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Association between Cystocele Severity and Coexistent Overactive–Underactive Bladder Syndrome: A Retrospective Analysis

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Abstract

CUOB (coexistent underactive overactive bladder) syndrome describes a clinical picture in which patients experience both storage and voiding difficulties that frequently fail to match the results seen on urodynamic testing. This study aimed to identify how patients with CUOB differ according to the presence or absence of a cystocele. Participants were selected from a total of 2000 women who had received urodynamic testing during the period 2008–2016. Relevant demographic and clinical details were extracted for 369 women whose reported symptoms matched the profile of CUOB. Cohort division was based on the Pelvic Organ Prolapse Quantification System. LUTS severity was measured with the International Consultation on Incontinence Questionnaire Short Form (ICIQ-UI SF). The analysis included 185 women with either no cystocele or only a grade I cystocele (group 1) and 185 women with grade II or III cystocele (group 2). The average age did not differ between the two groups. Body mass index was significantly higher in group 1 (27 vs. 25, $P = 0.02$). Factors known to increase prolapse risk—such as number of deliveries (1.7 vs. 2.1, $P = 0.001$) and the heaviest baby weight (3460 g vs. 3612 g, $P = 0.049$)—were elevated in group 2. Pelvic organ prolapse symptoms appeared 4.5 times more often in group 2 [n = 36/185 (19.5%) vs. n = 162/184 (88%), $P < 0.001$]. Group 1 demonstrated higher rates of stress urinary incontinence (70.8% vs. 55.4%, $P = 0.002$), urge urinary incontinence (64.9% vs. 50%, $P = 0.04$), and elevated ICIQ-UI-SF scores (8 vs. 5, $P < 0.001$). Maximum urinary flow rate proved lower in group 2 (17 vs. 15 mL/s, $P = 0.008$). Detrusor pressure during peak flow stayed identical (24 cm H_2O). Bladder Contractility Index values were greater in group 1 (108 vs. 96.5, $P = 0.017$), whereas weak bladder contractions (BCI < 100) occurred more commonly in group 2 (73/185; 39.5% vs. 95/184; 52.7%, $P = 0.011$). These outcomes indicate that CUOB may benefit from further subdivision depending on whether a cystocele is present. Future studies should investigate the outcomes of prolapse correction surgery in women who have both CUOB and cystocele so that clinicians can provide more accurate guidance to patients.

Keywords: Coexistent detrusor overactivity–underactivity, CUOB, Pelvic organ prolapses, Underactive bladder, Urodynamics

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Introduction

Women with lower urinary tract symptoms (LUTS) are typically placed into categories based on whether they mainly suffer from storage problems (for example, sudden urgency or leakage) or voiding problems (such as slow or incomplete bladder emptying). Nevertheless, a substantial number of patients report experiencing both sets of complaints simultaneously [1-3]. Such symptoms occur with high frequency in women following menopause [4, 5]. Clinically, they are often attributed to either overactive bladder (OAB) or underactive bladder (UAB), which correspond to storage-phase or emptying-phase disorders. Urodynamic investigations link these conditions to detrusor overactivity (DO) or detrusor underactivity (DU), respectively [6].

Uroflowmetry in healthy women without neurological issues typically reveals an immediate sharp rise to a strong peak flow at the onset of voiding, a swift return to baseline, completion of micturition within 60 seconds, and almost no residual urine. When voiding dysfunction exists, however, the tracing commonly becomes flatter and more drawn out, the time needed to reach peak flow lengthens, and the maximum flow rate drops or becomes interrupted. These changes are typical of bladder outlet obstruction or reduced detrusor strength and often leave behind a considerable volume of residual urine [7].

