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Understanding the Health Characteristics and Treatment Choices of Older Men with Stress Urinary Incontinence

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Abstract

OBJECTIVE—To describe the health characteristics and current treatment choices of male stress urinary incontinence (mSUI) patients to inform patient-centered decision-making.

METHODS—We identified a cohort of mSUI patients aged ≥65 at UCSF and San Francisco VA. Using retrospective chart review and telephone interviews, we ascertained demographics, incontinence characteristics, Charlson Comorbidity Index (score ≥ 4 indicates significant morbidity), frailty with Timed Up and Go (TUG) test, functional dependence with activities of daily living (ADL), calculated life expectancy, and assessed mental health and quality of life (QOL). Bivariate analysis evaluated associations between subject characteristics and ultimate treatment type (conservative vs. surgery; sling vs. sphincter). Logistic multivariable models evaluating treatment choice were also constructed.

RESULTS—The 130 participants had a mean age of 75 and a mean incontinence score of 14.2 representing moderately bothersome incontinence. Nearly 80% had significant morbidity, three-quarters had >50% 10-year mortality risk, 10% needed help with 1+ADL and 22% had a TUG > 10 seconds indicating frailty. The mean physical and mental QOL scores were similar to

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the general population. Anxiety and depression were reported by 3.9% and 10%. In univariate and multivariable analysis, only incontinence characteristics were associated with conservative versus surgical treatment choice ($p < 0.01$).

CONCLUSION—Multi-morbidity, functional dependence, frailty, and limited life expectancy are common among older men with mSUI, yet current treatment choices appear to be driven by incontinence characteristics. As such, mSUI surgery should be considered among men across the spectrum of health and life expectancy.

Introduction

Approximately 40% of men with stress urinary incontinence (mSUI) are ≥65 years old and 70% of operations for mSUI are performed in men ≥70 years old.[1] Choice of treatment for mSUI is complex given that complications and need for future surgery vary significantly between treatment types, as well as the need to consider the patients' cognition and dexterity to operate a mechanical device in the case of an artificial urinary sphincter (AUS). Thus, determining which mSUI treatment to pursue requires an individualized approach that considers treatment options in the context of patient characteristics. Many older adults who present for mSUI treatment might have unrecognized functional or cognitive limitations that could impact their treatment decision-making or outcomes. Frailty is not uncommon among community-dwelling men with lower urinary tract symptoms and multimorbidity is common among older adults and has been shown to be associated with surgical complications.[2–4] Other studies have shown the association between geriatric conditions and surgical outcomes.[5–7] Furthermore, it has been suggested that mSUI treatment is underutilized, and this may be related to concerns that patients are older and with significant comorbidities, which may lead to both patients and physicians to shy away from offering surgical treatment despite the known quality of life (QOL) improvement after mSUI surgery.[8]

Research in other fields has shown that geriatric conditions and syndromes can affect treatment decision-making. For example, frailty was found to be associated with treatment decisions in older women with breast cancer facing surgery.[9] In another example, the use of a comprehensive geriatric assessment among older patients with hip fracture affected decision-making about whether to pursue surgery.[10] In other studies, physical performance status, age, and comorbidities have all found to be associated with treatment decisions.[11–13] Despite this, these patient health characteristics have not been comprehensively assessed in the mSUI patient population.[14,15]

To address this gap, given the older age of these patients and the complexity of decision-making for mSUI, we sought to describe the health characteristics and functional status of this patient population that might be useful to inform patient-centered decision-making. We recruited a cohort of older men with mSUI and examined the prevalence of physical and mental health conditions, functional limitations and frailty. We also examined the association of these factors with treatment decisions. We hypothesized that poor health and functional limitation would be common but not necessarily associated with treatment decisions, given that these are often driven by incontinence characteristics.

Methods

Participants and Data Collection

We recruited men age ≥65 years of age at University of California San Francisco (UCSF) and the San Francisco Veterans Affairs Healthcare System (SFVAHCS) who underwent initial consultation for mSUI (International Classification of Diseases 9/10 diagnosis code 788.32/N39.3) between June 2015 and March 2020 and had not previously undergone surgery for male SUI. These institutions serve as high-volume centers of excellence for mSUI treatment, with reconstructive-trained urologists providing counseling and treatment. We recruited participants by phone, using electronic medical record (EMR) review and a telephone survey to assess various characteristics among those who consented (Supplemental Table 1). Participants were provided a $20 Amazon gift certificate after completion of the interview. Institutional Review Board approval for the study was obtained at the University of California, San Francisco.

