Adult Urodynamics: American Urological Association (AUA)/Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction (SUFU) Guideline

IDENTITY

Citation

· Winters JC, Dmochowski RR, Goldman HB, Herndon CD, Kobashi KC, Kraus SR, Lemack GE, Nitti VW, Rovner ES, Wein AJ. Adult urodynamics: American Urological Association (AUA)/Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction (SUFU) guideline. Linthicum (MD): American Urological Association (AUA); 2012 Apr. 30 p. [119 references]

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DEVELOPER

Developer Name

· American Urological Association

Conflict Of Interest Policy

Conflict Of Interest Disclosure

PURPOSE

Objective

· This guideline is intended to review the literature regarding the use of urodynamic testing in common LUT conditions and present the clinician with principles of application and technique. As UDS is only one part of the comprehensive evaluation of LUTS, these findings are intended to assist the clinician in the appropriate selection of urodynamic tests following an appropriate evaluation and symptom characterization. At this point, the clinician may utilize the principles in these guidelines to formulate urodynamic questions and select the appropriate urodynamic tests. The literature is inconclusive and “pure” symptomatology is rare; therefore, this guideline will not specify whether UDS testing should be done routinely in SUI or LUTS. The intent of this guideline is to identify concurrent factors and conditions in these patients and make recommendations regarding appropriate urodynamic techniques in these settings.

INTENDED AUDIENCE

Intended Users

· urologists

· urogynecologists
Care Setting

METHOD OF DEVELOPMENT
Rating Scheme
Evidence Quality Rating Scheme
· The AUA categorizes body of evidence strength as Grade A (well-conducted RCTs or exceptionally strong observational studies), Grade B (RCTs with some weaknesses of procedure or generalizability or generally strong observational studies) or Grade C (observational studies that are inconsistent, have small sample sizes or have other problems that potentially confound interpretation of data).
Recommendation Strength Rating Scheme
· STANDARDS are directive statements that an action should (benefits outweigh risks/burdens) or should not (risks/burdens outweigh benefits) be undertaken based on Grade A or Grade B evidence. RECOMMENDATIONS are directive statements that an action should (benefits outweigh risks/burdens) or should not (risks/burdens outweigh benefits) be undertaken based on Grade C evidence. OPTIONS are non-directive statements that leave the decision to take an action up to the individual clinician and patient because the balance between benefits and risks/burdens appears relatively equal or unclear; the decision is based on full consideration of the patient‘s prior clinical history, current quality of life, preferences and values. Options may be supported by Grade A, B, or C evidence. In some instances, the review revealed insufficient publications to address certain questions from an evidence basis; therefore, some statements are provided as Clinical Principles or as Expert Opinion with consensus achieved using a modified Delphi technique if differences of opinion emerged. A Clinical Principle is a statement about a component of clinical care that is widely agreed upon by urologists or other clinicians for which there may or may not be evidence in the medical literature. Expert Opinion refers to a statement, achieved by consensus of the Panel, that is based on members' clinical training, experience, knowledge and judgment for which there may be no evidence.
Qualifying Statement
Patient And Public Involvement

TARGET POPULATION
Inclusion Criterion
· adults
· lower urinary tract symptoms (LUTS)
Exclusion Criterion

KNOWLEDGE COMPONENTS

DEFINITIONS

Term:	occult SUI
Term Meaning:	stress incontinence observed only after the reduction of co-existent prolapse.

RECOMMENDATION: 1

Conditional: Clinicians who are making the diagnosis of urodynamic stress incontinence should assess urethral function. {Rec_1:Cond_ 1 }

Decision Variable: performing invasive urodynamics testing

Value: true

Decision Variable: urodynamic stress incontinence demonstrated

Value: true

Action: assess urethral function using Valsalva leak point pressure/abdominal leak point pressure (VLPP/ALPP)

Actor: clinicians

Verb: assess

Complement: urethral function using Valsalva leak point pressure/abdominal leak point pressure (VLPP/ALPP)

Deontic: should

Action: assess urethral function using lower cough leak point pressure (CLPP)

Actor: clinicians

Verb: assess

Complement: urethral function using lower cough leak point pressure (CLPP)

Deontic: should

Action: assess urethral function using maximal urethral closure pressure (MUCP)

Actor: clinicians

Verb: assess

Complement: urethral function using maximal urethral closure pressure (MUCP)

Deontic: should

Reason: During invasive UDS testing, the clinical tools necessary for assessment of urethral function (e.g., intravesical catheter) are already in place and, in patients with urodynamic SUI, a quantitative assessment such as VLPP should be performed synchronously with the demonstration of urodynamic SUI. Although the clinical utility of such a measurement is controversial, it may provide useful information in certain situations. Although not a universal finding, poor urethral function, as suggested by lower cough leak point pressure (CLPP), Valsalva leak point pressure/abdominal leak point pressure (VLPP/ALPP), and/or maximal urethral closure pressure (MUCP) tends to predict less optimal outcomes with some types of therapy. Some clinicians may utilize information about urethral function obtained from an invasive UDS exam to guide surgical treatment decisions. In such situations, an assessment of

urethral function such as VLPP testing has clinical value and should be performed. For example, some clinical data suggest that certain anti-incontinence surgical procedures may have inferior outcomes in patients with low VLPP and/or low MUCP. In such cases, urethral function testing will potentially influence the choice of surgery. While CLPP has been reported to be superior in demonstrating urodynamic SUI as compared to VLPP/ ALPP both maneuvers can easily be performed to provide maximal information during routine invasive UDS.

Evidence Quality: Grade C

Recommendation Strength: Recommendation

Logic:

If
performing invasive urodynamics testing is [true]
AND
urodynamic stress incontinence demonstrated is [true]
Then
assess urethral function using Valsalva leak point pressure/abdominal leak point pressure (VLPP/ALPP)
OR
assess urethral function using lower cough leak point pressure (CLPP)
OR
assess urethral function using maximal urethral closure pressure (MUCP)

RECOMMENDATION: 2

Conditional: Surgeons considering invasive therapy in patients with SUI should assess PVR urine volume. {Rec_1:Cond_ 2 }

Decision Variable: stress urinary incontinence
Value: true

Decision Variable: considering invasive therapy
Value: true
Description: urethral bulking injection therapy or SUI surgery

Action: assess post-void residual (PVR) urine volume
Actor: surgeon
Verb: assess
Complement: post-void residual (PVR) urine volume
Deontic: should
Description: A PVR can be obtained in the office by bladder ultrasound or urethral catheterization. Ultrasound is less invasive and painful than catheterization and does not introduce the risk of

infection or urethral trauma. However, portable office ultrasound bladder scanners have a measure of operator independence and can be inaccurate in several clinical circumstances including obesity, prior lower abdominal surgery, cystic pelvic pathology, pregnancy, peritoneal dialysis and in the setting of ascites.

Description: Assessment of PVR is generally safe and inexpensive but can be associated with several pitfalls. A single elevated PVR should not be considered a satisfactory assessment of bladder emptying ability. For example, a falsely elevated PVR may result from rapid diuresis or psychogenic inhibition (e.g., patient difficulty with emptying due to environmental factors), amongst other factors. Thus, an elevated PVR should be confirmed with a second measurement at a subsequent office visit.

