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RECONSTRUCTED BLADDER FUNCTION & DYSFUNCTION (M KAUFMAN, SECTION EDITOR)

Dilemmas in Management of the Geriatric Bladder

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Abstract

Purpose of Review In this article, we will review current dilemmas regarding evaluation and management of the geriatric bladder incorporating concepts of normal changes of aging as well as common lower urinary tract dysfunction.

Recent Findings Increasing age leads to functional changes in essentially all organ systems including the genitourinary system. Understanding the natural changes with age of the bladder as well as the signs and symptoms of pathologic conditions is paramount to diagnosis and treatment of urologic conditions in the geriatric population.

Summary There are several conundrums in the diagnosis and evaluation of the geriatric bladder including the ability of the bladder to store, empty, as well as sensitivity disturbances. Diagnostic testing and goals of treatment should be individualized for each patient and personalized to consider patient comorbidities, limitations, and expectations.

Keywords Geriatric urology · Aging bladder · Lower urinary tract symptoms · Incontinence · Voiding dysfunction

Introduction to the Aging Bladder

One of the greatest challenges in geriatric urology is to differentiate the contributions of normal aging versus age-associated pathologic processes to genitourinary perceptions and control. Changes in function with increasing age are seen in essentially all organ systems and the genitourinary system is no exception. Lower urinary tract (LUT) control requires managing the physiologic challenge of constant renal output in a socially appropriate context. Functional changes with aging might represent successful adaptation by the aging system, in contrast to the a priori assumption that all changes represent a pathology of aging. Complicating this scenario are age-associated diseases/conditions and other systemic declines which directly or indirectly impact urinary control [1•]. This article will address the aging bladder and conundrums in diagnosis and treatment for this vulnerable and, oftentimes, medically complex patient population.

Most knowledge of the aging bladder structure and function is derived from symptomatic older patients. The ratio of smooth muscle to collagen in the wall of the bladder decreases with aging. Using electron microscopy and other structural imaging modalities in tissues from symptomatic patients, studies demonstrated these changes as well as the development of "dense bands" and loss of caveolae, which, when altered, are associated with impaired bladder smooth muscle contraction [2, 3]. These structural alterations with aging have been linked to changes in contraction strength and velocity as well as increased involuntary detrusor contractions. Age- and disease-related changes in bladder compliance may in turn affect both urine storage and bladder emptying [4].

Less is understood about LUT functional changes in asymptomatic adults. Based on studies employing urodynamics, bladder capacity was found to remain relatively stable or to decrease only slightly with advancing age [5, 6]. Animal models can also help to define specific aspects of "normal" aging. Reactive oxygen species may function as a major factor in the progressive deterioration of bladder

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dysfunction with the bladder a target organ for increased oxidative stress with aging. In a study of rat bladders, aging and diabetes were both independently found to cause an increase in collagen fibers in the lamina propria and tunica muscularis in bladder tissue via free radical damage [7]. Sensory changes may be caused by alterations in the urothelium and associated receptors and neurotransmitters could compound structural and biomechanical changes in the bladder wall, altering both sensory and motor functions relating to bladder content.

Anatomic changes in pelvic floor support and muscle strength that occur with aging can also affect LUT function and urination. Based on cadaveric studies using biopsy specimens of the urogenital diaphragm, many older women have substantially reduced or even absent striated muscle tissue relative to connective tissue [8]. While there are multiple other factors that may influence the strength of the pelvic floor, including parity and history of vaginal delivery, pelvic floor muscle dysfunction is common among elderly women. Many elderly women are not able to generate voluntary muscle contractions on initial physical examination, even independent of body mass index, parity, or history of hysterectomy [8]. Decreased striated muscle density in the rhabdosphincter can lead to an increased propensity for stress urinary incontinence (SUI). Apoptotic cellular changes in these tissues that come with aging have been associated with pelvic organ prolapse and SUI in postmenopausal women [9–11].

Finally, urinary control expresses the age-sensitive relationship of lower urinary tract and brain control. Both independent of, and dependent on, specific changes to the lower urinary tract, aging impacts brain responses to bladder filling, as suggested by functional imaging studies [12]. Cognition and executive functions are linked to urinary control. The severity of a degenerative brain condition common in aging, white matter hyperintensity disease (WMHD), is linked to the severity of urinary symptoms [13]. Common pharmacotherapies, while having a salutary effect on the bladder itself, may in fact complicate therapy by impairing cognition. Complexities such as these characterize the evaluation and management of older adults with functional lower urinary tract disorders.

Therapeutic Conundrums

Treating lower urinary tract symptoms (LUTS) in a geriatric population can be complicated by a variety of comorbidities, polypharmacy, and overlapping symptoms making it critically important for practitioners to characterize the relationships of systemic as well as urinary function to symptoms. A careful search for treatable causes of LUTS that are unrelated to a urologic etiology is necessary in the evaluation of geriatric patients, especially in patients presenting with urinary incontinence. A significant proportion of these patients' symptoms are resultant of conditions included in the mnemonic DIAPPERS: delirium, infection, atrophic vaginitis, pharmaceuticals, psychosocial factors, excess urine output, restricted mobility, and stool impaction [14]. Addressing these comorbidities may improve a patient's urologic symptoms without the need for specific LUT treatment. A vast array of neurologic conditions prevalent in elderly patients are strongly correlated with urinary incontinence and voiding dysfunction including neurovascular accidents (i.e., stroke), spinal cord disease, and primary neurologic diagnoses such as multiple sclerosis and Parkinson's disease.

In the interest of effective alleviation of patient distress, evaluation of the geriatric patient should seek to elicit the most bothersome symptoms to the patient, and detect pathophysiology which may prove detrimental to the aging system. These features will drive the subsequent search for a physiologically sound diagnosis. A detailed history, physical exam, urinalysis (and urine culture if indicated), post void residual (PVR) measurement, are a crucial first step in determining the patient's historic background, cognitive reserve, and physical condition and performance. A voiding diary is a useful tool to help characterize and quantify the patient's typical fluid intake, voiding habits, and severity of symptoms. It may also be necessary to perform urodynamics, radiological evaluation, and cystoscopy in certain patients. Due to their special expertise, collaboration with a geriatrician should be strongly considered especially in the cognitively impaired and the frail older patient.

Treatment of LUTS in the geriatric patient can generally be divided into four categories: behavioral modification, physiotherapy, pharmacologic therapy, and surgical intervention. An in-depth review of each of these modalities is beyond the scope of this paper but in general, every attempt should be made for individualized assessment and treatment recommendations based on the patient's functional status, expectations, and desired outcome of treatment. For many patients, conservative and minimally invasive treatment options would be preferred. It is important to reference the American Geriatrics Society Beers Criteria which lists potentially inappropriate medications for use in older adults [15], many of which are commonly used to treat urologic conditions. For example, antimuscarinic agents used in the treatment of OAB and urgency urinary incontinence should be avoided in older adults with a history of chronic constipation or cognitive impairment. Notably, a recent article by Coupland et al. found an increased risk of dementia associated with anticholinergic medication use [16]. Older adults with impaired renal function (GFR below 60 mL/min) should not be prescribed nitrofurantoin nor should it be used for long-term prophylaxis due to the small but present risk of pulmonary fibrosis.

Common Classification

Common classification of bladder function can be thought of in terms of a failure to store urine and a failure to empty

("void"). The International Continence Society defines overactive bladder syndrome (OAB), which is based on symptoms and not urodynamic findings, as "urinary urgency, usually accompanied by increased daytime frequency and/or nocturia, with urinary incontinence (OAB-wet) or without (OAB-dry), in the absence of urinary tract infection or other detectable disease" [17]. Underactive bladder syndrome (UAB) is characterized by a slow urinary stream, hesitancy, and straining to void, with or without a feeling of incomplete bladder emptying sometimes with storage symptoms [18••]. OAB is applicable during the storage phase of the micturition cycle while UAB is evident during the voiding phase, therefore it is possible for both symptom syndromes to be present in the same individual. Urodynamically, non-voiding detrusor pressurization is termed detrusor overactivity (DO), and the related lack of sufficient detrusor pressure to effect efficient and timely voiding is termed detrusor underactivity (DU). Despite the nominal similarities, OAB and UAB do not signify the presence of DO and/or DU, nor do DO and DU necessarily produce OAB and UAB [19]. Impaired storage in combination with impaired voiding is known as detrusor hyperactivity with impaired contractility (DHIC) [20]. DHIC is the second most common cause of urinary incontinence in institutionalized elderly patients and has been increasingly recognized as a cause of LUTS among all elderly patients [21]. Confusion resulting from imprecise terminology referring to perhaps distinct but overlapping pathophysiologies, dysfunctions, and symptoms has likely been detrimental to the development of truly effective diagnostic and therapeutic models.

A Suggested Functional Classification and Treatment

Patients with storage-associated symptoms may be experiencing volume hypersensitivity, the sensation of bladder fullness and need to void at lower than normal volumes, which translates into the OAB symptom complex. There are several treatment modalities directed toward decreasing detrusor hypersensitivity. Muscarinic receptors on the detrusor muscle are stimulated by acetylcholine (ACh) which is released from activated cholinergic (parasympathetic) nerves. Although the source of M3 stimulation is not entirely clear, antimuscarinic medications canonically work by blocking this activation of these receptors and decreasing resultant overactive symptoms. In general, antimuscarinics can be divided into tertiary and quarternary amines which differ with regard to lipophilicity, molecular charge, and molecular size [22]. Tertiary amines have high lipophilicity, small molecular size, and less charge which increases the possibility to pass the blood-brain barrier. Quarternary ammonium compounds, such as trospium, have limited passage into the central nervous system (CNS) with a low incidence of CNS side effects, making them a potentially better option for a geriatric population at higher risk for cognitive side effects [23].

Beta-3 adrenoreceptor agonists, such as mirabegron, are another class of medications used for the treatment of OAB. By stimulation of the $ß_3$-adrenergic receptor, mirabegron acts to both relax and maintain low detrusor tone during filling and also to inhibit activity to sensory afferents. Mirabegron can increase bladder capacity without changing voiding pressure or voiding volume [24]. Additional consideration needs to be taken with geriatric patients prior to prescribing mirabegron in terms of cardiovascular side effects and interaction with hypertensive medications, especially metoprolol.

OnabotulinumtoxinA, sacral neuromodulation (SNM), and posterior tibial nerve stimulation (PTNS) are all approved third-line therapy options for medication-refractory OAB. While more invasive, third-line therapy in the appropriately selected patient has the potential to provide similar efficacy to pharmacotherapy with a potentially lower side-effect profile in terms of systemic side effects [25]. Although literature specifically focused on third-line therapy in an elderly population is limited, PTNS is typically well-tolerated with minimal side effects. A potential downside to PTNS for a geriatric patient is the need for weekly 30-min treatment sessions for a course of 12 weeks, followed by monthly maintenance sessions. For patients with limited mobility and transportation options, this PTNS schedule could be prohibitive. In regard to SNM, a recent study looking at the impact of age on the use of SNM reported no difference in the success rate of either test stimulation or permanent implantation between age groups [26•]. This suggests that age alone should not be a predictor of SNM treatment response; however, it is critically important to practice vigilant patient selection when moving forward with third-line therapy. Elderly patients who are unable to operate the neurostimulator device or who may need future magnetic resonance imaging are not candidates for SNM. Additionally, a patient undergoing SNM implantation must have the cognitive capacity to assess efficacy during a trial phase and ability to make program adjustments to the neurostimulator. Falls, more common in elderly patients, can also cause lead displacement with subsequent need for further operative intervention for replacement or removal. Treatment of elderly patients with onabotulinumtoxinA has the advantage of a relatively low risk procedure which can be performed in an office setting without systemic anesthesia. However, this population has an increased rate of urinary tract infections and longer duration of urinary retention following intradetrusor onabotulinumtoxinA injection [27, 28]. These are important factors to consider during patient selection and counseling for third-line therapies.

Volume hyposensitivity, the decreased perception of bladder fullness, may also mediate the syndrome of UAB. This theory suggests that premature termination of the micturition reflex due to impaired afferent receptivity may be etiologic in the failure to empty efficiently which characterizes DU [29]. Bethanechol chloride, a cholinergic agonist, may improve

detrusor contractility for patients with DU and has been prescribed for decades; however, clinical efficacy is limited [30]. It is difficult to find reproducible urodynamic data that supports the use of oral bethanchol, despite its cholinergic agonist properties. It is possible that bethanechol, by increasing static intravesical pressure, may cause afferent stimulation at a lower bladder volume than usual, thus prompting detrusor contraction at a more favorable bladder volume [24]. This would only be expected to occur in bladders that were not truly acontractile and instead hyposensitive. Given the multiple side effects, including flushing, nausea, vomiting, diarrhea, gastrointestinal cramps, bronchospasm, headache, salivation, sweating, and difficulty with visual accommodation, as well as limited efficacy, the use of bethanechol in a geriatric population cannot be recommended. The use of distigmine, an anticholinesterase agent, with or without the addition of an alpha blocker, has been shown in small studies to improve detrusor function in patients with detrusor underactivity [31, 32]. However, efficacy is also limited and caution should be used in prescribing this to a geriatric patient. Sacral neuromodulation is also FDA approved for the treatment of nonobstructive urinary retention and has been shown to be an effective therapy in this population. SNM should include a trial phase prior to permanent implantation and, as discussed above, carries the same concerns regarding implantation in a geriatric population [33].

Recurring Infections

Urinary tract infections (UTIs) are one of the most common bacterial infections and sources of bacteremia in older adults [34]. Due to the high prevalence of asymptomatic bacteriuria (ASB) and the possibility of atypical clinical manifestations of UTIs in older adults, many hospitalizations are attributed to UTIs, leading to an elevated use of antibiotics. Suspected uncomplicated UTI is also the most common reason that antibiotics are prescribed to older nursing home residents [35]. Regardless of the care setting, providers are more likely to prescribe antibiotics to older adults [36]. Judicious prescribing of antibiotics in geriatric patients is important as these patients may experience a greater number of side effects due to polypharmacy, comorbid conditions, cognitive disabilities, or weakened immune systems and the unnecessary prescribing of antibiotics can promote the development of antibiotic-resistant organisms.

It is exceedingly important that providers understand the clinical difference between ASB and a true UTI. The prevalence of standard bacteriuria discovered incidentally in nursing home residents ranges from 15 to 50% [37]. It is common, especially for patients with indwelling catheters, those who perform clean intermittent catheterization, or elderly women, to have colonized urine. However, in an absence of symptoms, these patients should not be treated with antibiotics. For elderly patients with delirium, falls, confusion, or other geriatric syndromes, there is no evidence to suggest that antibiotic treatment of asymptomatic bacteriuria improves outcomes [38]. Expert guidance and consensus statements do not recommend testing for, making the diagnosis of, or treating a UTI in non-catheterized, otherwise asymptomatic long-term care residents who become delirious, even if they are febrile [38]. Recently released guidelines by the American Urological Association on recurrent UTI in women also state that clinicians should not perform surveillance urine testing or treat ASB, including in high risk populations such as the elderly or immunocompromised [39].

Elderly individuals with acute-onset dysuria and significant bacteriuria should have a urine culture performed for confirmation of UTI and then a short course of antibiotic therapy is standard of care. However, acute uncomplicated cystitis rarely progresses to severe disease, such as pyelonephritis and sepsis, even if untreated with antibiotics [38]. As the primary goals is alleviation of acute cystitis symptoms, these patients should be encouraged to increase oral fluid intake and take an oral analgesic such as ibuprofen, if they have no other contraindications to do so.

The most commonly cultured organism in both community-dwelling and institutionalized individuals is *Escherichia coli*, with the majority of remaining cultures attributed to *Klebsiella*, *Proteus mirabilis*, and *Enterococcus.* Patients with indwelling catheters are uniquely at higher risk for biofilm-associated organisms, making colonization and infection by *Proteus mirabilis*, *Providencia stuartii*, and *Pseudomonas aeruginosa* significantly more common, as well as polymicrobial and fungal infection [40, 41]. When a UTI is suspected, indwelling catheters should be removed and replaced prior to collection of a urine specimen and initiation of treatment.

The urinary collecting system from Bowman's capsule to the urethral meatus is essentially a part of the body surface, similar to the lining of the respiratory system which is continuously in contact with air. While the urinary tract has traditionally been considered "sterile," the plausibility of a true sterile condition is quite low as the urinary tract has been shown to hold complex microbial communities. As a balanced microbiome of the urinary tract is important in staving off pathogenic overgrowth, ASB may be protective to the individual [42]. While this is becoming more widely accepted, further research is needed to reveal the underlying benefits of the microbiome and its protective influence on the urinary tract. Emerging biomic research suggests that "urinary tract infection" especially in older adults is poorly understood, and identification of the elderly patient requiring pharmacotherapy must be approached with great caution [38].

The Post Void Residual

The definition of significant post void residual (PVR) urine volume and the clinical impact of an elevated PVR remain

subjective and controversial. The International Continence Society consensus indicates that a PVR by ultrasound over 50 mL, following double voiding, might prompt the suspicion of voiding dysfunction [43]; however, the need for intervention or treatment of an individual with an elevated PVR must be considered on an individual basis. In a longitudinal study of community dwelling men, PVR was found to gradually increase and voiding volume gradually decrease with age [44]. Analysis by Kershen et al. [45] found that human bladder blood flow tends to increase with increasing volume and pressure; however, blood flow at capacity is significantly decreased. This study also demonstrated that decreased bladder blood flow and decreased bladder wall compliance correlated strongly, suggesting that ischemia may lead to structural changes in the bladder wall. Thereby large PVRs might contribute to increased detrusor ischemia and longer term functional degradation. Intervention for a large PVR in an asymptomatic patient is of unclear benefit, although high pressure urine storage and concern for the consequences of diminished perfusion are sensible indications. In the older patient, these considerations should be individualized.

Many factors can contribute to the development of an elevated PVR, including bladder outlet obstruction, detrusor underactivity, anatomic variation such as pelvic organ prolapse, and neurogenic bladder conditions. Without urodynamic studies, it will be complex to determine the true underlying etiology and optimize potential treatment options. In general, especially in a geriatric population, clinicians should consider the degree of bother of a patient's LUTS, any upper tract hydronephrosis, history of UTIs, comorbid conditions, and the patient's cognitive status when counseling a patient on workup and treatment options.

Special Consideration of Co-existing Conditions

Pelvic organ prolapse (POP) in women is associated with voiding dysfunction including urinary hesitancy and incomplete emptying. Physical examination and assessment of POP is critically important as an elevated PVR due to POP can mimic other LUTS such as urgency, frequency, and incontinence in women. Several studies have noted the association of anterior and apical prolapse with elevated PVR [46, 47]. A recent study evaluating functional outcomes and urodynamic findings in women with stage II–IV POP before and after laparoscopic sacrocolpopexy found maximum flow significantly improved following surgery compared to baseline (14.17 ± 2.3 vs. 27 ± 8.4 mL/s; $p = 0.02$) and the percentage of patients with elevated PVR significantly decreased (33.3% vs. 11.1%; $p = 0.001$) [48]. For an elderly woman with POP undergoing urodynamics, it can be helpful to repeat the study with her prolapse reduced to further assess bladder functioning and attempt to predict postoperative voiding function and occult stress incontinence with her prolapse corrected. Elderly patients with POP and voiding dysfunction should be counseled with individual patient factors in mind as treatment options vary greatly and may include pessary, vaginal native tissue repair, sacrocolpopexy, or colpocleisis.

Many elderly patients with urinary incontinence may also fit criteria for frailty. The frail elderly can be defined as "those over the age of 65 with a clinical presentation or phenotype combining impairments in physical activity, mobility, balance, muscle strength, motor processing, cognition, nutrition, and endurance including feelings of fatigue and exhaustion" [49•]. It is generally accepted that a loss in mobility is a risk factor for incontinence. A recent study of nursing home residents found a positive correlation between the level of decreased mobility and the grade on incontinence which the authors attributed to difficulty toileting independently due to impaired mobility and possibly insufficient aid by nursing home staff [50]. The same study also found a direct relationship between worsening incontinence and degree of dementia. Behavioral interventions, such as prompted voiding, habit retraining, and timed voiding, have been the mainstay of urinary incontinence treatment in the frail elderly. One recommended behavioral intervention for the frail elderly is combined toileting and exercise therapy incorporating strengthening exercises and mobility skills into toileting routines [49]. Pharmacologic agents may also be used in the frail elderly population but providers should be cognizant of total anticholinergic load and use caution when prescribing medications that meet AGS Beer's criteria as discussed above.

Evaluative Conundrums

Geriatric patients may present with a wide spectrum of mental and physical disabilities which may complicate any presentation of LUTS. Therefore, clinical evaluation and therapeutic recommendations for this patient population must be highly individualized with great consideration also placed on severity of comorbid conditions and overall functional status. It is important to have a discussion with the patient and/or their caregivers regarding the goals of treatment as well as benefits and risks with any planned workup or therapeutic intervention. Providers must be careful to avoid two great errors that can be made in the care of a geriatric patient: withholding adequate care because of chronological age alone or providing overaggressive care in spite of physiological frailty [51].

When to Culture the Urine?

A urine culture should be obtained in elderly patients presenting with localizing genitourinary signs and symptoms [37]. Both the updated McGeer Criteria for residents in long-term care facilities [52] and the choosing widely initiative from the AGS agree that elderly patients with ASB should not have a

urine culture performed or receive treatment with antimicrobials [37]. If a patient is planned to undergo an invasive procedure on the urinary tract, a urine culture should be obtained and treated with culture-directed antimicrobials preoperatively to reduce the risk of postoperative bacteremia and complications.

When to Do Urodynamic Studies?

Urodynamic studies (UDS) are an invaluable tool in the work-up and diagnosis of voiding dysfunction, especially in an elderly patient with multiple comorbidities and factors to consider [53]. It is important to discuss the invasive nature of UDS with the patient as the study itself is not without risks such as discomfort, UTI, hematuria, and creation of false passages with traumatic catheterization. Certain modifications during testing may be needed based on the elderly patient's fitness for the test, such as the inability to stand for prolonged periods of time, and thus, as always, testing should be individually tailored to the patient. Prior to proceeding with testing, the clinician should recognize and discuss with the patient whether or not the results of the study will change treatment recommendations or their willingness for future therapeutic interventions.

In a patient presenting with storage dysfunction, it is important to identify if low-storage pressures can be presumed. Does the patient have normal renal function without upper tract dilation? UDS can be performed to evaluate storage pressures, reservoir capacity, detrusor function and overactivity, and why leakage is occurring. In patients with an elevated PVR and voiding symptoms, UDS can be useful to evaluate detrusor strength and function and the characteristics of the outlet. UDS and the inclusion of fluoroscopy throughout the study can help to diagnose detrusor-sphincter dyssynergia (DSD), ureteral reflux, bladder diverticuli, and other pathologies.

When to Image?

In addition to improving a patient's symptoms, one of the mainstays in treatment of patients with LUTS is to ensure the upper urinary tract is protected and renal function is preserved. If there is clinical concern for storage at high pressures, incomplete emptying, reflux to the upper tracts, or renal dysfunction, it is reasonable to obtain an ultrasound of the kidneys. Ultrasound is widely available, relatively easy to perform and interpret, and does not expose the patient to radiation or a contrast agent. Alternatively, CT scan or MRI can be used to evaluate for hydronephrosis, renal parenchyma, anatomic abnormalities of the genitourinary tract, calculi, hematuria, and a variety of other pathologies. In the setting of acute urinary retention and presence of hydroureteronephrosis, interval imaging after resolution of obstruction is important to assess for improvement of this dilation.

Ultrasound can also be used to image the lower urinary tract in the setting of LUTS and voiding dysfunction. Bladder distention, bladder wall thickening, bladder diverticuli, bladder calculi, prostatic enlargement, prostatic abscess, uterine pathology, and several other diagnoses can be made using ultrasound, CT, or MRI. A fluoroscopic cystogram can also be used to evaluate capacity, diverticuli, upper tract reflux, and the presence of fistula if there is clinical concern. As mentioned above, the incorporated use of video during UDS studies can aid in the diagnosis of DSD, vesicoureteral reflux, and pelvic floor dysfunction.

Dynamic MRI with defecography offers information on the four compartments of the pelvis with a high resolution and a direct visualization of muscles and fascia in multiple planes allowing for complex analysis of pelvic floor and levator ani function [54]. Dynamic MRI may be useful in very complex cases for surgical planning, especially in distinguishing enterocele from rectocele [55]. However, the correlation of most measurement using dynamic MRI with clinical examination, the gold standard for diagnosis of POP, and clinical symptoms seems poor and thus dynamic MRI should only be used in select patients.

Overall, imaging studies in the geriatric patient should be ordered and performed only when the results of the studies will add diagnostic information and could change the management recommendations and treatment plan. For example, if a patient has normal renal function, chronic urinary retention, and you suspect a large bladder diverticulum but they successfully managed and content with clean intermittent catheterization and are not a candidate for surgery due to multiple comorbidities, an imaging study will not change management and therefore may be omitted.

Conclusion

Clinical evaluation and therapeutic recommendations for urologic conditions in geriatric patients must be highly individualized with great consideration placed on severity of comorbid conditions and overall functional status. Providers must be careful to ensure adequate care is provided despite a patient's chronological age while also limiting overaggressive care in the presence of physiological frailty. A geriatric patient's unique comorbidities, polypharmacy, functional status, and treatment expectations should always be considered and discussed when offering the array of diagnostic and treatment modalities available for their urologic condition.

Compliance with Ethical Standards

Conflict of Interest SM Hartigan, WS Reynolds, and PP Smith declare that they have no conflict of interest.

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- • Of importance
- •• Of major importance

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