Measures

Our primary measures of interest were characteristics commonly identified among older adults that may impact treatment decision-making, including comorbidities, functional status, frailty, life expectancy, mental health, cognition, and QOL. Comorbidities were obtained from the EMR and compiled into a Charlson Comorbidity Index (CCI) score.[16] Functional status was assessed using a brief disability screen, comprised of a 5-question combination of activities of daily living and instrumental activities of daily living based on the Health and Retirement Study.[17] Frailty was assessed using the Timed Up and Go test (prefrail/frail > 10 seconds) which had been previously administered to a subset of patients when they were seen in clinic.[18] In addition, we used the the Lee Index to estimate 10-year life expectancy defined by a cut-point of 50% mortality in 10 years.[19]

Mental health measures included assessment of anxiety by the Generalized Anxiety Disorder 2-item scale[20] and depression via the Patient Health Questionnaire 2-item scale.[21] Cognition was measured by the Short Portable Mental Status Questionnaire.[22] Finally, general QOL was assessed using the Patient-Reported Outcomes Measurement Information System (PROMIS®) Global Health v1.2 measure, which is intended as a generic self-assessment of individuals' health and QOL and is divided into physical and mental QOL subscores (reported as a T-score where 50 represents the mean of the reference population with a standard deviation of 10).[23]

Demographics assessed included age, race, education, marital status, and health literacy. Health literacy was assessed using a single question "How confident are you filling out medical forms by yourself?" with answers of "somewhat", "a little", nor "not at all" considered low health literacy. Details about the etiology and type of incontinence (pure stress versus urge symptoms present at consultation) as well as prior radiation or hormone therapy were obtained from EMR extraction. Participants were asked to recall baseline (pre-consultation) and current incontinence characteristics by completing the International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form (ICIQ-UI-SF). This is a validated patient-reported outcome measure which provides an overall

incontinence score which ranges from 0 (no incontinence) to 21 (significant, bothersome incontinence) as well as provides detailed incontinence characteristics such as the frequency, amount, and interference of urinary incontinence.[24]

Statistical Analysis

Descriptive summary statistics are reported using mean ± standard deviation for continuous variables and number and and percentages for categorical data. Bivariate analyses were carried out to evaluate the association between patient characteristics of interest and ultimate treatment type using one-way analysis of variance, and Chi-squared or Fisher's exact test where appropriate.

Using multivariable models we examined the association of patient characteristics with overall choice of surgical versus conservative treatment. In a second model, we also examined the association of patient characteristics with sling versus sphincter surgery. STATA 16.1 was used for analysis with p-value of <0.05 considered significant.

RESULTS

Out of 186 eligible participants, 130 completed the interview and were included for analysis (70%), with a mean time since consultation of 31.6 ± 15.8 months (Table 1). Participants were on average 75 years of age, mostly white (87%), college-educated (76%), married (79%), and about 4% had low health-literacy. Incontinence was due to surgery alone in 45% of cases and combined surgery and radiation in 53% of cases, with the vast majority related to an underlying prostate cancer diagnosis.

Incontinence Characteristics

At the time of consultation, the majority of men reported leaking a moderate (55%) or large (25%) amount of urine, with the vast majority reporting leakage occurring daily (12%), several times per day (32%), or all the time (53%). Leakage was noted to have moderate interference with daily activities, with a mean interference score of 5.7 ± 3.2 on a scale of 0 (not at all) to 10 (a great deal). Slightly less than one-quarter (22%) of individuals endorsed concomitant urge symptoms. The mean pre-consultation ICIQ-UI-SF score of the cohort was 14.2 ± 4.4 (12.1 ± 4.2 for those ultimately electing conservative management vs. 16.6 ± 3.4 for those ultimately electing surgical management), representing moderate leakage and interference. We evaluated the difference between pre-consultation and current incontinence scores, finding that the mean current ICIQ-UI-SF score of the cohort was 9.0 ± 5.1 (10.9 ± 4.7 for conservative management vs. 6.9 ± 4.8 for surgical management). Using a t-test we found that participants who had undergone surgical treatment had much larger improvements in their incontinence scores (+9.7, $p < 0.01$) compared to participants who did not undergo surgery (+1.2, $p = 0.01$).