Reason: Although most studies have not demonstrated a clear association between PVR and treatment outcomes, PVR assessment is important for several reasons. PVR assessment, particularly if the PVR is elevated, can provide valuable information to the clinician and patients during consideration of treatment options. An elevated PVR is suggestive of detrusor underactivity, bladder outlet obstruction (BOO) or a combination of both. The exact clinical definition of "elevated" PVR volume remains unclear as does the optimal method of measurement (e.g., catheter, ultrasound). Nevertheless, patients with elevated preoperative PVR may be at an increased risk for transient or permanent postoperative voiding difficulties following urethral bulking injection therapy or SUI surgery. Additionally, postoperative urinary retention is not well defined, particularly regarding the volume and timing of urination in the postoperative period. Individuals who chronically carry an elevated residual volume or remain in chronic urinary retention are at increased risk of sequelae related to incomplete emptying such as ongoing voiding dysfunction, stone disease and recurrent UTIs.

Reason: Assessment of postoperative PVR can be helpful in evaluating new onset postoperative voiding dysfunction, and, ideally, a preoperative PVR should be available for comparison. For example, if patients present with new obstructive or OAB symptoms after anti-incontinence surgery that are suggestive of BOO, an elevated PVR (as compared to the preoperative value) may be one of the findings that supports such a diagnosis. Although de novo postoperative BOO may not be associated with an elevated PVR in all

cases, this finding can be helpful in directing further diagnostic testing and/or treatment.
Recommendation Strength: Expert Opinion
Logic:

If
stress urinary incontinence is [true]
AND
considering invasive therapy is [true]
Then
assess post-void residual (PVR) urine volume

RECOMMENDATION: 3

Conditional: Clinicians may perform multi-channel urodynamics in patients with both symptoms and physical findings of stress incontinence who are considering invasive, potentially morbid or irreversible treatments. {Rec_2:Cond_ 4 }

Decision Variable: symptoms of stress incontinence
Value: true
Decision Variable: physical findings of stress incontinence
Value: true
Decision Variable: considering invasive, potentially morbid or irreversible treatment
Value: true
Description: surgical therapy; bulking agent therapy
Action: clinicians may perform multi-channel urodynamics
Actor: clinicians
Verb: perform
Complement: multi-channel urodynamics
Deontic: may
Reason: While urodynamic assessment may provide valuable information for some clinicians in stress incontinent patients who are considering "definitive" therapy, UDS are not absolutely necessary as a component of the preoperative evaluation in uncomplicated patients. In such patients (previously defined as one who has symptoms and signs of SUI with no relevant prior surgery, no neurological history or symptoms, no major health concerns and no other pelvic pathology (e.g., POP) or other LUTS such as frequency, urgency, UUI, or nocturia), direct observation of urinary leakage with coughing or straining on physical examination may provide an adequate urethral assessment. UDS can be considered an option in the evaluation of such patients.
Reason: Information obtained from a multichannel UDS study may confirm or refute a diagnosis made based on history, physical examination and stress test alone. UDS may

also facilitate specific treatment selection and provide important data that promotes full and accurate preoperative counseling of patients.
Reason: Multichannel UDS has not been shown to correlate with outcomes of various interventions for SUI. However, UDS may alter the choice of therapy or provide guidance in patient selection to minimize the incidence of some postoperative voiding symptoms. With the addition of fluoroscopy to the UDS (VUDS), the reliability of the study for diagnosis of SUI and in assessing for concurrent conditions (e.g., BOO secondary to POP) may be enhanced. Although the literature is mixed with regard to specific treatment selection based on UDS parameters, clinicians may need to adjust the treatment plans if the UDS studies suggest findings other than those which were expected based on history and physical examination alone, such as lack of SUI, DO or incomplete emptying.
Evidence Quality: Grade C
Recommendation Strength: Option
Logic:

If
symptoms of stress incontinence is [true]
AND
physical findings of stress incontinence is [true]
AND
considering invasive, potentially morbid or irreversible treatment is [true]
Then
clinicians may perform multi-channel urodynamics

RECOMMENDATION: 4

Conditional: Clinicians should perform repeat stress testing with the urethral catheter removed in patients suspected of having SUI who do not demonstrate this finding with the catheter in place during urodynamic testing. {Rec_3:Cond_ 5 }

Decision Variable: complain of SUI symptoms
Value: true
Decision Variable: SUI is suspected based on history
Value: true
Decision Variable: the presence of documented SUI would change management
Value: true
Decision Variable: SUI demonstrated during Valsalva maneuvers
Value: false

Decision Variable: SUI demonstrated during cough testing
Value: false
Decision Variable: urodynamic testing with urethral catheter in place demonstrates SUI
Value: false
Action: remove urethral catheter
Verb: remove
Complement: urethral catheter
Deontic: should
Action: perform repeat stress testing
Verb: repeat
Complement: stress test
Deontic: should
Reason: A fundamental tenet of good urodynamic practice is to ensure that testing reproduces the patients' symptoms. If urodynamic testing does not demonstrate SUI in patients who complain of the symptom of SUI, it may not necessarily indicate that they do not have SUI, but may in fact suggest that the testing did not fully replicate symptoms.
Reason: Some patients with SUI demonstrated during physical examination will not have such findings during UDS with the urethral catheter in place. Removal of the urethral catheter will allow demonstration or "unmasking" of SUI in many of these individuals with repeat stress maneuvers. Over 50% of women with symptoms of SUI who do not demonstrate SUI with the urethral catheter in place will do so when it is removed. One study found that 35% of men with post -prostatectomy incontinence did not demonstrate SUI until after catheter removal. Removal of the urethral/ intravesical catheter renders the measured LPP to be based on the true intraabdominal pressure, which in most cases should very closely approximate the intravesical pressure.
Logic:

If
(complain of SUI symptoms is [true]
OR
SUI is suspected based on history is [true]
OR
the presence of documented SUI would change management is [true])
AND
SUI demonstrated during Valsalva maneuvers is [false]
AND
SUI demonstrated during cough testing is [false]
AND

urodynamic testing with urethral catheter in place demonstrates SUI is [false]
Then
remove urethral catheter
AND
perform repeat stress testing

RECOMMENDATION: 5

Conditional: In women with high grade pelvic organ prolapse (POP) but without the symptom of SUI, clinicians should perform stress testing with reduction of the prolapse. {Rec_4:Cond_ 7 }

Decision Variable: high grade pelvic organ prolapse (POP)
Value: true
Decision Variable: symptom of SUI
Value: false
Decision Variable: presence of SUI would change the surgical treatment plan
Value: true
Action: perform stress testing with reduction of the prolapse to evaluate for occult SUI
Actor: clinicians
Verb: perform
Complement: stress testing with reduction of the prolapse to evaluate for occult SUI
Deontic: should
Description: This can be done independently or during urodynamic testing. Prolapse can be reduced with a number of tools including but not limited to a pessary, a ring forceps or a vaginal pack. Manual prolapse reduction during stress testing is not recommended as this will inaccurately assess VLPP. During such testing, the investigator should be aware that the instrument utilized for POP reduction may also obstruct the urethra creating a falsely elevated VLPP or prevent the demonstration of SUI.
Reason: Occult SUI is defined as stress incontinence observed only after the reduction of co-existent prolapse. A significant proportion of women with high grade POP who do not have the symptom of SUI will be found to have occult SUI. If the presence of SUI would change the surgical treatment plan, stress testing with reduction of the prolapse to evaluate for occult SUI should be performed.
Evidence Quality: Grade C
Recommendation Strength: Option
Logic:

If
high grade pelvic organ prolapse (POP) is [true]
AND
symptom of SUI is [false]
AND
presence of SUI would change the surgical treatment plan is [true]
Then
perform stress testing with reduction of the prolapse to evaluate for occult SUI

Conditional: Multichannel urodynamics with prolapse reduction may be used to assess for occult stress incontinence and detrusor dysfunction in these women with associated LUTS. {Rec_4:Cond_ 26 }

Decision Variable: high-grade pelvic organ prolapse (POP)

Value: true

Decision Variable: associated lower urinary tract symptoms (LUTS)

Value: true

Description: Such as elevated PVR or urinary retention

Action: multichannel urodynamics with prolapse reduction may be used to assess for occult stress incontinence

Actor: clinicians

Verb: use

Complement: multichannel urodynamics with prolapse to assess for occult stress incontinence

Deontic: may

Reason: Multi-channel UDS can also assess for the presence of detrusor dysfunction in women with high grade POP. Some patients with high grade POP may have an elevated PVR or be in urinary retention. UDS with the POP reduced may facilitate evaluation of detrusor function and thus determine if the elevated PVR/ retention is due to detrusor underactivity, outlet obstruction or a combination of both. Invasive UDS may be performed both with and without reduction of the POP to evaluate bladder function. This may be helpful in the prediction of postoperative bladder function once the POP has been surgically repaired.

Logic:

If
high-grade pelvic organ prolapse (POP) is [true]
AND
associated lower urinary tract symptoms (LUTS) is [true]

Then
multichannel urodynamics with prolapse reduction may be used to assess for occult stress incontinence

RECOMMENDATION: 6

Conditional: Clinicians may perform multi-channel filling cystometry when it is important to determine if altered compliance, detrusor overactivity or other urodynamic abnormalities are present (or not) in patients with urgency incontinence in whom invasive, potentially morbid or irreversible treatments are considered. {Rec_5:Cond_ 8 }

Decision Variable: urgency incontinence
Value: true
Decision Variable: invasive treatment is being considered
Value: true
Decision Variable: potentially morbid treatment is being considered
Value: true
Decision Variable: irreversible treatment is being considered
Value: true
Action: Clinicians may perform multi-channel filling cystometry
Verb: perform
Complement: multi-channel filling cystometry
Deontic: may
Reason: Cystometry is the foundation in the assessment of urinary storage. When performing filling cystometry, a multi-channel subtracted pressure is preferred over a single-channel cystometrogram, which is subject to significant artifacts of abdominal pressure. In many uncomplicated cases, employing conservative treatments and empiric medical therapy for OAB without a urodynamic diagnosis is common and prudent practice. In patients with urinary urgency and/or urgency incontinence, filling cystometry, which provides subtracted pressure measurements, is the most accurate method in determining bladder pressure. channel filling cystometry offers the most precise method of evaluating bladder storage pressures. The main urodynamic findings of OAB are DO (phasic and tonic) and increased filling sensation. DO is characterized by involuntary phasic rises in detrusor pressure during filling, which may be associated with urinary leakage. Tonic abnormalities of compliance are fortunately easier to measure and do appear on cystometry more readily. Compliance assessment is a very important measurement in patients with neurogenic conditions at risk for upper urinary

tract complications as a result of high-pressure urinary storage.
Evidence Quality: Grade C
Recommendation Strength: Option
Logic:

If
urgency incontinence is [true]
AND
(invasive treatment is being considered is [true]
OR
potentially morbid treatment is being considered is [true]
OR
irreversible treatment is being considered is [true])
Then
Clinicians may perform multi-channel filling cystometry

RECOMMENDATION: 7

Conditional: Clinicians may perform pressure flow studies (PFS) in patients with urgency incontinence after bladder outlet procedures to evaluate for bladder outlet obstruction (BOO). {Rec_6:Cond_ 9 }

Decision Variable: bladder outlet procedure performed
Value: true
Decision Variable: post-procedure refractory urgency incontinence
Value: true
Action: Clinicians may perform PFS to evaluate for bladder outlet obstruction (BOO)
Actor: clinicians
Complement: pressure flow studies (PFS) to evaluate for bladder outlet obstruction
Deontic: may
Reason: Symptoms of bladder storage failure are a source of decreased patient satisfaction following treatment for SUI. It is imperative to determine the etiology of these symptoms as urinary obstruction, urethral injury, bladder injury and urethral erosion may present with storage symptoms. In addition to a comprehensive assessment and endoscopic examination, urodynamic testing may be useful. PVR volumes alone cannot diagnose outlet obstruction. The clinician should consider pressure flow testing to assess for BOO in patients with refractory urgency symptoms after a bladder outlet procedure. Although there is no urodynamic

standard for obstruction and the classical “high pressure/low flow” pattern characteristic of male BOO may not be found in obstructed women, the finding of an elevated detrusor voiding pressure in association with low flow may suggest obstruction, particularly in the presence of new onset filling/storage or emptying symptoms after surgery. In patients found to be obstructed, sling incision or urethrolysis may be beneficial and is frequently associated with symptom resolution. In women with significant elevations in PVR, urinary retention or definite alterations in voiding symptoms following an anti-incontinence procedure, these findings strongly imply BOO, and urodynamics may not be necessary before intervention.

Recommendation Strength: Expert Opinion

Logic:

If
bladder outlet procedure performed is [true]
AND
post-procedure refractory urgency incontinence is [true]
Then
Clinicians may perform PFS to evaluate for bladder outlet obstruction (BOO)

RECOMMENDATION: 8

Conditional: Clinicians should counsel patients with urgency incontinence and mixed incontinence that the absence of detrusor overactivity (DO) on a single urodynamic study does not exclude it as a causative agent for their symptoms. {Rec_7:Cond_ 10 }

Decision Variable: urgency incontinence
Value: true
Decision Variable: mixed incontinence
Value: true
Decision Variable: detrusor overactivity demonstrated on UDS
Value: false
Action: Clinicians should counsel patients that DO is not excluded as a causative agent for their symptoms.
Actor: clinicians
Verb: counsel
Complement: patients that DO is not excluded as a causative agent for their symptoms.
Deontic: should
Description: Urodynamic findings should be interpreted in the context of the global assessment,

including examination, diaries and residual urine as well as other pertinent information. Additionally, it is equally prudent in many cases to reserve urodynamic testing until after a failed empiric treatment or following consideration of a form of invasive therapy. In these situations, UDS is equally important in determining the presence or absence of other factors (e.g., SUI, BOO) that could influence treatment decisions.

Reason: The technical reasons for the inability to elicit the finding of DO in certain individuals, whether spontaneous or provoked, are unclear. Thus, it is very important to attempt to replicate symptoms as precisely as possible. Despite this, UDS may not diagnose DO even in patients who are very symptomatic.

Recommendation Strength: Clinical Principle

Logic:

If
(urgency incontinence is [true]
OR
mixed incontinence is [true])
AND
detrusor overactivity demonstrated on UDS is [false]
Then
Clinicians should counsel patients that DO is not excluded as a causative agent for their symptoms.