The simultaneous appearance of both storage and emptying symptoms in one individual has lately been labeled CUOB, standing for coexistent underactive overactive bladder [8, 9]. CUOB is recognized as a distinct clinical syndrome characterized by overlapping lower urinary tract symptoms, regardless of the exact cause or underlying process. It correlates strongly with urodynamic traces that display combined detrusor overactivity–underactivity (DOU). Even in the absence of clear urodynamic confirmation of both DO and DU, CUOB is accepted today as a true syndrome that stands apart from pure OAB or pure UAB and should not be viewed simply as the addition of the two. Multiple conditions can give rise to CUOB, among them pelvic organ prolapse, loss of neural drive, reduced blood supply, tissue scarring, and mechanical obstruction at the bladder outlet [5, 9]. The disorder is considered multifactorial, and increasing age is a key contributor due to cumulative cellular damage. Much remains unknown about its development, prevalence, and urodynamic patterns.

Recent data show that 18.8% of women seeking care for pelvic organ prolapse (POP) symptoms meet the criteria for CUOB, and the degree of alignment between this clinical diagnosis and urodynamic signs of simultaneous detrusor overactivity–underactivity (DOU) can reach 75.8% [10]. Among the mechanisms proposed for CUOB are higher urethral resistance, poorer detrusor function, or both [10, 11]. Despite growing recognition, CUOB remains an incompletely defined entity that needs a more precise classification.

The goal of the present study was to compare clinical features and urodynamic measurements in patients with CUOB according to the presence or absence of a clinically relevant cystocele.

Materials and Methods

This investigation was a retrospective cohort analysis conducted at a large tertiary teaching hospital (San Gerardo Hospital, Monza, Italy). The cohort was assembled from 2000 female patients who had received urodynamic investigations between 2008 and 2016 due to pelvic floor dysfunction (PFD) [10]. Within this pool, 369 women reported symptoms matching the definition of CUOB, whereas the other 1671 women showed no evidence of CUOB.

All participants underwent a structured medical history interview focused on lower urinary tract symptoms (LUTS). Questions covered urgency related to overactive bladder (OAB), urge urinary incontinence (UUI), stress urinary incontinence (SUI), difficulties during voiding (VS), and feelings of vaginal bulging [12]. To gauge how patients subjectively experienced the severity of their LUTS, the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-UI SF) was administered [13].

A specialized urogynecologist performed both the physical urogenital examination and the full urodynamic evaluation, using standardized techniques described in earlier publications [14]. During the gynecological exam, pelvic organ prolapse was staged using the Pelvic Organ Prolapse Quantification (POP-Q) system [15]. Urodynamic studies followed the International Continence Society (ICS) recommended guidelines for good urodynamic practice and terminology [16]. The primary reasons prompting urodynamic testing were stress urinary incontinence in 61.1% of cases, overactive bladder symptoms in 57.5%, and voiding problems in 35.6%, although several patients had more than one indication.

In the filling (storage) phase, recorded measurements included bladder volume at the first sensation of desire to void and at strong desire, whether urgency occurred with or without leakage, the highest detrusor pressure during filling (PdetMax), the maximum tolerated bladder capacity, and any leakage triggered by the Valsalva maneuver. Leakage caused by raised abdominal pressure in the absence of detrusor activity was documented as urodynamic stress urinary incontinence (UD-SUI). For the voiding phase, the assessed parameters comprised peak urine flow rate, maximum detrusor pressure (Pdet) at the start and finish of micturition, detrusor pressure at the moment of highest flow (PdetQmax), and the volume of urine remaining after voiding (PVR). Voiding dysfunction was identified per ICS standards when micturition was abnormally slow or incomplete, judged by reduced flow rates or unusually large post-void residuals. A flow rate below 12 mL/s was classified as abnormally slow, and post-micturition residual exceeding 100 mL was considered positive (PPVR). Detrusor underactivity (DU) was determined using the Bladder Contractility Index (BCI) originally proposed by Abrams [17], in which a score below 100 indicated DU.

Ethical approval for this research was granted by the Institutional Review Board of the ASST Monza Ethical Committee under Approval Code: RE-PFDs dated 11 February 2022.

