AUA White Paper on

OPTIMIZING OUTCOMES IN UROLOGIC SURGERY: PRE-OPERATIVE CARE FOR THE PATIENT UNDERGOING UROLOGIC SURGERY OR PROCEDURE

WORKGROUP:

John T. Stoffel, MD (Chair)
Jeffrey S. Montgomery, MD
Anne M. Suskind, MD, MS, FACS
Christopher Tucci, MS, RN, BC, CURN
Alex J. Vanni, MD (Co-Chair)

AUA STAFF:

Heddy Hubbard, PhD, MPH, RN, FAAN
Suzanne Pope, MBA
Jennifer Bertsch
Margaret Hoogland (Medical Librarian)

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Introduction

Urologic patients undergoing operative procedures require thorough pre-operative assessments and planning prior to intervention. Failure to properly assess the pre-operative needs of these patients can potentially result in increased intra-operative/post-operative morbidity. The impact can be temporary, such as increased post-operative dementia in geriatric patients on certain pre-operative medications,[1] or more insidious as seen with increased complications among cystectomy patients with low nutrition.[2] In addition to increased morbidity, an incomplete pre-operative assessment can have financial ramifications for both the patient and hospital system. For example, a 2011 prospective cross sectional study examined surgical cancellation rates across 25 hospitals and found that approximately eight percent of elective urologic surgeries were cancelled within 24 hours of the scheduled procedure and needed to be rescheduled. Medical administrative reasons, such as incomplete medical work up, were cited as a significant source for many of the cancellations.[3]

The purpose of this white paper is to review key components of pre-operative evaluation of the urologic patient and familiarize urologists with existing pre-operative practices in order to identify risk factors that can be modified and allow for more effective counseling of patients prior to surgery. It should be emphasized that a comprehensive pre-operative evaluation requires a team of medical professionals to assess and evaluate the specific patient's needs. Although the urologic practitioner is not primarily responsible for many of the evaluations noted in this document, this white paper is intended to serve as a tool to coordinate care between the operative and supportive pre-operative medical teams. The target audience is urologists, urologic residents, advanced practice providers, and primary care physicians performing pre-operative clearance for urologic patients.

Methodology
This topic was submitted to the American Urological Association Quality Improvement and Patient Safety Committee and selected as a white paper. A Pre-Operative White Paper Panel comprised of practicing urologists and urologic nurses was assembled. The topic was researched via English language literature search from 1980 through 2018 and focused on pre-operative evaluation and safety. Best practice recommendations were also reviewed from specialty societies, including the American College of Cardiology/American Heart Association, American Society of Anesthesiologists, American Gastroenterological Association, and the European Association of Urology. Recommendations contained in this manuscript reflect expert opinion from the Pre-Operative Panel and are based on review of available evidence and existing best practice statements.

Definition
Urologic pre-operative care is defined as medical evaluation or treatment received in preparation prior to a urologic surgery or procedure.

Pre-Operative History/Physical

Timing/Documentation Requirements
Per the Centers for Medicare & Medicaid Services (CMS) guidelines, a pre-operative history and physical (H+P) must be completed not more than 30 days prior to surgery as set forth in the Conditions of

Participation. These are requirements that healthcare organizations must meet in order to begin and continue participating in Medicare and Medicaid programs. It is acceptable to perform the H+P the day of the procedure, but as CMS stipulates, appropriate medical personnel accredited and privileged by the hospital/facility/surgery center to perform the H+P must be present. This may include advanced practice providers per individual state licensing requirements, although the responsible urologist still is required to sign off. However, the patient cannot be under anesthesia, sedation, or in the operating theater when the H+P is performed. CMS and The Joint Commission also note that "an update is required within 24 hours AFTER the patient physically arrives for admission/registration but prior to surgery or a procedure requiring anesthesia services."[4] If the H+P is not performed the day of the surgery, but within 30 days, the surgeon should provide an update noting the H+P exam and indicating appropriate changes in the patient's status. This required update also applies to patients who may have been in the hospital longer than 24 hours prior to surgery.

Components of the H+P

The purpose of the H+P is to determine if anything in the patient's history or condition could potentially affect the surgery or procedure. Although there are no standardized documentation requirements for the pre-operative H+P, the following components may be included:

- *Chief Complaint:* The patient's urologic chief complaint to be addressed by the intervention is noted. Laterality, if applicable, is stated in the History of Present Illness.

- *History of Present Illness:* This describes the patient's symptoms and physical signs related to the underlying urologic condition and notes the duration, severity, and location of each. Previous urologic interventions, testing, and imaging relevant to the present condition can be also added in this segment. Additionally, the impact of comorbid conditions on this present illness is also documented here.

- *Past Medical History/Past Surgical History*: Any and all co-morbid conditions are listed, ideally divided into active and resolved issues. Previous surgical intervention is noted with either dates or estimates of when performed. Special attention is usually noted to implantable devices that could affect the planned surgical intervention.

- *Review of Systems:* A multi-system evaluation will help identify any active issues in major organ systems prior to surgery. Urologic issues such as urinary frequency, urgency, incontinence, sexual function, and pain are also helpful to document prior to surgery to establish a baseline.

- *Allergies:* Reactions to medications, foods, supplements, and materials are updated and type of allergic reaction noted. Previous reactions to anesthesia can be noted here.

- *Medications:* An updated medication list includes active medication, dosage, delivery, and frequency. Nutritional supplements are also documented.

- *Social History:* Smoking, alcohol/drug usage, including duration of use, are recorded. A description of the person's job/activities that may impact surgery or recovery are also helpful to describe (e.g., person is not a smoker but worked as a bartender in a bar for 35 years). Marital status can also be noted here.

- *Physical Exam:* A general physical exam should include major organ systems. The type, size, and date of placement for urologic drains/catheters can be noted in this section, if relevant to upcoming surgery. Additionally, the urologist can assess the patient for difficulties with intra-operative positioning and document potential concerns. For example, patients being positioned dorsal lithotomy should have lower extremity range of motion. Flank, supine, and prone positioning can also be similarly modeled in the pre-operative assessment to potentially identify limitations.

  Certain urologic surgeries may require additional specific physical examinations. Patients undergoing a urostomy or continent stoma benefit from a pre-operative marking of potential stoma sites that are free from skin folds or dermatologic scarring. Placement of a suprapubic tube likewise requires an accessible site on the abdomen. For more information, please refer to AUA-WOCN reference on stoma evaluation: http://www.auanet.org/guidelines/stoma-marking.[5]

- *Assessment/Plan:* The procedure, with any laterality, and the assessment that the patient is ready for surgery should be stated. CMS guidelines require that the pre-operative history and physical note that the patient is cleared for surgery in an ambulatory setting.

Although not part of the H+P, urologists should also be familiar with American Society of Anesthesiology (ASA) Physical Classification.[6] Per ASA standards on physical status:

- ASA I – Normal healthy patient;
- ASA II – Patient with mild systemic disease;
- ASA III – Patient with severe systemic disease;
- ASA IV – Patient with severe systemic disease that is a constant threat to life;
- ASA V – Moribund patient who is not expected to survive without the operation; and
- ASA VI – Declared brain-dead patient whose organs are being removed for donor purposes.

Frequently, ASA classification determines if a patient can be scheduled in an ambulatory surgery center or in an inpatient hospital facility. Many ambulatory surgery centers require specific clearance for ASA III or above.

Informed Consent

Informed consent is a legal and ethical process designed to protect the patient by promoting decision and voluntary authorization for treatment or surgical procedure. The process is based on three tenets: preconditions, information, and consent. Preconditions include competence and voluntariness of the patient. Informational elements represent the disclosure of information, recommendation of a care plan and the patient's understanding of the proposed procedure. Consent includes the patient's decision and authorization.[7]

Studies have shown that many patients may not fully understand the risks, potential complications and benefits of surgery.[8] Key components that reflect capacity to make medical decisions include: 1) if the patient is able to indicate his or her treatment choice; 2) whether the patient understands the relevant information communicated by the clinician; 3) if the patient acknowledges his or her medication condition, treatment options and likely outcomes; and 4) whether the patient can engage in a rational

discussion about treatment options.[9] If a patient is unable to sign surgical consent, a proxy consent can occur through an individual who is provided with the legal right to make decisions on behalf of the patient.

Informational elements of informed consent include the education provided to the patient. Key concepts should include description of the treatment or surgical procedure, including alternatives, complications, and risks, description of the pre-operative and post-operative courses, surgical approach and the desired result. For academic medical centers and teaching facilities, acknowledging care performed by assistants is also encouraged.

In its Statements on Principles, the American College of Surgeons also encourages surgeons to inform patients if the surgeon will be participating in overlapping surgeries.[10] An institution or health system may also have specific policies regarding concurrent or overlapping surgeries.

Pre-Operative Education

Counseling and education are vital components of pre-operative preparation, care, and the informed consent process. A team approach, including but not limited to the urologist, advance practice providers, and nursing, frequently work together to educate patients throughout the pre-operative assessment. Key components to discuss include type of sedation or anesthesia, incision size and location, surgical approach, drain, device, catheter or stoma care and management, complications and their prevention, pulmonary optimization and toileting, ambulation, venous thromboembolism prophylaxis, pain management, bowel function, side effects, effective coping, recovery timeline, and post-operative limitations, and the need for additional follow up, procedure, or treatments.[11] A discussion about the patient's specific cultural norms and values that may impact the pre-operative evaluation is also very helpful to alleviate concerns and to address the patent's potential pre-operative or postoperative needs.

Tailored education should accompany specific treatments and procedures. For example, stoma marking and ostomy education precedes cystectomy and ileal conduit urinary diversion creation, clean intermittent catheterization and irrigation training precedes cystectomy with neobladder and continent urinary reservoir surgery, antiviral medication regimen education precedes renal transplant surgery, urinary catheter care and management precedes prostatectomy.[12]

Pre-operatively discussing specific elements of care that will occur while the patient is sedated versus awake is recommended to relieve any fears and reduce the risk of last minute procedure cancellation. Some patients may only consent for certain procedures to be performed while sedated, such as urinary catheterization or ureteral stent removal. Types of care to discuss include catheterization, intravesical instillation, or intravenous catheter placement.