RECOMMENDATION: 9

Conditional: Clinicians should perform post-void residual (PVR) assessment, either as part of complete urodynamic study or separately, during the initial urological evaluation of patients with relevant neurological conditions (such as spinal cord injury and myelomeningocele) and as part of ongoing follow - up when appropriate. {Rec_8:Cond_ 11 }

Decision Variable: spinal cord injury (SCI)
Value: true
Decision Variable: myelomeningocele (MMC)
Value: true
Decision Variable: multiple sclerosis (MS)
Value: true
Decision Variable: Parkinson’s disease (PD)
Value: true
Decision Variable: stroke/cerebrovascular accident
Value: true
Decision Variable: traumatic brain injury (TBI)

Value: true
Decision Variable: brain tumor
Value: true
Decision Variable: spinal cord tumor
Value: true
Decision Variable: transverse myelitis
Value: true
Decision Variable: cauda equina syndrome
Value: true
Decision Variable: herniated disk
Value: true
Decision Variable: other back or spine disease
Value: true
Decision Variable: diabetes
Value: true
Decision Variable: peripheral nerve injury
Value: true
Decision Variable: cervical myelopathy
Value: true
Decision Variable: childhood history of posterior urethral valves
Value: true
Decision Variable: multiple systems atrophy
Value: true
Decision Variable: other relevant neurological conditions
Value: true
Action: Clinicians should perform PVR assessment during the initial urological evaluation
Actor: clinicians
Verb: perform
Complement: PVR assessment during the initial urological evaluation
Deontic: should
Description: either as part of complete urodynamic study or separately
Action: Clinicians should perform PVR assessment as part of ongoing follow -up when appropriate
Actor: clinicians
Verb: perform
Complement: PVR assessment as part of ongoing follow -up when appropriate
Deontic: should
Reason: Patients with a variety of neurological conditions may develop bladder dysfunction either early in the course of the disease or as the disease progresses. In these patients, PVR is a useful tool for assessing the possibility of significant

bladder and/or outlet dysfunction. In some cases such as SCI, the neurogenic bladder condition that ensues occurs abruptly, and after an initial period of stabilization (spinal shock), the resultant bladder function tends to be fairly fixed. In other cases, there tends to be progression of bladder dysfunction as the disease progresses (e.g., multiple sclerosis (MS), Parkinson's disease (PD)), although there exists considerable variability. In some conditions, bladder dysfunction occurs early, often before other neurological sequelae (multiple systems atrophy). In many conditions, perhaps none more notable than cerebrovascular accident, the development of bladder dysfunction can be profound, but the additional presence of mobility disturbances often clouds the issue of those symptoms that are due to neurogenic bladder versus functional disturbances. Notably, patients with these conditions and others (e.g., MMC, cervical myelopathy, childhood history of posterior urethral valves, transverse myelitis, disc disease) may not have classic lower urinary tract symptoms. Therefore, evaluation with PVR assessment is appropriate both at the time of diagnosis and after to monitor for changes in bladder emptying ability periodically regardless of the symptoms or at the discretion of the physician. In addition to those mentioned, other systemic conditions/treatments may affect bladder function. Among those most commonly mentioned are diabetes mellitus, chronic alcohol use, AIDS and radical pelvic surgery.
Reason: PVR assessment has been shown to influence treatment planning in a variety of neurological conditions. While the definition of elevated residual has varied (usually either a specific volume or proportion of overall bladder volume), the finding of elevated residual urine volume may influence decision making.53.53-55 The implications of an elevated PVR in neurogenic voiding dysfunction include the development of UTI's, urosepsis, upper tract deterioration and stone disease. The implementation of intermittent catheterization or consideration for surgical intervention to reduce PVR may be appropriate once the cause of elevated residual is determined. In this regard, the use of PVR may serve as a useful screening tool in patients who have already undergone complete urodynamic testing to determine the need for reassessment and/or change in bladder management. Ultimately, PVR results alone may not be sufficient to make certain management decisions without additional information (e.g., bladder compliance or poor detrusor contractility) obtained from a multichannel urodynamic study.
Evidence Quality: Grade B

Recommendation Strength: Standard
Logic:

If
spinal cord injury (SCI) is [true]
OR
myelomeningocele (MMC) is [true]
OR
multiple sclerosis (MS) is [true]
OR
Parkinson's disease (PD) is [true]
OR
stroke/cerebrovascular accident is [true]
OR
traumatic brain injury (TBI) is [true]
OR
brain tumor is [true]
OR
spinal cord tumor is [true]
OR
transverse myelitis is [true]
OR
cauda equina syndrome is [true]
OR
herniated disk is [true]
OR
other back or spine disease is [true]
OR
diabetes is [true]
OR
peripheral nerve injury is [true]
OR
cervical myelopathy is [true]
OR
childhood history of posterior urethral valves is [true]
OR
multiple systems atrophy is [true]
OR
other relevant neurological conditions is [true]
Then
Clinicians should perform PVR assessment during the initial urological evaluation
AND
Clinicians should perform PVR assessment as part of ongoing follow -up when appropriate

RECOMMENDATION: 10

Conditional: Clinicians should perform a complex cystometrogram (CMG) during initial urological evaluation of patients with relevant neurological conditions with or without symptoms and as part of ongoing follow-up when appropriate. {Rec_9:Cond_ 12 }

Decision Variable: spinal cord injury (SCI)

Value: true

Decision Variable: myelomeningocele (MMC)

Value: true

Decision Variable: at risk of renal impairment

Value: true

Action: Clinicians should perform a complex cystometrogram (CMG) during initial urological evaluation

Actor: clinicians

Verb: perform

Complement: a complex cystometrogram during initial urological evaluation

Deontic: should

Risk/Harm: While UDS typically carry risks of bleeding, discomfort and infection, the patient with NGB may be particularly prone to risk of infection due to the voiding disorder itself, which might be exacerbated by CMG. Perhaps more important is the concern of causing AD, which is well known in the NGB patient due to SCI and can be life threatening. The panel's consensus is that the clinician who performs CMG in the patient at risk for AD be adept in its detection and prompt management, including having necessary monitoring equipment and the ability to provide quick drainage and pharmacologic intervention when necessary.

Action: Clinicians should perform a complex cystometrogram (CMG) as part of ongoing follow-up when appropriate.

Actor: clinicians

Verb: perform

Complement: a complex cystometrogram (CMG) as part of ongoing follow-up when appropriate.

Deontic: should

Reason: Patients with a variety of neurological conditions can develop significant bladder dysfunction that may dramatically impact quality of life and renal function. While the interval of repeated CMG testing is debatable and often dependent on the findings of initial testing and/or patients' responses to initial interventions, CMG is recommended at the time of initial consultation (or after the spinal shock phase in the case of SCI) of patients for neurogenic bladder conditions due to SCI

and MMC and others thought to be at risk for the development of renal impairment. Performance of a CMG in patients with these and other neurological conditions will give an accurate assessment of detrusor dysfunction (e.g., neurogenic DO, hyporeflexia, areflexia, altered compliance) and may provide guidance as to appropriate management strategies. The maintenance of low intravesical pressures is a clinical tenet initially reported in MMC patients that has been adopted for other neurological conditions such as SCI. As such, CMG provides diagnostic, therapeutic and prognostic information in patients with SCI and MMC.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
(spinal cord injury (SCI) is [true]
OR
myelomeningocele (MMC) is [true])
AND
at risk of renal impairment is [true]
Then
Clinicians should perform a complex cystometrogram (CMG) during initial urological evaluation
AND
Clinicians should perform a complex cystometrogram (CMG) as part of ongoing follow-up when appropriate.

