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Impact of body mass index on the efficacy of treatment modalities in women with refractory overactive bladder

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Overactive bladder (OAB) is a prevalent condition that substantially impairs quality of life. Obesity and overweight status are recognized as significant risk factors for OAB, but their influence on treatment efficacy is not well understood. This cross-sectional study was conducted from January 2023 to October 2024 at a tertiary care hospital. Women diagnosed with refractory OAB were classified into normal weight, overweight, and obese groups according to their body mass index (BMI). Treatment options included combination pharmaceutical therapy and Botulinum toxin injections. Outcomes were assessed using the Overactive Bladder Symptom Score (OABSS) and quality of life questionnaires, administered before and 12 weeks after treatment. A total of 197 women were included in the study. Normal weight women demonstrated significant improvements in OAB symptoms and quality of life following both combination therapy and Botulinum toxin injection. Conversely, overweight and obese women showed limited improvement with pharmaceutical therapy but responded better to Botulinum toxin injections. The findings suggest that Botulinum toxin injection may be a more effective treatment modality for overweight or obese women with refractory OAB compared to pharmaceutical therapy. Normal weight women might benefit from initiating treatment with combination medication therapy.

Keywords Body mass index, Overweight, Obesity, Overactive bladder, Quality of life

Overactive bladder (OAB) is characterized by increased daytime urinary frequency, urgency, and nocturia, with or without incontinence, in the absence of a urinary tract infection, as defined by the International Continence Society/International Urogynecological Association[1]. Diagnosis is primarily based on these symptoms, which significantly impair daily quality of life. The condition is relatively common, with a large-scale population-based study reporting a prevalence of 12% among women, increasing with age and menopausal status[1]. Additionally, several studies have identified overweight and obesity as risk factors for OAB[2]. One study even found that obese patients experience urgency urinary incontinence episodes more frequently and suffer from worsening symptoms and quality of life compared to their normal or overweight counterparts[3]. Therefore, identifying appropriate treatments for these patients is critical.

The standard pharmaceutical treatments for OAB include anticholinergics. Another option is the beta-3-adrenergic agonist, a novel medication approved by the United States Food and Drug Administration in 2012[4]. The effectiveness and safety of these medications have been validated in multiple clinical trials and meta-analyses[4,5]. Patients who fail to respond to at least one medication after 4 to 8 weeks are classified as having refractory OAB, a common yet challenging condition due to the unsatisfactory outcomes of traditional treatments. While overweight and obesity have been shown to be independent risk factors for urinary incontinence and OAB, the efficacy of various treatment modalities in these patients remains unclear[3]. This study aimed to evaluate the impact of body mass index (BMI) on the effectiveness of different treatment modalities in women with refractory OAB by comparing symptom relief and quality of life after pharmaceutical therapy and Botulinum toxin injections in normal-weight versus overweight and obese patients.

Methods.

Study Design and Participants: This cross-sectional study was conducted at a tertiary referral hospital between January 2023 and October 2024. Ethical approval was obtained from the Institutional Review Board of Mackay

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Memorial Hospital (22MMHIS039e). The research was performed in accordance with relevant regulations, and informed consent was obtained from all individual participants included in the study. Women presenting with OAB symptoms were reviewed, and those with current urinary tract infection, advanced pelvic organ prolapse, use of vaginal pessary, contraindications to anticholinergic or β3-agonist medications, or any neurological disorders affecting lower urinary tract symptoms were excluded.

Interventions: Participants were initially prescribed either anticholinergic drugs or β3-adrenergic agonists. Patients who did not respond to either medication after one month were offered combination therapy (Solifenacin 5 mg once daily plus 0.5 g conjugated estrogen intravaginal cream [0.625 mg/g] twice weekly or Solifenacin 5 mg plus Mirabegron 25 mg per day). OnabotulinumtoxinA (100 U) was administered via cystoscopy as 20 intradetrusor injections, with each injection delivering 0.5 ml[6]. All patients in the study had refractory OAB and were offered combined medication therapy after thorough explanation. Prior to administering onabotulinumtoxinA injections, we clearly explained all potential side effects, including the risk of urinary retention, which may require intermittent self-catheterization if necessary. We also discussed the adverse events associated with pharmacological treatments. To ensure clarity, we have addressed these points in the manuscript. The choice of therapy was based on patient preference.