Comorbidities and Functional Status

The mean CCI of the cohort was 5.2, with 79% having a score ≥4 indicating significant multimorbidity. When prostate cancer was removed as a solid tumor from the CCI calculation, the mean index score still remained high at 4.6, with 59% having a score of

≥ 4. In the entire cohort, one in 10 (10.0%) men reported needing help with 1 or more ADL. The mean TUG score, which was obtained in 79% of our population, was 9.6 ± 2.4 seconds, with 22% of those with TUG data having a score of > 10 seconds indicating prefrail or frail status. The mean upper extremity function scores was 52.9 ± 3.6, which is within the range of the reference population. Nearly three-quarters of men (71.5%) had a 10-year mortality risk greater than 50%, indicating a life expectancy less than 10 years.

Mental Health & Cognition

Overall, fewer than 4% of men met the criteria for anxiety while nearly 10% met criteria for depression. None in the cohort met criteria for cognitive impairment. Overall physical and mental QOL were comparable to the general population (mean T-score 51.3 ± 9.1 and 55.6 ± 8.4, respectively, compared to a general population mean of 50).

Health and Incontinence Characteristics by Treatment Type

When evaluating whether geriatric conditions were correlated with treatment type, neither age nor any of the health characteristics assessed were found to be significantly associated with choice of surgical versus conservative management (all $p > 0.05$). (Table 2, Figure 1) Incontinence characteristics were significantly associated with surgical versus conservative management, with those electing to undergo surgery having greater amounts and frequency of leakage, higher overall incontinence scores, and greater leakage interference (<0.01 for all). Several multivariate models were considered utilizing incontinence score as the marker for incontinence: (1) incorporating only health variables significant on univariate analysis, (2) incorporating health variables with a p-value of <0.3 on univariate analysis, and (3) incorporating conditions of interest such as age, comorbidity, mortality, functional status, and frailty. However, in all of these models, only incontinence score was significantly associated with conservative versus surgical treatment choice, where higher (worse) incontinence scores were associated with surgical treatment choice ($p < 0.01$).

Comparing those who underwent sling versus AUS surgery, those who underwent sling procedures were less likely to have had radiation ($p < 0.01$) and had lower TUG scores (<0.01) but otherwise did not have any significant differences between incontinence or other characteristics. (Table 2) In a multivariate model including radiation and TUG scores (adjusted $R^2 = 0.39$), radiation remained significantly associated with undergoing AUS surgery (OR 24.1; 2.38, 244.05) and TUG did not quite reach significance (OR 1.9; 0.92, 3.84). In a forward stepwise regression model optimizing for adjusted R^2 (adjusted $R^2 = 0.62$), prior radiation (OR 99.8; 1.89, 5256.86) and lower age (OR 0.57; 0.32, 0.99) were significantly associated with choosing sphincter surgery, increasing TUG score (OR 3.13; 0.98, 9.98) was nearly significant, and CCI was not significant.

DISCUSSION

In this study of men ≥ 65 years of age who presented for a discussion of SUI evaluation and management, we identified a high proportion with significant multi-morbidity and low life expectancy, as well as functional limitations and markers of frailty among a significant minority. This study adds to the existing literature given that, unlike utilization

of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) data which reports only on patients who have undergone surgery, our cohort includes participants who ultimately elected not to pursue surgery and thus creates a robust comparison between surgical and conservative management. Based on our cohort, choice of conservative versus surgical treatment appeared to be driven solely by incontinence characteristics and not by health conditions or life expectancy. These findings underscore the concept that treatment of mSUI focuses on QOL improvements, and should be considered among men with a broad spectrum of health and life expectancy.

