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

TARGET POPULATION	Decidable (Y or N)
Eligibility	
Inclusion Criterion	
· adults	
· lower urinary tract symptoms (LUTS)	
Exclusion Criterion	

RECOMMENDATIONS

Recommendation
1

Conditional: Clinicians who are making the diagnosis of urodynamic stress incontinence should assess urethral function.

IF	**Decidable**	**Vocab**
performing invasive urodynamics testing		
Value: true		
urodynamic stress incontinence demonstrated		
Value: true		
THEN	**Executable**	**Vocab**
assess urethral function using Valsalva leak point pressure/abdominal leak point pressure (VLPP/ALPP)		
assess urethral function using lower cough leak point pressure (CLPP)		
assess urethral function using maximal urethral closure pressure (MUCP)		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF
stress urinary incontinence

Decidable	Vocab

Value: true
considering invasive therapy

Value: true
THEN
assess post-void residual (PVR) urine volume

Executable	Vocab

Evidence Quality:

Strength of Recommendation: Expert Opinion

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.

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.

IF

Decidable	Vocab

	symptoms of stress incontinence **Value:** true		
	physical findings of stress incontinence **Value:** true		
	considering invasive, potentially morbid or irreversible treatment **Value:** true		
	THEN clinicians may perform multi-channel urodynamics	**Executable**	**Vocab**

Evidence Quality: Grade C

Strength of Recommendation: Option

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.

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.

IF	Decidable	Vocab
complain of SUI symptoms **Value:** true		
SUI is suspected based on history **Value:** true		
the presence of documented SUI would change management **Value:** true		
SUI demonstrated during Valsalva maneuvers **Value:** false		
SUI demonstrated during cough testing **Value:** false		
urodynamic testing with urethral catheter in place demonstrates SUI **Value:** false		

THEN	Executable	Vocab
remove urethral catheter		
perform repeat stress testing		

Evidence Quality:

Strength of Recommendation:

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.

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.

IF	**Decidable**	**Vocab**
high grade pelvic organ prolapse (POP)		
Value: true		
symptom of SUI		
Value: false		
presence of SUI would change the surgical treatment plan		
Value: true		
THEN	**Executable**	**Vocab**
perform stress testing with reduction of the prolapse to evaluate for occult SUI		

Evidence Quality: Grade C

Strength of Recommendation: Option

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.

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.

IF

Decidable	Vocab
high-grade pelvic organ prolapse (POP)	
Value: true	
associated lower urinary tract symptoms (LUTS)	
Value: true	

THEN

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

Evidence Quality:

Strength of Recommendation:

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.

IF	**Decidable**	**Vocab**
urgency incontinence		
Value: true		
invasive treatment is being considered		
Value: true		
potentially morbid treatment is being considered		
Value: true		
irreversible treatment is being considered		
Value: true		
THEN	**Executable**	**Vocab**
Clinicians may perform multi-channel filling cystometry		

Evidence Quality: Grade C

Strength of Recommendation: Option

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.

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).

IF	**Decidable**	**Vocab**
bladder outlet procedure performed **Value:** true		
post-procedure refractory urgency incontinence **Value:** true		

THEN	**Executable**	**Vocab**
Clinicians may perform PFS to evaluate for bladder outlet obstruction (BOO)		

Evidence Quality:

Strength of Recommendation: Expert Opinion

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.

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.

IF	**Decidable**	**Vocab**
urgency incontinence **Value:** true		
mixed incontinence **Value:** true		
detrusor overactivity demonstrated on UDS **Value:** false		

THEN	**Executable**	**Vocab**
Clinicians should counsel patients that DO is not excluded as a causative agent for their symptoms.		

Evidence Quality:

Strength of Recommendation: Clinical Principle

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.

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.

IF	**Decidable**	**Vocab**
spinal cord injury (SCI)		
Value: true		
myelomeningocele (MMC)		
Value: true		
multiple sclerosis (MS)		
Value: true		
Parkinson’s disease (PD)		
Value: true		
stroke/cerebrovascular accident		
Value: true		
traumatic brain injury (TBI)		
Value: true		
brain tumor		
Value: true		
spinal cord tumor		
Value: true		
transverse myelitis		
Value: true		
cauda equina syndrome		
Value: true		

	herniated disk **Value:** true		
	other back or spine disease **Value:** true		
	diabetes **Value:** true		
	peripheral nerve injury **Value:** true		
	cervical myelopathy **Value:** true		
	childhood history of posterior urethral valves **Value:** true		
	multiple systems atrophy **Value:** true		
	other relevant neurological conditions **Value:** true		
	THEN	**Executable**	**Vocab**
	Clinicians should perform PVR assessment during the initial urological evaluation		
	Clinicians should perform PVR assessment as part of ongoing follow -up when appropriate		

Evidence Quality: Grade B

Strength of Recommendation: Standard

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.
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.

IF	**Decidable**	**Vocab**
spinal cord injury (SCI)		
Value: true		
myelomeningocele (MMC)		
Value: true		
at risk of renal impairment		
Value: true		
THEN	**Executable**	**Vocab**
Clinicians should perform a complex cystometrogram (CMG) during initial urological evaluation		
Clinicians should perform a complex cystometrogram (CMG) as part of ongoing follow-up when appropriate.		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF	**Decidable**	**Vocab**
multiple sclerosis (MS)		
Value: true		
Parkinson's disease (PD)		
Value: true		
cerebrovascular accident (CVA)		
Value: true		
lower urinary tract symptoms (LUTS)		
Value: true		
THEN	**Executable**	**Vocab**
physicians may consider CMG as an option in the urological evaluation		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF	**Decidable**	**Vocab**
relevant neurological disease		
Value: true		
other neurologic disease		
Value: true		
elevated post-void residual (PVR)		
Value: true		
urinary symptoms		
Value: true		

THEN	**Executable**	**Vocab**
Clinicians should perform pressure flow analysis		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF	**Decidable**	**Vocab**
spinal cord injury (SCI)		
Value: true		
myelomeningocele (MMC)		
Value: true		
multiple sclerosis (MS)		
Value: true		

	Parkinson's disease (PD) **Value:** true		
	stroke/cerebrovascular accident **Value:** true		
	traumatic brain injury (TBI) **Value:** true		
	brain tumor **Value:** true		
	spinal cord tumor **Value:** true		
	transverse myelitis **Value:** true		
	cauda equina syndrome **Value:** true		
	herniated disk **Value:** true		
	other back or spine disease **Value:** true		
	diabetes **Value:** true		
	peripheral nerve injury **Value:** true		
	cervical myelopathy **Value:** true		
	childhood history of posterior urethral valves **Value:** true		
	at risk for neurogenic bladder **Value:** true		
	THEN	**Executable**	**Vocab**
	when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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).
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.

IF	**Decidable**	**Vocab**
other neurologic disease **Value:** true		
post-void residual (PVR) **Value:** true		
urinary symptoms **Value:** true		
THEN	**Executable**	**Vocab**
when available, clinicians may perform fluoroscopy at the time of urodynamics (videourodynamics)		

Evidence Quality:

Strength of Recommendation:

Reason:

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.

IF	**Decidable**	**Vocab**
spinal cord injury (SCI) **Value:** true		
myelomeningocele (MMC) **Value:** true		
multiple sclerosis (MS) **Value:** true		
Parkinson's disease (PD) **Value:** true		
stroke/cerebrovascular accident **Value:** true		
traumatic brain injury (TBI) **Value:** true		
brain tumor **Value:** true		
spinal cord tumor **Value:** true		
transverse myelitis **Value:** true		
cauda equina syndrome **Value:** true		
herniated disk **Value:** true		
other back or spine disease **Value:** true		
diabetes **Value:** true		
peripheral nerve injury **Value:** true		
cervical myelopathy **Value:** true		
childhood history of posterior urethral valves **Value:** true		

	at risk for neurogenic bladder **Value:** true		
	THEN Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS	**Executable**	**Vocab**
Evidence Quality:	Grade C		
Strength of Recommendation:	Recommendation		
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.		
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.

IF	**Decidable**	**Vocab**
other neurologic disease **Value:** true		
post-void residual (PVR) **Value:** elevated		
urinary symptoms **Value:** true		
THEN	**Executable**	**Vocab**
Clinicians should perform electromyography (EMG) in combination with cystometry (CMG) with or without pressure flow studies PFS		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF
LUTS

Value: true

Decidable	Vocab

THEN

Executable	Vocab
Clinicians may perform PVR initially as a safety measure to rule out significant urinary retention	
Clinicians may perform PVR during follow-up as a safety measure to rule out significant urinary retention	

Evidence Quality: N/A

Strength of Recommendation: Clinical Principle

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.

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.

IF	**Decidable**	**Vocab**
male **Value:** true		
lower urinary tract symptoms (LUTS) suggest an abnormality of voiding/ emptying **Value:** true		

THEN	**Executable**	**Vocab**
Uroflow may be used by clinicians in the initial evaluation		
Uroflow may be used by clinicians in the ongoing evaluation		

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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.

IF
lower urinary tract symptoms (LUTS)

Value: true

Decidable	Vocab

THEN
Clinicians may perform multi-channel filling cystometry, particularly when invasive, potentially moribd or irreversible treatments are considered.

Executable	Vocab

Evidence Quality: N/A

Strength of Recommendation: Expert Opinion

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.

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.

IF	**Decidable**	**Vocab**
sex		
Value: male		
suspected BOO		
Value: true		
lower urinary tract symptoms (LUTS)		
Value: true		
THEN	**Executable**	**Vocab**

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

Evidence Quality: Grade B

Strength of Recommendation: Standard

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.

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.

IF	**Decidable**	**Vocab**
sex		

Value: female

suspected bladder outlet obstruction (BOO)

Value: true

Executable	Vocab

THEN

Clinicians may perform pressure flow studies (PFS) when it is important to determine if obstruction is present.

Evidence Quality: Grade C

Strength of Recommendation: Recommendation

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.

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).

IF

obvious anatomic cause of obstruction

Value: false

Decidable	Vocab

	suspected bladder outlet obstruction (BOO) **Value:** true		
	sex **Value:** male		
	age **Value:** young		
	sex **Value:** female		
	age **Value:** any		
	THEN	**Executable**	**Vocab**
	Clinicians may perform videourodynamics (VUDS) to localize the level of obstruction particularly for the diagnosis of primary bladder neck obstruction (PBNO).		

Evidence Quality:

Strength of Recommendation: Expert Opinion

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.

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).