Most patients believe the amount of information offered by their provider is sufficient; however the degree of comprehension of the various components of the informed consent process may not be adequate. Well-designed tools, such as written material, and interactive or audiovisual media, may increase the degree of patients' understanding of the information provided.[13] Although there is no consensus on the type or format of any decision aids, making a variety of tools available can help the patient select the format that best suits his/her learning style. Evaluation of understanding is a vital

component of patient education. Teach back or repeat back is a tool that allows patients to reiterate in their own words what they understood about content. This has been shown to have a positive effect on patient comprehension.[14] Documentation of teaching also helps the surgical team refer back to previous education and address knowledge gaps.

Goals and Expectations

Evaluation and discussion of a patient's preferences and wishes pre-operatively provides clear guidance to the care team. This is especially important during times of post-operative complications, delirium or incapacity to express one's wishes. Studies have shown the majority of elderly pre-operative patients have specific wishes about the types of medical treatment they want but have not discussed with their healthcare providers.[15] Shared decision making is encouraged pre-operatively to ensure all are in agreement with the patient's wishes. Shared decision making is associated with increased patient knowledge and satisfaction, and more realistic expectations, as well as higher patient engagement through rational discussion between the patient and provider about treatment options that coincide with the patient's wishes and goals.[16] Discussion of one's goals, as applicable to treatment options and quality of life, presents an excellent opportunity for advance care planning. The patient's expectations should be explored, and the provider should clarify or correct unrealistic expectations to ensure appropriate understanding.

Advance Care Planning

Patients and providers should discuss advance care planning during the informed consent process. Pre-operative discussion and agreement on one's wishes, goals of care, and treatments helps the care team to understand what measures to pursue. The patient should appoint a healthcare proxy who actively participates in the informed consent process and clearly understands the patient's goals and wishes.[17] Conversation should include discussion of the patient's wishes if complications arise or if intra-operative findings prompt an alternative treatment approach.

Social Needs Assessment

Assessing a patient's social needs and support pre-operatively helps to identify any essential needs that may be unmet. As with other pre-operative education, pre-operative teams can utilize a team approach to complete the assessment. Key domains to inquire about include food insecurity, housing instability, utility needs, financial resource strain, transportation, exposure to violence, and socioeconomic status.[18] A lack of resources may have a detrimental impact on a patient's recovery. One's healthcare insurance plan should be reviewed and considerations given for co-payment costs, deductible costs, and the ability to purchase any costly medical supplies or medications. A patient's support system should be evaluated to identify from whom the patient may receive assistance before and after surgery. Identification of any needs pre-operatively may allow additional resources to be allocated, a social work professional may be engaged, and concerns that affect a patient's coping and recovery be addressed, thereby preventing potential post-operative discontinuities.

Questions to screen for social need support may include the following:

- In the last 12 months, did you ever eat less than you felt you should because there was not enough money for food?
- Are you worried or concerned that in the next two months you may not have stable housing that you own, rent, or stay in as a part of a household?
- In the past year, has the utility company shut off your service for not paying your bills?
- In the last 12 months, was there a time when you needed to see a doctor but could not because of cost?
- In the last six months, have you ever had to go without healthcare because you did not have a way to get there?
- Are you afraid you might be hurt in your apartment building or house?
- Do problems getting childcare make it difficult for you to work or study?
- Do you ever need help reading hospital materials?
- During the last four weeks, have you been actively looking for work?[18]

Role of Support

The patient's identified support person or health coach is advised to accompany the patient to appointments, especially during explanation of treatment options and surgical procedure, counseling, informed consent, shared decision making, or identification of preferences and wishes. Expected duties of the health coach should be verbalized, such as driving the patient to the hospital, staying with the patient following surgery, assisting with activities of daily living or assisting with care of medical devices post-operatively. Clear understanding of the duties of the health coach and agreement by the patient and health coach to fulfill these needs will reduce any confusion post-operatively.

Identification of unmet needs pre-operatively may allow opportunity for a patient to arrange support to correct any deficits or refine a discharge plan to a rehabilitation center, skilled nursing facility or home with visiting nurse services. If a patient's unmet needs are not addressed pre-operatively, negative outcomes may ensue post-operatively to include elongated length of stay, readmission, reoperation or mortality.

Physical Function, Frailty and Risk Calculators

In addition to the standard pre-operative assessment by organ system, a more global and holistic assessment of an individual's "surgical fitness" is important, particularly among older adults. Pre-operative assessment of "surgical fitness" includes evaluation of functional status and frailty, both of which are known to be associated with increased risk of post-operative morbidity and mortality, prolonged hospitalization, prolonged intensive care lengths of stay, deleterious effects on health-related quality of life, and loss of independence.[19,20] Risk assessment tools also exist that incorporate functional status, frailty, and other factors. Collectively, these assessments serve to help counsel, risk stratify, and potentially risk modify patients in the pre-operative setting.

Functional Status

Pre-operative assessment of physical function in the urologic patient is essential, particularly in adults ages 65 and older. Poor physical function is associated with increased risk of post-operative surgical complications, increased need for intensive rehabilitation services and increased rates of discharge to skilled nursing facilities.[21,22] Specifically in older adults, impaired physical function is also associated with increased risk of delirium[23,24] and surgical site infections with Methicillin-resistant Staphylococcus aureus (MRSA).[25,26]

Pre-operative functional status can be measured by assessment of activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Basic ADLs include grooming, feeding, toileting, bathing, dressing, transferring from bed to chair and ambulating across the room.[27] IADLs, which include eight additional more complex self-care abilities, consist of using the telephone, accessing transportation away from home, purchasing groceries, preparing meals, housework, laundry, managing medications and managing finances.[28]

The American College of Surgeons National Surgical Quality Improvement Program/American Geriatrics Society (ACS NSQIP/AGS) Best Practice Guidelines for Optimal Pre-operative Assessment of the Geriatric Surgical Patient recommend assessment of functional status using a simple screening test (Table 1).[29,30]

Table 1. Assessment of Baseline and Current Functional Status in Ambulatory Patients*
1. Assess patient's ability to perform daily activities 1. *Can you get out of bed or chair yourself?* 2. *Can you dress and bathe yourself?* 3. *Can you make your own meals?* 4. *Can you do your own shopping?* †If NO to any of the above, more in-depth evaluation should be performed, including full screening of ADLs and IADLs. †NOTE: Patient's responses may not be reliable in the presence of cognitive impairment of dementia.
2. Document deficits in vision, hearing, or swallowing.
3. Inquire about history of falls (*"Have you fallen in the past year?").*
4. Evaluate the patient for limitations in gait and mobility [using the Timed Up and Go Test (TUGT)] and determine risk for falls.

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Pre-operative impairment in ADLs and IADLs have been shown to be strong predictors of sustained post-operative functional impairment following major abdominal surgery in older adults,[31] in addition to being important risk factors for post-operative geriatric syndromes (i.e., delirium, functional decline, falls and pressure ulcers).[32] In the urologic literature, one study of 176 patients undergoing

percutaneous nephrolithotomy (PCNL) demonstrated that pre-operative impairment in ADLs independently predicted post-operative complications, while ASA classification and Charlson comorbidity index did not.[33] Another study of nursing home residents undergoing transurethral resection of the prostate (TURP) demonstrated increased risk of TURP failure (measured by the presence of a Foley catheter one year after surgery) and prolonged post-operative functional impairment up to one year following surgery in patients with impaired baseline functional status (as measured by ADLs).[34]

Functional status can also be evaluated with walking speed tests such as the TUGT. The TUGT starts with the subject seated in a chair. The subject is then instructed to stand up, walk 10 feet, return to the chair and sit down. The TUGT is scored as "fast" ($\leq$ 10 seconds), "intermediate" (11-14 seconds), and "slow" ($\geq$ 15 seconds). Slower TUGT speeds are associated with worse post-operative outcomes. A prospective cohort study of patients ages 65 and older undergoing elective colorectal operations underwent a pre-operative TUGT. Slower TUGT speeds were associated with increased post-operative complications (fast 13 percent, intermediate 29 percent, slow 77 percent; $p<0.001$) and increased one-year mortality (fast 3 percent, intermediate 10 percent, slow 52 percent; $p=0.006$).[35]

Patients with urologic conditions may have more functional impairment compared to the general population. One study measured TUGT times among patients presenting to an academic benign urology practice and found that average TUGT times are slower than those of the general population. TUGT times also increased with age and varied by urologic diagnosis, whereby, diagnoses of urinary tract infection, neurogenic bladder and urinary urgency/frequency/overactive bladder were associated with the slowest TUGT times.[36] Another study of 215 patients undergoing various major and minor urologic surgeries demonstrated that slower TUGT times were independently associated with post-operative delirium.[37]

Patients with identified functional impairments should be referred to a physical and occupational therapist for further evaluation for the potential need for pre-operative physical therapy, assistive devices, and plans for post-operative rehabilitation.[38] Prehabilitation programs, which are present in some institutions, may also be helpful and aim to enhance pre-operative functional capacity for patients to optimize surgical recovery.[39]

Frailty

Frailty is a syndrome of decreased physiologic reserve and resistance to stressors, resulting in increased vulnerability to poor health outcomes including falls, morbidity, disability, hospitalizations, and death.[38] Frailty is distinct from both comorbidity and disability, although some overlap may occur.[19] Fried developed an operational definition of frailty based on a longitudinal cohort of community-dwelling men and women from the Cardiovascular Health Study. This definition includes five criteria (Table 2) and is independently predictive of incident falls, worsening mobility or ADL disability, hospitalization, and death over three years.[20]

Table 2. Fried Frailty Score*[38,20,40]	
Criteria	Definition
1. Shrinking (weight loss)	≥10 pounds in the last year
2. Exhaustion	Self-reported exhaustion and endurance measured by 10-item Center for Epidemiological Studies – Depression scale.
3. Weakness	Decreased grip strength measured by a dynamometer adjusted for gender and body mass index.
4. Slow walking speed	Measured by averaging 3 trials of waking 15 feet at a normal pace
5. Low physical activity	Low weekly energy expenditure
Scoring: Patient receives 1 point for each criteria met. 0-1, not frail; 2-3, intermediate frail (pre-frail); 4-5, frail.	

