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GERIATRIC UROLOGY

*Tomas L. Griebling, MD**

It is well recognized that the population of the United States is changing, as the proportion of older adults grows dramatically. Because disorders of the genitourinary system are particularly common in older adults, the specialty of urology will be significantly affected by these trends. Research is critically needed to provide data that will allow a better understanding of the unique nature of urologic disease in the older adult. This information will affect diagnostic and treatment interventions for older adults, particularly the role of urologic surgical therapy.

This chapter summarizes the available literature on the six conditions most commonly encountered in geriatric urology: urinary incontinence, urinary tract infections (UTIs), prostate disease and genitourinary malignancies, sexual dysfunction, stone disease, and renal transplantation. The goal of this review is to provide a framework for developing future research in geriatric urology.

METHODS

A comprehensive literature search was performed to identify literature relevant to geriatric urology. The search was conducted on the National Library of Medicine's PubMed database. The period covered was from 1985 to March 19, 2001. Older literature was included if it provided important historical or other unique information. Newer literature cited for some topics was added during manuscript revision, and results from searches for kidney and bladder neoplasms were also added. Several guidelines and consensus reviews regarding the evaluation and management of urinary incontinence, prostatic disease, and other genitourinary disorders provided pertinent information on the diagnosis and treatment of urologic conditions in older adults that was also extracted for this review.

The search was limited to the English language, human subjects, and an age delineation of 65 years and older. The following six topics were initially searched: prostate disease, renal transplantation, sexual dysfunction, stone disease, urinary incontinence, and urinary tract infections.

For the prostate, the search strategy combined terms for prostate radiology and surgery with terms for prostate diseases and procedures, age factors, postoperative care, outcomes, length of stay, functional status, and complications. This search resulted in 1519 references.

For renal transplantation, the search strategy combined the term *kidney transplantation* with the terms for age factors and postoperative course, along with the terms *reject, tissue donor, cadaveric donor,* and *patient selection.* This search resulted in 1530 references.

For sexual dysfunction, the search strategy used the terms *hormone replacement therapy, testosterone, aged, sexual dysfunctions, sex disorders, libido, penile erection,* and *impotence.* This search resulted in 1318 references.

For stone disease, the search strategy combined the terms *lithotripsy, urinary calculi, kidney calculi,* and *nephrostomy* with the terms for age factors, postoperative care, out-

* Assistant Professor of Urology, Assistant Scientist—Center on Aging, University of Kansas, Kansas City, KS.

comes, length of stay, functional status, and complications. This search resulted in 633 references.

For urinary incontinence, the terms used were *urinary incontinence, aged,* and *age factors* combined with *postoperative care, prognosis, outcome, length of stay, predict, forecast, recovery, functional status,* and *postoperative complications*. This search retrieved 1042 items.

For urinary tract infections, the search strategy was simply for the terms *urinary tract infections* and *aged.* It elicited 1132 references.

Analysis of titles and abstracts by the content expert resulted in the selection of the items used in this review.

SPECIFIC GENITOURINARY DISORDERS IN OLDER ADULTS

Although there has been a plethora of research related to the disorders commonly associated with aging and the genitourinary system, very little of this work has focused on the natural history, pathophysiology, or clinical outcomes in older adults. Clinical studies have commonly not been randomized; most lack long-term follow-up and do not separate outcomes for older adults from those for their younger counterparts. In addition, comparison of studies is complicated by a general lack of standardized operational terminology and validated, reproducible outcomes measures.

URINARY INCONTINENCE

Background and Epidemiology

The epidemiology of incontinence in the geriatric population has been closely examined. Urinary incontinence is a very common disorder among older adults; it is estimated that between 15% and 35% of community-dwelling adults in the United States aged 60 or over suffer from urinary incontinence. [1] The overall prevalence increases with age in both men and women. A recent survey of 10,458 community-dwelling men in Sweden revealed a linear relationship between the prevalence of urinary incontinence and age. [2] The overall prevalence of urinary incontinence was found to be 6.1% at 65 years, 9.6% at 75 years, 21.8% for those between 85 and 89, and 28.2% for those aged 90 years and over. A similar study in a cohort of 7949 older women with a mean age of 76.9 $\pm$ 5.0 years revealed that 41% reported urinary incontinence, with 14% suffering from daily incontinent episodes. [3] This latter study found the prevalence of urinary incontinence to be strongly associated with age, using multivariate regression analysis (odds ratio [OR] 1.3 per 5 years, 95% CI [confidence interval] 1.2 to 1.5). The authors also found that some common conditions associated with aging are strongly correlated with increased incontinence; these include prior hysterectomy, obesity, history of stroke, chronic obstructive pulmonary disease, diminished gait speed, and poor overall health. This finding supports prior studies that have also demonstrated the relationships between urinary incontinence and other chronic disorders associated with increasing age. [4]

Urinary incontinence can have significant negative impact on self-esteem and has been associated with increased rates of depression. [5,6] Incontinence also affects social aspects of quality of life and activities of daily living. [7,8] It may result in increased dependence on

caregivers. Survey data suggest that at least 50% of homebound older adults suffer from urinary incontinence. [9] Those who are incontinent demonstrate significant impairments in social interaction. [10]

Incontinence has been identified as one of the major risk factors that in the United States leads to nursing-home admission, and this relationship has been extensively studied. Using data from the Longitudinal Study on Aging, Coward et al learned that incontinent people in less urbanized or populous areas are more at risk for nursing-home admission than are those in more populous areas. [11] A relative lack of community support services may explain this finding. Other geriatric syndromes that are associated with urinary incontinence can significantly increase the risk of functional dependence. In particular, cognitive impairment and gait abnormalities have been linked to increased rates of both isolated urinary incontinence and combined urinary and fecal incontinence. [12,13] Tinetti et al demonstrated a strong association between urinary incontinence and an increased risk of falls. [14] Seidel et al looked at the relationship between cognition and continence status in an attempt to predict discharge placement after inpatient rehabilitation. [15] They found that analysis of continence and cognitive status at the time of admission to rehabilitation services allows prediction of continence status at discharge that could impact placement decisions.

Even those who are continent at the time of admission to a nursing home have been shown to be at significantly increased risk for the development of urinary incontinence. The estimated incidence of new-onset urinary incontinence in nursing-home residents is approximately 27% per year. [16] However, age itself has not been identified as a risk factor. In a review of 434 nursing-home residents, Palmer et al identified incontinent episodes or poor behavioral adjustment within 2 weeks of admission, male gender, dementia, or impaired mobility within 2 months as significant risk factors for chronic incontinence in nursing-home residents. [17]

Although urinary incontinence is certainly more prevalent among older adults, it should not be considered a normal or inevitable part of aging. A variety of diagnostic and therapeutic techniques have been developed to address this condition; many have shown great promise for improving or eliminating incontinence even in very elderly persons. In addition, there is an increased awareness of the role of preventive therapies. [18]

Types of Urinary Incontinence

Although urinary incontinence has been operationally defined in a variety of ways, the central feature is considered to be the involuntary loss of urine. This may be either acute or chronic. Urinary incontinence that is acute in onset is often transient and is typically caused by nonurologic factors such as fecal impaction, delirium, or polypharmacy. Correction of the underlying problem often leads to resolution of the urinary incontinence.

There are a variety of forms of chronic urinary incontinence, including stress incontinence, urge incontinence, overflow incontinence, and functional incontinence. Mixed patterns are very common. Determining the type of urinary incontinence an individual has is critically important because type influences the choice and success of a given therapy. Surgical therapies are commonly used to treat stress incontinence and selected patients with urge incontinence.

Stress incontinence is caused by a decrease in outlet resistance at the level of the bladder neck. Leakage occurs when the pressure in the bladder exceeds the outlet closure

pressure. Patients describe episodes of incontinence with activities that increase intra-abdominal pressure, such as coughing, sneezing, or laughing. This may be caused by either urethral hypermobility or intrinsic sphincter deficiency. Research has suggested that apoptosis of the rhabdosphincter cells may be one of the primary causes of sphincteric dysfunction in older adults. [19,20]

Urge incontinence is typically caused by overactivity of the detrusor muscles in the bladder wall. Abnormal contractions during bladder filling lead to a sensation of urgency, and if strong enough, these contractions may cause urinary leakage. Urge incontinence is often associated with neurologic disorders, such as prior stroke.

Overflow incontinence is caused by an inability to completely empty the bladder with each voiding attempt. This is often caused by poor detrusor contractility and may be associated with chronic conditions such as diabetes mellitus and some neurologic disorders. Patients typically describe constant dribbling incontinence caused by leakage from the full bladder. Sensation is often diminished, and patients may not sense an elevated postvoid residual volume.

A unique form of incontinence in the elderly population is detrusor hyperactivity with impaired contractility. [21] This is essentially a combination of urge and overflow incontinence. In these cases, the bladder demonstrates abnormal contractions with filling but diminished contractile function during the voiding effort. It is particularly common in frail elderly persons.

Functional incontinence refers to loss of independent urinary control caused by other functional limitations, such as diminished mobility or cognition. Common causes of mobility limitations include arthritis and gait disturbances. Urinary incontinence seen in people with dementia is often functional in origin.

Nocturia is another very common complaint in older adults and is often associated with functional incontinence. Nocturia can have significant physical and psychosocial impacts, including a higher risk of falls and sleep deprivation. The pathophysiology of nocturia in older adults is still not completely understood.

Diagnostic Evaluation

The evaluation of the patient with urinary incontinence must begin with a detailed history and physical examination. This provides the most valuable information for diagnosis and therapeutic planning. However, a variety of other techniques have been developed, ranging from validated survey instruments to predictive algorithms and sophisticated urodynamic tests. Although these tools are widely employed in the evaluation of the incontinent patient, few studies have examined their utility specifically for the older adult. [22,23]

A large number of both self- and interviewer-administered survey instruments have been designed to assess types and degrees of urinary incontinence. However, there is no clear consensus about which instruments are best or should be used particularly in the geriatric population. One study demonstrated that brief questionnaires may be inaccurate and tend to correlate poorly with urodynamic findings in older adults. [24]

The role of formal urodynamic tests and video imaging studies in the evaluation of geriatric urinary incontinence remains controversial. The World Health Organization convened worldwide consensus conferences on urinary incontinence in 1998 and 2001. A committee focused on geriatric incontinence met at each of these conferences to review and discuss issues related to the evaluation and management of incontinence in older

adults. The committee concluded that, although urodynamic studies are generally not required as part of a routine evaluation, they may be particularly important in evaluating geriatric patients being considered for anti-incontinence surgery. [25] These studies can help to differentiate stress, urge, and overflow incontinence, which can affect surgical decisions. Other authors concur with this recommendation for formal urodynamic evaluation prior to development of surgical plans. [26,27] Diokno et al examined the utility of urodynamics in a community-based sample of 167 women aged 60 years and older. [28] In this sample, 26.9% were 70 to 79 years old and 7.2% were 80 years or older. The researchers found that provocative stress tests, including cough and the Valsalva maneuver, significantly distinguish continent from incontinent persons and differentiate between stress and other forms of urinary incontinence. The overall sensitivity and specificity were 39.5% and 98.5%, respectively. Similarly, Wagg et al used urodynamics to identify age-related differences in bladder neck and urethral capacity in older women, including a loss of external sphincter function associated with stress incontinence. [29] Fluoroscopic video imaging is often used with multichannel urodynamics and may enhance interpretation of results. A study of a group of 69 elderly women (mean age of 72.5 years) revealed voiding cystourethrography to be useful for identifying factors associated with urge incontinence seen on urodynamics. [30]

Treatment

Biobehavioral Therapies. A variety of biobehavioral therapies have been developed to address urinary incontinence, including bladder retraining, pelvic floor muscle exercises, and prompted or assisted voiding routines. These conservative therapies are usually recommended as first-line treatment options, particularly for geriatric patients. [25,31] Although they have been shown to be effective in general, few have been studied in elderly persons. [32] In addition, interpretation and generalization is often difficult because many studies include a heterogeneous population with various forms of urinary incontinence. [31]

Wyman et al performed a randomized clinical trial comparing bladder training with scheduled toileting, pelvic floor muscle exercises, and a combination of the two techniques; their subjects were 204 women with a mean age of 61 $\pm$ 10 years who were suffering from stress or urge incontinence, or both. [33] After a 12-week intervention program, the group using the combined treatments was found to have significantly fewer incontinent episodes than did groups using either technique alone. However, at 3-month follow-up, there was no significant difference between groups, suggesting that enrollment in a structured intervention program may be more important than the exact protocol. In a single-arm trial, Publicover and Bear examined the utility of scheduled voiding with weekly clinician counseling. [34] In a group of 19 women aged 64 to 88 years (mean age 75.2), they found that behavioral intervention significantly reduces the number of urinary incontinent episodes during treatment and at 6-month follow-up. The causes and types of incontinence were not defined in this study.

Prompted voiding techniques have also been developed and used successfully with nursing-home residents. [35] Ouslander et al demonstrated an overall response rate of 41% in a cohort of 191 elderly incontinent nursing-home residents (mean age 84.5 years) who underwent a prompted toilet training program. [36] These researchers found that the overall wet percentage went from 26.7% to 6.4% and was sustained at 9.6% after 9 weeks.

Several studies have examined the differences between drug and behavioral therapies. In a randomized controlled trial comparing pelvic floor exercises with biofeedback to anticholinergic medications for treatment of urge incontinence, Burgio et al demonstrated superior results for the behavioral therapy. [37] In this study, 197 women were randomized to behavioral therapy, anticholinergic medication, or placebo. Subjects were 55 to 92 years old (mean age 67.7 $\pm$ 7.5 years). Behavioral therapy was found to result in an 80.7% reduction in urge incontinent symptoms; anticholinergics, in only a 68.5% reduction; and placebo, in 39.4% (all, $P < .05$). In a subsequent modified crossover trial, the same researchers found that, in a cohort of 35 women aged 55 to 91 years (mean 69.3 $\pm$ 7.9), the combination of oxybutynin and pelvic floor exercises supplemented with biofeedback is successful in reducing urge incontinent episodes by 84.3% to 88.5%. [38] In comparison, women on medication or behavioral therapy alone demonstrated improvements of 57.5% to 72.7%. Szonyi et al found similar results in a randomized, double-blind, controlled trial with 57 elderly subjects aged 72 to 98 years (mean 82.2 $\pm$ 6.06). [39] The overall efficacy of the combination of oxybutynin and behavioral therapy was found to be superior to that of placebo or of either medical or behavioral therapy alone.

Pharmacotherapy. Pharmacotherapy has been widely used to treat urinary incontinence, particularly for the treatment of urge incontinence. The most commonly used medications for urge incontinence are anticholinergics; examples are oxybutynin and tolterodine. Both have shown efficacy in older adults, but their use can be associated with significant side effects, including dry mouth, constipation, blurred vision, and confusion. Newer drugs currently in development are more uroselective and may have fewer systemic side effects in older adults.

Few pharmacologic agents are available for the treatment of stress incontinence. Phenylpropanolamine was used in the past to treat some patients with mild stress urinary incontinence. However, the U.S. Food and Drug Administration recently removed this drug from the market because of an associated increased risk of stroke. At this time, the only medication that shows some efficacy in the treatment of stress incontinence is topical vaginal estrogen. Published results are somewhat controversial, and there is a large amount of conflicting data. Data on geriatric cohorts is extremely limited, and many studies are confounded by heterogeneous subject demographics, outcomes measurements, and diagnostic criteria. However, a meta-analysis by Fantl et al did present supportive evidence that estrogen replacement subjectively improves urinary incontinence symptoms in postmenopausal women. [40]

Complementary Therapy. To date, there have been almost no studies examining the role of complementary therapies in the treatment of urinary incontinence in elderly persons. However, interest in such treatments is likely to increase. One uncontrolled pilot study examined the outcomes of acupuncture in a group of 15 elderly women with urge or mixed urinary incontinence that was refractory to other behavioral or medical therapies. [41] Mean age was 76.4 years (range 66 to 82). All subjects underwent 12 acupuncture treatments over a 6-week period. Twelve of the 15 women (80%) considered themselves significantly improved at 3-month follow-up.

Surgery. Surgical therapy has long been a mainstay of treatment, particularly for stress urinary incontinence. It is widely used in treating younger women, but there is some hesitation to choose surgery for older women. Most agree that the first line of treatment

for stress incontinence in older women, particularly those who are frail, should be conservative therapy. [25] Although there is a plethora of data on the indications, efficacy, and potential complications of a wide variety of surgical procedures for the treatment of stress urinary incontinence, very little research has focused on the geriatric patient. Most published studies include a wide range of patients, and it is often difficult to extract results specific to older adults. Research in this field is also hampered by a lack of standardized diagnostic criteria, terminology, and outcomes measures. In addition, there is a dearth of well-designed randomized trials that directly compare the various forms of surgery such as bladder neck injection of bulking agents, retropubic or transvaginal bladder neck suspensions, or pubovaginal sling procedures. Many studies have short-term follow-up of 1 or 2 years, and they often lack information regarding specific reporting intervals. A number of leading professional organizations, including the American Urological Association, the International Continence Society, and the World Health Organization, have identified these limitations in the available research and have made recommendations to improve the quality of future studies. [25,42,43]

The risks of morbidity and mortality for geriatric patients undergoing anti-incontinence surgery are similar to those of other major surgical procedures. In a review of 66,478 Medicare patients, Sultana et al found the overall postoperative surgical mortality to be 0.3% at 30 days, 0.5% at 60 days, and 0.6% at 90 days. [44] The mean and median patient age in this cohort was 71 years. The risk of significant postoperative morbidity and mortality was found to increase linearly with age. In the group aged 75 to 84 years, the mortality rates were 0.5%, 0.7%, and 0.9% at 30, 60, and 90 days, respectively. In the cohort of those 85 years and older, the postoperative mortality rates were 1.6%, 2.0%, and 2.3%, respectively. Median length of hospital stay and readmission rates were also somewhat higher in this older cohort. However, in a multivariate analysis age was not identified as an independent risk factor for morbidity or mortality. The authors concluded that anti-incontinence surgery can be done safely in all age groups, and that the associated comorbidities in very elderly persons are likely more significant contributors to postoperative morbidity and mortality than is age itself.

Injection therapy represents an effective, minimally invasive surgical treatment for stress urinary incontinence caused by intrinsic sphincter deficiency. The procedure can be performed under local or general anesthesia. A bulking agent is injected into the submucosal space at the level of the bladder neck with the use of cystoscopic guidance. Although a variety of materials have been used for the injections, the most widely used material is glutaraldehyde cross-linked collagen. The material acts to increase outlet pressure at the bladder neck. Overall success is approximately 80% in women and 15% in men. Many patients need repeat injections over time to maintain continence. Most studies include a diverse range of patient ages, but the treatment appears to be effective in older women. One study examining the response to collagen injection in elderly women reported a 77% cure rate at 2 years of follow-up (mean age 76 years, range 62 to 90). [45] The procedure is minimally invasive and repeatable, which makes it attractive for use in older adults. Most studies have found that age does not correlate with outcomes for injection therapy. [46–48]

Open surgical procedures for female stress incontinence include bladder neck suspensions or pubovaginal slings. The suspension procedures may be performed via either a transvaginal or retropubic approach. Several studies have examined the utility of these

procedures in elderly women. Nitti et al retrospectively examined the results of the Raz transvaginal suspension procedure in 92 women aged 65 to 87 years (mean 72 years). [49] At a mean of 17 months of follow-up, the overall success rates were 100% for those with mild incontinence, 93% for those with moderate incontinence, and 65% for those with severe incontinence. The researchers compared these results with those from a cohort of 141 patients younger than 65 years. Overall, they found similar continence and complication rates in the two groups. They concluded that this procedure can be done safely and effectively for patients regardless of age.

Pubovaginal sling procedures are being used in increasing numbers for the treatment of female stress urinary incontinence. In contrast to suspension procedures, which place sutures in the periurethral tissues and suspend the urethra to decrease its hypermobility or angulation, sling procedures place a supportive graft underneath the urethra. The procedure has been shown to be effective for stress incontinence caused by either urethral hypermobility or intrinsic sphincter deficiency. Carr et al looked at the results of pubovaginal sling in a retrospective cohort of 19 elderly women (median age 72 years, range 70 to 82). [50] The researchers compared their results with those in a group of 77 women with a median age of 60 years (range 26 to 69). The overall morbidity and success rates of the sling procedure were equivalent in the two groups. Stress incontinence had been resolved in 100% of the older women and 97% of the younger women at a mean follow-up of 22 months. No patients developed significant urinary retention, and the rate of postoperative urinary urgency was 10% in both groups. The researchers concluded that pubovaginal sling cystourethropexy is a safe and effective surgical option for both older and younger women.

Tension-free vaginal tape is a new procedure that uses a synthetic mesh for the suburethral sling. To date there have been limited studies on its use, and follow-up is quite short. However, the short-term data do demonstrate good continence outcomes even in elderly patients. [51] Longer term follow-up in a larger sample will be necessary, as synthetic materials are prone to increased rates of urethral erosion and infection.

Needed Research in Urinary Incontinence

Future studies need to include standardized operational definitions for urinary incontinence, a clear separation of the types of incontinence included in the study population, and requirements for patient inclusion and exclusion.

Although a number of survey instruments are currently used to evaluate patients with incontinence, few have been developed or validated for use in older adults. In the area of diagnostic evaluation, there is a need to better define the role of formal urodynamic testing, including videourodynamics in the assessment of older patients with urinary incontinence. This is particularly important for those considered as surgical candidates.

Urinary incontinence and pelvic organ prolapse often coexist in older women. Additional research on the diagnosis and management of prolapse in older women is needed, particularly to help define the role of surgical therapy in this population.

Several sets of clinical guidelines have been developed for the evaluation and management of urinary incontinence. Formal outcomes research is needed to identify the utility of these guidelines in both institutionalized and community-dwelling older adults.

Although there has been some research examining the association between urinary incontinence and other chronic health conditions in older adults, more work is needed to

better understand these complex interactions. Examination of the relationship between urinary incontinence and other functional impairments, such as cognitive and physical limitations, will be particularly important. Urinary incontinence is commonly associated with chronic neurologic conditions, such as stroke, Parkinson's disease, multiple sclerosis, and Alzheimer's disease. The urologic implications of these disorders, particularly for rehabilitation outcomes, are still relatively poorly understood. In addition, there is a need for additional work on the urologic outcomes in geriatric patients with spinal cord injuries.

Research on behavioral techniques and pharmacotherapy for urinary incontinence must include older adult subjects. Ideally, these treatments should be analyzed for evidence of age-related effects. Studies should also include a variety of subjects, including community-dwelling older adults and people residing in assisted-living and long-term-care environments.

Studies regarding surgical therapy for urinary incontinence should examine outcomes, including potential complications in older adults. Although short-term studies are necessary to begin this work, long-term data will be required to fully evaluate the risks and benefits of anti-incontinence surgeries in older patients. Ideally, this would include 5- to 10-year follow-up with both subjective and objective outcomes measures. Standard surgical techniques, such as injection of bulking agents at the bladder neck, bladder neck suspension procedures, pubovaginal sling cystourethropexy, and artificial urinary sphincter placement, need to be examined in older patient populations in a prospective fashion, with an appropriate length of follow-up.

New anti-incontinence surgical techniques are being developed for both men and women. Many of these procedures are minimally invasive, and they have the potential to offer good clinical outcomes with less surgical risk. However, they need to be studied in comparison with currently accepted procedures. Prospective randomized trials that include older adults in a subgroup analysis would be the ideal. Innovative surgical techniques for urge incontinence such as sacral nerve stimulator implantation also need to be studied in a prospective fashion in this patient population.

Quality of life and cost must be considered in the evaluation and treatment of urinary incontinence in older adults. These types of studies help to define clinical needs from a social standpoint. Ultimately, this information helps to shape decisions about health care policy and reimbursement.

Urol 1 (Level B): **Studies are needed on the pathophysiology of nocturia, which occurs in a wide variety of conditions, including heart failure, renal failure, vascular insufficiency, sleep disorders, prostate enlargement, and polyuria of various causes.**

Urol 2 (Level B): **Studies are needed to establish the validity of new and existing survey instruments to assess the types and degrees of urinary incontinence in older adults.**

Urol 3 (Level B): **Systematic prospective cohort or case-control studies are needed to determine whether urodynamic and imaging techniques are associated with better outcomes in urinary incontinence in older patients.**

Urol 4 (Level A): **Depending on the results of studies of the impact of urodynamic and imaging techniques on outcomes (Urol 3), the ef-**

fect of particular urodynamic or imaging studies on the accuracy of diagnosis and outcomes of treatment should be assessed in randomized controlled trials.

Urol 5 (Level A): **Further randomized controlled trials are needed to test the efficacy and safety of both new and established anticholinergic drugs for the management of urinary incontinence in older adults.**

Urol 6 (Level A): **Randomized controlled trials with large numbers of subjects will be required to determine whether acupuncture or other complementary therapies have a significant beneficial effect in treating urge or mixed urinary incontinence in older patients.**

Urol 7 (Level A): **The bladder neck suspension and sling procedures have been proven effective in older women studied an average of 17 months after surgery. Prospective cohort studies with longer-term follow-up periods are needed to determine whether these procedures have sustained longevity.**

Urol 8 (Level B): **Prospective cohort studies are needed to explore the factors that identify which elderly patients will do better with early surgical intervention than with more conservative treatment options.**

Urol 9 (Level A): **Performing randomized controlled trials to extend the studies of factors that identify appropriate candidates for early surgery for incontinence could lead to the development and validation of predictive models useful for guiding treatment decisions for various types of urinary incontinence in older patients (see also Key Research Questions in Geriatric Urology, end of chapter).**

URINARY TRACT INFECTIONS

UTIs and asymptomatic bacteruria are common in older adults, particularly those in long-term-care settings. Although there is consensus that symptomatic infections should be treated with antibiotics, the implications of recurrent infections and asymptomatic bacteruria on long-term morbidity and mortality outcomes are more controversial. In a prospective cohort study of 1491 women, Abrutyn et al did not find UTI to be a risk factor for mortality.[52] In contrast, they did find age and poor self-reported health status to be significant predictors of mortality. However, a previous longitudinal cohort study of 1148 men and women reported by Nordenstam et al did demonstrate a significant increase in 5-year mortality for men with bacteruria.[53] The similar finding in women disappeared when those with indwelling catheters were excluded from the analysis. In contrast, Nicolle et al reported no significant survival difference between men with and without asymptomatic bacteruria.[54]

Bacteruria has been shown to be a transient phenomenon in older adults. Monane et al performed a prospective observational study on 61 women.[55] Subjects included both community-dwelling persons and long-term-care residents. The researchers found asymptomatic bacteruria to be present in 20% of all urine samples and in one third of all subjects over 6 months of follow-up. Variation was seen on a month-by-month basis, with frequent spontaneous alterations in positive and negative specimens.

These data support the consensus that asymptomatic bacteruria in the older adult does not usually warrant initiation of antibiotic therapy. In a randomized trial of antibiotic treatment for 50 institutionalized elderly women (mean age 83.4 ± 8.8 years) with asymptomatic bacteruria, Nicolle et al found no short-term benefits to be associated with therapy. However, they did identify increased long-term risks, including reinfection with resistant organisms. [56] Similarly, Ouslander et al found that treating asymptomatic bacteruria in institutionalized elderly women does not improve rates of chronic urinary incontinence. [57]

Bacteruria is also commonly associated with chronic indwelling catheter use and typically does not require treatment. However, UTIs associated with short-term catheterization of less than 2 weeks in older adults should be addressed. In a prospective randomized controlled trial, Harding et al examined the role of antibiotic therapy in a group of 119 women with catheter-acquired UTIs [58] and found that infections resolve spontaneously more often in younger women than in those aged 65 years or older (89% versus 62%; $P < .001$). They also found that single-dose antibiotic therapy is generally effective, although more so in the younger women.

Raz et al examined the risk factors associated with recurrent UTI in a case-control study of 149 postmenopausal women referred for evaluation and treatment of UTIs. [59] Compared with the 53 age-matched control subjects, the case subjects tended to have at least one of three common urologic conditions believed to predispose them to infection: urinary incontinence (41% versus 9%, $P < .001$), cystocele (19% versus 0%, $P < .001$), and elevated postvoid residual urine volume (28% versus 2%, $P < .001$). Age was not identified as a significant risk factor in this study.

Two studies have shown the prevalence of UTI in hip fracture patients to be approximately 23% to 25%. [60,61] Catheterization was not found to be a significant risk factor. However, female gender, prior history of UTIs, poor general medical health, and delay in operative treatment of the fracture were found to be predictors of UTI. The identification and treatment of UTIs in this patient population are also important to help prevent potential infection of implanted orthopedic prostheses.

Vaginal estrogen replacement has long been a mainstay of therapy for the prevention of recurrent UTIs in postmenopausal women. [62] Many patients find cream-based preparations messy and uncomfortable. A recent randomized open, parallel study by Eriksen revealed good response to an estrogen-impregnated vaginal device (Estring). [63] Its use has not been studied in a geriatric population; however, improved satisfaction could lead to increased adherence by older patients.

Cranberry juice and other cranberry preparations have long been used as prophylactic treatments for recurrent UTIs. It is hypothesized that cranberries contain compounds that prevent bacterial adhesion to the urothelium. Studies support the prophylactic use of cranberry products, particularly in institutionalized older adults. [64] Avorn et al performed a randomized, double-blind, placebo-controlled trial with 153 older women (mean age 78.5 years). [65] Consumption of 300 mL of cranberry juice each day was found to reduce the odds of clinically significant bacteriuria ($\geq 10^5$ organisms) with associated pyuria to 42% of that seen in the control subjects ($P = .004$). In another study, Kontiokari et al compared consumption of cranberry-lingonberry juice, *Lactobacillus GG*, and placebo in a group of 150 women previously diagnosed with acute *Escherichia coli* UTIs. [66] They found a 20% reduction in the absolute risk of recurrent UTI (defined as a urine culture with $\geq 10^5$

colony-forming units of bacteria) for the women who drank the juice in comparison with the control group (P = .023, 95% CI = 3% to 36%). The recurrence rate for those who consumed *Lactobacillus* did not differ from that of the control group in this series.

Most research on UTIs in older adults has examined patient risk factors and the bacteriology associated with infection. Studies are often confusing because they lack detailed information on what constitutes an infection. The definition of asymptomatic bacteruria is especially a problem. Future research studies must clearly state the inclusion and exclusion criteria used for subject selection.

Clinical drug studies of new antibiotic agents need to consider the unique needs of older adults. They must include issues of safety, efficacy, and tolerability in this patient population. Special attention must be paid to drug-drug interactions and the issue of polypharmacy. Studies on the epidemiology of infection are needed, particularly with regard to development of resistant pathogens. Research on prophylaxis should include specific analysis of indications and outcomes in older adults.

Urol 10 (Level B): **Additional research is needed to clarify the operational definitions of urinary tract infection and of asymptomatic bacteruria.**

Urol 11 (Level B): **The natural history and potential risks of urinary tract infection or asymptomatic bacteruria and forms of preventive therapy warrant further study (see Key Research Questions in Geriatric Urology, end of chapter).**

Urol 12 (Level A): **Research on new antibiotic agents for the treatment of urinary tract infection should include randomized controlled trials specifically designed to assess the safety and efficacy of these drugs in geriatric patient populations.**

PROSTATE DISEASES

Prostate disorders are common in men of all ages, although the incidence and prevalence increase with age. The most common disorders include prostatitis and chronic pelvic pain, benign prostatic hyperplasia (BPH), and prostate cancer. This review focuses on BPH and prostate cancer. Although a variety of treatment options now exist for both of these disorders, emphasis herein is placed on surgical therapy in the older adult.

Benign Prostatic Hyperplasia

BPH is caused by a proliferation of the stromal components of the prostate, typically beginning after age 40 and leading to functional obstructive changes. The development of lower urinary tract voiding symptoms in men appears to be related to this hyperplastic aging process. In a cross-sectional analysis of 1557 men (mean age 51.3 years, range 40 to 96), Haidinger et al found that increasing age is an independent risk factor for onset of symptoms.[67] Other studies have supported this finding but suggest that age does not influence the outcome of subsequent surgery for BPH.[68] Interestingly, symptoms such as urinary urgency and frequency have also been found to be correlated with increasing age in women, but outlet obstruction is uncommon. In a prospective cohort analysis of 2280 men followed for almost 25 years, the development of obstructive voiding symptoms such as urgency, frequency, hesitancy, decreased force and caliber of urinary stream, and

nocturia was found to be highly predictive of the need for prostate surgery, and the risk varies significantly by age. [69] These authors found that men aged 62 to 68 years are more likely than their younger counterparts to require surgery.

Over the past 15 years there has been a general shift from surgical to medical therapy as the preferred initial treatment for most patients with BPH. The development of safe, clinically effective pharmacologic agents, including α_1-adrenoceptor antagonists such as doxazosin, terazosin, and tamsulosin, and 5-α-reductase inhibitors such as finasteride, has led to a decline in rates of surgery for BPH. [70–72] Breslin et al reviewed a series of 1822 BPH patients in a single private practice between July 1, 1987 and June 30, 1991 and determined that the rate of surgery dropped from 28% in the first year of the study to 8% in the last year. [73] This matches the timing of the increased acceptance and use of pharmacotherapy for the treatment of BPH. In a review of the Medicare database, Holtgrewe identified a 30% decline in surgery for BPH despite an increase in the number of older men enrolled in the program. [74]

Phytotherapy has recently gained popularity as a medical treatment option for BPH. Several compounds have been used, including *Pygeum africanum*, *Hypoxis rooperi*, and *Serenoa repens*. There have been few randomized controlled trials of these types of agents, and research is complicated by the lack of standardization in the preparation of most of these compounds. A recent meta-analysis by Wilt et al examined data from 18 trials involving 2939 men. [75] They found an improvement in obstructive urinary symptoms with many different phytotherapy preparations. However, most studies have limited follow-up of less than 1 year, and none targeted geriatric patients. [76]

Despite the increase in the use of pharmacotherapy for the treatment of BPH, some patients ultimately require surgical intervention. Several studies support the fact that surgical therapy for BPH, such as transurethral resection of the prostate (TURP), is generally well tolerated even by elderly patients. A study by Concato et al revealed that, after adjusting for age and severity of comorbidity, there is no difference in 5-year mortality between older men undergoing TURP and those undergoing open surgery. [77] Ibrahim et al also showed that there is no increase in morbidity or mortality with advancing patient age for men undergoing surgery for BPH. [78] Improvements in surgical technique have decreased operative times and the associated risks, such as hyponatremia due to absorption of large volumes of irrigation fluid used in surgery. [79] In a retrospective analysis of 229 men between the ages of 80 and 97, Ilkjaer et al found that overall outcomes from TURP are excellent. [80] In this study, the perioperative mortality rate was 2%, and complications such as UTI or bleeding occurred in 21%. These data match historical control data on younger subjects. [79] In long-term follow-up (range 6 to 16 years), the overall satisfaction rate was excellent, at 86%. In a separate retrospective population-based study of 621 men undergoing TURP for treatment of BPH, Pientka et al found that age is not a risk factor for perioperative morbidity or mortality. [81] This was found to be true for both those with and without significant underlying comorbidities.

Alterations in sexual function have been reported after TURP for treatment of BPH. However, age may also influence these clinical outcomes. In an analysis of postprostatectomy sexual adjustment in 72 men aged 50 to 79 years (mean age 65 years), Libman et al found age to be a significant risk factor for postoperative erectile dysfunction. [82]

A wide variety of minimally invasive surgical therapies for the treatment of BPH have been developed over the past 20 years. Examples include microwave thermotherapy, laser tissue ablation, high-intensity focused ultrasound, tissue electrovaporization, placement of intraprostatic stents, and transurethral needle ablation. These types of therapy offer several potential advantages for older adults, including decreased blood loss, fluid absorption, and anesthetic requirements. However, most studies on these types of therapies lack long-term follow-up, and none have focused on geriatric patients. In outcome analyses, none of these treatments matched the level of results obtained with TURP, currently considered the gold standard surgical option. [83–85]

Prostate Cancer

Age has clearly been identified as a risk factor for the development of prostate cancer. Early detection is possible in most cases by the use of a combination of serum prostate-specific antigen (PSA) testing and digital rectal examination. The American Cancer Society currently recommends annual screening examination using the combination of PSA and digital rectal examination for men aged 50 and over who have a life expectancy of at least 10 years. [86] Men in high-risk groups, including black Americans and those with a first-degree relative with prostate cancer, should begin screening at 40 to 45 years of age.

Using data from the Baltimore Longitudinal Study of Aging, Carter et al have reported that biennial testing in older men may provide similar results in terms of cancer detection at a significant cost savings. [87] The age at which annual prostate cancer screening may be suspended is much more controversial. Most urologists agree that patients need an estimated 10-year life expectancy to justify definitive therapy for localized prostate cancer, such as radical prostatectomy or radiation therapy. The median current life expectancy for men in the United States who have reached age 65 is estimated to be approximately 82 years. Therefore, one could argue to continue screening with annual PSA and rectal examination into the mid-70s for many men. However, this has not been adequately examined. It is currently recommended that the risks and benefits of screening and the possible need for treatment be discussed with elderly men prior to making decisions about screening. [88,89]

PSA levels appear to correlate directly with increasing age, and some authors have argued for the use of age-adjusted normal ranges for interpretation of results. [90] However, other authors disagree. In a study of 773 men, Catalona et al found that age-specific PSA cutoffs enhance specificity but lack appropriate sensitivity. [91] They found that 20% to 60% of cancer in men aged 60 and over would have been missed with the use of age-specific PSA norms.

Age may also influence the choice of treatments for prostate cancer. Many urologic surgeons are reluctant to perform radical prostatectomy on patients aged 70 years and over. However, recent literature suggests that projected life expectancy may be a more useful diagnostic criterion for surgical selection than patient age alone. [92] However, the best methods to establish projected life expectancy have not been definitively established. It has been shown that surgical therapy is generally well tolerated by elderly men if they are carefully selected and screened for comorbid disease. [93,94] However, this must be balanced with data that identify increased age at the time of diagnosis as a strong predictor of a decreased probability of surgically curable prostate cancer. [95]

Age also appears to affect patient choices about treatment options. In a study using a convenience sample of 163 men seen at an urban Veterans Affairs Medical Center, Mazur and Merz found that patients were willing to trade off complications from surgery for increased potential cancer survival. [96] Mean patient age was 65.2 years (range 35 to 84). Overall, 62% of the patients were willing to accept a 100% chance of postoperative urinary incontinence and 83% were willing to accept a 100% chance of erectile dysfunction for better 5-year survival. Age influences the results; older subjects are less willing to accept complications for increased survival. In a similar trial, these authors also reported that older patients are more willing to accept expectant management than radical surgery. [97] These results were found to be influenced by age within the context of pre-existing urologic conditions. Subjects with current urinary dribbling or incontinence or sexual dysfunction were found to be much more likely to prefer expectant management over surgery.

Outcomes and complications may differ with patient age. Kerr and Zincke reported a significantly higher rate of postoperative urinary incontinence in elderly men after radical prostatectomy. [98] They compared outcomes from 191 men aged 55 years or younger at the time of surgery with 51 men who were aged 75 years or older. In this retrospective cohort analysis, 16% of the elderly patients but only 3% of the younger patients reported significant urinary incontinence ($P = .001$). A large population-based study of Medicare claims data for 101,604 men revealed that there is an increase in 30-day mortality after radical prostatectomy that is associated with age ($< 0.5\%$ for men aged 65 to 69 years, and approximately 1% for men aged 75 years and older). [99]

Disease-free survival may also be influenced by patient age at the time of surgery. In a retrospective study of 489 consecutive men treated with radical prostatectomy, Öbek et al reported that age may be an independent prognostic factor for the risk of biochemical recurrence. [100] At a mean follow-up of 25.4 months, 12% of those 70 years or younger but 25% of older men were found to demonstrate rising PSA levels ($P = .01$). The researchers also found that younger age is associated with a longer time to recurrence ($P < .02$).

The effects of surgical intervention for localized prostate cancer on general and disease-specific quality of life can be substantial. In a cross-sectional analysis of 528 managed-care enrollees, Litwin et al found significant impairment in health-related quality of life for men who underwent radical prostatectomy. [101] This was found to occur even after adjusting for age and pre-existing urinary and sexual dysfunction. Stanford et al reported similar results in a population-based longitudinal cohort of 1291 men who underwent radical prostatectomy with 24-month follow-up. [102] Patients aged 65 to 74 years constituted 40.9% of subjects, and 2.8% were between ages 75 and 79. Urinary and sexual dysfunction side effects were found to be more common in the older men and to lead to a decrease in quality of life.

Changes in quality of life have also been reported in men with metastatic prostate cancer. Hormonal manipulation with either surgical or medical androgen ablation is commonly used in the treatment of these men. Litwin et al reported that there is no significant difference in health-related quality of life in elderly men (mean age 71.2 to 75.4 years) treated with orchiectomy and those receiving pharmacologic agents for androgen ablation. [103] Survival data have historically been equivalent between these treatment options.

The biology of prostate cancer has recently attracted a great deal of research attention. The role of androgens in the growth and spread of prostate cancer has been extensively

examined. Prostate cancer is unique in that it is typically a very slow-growing tumor. Adequate follow-up of at least 5 to 10 years or more will be required to provide adequate interpretation of results for most prostate cancer studies.

Needed Research in Prostate Disease

Although there has been a large amount of research on prostate diseases, including both BPH and prostate cancer, relatively few studies have targeted geriatric patients. The greatest advances have come in the understanding of the pathophysiology of prostate disorders and the relationship to the normal aging process. Currently, there is a strong focus on the molecular biology of prostate disease and possible preventive therapies. Studies of new technology, such as gene therapy for BPH and prostate cancer, should include prospective research with older men.

Pharmacotherapy for BPH has certainly changed the initial approach to this disorder for most patients. As new, more uroselective products are developed for the treatment of BPH, they must be tested for safety and efficacy in older men. Phytotherapy is becoming quite popular, and additional research is needed to better understand the pharmacologic mechanisms of these products. Randomized placebo-controlled trials will be needed to establish outcomes data, particularly for older adults.

Research has established the safety and efficacy of TURP surgical therapy for BPH, even in quite elderly men. Research on new, less invasive surgical techniques needs to examine clinical outcomes, including complications, in older men. Results must be compared with the current gold standard, TURP, and studies should ideally be randomized. Future research on both surgical and nonsurgical therapies for BPH must also include an analysis of cost and the impact on health-related quality of life.

The optimal treatments for localized and metastatic prostate cancer in elderly men remain controversial. The biological nature of prostate cancer is unique in that it is generally a slow-growing tumor. Therefore, it will be critical that future clinical research studies include adequate long-term follow-up of at least 5 to 10 years.

A large amount of research has focused on the role of screening for prostate cancer by the use of PSA testing and rectal examination. It is now widely accepted that patients should have a projected life expectancy of at least 10 years to be considered for definitive treatment of localized prostate cancer with either radical prostatectomy or radiation therapy. Most research on life expectancy is population based. However, in order to use this 10-year clinical criterion, we need to develop better models for prediction of life expectancy for individuals. There is also no clear consensus regarding when routine screening in older men may be discontinued. Studies to identify the risks and benefits of continued screening, including potential costs and complications from screening and treatment, will be needed to answer this question. Decision-analysis models that include patients' desires regarding evaluation and treatment may be helpful in this regard.

The role of hormone therapy in the management of metastatic prostate cancer has been extensively examined. However, there are still conflicting data on its utility, especially in elderly men. Future studies on this topic will need to include information about health-related quality of life, which may be significantly altered with hormonal therapy. The use of hormone replacement in older men is still poorly understood. Testosterone replacement therapy may have significant impacts with regard to emotional health, libido and sexual function, and prevention of osteoporosis and other orthopedic disorders.

Urol 13 (Level A): **Randomized controlled trials in elderly men are needed to compare phytotherapies with placebo or with established medical therapies for benign prostatic hyperplasia.**

Urol 14 (Level A): **Randomized trials in elderly men are needed to compare minimally invasive surgical therapies for benign prostatic hyperplasia with the gold standard procedure, transurethral resection of the prostate.**

Urol 15 (Level A): **Randomized controlled trials are needed to compare outcomes of early transurethral resection of the prostate with outcomes of initial medical therapy followed by subsequent transurethral resection of the prostate when clinically necessary.**

Urol 16 (Level B): **Prospective cohort studies and decision-analysis models are needed to identify the characteristics that predispose an older patient with benign prostatic hyperplasia to benefit from early transurethral resection of the prostate (see Key Research Questions in Geriatric Urology, end of chapter).**

Urol 17 (Level B): **Because screening for prostate cancer is so widespread, it may be very difficult to design a randomized controlled trial comparing prostate-specific antigen screening with rectal examination alone, using risks, benefits, and costs as outcome measures. Therefore, the decision as to when to stop routine screening for prostate cancer in elderly men may depend on prospective cohort studies.**

Urol 18 (Level A): **Because there is so much uncertainty regarding the best treatment plan for localized or locally metastatic prostate cancer, it is justified and indeed necessary to design randomized clinical trials in large populations of elderly men, with subgroup analyses, to examine the effects of clinical characteristics on treatment decisions.**

OTHER GENITOURINARY MALIGNANCIES

Bladder cancer and renal malignancies, including both renal cell carcinomas and transitional cell carcinomas of the upper urinary tract, are more common in older than in younger adults. However, the natural history, pathophysiology, and long-term treatment outcomes of these disorders have not been extensively studied in older adults.

Transitional cell carcinoma is the most common malignant tumor of the urinary bladder in the United States. Superficial tumors are usually treated by endoscopic resection. However, the overall recurrence rate is up to 70%, and long-term surveillance is recommended to identify recurrent disease. Adjuvant intravesical chemotherapy or immunotherapy with Bacillus-Calmette-Guerin is commonly used to treat recurrences. In contrast, the standard treatment for muscle-invasive bladder cancer is radical cystectomy and urinary diversion. This major surgery may be associated with significant risk of perioperative morbidity and mortality. Research has shown that radical cystectomy with urinary diversion can be safely performed in elderly patients; however, the long-term outcomes have not been assessed. [104–107] In particular, the effects of such major surgery on activities of daily

living, instrumental activities of daily living, and overall rehabilitation status in older adults have not been clearly identified. The efficacy of less invasive forms of surgical therapy, including partial cystectomy or aggressive endoscopic resection with adjuvant radiation or chemotherapy, has not been studied in older adults.

Renal and adrenal malignancies, particularly small, incidentally detected tumors, are also more common in older adults. However, the natural history of these types of tumors, particularly in elderly patients, needs additional study. [108] Renal and adrenal tumors are often chemo- and radioresistant. Traditional surgical therapies for these types of tumors include radical nephrectomy, nephroureterectomy, or adrenalectomy. Newer, less invasive techniques such as laparoscopic surgery, cryotherapy, and nephron-sparing surgery have been used in older adults and may offer the promise of reduced morbidity. [109]

Additional research regarding the natural history and pathophysiology of both bladder and renal cancer is needed. In particular, the most appropriate diagnostic and treatment modalities for management of the small, incidental renal or adrenal mass need to be better defined. Outcome analyses for new, minimally invasive treatment options will be particularly valuable.

Urol 19 (Level A): **Randomized clinical trials are needed to determine the overall safety and long-term efficacy of less invasive therapy for bladder and renal malignancies in older adults, comparing these with the standard procedures (radical cystectomy and radical nephrectomy).**

Urol 20 (Level A): **Predictive outcomes models to identify who would most benefit from the various forms of therapy for bladder and renal malignancies need to be developed and validated (see Key Research Questions in Geriatric Urology, end of chapter).**

SEXUAL DYSFUNCTION

Sexual dysfunction occurs in both men and women, and the overall prevalence of these disorders increases with age. However, like other genitourinary complaints, sexual dysfunction should not be accepted as a normal part of aging. Recent research has examined this issue in an attempt to sort out differences resulting from the physiology of aging and from other causes.

Male Sexual Dysfunction

The prevalence of sexual complaints increases with age. Panser et al conducted a population-based cross-sectional study of 2115 men and found that, in comparison with men aged 40 to 49 years, older men (70 to 79 years) are more worried about their overall sexual function (24.9% versus 46.6%) and report that they experienced worse actual performance over the past year. [110] The older men also have rated higher levels of dissatisfaction, decreased libido, and impaired erectile function. However, in a multivariate analysis, age itself was not found to be an independent predictor of the results. On the basis of survey results from a convenience sample of 1680 men in different geographic locations, Jønler et al confirmed that the prevalence of erectile dysfunction increases with age. [111] In an analysis of data from the Massachusetts Male Aging Study, Johannes et al reported the crude incidence rate for erectile dysfunction to be 25.9 cases per 1000 man-years (95%

CI = 22.5 to 29.9). [112] The incidence increases significantly with increasing age, with 12.4, 29.8, and 46.4 cases per 1000 man-years for men in their 40s, 50s, and 60s, respectively. They also found that other risk factors for erectile dysfunction include lower education as well as comorbid disease, such as diabetes mellitus, heart disease, and hypertension.

Diabetes and use of hydrogen-blocker medications for the treatment of gastric acidity and reflux were found to be significant risk factors for erectile dysfunction (relative risk [RR] for both, 2.3) in a cross-sectional survey study of older men by Helgason et al. [113] They also identified prostate cancer as a significant risk factor (RR 1.9). However, they did not conclude that age itself is a risk factor. Despite these increases in the prevalence of sexual dysfunction, older men remain interested in sexual function and activity. [114] A similar trend has been documented in a small convenience survey of older men residing in long-term-care facilities. [115] Sexual dysfunction in older adults has been associated with a decreased quality of life and mental health impairment, including depression. [116–118]

Several multidimensional assessment instruments have been developed to identify the levels of sexual dysfunction and their impact on disease-specific quality of life. [119–121] These survey instruments have been well designed and appear to have appropriate reliability and validity when used with elderly persons.

Female Sexual Dysfunction

An instrument to evaluate female sexual dysfunction has been developed and validated. [122] Very little is known about the psychosocial and physiologic aspects of female sexual dysfunction. Interest is growing both in the scientific community and the lay public. Several studies have documented that sexual dysfunction in women increases with age, but the causes of these changes are still poorly understood. [123,124] A survey of 964 women in a primary care practice revealed that 98.8% expressed at least one sexual concern. [125] Mean patient age in this study was 45.4 $\pm$ 16.8 years, with a range of 18 to 87 years. (See also Chapter 9, section on sexuality.)

Influence of Comorbid Disease

Several studies have presented early data to suggest that most sexual dysfunction in older adults is related to the effects of other chronic comorbid diseases rather than normal aging alone. [126] The most common associated disorders include hypertension, diabetes mellitus, atherosclerosis, and other diseases of the cardiovascular system. [127–131] Associated changes in penile vasculature lead to impairment of penile blood flow and subsequent erectile dysfunction. Sexual dysfunction related to impaired penile blood flow is also a side effect of many antihypertensive medications, particularly those containing β-blockers.

Chronic pain is associated with an increased rate of sexual dysfunction and may be associated with the concomitant increase in depressive symptoms in chronic pain patients. [132] Similarly, patients with end-stage renal disease on peritoneal dialysis display increased rates of sexual dysfunction, depression, and impaired quality of life. [133] Gastrointestinal and urinary diversion surgeries are common in older adults for treatment of bladder and bowel cancers. Ostomy patients typically report poorer quality of life and limitations in sexual function than do patients without a stoma. [134–136] These changes are often caused by impaired body image and lack of knowledge about techniques to improve sexual function despite these handicaps.

Studies of the relationship between sleep apnea and sexual dysfunction have provided conflicting data. Karacan and Karatas examined 22 men with sleep apnea (mean age 54, range 27 to 73) and found that erectile function improved in one third of the men with use of continuous positive airway pressure. [137] However, Schiavi et al did not find sleep apnea to be a significant risk for erectile dysfunction in a similar cohort of 70 men aged 45 to 75 years. [138]

Neurologic disorders are very common in older adults, and in retrospective cohort studies several have been associated with impaired sexual function. Stroke appears to be a cause of significant sexual dysfunction in both men and women. [139] Right hemispheric stroke appears to cause greater impairments than left hemispheric stroke. [140] It must also be remembered that any sexual dysfunction will affect both the individual patient and his or her partner(s). [141] Parkinson's disease is also associated with sexual dysfunction. In a cohort study of 50 subjects (mean age 67.3 years) with evidence of autonomic nervous system dysfunction, Koller et al found a 70% rate of sexual impairment. [142]

Dementing illnesses such as Alzheimer's disease can significantly impair the sexual function of both patients and partners. [143] Inappropriate sexual behaviors are common in this patient population, occurring in approximately 15% of affected individuals. [144] Clinical management of these associated behavior disorders can be difficult and may lead to requirements for placement in long-term care. Anecdotal information suggests that antiandrogens, estrogen, gonadotropin-releasing hormone analogues, selective serotonin-reuptake inhibitors, and cimetidine may be helpful. [145,146] Additional randomized placebo-controlled trials will be necessary to identify the utility of these types of pharmacotherapies in older adults with inappropriate sexual behaviors associated with cognitive impairment.

Treatment of Sexual Dysfunction

Over the past decade, the variety of options for the treatment of sexual dysfunction, particularly erectile dysfunction, has increased dramatically. Clinical evaluation has been simplified, and invasive testing is usually deferred in favor of empiric, goal-directed therapy. The introduction of sildenafil citrate (Viagra) has revolutionized the clinical management of erectile dysfunction. Although studies have shown general clinical efficacy, research stratified by age is still lacking. [147,148] Trials for the use of sildenafil citrate in women are in progress. Early data suggest that it may improve sexual function in younger women ($<$ 65 years). [149] The widespread acceptance of oral therapy for sexual dysfunction has led to a decreased use of other forms of treatment, including intracavernosal injection therapy, vacuum erection devices, and penile prosthesis.

Needed Research in Sexual Dysfunction

Research on sexual function and dysfunction in older adults has focused primarily on basic physiology and pathophysiology. The general associations between chronic disorders such as diabetes mellitus and vascular disease have been identified, but more work will be needed to examine these complex relationships. The development of new diagnostic and therapeutic options must include prospective analysis of utility in older adults. Potential side effects of therapy must be carefully examined. For example, currently used oral medications have potential interactions with other drugs that may lead to cardiovascular

complications. Critical outcomes analysis in older persons will be needed to determine safety and efficacy of new products.

The physiology of sexual function and dysfunction in older women is very poorly understood. Research is critically needed to better understand this basic biology in order to develop effective treatment modalities. Cost and quality-of-life research is also needed regarding sexuality in both older men and women.

Urol 21 (Level B): **Most of the studies that examine the relationship between sexual dysfunction and comorbid conditions are small retrospective reviews or case series, and they typically do not focus on elderly subjects. Larger, well-designed prospective cohort studies will be necessary to confirm these associations in older adult populations (see Key Research Questions in Geriatric Urology, end of chapter).**

Urol 22 (Level B): **Time series (before-and-after) studies may be sufficient to assess the effect of sildenafil on sexual function of women aged 65 to 74, 75 to 84, and 86 years and older.**

Urol 23 (Level B): **Time series (before-and-after) studies may be sufficient to assess the effect of sildenafil on sexual function of men aged 65 to 74, 75 to 84, and 86 years and older.**

Urol 24 (Level B): **Prospective clinical series are needed to examine the use of intracavernosal injections, vacuum erection devices, and penile prostheses by men who are nonresponsive to sildenafil or are ineligible to use it.**

STONE DISEASE

Urinary tract stone disease is one of the most common disorders treated by the urologist. It is estimated that approximately one in every five individuals will experience an episode of urolithiasis at some point in life. The risk factors and symptoms associated with the development and passage of urinary stones are the same in older and younger persons. Swallowing difficulties and fear of increased incontinence are common in older adults and may cause decreased fluid intake, which can increase the propensity for stone production.

Very few studies have examined the surgical management of stone disease in geriatric patients. Extracorporeal shock-wave lithotripsy (ESWL) has become a popular form of effective, minimally invasive therapy, especially for stones in the renal collecting system and upper ureter. Kramolowsky et al reviewed the utility of ESWL as a function of age. [150] They examined a cohort of 789 consecutive patients undergoing ESWL for treatment of stones in the upper urinary tract. Of these patients, 96 (12%) were aged 70 or over, with a mean age of 75 (range 70 to 93). A total of 905 treatment procedures were performed, of which 107 procedures were in the older group. No significant differences were identified between the groups with regard to treatment-related complications, length of postoperative hospitalization, or clinical efficacy. The need to perform secondary procedures to render patients stone-free was similar in the groups (12.5% older, 13% younger).

Newer forms of minimally invasive surgical therapy for stone disease have revolutionized the care of patients with urolithiasis. Surgical procedures include retrograde

ureteroscopic stone extraction and percutaneous nephrostolithotomy. Many of these procedures also use lithotripsy technology such as ultrasound, electrohydraulic shock-wave therapy, and holmium laser energy.

Although it is estimated that stone disease occurs in older adults with the same incidence as younger people, there has been almost no research on the evaluation and management of this disorder in adults aged 65 and over. Studies are needed to define the role of formal metabolic evaluation and medical management in these patients. Established and evolving surgical technologies need to be examined in older adults with regard to utility, safety, and clinical efficacy. Many of these newer techniques are minimally invasive and may offer potential benefits for older adults that are significantly better than those of more invasive procedures. Cost and health-related quality of life must also be considered in studies on diagnosis and treatment of urolithiasis.

***Urol 25 (Level B)*: Cohort studies are needed to evaluate the safety and clinical efficacy of minimally invasive surgical techniques in older adults with stone disease.**

RENAL TRANSPLANTATION

End-stage renal disease (ESRD) is a common clinical problem with a variety of causes, and the prevalence increases with increasing age. Although chronic peritoneal or hemodialysis is effective therapy for ESRD, renal transplant is often the preferred form of therapy because of better survival and overall and disease-specific quality of life. [151] The incidence rates for ESRD have more than doubled for most age groups over the past decade. [152] In fact, the incidence for those aged 75 and over has increased by a factor of 2.4 times. In 1996 in the United States, 73,000 new ESRD cases were identified, and 46% of these patients were aged 65 years or over. [153] ESRD has important implications for overall quality of life. Beusterien et al reported significant impairment in essentially all quality-of-life domains, with ESRD patients scoring lower than those with congestive heart failure or clinical depression. [154] In an analysis of Medicare claims data for almost 43,000 transplants, Whiting et al demonstrated a significant cost savings for transplant over chronic dialysis even when quality of life was not figured into the cost-equation models. [155]

The role of renal transplantation in older adults with ESRD has long been a source of controversy, particularly in terms of the ethical and cost implications. Becker et al pointed out that the debate focuses both on whether older adults should undergo transplant, and whether kidneys from older donors should be used for older recipients, given a theoretically shorter graft life span. [156] They concluded that physiologic function is more important than age in the determination of suitability for transplant. A number of studies have examined the utility of renal transplant in older adults. Recent research has focused on the use of kidney grafts taken from older adults as donors for both older and younger recipients.

The Older Adult as Donor

Studies on data from the United Network for Organ Sharing have suggested that overall graft survival from donors aged 55 and over is approximately 10% lower than for grafts from younger donors. However, results depend largely on how graft survival is defined.

Many studies combine perioperative deaths with other causes of graft loss. Other research examines outcomes more critically, using biochemical parameters.

Shimmura et al examined predonation creatinine clearance for living related donors and found no significant differences in graft survival that are based on this parameter. [157] Hayashi et al suggested that graft survival from living related older donors is most likely due to the fact that no preservation or significant cold ischemia time is required for these transplants. [158] They also pointed out that follow-up in the living related older donor (age > 66) revealed no significant changes in postoperative serum creatinine in comparison with younger historical controls. In a retrospective cohort analysis of extreme-age donors (< 10 or > 60 years old), Ferraresso et al reported actuarial graft survival at 1 and 4 years of 90% and 87% in kidneys from older living related donors. These figures are statistically equivalent to historical controls. [159]

There is continued controversy over whether older kidney grafts should be used exclusively for older recipients. In a retrospective cohort study using biochemical parameters, Vianello et al found that grafts from persons of "high donor age" (50 to 66 years) had lower survival than did grafts from younger persons. [160] They concluded that when kidneys from donors aged 50 years and over are used, they should probably be given to recipients with an estimated life expectancy of no more than 10 to 15 years. However, a more recent retrospective analysis of 509 transplants challenges this conclusion. [161] These investigators compared results stratified by both donor and recipient age. This study was unique in that it considered age as a continuous rather than a categorical variable. They found that the age of both the donor and recipient independently influences the overall graft survival rates when results are censored for deaths. They found no interaction between these variables, which suggests that trying to match the ages of donors and recipients may not be necessary.

Chronic organ rejection does not appear to differ on the basis of the age of the graft donor. In a retrospective cohort analysis comparing graft survival from 112 older living related donors (55 to 81 years) with that from 87 younger donors (< 45 years), Kumar et al found no difference in overall graft survival between the groups. [162] In addition, they found no difference in graft function, using biochemical parameters, including serum creatinine or glomerular filtration rate. However, they did identify a significantly higher rate of acute graft rejection in kidneys obtained from the older donors.

Although the quality of transplanted kidneys is very important, a recent prospective multicenter case-control study by Remuzzi et al suggested that volume of functioning nephrons in the transplant may be of equal significance. [163] In this analysis of grafts from older (≥ 60 years) cadaveric donors, they found that en bloc transplant of both kidneys of "marginal quality" yields better clinical results than transplant of a single, more "ideal" older kidney.

The Older Adult as Recipient

Although it has been well documented that older adults can successfully undergo kidney transplantation for renal replacement therapy, statistics on graft survival usually show lower success in older adults than in younger recipients. However, the method used to define graft loss is important for analysis and interpretation. Most studies include perioperative deaths as a graft loss. However, in a retrospective cohort analysis comparing 206 recipients aged 60 years or over with 1640 younger recipients, Doyle et al found no

significant differences in graft survival when death is censored as a cause of graft loss. [164] In fact, graft loss in older adults appears to be due more to perioperative mortality than to other factors. [165]

The primary risk factor for perioperative mortality in older renal transplant recipients appears to be concomitant cardiopulmonary disease. In a small retrospective analysis of 26 kidney recipients aged 60 years or over, Schulak et al found that both overall patient and graft actuarial survivals are influenced by the presence of cardiovascular comorbidity. [166] Low-risk patients had 1- and 3-year graft and patient survival rates of 91% and 84%, respectively, but high-risk patients had survival rates of 67% and 58%. Their findings are supported by data reported by Tesi et al in an analysis of 1222 consecutive transplants. [167] They found that underlying cardiovascular disease was the leading cause of death in both older and younger recipients.

The presence of underlying cardiovascular disease certainly influences patient selection for transplant. In a sociodemographic cohort analysis of 4118 subjects started on dialysis between 1986 and 1987, Gaylin et al found cardiovascular disease to be the most predictive parameter of who received a transplant. [168] This suggests that potential recipients are being well screened to help maximize clinical outcomes.

There are data to suggest that the immunosuppression requirements for older graft recipients are lower than for younger patients. [169] This likely reflects the fact that overall immune response tends to decrease with the normal aging process. Soran et al found in a cohort of 230 older ($>$ 60 years) recipients that the administration of tacrolimus, a relatively new immunosuppressive agent, results in overall graft survival rates for repeat transplants equal to that of first transplants. [170]

Needed Research in Renal Transplantation

There has been a large amount of research on renal transplantation for the management of ESRD in older adults. Most of this work has focused on the use of kidneys from older donors for younger recipients. More recent studies have examined the ability to perform transplants in older recipients. As surgical techniques for renal harvest and transplant improve, these methods will need to be studied in older adult populations. Laparoscopic donor nephrectomy for living related kidney donors has recently gained widespread attention as a minimally invasive technique. As transplant surgeons continue to push the age limits for donation, this technique will need to be examined in older adults.

Our understanding of immunosuppression has improved dramatically over the past several years. As new immunosuppressive agents are developed, their safety and efficacy will need to be studied in older adults who may now be eligible for transplant. In addition, the impact of various forms of renal replacement therapy (chronic dialysis versus transplantation) on health-related quality of life in older adults should be addressed.

> *Urol 26 (Level B)*: **The role of renal transplantation in older adults has grown recently, with the expansion of both donor and recipient age limits and other clinical criteria. Research is needed to clarify the unique needs of geriatric transplant patients, particularly with regard to immunosuppression and clinical outcomes. The effect of age of the kidney donor, age of the recipient, methods and degrees of immunosuppression, and the presence of concomitant disease need to be evaluated in prospective cohort studies.**

KEY RESEARCH QUESTIONS IN GERIATRIC UROLOGY

Urol KQ1: **Research is needed to better define the pathophysiology and natural history of the most common genitourinary disorders affecting older adults. These include but are not limited to urinary incontinence, urinary tract infection, prostate diseases, urologic malignancies, sexual dysfunction, stone disease, and renal failure and transplantation.**

Hypothesis-generating: Basic science and clinical studies are recommended to examine these issues, particularly the impact of common comorbid illnesses that may influence genitourinary health, for example, diabetes mellitus, hypertension, and chronic neurologic conditions. Large-scale cohort studies, well-designed case-control studies, and community-based research techniques are needed to develop this baseline knowledge.

Hypothesis-testing research that is based on this improved understanding of genitourinary disorders in older adults should then be conducted. Randomized therapeutic trials with appropriate operational definitions and adequate longitudinal follow-up should be developed to identify the most effective surgical and nonsurgical treatment options for each of these conditions.

Urol KQ2: **Research is needed to develop and validate predictive models to identify appropriate candidates for early surgical or other more active therapies for urologic disorders versus appropriate candidates for an initial trial of more conservative treatment options.**

Hypothesis-generating research: For most urologic conditions that affect older adults, a range of treatment options are available, including conservative nonsurgical therapies, biobehavioral treatments, pharmacotherapy, or surgical interventions. There is a perceived general tendency to favor initial trials of conservative therapy in older adults. Research is needed to determine whether delay in treatment may make subsequent surgical intervention more difficult or less successful. Conversely, it is possible that a planned course of preoperative nonsurgical therapy may potentially improve subsequent surgical outcomes. In addition, models to determine what preoperative evaluation techniques best influence outcomes should be developed. For example, which patient undergoing treatment for urinary incontinence would most benefit from formal urodynamic evaluation? Ideally, these models should be created on the basis of findings from randomized controlled clinical trials of diagnostic evaluations and treatments outlined in Urol KQ1, above.

Hypothesis-testing research to determine the validity and reliability of these predictive models will then be required. This will involve prospective cohort studies and clinical trials of these models.

Urol KQ3: **Research is needed to analyze the longitudinal outcomes of various urologic therapies, including potential risks, benefits, and costs.**

Hypothesis-generating research: The genitourinary disorders that affect older adults are diverse, and each presents unique diagnostic dilemmas and treatment challenges. Large-scale, prospective cohort studies and randomized controlled clinical trials will be needed to identify the impact of the information gained from work on Urol KQ1 and Urol KQ2. Emphasis should be placed on risks and benefits associated with health-related quality of life, improvement or preservation of functional capacity, and costs. The development of cooperative databases from multiple clinical centers will help to facilitate this type of outcomes research.

Hypothesis-testing research using randomized controlled trials will subsequently be required to demonstrate the clinical utility and longevity of these therapies. It will be critically important for these studies to be designed with a sufficient follow-up interval to document the durability of outcomes.

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