tract symptoms has been prepared, nocturia has been the most common and most frequently referred bothersome symptom, but it has not been adequately discussed and hence remains in the shadow of urinary incontinence and cannot be treated (Bosch & Weiss, 2013). In this study, it was shown that more than 85% of older women over 65 years old woke up to void at least once during the night and about 70% at least twice. These results are similar to previous study results. In a review published by Bosh et al., the rate of 1 and more voiding was 68.9% -93%, while 2 and more was 29%-59.3% in older men, whereas in elderly women these rates were 74.1% -77.1% and 28.3% - 61.5%, respectively (Bosch & Weiss, 2013). In the majority of studies, nocturia is observed to be very common in the elderly and it is more common in women like other lower urinary tract symptoms(Wang et al., 2015). However, despite this high prevalence, the importance of nocturia in geriatric practice is not known fully. Therefore, in this study, for the first time, the relationship of nocturia with comorbid diseases, drugs and geriatric syndromes in elderly people was examined in detail.

Nocturia is a multifactorial syndrome. There is a close relationship between comorbid diseases and nocturia with increasing frequency. The prevalence of patients with COPD (presumably due to hypoxia, coughing, and frequent use of anticholinergic drugs) and diabetes mellitus (since high blood glucose has been attempted to be removed from the body through more urine) increases as the incidence of nocturia does (Ayik, Bal, & Akhan, 2014). In addition, a decrease in the ability of the kidneys to concentrate urine due to age leads to the development of nocturia and in our study, with the decrease of GFR, the frequency of nocturia increased (Varilla et al., 2011). In addition, diminished functional bladder capacity, increased postvoid residual volume, detrusor overactivity and weak pelvic floor are responsible for the development of both nocturia and urge type incontinence in women (Varilla et al., 2011). Therefore, the strong correlation between nocturia and incontinence is not surprising. In women with nocturia, urinary incontinence may be 2.5-3.0 times more frequent. Therefore, these two lower urinary tract symptoms should be evaluated together and both conditions should be questioned when evaluating the response to treatment (Cipullo et al., 2014). Another important point here is the fact that, because in most of the studies performed on nocturia, urinary incontinence is not evaluated simultaneously, it is not clear whether the results are caused by nocturia or urinary incontinence(Lee et al., 2012; Lightner et al., 2012). Therefore, unlike the studies done so far, the results of this study were adjusted according to incontinence, and the clinical significance of nocturia in geriatric patients was clearly demonstrated.

The relationship between nocturia and insomnia is well known. For example, in a study of 1485 people aged 50-93 years, nocturia (67.5%) was found to be the most common cause of deterioration of sleep continuity (Middelkoop, Smilde-van den Doel, Neven, Kamphuisen, & Springer, 1996). However, it is difficult to say whether the nocturia is the cause or the result of the insomnia. In a few studies, the use of antimuscarinic drugs and desmopressin improved sleep time and quality, reducing the nocturia episodes; in other words, the nocturia was shown to be the cause of insomnia(van Kerrebroeck et al., 2007). More nocturnal voids may lead to further sleep disturbance. As in our study, Asplund found that patients with three or more nocturnal episodes (vs. 2 nocturnal) had more sleep disturbances (Asplund, 2002).

In addition to nocturia-related insomnia, daytime sleepiness, the impaired attention and balance function; the episode of getting out of bed in the dark in the night and coming to the bathroom is a potential fall risk for the elderly(Varilla et al., 2011). Therefore, nocturia causes falls not only in the night but also during the day (Nakagawa et al., 2010). Stewart et al showed that patients who described two or more nocturnal episodes were at increased risk of falling, which increased as the number of episodes increased (Stewart, Moore, May, Marks, & Hale, 1992). Asplund has found that the nocturnal frequency causing hip fracture is ≥3 (Asplund, 2006). In our study, we found that in older women and those who reported ≥ 2-4 nocturia, the risk of falling was higher, which indicates that nocturia may be a risk factor for the fall, independent of incontinence.

As far as we know, there is no study showing the relation between polypharmacy and nocturia. In our study, 1.6 fold polypharmacy risk was found in patients with ≥4 nocturia. This may be due to increased drug interactions and adverse drug reactions as the number of drugs used in the elderly increases (Unutmaz et al., 2018). It may be another reason why some drugs such as antidepressants, antipsychotics, and bronchodilators may cause detrusor overactivation as a cause of anticholinergic burden(Unutmaz et al., 2018). Therefore, before starting treatment, clinicians assessing nocturia should question not only the drugs such as diuretic, calcium channel blockers, but also the polypharmacy itself. On the other hand, since diuretics were performed at morning or at noon in our clinical practice, no relationship may have been found between nocturia and these drugs.