Outcome Measures: After treatments, patients were scheduled for follow-up at 4 and 12 weeks. The decision to assess outcomes at 12 weeks was based on both our clinical experience and relevant literature. OnabotulinumtoxinA injections generally require a few weeks to reach full efficacy, and the 12-week mark is widely used to evaluate the treatment's effectiveness[6]. For pharmacological treatments, multiple studies have also adopted the 12-week period to measure treatment response and patient outcomes[4]. This time frame is considered sufficient to observe improvements in symptoms for both treatment modalities. The outcome measures included: OAB symptoms, including micturition urgency, frequency, and nocturia episodes, were evaluated within 24 h before and 12 weeks after treatment. Participants completed the Urogenital Distress Inventory (UDI-6) and Incontinence Impact Questionnaire (IIQ-7) to assess incontinence-related symptom distress and quality of life[7]. The severity of OAB symptoms was quantified using the Overactive Bladder Symptom Score (OABSS)[8]. Patients were categorized according to the criteria of the Department of Health in Taiwan as follows: BMI ≥ 27 kg/m^2 for the obese group, BMI 24.0–26.9 kg/m^2 for the overweight group, and $18.5 \leq$ BMI < 24 kg/m^2 for the normal weight group[9], and treatment outcomes were compared across these groups.

Statistical Analysis: One-way analysis of variance was used to assess differences between groups. Paired-sample t-tests and the McNemar test were employed for intragroup comparisons of questionnaire scores and OAB symptoms. Statistical analyses were conducted using SPSS version 26.0 for Windows (SPSS, Chicago, IL, USA), with a p-value of less than 0.05 considered statistically significant.

Results

During the study period, 197 women with refractory OAB were included. Of these, 102 (51.7%) were of normal weight, 41 (20.8%) were overweight, and 47 (23.8%) were obese. Regarding treatment modalities, 68 (34.5%) received Solifenacin and local estrogen treatment, 79 (40.1%) received Solifenacin and Mirabegron, and 42 (21.3%) underwent Botulinum toxin injection. The baseline quality of life scores and patient characteristics are presented in Table 1. Significant differences were observed in BMI (normal: 21.3 ± 1.8, overweight: 26.4 ± 1.2, and obese: 31.1 ± 3.2 kg/m^2, respectively; $p < 0.001$), incidence of hypertension (11.2%, 27.1%, and 34.0%, respectively; $p = 0.003$), vaginal deliveries (1.6 ± 1.3, 2.4 ± 1.6, and 1.7 ± 1.6, respectively; $p = 0.009$), and age (57.8 ± 12.5, 65.4 ± 14.1, and 60.2 ± 11.2, respectively; $p = 0.003$). Baseline quality of life scores were worse in overweight women, with a higher OABSS score (normal: 7.7 ± 3.5, overweight: 9.6 ± 3.2, and obese: 8.9 ± 3.4, respectively; $p = 0.005$), although other differences were not statistically significant.

Table 2 presents the outcomes for women with different BMIs who received Solifenacin 5 mg once daily plus 0.5 g conjugated estrogen intravaginal cream (0.625 mg/g) twice weekly. In normal-weight women, all OAB symptoms and quality of life scores significantly improved after Solifenacin and local estrogen therapy, except for the IIQ-7 score (before and 12 weeks after treatment: 6.8 ± 5.6 vs. 5.5 ± 5.7, $p = 0.923$), and urgency episodes within 24 h (before and 12 weeks after treatment: 3.5 ± 3.2 vs. 2.7 ± 2.8, $p = 0.606$). For overweight women, only OABSS scores (9.5 ± 3.4 vs. 7.7 ± 3.4, $p = 0.038$) significantly improved. However, for obese women, none of the items significantly improved.