Frequencies and percentages were used to describe categorical data. Normally distributed continuous variables were expressed as mean values accompanied by standard deviation (SD). Variables with skewed distributions were summarized using the median and interquartile range. Group comparisons for categorical variables relied on the Chi-square test or Fisher's exact test as appropriate. Differences in continuous variables were examined using the independent samples t-test or the Mann–Whitney test. Every statistical test was performed two-sided, and significance was set at $p < 0.05$. All calculations and analyses were executed with SPSS software (IBM SPSS for Windows, version 28, IBM Corporation, Armonk, New York, NY, USA, 2021).

Results and Discussion

POP-Q assessment revealed that cystocele occurred at a significantly higher rate among women diagnosed with CUOB than among those without CUOB (184/369; 49.9% vs. 671/1671; 40.2%, P = 0.006).

When stratified by POP-Q findings, 185 participants (185/369; 50.1%) were in group 1, comprising 102 women with no cystocele (grade 0) and 83 with grade I cystocele. The remaining 184 participants (184/369; 49.9%) formed group 2 and presented with grade II or III cystocele. No cases of stage IV cystocele were observed in the entire cohort. Patient age was similar across groups (61.7 ± 13 years for group 1 versus 64.7 ± 10 years for group 2; P = 0.14). Body mass index proved significantly higher in group 1 (27 kg/m² versus 25 kg/m²; P = 0.02). Prolapse risk factors, specifically parity and the highest neonatal birth weight, were elevated in group 2 (1.7 vs. 2.1, p = 0.001; 3460 g vs. 3612 g, P = 0.049) **(Table 1)**.

Table 1. Population characteristics and lower urinary tract symptoms.

Patients with CUOB (n = 369)	P-value	Cystocele grade 2\3 (n = 184)	No cystocele or grade 1 (n = 185)
Age (years)	0.14	64.7 ± 10.1	61.7 ± 13.8
BMI (kg/m²)	0.002	25 (22.1–26.6)	27 (23.9–32)
Parity (number of births)	0.001	2.14 + 1	1.71 ± 1.1
Mean birthweight (g)	0.049	3612.7 ± 540	3464 ± 541
Urge urinary incontinence	0.002	102 (55.4%)	131 (70.8%)
Stress urinary incontinence	0.004	92 (50.0%)	120 (64.9%)
ICIQ-UI SF score	< 0.001	5 (0–11)	8 (3–13)
Q-tip test value	0.79	40 (20–50)	40 (25–50)
Presence of POP symptoms	< 0.001	162 (88%)	36 (19.5%)
Any degree of apical prolapse	< 0.001	171 (92.9%)	61 (33%)
Any degree of posterior prolapse	< 0.001	151 (82.1%)	78 (42.2%)

Data are presented as mean ± standard deviation or count (percentage), median, and IQR (interquartile range). Non-continuous data are shown as absolute frequency. Abbreviations: CUOB = coexistent underactive overactive bladder; BMI = Body Mass Index; ICIQ-UI SF = International Consultation on Incontinence Questionnaire—Urinary Incontinence Short Form; POP = Pelvic Organ Prolapse.

Pelvic organ prolapse symptoms occurred 4.5 times more often in group 2 (n = 162/184; 88%) than in group 1 (n = 36/185; 19.5%, P < 0.001). Involvement of other (non-anterior) vaginal compartments in prolapse was two to three times higher in group 2, with statistical significance (P < 0.001) **(Table 1)**.

Complete details of all POP-Q measurements appear in **Table 2**.

Table 2. POP-Q parameters.