For the first time in this study, there was a significant correlation between nocturia and frailty regardless of incontinence. According to our results, frailty is more common in older women who have had four or more voiding a night. Besides, the relationship between low gait speed and decrease in daily living activities suggest that nocturia can be considered as an indicator of physical frailty and poor health. In frailty, many urinary system changes due to aging may be more severe. For example, in a study that evaluated frailty with the TUG, it was found that overactive bladder was found to be higher in frail patients, regardless of age (Pratt & Suskind, 2018). In fact, the fact that 27% of frail patients fall in the night and more than half are associated with toileting, supports this (Pratt & Suskind, 2018). On the other hand, frailty has been shown to cause autonomic nervous system insufficiency through its cardiac effects (Parvaneh et al., 2015). The autonomic nervous system is also responsible for the regulation of bladder relaxation and contraction; therefore, there may be a connection between frailty and nocturia, but further studies are needed to explain this. In patients with numerous nocturnal episodes, increased insomnia and recurrent showers may cause patients to participate in lesser daily activities to protect themselves, which decreases their physical function over time. This may be reflected in the geriatric assessment as a decrease in gait speed and deterioration in activities of day living.

Limitations: First, this is a cross sectional study. Second, patients were not asked to complete the three-day frequency volume (FV) charts and nocturnal polyuria, and low nocturnal bladder capacity was not evaluated. Third, nighttime fluid intake and coffee or alcohol intake were not assessed. Lastly, any validation scale, such as overactive bladder symptom score by Blaivas or bladder diary was not used for nocturia evaluation. (Blaivas, J. G., Panagopoulos, G., Weiss, J. P., & Somaroo, C. (2007). Validation of the overactive bladder symptom score. The Journal of Urology, 178(2), 543-547.) Strengths: First, because the study was performed only in older women, gender-related hormonal and structural factors could be eliminated. Second, urinary incontinence is also evaluated simultaneously and the effect on the parameters is eliminated.

1. **CONCLUSIONS**

Nocturia is quite common and associated with insomnia, frailty, polypharmacy, incontinence, falls, lower gait speed, and functionality in older women. Therefore, clinicians should be alert to older women with 2 and more nocturnal episodes, because, if the number of episodes of nocturia can be reduced or treated (e.g. by avoiding polypharmacy), the risk of falls and insomnia can be reduced. Additionally, ≥2 nocturia episodes can be a clinical marker of poor health status, because these patients are more likely to have frailty, polypharmacy, incontinence, and lower functional capacity, which are high risk indicators for a large number of adverse clinical events. As a result, these findings have shown that nocturia is very important for geriatric practice; evaluation of nocturia and nocturia frequency should be a part of comprehensive geriatric assessment.