Table 3 shows the outcomes for women with different BMIs who received Solifenacin 5 mg plus Mirabegron 25 mg per day. All OAB symptoms and quality of life scores significantly improved in the normal-weight group after combination medication therapy (all $p < 0.05$). For obese women, only the IIQ-7 score showed significant improvement (10.8 ± 5.3 vs. 6.5 ± 4.6, $p = 0.044$), while other measures did not, suggesting that combination medication therapy may not effectively address OAB symptoms in women with higher BMIs.

Table 4 presents the outcomes for women who underwent Botulinum toxin injection. All OAB symptoms and quality of life scores significantly improved in the normal-weight group after Botulinum toxin injection. Similarly, in the overweight group, all OAB symptoms and quality of life scores significantly improved after Botulinum toxin injection, except for micturition episodes (8.6 ± 3.8 vs. 7.3 ± 4.8, $p = 0.281$). For obese women, all OAB symptoms and quality of life scores significantly improved, except for IIQ-7 score (11.7 ± 7.4 vs. 5.5 ± 7.3, $p = 0.142$), nocturia episodes (3.1 ± 1.9 vs. 1.5 ± 1.6, $p = 0.079$) and incontinence episodes (2.2 ± 1.5 vs. 0.8 ± 1.2, $p = 0.324$).

Discussion

This study indicates that normal-weight women with refractory OAB respond well to combination medication therapy or onabotulinumtoxinA injection; however, overweight and obese women may not find pharmaceutical

	Normal weight 18.5 ≦ BMI < 24 ($n = 102$)	Overweight 24 ≦ BMI < 27 ($n = 48$)	Obese 27 ≦ BMI ($n = 47$)	p
Age, y	57.8 ± 12.5	65.4 ± 14.1	60.2 ± 11.2	0.003
Parity, n	1.9 ± 1.2	2.4 ± 1.6	2.2 ± 1.3	0.059
Vaginal delivery, n	1.6 ± 1.3	2.4 ± 1.6	1.7 ± 1.6	0.009
Cesarean section, n	0.3 ± 0.6	0.1 ± 0.4	0.4 ± 0.8	0.019
Body mass index, kg/m^2	21.3 ± 1.8	26.4 ± 1.2	31.1 ± 3.2	< 0.001
Hypertension	11 (10.7%)	13 (27.1%)	16 (34.0%)	0.003
Diabetes mellitus	4 (3.9%)	10 (20.8%)	6 (13.0%)	0.005
Hyperlipidemia	12 (11.8%)	8 (16.7%)	10 (22.2%)	0.332
Prior hysterectomy	5 (4.9%)	13 (27.7%)	8 (17.8%)	0.001
Prior urogynecology surgery	12 (10.7%)	12 (25.0%)	11 (23.4)	0.142
Mean episodes of voids per 24 h, n	10.2 ± 4.4	8.9 ± 4.3	8.5 ± 3.3	0.057
Mean episodes of nocturia per night, n	2.7 ± 1.8	3.1 ± 1.5	2.7 ± 1.8	0.414
Mean episodes of urgent micturition per 24 h, na	4.1 ± 3.5	4.8 ± 4.4	4.3 ± 4.2	0.556
Mean episodes of urinary incontinence per day, n	2.3 ± 2.9	2.7 ± 3.0	2.0 ± 1.4	0.484
UDI-6	7.5 ± 3.9	8.8 ± 4.2	7.1 ± 3.1	0.102
IIQ-7	8.8 ± 6.3	10.4 ± 6.0	9.7 ± 6.1	0.347
OABSS	7.7 ± 3.5	9.6 ± 3.2	8.9 ± 3.4	0.005
PISQ12	30.0 ± 8.1	24.9 ± 15.8	31.8 ± 6.3	0.131

Table 1. Demographic and clinical characteristics of participants. Data are presented as mean ± standard deviation or as number (percent) of patients. UDI-6: the short form of the Urogenital Distress Inventory, IIQ-7: the short form of the Incontinence Impact Questionnaire, OABSS: overactive bladder symptom score.

therapy as effective. For these patients, onabotulinumtoxinA injection may be a more effective treatment option compared with medication therapies.