In our study, we found a high rate of comorbidities in this patient population. One comprehensive NSQIP study found that about 55% of individuals undergoing sling or sphincter surgery had a CCI ≥4, with the most common comorbidities being hypertension and diabetes.[25] In line with our findings, they reported that the overall health of the patient did not appear to affect the choice of procedure, with similar CCIs between those undergoing slings and sphincters ($p = 0.425$). Importantly, we additionally found that CCI did not differ between those electing conservative versus surgical treatment. While comorbidity scores have been utilized in general to predict surgical outcomes such as complications, readmission, and short-as well as longer-term mortality rates, CCI has not been found to be associated with complications in those undergoing slings or sphincters based on NSQIP data.[8] This likely speaks to the point that specific comorbidities such as history of radiation or prior urethral surgery may be more important to outcomes in this patient group than an overall comorbidity index. In addition, comorbidity assessment alone cannot capture more global outcomes such as mental and physical functional outcomes that may be important to older adults.

One in ten men in our cohort reported needing help with 1 or more ADL and the mean TUG score was 9.6, with nearly one-third being frail or pre-frail. In the surgical subset of our cohort, men undergoing sphincter placement had a greater chance of meeting criteria for frail or pre-frail status. This aligns with recent NSQIP data showing that 47% of those undergoing sphincters and 42% undergoing slings had one Frailty Index condition and 25% of those with AUS and 19% of those with slings had two or more Frailty Index conditions.[8] As shown in other surgical fields, considering frailty has had a significant influence on surgical treatment decision-making.[9,10] Evaluation of functional status and frailty preoperatively has been shown to help identify at-risk individuals and allow optimization of health and functional status to reduce adverse post-operative outcomes and improve care coordination.[26,27] In relation to mSUI surgery in particular, the data are mixed. One NSQIP study found that among those undergoing AUS surgery, frailty was associated with an increased likelihood of major surgical complications.[28] On the other hand, another study of NSQIP data evaluating frailty among those who underwent slings and AUS found that frailty was not associated with complications in either group.[8]

Yet even apart from the importance to surgical outcomes, functional status and frailty also have implications for conservative management of male SUI; if individuals are functionally impaired, they may have more difficulty with and adverse events related to incontinence. Incontinence itself is a known independent predictor of functional limitations and is associated with increased falls, which can result in injuries and further

mobility impairment.[29,30] Thus limited functional status should not preclude patients from undergoing mSUI surgery, but identification of limitations may be helpful for optimizing perioperative outcomes.

Multiple conditions contribute to estimating life expectancy and in our cohort, nearly 75% had a life expectancy of less than 10 years, with almost 10% having a 10-year mortality risk of > 82%. In our cohort, many with low life expectancy still pursued surgical treatment, showing that mSUI is still a critical issue that affects individuals' QOL and one that they are interested in addressing despite their shortened life expectancy given that mSUI treatment can provide near-term QOL improvements.[31–34] Rather than withhold mSUI treatment from these older adults, we need to develop meaningful ways to counsel patients about mSUI management in the context of shortened life expectancy while identifying and mitigating the negative effects of comorbidities, cognition, and function to improve outcomes.

Our study does have several limitations. Overall this represents a cohort that is mostly white and college-educated with high health literacy who received care in two facilites in San Francisco. This relatively homogenous study cohort could result from a variety of explanations, including the population who is being offered prostatectomy for prostate cancer in the first place, the population that is getting referred for mSUI evaluation and treatment, or the makeup of the local population itself. In addition, the retrospective nature of the study also means that some of the variables reported rely on information collected at the time of the interview rather than at the time of consultation. To further investigate the recollected incontinence scores, we evaluated the change in ICIQ-UI-SF for conservative versus surgical management, finding only a small improvement in conservatively managed incontinence scores from pre-consultation to present, and a much larger improvement among those individuals who pursued surgery. Given that these findings aligned with our expectations of how the incontinence scores would change based on treatment type, we believe this can at least somewhat temper unavoidable concerns about recollection bias.. In addition, we analyzed geriatric characteristics based on whether the patient completed the telephone survey within a year of their initial consultation or greater than a year out, and found no significant differences in any of the geriatric conditions when making this comparison. (Supplemental Table 2) Finally, it is important to note that treatment decisions are two-sided, and our data did not include any evaluation of the physician factors that drove treatment recommendations, which is an area that warrants future study.