Patients with CUOB (n = 369)	P-value	Cystocele 2\3 (n = 184)	No cystocele or grade 1 (n = 185)
Point Aa	< 0.001	0.5 (0 to 2)	−3 (−3 to −2)
Point Ba	< 0.001	1 (0 to 2)	−3 (−3 to −2)
Point Ap	< 0.001	−2 (−2 to −1)	−3 (−3 to −2)
Point Bp	< 0.001	−2 (−2 to −1)	−3 (−3 to −2)
Point C	< 0.001	−0.25 (−4 to −1)	−7 (−8 to −6)
Point D	< 0.001	−4 (−6 to −3)	−8 (−9 to −7)

Genital hiatus (GH)	< 0.001	3.5 (3 to 4)	3 (3 to 3.5)
Perineal body (PB)	< 0.001	3 (2.5 to 3)	3 (3 to 3)
Total vaginal length (TVL)	0.428	9 (9 to 10)	10 (9 to 10)
Apical prolapse stage	< 0.001	2 (1 to 2)	0 (0 to 1)
Posterior compartment stage	< 0.001	1 (1 to 2)	0 (0 to 1)

Note: Data are presented as median and IQR (interquartile range). Abbreviations: POP-Q = Pelvic Organ Prolapse Quantification system (centimeters); GH = Genital Hiatus; PB = Perineal Body; TVL = Total Vaginal Length; CUOB = coexistent underactive/overactive bladder.

Stress urinary incontinence occurred more often in group 1 (131/185; 70.8% vs. 102/185; 55.4%, P = 0.002), as did urge urinary incontinence (120/185; 64.9% vs. 92/184; 50%, P = 0.004). ICIQ-UI SF scores also proved significantly higher in this group (8 vs. 5, P < 0.001).
Peak flow rate (Qmax) reached a modestly higher level in group 1 (17 mL/s vs. 15 mL/s, P = 0.008). Bladder Contractility Index (BCI) values were elevated in group 1 as well (108 vs. 96.5, p = 0.017). In contrast, weak detrusor contractions, defined as BCI < 100, were more frequent among women in group 2 (73/185; 39.5%) than in group 1 (95/184; 52.7%; P = 0.011). Detrusor pressure recorded at the point of maximum flow (Pdet-Qmax) remained the same in both groups (24 cm H2O; P = 0.278). Evaluation with the Schäfer nomogram indicated that bladder contractility was weaker in group 2 (normal versus weak contraction, p = 0.003). Furthermore, the combination of low BCI scores together with positive post-void residual volume was observed more commonly in group 2 compared with group 1 (97/184; 52.7% vs. 73/185; 39.5%, P = 0.011, and 45/184; 24.5% vs. 27/185; 14.6%, P = 0.017, respectively) **(Table 3)**.

Table 3. Urodynamic parameters in women with CUOB.

Patients with CUOB (n = 369)	P-value	Cystocele 2\3 (n = 184)	No cystocele or grade 1 (n = 185)
First desire to void (mL)	0.114	138 (102.2–191.7)	129 (88.5–184)
Maximum cystometric capacity (MCC, mL)	0.804	372 (320–447)	380 (329–444)
Detrusor pressure at end filling phase (cm H_2O)	0.878	8 (5–12)	8 (5–13.5)
Opening detrusor pressure (cm H_2O)	0.522	21 (13–31)	20 (13–28)
Closing detrusor pressure (cm H_2O)	0.072	22.5 (14–33)	19 (11–32)
Maximum flow rate (Qmax, mL/s)	0.008	15 (9–19)	17 (10–23)
Detrusor pressure at Qmax (cm H_2O)	0.278	24 (18–35)	24 (15.5–33.5)
Post-void residual (PVR, mL)	0.141	1 (0–98)	0 (0–58)
PVR (%)	0.148	0.4 (0–26.5)	0 (0–16.4)
Post-void residual proportion (PPVR)	0.017	45 (24.5%)	27 (14.6%)
Bladder contractility index < 100	0.011	97 (52.7%)	73 (39.5%)
Weak detrusor contraction (BOO excluded)	0.103	83 (45.1%)	68 (36.8%)
Qmax < 12 mL/s and Pdet < 10 cm H_2O	0.784	8 (4.3%)	7 (3.8%)
Urodynamic stress urinary incontinence (U-SUI)	0.157	78 (42.4%)	92 (49.7%)
Detrusor overactivity (DO) on UDS	0.641	77 (41.8%)	74 (40%)
Voiding difficulty on UDS	0.003	131 (71.2%)	104 (56.2%)
Detrusor overactivity with impaired contractility (DOU)	0.406	37 (20.1%)	31 (16.8%)
Bladder contractility index (BCI)	0.017	96.5 (79–124)	108 (79–142)
Schäfer grade	0.01	3 (3–4)	4 (3–5)
Simplified Schäfer class	0.003	1 (1–2)	2 (1–2)
SUI severity score	0.332	0 (0–1)	0 (0–1)