Conditional: In patients with other neurologic diseases, physicians may consider CMG as an option in the urological evaluation of patients with LUTS. {Rec_9:Cond_ 25 }

Decision Variable: multiple sclerosis (MS)
Value: true
Decision Variable: Parkinson's disease (PD)
Value: true
Decision Variable: cerebrovascular accident (CVA)
Value: true
Decision Variable: lower urinary tract symptoms (LUTS)
Value: true
Action: physicians may consider CMG as an option in the urological evaluation
Actor: physicians
Verb: consider
Complement: CMG as an option in the urological evaluation
Deontic: may

Reason: The utility of CMG in other neurological conditions (e.g., MS, PD, and CVA) is less clear, specifically regarding preservation of renal function. However, CMG remains an option for the better evaluation of detrusor dysfunction in these disease processes and has been shown to accurately diagnose detrusor dysfunction in these subgroups. Patients with neurological diseases such as MS, PD, and CVA who do not respond symptomatically to initial medical management or who develop voiding dysfunction/ impaired bladder emptying as a result of the disease process or treatments for bladder dysfunction may benefit from CMG testing, which allows for better diagnostic acumen and appropriate therapeutic intervention.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
(multiple sclerosis (MS) is [true]
OR
Parkinson's disease (PD) is [true]
OR
cerebrovascular accident (CVA) is [true])
AND
lower urinary tract symptoms (LUTS) is [true]
Then
physicians may consider CMG as an option in the urological evaluation

RECOMMENDATION: 11

Conditional: Clinicians should perform pressure flow analysis in patients with relevant neurologic disease with or without symptoms, or in patients with other neurologic disease and elevated PVR or urinary symptoms. {Rec_19:Cond_ 24 }

Decision Variable: relevant neurological disease
Value: true
Decision Variable: other neurologic disease
Value: true
Decision Variable: elevated post-void residual (PVR)
Value: true
Decision Variable: urinary symptoms
Value: true
Action: Clinicians should perform pressure flow analysis
Actor: clinicians
Verb: perform
Complement: pressure flow analysis

Deontic: should
Risk/Harm: The benefits of PFS must be weighed against the potential risks imposed especially in this population. While UDS typically carry risks of bleeding, discomfort and infection, patients with NGB may be particularly prone to risk of infection, which might be exacerbated by PFS. Perhaps more important is the concern of causing AD, which is well known in the NGB patient due to SCI and can be life threatening. The panel's consensus is that the clinician who performs PFS in the patient at risk for AD be adept in its detection and prompt management, including having necessary monitoring equipment and the ability to provide quick drainage and pharmacologic intervention when necessary.

Reason: Pressure flow studies (PFS) are an appropriate component of the work-up of NGB. This is especially true for those patients thought to be at risk for or found to have elevated PVR, hydronephrosis, pyelonephritis, complicated UTIs and frequent episodes of AD. This study can accurately distinguish between BOO and detrusor hypocontractility/acontractility. It is also valid for those patients who seek management for voiding disorders caused by NGB as a means to help delineate possible treatment options as well as monitor treatment outcomes.

Reason: Voiding disorders in this patient population can be caused by a variety of factors due to the NGB. Complicating matters even further is the possibility that "normal" pathophysiologic processes (e.g., BPH, OAB, incontinence) can often co-exist in the patient with NGB. Use of PFS for diagnostic purposes is especially pertinent in this population as the underlying neurologic disease could impact or obscure patient symptomology. The assessment of whether the voiding disorder is due to BOO versus weakened or absent detrusor function can be readily determined by PFS. PFS was also reported to be beneficial in the assessment of LUTS when NGB was present along with co-existing OAB and/or diabetes.

Evidence Quality: Grade C

Recommendation Strength: Recommendation

Logic:

If
relevant neurological disease is [true]
OR
(other neurologic disease is [true]

AND
elevated post-void residual (PVR) is [true])
OR
(other neurologic disease is [true]
AND
lower urinary tract symptoms is [true])
Then
Clinicians should perform pressure flow analysis

RECOMMENDATION: 12

Conditional: When available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics) in patients with relevant neurologic disease at risk for neurogenic bladder, or in patients with other neurologic disease and elevated PVR or urinary symptoms. {Rec_13:Cond_ 16 }

Decision Variable: spinal cord injury (SCI)
Value: true
Decision Variable: myelomeningocele (MMC)
Value: true
Decision Variable: multiple sclerosis (MS)
Value: true
Decision Variable: Parkinson's disease (PD)
Value: true
Decision Variable: stroke/cerebrovascular accident
Value: true
Decision Variable: traumatic brain injury (TBI)
Value: true
Decision Variable: brain tumor
Value: true
Decision Variable: spinal cord tumor
Value: true
Decision Variable: transverse myelitis
Value: true
Decision Variable: cauda equina syndrome
Value: true
Decision Variable: herniated disk
Value: true
Decision Variable: other back or spine disease
Value: true
Decision Variable: diabetes
Value: true
Decision Variable: peripheral nerve injury
Value: true
Decision Variable: cervical myelopathy
Value: true

Decision Variable: childhood history of posterior urethral valves

Value: true

Decision Variable: at risk for neurogenic bladder

Value: true

Action: when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)

Actor: clinicians

Verb: perform

Complement: fluoroscopy (when available) at the time of urodynamics (videourodynamics)

Deontic: may

Risk/Harm: The benefits of VUDS must be weighed against the potential risks, especially in this population. The risks of infection, bleeding, discomfort and especially AD have been previously mentioned. It is believed that these risks are more likely related to the other components of urodynamic testing, and the addition of fluoroscopic studies does not increase these risks. Although the radiation dosage of videourodynamic studies is low, radiation exposure is additive. These studies should be done in a manner which provides the desired clinical information at the lowest possible radiation dose to the patient.

Reason: The use of simultaneous fluoroscopy with contrast-based UDS is an appropriate component in the urodynamic assessment of patients with NGB. The ability to assess the lower and upper urinary tract with simultaneous fluoroscopic imaging improves the clinician's ability to detect and understand underlying pathologies. Visual assessment aids clinicians in their ability to delineate specific sites of obstruction, identify the presence and grade of vesicoureteral reflux as well as the urodynamic parameters that are present at the time of reflux, identify anatomic and physical abnormalities of the bladder such as bladder diverticula, bladder outlet abnormalities, and bladder stones and provide a more accurate means to diagnose DESD, detrusor bladder neck dyssynergia, and specific conditions (e.g., primary bladder neck obstruction (PBNO) and dysfunctional voiding).

Reason: VUDS has been found to improve the diagnostic evaluation of patients with NGB. VUDS permits diagnosis of bladder neck abnormalities in patients with NGB due to a variety of different neurologic conditions and in some cases may help distinguish the etiology of NGB with respect to the underlying neurological disease.