While the prevalence of OAB symptoms in women is reportedly related to increasing BMI[10], the exact mechanisms by which obesity or overweight status affects OAB remain unclear. Increased BMI could lead to higher intra-abdominal and intravesical pressure. One theory suggests that the increased mechanical load may stimulate bladder sensory afferents, increase oxidative stress, and precipitate systemic inflammation and insulin resistance. These processes could result in chronic pelvic ischemia and urothelial dysfunction[11,12]. Another study reported that increased abdominal visceral fat associated with inflammatory cytokine production could lead to inflammatory changes in adipose tissue surrounding the bladder, subsequently causing OAB symptoms[12,13]. Obesity or overweight status is considered a chronic inflammatory state, contributing to OAB symptoms. Similar pathophysiological mechanisms have been reported in studies on inflammatory bowel disease, where visceral adiposity was associated with a more severe inflammatory phenotype[14]. These conditions may explain why overweight or obese patients experience worse OAB symptoms than those of normal weight[3].

The efficacy of combination therapy with Solifenacin and Mirabegron has been documented in several well-conducted studies[4,5]. Combination therapy has shown a significantly greater improvement in daily incontinence, micturition frequency, and urgency episodes compared to Solifenacin monotherapy[4]. The effect of combining antimuscarinic medication with local estrogen has also been confirmed[15]. A randomized controlled trial comparing tolterodine alone with tolterodine combined with local estrogen showed that the combination therapy had a synergic effect, resulting in greater improvement in incontinence-related quality of life[15]. However, in our study, refractory OAB symptoms in overweight and obese women persisted despite combination therapies. This may be due to the association of refractory OAB with urothelial dysfunction, chronic bladder ischemia, and chronic bladder inflammation, conditions also linked to overweight or obesity[16]. These factors may explain why normal-weight women showed significant improvement while overweight and obese women did not, even with combination therapy. The effects of pharmacological treatment and onabotulinumtoxinA injections cannot be directly compared due to their distinct pathophysiological mechanisms of action. Pharmacological treatments for OAB, such as antimuscarinics or beta-3 adrenergic agonists, work by targeting specific bladder receptors to modulate detrusor muscle activity. In contrast, onabotulinumtoxinA inhibits acetylcholine release at the neuromuscular junction, leading to partial paralysis of the detrusor muscle and significantly reducing bladder overactivity[6]. These different mechanisms explain the variation in efficacy. A randomized controlled trial has directly compared the efficacy of anticholinergic medications and onabotulinumtoxinA for the primary treatment of OAB[17]. In this trial, the mean BMI in the two groups was 32.9 ± 8.2 and 32.1 ± 7.0 kg/m^2, respectively. Results showed that patients receiving onabotulinumtoxinA had significantly higher rates of complete resolution of urgency urinary incontinence (27% vs. 13%, $p = 0.003$) and total incontinence (23% vs. 11%, $p = 0.003$) compared with those on anticholinergic therapy. Echoing these findings, we observed that onabotulinumtoxinA injections led to significant improvements in quality of life for overweight and obese women with refractory OAB, similar to the improvements seen in normal-weight women. This suggests that onabotulinumtoxinA can be an effective treatment across different BMI categories, particularly for those with higher BMI.