Note: Data are presented as mean ± standard deviation or count (percentage), median, and IQR (interquartile range). Non-continuous data are shown as absolute frequency. Abbreviations: CUOBS = Coexistent Overactive Underactive Bladder Syndrome; SUI = stress urinary incontinence; Qmax = maximal flow rate mL/s; pDet at Qmax = Detrusor Pressure at Maximum Flow; DOU = Detrusor Overactive Underactive; BOO = Bladder Outlet Obstruction; BCI = Bladder Contractility Index; PVR = PostVoid Residual; PVR% = (PVR/MCC) × 100; MCC = Maximum Cystometric Capacity; PPVR = Positive PVR (PPVR) volume. U-SUI = Urodynamic Stress Urinary Incontinence. DO in UDS—Detrusor Overactivity.

Diagnostic standards for CUOB have not yet been fully defined. Although the underlying disease mechanisms of CUOB are not entirely understood, they are largely linked to instability or reduced detrusor muscle function. Suggested explanations include partial nerve damage with altered sensory signaling, inefficient detrusor activation, repeated cycles of reduced blood supply followed by reperfusion injury, buildup of fibrous tissue within the detrusor muscle, and changes caused by bladder outlet obstruction leading to muscle thickening and eventual failure [4, 18, 19]. Earlier research has shown that worsening detrusor function is closely associated with the degree of anterior vaginal wall prolapse, which can create mechanical blockage through urethral kinking and eventually trigger detrusor muscle thickening and functional decline [20-22]. The idea that CUOB is frequently driven by mechanical blockage gains support from the observation that cystocele occurs at a markedly higher rate among women who do not report CUOB symptoms (P = 0.006).

The goal of the present study was to compare clinical features and urodynamic measurements in a large sample of older women with CUOB. Detailed uro-gynecological evaluation showed that moderate to advanced cystocele (stage II or III) affected half of the patients with this diagnosis.

Previous reports indicate that roughly 20% of women undergoing surgery for prolapse meet the criteria for CUOB and tend to have more advanced anterior compartment descent [10, 11]. In the current analysis **(Table 3)**, women with stage II or III cystocele showed a greater likelihood of reduced BCI (97/184; 52.7% vs. 73/185; 39.5%, P = 0.011), diminished bladder contractility (131/184; 71.2% vs. 104/185; 56.2%, P = 0.003), and elevated post-void residual volume (45/184; 24.5% vs. 27/185; 14.6%, P = 0.017) when compared with those having minimal or no anterior wall prolapse. These women also displayed lower peak urine flow rates (15 [9–19] mL/s vs. 17 [10–23] mL/s, P = 0.008). Using both the standard and simplified Schäfer nomograms — tools designed to distinguish detrusor underactivity from bladder outlet obstruction [8] — they achieved lower scores (3 [3–4] vs. 4 [3–5], P = 0.01 and 1 [1–2] vs. 2 [1–2], P = 0.003, respectively).