Despite these limitations we believe these data offer an in-depth look at the health characteristics and functional status among this vulnerable patient population as well as an understanding of what is driving current treatment decisions. While treatment choices do not currently differ by health characteristics, identifying health characteristics that affect perioperative outcomes could help improve individualized assessment and counseling. Furthermore, evaluating the impact of these characteristics on treatment satisfaction may help improve treatment decision-making in the future.

CONCLUSION

Multi-morbidity, functional dependence, frailty, and limited life expectancy are common among older men with mSUI. Identifying and optimizing health characteristics that could affect treatment outcomes might improve individualized assessment, counseling, decision-making, and perioperative outcomes. However, given that mSUI surgery has the potential to offer near-term QOL improvements to this patient population, mSUI surgery should be considered among men across the spectrum of health and life expectancy. Current treatment choices appear to be driven by incontinence characteristics alone, and future work will need to examine whether these other common health characteristics have an impact on patient satisfaction with treatment decisions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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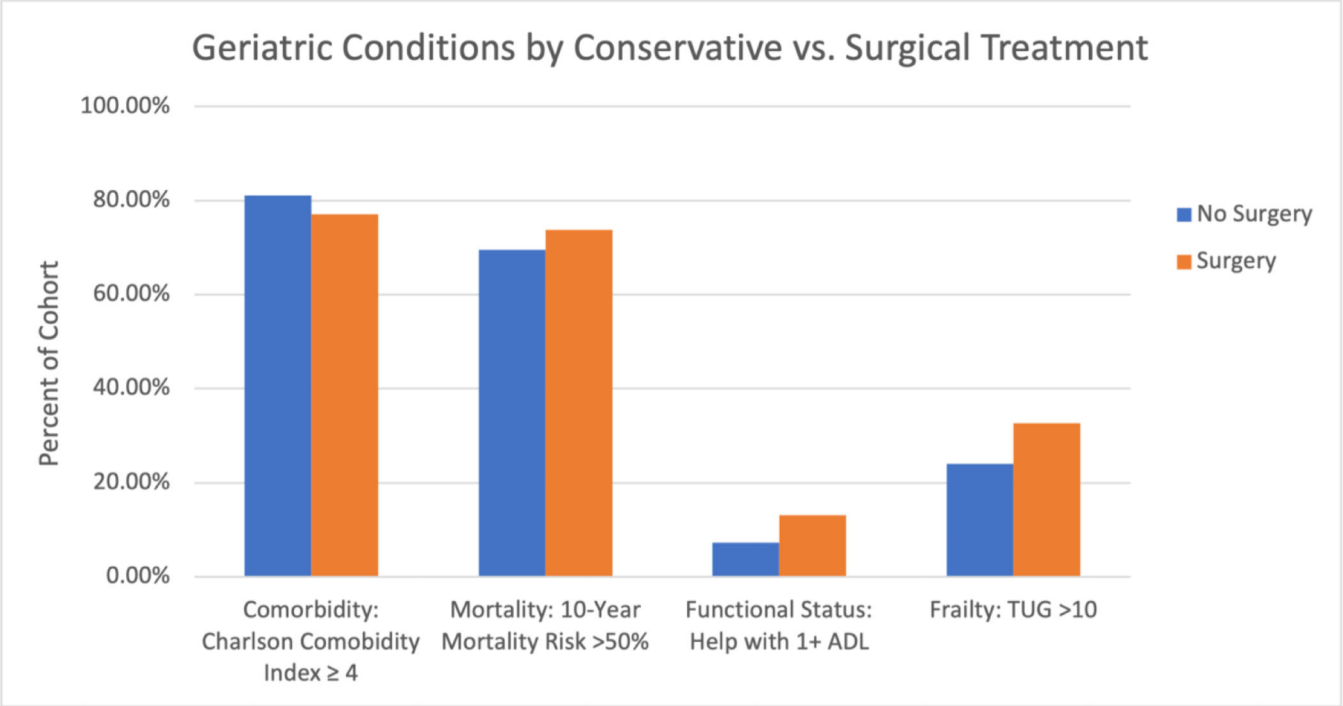