	Normal weight 18.5 ≦ BMI < 24 ($n = 34$)	Overweight 24 ≦ BMI < 27 ($n = 14$)	Obese 27 ≦ BMI ($n = 22$)	p
UDI-6				
Pre-treatment	6.4 ± 3.6	8.9 ± 4.0	7.1 ± 3.7	0.056
Post-treatment	4.5 ± 3.6	6.1 ± 2.9	5.5 ± 4.3	0.639
Difference	− 2.1 ± 5.2	− 2.1 ± 4.2	− 1.5 ± 3.5	0.954
P (intergroup)	0.009	0.147	0.107	
IIQ-7				
Pre-treatment	6.8 ± 5.6	9.1 ± 5.4	8.0 ± 5.4	0.044
Post-treatment	5.5 ± 5.7	5.7 ± 3.7	6.1 ± 5.2	0.882
Difference	− 1.3 ± 5.7	− 3.3 ± 6.0	− 2.3 ± 5.0	0.362
P (intergroup)	0.923	0.358	0.193	
OABSS				
Pre-treatment	6.5 ± 3.5	9.5 ± 3.4	8.1 ± 3.4	0.004
Post-treatment	3.8 ± 2.2	7.7 ± 3.4	7.2 ± 3.1	0.247
Difference	− 2.7 ± 3.8	− 1.7 ± 4.6	− 1.1 ± 3.8	0.392
P (intergroup)	0.041	0.038	0.252	
Micturition episodes				
Pre-treatment	10.1 ± 3.8	9.0 ± 4.1	8.3 ± 2.5	0.247
Post-treatment	7.8 ± 3.8	7.9 ± 3.8	7.4 ± 3.4	0.439
Difference	− 2.4 ± 3.4	− 1.2 ± 4.2	− 0.4 ± 3.2	0.501
P (intergroup)	0.008	0.195	0.646	
Nocturia episodes				
Pre-treatment	2.8 ± 1.7	3.2 ± 2.1	2.7 ± 2.1	0.979
Post-treatment	1.8 ± 1.5	2.5 ± 1.2	2.6 ± 0.9	0.172
Difference	− 0.8 ± 1.3	− 0.7 ± 0.8	0.5 ± 1.5	0.026
P (intergroup)	0.021	0.096	0.235	
Urgency episodes				
Pre-treatment	3.5 ± 3.2	4.6 ± 4.7	3.0 ± 2.6	0.041
Post-treatment	2.7 ± 2.8	4.0 ± 4.9	2.3 ± 2.1	0.424
Difference	− 0.6 ± 4.9	− 1.8 ± 7.7	− 1.2 ± 3.0	0.407
P (intergroup)	0.606	0.708	0.166	
Urinary incontinence episodes				
Pre-treatment	0.7 ± 1.0	2.7 ± 2.2	1.9 ± 1.5	< 0.001
Post-treatment	1.2 ± 1.2	2.0 ± 2.2	1.0 ± 1.3	0.234
Difference	0.6 ± 0.8	− 0.7 ± 3.9	− 0.9 ± 2.0	0.143
P (intergroup)	0.008	0.632	0.094	

Table 2. Treatment outcomes based on different body mass index before and after Solifenacin and estrogen intravaginal cream treatment. Data are presented as mean ± standard deviation or as number (percent) of patients. UDI-6: the short form of the Urogenital Distress Inventory, IIQ-7: the short form of the Incontinence Impact Questionnaire, OABSS: overactive bladder symptom score.

There is limited data evaluating the impact of BMI on treatment efficacy in women with OAB. To the best of our knowledge, only one prospective study has assessed the efficacy of β-3-adrenoreceptor treatment between normal-weight and overweight or obese women[3]. That study enrolled 169 women who received 50 mg of Mirabegron daily. After 12 weeks of treatment, micturition urgency and nocturia episodes within 24 h significantly improved across all BMI categories, as did quality of life. The authors concluded that body weight did not influence the treatment outcome of Mirabegron. However, that study focused on monotherapy with β-3-adrenoreceptor, and there is no existing data on the impact of BMI on refractory OAB treated with combination therapies or Botulinum toxin injections until now. Our study highlights that overweight or obese women with refractory OAB may not be satisfied with combination medication therapy and might benefit more from starting with Botulinum toxin injection therapy. This is the first study, to our knowledge, to report the treatment outcomes of different modalities in women with refractory OAB across different BMI categories. The strength of this study lies in its use of multiple validated questionnaires to comprehensively evaluate quality of life and OAB symptoms. The main limitations include the short duration of treatment and the small sample size. The other limitations included the lack of evaluation of the effect of different drug doses, and the data of bladder diaries. For future research, we aim to increase the sample size to improve the generalizability of findings, extending the follow-up period to assess long-term efficacy, and exploring new treatment strategies such as alternative dosing or combination therapies to enhance outcomes across BMI categories. Nonetheless, our study provides