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| **Table 1. PATIENTS CHARACTERISTICS** |
|  | **NOCTURIA GROUP (N=858)** |
|  | **0****(126)** | **1****(163)** | **2****(208)** | **3****(154)** |  **≥ 4** **(207)** | ***p*** ***value*** |
| Age (years) | 73.34±8.70 | 72.48±7.30 | 74.15±8.14 | 75.0±8.63 | 75.50±8.07 | **0.001** |
| Education (years) | 3.5 ±3.9 | 4.1±4.2 | 3.1±3.5 | 3.1 ±3.9 | 2.3±3.2 | **0.001** |
| CCI | 1.24±7.37 | 0.86±1.45 | 0.94±1.39 | 1.38±6.40 | 1.34±5.18 | **0.001** |
| **COMORBIDITIES (%)** |  |  |  |  |  |  |
| Cerebrovascular Events | 2. | 4.3 | 6.3 | 2.0 | 3.0 | 0.188 |
| Diabetes Mellitus | 21.8 | 33.1 | 39.5 | 39.7 | 40.0 | **0.005** |
| Ischemic Heart Disease | 6.5 | 8.6 | 112 | 8.6 | 12.7 | 0.360 |
| Congestive heart failure | 4.0 | 6.7 | 3.4 | 5.3 | 5.4 | 0.653 |
| Hypertension | 71.8 | 68.7 | 67.3 | 76.8 | 70.7 | 0.374 |
| COPD | 3.3 | 9.5 | 13.8 | 23.3 | 20.0 | **0.000** |
| Osteoarthritis  | 19.4 | 17.2 | 16.6 | 19.7 | 23.6 | 0.418 |
| Parkinson's disease | 0.8 | 1.2 | 1.9 | 1.3 | 3.9 | 0.228 |
| Constipation | 32.5 | 43.2 | 41 | 43.9 | 46.1 | 0.076 |
| **DRUG CLASS (%)** |
| NSAIDs | 20.5 | 20.1 | 21.1 | 31.6 | 27.5 | 0.075 |
| Antimuscarinics | 3.4 | 3.8 | 6.3 | 7.0 | 12.6 | **0.001** |
| Thiazide | 44.4 | 51.9 |  42.7 | 57.8 | 48.2 | 0.055 |
| Amlodipine | 13.8 | 11.3 | 15.0 | 16.3 | 13.1 | 0.751 |
| Alpha blockers | 0.0 | 0.6 | 0.0 | 0.0 | 1.6 | **0.03** |
| Furosemide | 1.7 | 5.0 | 2.0 |  3.4 | 4.2 | 0.362 |
| **URINE LABORATORY** |
| Glycosuria | 5.4 | 6.9 | 10 | 6.7 | 10.2 | 0.276 |
| Pyuria | 31.3 | 32.2 | 31 | 32.4 | 35.7 | 0.810 |
| Hematuria | 12.9 | 14.4 | 13.7 | 14.3 | 15.3 | 0.972 |
| \*Urine culture positive (%) | 17.2 | 20.7 | 10.9 | 14.3 | 21.1 | 0.673 |
| **BLOOD LABORATORY VALUES** |  |
| GFR | 79.85±20.54 | 79.74±19.44 | 78.10±19.49 | 79.52±18.27 | 76.16±19.39 | **0.032** |
| **GERIATRIC SYNDROMES (%)** |
| Dementia | 2.4 | 4.9 | 4.4 | 3.3 | 5.9 | 0.601 |
| Insomnia | 57.6 | 58.1 | 72.0 | 84.4 | 87.3 | **0.000** |
| Recurrent falls | 20.6 | 23.3 | 34.6 | 25.5 | 38.2 | **0.001** |
| Depression | 40 | 47.1 | 41.8 | 46.2 | 52.5 | 0.094 |
| Polypharmacy | 28.9 | 41.4 | 41.7 | 44.9 | 48.9 | **0.002** |
| Pain | 70.6 | 65.7 | 70.3 | 66.5 | 73.9 | 0.279 |
| Frailty | 30.5 | 26.3 | 26.8 | 37.7 | 48.6 | **0.000** |
| Dynapenia  | 39.6 | 36.1 | 41.6 | 43.3 | 55.6 | **0.006** |
| Malnutritionbod | 7.1 | 3.6 | 2.8 | 6.2 | 8.5 | 0.247 |
| Sarcopenia  | 18.3 | 20.2 | 26.9 | 29.9 | 31.9 | **0.038** |
| Orthostatic Hypotension | 24.8 | 33.8 | 29.1 | 36.5 | 34.6 | 0.240 |
| Urinary Incontinence |
| * None
 | 66.5 | 64.3 | 48 | 47.7 | 29.4 | **0.000** |
| * Urge
 | 21.9 | 25.4 | 38.1 | 33.8 | 52.8 |
| * Stress
 | 7.1 | 3.3 | 5.3 | 5.9 | 2.5 |
| **COMPREHENSIVE GERIATRIC ASSESSMENT** |
| Tinetti Gait | 14.02±3.66 | 14.7±2.42 | 14.19±3.26 | 13.95±3.37 | 13.56±3.59 | **0.002** |
| Tinetti Balance | 10.65±2.88 | 11.03±2.12 | 10.76±2.58 | 10.58±2.81 | 10.10±3.03 | **0.001** |
| Tinetti Total | 24.53±6.40 | 25.56±4.34 | 24.85±5.32 | 24.49±5.79 | 23.63±6.19 | **0.000** |
| TUG | 13.78±10.99 | 12.13±6.64 | 13.61±8.48 | 13.52±7.50 | 15.51±8.62 | **0.000** |
| Hand Grip strength | 21.87±7.87 | 23.58±7.99 | 23.22±8.57 | 23.32±8.57 | 21.02±8.28 | **0.003** |
| Basic ADL | 89.84±17.2 | 91.07±15.84 | 90.42±14.19 | 93.42±65.33 | 85.24±14.79 | **0.000** |
| Instrumental ADL | 17.91±6.08 | 19.30±9.50 | 18.59±7.74 | 16.66±6.25 | 15.95±6.26 | **0.000** |
| GDS | 4.47±4.47 | 4.97±4.62 | 4.23±3.78 | 4.63±4.14 | 5.32±4.22 | 0.068 |
| MMSE | 24.72±4.86 | 25.05±4.16 | 24.95±3.70 | 24.19±4.41 | 23.90±4.96 | **0.028** |
| MNA  | 23.71±4.39 | 24.17±3.77 | 24.29±3.53 | 24.03±3.95 | 23.23±4.13 | 0.059 |
| Fried Score | 1.50±1.60 | 1.43±1.46 | 1.47±1.47 | 1.61±1.45 | 2.15±1.54 | **0.000** |
| Insomnia Severity Index | 10.4±8.01 | 11.79±8.46 | 13.57±7.68 | 14.88±6.99 | 16.99±7.02 | **0.000** |