Figure 1:
Geriatric Conditions by Conservative vs. Surgical Treatment

TABLE 1:

Characteristics of Older Men Presenting for Stress Urinary Incontinence Consultation

	All N = 130
DEMOGRAPHICS	
Age (mean ± SD)	74.9 ± 4.6
Race: White (vs. non-white) – n (%)	113 (86.9%)
Education: College grad – n (%)	99 (76.2%)
Marital status: Married/partnered – n (%)	102 (78.5%)
Health literacy (low) – n (%)	5 (3.9%)
INCONTINENCE CHARACTERISTICS	
Etiology	
H/o surgery only – n (%)	58 (44.6%)
H/o surgery + XRT – n (%)	69 (53.1%)
Other etiology – n (%)	3 (2.3%)
Prior radiation – n (%)	71 (54.6%)
Prior hormone therapy – n (%)	30 (23.1%)
Amount of leakage – n (%)	
Small amount	25 (19.2%)
Moderate amount	72 (55.4%)
Large amount	32 (24.6%)
Frequency of leakage – n (%)	
2–3 times per week	3 (2.3%)
Daily	15 (11.5%)
Several times a day	42 (32.3%)
All the time	69 (53.1%)
Leakage interference, 0–10 (mean ± SD)	5.7 ± 3.2
Incontinence score[1] (mean ± SD)	14.2 ± 4.4
Urge symptoms at presentation – n (%)	29 (22.3%)
COMORBIDITIES & FUNCTIONAL STATUS	
Charlson Comorbidity Index (mean ± SD)	5.2 ± 2.0
10-year mortality risk[2] > 50% – n (%)	93 (71.5%)
Functional status: help with 1+ ADL – n (%)	13 (10.0%)
TUG score[3] (mean ± SD)	9.6 ± 2.4
Prefrail/Frail: TUG[3] > 10 seconds – n (%)	29 (22.3%)
MENTAL HEALTH & COGNITION	
Anxiety[4] – n (%)	5 (3.9%)

	All N = 130
Depression[5] – n (%)	13 (10.0%)
Cognitive impairment[6] – n (%)	0
Physical QOL[7] (mean ± SD)	51. 3 ± 9.1
Mental QOL[7] (mean ± SD)	55.6 ± 8.4

[1] Incontinence score determined by International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form. Score ranges from 0 (no incontinence) to 21 (significant, bothersome incontinence).

[2] 10-year mortality determined by the Lee Index

[3] TUG – Timed Up and Go Test. TUG score of > 10 seconds indicates prefrail or frail.

[4] Anxiety determined by Generalized Anxiety Disorder 2-item scale (GAD-2)

[5] Depression determined by Patient Health Questionnaire 2-item scale (PHQ-2)

[6] Cognitive impairment determined by Short Portable Mental Status Questionnaire (SPMSQ)[7] Cognitive impairment determined by Short Portable Mental Status Questionnaire (SPMSQ)

[7] Physical and mental QOL determined by PROMIS Scale v1.2 - Global Health. Raw scores are transformed into a standardized T-score where 50 represents the mean of the reference population with a standard deviation of 10.

Table 2:

Analysis of Health and Incontinence Characteristics by Treatment Type

	Conservative vs Surgical Treatment			**Sling vs. Sphincter Surgery**		
	No Surgery N = 69	**Surgery N = 61**	**p-value**	**Sling N = 12**	**Sphincter N = 49**	**p-value**
DEMOGRAPHICS						
Age (mean ± SD)	74.7 ±4.8	75.1 ±4.4	0.66	76.7 ±4.2	74.7 ± 4.3	0.16
INCONTINENCE CHARACTERISTICS						
Etiology			0.65			**<0.01**
H/o surgery only – n(%)	33 (47.8%)	25 (41.0%)		11 (91.7%)	14 (28.6%)	
H/o surgery + XRT – n (%)	35 (50.7%)	34 (55.7%)		1 (8.3%)	33 (67.4%)	
Other etiology – n (%)	1 (1.5%)	2 (3.3%)		0	2 (4.1%)	
Prior radiation	36 (52.2%)	35 (57.4%)	0.60	1 (8.3%)	34 (69.4%)	**<0.01**
Amount of leakage			**<0.01**			0.99
Small amount	21 (30.4%)	4 (6.7%)		1 (8.3%)	3 (6.3%)	
Moderate amount	40 (58.0%)	32 (43.3%)		6 (50.0%)	26 (54.2%)	
Large amount	8 (11.6%)	24 (40.0%)		5 (41.7%)	19 (39.6%)	
Frequency of leakage			**<0.01**			0.24
2–3 times per week	3 (4.4%)	0		0	0	
Daily	14 (20.3%)	1 (1.7%)		1 (8.3%)	0	
Several times a day	28 (40.6%)	14 (23.3%)		2 (16.7%)	12 (25.0%)	
All the time	24 (34.8%)	45 (75.0%)		9 (75.0%)	36 (75.0%)	
Incontinence score[1] (mean ± SD)	12.1 ± 4.2	16.6 ± 3.4	**<0.01**	16.7 ± 4.2	16.5 ± 3.2	0.90
Leakage interference, 0–10 (mean ± SD)	4.4 ± 3.0	7.2 ± 2.8	**<0.01**	7.3 ± 3.1	7.1 ± 2.7	0.80
Urge symptoms at presentation	18 (27.7%)	11 (19.6%)	0.39	3 (27.3%)	8 (17.8%)	0.67
COMORBIDITIES & FUNCTIONAL STATUS						
Charlson Comorbidity Index (mean ± SD)	5.2 ± 2.0	5.2 ± 2.0	0.96	5.2 ± 1.9	5.2 ± 2.1	0.93
10-year mortality risk[2] > 50% – n (%)	48 (69.6%)	45 (73.8%)	0.60	10 (83.3%)	35 (71.4%)	0.49
Functional status: help with 1+ ADL – n (%)	5 (7.2%)	8 (13.1%)	0.38	0	8 (16.3)	0.34
TUG score[3] (mean ± SD)	9.1 ± 1.8	10.0 ± 2.9	0.06	8.2 ± 1.0	10.5 ± 3.1	**0.03**
Prefrail/Frail: TUG[4] > 10 seconds – n (%)	13 (18.8%)	16 (26.2%)	0.33	0	16 (40.0%)	**0.02**
MENTAL HEALTH & COGNITION						
Anxiety[5] – n (%)	3 (4.34%)	2 (3.3%)	1.00	0	2 (4.1%)	0.99
Depression[6] – n (%)	6 (8.7%)	7 (11.5%)	0.77	0	7 (14.3%)	0.33
Cognitive impairment[7] – n (%)	0	0		0	0	

	Conservative vs Surgical Treatment			Sling vs. Sphincter Surgery		
	No Surgery N = 69	**Surgery N = 61**	**p-value**	**Sling N = 12**	**Sphincter N = 49**	**p-value**
Physical QOL[8] (mean ± SD)	51.4 ± 8.4	51.3 ± 9.9	0.94	54.6 ± 7.9	50.5 ± 10.2	0.20
Mental QOL[8] (mean ± SD)	55.6 ± 8.3	55.2 ± 8.6	0.58	55.9 ± 7.4	55.0 ± 9.0	0.74

[1]Incontinence score determined by International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form. Score ranges from 0 (no incontinence) to 21 (significant, bothersome incontinence).

[2]10-year mortality determined by the Lee Index

[3]TUG – Timed Up and Go Test. TUG score of > 10 seconds indicates prefrail or frail.

[4]Upper extremity function determined by Neuro-QOL Short Form v1.0 - Upper Extremity Function: Fine Motor ADL. Raw scores are transformed into a standardized T-score where 50 represents the mean of the reference population with a standard deviation of 10.

[5]Anxiety determined by Generalized Anxiety Disorder 2-item scale (GAD-2)

[6]Depression determined by Patient Health Questionnaire 2-item scale (PHQ-2)

[7]Cognitive impairment determined by Short Portable Mental Status Questionnaire (SPMSQ)

[8]Physical and mental QOL determined by PROMIS Scale v1.2 - Global Health. Raw scores are transformed into a standardized T-score where 50 represents the mean of the reference population with a standard deviation of 10.