	Normal weight 18.5 ≦ BMI < 24 ($n = 51$)	Overweight 24 ≦ BMI < 27 ($n = 19$)	Obese 27 ≦ BMI ($n = 12$)	p
UDI-6				
Pre-treatment	8.1 ± 4.2	8.7 ± 4.3	7.1 ± 2.1	0.611
Post-treatment	6.1 ± 4.8	7.8 ± 5.8	5.3 ± 2.6	0.198
Difference	− 2.5 ± 4.3	− 1.2 ± 7.0	− 1.9 ± 3.2	0.521
P (intergroup)	0.001	0.536	0.113	
IIQ-7				
Pre-treatment	9.9 ± 6.2	10.3 ± 5.9	10.8 ± 5.3	0.884
Post-treatment	6.5 ± 6.1	9.0 ± 6.4	6.5 ± 4.6	0.257
Difference	− 3.9 ± 5.2	− 2.1 ± 5.6	− 3.6 ± 4.5	0.436
P (intergroup)	< 0.001	0.203	0.044	
OABSS				
Pre-treatment	8.6 ± 3.3	8.8 ± 3.4	9.3 ± 2.9	0.783
Post-treatment	5.7 ± 4.0	5.9 ± 4.5	7.2 ± 2.9	0.830
Difference	− 2.6 ± 3.6	− 2.5 ± 4.8	− 2.3 ± 3.0	0.834
P (intergroup)	< 0.001	0.096	0.079	
Micturition episodes				
Pre-treatment	9.6 ± 4.5	8.8 ± 4.2	7.2 ± 3.6	0.228
Post-treatment	6.9 ± 4.7	7.1 ± 7.1	5.4 ± 2.3	0.669
Difference	− 2.7 ± 4.7	− 1.6 ± 6.8	− 2.0 ± 4.0	0.497
P (intergroup)	0.001	0.407	0.197	
Nocturia episodes				
Pre-treatment	2.6 ± 1.6	3.1 ± 1.5	2.2 ± 0.8	0.293
Post-treatment	2.2 ± 1.7	2.3 ± 2.0	1.9 ± 0.9	0.398
Difference	− 0.4 ± 1.1	− 0.6 ± 1.9	− 0.3 ± 0.5	0.630
P (intergroup)	0.027	0.275	0.081	
Urgency episodes				
Pre-treatment	4.2 ± 3.4	3.9 ± 4.4	3.3 ± 1.8	0.664
Post-treatment	2.7 ± 4.0	3.8 ± 6.1	2.7 ± 2.9	0.349
Difference	− 1.2 ± 3.3	− 0.2 ± 5.8	− 0.7 ± 2.4	0.345
P (intergroup)	0.039	0.925	0.438	
Urinary incontinence episodes				
Pre-treatment	2.8 ± 2.4	3.0 ± 4.0	2.1 ± 1.5	0.717
Post-treatment	1.2 ± 1.6	1.4 ± 1.6	0.9 ± 01.5	0.764
Difference	− 1.7 ± 2.1	− 1.8 ± 5.2	− 1.1 ± 1.8	0.875
P (intergroup)	< 0.001	0.241	0.139	

Table 3. Treatment outcomes based on different body mass index before and after a ***combination*** therapy with Vesicare and Mirabegron treatment. Data are presented as mean ± standard deviation or as number (percent) of patients. UDI-6: the short form of the Urogenital Distress Inventory, IIQ-7: the short form of the Incontinence Impact Questionnaire, OABSS: overactive bladder symptom score.

important insights suggesting that Botulinum toxin injection should be considered for overweight or obese women with refractory OAB, whereas normal-weight women may start with combination medication therapy. Categorizing patients according to their BMI may lead to improved treatment outcomes.