BADL: Barthel Index of Activities of Daily Living; CCI: Charlson Comorbidity Index; COPD: Chronic Obstructive Pulmonary Disease; GDS: Geriatric Depression Scale; GFR; Glomerular filtration rate; IADL: The Lawton Instrumental Activities of Daily Living Scale; MMSE: Mini-Mental State Examination. MNA: The Mini Nutritional Assessment;  NSAIDs: Non-steroidal anti-inflammatory drugs; TSH: [Thyroid stimulating hormone; TUG: Timed Up And Go Test.](http://www.yourhormones.info/hormones/thyroid-stimulating-hormone/) \* Definition of a positive culture: Bacteriuria is ≥105 colony forming units (CFU)/mL.

**Table 2. Associations Between Comprehensive**[**Geriatric Assessment**](https://www.sciencedirect.com/topics/medicine-and-dentistry/geriatric-assessment)**Parameters and Nocturia Groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **≥1 void/night** | **≥2 void/night** | **≥3 void/night** | **≥4 void/night** |
| **Women** |  |  |  |  |
|  | **OR (%95 CI)** | **p** | **OR (%95 CI)** | **p** | **OR (%95 CI)** | **p** | **OR (%95 CI)** | **p** |
| Recurrent falls | --- | --- | 1.6 (1.0-2.7) | 0.031 | 1.6 (1.2-2.3) | 0.005 | 1.5 (1.1-2.1) | 0.021 |
| Polypharmacy | --- | --- | --- | --- | --- | --- | 1.6 (1.0- 2.2) | 0.048 |
| Insomnia | 2.0 (1.2-3.4) | 0.006 | 2.3 (1.6- 3.4) | 0.000 | 2.7 (1.8 - 4.1) | 0.000 | 2.5 (1.5 - 4.2) | 0.000 |
| Frailty | --- | --- | --- | --- | --- | --- | 1.4 (1.1 - 1.7) | 0.006 |
| Urinary Incontinence\* | 2.7 (1.7-42) | <0.001 | 3.1 (2.2-4.4) | <0.001 | 2.6 (1.8-3.5) | <0.001 | 2.7 (1.8-4.0) | <0.001 |
| Number of Drugs | 1.2 (1.1-1.4) | 0.002 | 1.1 (1.0-1.2) | 0.021 | 1.1 (1.0-1.2) | 0.007 | 1.1 (1.0-1.2) | 0.039 |
| ISI Index Scores | 1.5 (1.2-1.7) | <0.001 | 1.6 (1.3-1.8) | <0.001 | --- | --- | --- | --- |
| TUG | --- | --- | 1.9 (1.1-3.3) | 0.017 | 2.0 (1.6-2.5) | <0.001 | 1.9 (1.5-2.5) | <0.001 |
| IADL scores | --- | --- | --- | --- | 0.9 (0.9-1.0) | 0.006 | --- | --- |
| Freid Frailty Score | --- | --- | --- | --- | --- | --- | 2.1 (1.2-3.7) | 0.013 |

IADL: The Lawton Instrumental Activities of Daily Living Scale; OR: Odd Ratio; ISI: Insomnia Severity Index; TUG: Timed Up And Go Test.\*Adjusted for age, education level, CCI, GFR, diabetes mellitus, COPD, antimuscarinic drugs and alpha blockers. While evaluating ORs of other parameters, it was adjusted for same covariates plus urge incontinence.