Reason: No relevant studies were found either supporting or refuting the use of VUDS to improve prognosis, clinical decision making or patient outcomes. Consensus amongst the panel confirmed that the addition of simultaneous fluoroscopy during CMG and PFS provided additional worthwhile information regarding the diagnosis beyond what either study alone could provide. Therefore, VUDS should be considered by the clinician when evaluating the patient with NGB. For example, in a patient with NGB, high PVR, urinary incontinence and hydronephrosis, the use of VUDS could delineate if vesicoureteral reflux was present and causing the hydronephrosis, if leakage was occurring due to storage problems or an incompetent outlet, whether obstruction was present or not and if so, specifically where the obstruction was localized and whether the obstruction was caused by DESD.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
(spinal cord injury (SCI) is [true]
OR
myelomeningocele (MMC) is [true]
OR
multiple sclerosis (MS) is [true]
OR
Parkinson's disease (PD) is [true]
OR
stroke/cerebrovascular accident is [true]
OR
traumatic brain injury (TBI) is [true]
OR
brain tumor is [true]
OR
spinal cord tumor is [true]
OR
transverse myelitis is [true]
OR
cauda equina syndrome is [true]
OR
herniated disk is [true]
OR
other back or spine disease is [true]
OR
diabetes is [true]

OR
peripheral nerve injury is [true]
OR
cervical myelopathy is [true]
OR
childhood history of posterior urethral valves is [true])
AND
at risk for neurogenic bladder is [true]
Then
when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)

Conditional: When available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics) in patients with relevant neurologic disease at risk for neurogenic bladder, or in patients with other neurologic disease and elevated PVR or urinary symptoms. {Rec_13:Cond_ 23 }

Decision Variable: other neurologic disease
Value: true
Decision Variable: post-void residual (PVR)
Value: true
Decision Variable: urinary symptoms
Value: true
Action: when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)
Actor: clinicians
Verb: perform
Complement: perform fluoroscopy (when available) at the time of urodynamics (videourodynamics)
Deontic: may
Logic:

If
other neurologic disease is [true]
AND
(post-void residual (PVR) is [true]
OR
urinary symptoms is [true])
Then
when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)

RECOMMENDATION: 13

Conditional: Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS in patients with relevant neurologic disease at risk for neurogenic bladder, or in patients with other

neurologic disease and elevated post-void residual (PVR) or urinary symptoms. {Rec_12:Cond_ 15 }

Decision Variable: spinal cord injury (SCI)
Value: true
Decision Variable: myelomeningocele (MMC)
Value: true
Decision Variable: multiple sclerosis (MS)
Value: true
Decision Variable: Parkinson's disease (PD)
Value: true
Decision Variable: stroke/cerebrovascular accident
Value: true
Decision Variable: traumatic brain injury (TBI)
Value: true
Decision Variable: brain tumor
Value: true
Decision Variable: spinal cord tumor
Value: true
Decision Variable: transverse myelitis
Value: true
Decision Variable: cauda equina syndrome
Value: true
Decision Variable: herniated disk
Value: true
Decision Variable: other back or spine disease
Value: true
Decision Variable: diabetes
Value: true
Decision Variable: peripheral nerve injury
Value: true
Decision Variable: cervical myelopathy
Value: true
Decision Variable: childhood history of posterior urethral valves
Value: true
Decision Variable: at risk for neurogenic bladder
Value: true
Action: Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS
Actor: clinicians
Verb: perform
Complement: EMG in combination with CMG with or without PFS
Deontic: should

Description: The signal source for measurement of EMG activity is the activity of the external urethral sphincter, the external anal sphincter and the pelvic floor musculature. The two most commonly used sources of measurement are surface electrodes and concentric needle electrodes. Needle placement may be a significant source of discomfort for patients, and reproducibility may be an issue without significant operator experience. The surface electrode has the advantage of ease (reproducibility) of placement and patient comfort. Although the signal source is less specific, surface electrodes can provide a good quality signal if properly used. The practical application of EMG involves determination of whether the perineal muscles are relaxed or contracting. The most important information provided by the EMG is the determination of whether perineal contractions are coordinated or uncoordinated with detrusor contractions.The major limitation of EMG testing is that this is a technically challenging, non-specific component of urodynamic testing. Artifacts are common, and interpretation of EMG requires close interaction between the clinician and the patient. The clinician must have a clear understanding of the history and any relevant physical findings. EMG alone rarely makes the diagnosis of an uncoordinated sphincter. The EMG diagnosis is taken into context with fluoroscopy, cystometry and flow rate in order to obtain the most accurate diagnosis.

Reason: Preservation of urinary tract integrity remains a primary goal in the long-term management of patients with neurogenic bladder. Patients presenting with abnormal compliance, detrusor external sphincter dyssynergia (DESD) and hydronephrosis are at higher risk for developing deterioration of renal function. EMG testing is a useful modality to assist in the diagnosis of DESD, which is characterized by involuntary contractions of the external sphincter during detrusor contraction. The most important information provided by the EMG is the determination of whether perineal contractions are coordinated or uncoordinated with detrusor contractions. Knowledge of this condition is important, as management should be initiated to lower urinary storage pressures and assure adequate bladder emptying.

Evidence Quality: Grade C

Recommendation Strength: Recommendation

Logic:

	If (spinal cord injury (SCI) is [true] OR myelomeningocele (MMC) is [true] OR multiple sclerosis (MS) is [true] OR Parkinson's disease (PD) is [true] OR stroke/cerebrovascular accident is [true] OR traumatic brain injury (TBI) is [true] OR brain tumor is [true] OR spinal cord tumor is [true] OR transverse myelitis is [true] OR cauda equina syndrome is [true] OR herniated disk is [true] OR other back or spine disease is [true] OR diabetes is [true] OR peripheral nerve injury is [true] OR cervical myelopathy is [true] OR childhood history of posterior urethral valves is [true]) AND at risk for neurogenic bladder is [true] Then Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS
Conditional:	Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS in patients with relevant neurologic disease at risk for neurogenic bladder, or in patients with other neurologic disease and elevated post-void residual (PVR) or urinary symptoms. {Rec_12:Cond_ 22 }
	Decision Variable: other neurologic disease

Value: true
Decision Variable: post-void residual (PVR)
Value: elevated
Decision Variable: urinary symptoms
Value: true
Action: Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS
Reason: Preservation of urinary tract integrity remains a primary goal in the long-term management of patients with neurogenic bladder. Patients presenting with abnormal compliance, detrusor external sphincter dyssynergia (DESD) and hydronephrosis are at higher risk for developing deterioration of renal function. EMG testing is a useful modality to assist in the diagnosis of DESD, which is characterized by involuntary contractions of the external sphincter during detrusor contraction. The most important information provided by the EMG is the determination of whether perineal contractions are coordinated or uncoordinated with detrusor contractions. Knowledge of this condition is important, as management should be initiated to lower urinary storage pressures and assure adequate bladder emptying.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
other neurologic disease is [true]
AND
(post-void residual (PVR) is [elevated]
OR
urinary symptoms is [true])
Then
Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS

RECOMMENDATION: 14

Conditional: Clinicians may perform post-void residual (PVR) in patients with lower urinary tract symptoms (LUTS) as a safety measure to rule out significant urinary retention both initially and during follow up. {Rec_11:Cond_ 14 }
Decision Variable: LUTS
Value: true

Action: Clinicians may perform PVR initially as a safety measure to rule out significant urinary retention

Benefit: The potential benefits of measuring PVR include the identification of patients with significant urinary retention and decreasing potential morbidity, including UTIs and upper tract damage. In such patients, the identification of an elevated PVR can facilitate selection and implementation of treatment as well as monitor treatment outcomes. While no conclusive evidence exists to support or refute the use of PVR to predict the outcome of LUTS treatment, it may be used on the basis of expert opinion as a safety measure to evaluate for significant urinary retention both initially and during subsequent monitoring.