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Makary and colleagues applied and validated this operational definition of frailty to a cohort of older surgical patients. They prospectively measured frailty based on the Fried criteria in 594 patients presenting for elective surgery and found that frailty independently predicted post-operative complications, length of stay and discharge to a skilled or assisted living facility.[40] Robinson proposed an alternative frailty index including a Katz ADL score ≤5, TUGT ≥15 seconds, Charlson Index ≥3, anemia <35 percent, Mini-Cog score ≤3, albumin < 3.4 g/dL and one or more falls in the past six months. According to this definition, the presence of zero or one traits is considered to be nonfrail, two or three traits to be prefrail and four or more traits to be frail. Based on these criteria, pre-operative frailty was associated with complications following colorectal surgery (21 percent in nonfrail, 40 percent in prefrail and 58 percent in frail; p=0.016), and frail individuals had longer hospital stays and higher 30-day readmission rates.[41]

Frailty indices have also been applied to NSQIP data and have shown significant associations between frailty and increased rates of mortality, 30-day complications and discharge to a skilled or assisted living facility among patients undergoing varying types of urologic surgery, ranging in complexity from partial nephrectomy to TURP.[42-45] Among patients undergoing radical cystectomy, frailty, more than ASA, was associated with an increased odds (OR 3.22, 95 percent CI 2.01-5.17) of major complications.[46] Similar findings have been reported in patients undergoing robotic-assisted radical prostatectomy and procedures for pelvic organ prolapse.[47,48]

Risk Calculators

Tools are available to help individualize risk calculation for patients undergoing surgery. One popular tool is the publically available ACS NSQIP calculator.[49] This calculator aims to provide patient-specific information to apply to the surgical decision-making and informed consent processes. The calculator uses patient predictors [age, gender, functional status, emergency status of a case, ASA class, steroid use for a chronic condition, ascites within 30 days prior to surgery, systemic sepsis within 48 hours prior to surgery, ventilator dependence, presence of disseminated cancer, diabetes, hypertension requiring medication, congestive heart failure in the 30 days prior to surgery, dyspnea, smoking status in the year prior to surgery, history of severe chronic obstructive pulmonary disease (COPD), dialysis, acute renal failure, and body mass index] and the planned procedure to predict the likelihood of 15 different outcomes within 30 days of surgery. Outcomes include complications such as pneumonia, cardiac complications, surgical site infections, urinary tract infections, venous thromboembolism, renal failure, colon ileus, colon anastomotic leak, readmission, return to the operating room, death, discharge to a nursing or rehab facility, and predicted length of hospital stay. The calculator is based on data collected from over 3.2 million operations from 668 hospitals across the country.[49]

While the ACS NSQIP risk calculator is a good starting point, it should be considered in combination with other important clinical information and not used in isolation. Studies looking at robot-assisted partial nephrectomy and radical cystectomy demonstrated that the ACS NSQIP risk calculator poorly predicts and discriminates which patients have complications. Specifically, for patients undergoing cystectomy, the calculator underestimated risks by 10-81 percent.[50] For patients undergoing robotic-assisted partial nephrectomy the calculator predicted a complication rate of 5.42 percent, while the observed complication rate was 14 percent.[51]

Prognostic indices for non-disease specific prediction of all-cause mortality exist and may also be helpful for patient counseling. Many of these indices can be found online at ePrognois.[52] These indices are designed for use in older adults with no dominant terminal illness to help guide clinicians about possible mortality outcomes. This site includes various indices ranging from six-month to 14-year mortality predictions for individuals living in the community, nursing home and hospital.[52,53]

Cognitive Impairment and Delirium

Cognitive Impairment

The incidence of cognitive impairment and dementia are exceedingly high in the older population, accounting for 22 percent and 14 percent of individuals ages 71 and older, respectively.[54,55] The presence of cognitive impairment and dementia are each highly associated with post-operative delirium, which in turn is associated with poor surgical outcomes including longer hospital stays, increased mortality and post-operative functional decline.[56-59]

One study examined baseline cognitive impairment in surgical patients ages 65 and older undergoing elective operations requiring post-operative intensive care unit (ICU) admission. The authors found that baseline cognitive impairment was associated with an increased incidence of one or more post-operative complications (41 percent vs 24 percent, p=0.011), higher incidence of delirium (78 percent vs 37 percent; p<0.001), longer hospital stays (15 +/- 14 vs 9+/- 9 days; p=0.001), higher rates of discharge institutionalization (42 percent vs 18 percent; p=0.001) and higher six-month mortality (13 percent vs 5 percent; p=0.040).[60] Another study specifically looked at survival among 330 patients undergoing major

operations (inclusive of urologic operations) and found that individuals who had cognitive impairment in combination with physical frailty had worse outcomes than those with either cognitive impairment or physical frailty alone, representing a 3.92 times higher risk of death compared to robust patients.[61]

The ACS NSQIP and the American Geriatric Society recommend assessing for cognitive impairment via the following components in the preoperative setting:

1. Obtain a detailed history and cognitive assessment, such as the Mini-Cog (Table 3) for any older patient without a known history of cognitive impairment or dementia.
2. If possible, interview a knowledgeable informant (i.e., spouse or family member) about the evolution of any cognitive or functional decline in the patient.
3. An identified decline in cognitive function should prompt referral to a primary care physician, geriatrician, or mental health specialist for further evaluation.
4. Carefully document pre-operative cognitive status because post-operative cognitive dysfunction is common but difficult to quantify without a baseline.
5. It is recommended that cognitive assessment be performed early in the evaluation since evidence of impairment or dementia may indicate that subsequent assessment of functional status and/or medication use may be unreliable.

Table 3. Cognitive Assessment with Mini-Cog*[38]

Assessment	Scoring
1. GET THE PATIENT'S ATTENTION, THEN SAY: • "I am going to say three words that I want you to remember now and later. The words are **banana, sunrise, chair**. Please say them now." • Give the patient three tries to repeat the words. If unable after three tries, go to next item.	
2. SAY ALL THE FOLLOWING PHRASES IN THE ORDER INDICATED: • "Please draw a clock in the space below. Start by drawing a large circle. Put all the numbers in the circle and set the hands to show 11:10 (10 past 11). • If subject has not finished clock drawing in three minutes, discontinue and ask for recall items.	(0 or 2 points) 0 points for abnormal clock 2 points for normal clock Normal clock has all of the following elements: • All numbers 1-12, each only once, are present in the correct order and direction (clockwise) in the circle. • Two hands are present, one pointing to 11 and one pointing to 2. • ANY CLOCK MISSING ANY OF THESE ELEMENTS IS SCORED ABNORMAL.

	REFUSAL TO DRAW A CLOCK IS SCORED ABNORMAL.
3. SAY: "WHAT ARE THE THREE WORDS I ASKED YOU TO REMEMBER?"	(0-3 points) 1 point for each correct word
Total score of 0, 1, or 2 suggests possible impairment Total score of 3, 4, or 5 suggests no impairment	

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Decision-making capacity should be further assessed by the physician to confirm that the patient can describe (in their own words) the important features of the medical condition, surgery, indications, and the risks/benefits/alternatives to surgery. The following four relevant criteria exist to gauge adequate decision-making capacity:[9]

1. The patient can clearly indicate his or her treatment choice.
2. The patient understands the relevant information communicated by the physician.
3. The patient acknowledges his or her medical condition, treatment options, and the likely outcomes.
4. The patient can engage in a rational discussion about the treatment options.

Post-operative Delirium

Post-operative delirium is defined as an acute change in cognition characterized by inattention, fluctuating levels of consciousness, and/or disorganized thinking. It is more common in older adults and particularly among individuals with cognitive impairment. Patients who experience post-operative delirium have increased mortality and post-operative complications (including falls), longer hospital lengths of stay, longer ICU lengths of stay, and higher rates of discharge to skilled nursing facilities, which result in increased costs of care.[62]

Post-operative delirium is common in older adults, occurring in up to nine percent of older patients undergoing major, elective non-cardiac operations[57] and 44 percent of post-operative patients requiring an ICU stay.[58] One study looking at patients ages 65 years and older undergoing urologic surgery found the incidence of delirium to be 26 percent. In this study, delirium was associated with older age, medications, surgical stress, biochemical imbalances, hemodynamic problems and electrolyte disorders.[63] Other studies looking at radical cystectomy and TURP found the incidence of post-operative delirium to be 29 percent (lasting one to five days) and 7.8 percent (lasting one to four days), respectively.[64,65] Of note, pre-operative cognitive impairment is one of the most common predictors of post-operative delirium, representing a two- to 17-fold increased risk of developing this syndrome.[66]

Urologists and other physicians should identify risk factors for the development of post-operative delirium (Table 4) in the pre-operative setting and avoid use of benzodiazepines and antihistamines in these individuals.[38] Individuals at risk may also benefit from formal geriatric assessment and should be reminded to bring all assistive devices, such as glasses and hearing aids, to the hospital at the time of surgery.[66]

Table 4. Risk Factors for Post-operative Delirium*[38]
Cognitive and behavioral disorders • Cognitive impairment and dementia • Untreated or inadequately controlled pain • Depression • Alcohol use • Sleep deprivation
Disease- or illness-related • Severe illness or comorbidities • Renal insufficiency • Anemia • Hypoxia
Metabolic • Poor nutrition • Dehydration • Electrolyte abnormalities
Functional impairments • Poor functional status • Immobilization • Hearing or vision impairment
Other • Older age ≥ 70 years • Polypharmacy and use of psychotropic medications (benzodiazepines, anticholinergics, and antihistamines) • Risk of urinary retention or constipation, presence of urinary catheter

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Pre-operative Evaluation of Pulmonary Risk, Cardiac Risk, and Anticoagulation Prior to Urologic Surgery

Pre-operative Evaluation of Pulmonary Risk

Post-operative pulmonary complications are a significant source of morbidity and mortality in surgical patients, and occur in up to six percent of patients undergoing major abdominal surgery with up to 25 percent of patients dying as a result of post-operative respiratory failure.[67,68] Pulmonary complications increase patient length of stay, and are a common cause of readmission and cost associated with radical cystectomy.[69,70] Identifying patient and procedure related risk is paramount in hopes of minimizing pulmonary complications following surgery.