Conclusion

Overweight or obese women with refractory OAB may benefit more from Botulinum toxin injection therapy compared to pharmaceutical therapies. Normal-weight women can consider starting with combination medication therapy. Stratifying patients by BMI could lead to more effective and personalized treatment strategies.

	Normal weight 18.5 ≦ BMI < 24 ($n = 17$)	Overweight 24 ≦ BMI < 27 ($n = 15$)	Obese 27 ≦ BMI ($n = 13$)	p
UDI-6				
Pre-treatment	9.0 ± 3.7	8.4 ± 4.1	7.4 ± 3.1	0.519
Post-treatment	3.9 ± 3.8	5.4 ± 3.6	3.4 ± 1.5	0.182
Difference	− 4.3 ± 4.0	− 4.7 ± 4.6	− 3.8 ± 3.5	0.689
P (intergroup)	0.020	0.035	0.045	
IIQ-7				
Pre-treatment	12.1 ± 6.0	10.3 ± 6.7	11.7 ± 7.4	0.771
Post-treatment	5.4 ± 8.2	5.4 ± 5.7	5.5 ± 7.3	0.759
Difference	− 5.5 ± 7.9	− 8.0 ± 8.7	− 5.3 ± 7.8	0.808
P (intergroup)	0.050	0.035	0.142	
OABSS				
Pre-treatment	9.2 ± 2.9	10.1 ± 2.8	10.3 ± 3.7	0.121
Post-treatment	5.0 ± 4.0	6.1 ± 4.8	5.8 ± 3.7	0.540
Difference	− 3.9 ± 5.9	− 4.3 ± 4.8	− 4.4 ± 4.6	0.991
P (intergroup)	0.016	0.033	0.015	
Micturition episodes				
Pre-treatment	10.8 ± 5.0	8.6 ± 3.8	9.7 ± 4.1	0.400
Post-treatment	5.7 ± 3.7	7.3 ± 4.8	4.6 ± 1.7	0.350
Difference	− 4.6 ± 5.3	− 2.9 ± 6.4	− 6.8 ± 5.0	0.501
P (intergroup)	0.023	0.281	0.039	
Nocturia episodes				
Pre-treatment	2.8 ± 2.1	3.4 ± 1.6	3.1 ± 1.9	0.746
Post-treatment	1.6 ± 1.4	2.4 ± 1.6	1.5 ± 1.6	0.378
Difference	− 1.2 ± 1.1	− 1.6 ± 1.3	− 1.8 ± 2.0	0.264
P (intergroup)	0.036	0.017	0.079	
Urgency episodes				
Pre-treatment	6.0 ± 4.6	5.5 ± 3.8	7.9 ± 6.2	0.455
Post-treatment	2.4 ± 3.5	2.5 ± 3.1	1.8 ± 2.2	0.657
Difference	− 4.0 ± 5.2	− 5.1 ± 5.7	− 7.8 ± 6.0	0.301
P (intergroup)	0.044	0.047	0.043	
Urinary incontinence episodes				
Pre-treatment	3.4 ± 4.7	2.3 ± 1.9	2.2 ± 1.5	0.418
Post-treatment	0.6 ± 0.8	1.1 ± 1.3	0.8 ± 1.2	0.778
Difference	− 2.7 ± 13.0	− 2.0 ± 1.9	− 1.2 ± 2.4	0.810
P (intergroup)	0.038	0.027	0.324	

Table 4. Treatment outcomes based on different body mass index before and after ***Botulinum*** toxin injection therapy. Data are presented as mean ± standard deviation or as number (percent) of patients. UDI-6: the short form of the Urogenital Distress Inventory, IIQ-7: the short form of the Incontinence Impact Questionnaire, OABSS: overactive bladder symptom score.

Data availability

The data associated with the paper are not publicly available but are available from the corresponding author on reasonable request.

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Declarations

Competing interests

The authors declare no competing interests.

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