Actor: clinicians

Verb: perform

Complement: PVR initially as a safety measure to rule out significant urinary retention

Deontic: may

Risk/Harm: The risks/harms of assessing PVR using catheterization are low and include UTI or urethral trauma. These risks can be eliminated with ultrasound determination of PVR. However, measurement of PVR may be associated with false positives and negatives and thus could lead to inappropriate treatment. Therefore, it is recommended that decisions not be based on a single measurement.

Action: Clinicians may perform PVR during follow-up as a safety measure to rule out significant urinary retention

Benefit: The potential benefits of measuring PVR include the identification of patients with significant urinary retention and decreasing potential morbidity, including UTIs and upper tract damage. In such patients, the identification of an elevated PVR can facilitate selection and implementation of treatment as well as monitor treatment outcomes. While no conclusive evidence exists to support or refute the use of PVR to predict the outcome of LUTS treatment, it may be used on the basis of expert opinion as a safety measure to evaluate for significant urinary retention both initially and during subsequent monitoring.

Actor: clinicians

Verb: perform

Complement: PVR as a safety measure to rule out significant urinary retention during follow up.

Deontic: may

Risk/Harm: The risks/harms of assessing PVR using catheterization are low and include UTI or urethral trauma. These risks can be eliminated with ultrasound determination of PVR. However, measurement of PVR may be associated with false positives and negatives and thus could lead to inappropriate treatment. Therefore, it is recommended that decisions not be based on a single measurement.

Reason: PVR may be elevated due to detrusor underactivity, BOO or a combination thereof. Thus, an elevated PVR is a non-specific indication of poor bladder emptying. For example, while men with LUTS and benign prostatic obstruction (BPO) may have an elevated PVR, an elevated PVR in isolation does not necessarily predict the presence of obstruction.50, .50,69 PVR alone cannot be used to differentiate between obstructed and nonobstructed patients. Furthermore, there is no agreed upon standard definition of exactly what constitutes an elevated PVR.

Reason: In general, urologists agree that in some patients an elevated PVR may be harmful. The potentially harmful impact of a large PVR has been derived from the experience in the pediatric population, the elderly, diabetics and neurogenic patients. It is not clear which patients with an elevated PVR and LUTS without any of these conditions are predisposed to harm. Furthermore, there are no relevant studies that have identified the usefulness of PVR for guiding clinical management, improving patient outcomes in patients with LUTS or predicting treatment outcomes in men and women.

Evidence Quality: N/A

Recommendation Strength: Clinical Principle

Logic:

If
LUTS is [true]
Then
Clinicians may perform PVR initially as a safety measure to rule out significant urinary retention
AND
Clinicians may perform PVR during follow-up as a safety measure to rule out significant urinary retention

RECOMMENDATION: 15

Conditional: Uroflow may be used by clinicians in the initial and ongoing evaluation of male patients with LUTS that suggest an abnormality of voiding/ emptying. {Rec_10:Cond_ 13 }

Decision Variable: male

Value: true

Decision Variable: lower urinary tract symptoms (LUTS) suggest an abnormality of voiding/ emptying

Value: true

Action: Uroflow may be used by clinicians in the initial evaluation

Actor: clinicians

Verb: use

Complement: uroflow in the initial evaluation

Deontic: may

Risk/Harm: Risks/harms of uroflowmetry include false positives and negatives, which may lead to inappropriate treatment.

Description: Uroflow results should be interpreted in light of the potential effects of artifact. Clinicians should be aware that uroflow studies (both peak and mean) can be affected by the volume voided and the circumstances of the test. Serial uroflowmetry measurements which are consistent, similar and comparable provide the most valuable information for the clinician. Furthermore, uroflowmetry should ideally correlate with the patient's symptomatology.

Action: Uroflow may be used by clinicians in the ongoing evaluation

Actor: clinicians

Verb: use

Complement: uroflow in the ongoing evaluation

Deontic: may

Risk/Harm: Risks/harms of uroflowmetry include false positives and negatives, which may lead to inappropriate treatment.

Description: Uroflow results should be interpreted in light of the potential effects of artifact. Clinicians should be aware that uroflow studies (both peak and mean) can be affected by the volume voided and the circumstances of the test. Serial uroflowmetry measurements which are consistent, similar and comparable provide the most valuable information for the clinician. Furthermore, uroflowmetry should ideally correlate with the patient's symptomatology.

Reason: Significant abnormalities in uroflow are indicative of a dysfunction in the voiding phase of the micturition cycle. In addition, because uroflow is dependent on voided volume, there may be significant variability of measured uroflows in the same patient. In males different studies have shown

variability in the diagnostic accuracy of uroflow for detecting BOO ranging from moderately high to low. The reported variability may be due to the variety of Qmax thresholds and reference standards used in the literature with no clear answer regarding the ideal threshold and reference standard.
Reason: Although the literature reviewed fails to specifically identify clinical scenarios when uroflowmetry is useful, the panel believes that this test has value in the evaluation of disorders of voiding, even if further testing is required to make a specific diagnosis. Uroflowmetry can also be used for monitoring treatment outcomes and correlating symptoms with objective findings.Based on the current literature and the relative ease of measurement of uroflow, the panel supports the use of uroflowmetry in the initial diagnosis and follow-up of LUTS in men. The correlation of urinary symptoms and uroflow in women is not as well understood.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
male is [true]
AND
lower urinary tract symptoms (LUTS) suggest an abnormality of voiding/ emptying is [true]
Then
Uroflow may be used by clinicians in the initial evaluation
AND
Uroflow may be used by clinicians in the ongoing evaluation

RECOMMENDATION: 16

Conditional: Clinicians may perform multi-channel filling cystometry when it is important to determine if DO or other abnormalities of bladder filling/urine storage are present in patients with LUTS, particularly when invasive, potentially morbid or irreversible treatments are considered. {Rec_14:Cond_ 17 }

Decision Variable: lower urinary tract symptoms (LUTS)
Value: true
Action: Clinicians may perform multi-channel filling cystometry, particularly when invasive, potentially moribd or irreversible treatments are considered.
Actor: clinicians
Verb: perform
Complement: multi-channel filling cystometry

Deontic: may

Reason: The role of filling cystometry and the finding of DO in predicting treatment outcomes remain controversial. No relevant studies that met the inclusion criteria were identified regarding the usefulness of cystometry for guiding clinical management in patients with LUTS. For some conditions associated with LUTS (e.g., DO), cystometry is the diagnostic standard. However, cystometry often fails to explain symptoms, and the reproducibility of finding DO from one study to another in the same patient can vary if the studies are performed consecutively56 56 or on different days.83 .83 Many studies have attempted to use cystometry to help determine prognosis after various treatments for LUTS in men and women.84.84-91 However, there is considerable variation in these studies with respect to the central thesis, and the findings revealed no apparent trends. Although the presence or absence of DO has not been shown to consistently predict specific treatment outcomes, the panel believes that there are instances when a particular treatment for LUTS might be chosen or avoided based on the presence of DO and, more importantly, impaired compliance. The panel felt that this could be particularly important when invasive or irreversible treatment is planned as it could aid in patient counseling. While there are no data to support or refute this recommendation, the panel believes that for many clinicians the presence of DO or impaired compliance remains an important piece of information in dictating treatment.