Among all patients with CUOB, stress incontinence was recorded in 57.5% (212/369) and urge incontinence in 63.1% (233/369). Notably, both SUI and UUI occurred less frequently in women with stage II or III anterior prolapse than in those with little or no anterior prolapse (92/184; 50.0% vs. 120/185; 64.9%, P = 0.004, and 102/184; 55.4% vs. 131/185; 70.8%, P = 0.002, respectively). This difference may stem from the increased urethral resistance created by the prolapsed tissue. In patients with CUOB, the sensation of vaginal bulging could partially offset overactive bladder symptoms. On the other hand, persistent prolapse without treatment appears to contribute to declining detrusor strength and the eventual development of underactivity [10, 11]. Some authors have proposed that the urodynamic similarities between CUOB and detrusor overactivity suggest these conditions may exist on a spectrum, with combined overactivity and underactivity representing the more advanced stage of detrusor dysfunction in CUOB cases [10, 11]. Prior investigations noted that individuals showing both overactivity and impaired contractility tend to be older and more often experience urinary retention or voiding difficulties than those with overactivity alone [22]. Overall, advancing age combined with reduced estrogen levels appears to promote CUOB through gradual cellular injury and programmed cell death. The present urodynamic data indicate that CUOB, accompanied by anterior wall prolapse, is marked by reduced Qmax, increased positive post-void residual, lower Schäfer scores, decreased BCI, and poorer contractility, underscoring the impact of obstruction. It appears that in approximately half of CUOB cases, mechanical obstruction plays a central role in the development of weakened bladder contractility. When cystocele is absent, CUOB is likely due to a range of age-related health issues. Therefore, CUOB with anterior vaginal prolapse and CUOB without it should be regarded as two distinct clinical entities.

Research has demonstrated that surgical correction of prolapse results in a substantial decrease in CUOB symptoms, with low detrusor pressure at the start of voiding being the only independent factor predicting CUOB persistence after surgery [10, 11]. It is reasonable to expect that greater preoperative detrusor damage and more pronounced loss of contractility will lead to poorer recovery of bladder function following prolapse repair. Consequently, when CUOB results from outlet obstruction caused by prolapse, addressing the prolapse itself should take priority to prevent long-term complications. This approach is especially relevant because pharmacological options intended to strengthen contractions or relieve outlet resistance are of limited usefulness in women. In contrast, prolapse management with pessaries or surgery is generally safe and uncomplicated in the large majority of cases.

Both CUOB and combined detrusor overactivity–underactivity share features with overactive bladder syndrome, including urge incontinence and voiding difficulties, and display elements of both excessive and insufficient bladder activity. Nevertheless, the diagnosis of CUOB is primarily based on clinical presentation rather than urodynamic findings [20, 22]. Urodynamic testing, however, continues to offer valuable support for accurate diagnosis and treatment planning.

The current study represents the first attempt to separate women with CUOB according to the presence or absence of significant anterior wall prolapse. The collected urodynamic values and POP-Q measurements supply initial reference data that may assist in designing future comparative research involving similar patients. The main advantage of this work lies in the sizable number of women confirmed to have CUOB. Among the limitations are the retrospective nature of the analysis and the variety of clinical indications prompting urodynamic evaluation.

These results reinforce the view that mechanical outlet obstruction contributes to the development of CUOB in a substantial subset of cases. However, the complete pathophysiological relationship between prolapse and CUOB remains unclear and requires further investigation.

Conclusion

Based on the present results, we believe that CUOB warrants a more refined categorization. Even though CUOB is defined clinically, urodynamic studies continue to play an important role in its evaluation, treatment decisions, and follow-up. Surprisingly, the frequency of detrusor overactivity on urodynamics was comparable between women with and without anterior wall prolapse, despite the lower occurrence of both urge and stress urinary incontinence in those with cystocele. The overactivity observed on urodynamic traces may represent compensatory hypertrophy that has not yet reached the level required to cause prominent incontinence.

Peak flow rate (Qmax) was modestly reduced in women with prolapse, most likely because of mechanical obstruction. Distinguishing clinically between CUOB caused by outlet obstruction (with or without impaired contractility) and CUOB unrelated to obstruction may prove useful when planning prolapse correction. In summary, clear classification criteria and standardized urodynamic parameters for CUOB remain to be established. Additional research is required better to define the contribution of anterior prolapse to CUOB and to improve patient counseling, with the aim of more effectively relieving symptoms.

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