The provider evaluating the urologic surgical patient needs to assess the risk for intra-operative pulmonary complications, determine whether pre-operative medical tests will clarify this risk, and attempt to mitigate the risks of pulmonary complication.

Patient and Procedure-Related Risk Factors

There are a number of patient related risk factors that have been well known to increase the risk of pulmonary complications, such as age >60 years, chronic lung disease, cigarette use, congestive heart failure, functional dependence (either partial or total dependence for activities of daily living), ASA classification, obesity, asthma, obstructive sleep apnea (OSA), impaired sensorium (acutely confused or delirious), alcohol use and weight loss.[71]

Procedure specific risk factors include procedures lasting greater than three to four hours, abdominal surgery, and emergent surgery.[71]

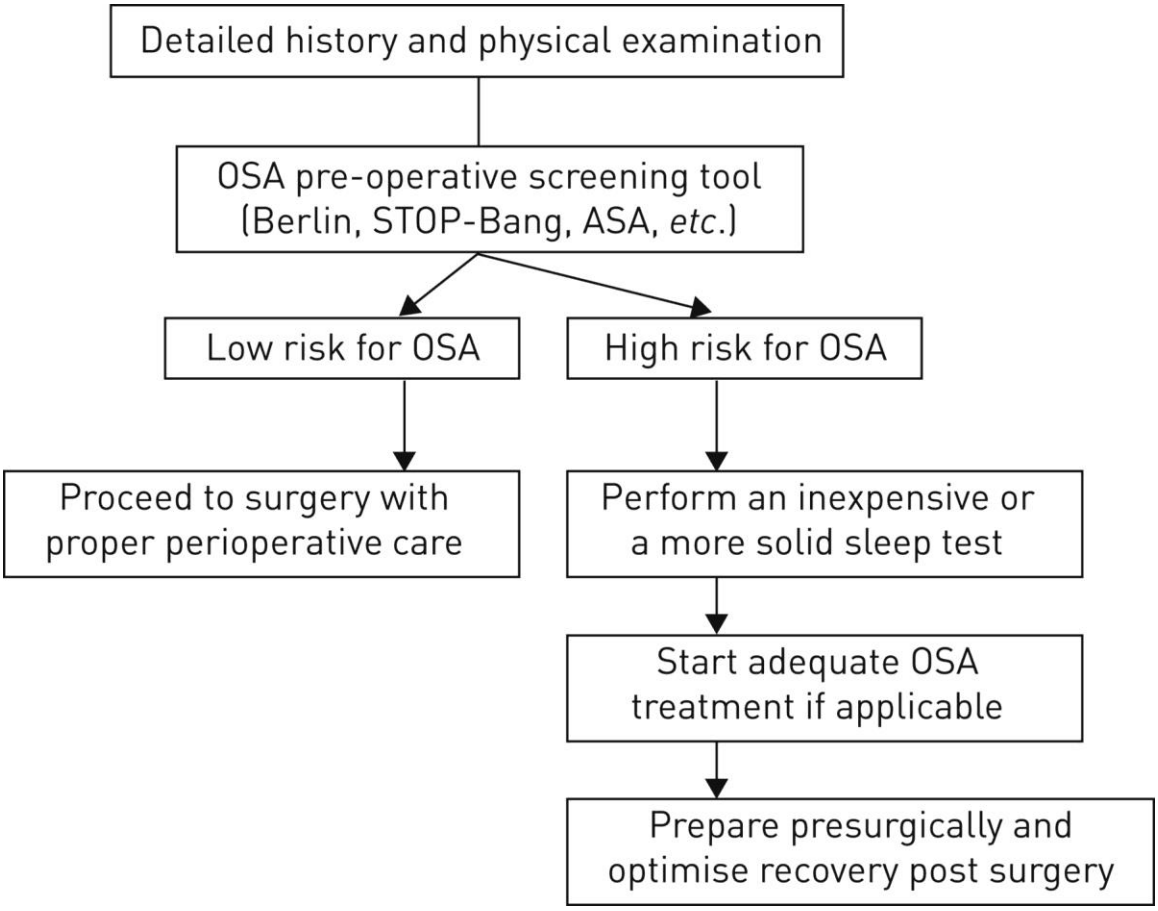
Again, the use of a risk calculator (as previously discussed, ASC NSQUIP calculator) allows clinicians to estimate the risk of post-operative respiratory failure. It is an important tool in the informed consent process and patient centered decision making prior to urologic surgery, and will allow for pre-operative optimization for at risk patients.

Obstructive Sleep Apnea

OSA is extremely common in the population with 10-17 percent of men and three to nine percent of women having the disease.[72] Although OSA is not included in the NSQIP pulmonary risk calculator, sleep disordered breathing represents a risk for potentially significant intra-operative morbidity. There are associated risks of obesity, abnormal upper airway anatomy and cardiovascular disease associated with OSA that potentially increase intra-operative pulmonary complications. The main intra-operative risk factors associated with OSA include upper airway collapse, hypoxemia and difficult airway control. Additionally, a recent meta-analysis demonstrated an increase in post-operative complications in surgical patients with OSA with an Odds Ratio of 2.43.[73,74]

In patients with known OSA, consistent use of continuous positive airway pressure (CPAP) pre-operatively and continuing post-operatively is the most effective means of reducing intra-operative and post-operative complications.[75,76] Identifying urologic surgical patients with a suspicion of OSA is of high importance due to the potentially significant morbidity associated with unrecognized and untreated OSA.[77] An algorithm to screen patients suspected of having OSA involves a detailed H+P, a screening questionnaire, and sleep study if necessary (Figure 1). Patients should be advised to bring their own CPAP or similar machine at time of surgery for inpatient, postoperative use.

Figure 1. Obstructive Sleep Apnea Workup*[77]



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Berlin Questionnaire© for Sleep Apnea https://www.sleepapnea.org/wp-content/uploads/2017/02/berlin-questionnaire.pdf[78]

American Society of Anesthesiologists STOP Questionnaire
http://anesthesiology.pubs.asahq.org/article.aspx?articleid=1932315[79]

Pre-operative Pulmonary Testing

Pulmonary Function Tests

Pulmonary function tests and spirometry help in diagnosing obstructive lung diseases. However, these tests are not predictive of post-operative pulmonary complications.[80] Spirometry should be used for patients with undiagnosed COPD or may be of use to determine if a patient with COPD is at their baseline prior to surgery, but spirometry is not useful as a pre-operative test to determine post-operative risk.[71]

Chest Radiographs

Pre-operative chest radiographs have not been shown to be predictive of post-operative pulmonary complications.[71] Additionally, several studies have shown that abnormalities are only found pre-

operatively in approximately 10 percent of patients with management changing in less than one percent of patients.[81-83] The primary role of the pre-operative chest radiograph in a patient at high risk of post-operative pulmonary complication is to serve as a baseline for management of a potential post-operative complication.[84]

Albumin

Patients with severe nutritional deficiency are likely to be at risk for a variety of post-operative complications. Serum albumin (<30 g/L) is an independent risk factor for the development of post-operative pulmonary complications as well as early post-operative morbidity and mortality in urologic oncology patients.[85,86] In nutritionally replete patients, there may be value for pre-operative nutritional supplementation prior to elective urologic surgery. Prehabilitation will be discussed in a subsequent section.

Pre-operative Evaluation of Cardiac Risk

Many patients undergoing urologic surgery are at risk for a cardiovascular event. A recent study found that patients undergoing non-cardiac surgery have a three percent risk of major cardiovascular and cerebrovascular events (in-hospital, all-cause death, acute myocardial infarction, or acute ischemic stroke).[87] The risks associated with development of a cardiovascular event are due to both patient and procedure specific factors. While the risks associated with various urologic procedures vary widely, identification of patient and procedure specific risk factors will help the urologist balance the risk-benefit ratio for patients and potentially identify interventions that may reduce the risk for a particular procedure or potentially identify cardiovascular conditions that require long-term management.

All patients undergoing urologic surgery should have an assessment of their cardiovascular risk prior to surgery, and the scope of this assessment will vary depending on the presence of risk factors and complexity of the surgical procedure. This assessment may reveal an undiagnosed condition, help the patient and urologist better understand the risks and benefits of surgery, and may influence the optimal timing of surgery. The patient's perspective in understanding their cardiovascular risk is an important factor in surgical decision making.

Determine Health Status

As part of the pre-operative evaluation, clinicians should inquire about the patient's history of hypertension, diabetes, heart disease, chest pain, dyspnea, palpitations, valvular heart disease, erectile dysfunction cerebrovascular and peripheral vascular disease, and chronic kidney disease. Erectile dysfunction often precedes cardiovascular disease, and may be a marker of cardiovascular disease.[88] The patient's prior cardiac testing should be obtained.

As part of the patient history, the cardiac functional status should be determined as this impacts whether further cardiac testing is recommended prior to surgery. Functional status can be expressed in metabolic equivalents (1 MET is defined as 3.5 mL O2 uptake/kg/min, which is the resting oxygen uptake in a sitting position).

Poor: <4 METs: activities of daily living, vacuuming, walking 2 mph
Moderate: 4-7 METs: Cycling, flight of stairs, golf, walking 4mph, yard work
Excellent: >7 METs: Squash, jogging (10 minute mile), scrubbing floors, tennis

In addition to a complete physical exam, a 12-lead electrocardiogram (ECG) may be performed in patients with known coronary artery disease, cardiac arrhythmia, peripheral arterial disease,

cerebrovascular disease, or other significant structural heart disease.[89] An ECG is not recommended for patients undergoing low-risk surgery and is not included in the commonly used cardiac risk stratification models; however, individual hospitals may have varying requirements.[89] Obtaining a pre-operative ECG is most helpful in evaluating an abnormal post-operative ECG. An ECG should be evaluated for the presence of Q waves or significant ST-segment elevation or depression, left ventricular hypertrophy, QTc prolongation, bundle-branch block, or arrhythmia. An abnormal pre-operative ECG should be evaluated by a member of the intra-operative team and referred to cardiology for evaluation if clinically indicated.[90]

Determine Risk Stratification

Determination of cardiac risk prior to urologic surgery is of critical importance when determining how to evaluate the urologic patient and is a useful tool in determining whether further cardiac testing is indicated. The 2014 American College of Cardiology/American Heart Association (ACC/AHA) guideline on perioperative cardiovascular evaluation and management of patients undergoing non-cardiac surgery[91] recommends stratifying patients into low-risk and high-risk procedures. A low-risk procedure was defined as one in which the combined surgical and patient characteristics predict a risk of major adverse cardiac event (MACE) death or myocardial infarction (MI) of less than one percent. An elevated-risk procedure has a MACE of greater than one percent. Other risk stratification schemes have utilized an intermediate- and high-risk cohort, but recommendations from the ACC/AHA do not differ significantly between the intermediate- and high-risk groups; thus they recommend a simpler risk stratification scheme.[89]

For patients with a **low risk** of intra-operative MACE, further testing is not recommended prior to surgical intervention.

In patients at **high risk** of MACE, referral to a cardiologist may be considered, and determination of cardiac functional status should be performed (as discussed above).

Several risk calculators exist that incorporate information gathered from the H+P, laboratory data, and type of surgery. Commonly used cardiac risk calculators can be easily accessed online and are derived from ACS NSQIP,[49,92] Revised Cardiac Risk Index,[93,94] or the Gupta Myocardial Infraction or cardiac arrest.[95,96]

Urgency of Surgical Procedure

The ACC and AHA have published guidelines on the intra-operative cardiovascular management of patients undergoing non-cardiac surgery.[89,91] The clinical decision making with regards to intra-operative cardiovascular testing is influenced by the temporal necessity of surgical intervention. The ACC/AHA guideline stratifies non-cardiac surgical patients into four categories:

1) Emergency: The procedure usually occurs in <6 hours as life or limb is threatened if not in the operating room.
2) Urgent: Life or limb is threatened if not in the operating room between 6-24 hours. A limited cardiovascular assessment may be made.
3) Time sensitive: A delay in surgery more than one to six weeks will negatively affect outcomes.
4) Elective: The procedure can be delayed for up to one year.

While individual institutions may have slightly different definitions of urgency and risk, a general framework is helpful to both providers and patients when evaluating patient and procedure risk and the necessary cardiovascular workup prior to surgery.

Pre-operative Cardiac Testing in the Patient with Coronary Artery Disease Risk Factors

Emergent Surgery

Patients who require emergent surgery are at an increased risk of cardiovascular event regardless of risk, but due to the nature of emergent surgery do not have time for a pre-operative evaluation and should proceed to surgery. Clinicians should determine the clinical risk factors that may impact intra-operative and post-operative management in order to optimize patient outcomes and seek the consultation of the appropriate medical services for post-operative management.[89]

Urgent, Time Sensitive, or Elective Surgery

If the patient does not require emergent surgery, the clinician should determine if the patient has acute coronary syndrome. If the patient has symptoms of acute coronary syndrome, then a cardiology evaluation is warranted and managed according to guideline-directed medical therapy (Figure 1). Routine coronary revascularization is recommended when clinically indicated and not performed to reduce intra-operative cardiac events.[89,97-99]

If the patient has stable coronary artery disease (CAD) and is low risk (MACE less than one percent), then the patient may proceed to surgery without further testing.

If the patient has moderate, good or excellent cardiac functional capacity (METs ≥4), then the patient may proceed to surgery without further cardiac testing.

If the patient has poor (<4 METs) or unknown cardiac functional capacity, then the patient, surgeon, and intra-operative team should evaluate whether further testing will impact the surgical decision making or intra-operative care. Cardiology referral and management of pharmacologic stress testing is appropriate if the results of testing will impact the decision to proceed with surgery (Figure 2).

Figure 2. Coronary Artery Disease Workup*[89]

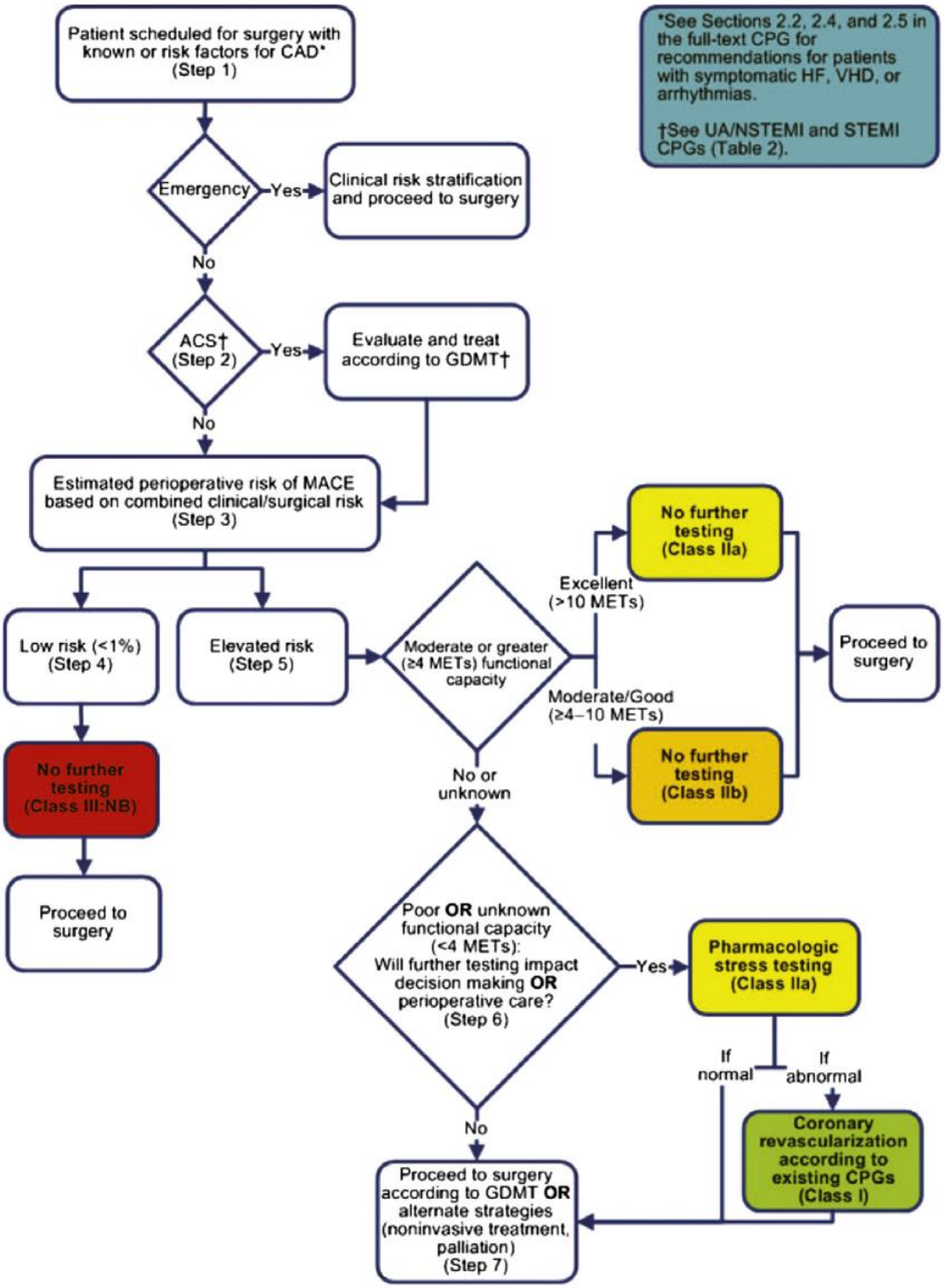

FIGURE 1 Stepwise Approach to Perioperative Cardiac Assessment for CAD

* As published in Circulation:

Fleisher LA, Fleischmann KE, Auerbach AD, et al: 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 130:2215-2245, 2014.

Pre-operative Cardiac Testing in the Patient with Valvular Heart Disease

Patients with clinically suspected moderate or greater degrees of valvular stenosis or regurgitation should undergo pre-operative echocardiography if there has not been a prior exam in the past year or if a significant change in clinical status of physical exam has occurred since last evaluation.[89]

Additionally, in patients with dyspnea of unknown origin or with known heart failure and worsening dyspnea, providers may refer to cardiology for evaluation of left ventricular function.[89]

Timing of Elective Surgery in Patients with Previous Percutaneous Coronary Intervention

Elective urologic surgery should be delayed for 14 days after coronary balloon angioplasty, 30 days after bare metal stent (BMS) implantation, and one year after drug-eluting (DES) implantation.[89] Elective urologic surgery may be considered after 180 days in patients with DES implantation if the risk of surgical delay is greater than the risk of cardiac ischemia and stent thrombosis. However, dual antiplatelet (AP) therapy should not be discontinued for elective urologic surgery in patients who had a BMS within 30 days or DES within one year.[89] As newer DES and antiplatelet agents are developed and the optimal time between stent placement and elective surgery changes, consultation with internal medicine or cardiology is important.

Management of Anticoagulation/Antiplatelet Medications

In 2014, the AUA and the International Consultation on Urological Diseases published a white paper[100] on anticoagulation/antiplatelet (AC/AP) therapy in urological practice.[100] A systematic literature review was performed, and urologic procedure specific recommendations were made based on numerous observational studies. Having a patient-centered conversation about the risks of procedural bleeding with thrombosis is critical when making decisions about AC medication strategies. For the purposes of the pre-operative evaluation of the urologic patient, a summary of the findings is provided.

1. For patients on clopidogrel or aspirin for secondary stroke prevention, especially for recent events, it is recommended to continue aspirin through the perioperative period.
2. Withdrawal of dual AP therapy (DAPT) should NOT occur prior to urologic procedures within 12 months of DES placement or within three months of BMS placement, due to the high risk of major adverse cardiac and cerebrovascular events.
3. Patients with mechanical heart valves are at high risk for thrombotic complications and should be bridged as appropriate.
4. For those patients with cardiac risk factors on low-dose aspirin alone, this can be continued in the perioperative period without increased risk of major bleeding.
5. Patients taking low-dose aspirin without specific medical indications may be scheduled electively, and discontinuing the antiplatelet drug (antiplatelet medications: inclusive of aspirin, clopidogrel, ticagrelor, ticlopine, dipyridamole) until directed by the surgical team.
6. Periprocedural management of novel oral anticoagulants (NOAC) for patients with non-valvular atrial fibrillation is stratified by procedural risk of bleeding and the urgency of the procedure:
    - For procedures with only a minor risk of bleeding, NOAC use does not have to be modified, similar to the management with warfarin or low molecular weight heparin.

- For urgent procedures: a delay of the procedure, if medically appropriate for 24 to 36 hours, allowing for expert consultation with cardiology/hematology/ thrombosis services.
- For emergent procedures: if there is an increased risk of bleeding associated with this procedure, consultation with experts is strongly advised. Spinal/epidural anesthetics are contraindicated.
- Renal reduction procedures will require assessment of renal function post-procedure in order to determine the safety and dosing of NOAC.

7. Perioperative management of atrial fibrillation in high risk surgical procedures requires that warfarin would be stopped five days before the surgical procedure and should be restarted 12 to 24 hours after surgery if the bleeding risk is acceptable.
8. Perioperative management of prosthetic valves should follow the American College of Cardiology/American Heart Association/Society for Cardiovascular Angiography and Interventions 2011 percutaneous coronary intervention Guidelines 23 for the management in patients with valvular heart disease.
9. In patients at high risk of thrombosis (defined as those with any mechanical mitral valve replacement or a mechanical aortic valve with any risk factor) bridging should be started when the international normalized ration falls below 2.0 (typically 48 hours before surgery), and the dose adjusted to achieve an activated partial thromboplastin time two to three times the control.
10. The American College Of Chest Physicians supports the use of three different bridging regimens for prosthetic valves:
    - A high-dose (therapeutic-dose) heparin bridging (e.g., low molecular weight heparin such as enoxaparin 1 mg/kg bid or 1.5 mg/kg daily, dalteparin 100 IU/kg bid or 200 IU/kg daily, tinzaparin 175 IU/kg daily, or i.v. unfractionated heparin to attain an activated partial thromboplastin time [aPTT] 1.5 to 2 times the control aPTT).
    - A low-dose (prophylactic-dose) heparin regimen (e.g., enoxaparin 30 mg bid or 40 mg daily, dalteparin 5,000 IU daily, unfractionated heparin 5,000-7,500 IU bid).
    - An intermediate-dose regimen (e.g., enoxaparin 40 mg bid).
11. AC (anticoagulant/anticoagulation medications: inclusive of coumarins, heparin, NOAC)/AP (anti-platelet) agents should be discontinued and/or reversed prior to shock wave lithotripsy.
12. Ureteroscopy can be performed with continuing oral AC/AP therapy.
13. Oral AC/AP medications should be discontinued prior to percutaneous nephrostolithotomy and patients bridged where deemed necessary.
14. In appropriately selected patients, laser prostate surgery can be safely accomplished for the patient with a therapeutic international normalized ratio who has a significant risk of thrombosis without the discontinuation of oral AC/AP.
15. AC/AP in patients undergoing transurethral resection of the prostate is associated with an increased risk of bleeding complications which may continue throughout the perioperative period.
16. Prostate biopsy can be performed safely for the patient on low dose aspirin with a risk of minor bleeding approximately one third higher than controls.
17. Higher risk urologic procedures, such as radical prostatectomy and partial nephrectomy, have been safely performed with bridging therapy in those with a higher risk of thromboembolic complications, albeit with an increased risk of bleeding.
18. In general, the perioperative continuation of aspirin may be associated with a minor risk of increased bleeding, but the transfusion rate is not increased and the consequences of that bleeding are minor with the probable exception of transurethral resection of the prostate.

Atrial Fibrillation

Approximately 2.6 million people will have atrial fibrillation by 2030, and it is estimated that 10 percent of patients will require disruption of AC for surgery every year.[101,102] The vast majority of patients with atrial fibrillation do not require bridge therapy. In patients who are anticoagulated for atrial fibrillation, randomized controlled trial evidence demonstrates that forgoing bridging therapy results in decreased major bleeding without increased risk of thrombosis.[103] Only select patients with atrial fibrillation require bridging therapy (very high risk of stroke, venous thromboembolism within the previous 12 weeks; recent coronary stenting, previous thromboembolism during interruption of chronic anticoagulation).[104]

Pre-operative Evaluation of Stroke Risk

Stroke is a devastating occurrence resulting in significant morbidity and mortality. While the incidence after urologic surgery is not well defined, the range of stroke in procedures other than cardiac, neurosurgical and carotid artery surgery ranges from 0.05-7.4 percent.[105-110] Identifying urologic patients who are at risk for the devastating complications of stroke pre-operatively is critical in hope of minimizing potential morbidity and mortality. Risk factors for stroke include hypertension, diabetes, heart disease, smoking, obesity, age, sex, transient ischemic attacks, brain aneurysms or arteriovenous malformations.[111]

There is a paucity of non-cardiac, non-neurosurgical data on risk factors and outcomes. The risk factors for post-operative stroke are similar to other cardiovascular risk factors and include age, prior stroke, atrial fibrillation, diabetes, hypertension, and smoking.[105,106,112] Carotid bruit does not correlate with the severity of underlying stenosis and has not been shown to increase the intra-operative stroke risk.[113,114] Patients with intracerebral artery stenosis have a higher risk of stroke in the nonsurgical setting as compared to carotid stenosis, and thus may have an increased risk of intra-operative stroke as well, and should be referred for evaluation prior to surgery.[115]

Pre-operative Carotid Artery Revascularization

Patients with symptomatic, high-grade carotid artery stenosis (>70 percent stenosis) should have carotid artery stenting or endarterectomy prior to elective urologic surgery. Symptomatic carotid stenosis is commonly defined as stenosis in the internal carotid artery, either intracranial or extracranial, leading to symptoms of amaurosis fugax, transient ischemic attacks, or ischemic stroke ipsilateral to the lesion.[116] Management of the asymptomatic patient with more than 60 percent stenosis also has improved outcomes with endarterectomy. Although the pre-operative implications of these findings have not been addressed in the literature, patients with significant carotid stenosis should be evaluated by vascular medicine/surgery pre-operatively to determine their risk of stroke and possible benefit of revascularization prior to elective urologic surgery.

Pre-operative Management of Atrial Fibrillation and Anticoagulation

Patients on antiarrhythmic or rate controlling agents should continue these medications for the intra-operative period.

As discussed previously, patients on clopidogrel or aspirin for secondary stroke prevention, especially for recent events, should continue aspirin through the intra-operative period.[100]

The management of oral AC in a patient with a high risk of stroke must weigh the risk of surgical bleeding with the risk of thrombosis. As previously discussed, patients should continue their anticoagulation for low risk procedures. The American College of Chest Physicians recommends patients

at high risk of bleeding who are at high risk for thrombosis (high risk of stroke or who have had a prior transient ischemic attack or stroke) should be anticoagulated with bridge therapy with LMWH.[104,117]

Endocrine/Gastrointestinal/Renal Evaluation

Diabetes

Diabetic patients are unable to maintain a consistent balance between insulin, epinephrine, glucagon, cortisol, and growth hormone. Surgery or procedures cause a neuroendocrine stress response, which can cause an increase in epinephrine and cortisol which then leads to hyperglycemia. Some diabetics may be unable to regulate this hyperglycemia due to an underlying lack of insulin production which may place such patients at risk for diabetic ketoacidosis (Type 1 diabetics) or hyperglycemic hyperosmolar nonketotic syndrome (Type II diabetics).[118] Hyperglycemia can also cause poor wound healing and increased coagulation. Consequently, it is important to identify the poorly controlled diabetics prior to surgery. In general, it is not necessary to check blood sugar levels on all patients prior to surgery unless diabetes is suspected, as noted in the American Academy of Family Physicians pre-operative testing guidelines.[119]

Prior to surgery, diabetic patients should have an HbA1c level measured. Underwood et al. assessed 622 diabetic patients undergoing non-cardiac surgery and found that pre-operative HbA1c levels greater than 8 percent were associated with longer hospital lengths of stay.[120] Similarly, the National Health System pre-operative guidelines recommend delaying elective surgery if HbA1c is greater than 6.9 percent, although this may not be a practical recommendation for many US urologic patients.[121] Other reviews suggest cancelling elective surgery for blood sugar measurements 400-500 mg/dL.[122] It should be remembered, however, that chronic infection can cause increased HbA1c levels and chronic urinary tract infections may be the underlying reason for the planned intervention. Diabetic patients may benefit from being scheduled early in the day to minimize the risk of hyper- or hypoglycemia. Tables 5 and 6 list recommendations for stopping or maintaining diabetic medications in the setting of a short starvation period, such as missing one scheduled meal.[121]

Table 5. Guideline for Intra-operative Adjustment of Oral Hypoglycemic Agents (short starvation period – no more than one missed meal)*[121]

Agent	Day before admission	Day of surgery	
		Surgery in the morning	Surgery in the afternoon
Meglitinides (e.g., repaglinide, nateglinide)	Take as normal	Omit morning dose	Give morning dose if eating
Sulphonylurea (e.g., glibenclamide, gliclazide, glipizide)	Take as normal	Omit morning dose (whether taking once or twice daily)	Omit (whether taking once or twice daily)

Agent	Day before admission	Day of surgery	
		Surgery in the morning	Surgery in the afternoon
SGLT-2 inhibitors[a] (e.g., dapagliflozin, canagliflozin)	No dose change	Halve the usual morning dose; check blood glucose on admission; leave evening meal dose unchanged	Halve the usual morning dose; check blood glucose on admission; leave the evening meal dose unchanged
Acarbose	Take as normal	Omit morning dose	Give morning dose if eating
DPP-IV inhibitors (e.g., sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin)	Take as normal	Take as normal	Take as normal
GLP-1 analogues (e.g., exenatide, liraglutide, lixisenatide)	Take as normal	Take as normal	Take as normal
Metformin (procedure not requiring use of contrast media[b])	Take as normal	Take as normal	Take as normal
Pioglitazone	Take as normal	Take as normal	Take as normal

[a]Also omit the day after surgery.
[b]If contrast medium is to be used or the estimated glomerular filtration rate is under 60 mL/min per 1.73 m^2, metformin should be omitted on the day of the procedure and for the following 48 h.
SGLT-2, sodium-glucose co-transporter-2; DPP-IV, dipeptidyl peptidase-IV; GLP-1, glucagon-like peptide-1.

*As published in Anaesthesia:

Barker P, Creasey E, Dhatariya K, et al: Peri-operative Management of the Surgical Patient with Diabetes 2015. Anaesthesia 70:1427, 2015.

Table 6. Day before Surgery Insulin Regimens Recommendations*[123]

Diet	NPH or 70/30 insulin		Non-Insulin Injectables	
	AM Dose	PM Dose	AM Dose	PM Dose
Normal Diet until Midnight (includes clear liquids until 2hrs prior to surgery)	80% of usual dose	80% of usual dose	Usual dose	Usual dose

Diet	NPH or 70/30 insulin		Non-Insulin Injectables	
	AM Dose	PM Dose	AM Dose	PM Dose
Bowel Prep (and/or clear liquids only 12-24hrs prior to surgery)	80% of usual dose	80% of usual dose	Hold when starting clear liquid diet/bowel prep	Hold when starting clear liquid diet/bowel prep

* As published in Curr Pharm Des.:

Duncan, A: Hyperglycemia and Perioperative Glucose Management. Curr Pharm Des 18:6195-6203.

Steroids

Patients taking chronic steroid medication should be identified prior to surgery. Not all patients on chronic steroid medications require changes in steroid dosing before surgery. Patients should be educated not to arbitrarily stop steroids without discussion with the pre-operative team since patients taking prednisone 20mg daily for at least three weeks may experience some suppression of the hypothalamus/pituitary/adrenal axis if steroid supplementation is suddenly stopped.[124] Some patients on long-term steroids for greater than three weeks may need to have steroid doses adjusted prior to surgery to address potential gastrointestinal bleeding risk or reactive airway issues during surgery. In general, most patients should continue current steroid dosing up to scheduled surgery and take the medication the night before surgery.

Pregnancy Testing

The ASA published recommendations in 2016 regarding recommendations for pre-operative pregnancy testing. The group recommended performing testing in patients at risk for fetal harm during or subsequent to the surgical procedure. Such procedures include those that could disrupt or affect uterine cavity or blood flow to the uterus.[125] The ASA previously published a report stating that the risk of anesthesia on early pregnancy is not completely known and suggested that pre-operative testing be performed if knowledge of a positive test would change decision making.[80] There is no standard pre-operative pregnancy testing recommendation regarding timing or method of testing, and recommendations may differ between practice sites.

Gastrointestinal

Constipation and irritable bowel symptoms are common gastrointestinal symptoms and rarely require formal evaluation prior to surgery. It is important for surgeons to have an understanding of the current symptoms so post-operative expectations can be clearly established. The American Gastrointestinal Association (AGA) describes constipation as follows: “Although physicians often regard constipation to be synonymous with infrequent bowel movements, typically fewer than three per week, patients have a broader set of symptoms, including hard stools, a feeling of incomplete evacuation, abdominal discomfort, bloating, and distention, as well as other symptoms (e.g., excessive straining, a sense of anorectal blockage during defecation, and the need for manual maneuvers during defecation), which suggest a defecatory disorder.”[126]

Patients with other gastrointestinal conditions requiring active management, such as inflammatory bowel disease, can be referred to gastroenterology prior to surgery for assessment and potential adjustment of immunosuppressive medications prior to any scheduled surgery.

Pre-operative Fasting
Pre-operative fasting is recommended to reduce the risk of intra-operative aspiration events. In 2017, the ASA formed a task force to review current literature and make guideline recommendations regarding pre-operative fasting. The group recommended that for solids and non-human milk products, a light meal may be ingested up to six hours before general anesthesia. More fasting time may be needed for intake of fried or fatty foods or meat. Clear liquids, not including alcohol, may be ingested up to two hours prior to surgery.[127]

Bowel Preparations
Historically, a pre-operative bowel preparation was prescribed to decrease the bacterial colony count in the colon, reduce the intraluminal pressure through removal of feces, decompress colon and improve the surgical field, and facilitate palpation of intraluminal bowel lesions. Several studies have investigated whether pre-operative mechanical bowel prep improves patient safety or outcomes. In 2011, a Cochrane review compared mechanical versus no prep in patients undergoing colon surgery and found no difference in rate of anastomotic leak or wound infection.[128] Regarding urologic surgery, there is no evidence to suggest that a mechanical bowel prep alone before cystectomy/ileal diversion reduces risk of bowel leak, obstruction or overall mortality.[129,130] In fact, European guidelines state that a mechanical bowel prep before cystectomy/urinary diversion is not needed.[131]

There are more data suggesting that an oral antibiotic prep may have efficacy in reducing surgical site infections during colonic surgery. Most oral antibiotic bowel preps utilize non-absorbable antibiotics, including aminoglycosides, macrolides, and/or polymixins. Bellows et al. performed at meta-analysis in 2011 demonstrating that oral and intravenous antibiotics were superior in reducing surgical site infections during colon surgery compared to intravenous antibiotics alone. However, there was no change in rate of other complications.[132] The benefits of oral antibiotic prep have not been well studied in urologic surgeries such as enterocystoplasty or continent diversion.

The following oral antibiotic prep prior to colon surgery has been well studied and found to be effective and well tolerated:[133]

- 1 g oral neomycin given at 2 pm, 3 pm and 10 pm
- 1 g erythromycin base given at 2 pm, 3 pm, and 10 pm
- Metronidazole 500 mg may be substituted for erythromycin for better tolerability.

Renal/Genitourinary
Patients with end stage renal disease (ESRD) could potentially have increased risk of morbidity and mortality after surgery due to electrolyte imbalances. To address these concerns, ESRD patients can be evaluated prior to surgery for hyperkalemia (>5.5 mmol/L), altered acid base status, prolonged bleeding times, and anemia. ESRD disease patients can also potentially be at risk for cardiovascular events. Cardiac evaluation (see above) can also be considered for selected ESRD patients prior to surgery.

The following pre-operative labs are recommended for patients with ESRD both as a baseline and, if concerned for change in fluid status, approximately two to three hours before surgery:[134]

- Renal panel – sodium, potassium chloride, blood urea nitrogen, creatinine, calcium, bicarbonate
- Complete blood count to assess for anemia
- Chest x-ray to identify potential volume overload

Antibiotic prophylaxis against endocarditis can also be considered for ESRD patients on dialysis.[135]

Urinary Tract Infection
Patients undergoing urologic procedures may also have indwelling catheters, urostomies, or other tubes that drain the urinary tract. As part of the pre-operative assessment, it is important to identify which of these patients could be at risk for intra-operative or post-operative urinary tract infections.

Urologists can minimize false positive pre-operative urine cultures by obtaining urine from patients unable to void via straight catheterization or directly from the indwelling tube, preferably immediately after a change. Urine cultures obtained from a drainage bag should not be used for clinical decision making. For further reference, the American Urological Association published a white paper regarding diagnosing catheter acquired urinary tract infections in urologic patients.[136]

Modifiable Pre-operative Factors

Prehabilitation
Patients need both aerobic reserve to compensate for surgical stressors and the strength to participate in critical aspects of the post-operative recovery program (e.g., incentive spirometry, early ambulation). Prehabilitation is the process of improving a patient's fitness prior to surgery, often involving cardiovascular and strength conditioning.

Major surgery results in a profound systemic inflammatory response with a significant increase in body oxygen requirement during the post-operative period.[137-141] Older or frail patients are less likely to have the physiologic reserve to compensate for the increased aerobic demands of major surgery. There is an inverse relationship between a patients' pre-operative aerobic capacity and poor surgical outcomes.[142,143] Patients with poor cardiopulmonary conditioning prior to cystectomy, for example, are at greater risk for post-operative complications and prolonged lengths of stay.[144] Importantly, aerobic capacity is trainable over a relatively short period before surgery. Previous work has demonstrated that a pre-operative exercise program as short as four weeks prior to pulmonary resection for lung cancer can lead to an increase in aerobic capacity of 21.5 percent.[145]

Older surgical patients often exhibit significant sarcopenia (muscle loss) as well with associated muscular weakness.[146,147] Major surgery results in significant additional loss of muscle mass and strength.[148] Many older surgery patients are unable to participate effectively in the standard post-operative recovery program. This results in surgical complications (e.g., venous thromboembolism and pneumonia) as well as need to discharge patients to skilled nursing facilities.[40]

Hospital readmission after major urologic surgery is one of the most pressing issues in the urologic patient population. Ninety-day hospital readmission rates for cystectomy patients, for instance, have been reported to be as high as 40 percent.[149] This readmission rate has been corroborated by other studies, with readmission being linked to patient gender, age and comorbidities.[150,151] Those patients readmitted also had a significantly higher rate of death within two years of surgery. The circumstances that lead to readmission not only delay patient recovery but also significantly increase healthcare costs.

Exercise interventions prior to surgery can range from unsupervised walking programs or in-home, patient-directed exercise training, to more-intense, supervised strength and cardiopulmonary exercise protocols. No matter the intervention, there is evidence that even a limited period of exercise is cardioprotective and can help avoid ischemic events.[152] There is evidence that prehabilitation improves indicators of fitness and function after major surgery when compared to rehabilitation;[153] this may be due to the delay in participating in significant physical activity as the patient recovers from surgery. The majority of the prehabilitation interventions reported in urology have focused on the cystectomy population.[154,155] Jensen et al. conducted a randomized control trial of a two-week, in-home, patient-directed strength and endurance conditioning program in which 66 percent of patients completed at least 75 percent of the prescribed exercise sessions, which resulted in an 18 percent improvement in muscle power at time of cystectomy when compared to the control group.[154]

There have been limited trials evaluating prehabilitation in prostatectomy patients.[156,157] Prehabilitation is safe in this population; strength and endurance parameters are improved and these improvements are maintained after surgery. Another form of prehabilitation that has been studied in prostatectomy patients is pre-operative pelvic floor exercises designed to hasten the recovery of post-operative urinary continence. In a randomized trial, Centemero et al. showed that patients who performed pre-operative plus post-operative pelvic floor exercises had superior continence outcomes compared with those patients who performed post-operative pelvic floor exercises alone.[158]

Although prehabilitation is not yet a common component of the urologic patient's pre-operative pathway, there is mounting evidence that strength and endurance conditioning prior to major surgery can reduce post-operative complications, shorten length of hospital stay, and result in durable improvements in physical capacity. Further work is necessary to establish soundly the functional and quality of life benefit of prehabilitation in urological patients. The optimal length and intensity of a prehabilitation intervention still needs to be established. Proving improved patient outcomes and cost savings is still necessary to sway payers to support making supervised prehabilitation a routine component of pre-operative care. For now, a simple intervention such as an at-home, graduated patient walking program is safe, inexpensive and likely will help improve patient outcomes after major urologic surgery.

Nutrition

Surgery increases a patient's metabolic requirements. An optimized baseline nutritional status plus adequate nutritional support during convalescence will meet these metabolic demands. Unfortunately, many urological patients are malnourished, and too often, this malnourished state goes unrecognized. This places patients at risk for complications and prolonged recovery.

Patients who are malnourished include those with weight loss greater than ten percent total weight within three months prior to surgery, those experiencing near starvation for five or more days, and those whose recovery will likely be prolonged and/or include a prolonged time to adequate oral nutritional intake.[159] Several tools, including the Nutritional Risk Screening 2002, are included in the European Society of Parenteral and Enteral Nutrition guidelines.[160,161] There are emerging data that indicate that improving the identification of malnourished patients and intervening in the pre-operative period can improve surgical outcomes for urologic patients.[162]

Fasting prior to surgery results in a depletion of glycogen, dehydration, muscle wasting, decreased immune response and proliferation of inflammatory mediators.[163] Allowing a light meal up to six hours prior to a general anesthetic (>eight hours for fried, fatty foods or meat) is gaining favor, is supported by

ASA guidelines,[127] and would limit these concerns. With the rise of enhanced recovery after surgery protocols, there has been a surge in interest in the use of pre-operative nutritional supplements two to four hours prior to major surgery. These include clear carbohydrate-rich beverages, oral nutritional supplements, and immunonutrition.[127,164] Carbohydrate-rich beverages reduce post-operative insulin resistance and immunodepression. Oral nutritional supplements improve muscle metabolism, patient strength and glucose storage. Immunonutrition, at least ten days prior to major scheduled surgery, could potentially lead to improved immune function, decreased inflammatory response, and reduced complication rates and length of stay.[165]

Behavioral Interventions Prior to Surgery

The doctor/patient interaction before an operative procedure provides an opportunity for urologists to positively impact a patient's overall health. A significant amount of information and education is transferred in the patient encounters leading up to the surgical date; time constraints can cause opportunities for intervention to be overlooked.

Smoking Cessation

Tobacco dependence is a chronic disease; nicotine is one of the most addictive substances known, behind only cocaine and heroin.[166] As many as 44 percent of the 45 million American smokers attempt to quit every year, but only as few as four to seven percent are successful.[167] The most successful smoking interventions combine both counseling and medications, including nicotine replacements (e.g., gum, patches, lozenges, inhalers, nasal spray), Bupropion SR (Zyban), and Varenicline (Chantix). Patients who attempt to quit smoking require ongoing support. Institutional or community smoking cessation programs can assist patients to better assure success. The crucial first step is for a medical provider to identify those patients who use tobacco products, encourage them to quit, and provide them with resources to better assure success. The pre-operative encounter presents such an opportunity.

Smokers are at a significantly increased risk for post-operative complications. Smoking cessation prior to surgery can decrease all complications, specifically wound complications.[168] Mills et al. performed a systematic review and pooled meta-analysis of the existing trials of smoking cessation prior to surgery.[169] Quitting smoking prior to surgery resulted in an overall 41 percent relative risk reduction for post-operative complications; each week of cessation increased the effect by 19 percent. Cessation at least four weeks prior to surgery decreased the total complication rate, and this effect was most notable for wound healing and pulmonary complications. While there may be some increased risk of having more secretions if smoking is stopped less than 72 hours prior to surgery, a meta-analysis did not confirm a commonly held belief that stopping smoking in the weeks preceding surgery caused increased post-operative morbidity.[170]

Managing Anxiety and Expectations

Surgery, no matter how minor, is a stressful event for a patient. Much of this anxiety comes from fear of the unknown; not knowing what to expect in the days leading up to a surgical procedure, the day of surgery, and post-operatively during recovery. Specific patient concerns that can be particularly anxiety provoking are surgical outcomes (i.e., the success rate of the surgery), recovery period (e.g., how long they can expect to be away from work and their usual activities), and pain management. Patients with higher anxiety levels can have delayed recovery from general anesthesia and require more pain medication after surgery.[171] Pre-operative anxiety has been linked to post-operative wound

complications, longer post-operative stay, risk for readmission and can even predict patient mortality.[172,173] Education and managing patient expectations is a crucial and often overlooked component of the surgical encounter.

Thorough, realistic counseling and expectation management improves urologic patient outcomes and procedure success.[174] Patient education can come is several forms. The simplest and most direct is discussion with the surgeon. It can come in other forms as well, such as pamphlets or handouts provided by the surgeon's office, pre-operative seminars, support groups, contact with past patients and vetted, reliable internet content or blogs. The more information a patient has about the pre- and post-operative period, the more at ease they will be leading up to the day of surgery.

There are several relaxation therapy techniques that can help manage patient anxiety. Music therapy can reduce patient anxiety, pain, and need for sedative medications. This has been shown to be true when patients listened to music when sedated for outpatient urological procedures[175] but can apply to the gamut of urologic procedures as well. Other relaxation methods that can help manage intra-operative stress include exercise, yoga, meditation, massage, and aromatherapy. A healthier and more relaxed patient psychological state will improve surgical outcomes and patient satisfaction.

Conclusion

A thorough pre-operative evaluation and assessment is important for urologic patients scheduled to undergo a surgical or procedural intervention. The pre-operative process can involve multiple different steps, based on an individual patient's needs, and a "team approach" can be beneficial to maximizing a patient's readiness for surgery.

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Peer Review

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Peter C. Albertsen, MD
Kristin L. Chrouser, MD, MPH
Peter E. Clark, MD
John D. Denstedt, MD, FRCS(C), FACS
Robert C. Flanigan, MD, FACS
Pat F. Fulgham, MD, DABU, FACS
E. Ann Gormley, MD
David F. Green, MD, FACS
Gwendolyn Hooper, PhD, APRN, CUNP/ Society of Urologic Nurses and Associates
Patrick Kenney, MD
Fernando J.W. Kim, MD, MBA, FACS
Barry A. Kogan, MD
John H. Lynch, MD, FACS
Janet Baack Kukreja, MD, MPH
John S. Lam, MD, MBA, FACS
Jodi K. Maranchie, MD, FACS
Paul Maroni. MD
Patrick H. McKenna, MD, FACS, FAAP
Jeff T. Mueller, MD, FASA/ American Society of Anesthesiologists
Matthew E. Nielsen, MD, MS
Sima P. Porten, MD, MPH
Glenn M. Preminger, MD
Roger E. Schultz, MD, FACS
Marc C. Smaldone, MD, MSHP, FACS
Angela B. Smith, MD, MS
Anthony Y. Smith, MD
Thomas F. Stringer, MD, FACS
Chandru P. Sundaram, MD
Jennifer M. Taylor, MD, MPH
Matthew F. Wszolek, MD
Harras B. Zaid, MD

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