Evidence Quality: N/A

Recommendation Strength: Expert Opinion

Logic:

If
lower urinary tract symptoms (LUTS) is [true]
Then
Clinicians may perform multi-channel filling cystometry, particularly when invasive, potentially moribd or irreversible treatments are considered.

RECOMMENDATION: 17

Conditional: Clinicians should perform pressure flow studies (PFS) in men when it is important to determine if urodynamic obstruction is present in men with LUTS, particularly when invasive, potentially morbid or irreversible treatments are considered. {Rec_18:Cond_ 21 }

Decision Variable: sex

Value: male

Decision Variable: suspected BOO

Value: true

Decision Variable: lower urinary tract symptoms (LUTS)

Value: true

Action: Clinicians should perform PFS when it is important to determine if urodynamic obstruction is present

Actor: clinicians

Verb: perform

Complement: PFS when it is important to determine if urodynamic obstruction is present

Deontic: should

Risk/Harm: Patients should also be made aware of the risks of PFS, which include hematuria, UTI and dysuria as well as some of the diagnostic pitfalls of the studies.

Description: particularly when invasive, potentially morbid or irreversible treatments are considered

Reason: BOO in men is a urodynamic diagnosis. This may or may not be associated with obstruction from benign prostatic enlargement. The voiding PFS is the current reference standard for the diagnosis of BOO in men. To be useable, a PFS study must be well performed with minimal artifacts. Many studies assessed the use of PFS to predict outcomes of men with LUTS treated with surgical procedures to reduce outlet resistance.95.95-108 While the results of these studies showed variability regarding the ability of PFS to predict outcomes of surgical procedures to treat benign prostatic obstruction (BPO), the panel concluded that the preponderance of evidence suggests that a diagnosis of obstruction on a PFS predicts a better outcome from surgery than a diagnosis of no obstruction. Therefore, it can be recommended as part of the evaluation of LUTS in men. The panel also believes that despite some limitations, PFS remain the only means of definitively establishing or ruling out the presence of BOO in men. However, it may not always be necessary to confirm urodynamic obstruction prior to proceeding with invasive therapy.

Evidence Quality: Grade B

Recommendation Strength: Standard

Logic:

If
sex is [male]
AND
suspected BOO is [true]
AND
lower urinary tract symptoms (LUTS) is [true]

Then
Clinicians should perform PFS when it is important to determine if urodynamic obstruction is present

RECOMMENDATION: 18

Conditional: Clinicians may perform pressure flow studies (PFS) in women when it is important to determine if obstruction is present. {Rec_17:Cond_ 20 }

Decision Variable: sex
Value: female
Decision Variable: suspected bladder outlet obstruction (BOO)
Value: true
Action: Clinicians may perform pressure flow studies (PFS) when it is important to determine if obstruction is present.
Actor: clinicians
Verb: perform
Complement: pressure flow studies (PFS) when it is important to determine if obstruction is present.
Deontic: may
Description: particularly if invasive treatment is planned
Reason: The urodynamic diagnosis of obstruction in females is not as well established as in men. Various diagnostic criteria have been used to define obstruction. One inherent problem with the diagnosis of female BOO is the number of conditions that may cause it and the lack of a highly prevalent condition, such as BPO in men, on which to base a nomogram. While definitions of female BOO vary, all studies have shown differences in pressure (higher in obstructed women) and flow rate (lower in obstructed women) though there tends to be tremendous overlap. Another limitation of PFS in women is the lack of literature correlating PFS findings with outcomes. The only study that evaluated a treatment response in “obstructed women” was for urethral dilation, a procedure not advocated by many experts. Other studies evaluating outcomes of stress incontinence surgery found no significant correlations.
Reason: Based on the current body of evidence, the panel supports the use of PFS as an option in women for the evaluation of potential BOO, particularly if invasive treatment is planned. We realize that diagnostic criteria are not standardized, and this is an area for current and future research. However, as there is no consistent evidence that shows the lack of value of PFS, it should remain as part of the diagnostic armamentarium. In addition, the documentation of

obstruction will likely influence treatment decisions, and PFS is a useful modality to aid in the diagnosis. Due to the limitations of PFS in women, the panel believes that the results of PFS should always be correlated with patient symptoms and other diagnostic tests to make the most accurate diagnosis of female BOO.
Evidence Quality: Grade C
Recommendation Strength: Recommendation
Logic:

If
sex is [female]
AND
suspected bladder outlet obstruction (BOO) is [true]
Then
Clinicians may perform pressure flow studies (PFS) when it is important to determine if obstruction is present.

RECOMMENDATION: 19

Conditional: Clinicians may perform videourodynamics (VUDS) in properly selected patients to localize the level of obstruction particularly for the diagnosis of primary bladder neck obstruction (PBNO). {Rec_15:Cond_ 18 }

Decision Variable: obvious anatomic cause of obstruction
Value: false
Description: like BPO in men or POP in women
Decision Variable: suspected bladder outlet obstruction (BOO)
Value: true
Decision Variable: sex
Value: male
Decision Variable: age
Value: young
Description: generally 20 to 50 years
Decision Variable: sex
Value: female
Decision Variable: age
Value: any
Action: Clinicians may perform videourodynamics (VUDS) to localize the level of obstruction particularly for the diagnosis of primary bladder neck obstruction (PBNO).
Actor: clinicians
Verb: perform

Complement: videourodynamics to localize the level of obstruction particularly for the diagnosis of primary bladder neck obstruction.
Deontic: may
Risk/Harm: The risks of VUDS include those related to the PFS study itself as well as those associated with radiation exposure.

Reason: In young men and women without an obvious anatomic cause of obstruction like BPO in men or POP in women, VUDS can differentiate between functional causes of obstruction like PBNO and dysfunctional voiding. PBNO is a videourodynamic diagnosis whose hallmark is relatively high detrusor pressures in association with low flow and radiographic evidence of obstruction at the bladder neck with relaxation of the striated sphincter and no evidence of distal obstruction. Videourodynamic evaluation is the only diagnostic tool that can document pressure/flow parameters and localize functional obstruction of the bladder neck. To date, there are no studies comparing treatment of PBNO on men or women diagnosed with VUDS versus those who had treatment but no VUDS. Since the perceived standard of diagnosis is VUDS and the condition is relatively rare, it is unlikely that such studies will be done. Therefore, the panel feels that VUDS remains the standard test in which to diagnose PBNO and should be an option for any young male or for a female patient in whom the condition is suspected.
Recommendation Strength: Expert Opinion
Logic:

If
(sex is [male]
AND
age is [young])
OR
(sex is [female]
AND
age is [any])
AND
obvious anatomic cause of obstruction is [false]
AND
suspected bladder outlet obstruction (BOO) is [true]
Then
Clinicians may perform videourodynamics (VUDS) to localize the level of obstruction particularly for the diagnosis of primary bladder neck obstruction (PBNO).

ALGORITHM: