AUA White Paper on

OPTIMIZING OUTCOMES IN UROLOGIC SURGERY: POSTOPERATIVE

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Introduction

Understanding best practices in perioperative care is critical for quality of care for our urologic patients. In the third part of this white paper series, we provide a summary of key elements to optimize postoperative care in adult urologic surgery. Optimal postoperative care includes minimizing postoperative complications, optimizing postoperative recovery and improving patients' postsurgical outcomes. The assembled white paper multidisciplinary writing team includes experts in a number of different areas (urologists, nurses, anesthesiologists) to address a comprehensive set of topics that urologic providers face when caring for postoperative patients.

The importance of improving postoperative care has grown out of the Enhanced Recovery after Surgery (ERAS) movement, which emphasizes the importance of standardizing elements of postoperative care. Lessons learned from ERAS protocols suggest that compiling *and using* the best evidence-based medicine can improve the surgical outcomes of our patients. However, assembling these resources is challenging, and we recognized a distinct need from our membership to compile a single, concise resource that provides this information in one place. Postoperative considerations include a number of relevant topics, which will be reviewed and synthesized to create a standard set of recommendations for optimal care. Herein, we present our recommendations for optimizing postoperative outcomes in adult patients by addressing three broad topics:

1) In-hospital considerations
2) Transition/discharge
3) Follow-up and surveillance

Part 1: In-hospital Postoperative Considerations

Checklists

Checklists have been instrumental in safety culture in the military and aviation industries.[1] By eliminating obvious errors of omission, checklists can also be useful in healthcare delivery and surgical care.[2,3] Several surgical checklists exist that largely focus on preoperative and intraoperative care, which are covered in our compendium white papers of the same topics. The most commonly used surgical checklist is the World Health Organization (WHO) Surgical Checklist, which consists of 19 items focused primarily on the preoperative and intraoperative states.[4] The WHO Surgical Checklist can be particularly helpful in navigating the transition from the operating room (OR) to the post-anesthesia care unit (PACU), as described in this documents' section on transfer of care below. A systematic review identified that implementation of this checklist improved patient outcomes postoperatively. Checklists that can be implemented postoperatively are less common but can equally impact postoperative

outcomes. Despite resistance by some physicians that checklists, standards, and guidelines erode physician autonomy, these same documents contribute to consistent application of clinical science.[5] Furthermore, checklists can be instrumental in correctly assigning diagnosis and procedure codes, which assist with accurate case attribution, reimbursement, and quality improvement. An important checklist which features several "forms" that span the preoperative to postoperative states is the SURgical PAtient Safety System (SURPASS) checklist.[6,7] Postoperative Checklist D covers transfer from the recovery room to the ward, suggesting that the anesthesiologist provides instructions to the ward physician in several areas including the following:

- Medication (including pain medication)
- Infusion fluids
- Oxygenation
- Postoperative checks (including laboratory checks)
- Wound care
- Diet
- Special circumstances

Postoperative Checklist E includes a comprehensive list of tasks to be completed by the surgeon (and supported by the nurse) before discharge (more specifically covered in the section Discharge Planning):

- Discussion of pathology results (when applicable)
- Instructions concerning wound care
- Instructions concerning diet
- Instructions concerning drains and feeding tubes
- Instructions concerning anticoagulants
- Medication list checked and signed (and compared to medication at admission)
- Outpatient clinic appointment surgeon/other specialties made
- Discharge letter to primary care physician (PCP) (and/or hospital, rehab center, nursing home if transfer occurs)

Implementing comprehensive checklists can assist the team in providing consistent and evidence-based care, particularly in settings in which members of the team may alternate.

Transition from Anesthesia to Surgical Team

Handoffs

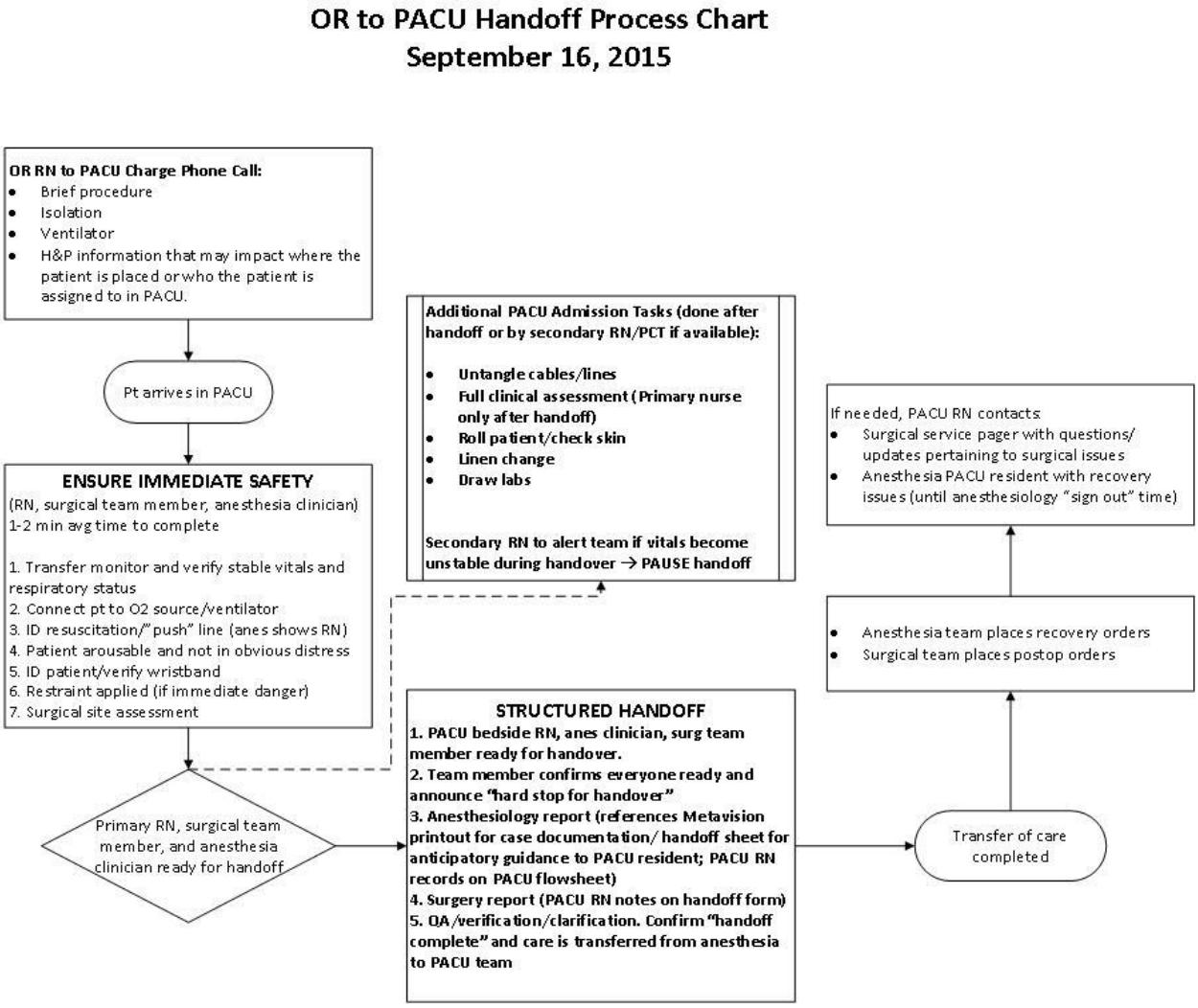
Successful completion of a surgical procedure marks the beginning of the crucial and dynamic recovery period for the surgical patient. After departure from the OR or procedural suite, the patient is transferred to the PACU or directly to an intensive care unit (ICU). There, critical information regarding the patient's condition, intraoperative events, and anticipatory guidance for postoperative care are transmitted from the intraoperative team to the postoperative care

providers, including a nurse and, in some circumstances, critical care or post-anesthesia care clinicians. The postoperative handoff is complex and critical; one study of OR to ICU handoff identified 37 individual steps in the handoff process, with 81 potential process failures including 22 deemed to be "critical."[8]

Evidence-based practice for postoperative transition of care includes use of both content checklists and standardized processes for information transfer.[9] The handoff process should not begin until the patient is monitored and stable. Multitasking by healthcare personnel during postoperative handoff, where equipment and information are transferred simultaneously, is common and may contribute to errors or omissions.[10] To reduce multitasking-associated errors, a standard handoff process may be designed to include a "hard stop" or "sterile cockpit" technique with an agreed-upon and verbalized start and end to the formal handoff as well as expectations that activities and conversation will be limited to the transfer of handoff information.[11] (Figure 1)

Use of a standardized, team-based handoff from the OR to postoperative setting is associated with fewer errors, improved quality of communication, and, in some studies, a decrease in preventable postoperative complications and improvement in short-term outcomes.[12-17] Postoperative use of formal structured handoff is associated with minimal, if any, increase in handoff duration.[11,14,16,17] Implementation in both the PACU and ICU settings is consistently viewed favorably by participants.[11,14,17,18] Although associated with a significant initial training investment of staff time for training, Weinger et al. demonstrated that multimodal handoff implementation, including use of simulation during training, improved the acceptability of postoperative handoffs even among clinicians and nurses who did not directly participate in training.[15] Importantly, this effect persisted for several years after the initial implementation.

Figure 1. Operating Room (OR) to Post-Anesthesia Recovery Unit (PACU) Handoff Process Chart*



*Permission for use granted by Dr. Megan Anders, 2015.

Level of Care Planning and Decision Making

Postoperative Cardiac Monitoring

For patients who remain in the hospital after surgery, the surgical care team must recognize indications for postoperative monitoring, including continuous cardiac monitoring (CCM) or continuous pulse oximetry. Some hospitals have limited capacity to provide monitoring from a remote station via wireless telemetry devices, allowing patients to undergo monitoring from any routine level of care, whereas other hospitals provide CCM or continuous pulse oximetry only in intermediate-care or other geographically-restricted settings. Other hospitals may not provide equipment or personnel trained to monitor patients continuously outside of the intensive-care setting.

Broadly, rationale for CCM in postoperative patients includes immediate recognition of lethal arrhythmias and cardiac arrest (facilitating early defibrillation), early recognition of deteriorating conditions, and diagnosis and management of non-life-threatening arrhythmias. Large, high-quality studies on the safety and efficacy of CCM are lacking, though a retrospective study of in-hospital cardiac arrests shows improved survival to hospital discharge for patients on telemetry monitoring at the time of arrest.[19] Potential negative consequences of CCM include alarm fatigue and cost for specialized equipment, requirement for trained personnel to monitor and respond to alarms, and costs of additional studies indicated by incidental findings. In practice, CCM is frequently ordered outside of accepted guidelines, with an average estimated cost of $86 per day.[20]

The American Heart Association's (AHA) scientific statements on practice standards for electrocardiographic monitoring in hospital settings describe indications for CCM in the diagnosis of arrhythmias, myocardial ischemia, and QT interval prolongation. Arrhythmia monitoring is computerized, automatic, and widely used.[21,22] Ischemia surveillance can be computerized, offering the ability to detect "silent ischemia" in the postoperative patient but may be the source of frequent false alarms and is underutilized.[23] QT interval monitoring is important in select clinical scenarios due to the association between QT prolongation and the life-threatening arrhythmia torsade de pointes. Measurement of the QT interval is indicated in scenarios such as the initiation or titration of medications associated with QT prolongation in patients with known history of prolonged QT interval, multiple QT prolonging medications, or other risk factors for torsade de pointes. (Table 1)

Table 1: Examples of Common Postoperative Medications with Risk of QT Prolongation and Torsade de Pointes*

Drug class	**Common examples**
Antiemetics	Ondansetron, droperidol
Antimicrobials	Levofloxacin, moxifloxacin, fluconazole, azithromycin
Antidepressants	Citalopram, escitalopram
Antipsychotics	Haloperidol
Opiate	Methadone

*Adapted from Credible Meds[24]

The 2017 update to the AHA guidelines states that CCM for arrhythmia monitoring is not generally indicated among asymptomatic patients after non-cardiac surgery, including those with chronic, rate-controlled atrial fibrillation.[22] Arrhythmia monitoring should be used in patients with moderate to severe imbalances of potassium or magnesium and in patients with postoperative anginal equivalent symptoms, acute heart failure symptoms, and symptomatic rhythm changes. Monitoring should continue uninterrupted for 24-28 hours (or until "ruled-out" by biomarkers) in patients with early-phase acute coronary syndrome, including workup conducted after transient intra- or postoperative ST segment changes.

Postoperative Respiratory Monitoring

Postoperative respiratory depression is a significant source of postoperative morbidity and mortality, ranging from transient hypoxemia to severe ventilatory impairment leading to brain damage or death.[25,26] Significant, often prolonged episodes of hypoxemia are common in hospitalized patients in the 48 hours after surgery and are frequently undetected by routine nursing assessments.[25,27] Risk factors for postoperative respiratory complications are related to patient, surgical, and anesthetic factors including: advanced age, female sex, presence of obstructive sleep apnea (OSA), pre-existing cardiopulmonary disease, obesity, duration and site of surgery, blood loss, colloid resuscitation, intraoperative tidal volume, opioid dependence, recurrent PACU respiratory events, use of patient-controlled analgesia, concomitant use of opioids and sedative medications, and mismatched pain and sedation scores (e.g. high pain and high sedation score at the same time).[28-31] Patients who experience desaturation to less than 89 percent or require prolonged (>60 minutes) oxygen therapy in the PACU have a higher risk of postoperative reintubation and may warrant special consideration, including postoperative admission to a monitored bed.[32]

The presence of OSA is an important risk factor for postoperative respiratory complications, particularly in patients receiving opioid therapy.[33-35] The 2014 American Society of Anesthesiologists Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea recommend continuous pulse oximetry monitoring for hospitalized postoperative patients "who are at increased risk of respiratory compromise from OSA." To establish that a patient is no longer at risk for respiratory depression, prolonged observation of the patient while breathing room air in an unstimulated environment, preferably while sleeping, is recommended.[35] Non-invasive positive pressure ventilation should be considered if severe or frequent airway obstruction or hypoxemia occurs. The once popular STOP-BANG (**S**nore loudly, **T**ired, **O**bserved to stop breathing during sleep, High blood **p**ressure, **B**ody Mass Index more than 35kg, Over 50 years of **a**ge, **N**eck circumference greater than 16 inches, and Male **g**ender) OSA screening tool is no longer considered to be predictive of postoperative respiratory depression and apnea,[36,37] suggesting the need for broad and/or individualized monitoring strategies. Institutionally-developed clinical algorithms[34] may be useful for integrating information about the patient's disease status, perioperative risk factors, and PACU course to guide decisions about postoperative monitoring.[34]

Multiple respiratory monitoring modalities are commercially available, including pulse oximetery, continuous capnography, and respiratory volume monitoring; these are the subject

of active clinical investigation without widely accepted indications at this time.[38,39] While the 2014 Cochrane Database systematic review concluded that postoperative pulse oximetry was of "questionable value" related to outcomes, more recent studies suggest that continuous respiratory monitoring may reduce need for rescue and transfer to ICU.[39-42]

Table 2: Common Indications for Postoperative Monitoring

Chronic, rate-controlled atrial fibrillation	No cardiac monitoring
Moderate to severe imbalances of potassium or magnesium	CCM
Postoperative anginal equivalent symptoms, acute heart failure symptoms	CCM
Symptomatic rhythm changes	CCM
Acute coronary syndrome, including transient intra- or postoperative ST segment changes	CCM for 24-48 hours or until "ruled-out" for acute coronary syndrome by biomarkers
Initiation or titration of medications associated with QT prolongation in patients with risk factors for torsade de pointes	QT interval monitoring
Known severe OSA	Monitored bed including continuous pulse oximetry
Known or suspected OSA with risk factors for postoperative respiratory complications (including recurrent PACU respiratory events or pain sedation mismatch with concurrent high pain and high sedation scores)	Monitored bed including continuous pulse oximetry

Enhanced Recovery after Surgery

ERAS protocols are evidence-based, multimodal pathways aimed at optimizing the perioperative care for patients undergoing complex surgery. These protocols were first introduced in colorectal surgery but have now expanded to other surgical disciplines, notably to patients undergoing radical cystectomy. A growing body of evidence has demonstrated the benefits of these protocols on clinical outcomes, including reduction in time to bowel function, complication rates, and, most significantly, reduction in length of hospital stay. ERAS principles have now been adopted by most surgical disciplines.[43,44] Although the term ERAS refers to management of the patient postoperatively, the concepts of enhanced recovery have implications for each aspect of the patient's surgical journey, starting with preoperative counseling, which are covered in other sections of this white paper series. Herein, the focus will be on interventions that enhance the patient's recovery following surgery.

Minimally invasive procedures including laparoscopy and robotic surgery have resulted in decreased operative blood loss, postoperative pain and length of hospitalization for radical prostatectomy in general.[45,46] Similarly, laparoscopic and robotic renal surgery techniques have greatly reduced the morbidity of these surgeries compared to their open counterpart.[47]

However, the benefits of minimally invasive approaches are less well defined in terms of postoperative complications and hospital length of stay (LOS) with complex procedures such as radical cystectomy and urinary diversion.[48] The main reason for prolonged LOS after cystectomy remains gastrointestinal (GI) morbidity, mostly paralytic ileus. It is within the framework of such procedures that ERAS protocols can contribute most in terms of postoperative recovery.

Enhanced recovery protocols (ERPs) were first established in the 1990s after recognition of significant variation in clinical outcomes for procedures among European centers. Early ERPs were conceptualized and implemented in the late 1990s for patients undergoing colorectal surgeries.[49] An ERAS study group subsequently formed in 2001 to evaluate perioperative care and implement evidence-based protocols.[50] An official society has now been formed (www.erassociety.org)[51] with established specialty-specific guidelines for perioperative care of complex surgical patients. Implementation of such guidelines throughout some specialties has been fairly slow, particularly within community practices where dogma prevails. Many of the ERAS principles, such as avoidance of nasogastric tubes (NGTs) and bowel preparations for patients undergoing bowel resection, are in direct contradiction to philosophies of patient care passed down for several generations. In the era of evidence-based medicine, one can find objective data available across numerous surgical disciplines demonstrating improved outcomes with ERAS protocols. Although many of the ERAS principles are applicable to prostate, kidney, and other retroperitoneal surgeries, the protocols have mostly focused on patients undergoing radical cystectomy and urinary diversion given the procedural complexity with its associated morbidity. This section will, therefore, focus mostly on enhanced recovery following radical cystectomy although the principles can be applied to other complex surgical procedures in urology.

Radical cystectomy with urinary diversion has historically been associated with prolonged hospital stays of up to two to three weeks.[44] As with most advances in medicine, progress has been incremental with application of principles established from other surgical disciplines. Shafii et al. performed a retrospective analysis of 86 patients undergoing cystectomy and ileal conduit with or without antimicrobial or mechanical bowel preparation. They found no significant differences in rates of wound infection, fistula, bowel anastomotic leaks, sepsis, or mortality. There was a lower incidence of ileus and shorter hospital stay in the no bowel preparation group.[52] Inman et al. published a retrospective evaluation of 420 patients undergoing radical cystectomy and urinary diversion in 2003. An NGT was placed at the discretion of the surgeon. They found that patients without an NGT had significantly shorter times to first flatus and significantly shorter durations of hospitalization with no increased risk of ileus, bowel obstruction, wound dehiscence, anastomotic leak, or aspiration pneumonia.[53] Soon “collaborative care pathways” were developed that demonstrated early NGT removal and metoclopramide injection would speed bowel function return and shorten hospital stay.[54] “Fast-track” protocols were initially developed with the aim of reducing the stress response and time to recovery following surgery.[55] Pruthi et al. were among the first to report outcomes of patients undergoing radical cystectomy using a “perioperative care plan” that included limited outpatient bowel preparation with sodium phosphate solution and additional formalized patient education, which included a discussion of the importance of early ambulation and

pulmonary exercises. Operative modifications included smaller incisions, initial preperitoneal dissection, and the use of surgical stapling devices. Postoperatively, the NGT was removed early, an oral diet was instituted earlier, and use of non-narcotic analgesics with prokinetic agents were used routinely. This led to a significant decrease in hospital LOS to 5.1 days.[56] In 2008, Arumainayagam et al. reported on an ERP that they had initiated at their institution in 2005. In this case-control study of 112 patients (56 each arm), the authors showed a four-day decrease in hospital stay with ERP (13 versus 17 days, $P < 0.001$). The key changes in the ERP group included no bowel preparation, early enteral feeding and mobilization, and epidural pain control. Early readmission rates were five percent in ERP versus nine percent in the control group.[57] Pruthi et al. reported an update on their experience with 362 consecutive patients using the "Fast-track" program at their institution, which included sodium phosphate or magnesium citrate for bowel preparation, no use of postoperative NGT, routine metoclopramide use, chewing-gum starting postoperative day one and non-narcotic analgesics. Eighty percent of patients were discharged home by postoperative day four or five with a 12 percent readmission rate.[58]

Evidence-based Components of ERAS in Urologic Surgery

Despite the plethora of literature citing the benefits of ERPs, there are a limited number of prospective trials evaluating these protocols in urologic surgery. Di Rollo et al. published a systematic review of these protocols and found a total of six studies that met the inclusion criteria (case control, cohort or randomized controlled trials) of which only three were published. However, all six studies, which included renal surgery (open or robotic partial nephrectomy, transperitoneal, or laparoscopic total nephrectomy) and radical cystectomy, showed a reduction in hospital stay without an increase in complication rate.[59] Given the differing ERAS protocols and variable implementation of protocols among centers, it has been difficult to document the incremental benefit of each component. Several components, which aimed to minimize GI complications and morbidity, however, have been studied individually, including early NGT removal, use of chewing gum, limitation of opioid pain medications, and most notably the use of alvimopan, an oral peripherally acting μ-opioid receptor antagonist. Alvimopan has limited ability to cross the blood–brain barrier to bind the μ-opioid receptors of the central nervous system, thereby avoiding the desired analgesic effects of opioids without affecting the intended blocking of μ-opioid receptors in the GI tract. One of the most important factors that allow early feeding and reduce ileus is minimizing use of opioids for postoperative pain control. A number of different methods for pain control are covered extensively in this paper's section on postoperative analgesia. Several randomized trials have shown the benefit of alvimopan in promoting a quicker GI recovery and shorter LOS in patients undergoing colorectal surgery. A multicenter double-blind placebo-controlled trial randomized patients undergoing radical cystectomy to alvimopan versus placebo. The use of alvimopan was associated with quicker GI recovery (5.5 versus 6.8 days), shorter mean LOS (7.4 versus 10.1 days), and fewer episodes of postoperative ileus (8.4 percent versus 29.1 percent).[60] These benefits have recently been confirmed in a meta-analysis.[61] Unfortunately, due to cost, the medication is restricted in some hospitals in the United States and not available in Europe or Asia. It is also contraindicated in patients who have taken therapeutic doses of opioids for more than seven consecutive days immediately before starting alvimopan. When available, however, alvimopan

should be a part of established ERAS protocol for patients undergoing radical cystectomy and urinary diversion. (Table 3).[43]

It is now clear that use of NGT following cystectomy does not prevent ileus or reduce GI complications but rather contributes to patient discomfort.[62-64] An NGT should, therefore, be avoided altogether or removed immediately after surgery. The use of chewing gum in the early postoperative period has been shown in cohort studies and randomized trials to decrease time to return of bowel function.[65,66]

Table 3. Example of an ERAS Protocol*

Preoperative	Intraoperative	Postoperative
• Precystectomy educational class • Carbohydrate loading • No bowel preparation (unless large bowel being used for diversion) • Alvimopan (12 mg po BID	• Opioid sparing anesthesia • Optimize intravenous fluid • Restrictive transfusion protocol	• Non-narcotic analgesia • No NGT • Nausea and vomiting prophylaxis • Sodium bicarbonate (1-2g TID) • 24-hour perioperative antibiotics • Early enteral feeding (cystectomy diet) • Early ambulation • Alvimopan • Neostigmine (0.5 mg/BID for 72 hours (SC or IM), should be kept under heart monitoring for bradycardia) • H2 blocker and proton pump inhibitor • Suppressive oral prophylactic antibiotics until or surrounding catheter/stent removal (*unproven benefit) • Home intravenous hydration

*Adapted from Daneshmand et al. 2014[43]

Experience with ERAS in Radical Cystectomy

Several series of ERPs for patients undergoing radical cystectomy have now been published (Table 4). The protocols vary; however, each contains several established evidence-based principles. Although comparison between the protocols is difficult, endpoints are measurable and include return of bowel function, measurement of complications using standardized reporting (i.e., Clavien grading), length of hospitalization, and readmissions. Karl et al. performed a randomized study of 101 consecutive patients undergoing radical cystectomy to "early recovery" (62 patients) versus a "conservative regimen" (39 patients) with the primary endpoint being difference in quality of life (QOL).[67] Secondary endpoints included postoperative morbidity, demand for analgesics, time spent in an ICU, mobility, and number of GI events during the hospital stay. QOL parameters based on EORTC QLQ-30 (European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire) were found to be significantly better in the ERAS group. In addition, postoperative morbidity was significantly lower in the ERAS group with regards to wound healing, fever, thrombosis, and demand for analgesics. An additional benefit of increased food consumption was observed in the ERAS group, but no significant differences were seen between the groups with respect to GI events, although alvimopan was not used in this protocol.[68] Although no other robust randomized trials have been published proving the benefits of ERAS, each of the modern ERAS protocols has consistently shown significantly shorter time to regular diet, time to return of bowel function, and length of hospitalization. In 2014, one of the largest prospective series from the University of Southern California included 113 consecutive patients who underwent an ERAS protocol and were matched to controls from the same institution. The protocol suggests no bowel preparation, avoidance of NGT postoperatively, early feeding with regular food on postoperative day one, and routine use of prokinetic agents including neostigmine, metoclopramide, and routine use of alvimopan until bowel movement. The surgeon's preference was to avoid the use of epidurals and emphasize opioid-sparing anesthesia as well as non-narcotic analgesia postoperatively through use of acetaminophen acetate, ketorolac tromethamine, and locoregional anesthetic catheters. This ERAS protocol significantly decreased the length of hospital stay compared to matched controls from four versus eight days ($P < 0.001$).[43] The authors noted no increase in 30- and 90-day complications or readmission rates. Use of opioids on the ERAS protocol was also noted to be substantially less compared to the standard protocol prior to implementation of the ERAS protocol.[69] In a recently published update on the series, Bazargani et al. reported on 292 ERAS patients, 65 percent of whom underwent an orthotopic neobladder construction. The median time to bowel movement was two days and the median hospital LOS remained four days. The 30-day GI complications rate was significantly lower in the ERAS cohort than in a control group (13 percent versus 27 percent; $p = 0.003$), as was the rate of postoperative ileus (seven percent versus 23 percent; $p < 0.001$). There were no anastomotic bowel leaks in the ERAS patients, and only three patients required total parenteral nutrition as a result of ileus. A recent meta-analysis found a faster return of bowel function (by one day), mean decrease in the length of hospital stay of greater than five days, and a lower complication rate with ERAS implementation (39.6 percent with ERAS versus 51.5 percent with standard care). No significant difference in overall readmissions or 90-day mortality was noted, however.[44] Another benefit included cost savings, which were mostly attributed to the shorter hospital LOS. Chipollini et al. reported

lower supply, treatment, and miscellaneous charges for patients managed with an ERAS protocol, while two other studies found an average savings of about $4,000 per procedure.[70-72]

Table 4. Enhanced Recovery Protocols (ERPs) for Patients undergoing Radical Cystectomy*

TABLE 1 Select prospective studies of ERAS for radical cystectomy

Reference	*n* (ERAS)	Emphasized ERAS protocol components	Reported outcomes
Brodner et al[36]	15	Epidural analgesia, early oral nutrition, enforced mobilization	Decreased fatigue, improved pain control, quicker recovery of bowel function
Saar et al[71,b]	31	Early nutrition, early mobilization, no bowel prep or drains	Earlier mobilization in room, quicker time to regular diet (4 vs 6 days), lower use of morphine equivalents
Mukhtar et al[35]	51	No bowel prep or NG drainage, preoperative carbohydrate drinks, epidural analgesia, early mobilization	Decreased length of hospital stay, decreased ICU stay, shorter time to bowel function and regular diet
Daneshmand et al[28]	126	No bowel prep or NG drainage, early feeding, non-narcotic pain management, cholinergic and μ-opioid antagonists use	Shorter time to bowel movement, shorter length of hospitalization, similar complication/readmission rates
Karl et al[46,a]	101	High calorie protein drinks day prior to surgery, no bowel prep, early enteral feeding and mobilization, early drain removal	Improved early QOL measures, decreased postoperative morbidity, time spent in ICU, analgesic use and improved food consumption
Perrson et al[71]	31	Preoperative counseling, carbohydrate loading, avoidance of bowel prep, epidural analgesia, no NG tubes, early oral nutrition and mobilization	Shorter mean time to passage of stool, decreased readmission rate at 30 days
Collins et al[61,b]	135	No bowel prep, early NG removal, multimodal ileus prevention, and others in accordance with ERAS society guidelines	Decreased median length of stay. No change in complication or readmission rates

[a]Randomized.
[b]Minimally invasive series.

* As published in J. Surg. Oncol.:
Zainfeld D and Djaladat H. Enhanced recovery after urologic surgery-Current applications and future directions: J Surg Oncol 2017; **116:** 630.

Open Versus Robotic Cystectomy Using ERAS Protocols

Several retrospective studies and systemic reviews suggest that robot-assisted radical cystectomy (RARC) is associated with shorter length of hospital stay[73,74] and fewer major complications than open cystectomy (OC).[75-77] However, the results should be interpreted with caution since almost all of these studies compare outcomes to open surgery prior to adoption of ERAS protocols. One randomized trial of open versus radical cystectomy from Memorial Sloan Kettering showed similar 90-day complication rates, hospital stay, pathologic outcomes, and 3- and 6-month QOL outcomes.[48] The recently completed RAZOR (randomized open versus robotic cystectomy) trial showed open radical cystectomy (ORC) group had higher estimated blood loss (EBL) ($p<0.0001$), higher intra- and postoperative blood transfusion rate ($p=0.0002$ and $p=0.0089$, respectively), but shorter operating time ($p=0.005$). Similarly, in this randomized trial, there were no significant differences in overall complications (grades I–V) or major complications (grades III–IV) between the two treatment groups.[78] Postoperative outcomes following radical cystectomy appear to be largely driven by perioperative management techniques rather than surgical approach. ERAS principles are applicable regardless of surgical approach or technique and should be implemented for robotic-assisted radical cystectomy

procedures where similar benefits can be realized.[79] The recently published AUA guidelines for muscle-invasive bladder cancer suggest a number of common ERAS components, including optimization of patient performance status prior to surgery, perioperative thromboembolic prophylaxis, and gives a "strong recommendation" for use of alvimopan.[80]

As ERAS protocols continue to develop and mature, the hope is that they will permeate throughout the surgical community to improve the quality of patient care across the world. ERAS protocols have proven to be safe and effective at reducing hospital stay and decreasing complications and cost. While these protocols are best established for patients undergoing radical cystectomy given its morbidity, the principles have also been applied to other urologic procedures, such as radical prostatectomy, and renal and retroperitoneal surgery, where there is still room for improvement in standardization of postoperative care with potential benefits in the patient experience and QOL.[81] The ERAS paradigm represents an evidence-based, patient-centered approach with the objective of delivering the highest quality of care for surgical patients. Incorporation of components of ERAS protocols are recommended for all complex urologic surgeries.

Nutrition in the Postoperative Period

Recovery from urologic surgery is dependent on a complex interplay between patient, surgical, and environmental factors. Nutrition is one of many factors that can influence postoperative recovery and outcomes. Nutrition is broadly defined as the intake of nutrients (calories from protein, fat, carbohydrates) to meet the needs of the human body. Consequently, malnutrition (bad nutrition) is a medical condition that specifically refers to undernutrition resulting from a nutritional imbalance where intake is not adequate to meet nutritional needs. Although clinicians and urologists are inherently familiar with the term "malnutrition," there is persistent evidence that a widespread failure to identify malnutrition in patients currently exists. This lack of identification has the potential to affect patient outcomes negatively.

The goals of this section are 1) to provide the urologic provider with a fundamental understanding of perioperative nutrition, and 2) to highlight areas of postoperative nutrition that are relevant for postoperative documentation and potentially modifiable via nutritional intervention. In a sense, the goal is to elevate the role of nutritional care beyond just placing a postoperative diet order and instead to include nutrition as a critical component of postoperative recovery. This section will supplement the discussion of nutrition in the preoperative period mentioned in the preoperative white paper in this series.

Information on nutrition is applicable across numerous types of urological surgeries. However, the malnutrition literature in general tends to focus on cancer patients and patients undergoing surgery involving the GI tract. Therefore, this urologic review will largely focus on cystectomy with urinary diversion for bladder cancer but will still contain nutrition information relevant to urologic surgeons who do not perform cystectomy.

Defining Malnutrition

Simply stated, malnutrition is a problem of supply and demand. Malnutrition has been described to occur based on a combination of contributing factors related to decreased supply (inadequate intake, impaired absorption, altered nutrient transport or utilization) or increased demand (increased requirements).[82]

Malnutrition is undernutrition with an imbalance in which food intake is inadequate to provide sufficient protein and energy supply to compensate for the increased demand of underlying disease processes and postoperative recovery. Malnutrition is based specifically on an imbalance where the intake of calories, protein, or other nutrients is inadequate for the needed requirements for tissue maintenance and repair. Malnutrition likely exists on a spectrum, but for classification purposes there is value in defining malnutrition as five categories: no malnutrition, at risk, and then by malnutrition severity (mild, moderate, or severe).

Malnutrition is also related to cachexia and sarcopenia. Cachexia has been defined as a multifactorial syndrome defined by an ongoing loss of skeletal muscle mass (with or without loss of fat mass) that cannot be fully reversed by conventional nutritional support and leads to progressive functional impairment[83] due to an underlying illness such as cancer. Sarcopenia refers to a deficiency of lean muscle mass with corresponding declines in muscle quality that is stereotypically associated with aging but may be accelerated secondary to malignancy or severe illness.[84] The pathophysiology of malnutrition and cachexia-related weight loss is thought to be related to a combination of undernutrition, inflammation, and catabolism.[85] This catabolic process creates a challenging treatment paradigm as cachexia is difficult to fully reverse by conventional nutritional support once it reaches later stages and leads to progressive functional impairment.[83]

Historically, malnutrition had been defined in the literature primarily using laboratory criteria of acute phase proteins, such as low albumin or low prealbumin. However, that laboratory-based definition has been supplanted by a clinically-based definition. The reason for that transition is that albumin and prealbumin are indicators of the severity of inflammatory response rather than true markers of poor nutritional status as laboratory value changes are not consistently associated with weight loss, calorie restriction, or nitrogen balance.[82,86]

The current standard of care malnutrition assessment tool is the 2012 Consensus Statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition (ASPEN): Characteristics Recommended for the Identification and Documentation of Adult Malnutrition. The consensus statement, which to date has not been used in the urologic literature, defines malnutrition based on the presence of two or more of the following six clinical characteristics: insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, fluid accumulation, or diminished functional status as measured by handgrip strength.[82]

Performing the evaluation recommended in the consensus statement is likely beyond the scope of a practicing urologist, but urologists should be familiar with the clinical characteristics of

malnutrition and recommend that dietitians utilize the criteria for patient evaluation (See Diagnosis of Malnutrition section below for more detailed discussion). Early in the discussion of malnutrition, it is relevant to note that nutrition and malnutrition education are typically lacking in physician education during medical school. As a result, urologic providers should engage in continuing education, but, perhaps more importantly, call upon the expertise of dietitians to engage in the nutritional assessments of patients.

Emergence of the Significance of Malnutrition

In 1974, surgeon Dr. Charles Butterworth called malnutrition "the skeleton in the hospital closet."[87] This assessment was based on a lack of attention to the essential impact of good nutrition on patient outcomes and the neglect of nutritional health while patients were hospitalized. In 1996, to improve the standards of nutritional care, the Joint Commission mandated that nutritional screenings be completed within 24 hours after inpatient admission.[88] However, the implementation of mandated screening in various hospital settings has been implemented poorly with many hospitals struggling with lack of consistent screening, delay in process, and a "lack of precision in diagnosis."[89] However, for urologists it is worth noting that nutritional screening of hospitalized patients, including postoperative patients, is likely occurring but may be out of the vision of the practicing surgeon.

The prevalence of malnutrition has been estimated to range from 15-60 percent in adult hospitalized patients and as high as 71 percent in some cancer patients.[90] Several retrospective and prospective studies have evaluated the rate of malnutrition in the inpatient population. In a review of 20 studies targeting at-risk patients, specifically surgical patients, ICU patients, and the geriatric population, the rate of malnutrition was noted to be between 20-50 percent.[91]

The prevalence of malnutrition in urologic patients has been most closely evaluated in bladder cancer patients undergoing radical cystectomy. A detailed review of the prevalence of malnutrition can be referenced in a recent *Journal of Urology* manuscript that discusses the emerging impact of malnutrition on surgical patients, including potential implications for cystectomy and bladder cancer.[92] This review highlights that radical cystectomy is associated with extensive and significant catabolic changes, including loss of protein and weight loss. To date, a limited number of studies have focused on assessing malnutrition in the cystectomy population with estimates of the prevalence of malnutrition ranging from 16-33 percent; however, many of these studies used low albumin as the definition for malnutrition, which has limitations as noted previously.

Real world evaluation of malnutrition diagnosis rates noted most academic medical centers have documented malnutrition rates of less than five percent of hospitalized patients, which is in contrast to higher rates of malnutrition occurring in that patient population.[93,94] Recently, increased attention has been turned toward improving the quality of malnutrition care. The Academy of Nutrition and Dietetics established a Malnutrition Quality Improvement Initiative (MQii), which is a multi-institutional collaborative to improve nutrition care and identification of malnutrition.[95] Online resources are available on the MQii website http://mqii.defeatmalnutrition.today/.[96]

In 2017, the American Society for Enhanced Recovery and the Perioperative Quality Initiative released a joint consensus statement on nutritional screening and therapy within a surgical enhanced recovery pathway, which provides a detailed discussion of nutrition in the context of ERAS.[97] Preoperative recommendations from that group included preoperative nutritional screening, evaluation of lean body mass (LBM) via computed tomography (CT) scan, emphasis on an overall protein intake goal of more than 1.2 g/kg/day (rather than an emphasis on a calorie goal), use of oral nutritional supplements (ONS), abandonment of preoperative fasting from midnight in exchange for preoperative guidelines allowing solid foods up to eight hours before anesthesia and clear fluids up to two hours, and preoperative carbohydrate loading with a drink containing at least 45 g of carbohydrates (except in type 1 diabetics). Postoperative guidelines from the joint group included early initiation of high-protein diet, focus on protein rather than calories, standardized protocols for postoperative nutrition, immunonutrition supplementation, supplemental nutrition for patients not meeting protein goals, and post-discharge use of oral supplements. Those concepts are further discussed in the preoperative nutrition section and in the sections below.

Impact of Malnutrition on Postoperative Outcomes

While a comprehensive review of the impact of malnutrition on postoperative outcomes is beyond the scope of this white paper, it is worth noting that malnutrition is dangerous and consistently associated with adverse postoperative outcomes. The development of disease-related malnutrition has been referred to as a vicious cycle in which both chronic and acute illness contribute to anorexia and/or intestinal malabsorption, which in turn lead to starvation, stress-related increased catabolic activity, cachexia, and dysregulated inflammation. This cyclic process ultimately leads to alterations in immune function, increased morbidity, and decreased patient well-being.[91] As a result, with malnutrition there is a significant shift toward catabolic metabolism at the expense of proper immune system function, including risk of delayed wound healing.

Weight loss with loss of LBM is a primary component of malnutrition. Importantly, postoperative patients are at increased risk because it is well known that bed rest accelerates loss of LBM, which is associated with negative outcomes:[97-99]

- 10 percent loss of LBM is associated with immune system suppression and increased risk of infection
- 15-20 percent loss of LBM impairs wound healing
- Over 30 percent loss of LBM can result in a complete lack of wound healing and development of spontaneous wounds such as pressure ulcers

There is a clear and consistent association between malnutrition and adverse postoperative outcomes, including increased LOS, hospital readmission, postoperative complications, and in some reports mortality.[82,97] More information on the relationship between malnutrition and adverse postoperative outcomes is available in several reviews.[82,92,100-102] In summary, the reported strong association between malnutrition and/or sarcopenia and adverse

postoperative outcomes is certainly sufficient to warrant increased attention on nutritional interventions, especially as nutritional status may be a potentially modifiable risk factor.

Economic Impact of Malnutrition and Importance of Malnutrition Documentation
The Agency for Healthcare Research and Quality (AHRQ) released a statistical brief highlighting the characteristics of hospital stays involving malnutrition; AHRQ reported that 1.95 million hospital stays in 2013 involved malnutrition (4.5 percent of all inpatient stays), which was associated with an economic burden of $42 billion.[94] Those numbers should be interpreted as an under-representation of the true economic impact of malnutrition based on the known rate of under-identification and underreporting of the condition.[93]

Simply stated, patients with malnutrition are likely sicker and require increased utilization of hospital resources with subsequent increased costs. Urologists should be mindful of the importance of malnutrition documentation with respect to hospital reimbursement. Hospital reimbursement is structured on Medicare Severity-Diagnostic-Related Groups (MS-DRGs) based on the presence or absence of comorbidities and/or complications. Malnutrition diagnosis potentially affects hospital reimbursement as unspecified malnutrition is a comorbidity, and severe malnutrition is a major comorbidity in the MS-DRG structure.[103] With the known economic impact of malnutrition, accurate documentation should be emphasized to ensure adequate hospital reimbursement and risk adjustment.

Principles of Measuring Malnutrition via Multi-Disciplinary Care: Nursing Screening, Dietitian Assessment, and Physician Diagnosis
Nutritional care is a team sport. Urologists are not experts in nutrition but can advocate for redesigning care delivery with an increased focus on nutrition. Tappenden et al. provide a good overview of nutrition care. Their multidisciplinary group developed a four-pronged approach including 1) creating an institutional culture where stakeholders value nutrition, 2) redefining clinician roles to include nutrition care, 3) recognizing and diagnosing all malnourished patients and identifying those at risk of developing malnutrition, and 4) implementing comprehensive nutrition interventions and monitoring.[103]

Understanding the postoperative nutritional care of the patient requires an understanding of multiple concomitant processes. In brief, these processes can be broken down into malnutrition screening, malnutrition assessment, and malnutrition diagnosis (Table 5), which then leads to malnutrition intervention. For the purpose of the following three sections, it is most useful to address each of those processes and the “role” that most commonly performs that function. Upon admission patients are typically screened for malnutrition by nursing staff. Patients who are deemed at risk are assessed by a registered dietitian. The results of the assessment are provided to the care provider who establishes the diagnosis.

Table 5. Processes Leading to Malnutrition Intervention

Malnutrition Screening	Malnutrition Assessment	Malnutrition Diagnosis

- Usually by nursing
- Ideally within 24 hours of admission and using a validated tool
- At risk patients referred to dietitian for assessment
	- Usually by dietitian
	- Consensus Statement criteria (2 or more)
	  - *Insufficient energy intake*
	  - *Weight loss*
	  - *Muscle mass loss*
	  - *Subcutaneous fat loss*
	  - *Fluid accumulation*
	  - *Decreased functional status as assessed by hand grip strength*
		- Usually by clinician
		- Informed by the dietitian assessment
		- Clinical diagnosis and documentation of malnutrition severity (mild, moderate, severe)

Nursing Malnutrition Screening

Effective nutrition screening identifies patients with early signs and symptoms of malnutrition who may benefit from a more thorough nutrition assessment and intervention. Importantly, malnutrition screening should be performed using a validated tool and not just an institutional questionnaire. Data from a national survey by Patel and colleagues show that although United States institutions are compliant with the Joint Commission mandate for nutrition screening within 24 hours of hospital admission, only 50 percent are using validated screening tools.[89] Dietitians are typically familiar with the details of nutritional screening and should be able to recommend a validated tool for use by nursing; however, it is helpful for urologists to have some basic understanding of validated nutritional screening tools. Two tools have the strongest evidence for validity and reliability: Nutritional Risk Screening (NRS-2002) and Malnutrition Universal Screening Tool (MUST).

The NRS-2002 screen (Appendix 1) is based on both nutritional status (weight loss, decreased food intake, body mass index) in addition to underlying disease process (with major abdominal surgery having a moderate weight) and an age adjustment for patients older than 70 years.[104] The NRS nutritional score classifies patients as no-, low-, medium- and high-risk. In prospective evaluations, between 21 percent and 55 percent of cystectomy patients are considered at risk of malnutrition with a ≥3 NRS score.[101,105-107] It is notable that any cystectomy patient age 70 years or above would be classified as “at risk.”

The MUST tool (Appendix 2) is a simpler tool and composed of two patient-reported variables: weight change and loss of appetite. It is assessed by yes and no questions and asking the patient to quantify the amount of unintentional weight loss. However, Kyle and colleagues demonstrated that the NRS-2002 has higher sensitivity and specificity than the MUST.[108]

Nutritional screening is typically performed after hospital admission; given the catabolic nature of bladder cancer and radical cystectomy, routine use of one of these validated tools prior to surgery should be considered to identify patients in need of nutritional intervention to better

prepare them for surgery. It should be noted that a consensus group has published a strong recommendation for the implementation of routine preoperative nutritional screening to identify patients in need of preoperative nutrition optimization.[97] Preoperative nutritional strategies are discussed in part one of this series.

Methods of Malnutrition Assessment

Once patients are identified from the nurse screening as being at risk of malnutrition, they should be referred to a dietitian for malnutrition assessment. The nutrition assessment directs the appropriate intervention.

The Academy of Nutrition and Dietetics and the ASPEN Consensus Statement standardized the identification and documentation of malnutrition based on six characteristics (noted previously).[82] The presence of two or more of the six key characteristics results in the diagnosis for adult malnutrition, and the table from that Consensus Statement is a useful resource.[82] Patients are then classified as having no malnutrition, non-severe (moderate) malnutrition, or severe malnutrition. Notably, the consensus statement reports that a strict body mass index cutoff is not required for the diagnosis of malnutrition as even patients with obesity can be malnourished.

Historically, the subjective global assessment (SGA) was used as an assessment tool for malnutrition and may still be used at some institutions.[109] The tool uses five components of medical history, including weight change, dietary intake, GI symptoms, functional capacity and metabolic stress as well as physical exam findings, fat loss and muscle wasting, and alterations in fluid balance. The SGA tool provides an assessment of well-nourished, moderately malnourished, or severely malnourished.[110]

Diagnosis of Malnutrition

After establishing the diagnosis of malnutrition, a care provider should document the diagnosis of malnutrition in the medical record, which can improve reimbursement by accurately describing patient complexity. Documentation of the malnutrition diagnosis typically is done based on confirmation of the assessment performed by a registered dietitian. In settings where a dietitian is not available, it would be helpful for the clinician to have a working understanding of clinical characteristics of malnutrition. “Real-world” data represent an alarmingly low rate of reported malnutrition diagnoses in comparison to the prevalence of malnutrition during prior focused research efforts.[93] A recent report from AHRQ and ASPEN as well as an additional report from a collaborative of academic medical centers reported that malnutrition was documented in less than five percent of all adult inpatient stays.[93,94] In a survey targeting members of ASPEN,[89] multiple factors were highlighted as reasons for the difference in the high prevalence of malnutrition on dietitian assessment compared to the low rate of documentation of a malnutrition diagnosis by providers, including lack of awareness, inadequate multidisciplinary care, lack of knowledge, and inadequate training.

Nutrition Intervention: Oral Nutritional Supplements Including Immunonutrition
Protein requirements are increased during times of stress, such as surgery, to accommodate the increased demands of wound healing, production of proteins involved in immune function, and the demands of hepatic acute phase protein synthesis; as a result the optimal intake of protein is increased, likely to a total of at least 1.2-2.0 grams of protein per kilogram per day.[97,111,112]

The use of high-protein ONS has been reported to decrease patient complications. A large Cochrane systematic review of 24 studies with 6,225 patients age 65 years or older at risk for malnutrition demonstrated fewer complications in patients receiving ONS compared with routine care (RR=0.86; 95 percent CI: 0.75 to 0.99).[103,113] A recently reported consensus opinion stated the key role of ONS in most perioperative patients, including both in the hospital and after discharge, was advocated for with protein delivery being emphasized over total calorie delivery.[97]

A short course of perioperative enhanced nutrition with the goal of modulating the immune system called immunonutrition, has been demonstrated to decrease immunosuppression, increase lymphocyte count, and both modify and enhance circulating systemic cytokines.[114-116] Immunonutrition consists of oral supplementation with nutrients such as arginine, glutamine, omega-3 fatty acids, and ribonucleic acid via a commercially available supplement that is relatively low-cost. A common supplement course of immune or nutrition is three times per day for five days either before surgery or before and after surgery.

Perioperative immunonutrition in colorectal surgery has been associated with significant decreases in postoperative complication. Based on systematic review of 35 studies predominantly from the colorectal surgery literature, Drover et al. reported that perioperative immunonutrition with arginine supplementation showed a strong reduction in infections (OR 0.59; 95 percent CI: 0.50 to 0.70; p<0.0001), and decrease in mean hospital LOS (OR -2.38; 95 percent CI: -3.39 to -1.36; p<0.0001). However, the authors did not identify any association with patient mortality (OR 1.08; 95 percent CI: 0.65 to 1.80; p=0.76).[117]

Recent pilot work has identified the potential for immunonutrition to positively impact the cystectomy population based on two reports of immunonutrition interventions. Bertrand et al.[118] conducted a 60-patient multicenter case-controlled pilot study of immunonutrition taken orally before surgery. They found a reduction in postoperative complications (decrease from 77 percent in the retrospective control to 40 percent in the prospective cohort; p=0.008) and postoperative infection rate (decrease from 60 percent to 23 percent; p=0.008). A limitation of this study was the use of a control historical cohort, which may have impacted clinical intervention and standards of care.

A second immunonutrition intervention was a randomized controlled trial of 29 patients by Hamilton-Reeves et al.[119] The intervention compared a calorie- and nitrogen-matched oral nutrition support before and after bladder surgery in 29 patients. The authors reported a 39 percent (p=0.027) reduction in infections occurring from 31-90 days post operatively but no

difference in the first 30 days after surgery. It was demonstrated that consuming immunonutrition perioperatively influenced the immune system by restraining the expansion of myeloid-derived suppressor cells (p=0.005). This study was not powered to robustly detect differences clinical outcomes or clinical characteristics of malnutrition. An adequately powered, randomized trial of immunonutrition would be of value in the cystectomy population and is being planned in the Southwest Oncology Group (SWOG).

Nutrition Intervention: Early Feeding in ERAS

The adoptions of ERAS pathways in urology have emphasized early feeding to provide adequate nutrition and stimulate bowel motility.[120] This protocol captures the known benefits of enteral nutrition. The guidelines from the Society of Critical Care Medicine and ASPEN suggest that using the gut is the best way to maintain intestinal integrity and modulate the immune response.[112] A recent prospective non-randomized study of cystectomy subjects showed that following an early feeding protocol similar to a regular diet was associated with a decrease in the LOS compared to postoperative total parenteral nutrition.[120] Similar to other surgical nutrition support literature, total parenteral nutrition in a randomized control study of cystectomy patients was associated with a higher infection rate when compared to consuming a regular diet (32 percent versus 11 percent; p = 0.001).[107]

A Cochrane review of early enteral feeding (within 24 hours) in the colorectal population analyzed 14 randomized trials of small heterogeneous patient populations with uncertain methodology; the review reported on multiple postoperative outcomes including wound infections, intraabdominal abscesses, complications, LOS, mortality, and other adverse events and concluded that, while not statistically significant, there was no benefit in withholding enteral nutrition.[121] A recently reported consensus opinion stated that "postoperatively, nutrition delivery should be started immediately after surgery," and advocated for early and sustained feeing after surgery as part of ERAS protocols.[97]

Summary

Malnutrition is a significant and often under-recognized problem in high-risk surgical patients such as those undergoing cystectomy and likely also has an impact in other urologic procedures. In addition, mounting evidence suggests that malnutrition may have significant impact on immune function and clinical outcomes. Appropriately, malnutrition is being increasingly recognized by the urologic community as a potentially modifiable risk factor in perioperative patients.

Mobilization after Surgery

Early patient mobilization has become regarded as standard practice following surgery, with urologic procedures being no exception. As surgeons, we have accepted the evidence associating prolonged postsurgical bed rest with an increased risk of thromboembolism, pneumonia, and physical deconditioning.[122,123] Specifically, patient functional decline has been appreciated to occur as early as within two days of immobilization.[124,125] Additionally, the

development of ERAS has further established early mobilization as a key element to reestablishing baseline patient function.[126] In fact, ERAS society guidelines for elective colonic surgery have designated a strong recommendation grade to early mobilization.[126] In addition to improving physical functioning, early mobilization has shown benefits in psychological and social outcomes of patients. Specifically, among hospitalized adults, mobilization was found to lower anxiety, depression, and symptom distress and enhance QOL and sense of independence.[125] Despite general agreement regarding the benefits of early mobilization following surgery, there remains a lack of clarity on how to optimally carry out this intervention and ensure compliance both during the patient's hospitalization and following discharge.

Within the nursing literature, patient ambulation has been identified as one of the most frequently missed elements of inpatient care.[127] Poor compliance to the intervention of early mobilization has also been recognized as a common theme amongst ERAS protocols.[128] It has been hypothesized that a reason for such low adherence may be due to the lack of available protocols detailing recommended mobilization strategies. To this end, a recent systematic review was performed evaluating the impact of mobilization protocols as compared to standard patient-driven mobilization following abdominal or thoracic surgery.[129] Table 6 outlines the specific strategies utilized in these mobilization protocols. Due to overall poor methodological quality of the few studies that were available and use of differing study outcomes, the authors were unable to conclude that protocol-directed mobilization is superior to patient-driven ambulation. Assessment of individual studies did reveal that engaging patients in a mobilization regimen, whether with or without physical therapist supervision, appeared to improve outcomes related to duration of stay, GI function, physical function, and the patient's perception of recovery. Interestingly, none of these studies showed a difference in postoperative complications between groups. Despite the inability to make firm conclusions, the authors support the notion that with improved study design and standardized outcome definitions, utilizing regimented protocols will lead to enhanced patient compliance and expedited reestablishment of baseline function over standard patient-driven mobilization following surgery.[129] The future challenge will then become identifying optimal protocol specifics such as the frequency and intensity of mobilization, whether protocols need customization to patient and surgery type, and whether dedicated personnel are necessary to achieve better outcomes.

Table 6. Specific Strategies Utilized in Mobilization Protocols*

Strategy 1	Walking with volunteers minimum of one lap around inpatient unit
Strategy 2	Supervised exercise twice a day escalating in duration and intensity—including stretching, core, resistance, and balance exercises + unsupervised walking in halls
Strategy 3	Ambulation goal—achieving $\geq$ 500 steps prior to discharge + encouragement signs by patient bedside
Strategy 4	Ambulation starting 12-24 hours postoperatively + walking $\geq$ 75 yards per session

Strategy 5	Once daily cycle (30 minutes/session) + strength training starting on first postoperative day + home walking program
Strategy 6	Structured exercise program twice a day—including aerobic, resistance, and stretching exercises + home exercise program
Strategy 7	Structured exercise program twice a day—including strength and mobility training + 12 week home program of paced exercise
Strategy 8	Scheduled sitting x 30 minutes at 3.5 hours post-surgery + walking 30 meters at four hours post-surgery then resuming patient directed mobilization

* As published in Surgery:
Castelino T, Fiore JF, Jr., Niculiseanu P, et al. The effect of early mobilization protocols on postoperative outcomes following abdominal and thoracic surgery: A systematic review: Surgery 2016; **159:** 991.

Ensuring patient compliance to continuing mobilization recommendations following discharge is another significant challenge. Although recovery is far from over and postoperative morbidity risk remains elevated, releasing the patient from the acute care setting often lends itself to a decline in patient motivation as well as difficulty in obtaining objective functional parameters of recovery by the physician. Unfortunately, subjective assessment of recovery by the patient has shown to poorly correlate to his or her true functional status.[130,131] With the advent of wearable devices that monitor activity, the opportunity to mitigate some of these post discharge mobilization issues has finally become available.

In the orthopedic literature, use of Fitbit wireless accelerometers is a feasible means of monitoring patient recovery once discharged following elective total hip arthroplasty (THA). Toogood et al. showed that THA patients had an 89 percent compliance with this technology over 30 days and that the data retrieved helped to identify deficiencies in recovery, thereby allowing targeted and early intervention to those failing to reach certain milestones.[130] The authors suggested that such opportunities to identify slow recovery and intervene early could ultimately help to reduce postoperative morbidity. Although utilization of these novel tools is still in its infancy and has yet to integrate into urologic practice, the tools have promise to become essential resources for patients at high risk of postoperative morbidity and poor compliance.

In conclusion, early postoperative mobilization shows benefit and should be incorporated into the management of all patients following surgery. However, the most effective method by which we should carry out this practice both during the acute care hospital stay and following discharge still needs clarification and thus represents a lucrative platform for future research.

Wound Care

Surgical incisions typically proceed through the normal healing processes of hemostasis, inflammation, proliferation, and early remodeling within 14 days. Complete remodeling will continue for up to two years. Wounds that deviate from this normal healing trajectory are

labeled as chronic. The most common time for wound dehiscence to occur is five to eight days after wound closure. Table 7 provides comprehensive recommendations for wound management based upon wound type (open or closed). Table 8 outlines a variety of wound healing products that may be used to enhance wound healing.

Table 7. Surgical Incision and Wound Protocol

Closed surgical incision	• Do not apply topical antimicrobial agents (i.e., ointments, solutions, or powders)[132] • Apply a sterile dry absorbent dressing using aseptic technique[133] • Advanced dressings (e.g., hydrocolloid, hydrofiber/calcium alginate, silver-impregnated, polyhexamethylene biguanide [PHMB]-containing) are unnecessary for most patients[133] • Secure the dressing with soft cloth surgical tape to reduce the risk of medical adhesive related skin injury • Fragile skin can be protected with a liquid skin sealant applied under tape • Surgical dressing should stay in place for 48 hours; change if leakage occurs[134] • Prophylactic antimicrobial dressings for up to two weeks may benefit high-risk groups (i.e., immunocompromised, poor tissue perfusion, multidrug-resistant organisms in culture, or evidence of delayed healing) • Incisional application of Negative Pressure Wound Therapy (NPWT) is beneficial in high-risk wounds (i.e., poor tissue perfusion, bleeding/hematoma, dead space, intraoperative contamination)[133,135]
Open surgical wound[134]	• Debride dead tissue from the wound bed; options include excisional/instrumental, mechanical (i.e., wet to dry gauze), enzymatic (i.e., collagenase cream, manuka honey), and autolytic (i.e., hydrogel and occlusive dressing) • Cleanse the wound at each dressing change • Consider antiseptic cleansing solutions for necrotic or infected wounds (i.e., hypochlorous acid, sodium hypochlorite) • Consider an antimicrobial product if symptoms of bacterial colonization (increased exudate, friable and/or exuberant granulation tissue, new necrosis) • Pack any dead space and maintain a moist wound environment (i.e., dry wounds: hydrogel; wet wounds: hydrofiber/calcium alginate, NPWT; infected wounds:

	gauze moistened with saline or antiseptic solution) • Maintain the wound at core body temperature (99°F) by utilizing materials that do not require frequent dressing changes (non-infected wounds) • Maintain open wound edges by preventing epibole (using silver nitrate cautery or excision) • When ample granulation tissue is present and no signs of infection, employ techniques to approximate wound edges (i.e., delayed primary closure or a variety of surgical "wick" techniques)

Table 8. Wound Products[134]

Wound Product Category	**Types and Properties of Wound Products**
Cleansers	• Saline • Commercial wound cleanser • Potable tap water (home setting)
Antiseptic solutions (used at concentrations non-toxic to fibroblasts)	• Sodium hypochlorite (i.e., Dakin's Solution) • Acetic acid • Hypochlorous acid • Mafenide acetate
Topical antimicrobial agents	• Silver-impregnated • Cadexomer iodine • PHMB • Manuka honey • Methylene blue and gentian violet
Calcium alginate/ hydrofiber dressings	• Absorb a moderate amount of exudate • Atraumatic removal from moist wound surface • Plain or silver-impregnated • Requires a secondary dressing • Typical frequency of dressing change: 1-3 days*
Hydrogels (amorphous)	• Add moisture to a dry wound • Delayed evaporation • Requires a secondary dressing • Typical frequency of dressing change: 1-3 days*
Contact layers	• Non-adherent, atraumatic removal • Can be occlusive (i.e., petrolatum-impregnated) or porous (i.e., silicone mesh) • Use porous products under NPWT sponges when fascia exposed or disrupted • Typical frequency of dressing change: 1-3 days*
Composite dressings	• Contain an absorptive layer, a cover layer, and an adhesive

	• Available in sizes to fit both incisions and open wounds over a packing material • Typical frequency of dressing change: 1-3 days*
Liquid skin sealant	• Two types: cyanoacrylate or polymer/solvent • Solvent may be alcohol or a non-stinging silicone • Protects skin from moisture, chemical, and mechanical injury • Reapplied every 1-3 days, depending on formulation
NPWT	• Reduces interstitial edema, removes exudate, increases blood flow, and stimulates angiogenesis • Evidence is lacking to show that NPWT has superior effectiveness on surgical wounds healing by primary or secondary intention[136,137]

*This frequency is specific to the setting of a surgical wound.

Ostomy and Diversion Care

Urostomy surgery creates changes in body image and function. Education should begin preoperatively, and an essential component of this encounter is stoma site marking by a qualified clinician. The procedure is described in the Wound, Ostomy and Continence Nurses (WOCN) Society and AUA joint position statement found in the following link:. http://c.ymcdn.com/sites/www.wocn.org/resource/resmgr/Publications/AUA_Stoma_Site_Marking_PS_(2.pdf.[138]

Postoperative education is essential for persons to adapt to the changes with a urostomy, a continent cutaneous urinary reservoir (most commonly an Indiana pouch), or an orthotopic neobladder. Ideally, a trained ostomy nurse specialist would provide this education, but access to this level of care is not available in all areas. Comprehensive patient education materials provided here are a resource for providers to use in facilitating the post-operative adjustment with urinary diversion surgery. Educational urostomy skills kits and videos can be found as a resource from the American College of Surgeons: https://www.facs.org/education/patient-education/skills-programs/ostomy-program/adult-ostomy.[139] Key points of this education are described in the following tables. Table 9 provides steps and rationale for management of urostomy stomas.

Table 9. Management of a Urostomy Stoma (Ileal or Colonic Conduit)

Step	**Rationale**
Pouch should be emptied into toilet when it is 1/3 to ½ full.	Reducing the weight in the pouch helps to keep the adhesive seal secure.
Changing the pouch in the morning before consuming any fluids may reduce stoma leakage during the pouch change. Pouch changes are usually done one to two times weekly.	If there is any moisture on the skin when a new pouch is applied, there is a greater chance that the seal will not remain secure.
Remove pouch gently and observe wafer for erosion or urine leakage to the edge of the wafer.	Avoid adhesive skin stripping or hair follicle irritation, which may lead to folliculitis if pouch is roughly or hastily removed. Observing the wafer may aid decision making about whether current wafer is appropriate for this person.
The stoma should be red, moist, and the mucocutaneous junction intact. The skin may be deep pink from the adhesive removal but should be free of rash or denudement.	This is an expected assessment. See stomal/peristomal complications (PSC) for other situations. Consider referral to a wound ostomy continence (WOC) nurse.
Measure stoma to determine size of opening that should be cut in the wafer.	A wafer that fits around the stoma without leaving skin exposed to urine will avoid maceration, which may lead to skin irritation and pseudoverrucous lesions.
Trace pattern on wafer and cut to size. After stoma no longer is edematous postoperatively, it may be possible to use a precut wafer.	A precut wafer simplifies the pouching procedure.
Wash peristomal skin with water. Pat dry.	Limit use of soap on skin unless in the shower where it can be rinsed well. Do not use soaps with lotion or moisturizer in them as any residual from these may interfere with the adherence of the ostomy pouch wafer.
Stand in front of a mirror and place pouch over stoma. Press firmly and hold hand on wafer for one to two minutes if possible.	Abdominal muscles are firmer when standing. It may be helpful to pull skin taut before pressing wafer into place. Wafers are heat and pressure sensitive.
If using a two-piece system, attach pouch or it may be attached prior to placement of wafer.	The pouch is essential for collection of urine whether it be a one-piece or two-piece pouching system.
At night the pouch may be connected to a night drainage bag such as the kind used for a Foley catheter. This system uses a connector that is packaged with the urostomy pouches.	Connecting to night drainage allows the person to sleep without having to get up to empty the pouch.

Obtaining a Urine Specimen from a Urostomy

Expert opinion suggests that urine specimens should be obtained by catheterizing the stoma. A catheterized specimen should be obtained by removing the ostomy pouch, cleansing the stoma, inserting a sterile straight catheter into the stoma, and waiting for urine to drain in a sterile container. Kits for individual one-time use catheterization to relieve retention and/or obtain specimens for urine culture work well for this purpose. If a catheter is not available, one can allow the urine to drip into a sterile cup from the stoma. The practice of obtaining the specimen from a clean pouch has been discouraged. However, a group of Finnish colleagues recently published findings of a study in which 36 subject comparisons of urine were cultured.[140] There were no statistically significant differences in bacterial growth between urine collection with clean catheterization, dripping urine into a cup or obtaining the specimen from a newly applied urostomy pouch.

Supplies

Urostomy supplies are covered by Medicare (80 percent), a Medicare supplement (20 percent), and most health insurance providers. A prescription is needed, and the specific requirements for these prescriptions vary with the company from whom the supplies are purchased. Large mail order supply companies will usually send a form to the provider for signature in lieu of a prescription. There are many different types of pouching systems, and assessment for the appropriate one should take place four to six weeks after surgery or when the patient experiences frequent leakage. Referral to a WOC nurse at this time will be helpful. Pouching systems are available as a one-piece product with the wafer and pouch permanently attached together or a two-piece system where the wafer and pouch can be separated. There are also flat and convex shaped wafers. Due to the liquid nature of the urostomy output, a convex wafer is often needed to provide a reliable and predictable wear time. Many accessory products are also available, and these are used to solve individual problems that may arise from a person's body habitus, work or leisure time activities, and personal preferences. The websites of manufacturers of ostomy supplies provide added information for persons with ostomies and healthcare providers. They commonly will send samples of pouches for persons to try before they order larger quantities.

Stomal Complications

Many stomal complications can occur following surgery. Table 10 describes these complications along with recommendations for assessment and intervention. While some of these complications occur during the immediate postoperative period, others may manifest later. To be complete, we have included both complication types.

Table 10. Stomal Complications[141,142]

Complication	Assessments	Interventions
Necrosis	• Closely monitor the depth of necrosis to determine if it is below the fascial level • Can insert a lubricated glass test tube into the stoma and use a penlight to visualize the lumen of the stoma	• Sharp debridement of necrotic tissue as needed • Possible stomal revision
Retraction	• Assess the height of the stoma in multiple positions: sitting, supine, standing, bending	• Consider the use of a convex ostomy wafer, with or without an ostomy belt • If the stoma is at the base of a deep crease, a flexible appliance with a flat wafer plus a barrier ring may be needed
Stenosis	• Attempt to insert a lubricated gloved finger into the stomal os • Monitor for frequent urinary tract infections, flank pain, decreased urinary output, or a projectile stream of urine	• In the short term, stomal dilation can be performed with the following lubricated items: a finger, stainless steel medical dilator, or tapered candlestick • Long-term dilation can cause scar tissue formation and may narrow the lumen of the ostomy further • Surgical revision may be required
Prolapse	• Monitor mucosal tissue for changes in color or duskiness	• Increase the size of the opening in the ostomy wafer to accommodate any swelling and prevent trauma • Measures to reduce edema include applying granular sugar and/or cold compresses to the mucosa • Use a hernia support belt with a prolapse flap, applied while the prolapse is reduced • Other types of support garments include elastic abdominal binders, athletic

		compression shorts, and elastic girdles
Trauma	• Assess for deep red, white, or yellow linear discolorations, lacerations, or abrasions	• Clean the stoma with soft moist paper or cloth wipes • Remove source of trauma (i.e., pad the seatbelt strap, assure that two-piece pouching system flange is not pinching the stoma) • Properly size the ostomy wafer opening to protect the skin and fit close to the stoma. • Stoma guards can be used during sports and other contact activities
Peristomal Hernia	• Assess for a fascial ring defect and a visible bulge in the peristomal area • Monitor mucosal tissue for changes in color or duskiness	• A flexible ostomy appliance with a flat wafer may be necessary to maintain a reliable seal • Use caution with convex ostomy wafers as peristomal pressure injury may occur • Use a hernia support belt, applied while the hernia is reduced • Other types of support garments include elastic abdominal binders, athletic compression shorts, and elastic girdles • A program of abdominal strengthening exercises combined with the use of an abdominal binder and the avoidance of heavy lifting can reduce the occurrence of peristomal hernia
Mucocutaneous Separation	• Gently probe the separation with a cotton swab to determine the depth; note characteristics of wound base tissue and type of drainage • Monitor for signs and symptoms of local/systemic infection or peritonitis	• Shallow separations can be filled with pectin-based stoma powder • Stoma paste can be used to fill small separations. Most pastes contain alcohol and may be painful. Non-alcohol containing pastes are available

	• As scar tissue fills the wound and contracts over time, monitor for stomal stenosis	• Deeper separations can be filled with an absorbent product such as hydrofiber or calcium alginate (plain or silver-impregnated) packing materials and may be covered with a hydrocolloid wafer or thin foam dressing before applying the ostomy wafer
Stomal Fistula	• Assess whether the fistula tract is draining to the environment or into the body cavity • Monitor for signs and symptoms of soft tissue or systemic infection	• Accommodate the opening in the ostomy wafer to allow the fistula to drain into the pouch

Peristomal Complications[141,142]

Incidence of PSC after urinary diversion ranges from 8-48 percent. Costs of postsurgical care are significantly higher for those patients who develop PSC and QOL is reduced.[143-145] Table 11 provides an outline of PSC along with recommended assessments and interventions.[143-145]

Table 11. Peristomal Complications: Assessment and Interventions

Complication	**Assessment**	**Interventions**
Allergic Contact Dermatitis	• Assess for pruritus and erythema/blisters that mirror the shape of the ostomy product used • Patch test with the patient's products to identify allergen and discontinue use of offending product	• Treat with a steroid *spray** (i.e., fluticasone, triamcinolone) at each pouch change until symptoms resolve • Weeping skin can be dried by applying a light dusting of stoma powder, covered with a no-sting liquid skin sealant
Fungal/Candidiasis Infection	• Assess for red maculopapular rash with satellite lesions, pruritus, and burning sensation	• Dust the rash with antifungal *powder** (i.e., nystatin, miconazole) covered with a no-sting liquid skin sealant, at each pouch change for two weeks
Mechanical Skin Trauma	• Assess for skin stripping under adhesive products	• Treat denuded skin by applying a light dusting of stoma powder, covered with a no-sting liquid skin sealant

		• Fragile skin can be protected with a liquid skin sealant • Gentle technique and use of adhesive remover wipes/spray reduces risk
Folliculitis	• Assess for erythematous pustule or papule at hair follicle	• Use hair clippers rather than shaving • Wash skin with antibacterial soap and rinse thoroughly • Severe cases may require antibiotic *powder** (i.e., polysporin), covered with a no-sting liquid skin sealant
Suture Granulomas	• Assess for granulomas on skin at the mucocutaneous junction that often bleed easily	• Remove loose suture material if present • Cauterize with topical silver nitrate at pouch changes • Resize opening in ostomy wafer to fit closely to stoma edge
Hyperplasia (Pseudoverrucous Lesions, Chronic Papillomatous Dermatitis, Peristomal Epitheliomatous Hyperplasia)	• Assess for exuberant growth of benign papules on skin at or near stoma edge	• Cauterize with topical silver nitrate at pouch changes • To prevent urine contacting skin, use a convex wafer and resize opening in ostomy wafer to fit closely to stoma edge
Alkaline Encrustations	• Assess for hard or gritty crystal formation on the skin	• 20-minute soaks with 30-50 percent vinegar compresses at pouch changes • Assure adequate fluid intake • Acidify the urine

* Do not use creams or ointments on the peristomal skin as they will cause poor adherence of the ostomy pouch wafer to the skin.

Continent Diversion Management

Considerations for continent diversion management are different than those for non-continent diversion as described above. Table 12 offers a step-by-step guide for caring for a continent cutaneous urinary reservoir or orthotopic neobladder in the early postoperative period along with rationale for each recommendation. Table 13 describes the steps for catheterization of the continent cutaneous reservoir. Table 14 highlights steps for timed toileting and catheterization of orthotopic neobladder followed by recommendations for intermittent catheterization. There

is little evidence to support a specific routine for continent diversion care, but it is essential to have education materials that can be adapted for provider preferences so that patients do not allow overfilling of their internal continent pouches or neobladders with mucus or urine in the early postoperative period. A timed toileting routine will promote continence in the patient with a newly created neobladder.

Table 12. Steps of Early Postoperative Care for Continent Cutaneous Urinary Reservoir or Othotopic Neobladder

Step	**Rationale**
Stents may be attached to the catheter in the reservoir or orthotopic neobladder or exit the body from a separate location that would require pouching.	Allow urine from the stents to drain into an ostomy pouch (see procedure described under management of a urostomy) until the stents are removed.
Patient education may vary depending on surgical procedures and provider preferences, but catheter irrigation is necessary for all patients to be able to perform when they are discharged from the hospital.	The irrigation of mucus produced in the intestinal lining of the reservoir or neobladder keeps it draining efficiently and prevents overfilling until the sutures lines have healed.
Patient/caregiver instructed to wash hands before and after procedure.	Reduce risk of contamination of equipment and transmission of infection.
Draw up 60 mL saline in a 60 mL syringe with a catheter tip.	This is the initial amount instilled into the reservoir or neobladder, though if large amounts of mucus are pulled back in the syringe, this step may be repeated.
Disconnect the catheter from the urinary drainage bag while being careful not to pull on the catheter.	Decrease risk of catheter being inadvertently removed from the reservoir or neobladder.
Insert the tip of the syringe into the catheter and push fluid into the reservoir or orthotopic neobladder. Pull fluid back out before removing the syringe from the catheter. Remove and empty the syringe. Repeat this until there are only a few shreds of mucus in the syringe.	This will clear the mucus produced by the intestinal segment from which the reservoir or neobladder has been created. Until suture lines are healed, the reservoir or neobladder should not be allowed to fill.
Reconnect the catheter to the urinary drainage bag. Patients are instructed to do this every 12 hours and as needed at home.	Keeps the reservoir or neobladder empty. Patients are instructed to perform this procedure more often if a reduction in urine output is noted or they feel pain or pressure in the area around the reservoir or neobladder.

Bedside urinary drainage bags and leg bags should be provided for patients to take home with instruction for their use. Catheters may be plugged only when patients are taking a shower.	Continuous flow of urine from the reservoir or neobladder is facilitated if dependent drainage is maintained.
This is a clean procedure, and patients are instructed to wash and reuse syringes. Saline may be made using six level teaspoons of salt in one gallon of distilled water.	Sterile supplies are costly and not necessary for this procedure if cleanliness is maintained to reduce risk of introducing pathogens into the reservoir or neobladder.

Table 13. Steps of Care for Catheterization of the Continent Cutaneous Reservoir

Step	**Rationale**
After the catheter is removed from the continent reservoir, patients are taught to catheterize through the abdominal stoma.	This allows emptying of the reservoir and avoids overfilling.
Initially, catheterization is done on a schedule, usually every two hours during the day and every three hours at night for the first week, then every three hours during the day and every four hours at night for the next week. After that, progress to every four hours during the day and every six hours at night. Frequency will depend on fluid intake, and patients are taught be alert to feelings of fullness in the area of the reservoir.	This allows for gradual increase in the capacity of the reservoir.
Straight or coudé red rubber or clear vinyl catheters may be used. Most common sizes are 14 or 16 Fr. Catheters may be washed with detergent and warm water for reuse or discarded after each use.	The type of catheter may depend on the access from the stoma to the reservoir, any angles in the pathway, and degree of difficulty in opening the valve.
Catheter may need to be lubricated with water-soluble jelly, or there may be sufficient natural lubricant from the intestinal segment.	Lubrication facilitates catheter passage.
Insert the catheter through the stoma and into the reservoir. Once urine flow is established, do not insert the catheter further. Allow it to drain into the toilet or an appropriate container.	The low pressure reservoir essentially “collapses” as it empties, and inserting the catheter further may impede complete emptying.
If there is difficulty emptying the reservoir, the first action to take is to irrigate with 60 mL saline or tap water as described in the early postoperative care chart.	The most likely reason for catheter blockage and difficulty emptying is an abundance of mucus from the intestinal lining of the reservoir.

Persons with continent cutaneous urinary reservoirs should be instructed to always carry one to two catheters with them so that they will always be able to empty the reservoir as needed.	When the reservoir fills, there is discomfort and a greater chance of reflux of urine into the kidneys if emptying cannot be done in a timely manner.

Table 14. Steps for Timed Toileting and Catheterization of Orthotopic Neobladder

Step	**Rationale**
Provide patients with a timed toileting schedule. Instruct them to void or attempt voiding every two hours during the day and every three hours at night for the first week, then every three hours during the day and every four hours at night for the next week. After that, progress to every four hours during the day and every six hours at night. Frequency will depend on fluid intake, and patients are taught to be alert to feelings of fullness over the neobladder.	This will allow the neobladder capacity to increase gradually.
A written schedule on which the time and amount of voiding is recorded should be kept for the first few weeks. This should also include recording incontinent episodes with estimates of volume recorded as small, medium, or large.	This serves as a reminder for the patient to keep to the toileting schedule and gives the provider information about progress in regaining continence.
Patients should be taught clean catheterization in the event they cannot empty their neobladder. Many urologic surgeons instruct patients to measure post-void residual (PVR) urine after they begin timed toileting. Often this is recommended one to two times a day initially and frequency is decreased as voiding volume increases.	Being able to catheterize assures that the bladder will not overfill as the capacity is increasing. PVR assesses if the neobladder is being emptied adequately.
If there is difficulty emptying the neobladder, the first action to take is to insert a catheter and to irrigate with 60 mL saline or tap water as described in the early postoperative care chart.	The most likely reason for catheter blockage and difficulty emptying is an abundance of mucus from the intestinal lining of the neobladder.
For clean catheterization procedure, instruct patients in steps described below.	Patients may need to catheterize many times or seldom depending on the function of the neobladder after healing is complete.

Below are additional resources, including instructions for clean intermittent catheterization, recommendations for pelvic muscle exercises (particularly for improving continence for neobladder patients) and a list of websites that provide additional resources for patients.

Clean Intermittent Catheterization for Women

1. Wash your hands with soap and water.
2. Wash your perineal area with mild soap and water or a pre-moistened cleansing towelette to reduce the chance of infection.
3. Take the catheter out of the package.
4. Put a large amount of water-soluble lubricant over the end of the catheter. This will help it slide in more easily.
5. Spread your legs. With one hand, spread the labia, or lips, of your vagina. Locate the urethral opening, the area where urine comes out. You may need to use a mirror to find it.
6. Once you have found the urethral opening, take the catheter in your other hand and gently insert it into your urethra. Keep pushing the catheter until it reaches the neobladder and urine starts to flow through the catheter.
7. When the urine stops flowing, gently remove the catheter.
8. Wash the catheter with detergent and warm water and allow it to dry or discard it. If using the catheter again, store it in a clean plastic bag.
9. Wash your hands with soap and water.

Clean Intermittent Catheterization for Men

1. Wash your hands with soap and water.
2. Wash your penis with mild soap and water or pre-moistened cleansing towelette to reduce the chance of infection.
3. Take the catheter out of the package.
4. Put a large amount of water-soluble lubricant over the end of the catheter. This will help it slide in more easily.
5. Sit on a toilet and spread your legs. Hold your penis out from your body in a horizontal position.
6. Take the catheter in the other hand and gently insert it into your urethra. Hold the other end of the catheter over the toilet bowl.
7. Keep pushing the catheter until it reaches the neobladder and urine starts to flow through the catheter.
8. When the urine stops flowing, gently remove the catheter.
9. Wash the catheter with detergent and warm water and allow it to dry or discard it. If using the catheter again, store it in a clean plastic bag.
10. Wash your hands with soap and water.

Pelvic Muscle Exercise

Strengthening the pelvic floor with pelvic muscle exercises may be helpful in promoting continence after an orthotopic neobladder procedure. Instructions are provided in documents that can be downloaded at these sites:

https://medlineplus.gov/ency/article/003975.htm

https://www.urologyhealth.org/educational-materials/bladder-control

Websites for Patient Information

https://www.bcan.org/assets/BCAN_Ileal-Conduit_Fact-Sheet.pdf

https://www.bcan.org/assets/BCAN_CCP_Indiana-Pouch_Fact-Sheet.pdf

https://www.bcan.org/assets/BCAN_Neobladder_Fact-Sheet.pdf

https://www.ostomy.org

Catheters and Drains

Catheters and drains are commonly used tools that can promote healing and drainage following many urologic procedures. Catheters and drains for urologic procedures generally consist of indwelling urinary catheters (IUCs), nephrostomy tubes, ureteral stents, and open or closed suction drains. Herein, we will describe a summary of the drains and tubes commonly used for urologic procedures along with general guidelines for postoperative drainage for common urologic procedures based on the existing literature.

Indwelling Urinary Catheters

IUCs come in many varieties and differ based on diameter, material, number of lumens, and type of tip (e.g., blunt straight, curved or coudé, [Figure 2] and wire-accommodating [e.g., Council tip in Figure 3]), all chosen depending on specific situation. Catheter sizes generally range from 12 to 30Fr and are used for specific indications. For example, smaller catheters may be needed for patients with urethral stricture disease whereas a larger size may be more appropriate for patients with large prostates. The French size of the catheter is the outer diameter of the catheter but does not correlate with luminal size since the number of lumens may vary. Although most IUCs have two lumens (one to allow drainage of fluid from the bladder and the other to fill the retaining balloon), others may have three lumens to permit inflow and irrigation, particularly in the setting of hematuria. The material size is often important in hematuria cases, given that the material impacts the flexibility and sturdiness of the catheter. Most IUCs are constructed of silicone, polyvinylchloride (PVC) or latex, and some may be coated with silver alloy to prevent infection. Silicone catheters are often preferred given that silicone is non-reactive, possibly associated with less bacterial adherence, and safe to use among patients with latex allergies. Most healthcare systems have adopted a latex-free policy, substituting all catheters for silicone or PVC. While Council catheters are excellent options for those undergoing dilation or procedures for urethral stricture disease, coudés are most useful in navigating a large prostate or angulation between the bladder and prostate.

Figure 2. Blunt Straight and Coudé Catheters

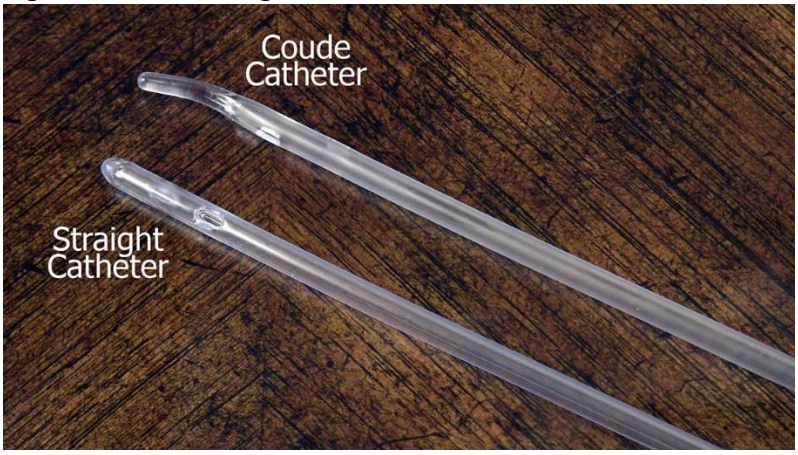


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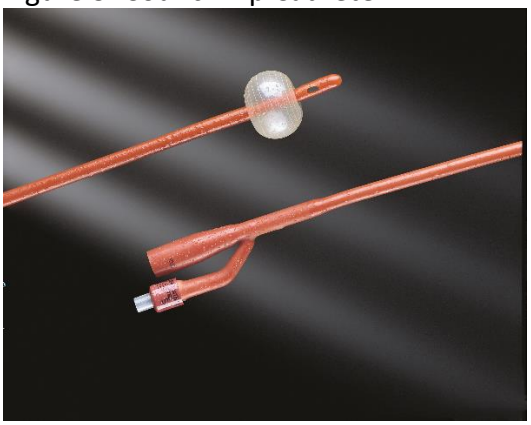
Figure 3. Council Tip Catheter*



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In patients for whom indwelling urethral catheters are not possible, contraindicated or refused by the patient, suprapubic (SP) tubes may be required. SP tubes are inserted through the low abdomen into the bladder and usually changed every four to six weeks. Several types of SP tube insertion kits (Figure 4) exist. SP tube placement may be performed by urology providers as well as interventional radiologists, either blindly or with imaging guidance, most commonly with the assistance of bed-side ultrasound. While some catheters have a pigtail with a securing loop (similar to pigtail nephrostomy tube) (Figure 5), others are simply Foley catheters with a retaining balloon.

Figure 4. Suprapubic Tube Insertion Kit.

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Figure 5. Nephrostomy Tube Pigtail*

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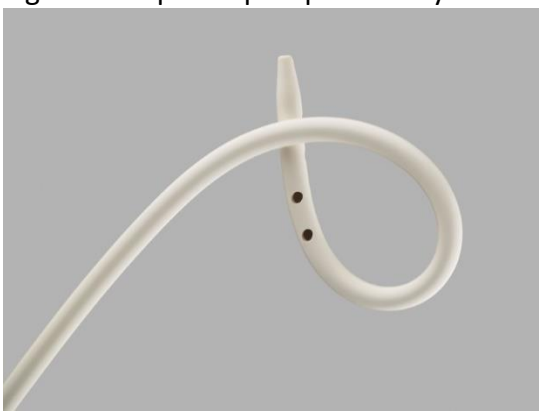
Particularly for IUCs, the risk of catheter-associated urinary tract infections (CAUTIs) should be considered and balanced with the need for postoperative drainage. From a postoperative standpoint, CAUTI relies on timely removal of IUCs following surgery. The Centers for Disease Control and Prevention/National Healthcare Safety Network guidelines[146] recommend rapid removal of any IUCs when clinically indicated with the caveat that specific urologic procedures may require catheterization of longer duration. Table 2 of the AUA CAUTI White Paper[147] serves as an excellent reference for common length of time for indwelling catheters after surgery. While CAUTI is beyond the scope of this manuscript, readers are encouraged to reference the AUA CAUTI White Paper,[147] which provides an excellent summary of this topic.

Nephrostomy Tubes

Nephrostomy tubes have become routine for relief of an obstructed kidney or postoperative management after percutaneous nephrolithotomy (PCNL), although tubeless PCNL may also be appropriate in certain circumstances.[148] A variety of nephrostomy tubes exist, ranging in size from 5 to 32 Fr, and tube material including silicone, polyurethrane, polyethylene, Silitek™, C-flex™, and Percuflex™. The choice of nephrostomy tube depends on procedural complexity, state of the kidney, and patient factors. A helpful guide[149] to nephrostomy tube selection following PCNL categorizes cases as routine, problematic, and complicated based on bleeding, mucosal damage, tears, perforation, edema, damage to adjacent organs, and stones. Each category warrants a different type of tube as described below.

Figure 6. Cope Loop Nephrostomy Tube*



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Pigtail catheters[149](Figure 5) are the smallest nephrostomy tubes available and range from 5 to 14 Fr. Their small size makes them an excellent choice for simple routine drainage, and the distal pigtail design prevents accidental dislodgement. The Cope loop (Figure 6) is a type of pigtail catheter that has a nylon string affixed between the last side hole and catheter tip. The nylon string functions as a self-retaining mechanism to avoid tube dislocation during patient movement. To facilitate removal, the nylon lock must be released to allow the stent to uncoil and be withdrawn. Special consideration should be made for small kidneys, particularly children, since the Cope loop requires a relatively large renal pelvis to be positioned as the nylon string-locking mechanism can lacerate the renal parenchyma in a small and undilated system. With the exception of the Cope loop, the diameter of the distal pigtail is not significantly altered by increasing the tube size.

Nephrostomy tube size is a consideration given its impact on patient comfort and need for adequate drainage. Several tubes may function as a nephrostomy tube, including balloon retention catheters (e.g., Foley, Council, Couvelaire) and Malecot (mushroom-style tip without balloon port) tubes (Figure 7). Usually, the ability to place a wire through the tube is ideal and recommended. Therefore, a Council tip catheter is preferred among these selections. Drainage after problematic PCNL usually involves balloon retention catheters, while Kaye Tamponade tubes[149] (Figure 8) may be best for complicated procedures in which serious bleeding is recognized at the time of tube placement.

Figure 7. Nephrostomy Tube Malecot*

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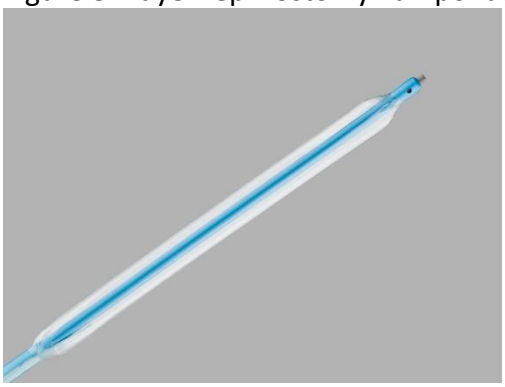
Figure 8. Kaye Nephrostomy Tamponade Balloon*



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Antegrade percutaneous internal/external nephroureteral stents are placed similarly to nephrostomy tubes (percutaneously) but also establish antegrade access to the kidney, ureter, and urinary bladder. This procedure can be useful in postoperative patients who may have ureteric obstruction or fistulas whereby retrograde access is challenging.

Ureteral Stents

Ureteral stents are hollow tubes with multiple side holes to permit drainage between the kidney and bladder.[150] The proximal and distal ends are typically curled to limit stent migration. Although many stent designs are available, it is beyond the scope of this white paper to list all available options. However, understanding the role of stent material, size, and shape is important to ensure that the appropriate stent is chosen for the intended purpose while minimizing patient discomfort. Like IUCs, the majority of stents are composed of silicone-based materials given that silicone is inert, flexible, and elastic.[151] However, drawbacks to silicone-

based stents include risk of luminal collapse with extrinsic compression, difficulty with placement in the case of narrow ureters, and the possibility of breakage with potential for retained fragments if the stent is stretched. Alternative stent materials may include biodegradable materials, but these have had issues with incomplete stent dissolution that can result in obstruction and/or become a nidus for infection.[152] Metal stents (Figure 9) are sometimes used for ureteral obstruction from extrinsic compression, such as in the case of malignant extrinsic compression.[153] Because metal stents can better resist external compression, they generally require fewer stent changes but may be uncomfortable for the patient.[154] However, they have also been found to increase the risk of ureteroiliac fistula.[155] Four types of metal stents have been used and include self-expanding, balloon-expandable, covered stent (e.g., coil-based stent), and thermo-expandable (e.g., Memokath). Thermo-expandable stents change conformation based on temperature and can be uncoiled if cold saline is instilled, making stent removal easier. Metal stents can be challenging to place and remove, especially when up to 50 percent develop a hyperplastic reaction, encrustation, or tumor ingrowth.[153] Furthermore, QOL of patients with metal stents may be diminished when compared to nephrostomy tubes or standard ureteral stents.[154] In lieu of metal stents, urologists may choose to place dual stents, (a standard stent parallel to the malfunctioning stent) rather than exchange it. Parallel stents can decrease subsequent malfunction, with patency rates up to 80 percent in a challenging population.[156]

Figure 9. Metallic Stent*

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In addition to the stent material, size and shape of ureteral stents also vary.[157] The most common stent design is the typical “double J” (Figure 10) which has both a proximal and distal curl to minimize stent migration. Other designs include the multi-length (Figure 11), “non-curled,” and tail stents (Figure 12). Tail stents taper to a softer, smaller-diameter distal loop designed to decrease bladder irritation. Loop stents can also serve a similar purpose.

Figure 10. Double J Ureteral Stent

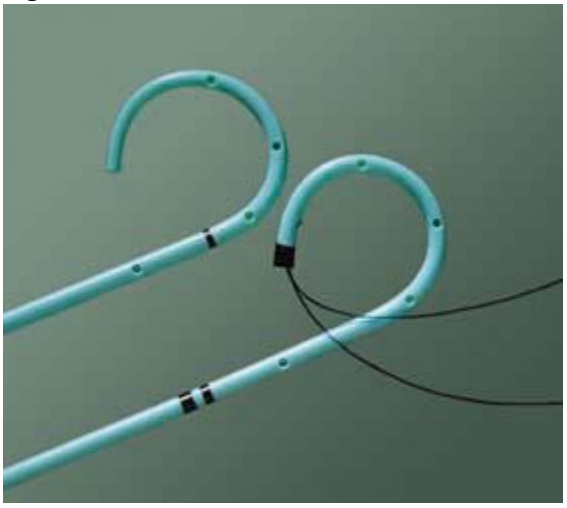

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Figure 11. Multi-length Ureteral Stent*

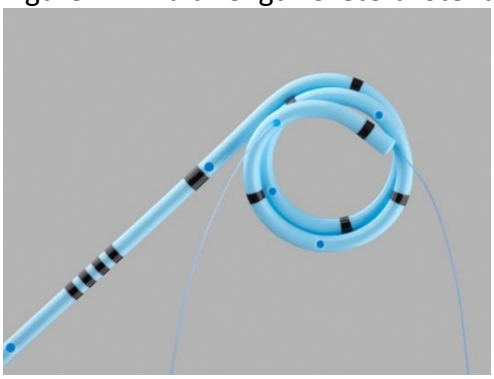

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Figure 12. Tail Stent*

* Permission for use granted by Boston Scientific, 2018.

Stent length has traditionally been based on patient height—with a 24 or 26 cm stent typically used. However, recent evidence suggests that stent measurement may be most accurately measured using CT measurement rather than height.[158] Stent diameter usually ranges from 4 to 7 Fr with 6 Fr being the most common diameter. Larger diameters are sometimes used in cases of malignant ureteral obstruction or after endopyelotomy for ureteral stricture disease. Smaller diameter stents may be used to reduce stent-related lower urinary tract symptoms, but whether these are effective is inconclusive.[159]

Strings are often used for stent extraction and are usually incorporated into most stent designs.[150] The urologist can decide to cut the string off the stent or leave it in place to facilitate removal without the need for cystoscopy. Urologists should be aware of the necessary time for indwelling stent duration given that the string can cause inadvertent stent removal. For stents in place for more than several weeks, a string may not be a prudent choice. Nevertheless, a string may be useful for those who do not tolerate cystoscopy well, or those who wish to remove the stent sooner than the provider's cystoscopy schedule will allow. When a string is left in place, it is generally taped (using steri-strips with benzoin or tegaderm) to the SP region in females or dorsum of the penile shaft in males. Regardless of string use or not, urologists should be aware of the length with which the stent has been left in place. Stents that are in place more than four to six months are more likely to encrust, requiring secondary surgery for extraction.[160]

Wound Drains

Surgical drains[161] are used both prophylactically and therapeutically following surgery, the most common use being the former, to either evaluate bleeding or the presence/absence of a urine, bowel, or lymph leak. The action of wound drains are divided into two categories: passive or active. Active drains use low or high negative pressure to remove accumulated fluid from a wound. Passive drains depend on higher pressure inside the wound, combined with gravity and capillary action to draw out fluid. Commonly used drains are categorized below.

Passive Drains

An example of a commonly used passive drain in urology is a Penrose drain (Figure 13). A Penrose drain consists of thin, soft, flexible tubes that are open at both ends, usually made of silicone (or sometimes latex), and available in diameters ranging from one quarter inch to two inches. Penrose drains are available sterile, with some coming with a safety pin that is used to ensure the drain does not retract into the wound. If the safety pin is used, the head should be crimped closed to avoid inadvertent opening of the pin and scratching of the patient. Otherwise, the surgeon should suture the Penrose in place to avoid inadvertent migration into the wound, which may require surgical removal. In urology, Penrose drains are best used with suppurative wounds, given that the open character of the drain allows drainage of thick and/or necrotic materials. The urologist should be aware that Penrose drains permit both ingress and egress and can cause colonization. The drain can also be helpful in closing abscess cavities since it can be gradually removed over several days to

facilitate collapse of wounds with large amounts of dead space. Penrose drains are often used in perineal and penile surgery for this purpose.

Figure 13. Penrose Drain[162]

Active Drains
Active drains are often referred to as "closed" wound drains and include a variety of types:

- Flat drains (Figure 14 and Figure 15 bottom) are those constructed of silicone impregnated with barium for x-ray detection of the drain. These drains come in variable widths, including 7mm or 10mm. A flat drain usually has a low profile, which helps promote tissue plane approximation within the body cavity. The inner lumen is constructed to avoid drain collapse, clogging, and preserve patency.

Figure 14. Flat Drain (Flat Drain Type Jackson-Pratt®)

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- Round drains (Figure 15, top) are constructed of silicone or PVC and have a radiopaque stripe for radiographic detection. Like Jackson-Pratt drains, these are available in a variety of sizes, such as 7, 10, 15, and 19 Fr. The drain has markings along its length to assist placement and are available with or without a trocar for insertion.

Figure 15: Round Drain*

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Drainage Systems

Closed wound drainage systems require a suction-generating device. A commonly used device in urology is the Jackson-Pratt drain (Figure 16), which is a bulb evacuator that creates negative pressure to draw fluid out of the wound. Bulb reservoirs range from 100-400cc capacity, and they are generally made from clear silicone to allow easy examination of the color and character of drainage. Reservoirs are also easy to empty and reactivate through squeezing the bulb while the valve is open, then closing the valve to initiate negative pressure.

Figure 16: Jackson-Pratt Drain*

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Another type of wound drainage system is the three-spring reservoir design. This type of wound suction system helps prevent backflow of fluid to the patient. The transparent sidewall allows easy evaluation of fluid amount and character and can accept most drain types.

Drain Insertion & Removal

When a drain is required, it is usually placed at the end of the procedure, often through a separate stab wound, created a few centimeters from the primary incision (or in the case of a robotic/laparoscopic procedure, a small trocar site). These can either be placed using a sharp trocar attached to the drain or a surgical instrument to pierce the skin, entering the wound space, and grasping the drain to pull it to its desired location. The drain is then secured to the skin, usually with a nylon suture. Although most drains are made of strong silicone or PVC, they are not immune to breakage. Silicone particularly is nick-sensitive (e.g., needle puncture, crimping from forceps, scalpel), and this can weaken the drain, causing it to break upon removal. Removal of drains are at the discretion of the surgeon, but usually are left in place until drainage has diminished. If the surgeon is concerned regarding a urine leak, the output may be sent for a drain creatinine and compared to the serum creatinine value. Likewise, the drain output can be sent for culture (if infection is considered) or pancreatic enzymes (if concern for pancreatic injury). Rare complications can occur if the drain is left in place for long periods of time, including erosion into surrounding tissues. In addition, inadvertent suturing of the drain in place may require reoperation for removal.

Postoperative Medication

Postoperative Analgesia

Postsurgical discomfort is common, and up to 75 percent of patients report moderate to extreme pain in the immediate postoperative period.[163] Although pain specialists and multi-disciplinary pain teams are a valuable resource in some scenarios, as surgeons, urologists often are on the front lines managing straightforward and often even more complex postoperative pain. Depending on the type of surgery, postoperative pain management may take place in either the inpatient or outpatient setting. The tools available and often the magnitude of pain in these settings can differ substantially.

The 2016 *Guidelines on the Management of Postoperative Pain*, created by the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists,[164] provide a comprehensive systematic review of the literature and evidence-based recommendations for managing postoperative pain for both inpatients and outpatients. Although these guidelines are based on evidence from various surgical specialties, there are many elements that are applicable to postsurgical care of urology patients.

The topic of postoperative analgesia has been given increasing attention in the context of the ongoing national opioid epidemic. Recent reports of prescribing patterns after various operations indicate there is substantial heterogeneity in the quantity of opioids prescribed to

patients receiving similar surgeries.[165-169] This variability, along with the recognition that as many as six percent of opioid-naïve patients develop new-persistent opioid use following initial exposure in the early postoperative period (i.e., use for more than 90 days after surgery),[170] indicate efforts to better understand and optimize postoperative prescribing practices are warranted. Opioids have proven efficacy for postoperative pain. Given their benefits, eliminating them from the postoperative setting would likely be an over-correction. However, consideration of risks, benefits, and alternatives to opioids where appropriate are strongly encouraged. Accordingly, the AUA's recent policy statement (published in conjunction with the *Choosing Wisely* campaign) urges urologists to prescribe "the lowest effective dose and number of doses [of opioids] required to address the expected pain."[171] Preoperative conversations regarding pain management and setting expectations with patients may be valuable for building a cohesive strategy. In follow-up, urologists should discuss surplus medications with their patients and consider offering advice on or mechanisms for disposal of unwanted opioids.

In general terms, the 2016 Pain Guidelines strongly recommend that physicians offer multimodal analgesia, targeting different mechanisms in the postoperative period to reduce opioid requirements.[164] This recommendation is based on data from randomized controlled trials showing that simultaneous use of medications with differing mechanisms of action or administered via different routes are associated with lower opioid requirements and better pain control.[172,173] Within urology, ERAS pathways (highlighted previously in this document), used increasingly and most commonly in post-cystectomy care, represent an example where multimodal analgesic strategies have been associated with improved postsurgical outcomes.[43,44,174,175] Regardless of the type of treatments used, the 2016 Pain Guidelines also strongly recommend the use of a validated pain assessment tool (e.g., visual analog scale, faces rating scales) to evaluate responses to postoperative pain treatments.[164] The classes of available therapy in the inpatient and outpatient settings and the evidence supporting their use will be presented below.

Inpatient Postoperative Analgesic Options

Opioids

Opioid pain medications are a common tool for postoperative pain management. These medications offer proven relief of pain in the postoperative setting and can be administered via multiple routes (e.g., oral, intravenous, neuraxial, transcutaneous). The efficacy of these medications is well recognized. However, they also carry risks of respiratory depression, sedation, nausea and vomiting, constipation, and the potential for addiction. Therefore, prudent, well-monitored utilization of opioids is warranted.

The 2016 Pain Guidelines provide several helpful recommendations for opioid administration. First, when opioids are necessary and there are no contraindications to oral medications, oral administration as opposed to parenteral opioid delivery is recommended as there is limited evidence that parenteral administration is superior.[164,176] When parenteral opioids are needed beyond the first several hours after surgery, intravenous patient-controlled analgesia (PCA) is recommended in favor of provider-initiated bolus

dosing due to evidence that there is more effective pain control and increased patient satisfaction.[177] Basal infusions of opioids via PCA systems are not recommended for opioid-naïve patients due to evidence that they increase the risk of nausea and vomiting and have been associated with increased risk of respiratory depression.[178]

Acetaminophen

Acetaminophen is strongly recommended in the Pain Guidelines as a part of multi-modal postoperative analgesia. When co-administered with opioids, acetaminophen is associated with lower levels of pain and decreased postoperative opioid consumption relative to single agent administration.[179-181] Intravenous acetaminophen is a relatively new option for postoperative pain control that has been incorporated into pain control regimens**.** The evidence for increased efficacy beyond oral acetaminophen is limited;[182,183] however, it may represent an important adjunct, especially in patients where oral administration is contraindicated.

Non-steroidal Anti-inflammatory Medications

Non-steroidal anti-inflammatory medications are also strongly recommended as components of multi-modal analgesia in the Pain Guidelines. Non-steroidals can reduce opioid consumption postoperatively.[184-186] Although side effects including possible impact on renal function and increased bleeding risk secondary to platelet inhibition need to be considered with this class of medications, they have demonstrated efficacy and safety following a variety of urologic procedures and represent an important adjunctive treatment.[187-190]

Gabapentin/ pregabalin

Gabapentinoids are also recommended as components of multi-modal perioperative pain management.[164] There is evidence from randomized trials of patients undergoing non-urologic abdominal and pelvic surgery that these medications may reduce opioid utilization in postoperative period when used in combination with other medications;[191-194] however evidence does not support their use for pain control in isolation.[194] Evidence for optimal perioperative use is limited; however, most studies demonstrating efficacy included a dose one to two hours prior to surgery. As a result, the Pain Guidelines recommend a consideration of a pre-operative dose of gabapentin or pregabalin in patients undergoing major surgery.[164]

Local, Regional, and Neuraxial Analgesia

Administration of local anesthetic agents via local infiltration, for peripheral regional nerve blockade, and/or to achieve neuraxial anesthetic effects (i.e., epidural or spinal administration) also are options for pain management postoperatively. The 2016 Pain Guidelines are tempered as to the role of local anesthetic infiltration, recommending against routine administration for all surgical patients due to mixed evidence on efficacy. Within urology there is no high-level evidence to guide specific recommendations regarding local anesthetic infiltration, but risks are likely low when benefits are felt to warrant utilization. Peripheral regional anesthetic use (e.g., transversus abdominus plane blockade)

is strongly recommended for procedures where efficacy has been demonstrated. Urologic studies of regional anesthesia are few and often limited in sample and study design. Transversus abdominus plane blockade has demonstrated varied efficacy when investigated following radical cystectomy, robotic assisted laparoscopic prostatectomy, retroperitoneoscopic urologic surgery, shockwave lithotripsy, and nephrectomy.[175,195-199] Neuraxial pain medications with epidural analgesia (local anesthetic +/- opioid) or spinal analgesia (intrathecal opioids) are strongly recommended in the Pain Guidelines for patients undergoing major thoracic or abdominal procedures based on convincing evidence that they reduce postoperative pain scores and may diminish other postoperative complications and possibly mortality.[200-203] As a result, neuraxial pain management should be considered for major urologic operations.

Outpatient Analgesic Options

Outpatient postoperative pain control is typically achieved with oral medications. Similar to the inpatient setting, opioid pain medications are an important option for addressing more substantial pain. Multi-modal pain strategies remain an important option for reducing opioid exposure in the outpatient setting.[204-206] Non-steroidal anti-inflammatories and/or acetaminophen can be either independently administered, combined with one another, or given in conjunction with opioids to achieve pain control and likely decrease quantity of opioids needed.[165]

Non-pharmacologic Pain Management

Although urology specific evidence for many non-pharmacologic interventions for postoperative pain is limited, there is evidence in the broader surgical literature that several non-pharmacologic strategies can be important tools in multi-dimensional pain management. The 2016 Pain Guidelines specifically recommend consideration of transcutaneous electrical nerve stimulation (TENS) as an evidence-based adjunct to pharmacotherapy. There are multiple studies showing TENS reduces postoperative use of pain medication following thoracic and abdominal surgeries, which may indicate value after urological surgery.[207-209] The evidence to support routine use of acupuncture for postoperative pain reduction is somewhat varied.[210,211] However, there is some randomized trial evidence specific to urology, albeit limited in sample size, demonstrating a potential benefit to electroacupuncture after prostatectomy.[212] Cognitive-behavioral modalities (e.g., guided imagery, hypnosis, music therapy, relaxation interventions), are recommended for consideration in the Pain Guidelines. Despite limited evidence in urology, if resources for cognitive-behavioral interventions are available, these strategies may warrant exploration as adjuncts to pain medication in light of their low-risk profile and potential to decrease pain medication needs.

Postoperative Anticoagulation and Antiplatelet Therapy

In the postoperative period, there are several pertinent topics related to the administration of anticoagulant and antiplatelet medications including 1) chemoprophylaxis against venous thromboembolic events (VTE) following surgery, and 2) continuation and/or re-initiation of antiplatelet or anticoagulant medications prescribed for reasons other than routine venous thromboembolic prophylaxis.

Chemoprophylaxis against Venous Thromboembolic Events
The American College of Chest Physicians guideline on *Prevention of VTE in Nonorthopedic Surgical Patients*[213] provides best practice guidance along with a comprehensive overview of the best available evidence for strategies to prevent VTE after urologic and other abdominopelvic surgery and is considered by many as the standard for recommendations regarding postoperative prevention of VTE. The guideline makes recommendations for specific target populations with the section most relevant to urology being "General and Abdominal-Pelvic Surgery, Including GI Surgery, Gynecologic Surgery, and Urological Surgery."

The chest guidelines recommend a tailored approach to postoperative VTE prevention where the perceived risks of VTE for a given patient are weighed against the potential for complications resulting from specific prophylactic treatments. Although risk estimation is not without limitations, the Rogers score[214] and the Caprini Score[215,216] are two tools that objectively stratify patients into different VTE risk categories to support evidence-based decisions regarding prophylaxis (Appendix 3). Absent a high-risk classification for major postoperative bleeding, pharmacologic prophylaxis (i.e., low molecular weight heparin [LMWH] or low-dose unfractionated heparin) is recommended for all patients classified as high-risk for VTE and suggested for all patients estimated to carry moderate VTE risk. Early ambulation alone is recommended for those at very low VTE risk, and mechanical prophylaxis is preferred over no prophylaxis among those at low risk for VTE.[213] Among patients in which major bleeding risk is high or in those where consequences of bleeding are thought to be severe, mechanical prophylaxis (e.g., sequential compression devices) is suggested in favor of no prophylaxis for patients with moderate VTE risk. Trials showing a benefit to pharmacologic prophylaxis typically included dosing that started prior to incision,[217,218] and thus the Chest guidelines recommend pre-operative dosing as a general consideration for good practice.[213] In scenarios with high bleeding risk and high VTE risk, mechanical prophylaxis with addition of pharmacologic prophylaxis once bleeding risk diminishes is suggested. The chest guidelines suggest against the use of inferior vena cava filters for primary VTE prevention and also suggest against surveillance venous ultrasounds for VTE screening in asymptomatic patients.

Special consideration is given in the chest guidelines to patients undergoing abdominal or pelvic cancer surgery who are not otherwise at high risk for major bleeding. In these patients, extended duration pharmacologic prophylaxis is recommended with LMWH for four weeks postoperatively. These recommendations are based on results from several meta-analyses[219-221] that demonstrate a reduction in VTE events with four weeks of prophylactic LMWH. Further, the CANBESURE trial, a large randomized controlled trial of patients undergoing surgery for cancer of abdominal or pelvic organs, demonstrated an 82.4 percent relative risk reduction in the rate of major VTE in patients receiving 28 days of LWMH versus just eight days of treatment.[222] Slightly more than seven percent of patients in the CANBESURE trial received surgery for urologic malignancies, and this represents the only Level 1 evidence for extended VTE chemoprophylaxis in urology. Several observational

urologic studies, predominantly in cystectomy patients, provide support for these randomized trial findings reporting significant reductions in VTE among patients receiving extended LMWH prophylaxis without substantial increases in bleeding-related complications.[223-225] Given that the rate of VTE in cystectomy patients is between five and eight percent[219,226,227] and the mortality rate among patients who develop pulmonary emboli is as high as 16 percent,[228] extended prophylaxis should be strongly considered in high-risk urologic cancer populations to reduce risks of substantial morbidity and possible mortality after surgery. Concerns have been raised about cost of these regimens in settings where insurance coverage transfers much of cost to patients. The benefits of therapy should be considered in context of cost for certain patients.[213]

Continuation and/or Re-initiation of Antiplatelet or Anticoagulant Medications for Indications Other Than VTE Prophylaxis

Patients with comorbid conditions calling for ongoing antiplatelet or anticoagulant therapies can present challenges in the perioperative period as the risks of perioperative bleeding or other issues associated with these medications needs to be balanced with the risks of stopping such therapies. In an effort to provide further urology-specific guidance on this subject, the AUA and International Consultation on Urologic Diseases (ICUD) published a recent white paper on this topic.[229] That manuscript as well as the preoperative paper written as a part of this perioperative series of papers can be referenced for greater detail on preoperative decision making regarding continuation of these medications.

Regarding decisions for when to restart anticoagulant or antiplatelet medications held for urologic procedures, the ICUD/ AUA White Paper on *Anticoagulation and Antiplatelet Therapy in Urological Practice*[229] again represents the most-comprehensive resource from the AUA on the topic to date. A full re-review of the literature was not performed for this white paper, and the entire contents of the ICUD/AUA manuscript will not be re-presented here. However, to summarize the most salient recommendations for the postoperative period, 1) multidisciplinary management of anticoagulant/antiplatelet medications is recommended for patients with recent thromboembolic events, mechanical cardiac valves, atrial fibrillation, and cardiac stents; 2) elective procedures requiring interruption of dual antiplatelet therapies should not be performed in patients with a recent bare metal or drug eluting stent who remain in the window when dual therapy is mandated (i.e., three months after bare metal stent and 12 months after drug eluting stent placement); 3) low-dose aspirin can be continued perioperatively for patients with cardiac risk factors without a significantly increased risk of major bleeding; and 4) for patients with coronary stents who discontinue antiplatelet agents prior to surgery, therapy should be resumed as soon as possible; however, there is no literature to guide specific timing.

Postoperative Antimicrobial Use

The majority of the discussion regarding perioperative antimicrobials pertains to the utilization of prophylactic preoperative treatment with or without the addition of a short duration of postoperative therapy designed to reduce the likelihood of postoperative infections. The AUA first published a best practice policy statement on urologic surgery antimicrobial prophylaxis in

2008.[230] It was most recently revised in 2012 and provides a comprehensive review of the literature on the subject. Further, the preoperative and intraoperative white papers published as a part of this series on perioperative care discuss antimicrobial therapy in those phases of care. As those documents indicate, there is limited literature supporting the utilization of antimicrobials for prophylactic purposes beyond the immediate perioperative period (i.e., preoperatively up to 24 hours postoperatively). Therefore, the utilization of antimicrobials for prophylactic reasons extending more than 24 hours into the postoperative period is generally not recommended following uncomplicated urologic surgery. This white paper will discuss the utilization of postoperative antimicrobials in several specific scenarios.

Antimicrobial Therapy Following Surgical Implantation of Urologic Prosthetic Devices
Although prescription of antimicrobials beyond the immediate perioperative period is common following urologic prosthetic surgery,[231] there are no randomized trials evaluating whether this practice reduces infectious complications. The 2008 AUA best-practice statement relies on evidence from non-urologic prosthetic surgery and states that "evidence from orthopedic literature suggests that prophylaxis for 24 hours or less is adequate."[230] A recent observational study drawing from a national database may support this statement in its finding that postoperative antibiotics were not associated with reduced odds of explantation following either penile prosthesis or artificial urinary sphincter surgery.[232]

Antimicrobial Therapy and Indwelling Urinary Catheters
Continuous antibiotic prophylaxis in patients with IUCs is not recommended in the AUA best-practice statement on antimicrobial prophylaxis. Antibiotic prophylaxis for less than 24 hours to reduce infectious complications is recommended at the time of urinary catheter removal for patients with recognized risk factors (i.e., advanced age, anatomic anomalies of the urinary tract, poor nutritional status, smoking, chronic corticosteroid use, immunodeficiency, externalized catheters, colonized endogenous/ exogenous material, distant coexistent infection, prolonged hospitalization).[230] Antimicrobials of choice include fluoroquinolones or trimethoprim/sulfamethoxazole, whereas aminoglycosides, ampicillin, first and second generation cephalosporins, and amoxicillin/clavulanate are alternative options. If a culture is sent prior to catheter removal and demonstrates no growth, then prophylactic treatment may be omitted.

Post-Operative Transfusions

Blood transfusion is common after complex and invasive procedures such as nephrectomy and cystectomy. Significant variation in transfusion rates is reported between hospitals for a given procedure, a finding that may be associated with surgical volume.[233] Most studies report transfusion rates for the duration of the surgical admission without differentiation between intraoperative and postoperative transfusion.[234,235] Requirement for perioperative transfusion is more common with advanced malignancies and, not surprisingly, by the presence of preoperative anemia.[235] While transfusion safety and blood screening have improved over

time, transfused patients are still exposed to potential risks from transfusion-related acute lung injury and circulatory overload in addition to transfusion reactions.[236] Transfused surgical patients with urologic malignancies may have worsened cancer-specific outcomes, though some studies fail to demonstrate this association.[68,237-241]

The 2016 clinical practice guidelines from the AABB (a transfusion medicine organization formerly known as the American Association of Blood Banks) recommend a restrictive transfusion threshold of seven g/dL for hospitalized, hemodynamically stable patients, including those who are critically ill, and eight g/dL for patients undergoing orthopedic and cardiac surgery and those with underlying cardiovascular disease.[242] The guidelines note that good clinical practice includes consideration of overall clinical situation, patient preference, and alternative therapies as well as the fact that high-quality safety data are lacking for many sub-groups. A recommendation for patients with acute coronary syndromes is not presented due to insufficient evidence; other published guidelines vary in their recommendations for this population with some advocating for more liberal thresholds, particularly in cancer patients.[236,243] More recently, several meta-analyses have suggested that more liberal thresholds may be associated with improved outcomes for perioperative patients.[244,245]

In the absence of active bleeding, transfusion with a single unit followed by reassessment of transfusion indications is recommended to reduce the risk of over-transfusion.[236,246] There is insufficient evidence to recommend routine use of postoperative oral or intravenous iron; limited studies suggest preoperative supplementation may be beneficial in known anemic patients.[247-249]

Palliative Medicine

Palliative care[250] is defined as an approach that "improves the QOL of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial, and spiritual."[251] Palliative care is one of the most rapidly growing fields of healthcare in the United States. Benefits have been shown in numerous clinical trials, with improved patient satisfaction, improved symptom control, fewer readmissions, less anxiety and depression, less caregiver distress, and cost savings.[251] However, access to palliative care services range within different states from 20-100 percent.[252] Larger, academic and religious-based hospitals are more likely to have a palliative care team.

While palliative surgery is an important category within the larger construct of palliative care, palliative surgery is beyond the scope of this white paper, which will focus on the role of palliative care in the postoperative setting. If the reader is interested in delving further into the topic of palliative surgery, several cited articles highlight the role of surgery in urologic palliation as well as surgical principles for these cases.[253-255]

Palliative care following surgery is a critical element of postoperative care in some patients, particularly those with poor prognosis, intractable symptoms and complex care. Thus, this section will cover several areas to address these elements: delivery of bad news, establishing goals of care, spiritual issues, and palliative and hospice care referrals.[256] While the urologist need not be an expert in any one of these areas, a general understanding of each topic is important to provide quality of care.

Delivering Bad News

Several aspects of delivery can be useful in this setting.[256-258] First, give fair warning. A statement such as "I am afraid I have some bad news for you" can be followed by a brief pause. Speak slowly and clearly, with small amounts of information. Present the information succinctly but also be prepared to repeat the information and present additional information, providing an early opportunity for questions and comments. Sit quietly to allow the patient and family to absorb the information and respond. Listen carefully and recognize the patient's and family's emotions verbally with statements such as "This is very difficult news." Be flexible and responsive, allowing the patient's and family's concerns to direct the conversation, and present information at the patient's and family's pace. While some families prefer to know a great amount of detail, others may prefer less. Starting with an initial overview allows the urologist to assess his/her understanding and answer questions, with the opportunity to determine whether additional detail is desired. Agree on a follow-up plan, and make sure that the plan matches the family's needs. For example, use a statement such as "I will return later today; please write down any questions you might have." Be sure to document your conversation in the chart, including who was present, information discussed, actions to be taken, and follow-up planned. Finally, be mindful of your own feelings and reactions. It is not uncommon to regress to false assurances or over-talking based on feelings of guilt, anger, fear, or sadness.

Goals of Care

Establishing goals of care for seriously ill patients following surgery is paramount. However, these discussions are best had prior to surgery as opposed to after a negative outcome has occurred. Often, these goals are best made with open and frank discussions with the family. Family conferences can provide a meaningful way to establish goals, manage expectations, and answer questions. If the family speaks another language, the presence of an interpreter is paramount. The ten-step process (Table 15) provides an excellent framework for effective goal setting and was excerpted from the American College of Surgeons' teaching guide for surgical palliative care.[256]

Table 15. Ten-Step Process for Goals of Care[256]

Pre-Meeting Planning	Before scheduling a conference, the provider should determine the reasons for convening a family conference, decide what testing and interventions are medically appropriate, review the medical history, and coordinate opinions (particularly if several consultants are involved). In addition, the provider should ascertain advance directive documents as well as psychosocial data (often gleaned from a social worker or clinical care manager). Finally, decide which attendees should be present during this meeting (providers, supporting staff, spiritual leaders, and members of the family) and designate one person to serve as the meeting leader.
Environment	Find a quiet, private setting and arrange chairs in a circle. If the patient is participating, make sure that he or she is as comfortable as possible.
Introductions	Before beginning, ask all participants to introduce themselves and their relationship to the patient, with particular attention to the healthcare power of attorney if the patient cannot make medical decisions. For larger groups, set ground rules regarding when to speak in order to avoid interruptions. Review the goals and purpose of the meeting and ask participants for their goals.
Determine What Is Known	Before delving into the meat of the discussion, determine what the patient and family already know. Using questions such as "What is your understanding of ___'s present condition?" or "What have you been told about ___'s condition?" can allow you to structure your conversation and avoid misunderstandings.
Medical Review	Provide a concise summary of the patient's current medical conditions and how this fits into the larger picture. Be sure to avoid medical jargon and avoid words that may be unclear or misinterpreted. Using words such as "dying" may be appropriate if this is accurate.
Allow Silence and Respond to Questions	For those situations in which no further treatment is possible, two common reactions include acceptance and non-acceptance. Common questions among acceptance include "How much time?" "What will happen next?" "What do we do now?" Questions/statements among non-acceptance include "Are you certain?" "We want a second opinion," and shifting questions to minor aspects

	of care. Be prepared to answer or address these statements before the meeting.
Present Broad Care Options	Generally, when discussing options, offer broad care options. For example, options usually can be categorized into two domains: 1) expanding life-saving treatments with a particular goal in mind, or 2) continuing comfort care but discontinuing life-prolonging treatments. If the patient can speak for himself/herself, be sure to ask him/her first and invite discussion from the family about supporting the patient's decision. If the patient cannot speak for himself/herself, ask each family member what their own wishes are for the patient. Some families may benefit from time alone (10-15 minutes) to talk before making a decision. Finally, if the family is unable to make a decision and requests your input, the provider must make a clear recommendation. Avoid statements such as "What would you like to do?" at this point, given that this question can worsen the family's sense of guilt.
Manage Conflict	Conflict can arise between family and the healthcare team or between family members themselves. Reasons for conflict can include grief, receipt of incorrect or conflicting information, anger, guilt, distrust, and differences in culture. To manage conflict effectively, employ active listening with civil discourse, correct any misunderstandings, offer empathy, and keep the focus of discussion on the patient's wellbeing. A recommendation for a time-limited trial of one management option could be offered, with the possibility of changing the decision (if this is possible). Finally, recommending additional resources may be very helpful, including a psychologist, palliative care team (see section below), spiritual counselor (described below), or ethicist.
Translate Goals into Care Plan	Once a decision is made, refocus the goals of care. Reestablish expectations regarding future hospitalizations, Do Not Resuscitate (DNR) status, use of artificial hydration/nutrition, blood products, antibiotics, and home support. Make sure that these goals match the patient's and family's goals.
Document and Discuss	Discuss the meeting with any members of the healthcare team who did not attend the meeting, and document all goals of care clearly including what was discussed, what was decided, what decisions were deferred, and next steps.

Spiritual Issues

Spiritual care is the job of all members of the interdisciplinary team (including surgeons) not just chaplains.[259] Spirituality differs distinctly from religion, in that religion represents a set of beliefs shared by a particular community. Spirituality, on the other hand, refers to one's personal understanding of the relationship between oneself as a human being (one's spirit, one's soul), other people, and the universe. Spiritual issues, unlike religion, arise for almost all dying persons and have an important role in palliative care. Although the urologist does not require extensive training or knowledge about religion or spirituality, the urologist should be able to recognize the need for support and assist patients in finding these resources. Engaging the palliative care team can assist with identification of such resources. Surgeons should be open to spiritual discussions/issues as they arise while seeking the assistance of professional pastoral care when appropriate.

Palliative and Hospice Care Referrals

Palliative care services are usually provided in hospitals as a consultation service or dedicated inpatient units.[256] Often, palliative services incorporate multiple providers including physicians, nurses, social workers, and chaplains. Palliative care providers can bill and receive payments through traditional Evaluation and Management codes. According to the American College of Surgeons' Guide for Surgical Palliative Care,[256] there are several indications for an inpatient consultation for palliative care services following surgery:

- Assistance with complex pain and symptom management
- Assistance with goal-of-care discussions and decisions
- Prognostication
- Hospice eligibility assessment
- Psychological and spiritual support for patients *and* families
- Assistance in discussions regarding symptom management for withdrawal of life-sustaining interventions

Postsurgical palliative care can impact five domains of quality care from the patient's perspective: 1) receiving adequate pain and symptom management; 2) avoiding inappropriate prolongation of dying if a patient is terminal; 3) achieving a sense of control; 4) relieving burden; and 5) strengthening relationships with loved ones.[260] Arguably, most surgeons are not adequately trained to carry out these types of conversations.[261] However, communications that frame the surgeon-patient relationship, particularly in aspects of palliative care, can be regarded as a worthwhile and important intervention. The American Medical Association, through Education for Physicians of End-of-Life Care (EPEC) has created interactive modules focused on communication and establishing goals of care which may be helpful to the surgeon interested in learning and practicing these palliative care techniques. Otherwise, use of in-hospital pain or palliative care service referral is appropriate. Urologists should be aware that palliative care consultation is often obtained too late. Among consultations at a level 1 trauma center, median time from consultation to death was one day, demonstrating an important opportunity to engage palliative care services earlier in the course of hospitalization.[262]

Hospice care focuses on health management for terminal care and is a subset of palliative care. Hospice care can be delivered in a Medicare-certified home hospice agency, a non-Medicare-certified home hospice agency, and inpatient beds within an acute care hospital, nursing home, or free-standing dedicated inpatient hospice facility. In general, eligibility for Medicare-covered hospice includes physician-certified prognosis of less than six months, treatment goals palliative rather than curative, and a physician willing to be identified as the physician on record. Hospice services can include a number of resources similar to the broader definition of palliative care, including physical symptom control; home health aide services for help with bathing, dressing and feeding; psychological counseling; preparation for death; spiritual support; volunteers to assist patient and family; and bereavement program for family after death.

Part 2: Transition to the Outpatient Setting

Clear and Readable Postoperative Education and Instructions

Engagement of the family, patient and/or caregiver in the postoperative education process with systematic preparation is critical to optimizing post-discharge outcomes. Self-management at discharge involves sharing the skills, practical tips, and repeating education as needed, tailored to the patients' needs.

Many times communication is unilateral, chiefly as a result of staffing and time constraints, hindering the effectiveness of postoperative education. Health professionals need to provide an opportunity for questions from the patient and their caregiver(s) in order to reduce the risk of confusion among patients in a vulnerable period in their postoperative care.

Ideally, in elective procedures, the education begins with the preoperative office visit, and a patient considering surgery receives a written protocol to outline what to expect during the admission process. General guidelines for care on discharge and awareness of signs and symptoms concerning for the occurrence of complications as well as prevention of those complications should be delivered at this visit.

During the transition to discharge, allow an opportunity for questions to better meet the needs of the patient who is returning to home or transitioning to an extended care facility based on the trajectory of his or her postoperative course. Education that is individually tailored, understandable for patients with low health literacy, and culturally competent is most beneficial. Effective tools—as described below—help patients navigate this complex healthcare process successfully. For any future procedures, these best teaching practices may improve patients' abilities to make more informed healthcare decisions.

The transfer of clear medical information is especially important. One of the most successful, evidence-based methods of patient education is the Teach-Back Method. Patient understanding

is verified when patients can restate the postoperative educational information in their own words.[263-265] Patients remember and understand less than half of what is explained to them.[266] This method helps healthcare providers confirm understanding and offer repeat teaching, if necessary, without embarrassment to the patient. Key components to this strategy include the use of plain language and a slow and clear speaking style.

Postoperative complications can be prevented with careful attention to early signs and symptoms, but patients must be aware of these signs. This can include having an accurate understanding of the need for adequate oral intake and diet to maintain good fluid and electrolyte balance and promote normalizing urine and bowel function. Instructions on pain management are critical as adequate pain control will allow for adequate rest and healing. This discharge education includes advisement that as healing continues, the need for analgesics decreases. Given physician-led efforts to address the opioid epidemic, many surgeons are systematizing discharge opioid prescriptions tailored to the patient and procedure performed.

Physical activity is always challenging with respect to patient education. Prevention of postoperative complications includes early ambulation and also rest as needed with possible leg elevation. However, this must be balanced with accurate instructions on lifting and activity restrictions as well as the impact of postoperative recovery on work release. Example instructions include splinting the incision when patients have to cough and deep breathing exercises.

With respect to wound management, based on the procedure performed, patients will receive different instructions related to when and how they may shower and care for the incision. Patients are often given restrictions to restrict bathing to showers and to avoid baths and spas. Although these instructions may not decrease infection rates after surgery, clear instructions may promote careful repeated inspection of the wound, in which patients may watch for any untoward signs of bleeding, swelling, or discharge.

At discharge, patients receive their discharge packet and prescriptions. After all teaching has been completed, discharge paperwork is given and follow-up appointments are confirmed. Phone numbers need to be included with the discharge packet for patients to have confidence that they have access to resources to address questions should they arise. Ideally, the patient should receive a phone call within 48 hours of discharge to check on maintenance of the discharge plan and if any problems or issues have occurred. These processes can ensure better patient satisfaction and, after complex procedures like radical cystectomy, avert some readmissions.[267]

Engagement of Family, Patient and/or Caregiver

Involvement of a patient's caregiver team in postoperative discharge planning is important to optimize patient-centered outcomes after surgery. Family members and caregivers often bear the brunt of home nursing care, especially when patients are discharged with surgical drains or

are learning to manage catheters and stoma appliances. Therefore, engagement of caregivers in postoperative discharge planning and discharge teaching is critical to reducing preventable complications after urologic surgery.

Few formal interventions targeting caregivers have assessed postoperative post-discharge outcomes, especially after urologic surgeries. Following cardiothoracic surgery, involvement of caregivers—most of whom were family members—in inpatient nursing care was associated with improved patient satisfaction and lower 30-day readmission rates in a retrospective review of participation in a program called Partners in Healing.[268] Among program participants, five percent were readmitted within 30 days of discharge compared with 13.5 percent of matched controls. Key components of the intervention included participation in patient activities such as incentive spirometry, transitions in and out of bed, and recording of bathroom trips. Caregivers noted that the program facilitated more efficient access to minor resources in the hospital, such as warm blankets or water, that usually require a nurse call, and caregivers reported increased confidence in the ability to manage the patient's postoperative needs at home.

Medication Management

Patients are particularly susceptible to medication errors following discharge after major surgery.[269] The postoperative period is a time of problematic discontinuity in care providers for patients undergoing major surgery. A major source of error includes the need for substantive changes to a patient's preoperative medication regimen at the time of discharge.

This may relate in part to inaccurate admission medication reconciliation.[270] Medication discrepancies are unfortunately common and can occur in more than half of surgical admissions.[271] These discrepancies may have clinical consequences. Admission medication regimen errors may be more common among patients with low health literacy or language barriers.

One possible solution is the use of pharmacists in admission medication reconciliation. In one large randomized controlled trial, the performance of admission medication reconciliation by clinical pharmacists was associated with a large reduction in medication errors.[272] This can be supplemented and accuracy further ensured when the pharmacist prescribes the discharge medications to rectify any observed errors. Preventable adverse drug events can be reduced from 11 percent at discharge to one percent among patients randomized to usual care versus a pharmacist-led reconciliation intervention, respectively.[273] The intervention included clarification of the medication regimen, detailed discussion of the medications including doses and side effects, screening for barriers to medication adherence, and a telephone follow-up three to five days after discharge to discuss any concerns. Unfortunately, only five percent of US postoperative discharges involve clinical pharmacists in obtaining medication histories.[274] This consideration is more critical among patients with multiple health conditions subject to polypharmacy.

Inpatient medication changes often relate to the intensity of the postoperative recovery. As patients experience hemodynamic changes, dietary restrictions, and large-scale fluid shifts, medications such as anti-hypertensives and hypoglycemics are often held. Reintroduction of these medications may require temporary dose adjustments. Hospital medication formularies can impact inpatient utilization of home medications as substitutions are often required. This necessitates more careful consideration of medication reconciliation at hospital discharge.

Discharge reconciliation involves consideration of resumption of preadmission medications, intentional changes in the doses of those medications, the addition of newly added medications, and cessation of medications that were transiently required during the inpatient admission. Common examples of short-term perioperative medications that may be discontinued at discharge include venous thromboprophylaxis and prophylaxis against stress gastritis.

Formal multidisciplinary medication reconciliation at discharge reduces the risk of medication errors. The American College of Surgeons and American Geriatric Society released a joint guideline on the perioperative care of geriatric patients,[275] who comprise a large proportion of patients undergoing urologic surgeries. These guidelines explicitly state that a "patient or patient caregiver should receive a complete list of all medications and dosages to continue on discharge from the hospital. Medication changes made during the hospital stay should be emphasized." As such, use of medication reconciliation at hospital discharge is a performance metric in the Healthcare Effectiveness Data and Information Set (HEDIS) Measures.[276]

Coordinated Care/Follow-up with Primary Care Physician

Successful transition to home requires coordination of follow-up with a PCP. This appears to be a gap for both medical and surgical discharges. For example, many patients discharged after a medical or surgical admission require additional outpatient workups, often intended to be completed by the PCP. Yet, one study of discharges from a large academic medical center demonstrated that 36 percent of discharged patients do not complete recommended workups.[277] Longer time to a post-discharge visit with a primary care doctor was associated with a lower likelihood of completing a recommended evaluation. Table 16 highlights several challenges and possible solutions for ensuring better transitions between inpatient teams and PCPs.[278]

Table 16. Challenges and Solutions in Coordination between Surgeons and Primary Care Physicians[278]

Postoperative transition challenges	**Opportunities and solutions in postoperative transitions**
Communication between surgeons and PCPs	• Efficient delivery of discharge summaries to PCPs • Inform PCPs of new diagnoses, new medications, and postoperative care instructions • List follow-up care and tests that need to be coordinated
Changes in preoperative medication regimen	• Display preadmission medication list alongside discharge medication list. • Provide indications for new medications and changes to existing medications • Partner with clinical pharmacists for medication reconciliation
Self-management responsibilities	• Multidisciplinary discharge team to address postoperative education • Coordinate follow-up appointments with PCP • Telephone follow-up of discharged patients; clarify medication concerns

Follow-up with a PCP after urologic surgery can help reduce the risk of medication-related errors, clarify the resumption of preadmission medications, and reinforce postoperative care instructions. Only 49 percent of patients admitted for medical indications to a tertiary care academic medical center had timely primary care follow-up in a small prospective pilot study.[279] Readmission rates were lower among patients with timely primary care follow-up after discharge (three percent versus 21 percent among patients without timely primary care follow-up). This small pilot echoes a larger study of readmissions among Medicare beneficiaries in which 50 percent of readmitted Medicare beneficiaries had no identifiable bill for an outpatient visit between discharge and their readmission.[280]

Barriers to adequate primary care follow-up can include lack of an assigned primary care doctor, payer coverage and concern about co-pays, transportation (especially after complex surgical procedures), and lack of scheduling while the patient was admitted. Clinical care pathways that include preoperative and postoperative elements could consider making post-discharge primary care appointments prior to scheduled surgeries to try to increase adherence to primary care follow-up after an operation.

Need for Home Health at Discharge

Inpatient assessments by nursing, enterostomal therapy, physical therapy, and occupational therapy often determine the need for home health services. For some surgical procedures, home healthcare may be a source of excessive expenditure without improved outcomes.

Patients undergoing radical prostatectomy in the Michigan Urologic Surgery Improvement Collaborative (MUSIC) received home healthcare services 13 percent of the time without benefit to their short term health outcomes.[281] Yet home healthcare can be a valuable source of support for patients managing complex postoperative recoveries, navigating multiple surgical tubes or drains, learning to care for new urostomies, or requiring additional physical therapy services.

Home health services have not been robustly examined after urological surgery. After total joint arthroplasty and pancreatectomy, home health services can lead to an increase in readmissions for minor complications, possibly a consequence of overdiagnosis of less severe adverse events.[282,283] Yet, conceptually, the early identification of complications after certain urologic surgeries where these events are common could have benefit as is the case following radical cystectomy.

Checklists may identify the need for home health services at discharge. However, standard checklists that determine the need for postoperative post-discharge home health services are unavailable at this time.

Additional Considerations for High-Risk Readmissions

Among urologic procedures, radical cystectomy carries the highest risk of readmission within 30 days of discharge, with published readmission rates ranging from 21-31 percent.[284-287] Risk factors that have been associated with readmissions after radical cystectomy include the occurrence of complications during the index hospitalization; certain patient characteristics including age, preexisting diabetes, and obesity; as well as discharge to a skilled nursing facility. Many of these factors are likely correlated with adverse events during the index stay.[285,288]

Certainly, given the morbidity of the surgery and the combination of an extirpative and reconstructive surgical procedure into one operation, many of these complications are likely non-modifiable.[288] However, understanding the time course of readmissions may allow for healthcare team communications with discharged patients to avert some of these unplanned readmissions. Most readmissions occur within two weeks of discharge with predominant causes of readmissions including infectious complications and failure to thrive.[267,285,289] This may inform the timing of outpatient encounters—including telephone calls—which in one systems engineering modeling study was anticipated to avoid 16 percent of potential readmissions.[267] The majority of these would involve earlier detection of infectious complications at a time point when they could be managed as an outpatient. Early pulmonary rehabilitation that includes post-discharge encounters involving home health have incorporated efforts to mitigate failure to thrive-related readmissions through home-based intravenous fluid hydration.

The identification and prevention of readmissions after high-risk surgeries could involve checklists such as the SURPASS checklist described above. Postoperative Checklist E describes

physician-led and nurse-led tasks and includes discussion of needed wound care, diet, management of surgical drains, anticoagulant management, and medication reconciliation. Better wound care instructions and awareness of the early signs and symptoms of surgical site infections may help with reduction in infection-related readmissions. An emphasis on diet and hydration may decrease revisits associated with failure to thrive. Medication management and anticoagulation management are critical, especially as 10 percent of patients undergoing radical cystectomy experience VTE.[288] Most of these occur after discharge.[288]

The SURPASS checklist likewise includes post-discharge appointments and coordination with PCPs. By systematizing the generation of these appointments, healthcare teams can ensure appropriate follow-up with the primary surgical team, and appropriate communications with patients' PCPs as discussed above. Especially among high-risk patients, based on their characteristics or the magnitude of the surgery involved, these visits can further allay the burden of preventable readmissions.

Part 3: Post-Discharge Postoperative Considerations

Follow-up and Surveillance Strategies – Value of Risk-Based Algorithms

The purpose of postoperative follow-up revolves around decreasing and preventing complications, emergency visits, and hospital readmissions. For cancer patients, the intent of follow-up extends beyond these measures to the hope of capturing recurrences early, thereby allowing for a positive impact upon oncologic outcomes. Follow-up also allows the clinician to learn the natural history of disease processes after surgery and the impact of interventions. Although a critical element in postoperative care, consensus recommendations on follow-up are lacking.

Follow-up of the Non-Oncologic Patient
Currently, for the non-oncologic patient, the decision for postoperative follow-up may be dictated by drain management, risk of postoperative morbidity, patient health factors, and billing as well as clinic resources and availability. Such multi-factorial decision-making combined with a multiplicity of different procedures makes creation of standardized postoperative follow-up recommendations difficult and its practice heterogeneous. Although development of a consensus regimen would be arduous, novel approaches to follow-up are worth mentioning and may be useful to the urologic surgeon.

Krishnan et al.[267] used a systems engineering methodology to develop an optimal model for follow-up after radical cystectomy to reduce hospital readmissions. Using a delay-time analysis, the group found that the timing of the follow-up encounter was the most critical element to detecting patients at risk for readmission, with the key period being between four to five days after discharge. Interestingly, the type of encounter utilized, office visit versus telephone call, as well as the order of such encounters were found to be less important. Here, the authors

learned that telephone calls might serve as sufficient proxy for a postoperative office visit intended to identify patients at risk. Utilization of the telephone call by a nurse, inquiring about symptom management and treatment side effects, was felt to be a unique follow-up strategy that urologic surgeons could capitalize on during the early postoperative period and especially in the setting of increasing regionalization of high-risk procedures to large volume medical centers.[267] Although this study focused on follow-up after cystectomy, extension of this industrial-like approach to other high-risk procedures could afford us a better understanding of the optimal timing for initial postoperative encounters and whether use of alternative strategies to the office visit may be sufficient substitutes.

Certainly with the evolution of telemedicine, novel opportunities to engage in closer contact with patients and obtain more real-time information outside the typical office visit, with telephone calls and use of physician extenders becoming readily available. Although likely to become a part of all our future practices, the optimal manner by which we should incorporate such applications into the typical postoperative follow-up algorithm necessitates further investigation.

Follow-up of the Oncologic Patient

As compared to the non-oncologic patient, there are multiple resources available to guide postoperative oncologic follow-up. The most nationally recognized sources outlining specific surveillance schedules are the AUA,[290] the National Comprehensive Cancer Network (NCCN)[291] and the European Association of Urology (EAU).[292] These organizations derive follow-up strategies by reviewing the best evidence to date on recurrence patterns and prognostic indicators and finalize recommendations via panel discussions. A commonality among guidelines is the use of a risk-stratified approach to grade intensity of follow-up. Although most use pathologic stage for stratification, surveillance schedules among these organizations are not uniform. Even for the same cancer type, recommendations from the AUA, NCCN and EAU vary in frequency and duration of follow-up as well as type of imaging utilized.[290-292] This guideline heterogeneity continues to perpetuate due to a lack high-level evidence validating a preferred frequency, duration, and type of surveillance testing. Without guideline standardization, urologists have resorted to more independent decision making in their delivery of surveillance care, creating variable practice patterns of follow-up,[293] which are poorly compliant with published recommendations.[294,295]

Despite the lack of level 1 evidence, there are a number of valuable concepts that can be gleaned from the existing literature that may enhance the urologists' delivery of surveillance care. First, the practice of scheduled oncologic follow-up shows potentially beneficial patient outcomes as well as harms that can be mitigated. Although, demonstration of a survival benefit from surveillance is challenging, retrospective analyses by both Boorjian et al.[296] and Merrill et al.[297] in bladder and renal cell cancer, respectively, provide initial evidence that such a survival advantage may be occurring from scheduled cancer follow-up. In both cancer cohorts, a survival benefit was afforded to patients whose recurrences are captured asymptomatically (i.e., from imaging) as compared to patients whose recurrences were detected from symptoms that prompted evaluation.[296,297] While only retrospective analyses, these studies are the first to

demonstrate that improved patient survival may exist from the practice of surveillance in urologic cancers. Additionally, Strope et al.[298] raised the idea that certain elements of follow-up care may be more important than others to improving patient survival, such as physician visits and urine tests in bladder cancer, as well as the time period of surveillance visits following surgery (7-24 months post-surgery versus earlier).

When there are benefits, there can also be harms. Investigation of the harms of surveillance, such as development of secondary malignancies from serial ionized imaging, has been a topic of particular concern for stage I testicular cancer patients.[299] However, with the advent of low-dose CT protocols, more sensitive scanners, and less intensive surveillance schedules, risk of secondary malignancies, even for a 20-year-old, could be mitigated significantly and potentially reduced to a lifetime risk of one percent.[300]

Another potential harm of surveillance can be the anxiety and fear of recurrence that the survivor generates around these follow-up visits. Addressing such psychological aspects of survivorship issues is another valuable concept that should be incorporated into the urologists' surveillance practice. Even for the long-term testicular and prostate cancer survivor, fear of recurrence can persist to a modest intensity over five years from diagnosis showing no significant change over time.[301,302] Despite having heightened anxiety during visits, survivors, specifically with colorectal cancer, have reported a strong preference to continuing follow-up, irrespective of such visits leading to an earlier detection of recurrence.[303] Provision of strategies to cope with the fear of recurrence[304] and overall generating a good patient-centered communication during follow-up visits[305] were found to be key elements in mitigating the psychological stress connected with oncologic surveillance.

An additional important concept garnered from the literature is that guidelines in their current form may benefit from optimization. Using retrospective databases, the effectiveness of the NCCN and AUA renal cell carcinoma (RCC) surveillance guidelines postsurgical resection as well as the NCCN and EAU urothelial cancer (UC) guidelines following cystectomy were evaluated. If strictly followed, all protocols would fail to capture disease recurrence comprehensively. Specifically, for RCC, the NCCN and AUA recommendations would miss approximately 32 percent and 33 percent of all primary recurrences, respectively.[306] For UC, the NCCN and EAU would miss approximately 30 percent and ten percent of all primary recurrences, respectively.[307] All protocols, irrespective of cancer type, were most limited in detecting recurrences among low-stage patients. For RCC, it was estimated that capturing 95 percent of recurrences would require current surveillance protocols to extend beyond 10 years for all risk strata. Not surprisingly, such extension of surveillance was found to be more costly than current recommendations.[306] With rising cancer costs and the need to improve medical resource allocation, extension of existing guidelines becomes unreasonable.

The reasons behind guideline underperformance are multiple. Currently, protocols define their duration of follow-up on recurrence patterns estimated using the cumulative incidence of recurrence. This linear method of estimating recurrences assumes a patient's risk profile remains static over time. However, based on a concept termed conditional survival, this

assumption may no longer be true. The concept of conditional survival, where the duration of survivorship influences the probability of future survival, has been shown to occur in multiple malignancies.[308-311] Use of a more sophisticated risk model to define follow-up schedules may improve guideline performance and allow for a reduction in surveillance intensity with longer survivorship. Lastly, current guidelines focus only on disease related variables to define their risk stratification schemes. However, incorporation of non-cancer variables and use of a competing risk approach may better simulate a patient's natural disease course. In RCC, both age and comorbidity status were found to be strong predictors of non-RCC death, and when integrated into prediction models, quantification of a patient's competing risk of death improved.[312] Thus, incorporation of non-cancer variables and utilization of a competing risk approach may improve guideline performance by allowing better contextualization of a patient's overall risk status.

Based on current guideline shortcomings, the urologist should be aware of some alternate surveillance strategies that incorporate these modern concepts; as such, novel approaches may be the framework upon which future protocols become generated. For both RCC and UC, surveillance schedules were developed that utilize a sophisticated technique called Weibull modeling, which graphically displays how a patient's risk of cancer recurrence matures with time and becomes modified by their cancer specific and non-cancer features.[313,314] By stratifying a patient's risk of cancer recurrence by pathologic stage and relapse site and modeling it along with the patient's risk of non-cancer death, stratified by age and Charlson Comorbidity index, the dynamic interplay that was occurring between these competing risks over time became apparent. A reasonable stopping point for routine surveillance was estimated by identifying the time point at which a patient's risk of non-cancer death exceeded their risk of cancer recurrence. This point was felt to be the first time when a patient's competing health conditions became the more important driver of survival than their cancer. Using this method, vastly different surveillance durations were derived as compared to current guidelines for both RCC and UC patients, showing that some patient groups needed longer surveillance and some significantly less.[313,314]

While this novel approach to surveillance improves upon some of the limitations of current guidelines, to date, it has not been validated nor compared in efficacy to existent protocols. However, it does set the stage for initiating the future sophistication of present-day surveillance protocols. Until higher level of evidence in the arena of cancer follow-up is achieved, the urologist must recognize that the practice of surveillance may afford beneficial patient outcomes, such as potentially improved survival. Furthermore, judicious surveillance should mitigate the harms it could generate, such as from radiation exposure and fear of recurrence. Appreciating that there can be a significant psychological stress to cancer survivorship and the need to address such issues during surveillance visits allows the urologist to deliver more patient-centric follow-up care. Finally, understanding the shortcomings of current protocols, appreciating the concepts highlighted in alternative strategies alongside with using sound clinical judgment, will help the urologist optimize their surveillance practice until guideline standardization can be negotiated.

Telehealth

Telehealth—the remote delivery of healthcare services using telecommunications technology—is increasingly used for perioperative care.[315] Telehealth includes a large spectrum of services including video visits, telephone calls, and remote patient monitoring.[316,317] These technologies can be used to enhance surgeon-patient interactions during postoperative care. Specifically, telehealth can be used for three primary reasons: 1) Scheduled follow-up,[318-320] 2) Remote patient monitoring,[321,322] and 3) Management of acute issues.[323,324]

Scheduled Follow-up
The most illustrious example of the use of telehealth for scheduled postoperative care is the video visit. A video visit is a two-way audiovisual clinical appointment that is conducted through the use of videoconferencing software. Patients connect through a web-cam enabled laptop, smartphone, or tablet. The patient can connect from home or from a medical facility.

In general, studies have shown that patients have an interest in video visits,[325,326] and video visits can be used to enhance the patient experience and access to care. For example, after prostatectomy, video visits for postoperative care have been shown to reduce the patient's time away from work and eliminate costs associated with travel.[318]

Remote Patient Monitoring
Remote patient monitoring encompasses a suite of telehealth services involving the use of digital health technologies to monitor patients at home or provide information to them. Remote patient monitoring has demonstrated significant improvement in outcomes for medical conditions like congestive heart failure[327-332] but are now more frequently used for surgical care. For example, in a multicenter study of patients who underwent joint replacement, the use of an automated digital patient engagement platform was associated with a significant reduction in avoidable complications and costs at 90 days.[333] Text messaging applications have been successfully used by some health systems to capture patient-reported outcomes (PROs) and daily measurements (e.g., drain output).[322] At the University of Michigan Health System, urologists have used a chatbot (an automated conversational tool) as a remote patient engagement tool to reduce patient phone calls and anxiety. Finally, the development of widely available commercial physical activity trackers (e.g., Fitbit™) has led to increased research into the potential for these devices to improve healthcare.[334] Preliminary evidence suggests that the use of wearables may be beneficial for men after prostatectomy[335] and other major surgeries.[336]

Management of Acute Issues
While most healthcare institutions rely on phone calls from patients and the emergency room to triage and manage postoperative complications, the use of text messages and smart-phone photography may help reduce downstream healthcare utilization.[323,324] In addition, while not widely studied in surgical care, the use of video visits may represent a lower-cost alternative to care administered in clinic or in the emergency department.[337]

Barriers to Widespread Use of Telehealth in Postoperative Care

While the advantages of telehealth for postoperative care are promising, there are several barriers to wider adoption. First, significant knowledge gaps remain. While there are hundreds of telehealth studies, there is a surprising lack of comparative effectiveness data on the use of telehealth for surgical care. The lack of data may keep health systems from making large investments in telehealth resources. Second, while many commercial payers are beginning to compensate providers for telemedicine services such as video consultations, Medicare has not yet followed suit. Medicare's strict reimbursement regulations have hindered the growth of telemedicine services for Medicare beneficiaries. These regulations include (but are not limited to) the following:

1. Origination site requirement - The patient cannot connect from home and must be located in a medical facility at the time of the telemedicine encounter
2. Geographic location of service restriction - The patient must be located in a non-metropolitan statistical area or Health Professional Shortage Area at the time of the service.
3. Service restriction - In most cases, only live video visits are reimbursed.

Finally, there is significant variation in how telemedicine is defined and regulated at the state level. These state regulations impact commercial and Medicaid reimbursement policies. For instance, some states define telemedicine as "real-time," and therefore all forms of store-and-forward telemedicine services and remote patient monitoring may not be reimbursed by commercial payers and Medicaid programs in the state.

While telehealth is increasingly used in the postoperative setting, there is a lack of robust data to support (or refute) its use. In addition, significant reimbursement barriers still remain. As telehealth services continue to grow, large scale randomized-trials are needed to assess their true value in the postoperative setting.

Patient-Reported Outcomes

PROs are defined as any report of the status of a patient's health condition that comes directly from the patient without interpretation of the patient's response by a clinician or anyone else.[338] They record patients' appraisal of their health and well-being and document the effects (good or bad) of disease and treatment. As such, PROs capture the patient voice, perspective, and priority and therefore are a key aspect to patient centeredness both in research and clinical care. Examples of PROs include functional status, symptoms, and QOL. Though initially developed for use in clinical trials to augment standard clinical outcomes in efficacy studies, PROs now support broader research areas and underpin QOL research. PROs are also currently being examined as clinical tools and quality measures.[337-340] This expansion in footprint has generated a new lexicon and a growing list of acronyms, including patient reported outcome measures (PROMs), patient-reported outcomes adverse events (PRO-AEs), and patient-reported outcome performance measures (PROM-PMs).

Prior research has shown that PROs such as QOL closely correlate with important clinical outcomes, such as complications and survival. Further, routine use of PROs in clinical care has been shown to improve communication between patients and providers, focus clinical visits on important patient concerns, guide symptom management, and result in higher patient satisfaction.[341-344] These findings have propelled PROs and PROMs into clinical and quality arenas. For example, the Center for Medicare and Medicaid Services currently uses PROs for quality evaluations for patients treated with orthopedic surgery (e.g., knee and hip replacement) and is expanding PRO-PMs into other clinical areas such as percutaneous coronary intervention. The importance and potential of PROs and PROMs in influencing patient care is underscored by two recent seminal studies. The first reported by Cleeland and colleagues demonstrated that using PROs to tract symptoms and alert clinical care teams to the presence of severe pain, distress, sleep disturbance, or shortness of breath resulted in better symptom management and fewer uncontrolled symptoms after thoracic surgery.[345] More recently, Basch and colleagues reported that patients receiving chemotherapy who routinely self-reported symptoms through a PRO symptom assessment system during on-treatment clinic visits stayed on treatment longer, had fewer urgent or emergent healthcare visits, reported higher QOL scores, and lived an average of five months longer than patients who were managed with usual care that did not include clinically integrated PROs.[346,347] Combined, these data suggest that PROs should be considered as a tool to guide clinical care.

This section is oriented toward the clinical use of PROs in postoperative patient management after urologic surgeries. Accordingly, the primary focus will be on how PROs can be used to reduce postoperative complications, optimize postoperative recovery and improve patient outcomes associated with surgical episodes. Though PROs cover a number of areas and outcomes, this paper will examine PROs that link to postoperative follow-up care, such as symptoms and functional status, and those that are both responsive to a clinically important outcome of interest and actionable. Table 17 provides examples of PROMS with associated target domains.

Table 17: Examples of PROMs with Associated Target Domains

Target Domain	Description	Example PROMs
General symptoms	Symptoms, such as pain, nausea/vomiting, shortness of breath, lack of appetite, fatigue, sleep disturbance, or distress	ESAS, MDASI, PRO-CTCAE
Urologic symptoms	Specific urologic symptoms, such as urgency, frequency, nocturia, incontinence, erectile dysfunction (ED), pelvic pain	AUA-SS, IIEF-5, I-QOL, USSQ

Recovery	Physical function domains related to recovering from surgery, such as pain, GI function, cognition, and overall activity	CARE, QoR-40
Condition-specific functional outcomes	Functional outcomes that are of interest for specific health conditions or procedures, such as bowel, sexual, and urinary function after pelvic surgery	EPIC, BCI, VCI, Wisconsin StoneQOL
Cognition	Cognitive symptoms, such as confusion, disorganized thought or speech, impaired executive function, or inability to focus that can be classified as post-operative cognitive dysfunction	MMSE
General QOL	Broad physical or mental health concerns or functional impairments that impact overall QOL	SF-36, SF-12, EQ-D5, SIP

Postoperative Symptoms Assessment and Management

Surprisingly little research regarding symptom assessment, severity, and management after surgery has been pursued to date. This may be the result of a pragmatic approach to evaluating and managing symptoms after surgery, in addition to a presumption that procedure-based symptoms are relatively limited to physical domains, such as pain, nausea, and fatigue. As a result, specific tools to evaluate symptoms after surgery are lacking, though general symptom scales and inventories developed mostly in cancer patient populations are available. These include questionnaires such as the Edmonton Symptom Assessment System (ESAS), the MD Anderson Symptom Inventory (MDASI), and the Patient-Reported Outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE),[348] which was developed by the National Cancer Institute (NCI) for adverse event reporting in clinical trials research.

Developed in 1991, ESAS is a valid and reliable assessment tool designed to evaluate nine common symptoms, including pain, tiredness, nausea, depression, anxiety, drowsiness, appetite, well-being, and shortness of breath.[349] Initially developed to evaluate symptoms commonly experienced by cancer patients, ESAS has also been used on non-cancer populations, including nephrology and cardiology patients,[350] and several of the items within ESAS (most notably pain, nausea, and shortness of breath) may be relevant to patients recovering from urologic procedures. The MDASI is a multi-symptom PRO assessment measure designed for clinical and research use among patients treated with cancer therapies. It consists of 13 symptom items (pain, fatigue, nausea, disturbed sleep, distress, shortness of breath, difficulty remembering, lack of appetite, drowsiness, dry mouth, sadness, vomiting, and numbness) and

six interference items (walking, activity, working, personal relationships, enjoyment of life, and mood).[351] The PRO-CTCAE, which is an item set targeting a subset of adverse events taken from the NCI CTCAE, covers a number of domains that are pertinent to surgical and urologic patients, such as GI, respiratory, cardiac, pain, and urinary adverse event groups. The structure of the PRO-CTCAE includes frequency, severity and interference questions, which may add to the total number of required questions. Additionally, the PRO-CTCAE was designed as an adverse event assessment tool, not as a symptoms screen, which may impact how it is used in clinical care. The clinical application of the PRO-CTCAE, however, is supported by prior research that used CTCAE items to identify and prompt management of symptomatic adverse events associated with treatment.[346,347] Using an early version of the PRO-CTCAE, researchers at the Memorial Sloan Kettering Cancer Center studied 120 women treated surgically for suspected or confirmed gynecologic malignancies using a proactive symptom assessment system augmented with clinical alerts. This resulted in 112 alerts, 28 patient contacts, and two referrals for urgent clinical evaluation in the emergency department, most commonly for poor performance status, nausea, and fatigue.[352]

The Patient-Reported Outcomes Measurement Information System (PROMIS) is another PRO platform that that is available to evaluate postoperative outcomes and recovery. It consists of a set of patient-centered measures designed to evaluate and monitor physical, emotional, and social health of adults and children. Supported by the National Institutes of Health, the PROMIS project resulted in the creation of an item bank covering a number of health domains that can be used to follow QOL and other PROs over time. These include many of the symptoms and symptom clusters discussed above, such as fatigue, pain, and sleep disturbance. PROMIS also covers other areas more comprehensively, including GI symptoms, sexual function, anxiety, depression, cognitive function, social functioning, and activities. Examples of some of the adult measures include global health, dyspnea, fatigue, GI function, pain, physical functioning, sexual functioning and satisfaction, and sleep disturbances.[353] Though clinical use is very limited, a recent pilot study evaluated PROMIS as a measure of recovery after abdominal surgery and reported reasonable responsiveness among PROMIS physical function domains in a small 30 patient sample.[354] PROMIS questionnaires are publicly available for use in clinical practice without licensing or royalty fees and can be downloaded at http://www.healthmeasures.net/search-view-measures.[355]

Recovery after Surgery

Beyond symptoms, assessing and supporting general recovery after surgery is of interest for surgeons. Though not widely used, recovery after surgery can be evaluated using an assessment tool called the Convalescence and Recovery Evaluation (CARE).[356] Based on iterative content development and psychometric testing, CARE is a reliable and valid 27-item scale that assesses four recovery domains based on patient-reported pain, GI symptoms and function, cognition, and physical activity.[356] In a follow-up study of 96 patients managed with abdominal or pelvic surgery, researchers reported that 44 percent of patients recovered to 90 percent baseline status within two weeks of surgery, 28 percent recovered to baseline between two to four weeks, and 28 percent took more than four weeks to recover. Bowel and cancer surgery were associated with longer recovery times.[357] In the context of cystectomy, which is arguably

one of the most if not the most complex and morbid surgeries performed in urology, recovery was prolonged and characterized by deficits across all domains with minimal to moderate recovery at six weeks, which was the distal evaluation point.[358]

Patient-Reported Function after Surgery

Perhaps the most robustly developed and research area of PROs in urology, recovery of functional status carries obvious importance after urologic procedures. Most prior PRO research in urology has focused on sexual and urinary function. Though a comprehensive review and catalogue of existing PROMs is beyond the scope of this white paper, several of the most common urologic measures that evaluate function will be discussed herein. One of the most widely used PROMs for evaluating non-specific lower urinary tract symptoms such as urgency, frequency and dysuria is the International Prostate Symptom Score (IPSS).[359] The IPSS consists of seven items (incomplete emptying, frequency, intermittency, urgency, weak stream, straining, and nocturia) scored on a five-point scale with an additional QOL question and can be used to evaluate urinary symptoms among both men and women. Summed scores of 0-7 indicated mild urinary symptoms, while scores between 8-19 and 20-35 correspond to moderate and severe symptoms, respectively.

Similarly, sexual and erectile function are focal points after a number of urologic procedures and are a target outcome of interest for urologists and urologic patients. Straightforward erectile function indices, such as the International Index of Erectile Function (IIEF)[360] have been available to screen for ED for years. The IIEF consists of 15 questions related to erectile function, orgasm, sexual interest, and sexual satisfaction and has been used extensively in clinical research. A shorted five-item version, the Sexual Health Inventory for Men (SHIM)[361] is used more commonly in clinical practice due to its ease of administration and scoring. A threshold SHIM score of 17-21 out of a total score corresponds to mild ED, while scores in the range of 12-16 correspond to mild to moderate ED, 8-11 indicate moderate ED and scores below 7 mark ED. Sexual and erectile function are also included in multi-domain PROMs, such as the Expanded Prostate Cancer Index Composite (EPIC),[362] which is a 26-item health questionnaire containing questions regarding not only sexual function, but also urinary, bowel, and hormonal function.[363] EPIC has been used extensively in clinical research studies to map the recovery trajectory of sexual and urinary function after surgery, as well as to compare functional outcomes across different treatment modalities.[364] More recently, quality initiatives aimed at reducing treatment morbidity associated with actively managing prostate cancer have relied on EPIC as a PROM-PM. In addition, a 16-item one-page version of EPIC designed to be administered and scored in clinical practice settings (EPIC-CP) is available.[362,365] This version reduces the number of questions answered by patients and can be scored by clinicians in a straightforward manner similar to the scoring of the AUA Symptom Index. Similar multi-domain PROMs exist for several urologic conditions. Though a complete review of all of disease-specific PROMs is beyond the scope for this review, several comprehensive reviews are available for additional reading.[366]

Cognitive Impairment after Surgery

Post-operative cognitive dysfunction (POCD) is defined by a decline in cognitive performance after surgery compared to preoperative neuropsychological functioning and seen in approximately 12 percent of patients after surgery.[367] Though widespread assessments for POCD are not common in everyday practice, the syndrome is associated with deficits in QOL, a decreased likelihood of returning to work, and increased mortality after surgery and may also be associated with dementia later in life. Several risk factors for POCD have been identified, including general versus regional anesthesia, older age at time of surgery, and existing cognitive impairment.

Emerging Targets for PROMs

Other areas of postoperative recovery where PROs and PROMs could provide valuable information include nutritional assessment and more discrete aspects of functional status, such as direct estimates of physical activity (e.g., time spent walking, steps taken). The CARE instrument discussed above covers some of these topics but is not widely used. Recent literature has highlighted the association with preoperative depression with poor postoperative complications, such as delirium, complications, persistent pain, prolonged hospitalization, and mortality, suggesting that mental health and depression screens could be considered prior to surgery and that future research should determine if interventions to target and manage depression translate to improved postoperative outcomes. Similar results have been chronicled with frailty and deficits in postoperative recovery.[368] Quality of recovery has also been assessed using measures that developed in the anesthesiology field. For example, the Quality of Recovery-40 measure assesses recovery across five dimensions: patient support, comfort, emotions, physical independence, and pain, and is oriented toward recovery from anesthesia more than specific surgical procedures, but it could be used to track postoperative recovery after urologic procedures.[369,370] The postoperative recovery scale is another measure that has also been developed, but limited clinical evidence regarding its use in clinical care or in urologic patients is available.[371]

Conclusion

This white paper summarizes a wide variety of postoperative factors that may impact surgical outcomes in urology. A listing of take-home points is provided below. By understanding and applying the best practices for postoperative care described in this practical guide, urologists can optimize the quality of care for their urologic patients.

1. In-Hospital Considerations
    a. Use of a standardized, team-based handoff from the OR to postoperative setting is associated with fewer errors, improved quality of communication, a decrease in preventable postoperative complications, and improvement in short-term outcomes.

b. Postoperative cardiac and respiratory monitoring may be helpful in select postoperative patients with risk factors for clinical deterioration.
c. Evidence-based ERAS protocols are recommended for all complex urologic surgeries.
d. Malnutrition is a significant and under-recognized problem in high-risk surgical patients, such as those undergoing cystectomy, and may have an impact on immune function and clinical outcomes. Malnutrition should be recognized as a modifiable risk factor and treated accordingly.
e. Surgical incisions proceed through normal healing processes within 14 days. Wounds that deviate from normal healing trajectory can be managed through specific evidence-based recommendations that take into account the wound type and selection of specific wound products.
f. Management of urostomy stomas should involve a wound ostomy nurse if possible. Providers should understand the appropriate method for obtaining a urine specimen, ordering supplies, and managing stomal complications.
g. Considerations for continent diversion management differ from those for non-continent diversions. Providers should teach patients stepwise instructions for caring for a continent diversion (such as orthotopic neobladder) along with appropriate catheterization technique, following similar methods employed for intermittent catheterization.
h. Early mobilization after surgery shows benefit and should be incorporated into the postoperative management of all patients.
i. Catheters and drains are commonly used tools that can promote healing and drainage following many urologic procedures. Providers should understand commonly used drains and tubes for urologic procedures, along with general guidelines for their selection and management.
j. Postoperative analgesia should apply a multimodal approach, targeting different mechanisms (pharmacologic and non-pharmacologic) in the postoperative period to reduce opioid requirements.
k. Chemoprophylaxis against VTE should be tailored to the perceived risks of VTE for a given patient, using the standardized CHEST guidelines when possible.
l. Continuation and/or re-initiation of antiplatelet or anticoagulant medications should be carefully considered in the postoperative period, drawing from suggestions from the AUA/ICUD white paper on *Anticoagulation and Antiplatelet Therapy in Urological Practice.*
m. Postoperative antimicrobial use should consider AUA best practice guidelines on urologic surgery antimicrobial prophylaxis, with special considerations for patients with urologic prosthetic devices and IUCs.
n. Postoperative blood transfusion is common after complex invasive urologic procedures, and decisions should be based on criteria outlined in the clinical practice guidelines from the AABB.
o. Palliative medicine may be relevant for some postoperative patients with poor prognosis, intractable symptoms and complex care. Providers should therefore

be aware of method to address these issues through treatment, consultation and referral.

p. Checklists may be useful to improve safety culture in the postoperative setting. The SURgical PAtient Safety System (SURPASS) checklist provides several postoperative checklists that can be incorporated into a surgeon's practice to reduce variation and improve standardized care.

2. Transition/Discharge
    a. Postoperative education and instructions should be clear and readable, including a description of possible complications, expectations for physical activity and wound management, and medication reconciliation.
    b. If possible, engagement with the family or caregiver can improve postoperative discharge planning and optimize postoperative outcomes.
    c. Medication management and reconciliation is vital to avoid errors during transition from the inpatient to outpatient setting.
    d. Coordination of care with a PCP after discharge can reduce medication errors and optimize outcomes.
    e. Home health services may provide a valuable source of support for managing complex postoperative recovery, navigating surgical tubes or drains, learning to care for a new urostomy or requiring physical therapy.
3. Follow-up and Surveillance
    a. Postoperative follow-up should focus on decreasing and preventing complications, reducing emergency visits, and preventing hospital readmissions.
    b. Non-oncologic surveillance varies and may depend on drain management, risk of postoperative morbidity, patient health factors, and billing.
    c. Oncologic surveillance can be determined using nationally recognized resources such as the AUA, NCCN, and EAU, which review the best evidence to date on recurrence patterns and finalize recommendations via expert panel discussions.
    d. Telehealth involves the remote delivery of healthcare services using telecommunications and may be employed postoperatively for scheduled follow-up, remote patient monitoring, and/or management of acute issues. While telehealth has many benefits, several barriers such as geographic location and service restriction may limit its use.
    e. PROs are defined as any report of the status of a patient's health condition that comes directly from the patient without interpretation by a clinician or anyone else. PROs correlate closely with clinical outcomes and should be incorporated into postoperative surveillance to improve communication, guide symptom management, and improve patient satisfaction.

References

1. Clay-Williams R and Colligan L. Back to basics: checklists in aviation and healthcare. BMJ Qual Saf 2015; 24**:** 428.
2. Lingard L, Espin S, Rubin B, et al. Getting teams to talk: development and pilot implementation of a checklist to promote interprofessional communication in the OR. Qual Saf Health Care 2005; 14**:** 340.
3. Makary MA, Holzmueller CG, Thompson D, et al. Operating room briefings: working on the same page. Jt Comm J Qual Patient Saf 2006; 32**:** 351.
4. World Health Organization. Surgical Safety Checklist. 2009. World Health Organization website. http://apps.who.int/iris/bitstream/handle/10665/44186/9789241598590_eng_Checklist.pdf;jsessionid=65FF7F124E3E3AC336E7D245BE39AFC0?sequence=2. July 17, 2018.
5. Reinertsen JL. Zen and the art of physician autonomy maintenance. Ann Intern Med 2003; 138**:** 992.
6. de Vries EN, Hollmann MW, Smorenburg SM, et al. Development and validation of the SURgical PAtient Safety System (SURPASS) checklist. Qual Saf Health Care 2009; 18**:** 121.
7. SURPASS SURgical Patient Safety System. 2011. SURPASS SURgical Patient Safety System website. https://www.surpass-checklist.nl/index_en.html. September 19, 2018.
8. McElroy LM, Collins KM, Koller FL, et al. Operating room to intensive care unit handoffs and the risks of patient harm. Surgery 2015; 158**:** 588.
9. Segall N, Bonifacio AS, Schroeder RA, et al. Can we make postoperative patient handovers safer? A systematic review of the literature. Anesth Analg 2012; 115**:** 102.
10. van Rensen EL, Groen ES, Numan SC, et al. Multitasking during patient handover in the recovery room. Anesth Analg 2012; 115**:** 1183.
11. Gleicher Y, Mosko JD and McGhee I. Improving cardiac operating room to intensive care unit handover using a standardised handover process. BMJ Open Qual 2017; 6**:** e000076.
12. Hall M, Robertson J, Merkel M, et al. A Structured Transfer of Care Process Reduces Perioperative Complications in Cardiac Surgery Patients. Anesth Analg 2017; 125**:** 477.
13. Agarwal HS, Saville BR, Slayton JM, et al. Standardized postoperative handover process improves outcomes in the intensive care unit: a model for operational sustainability and improved team performance*. Crit Care Med 2012; 40**:** 2109.
14. Caruso TJ, Marquez JL, Wu DS, et al. Implementation of a standardized postanesthesia care handoff increases information transfer without increasing handoff duration. Jt Comm J Qual Patient Saf 2015; 41**:** 35.
15. Weinger MB, Slagle JM, Kuntz AH, et al. A Multimodal Intervention Improves Postanesthesia Care Unit Handovers. Anesth Analg 2015; 121**:** 957.
16. Mukhopadhyay D, Wiggins-Dohlvik KC, MrDutt MM, et al. Implementation of a standardized handoff protocol for post-operative admissions to the surgical intensive care unit. Am J Surg 2018; 215**:** 28.
17. Petrovic MA, Aboumatar H, Scholl AT, et al. The perioperative handoff protocol: evaluating impacts on handoff defects and provider satisfaction in adult perianesthesia care units. J Clin Anesth 2015; 27**:** 111.
18. Dixon JL, Stagg HW, Wehbe-Janek H, et al. A standard handoff improves cardiac surgical patient transfer: operating room to intensive care unit. J Healthc Qual 2015; 37**:** 22.
19. Cleverley K, Mousavi N, Stronger L, et al. The impact of telemetry on survival of in-hospital cardiac arrests in non-critical care patients. Resuscitation 2013; 84**:** 878.
20. Benjamin EM, Klugman RA, Luckmann R, et al. Impact of cardiac telemetry on patient safety and cost. Am J Manag Care 2013; 19**:** e225.

21. Drew BJ, Califf RM, Funk M, et al. Practice standards for electrocardiographic monitoring in hospital settings: an American Heart Association scientific statement from the Councils on Cardiovascular Nursing, Clinical Cardiology, and Cardiovascular Disease in the Young: endorsed by the International Society of Computerized Electrocardiology and the American Association of Critical-Care Nurses. Circulation 2004; 110**:** 2721.
22. Sandau KE, Funk M, Auerbach A, et al. Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings: A Scientific Statement From the American Heart Association. Circulation 2017; 136**:** e273.
23. Funk M, Winkler CG, May JL, et al. Unnecessary arrhythmia monitoring and underutilization of ischemia and QT interval monitoring in current clinical practice: baseline results of the Practical Use of the Latest Standards for Electrocardiography trial. J Electrocardiol 2010; 43**:** 542.
24. CredibleMeds. Search for Drugs that Prolong QT & induce Torsades de Pointes. CredibleMeds website. https://www.crediblemeds.org/index.php/drugsearch. July 10, 2018.
25. Sun Z, Sessler DI, Dalton JE, et al. Postoperative Hypoxemia Is Common and Persistent: A Prospective Blinded Observational Study. Anesth Analg 2015; 121**:** 709.
26. Lee LA, Caplan RA, Stephens LS, et al. Postoperative opioid-induced respiratory depression: a closed claims analysis. Anesthesiology 2015; 122**:** 659.
27. Taenzer AH, Pyke J, Herrick MD, et al. A comparison of oxygen saturation data in inpatients with low oxygen saturation using automated continuous monitoring and intermittent manual data charting. Anesth Analg 2014; 118**:** 326.
28. Gupta K, Prasad A, Nagappa M, et al. Risk factors for opioid-induced respiratory depression and failure to rescue: a review. Curr Opin Anaesthesiol 2018; 31**:** 110.
29. Canet J, Gallart L, Gomar C, et al. Prediction of postoperative pulmonary complications in a population-based surgical cohort. Anesthesiology 2010; 113**:** 1338.
30. Fernandez-Bustamante A, Frendl G, Sprung J, et al. Postoperative Pulmonary Complications, Early Mortality, and Hospital Stay Following Noncardiothoracic Surgery: A Multicenter Study by the Perioperative Research Network Investigators. JAMA Surg 2017; 152**:** 157.
31. Gali B, Whalen FX, Schroeder DR, et al. Identification of patients at risk for postoperative respiratory complications using a preoperative obstructive sleep apnea screening tool and postanesthesia care assessment. Anesthesiology 2009; 110**:** 869.
32. Ramachandran SK, Thompson A, Pandit JJ, et al. Retrospective observational evaluation of postoperative oxygen saturation levels and associated postoperative respiratory complications and hospital resource utilization. PLoS One 2017; 12**:** e0175408.
33. Chung F, Memtsoudis SG, Ramachandran SK, et al. Society of Anesthesia and Sleep Medicine Guidelines on Preoperative Screening and Assessment of Adult Patients With Obstructive Sleep Apnea. Anesth Analg 2016; 123**:** 452.
34. Seet E and Chung F. Management of sleep apnea in adults - functional algorithms for the perioperative period: Continuing Professional Development. Can J Anaesth 2010; 57**:** 849.
35. American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep a. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2014; 120**:** 268.
36. Khanna AK, Sessler DI, Sun Z, et al. Using the STOP-BANG questionnaire to predict hypoxaemia in patients recovering from noncardiac surgery: a prospective cohort analysis. Br J Anaesth 2016; 116**:** 632.

37. Schumann R, Kwater AP, Bonney I, et al. Respiratory volume monitoring in an obese surgical population and the prediction of postoperative respiratory depression by the STOP-bang OSA risk score. J Clin Anesth 2016; 34**:** 295.
38. Voscopoulos CJ, MacNabb CM, Freeman J, et al. Continuous noninvasive respiratory volume monitoring for the identification of patients at risk for opioid-induced respiratory depression and obstructive breathing patterns. J Trauma Acute Care Surg 2014; 77**:** S208.
39. Stites M, Surprise J, McNiel J, et al. Continuous Capnography Reduces the Incidence of Opioid-Induced Respiratory Rescue by Hospital Rapid Resuscitation Team. J Patient Saf 2017;
40. Pedersen T, Nicholson A, Hovhannisyan K, et al. Pulse oximetry for perioperative monitoring. Cochrane Database Syst Rev 2014; CD002013.
41. Lam T, Nagappa M, Wong J, et al. Continuous Pulse Oximetry and Capnography Monitoring for Postoperative Respiratory Depression and Adverse Events: A Systematic Review and Meta-analysis. Anesth Analg 2017; 125**:** 2019.
42. Taenzer AH, Pyke JB, McGrath SP, et al. Impact of pulse oximetry surveillance on rescue events and intensive care unit transfers: a before-and-after concurrence study. Anesthesiology 2010; 112**:** 282.
43. Daneshmand S, Ahmadi H, Schuckman AK, et al. Enhanced recovery protocol after radical cystectomy for bladder cancer. J Urol 2014; 192**:** 50.
44. Tyson MD and Chang SS. Enhanced Recovery Pathways Versus Standard Care After Cystectomy: A Meta-analysis of the Effect on Perioperative Outcomes. Eur Urol 2016; 70**:** 995.
45. Hu JC, Gandaglia G, Karakiewicz PI, et al. Comparative effectiveness of robot-assisted versus open radical prostatectomy cancer control. Eur Urol 2014; 66**:** 666.
46. Koch MO. Robotic versus Open Prostatectomy: End of the Controversy. J Urol 2016; 196**:** 9.
47. Rogers C, Sukumar S and Gill IS. Robotic partial nephrectomy: the real benefit. Curr Opin Urol 2011; 21**:** 60.
48. Bochner BH, Dalbagni G, Sjoberg DD, et al. Comparing Open Radical Cystectomy and Robot-assisted Laparoscopic Radical Cystectomy: A Randomized Clinical Trial. Eur Urol 2015; 67**:** 1042.
49. Basse L, Hjort Jakobsen D, Billesbolle P, et al. A clinical pathway to accelerate recovery after colonic resection. Ann Surg 2000; 232**:** 51.
50. Ljungqvist O, Scott M and Fearon KC. Enhanced Recovery After Surgery: A Review. JAMA Surg 2017; 152**:** 292.
51. ERAS Society. 2016. ERAS Society website. www.erassociety.org. September 25, 2018.
52. Shafii M, Murphy DM, Donovan MG, et al. Is mechanical bowel preparation necessary in patients undergoing cystectomy and urinary diversion? BJU Int 2002; 89**:** 879.
53. Inman BA, Harel F, Tiguert R, et al. Routine nasogastric tubes are not required following cystectomy with urinary diversion: a comparative analysis of 430 patients. J Urol 2003; 170**:** 1888.
54. Chang SS, Cookson MS, Baumgartner RG, et al. Analysis of early complications after radical cystectomy: results of a collaborative care pathway. J Urol 2002; 167**:** 2012.
55. Wilmore DW and Kehlet H. Management of patients in fast track surgery. BMJ 2001; 322**:** 473.
56. Pruthi RS, Chun J and Richman M. Reducing time to oral diet and hospital discharge in patients undergoing radical cystectomy using a perioperative care plan. Urology 2003; 62**:** 661.
57. Arumainayagam N, McGrath J, Jefferson KP, et al. Introduction of an enhanced recovery protocol for radical cystectomy. BJU Int 2008; 101**:** 698.
58. Pruthi RS, Nielsen M, Smith A, et al. Fast track program in patients undergoing radical cystectomy: results in 362 consecutive patients. J Am Coll Surg 2010; 210**:** 93.
59. Di Rollo D, Mohammed A, Rawlinson A, et al. Enhanced recovery protocols in urological surgery: a systematic review. Can J Urol 2015; 22**:** 7817.

60. Lee CT, Chang SS, Kamat AM, et al. Alvimopan accelerates gastrointestinal recovery after radical cystectomy: a multicenter randomized placebo-controlled trial. Eur Urol 2014; 66**:** 265.
61. Cui Y, Chen H, Qi L, et al. Effect of alvimopan on accelerates gastrointestinal recovery after radical cystectomy: A systematic review and meta-analysis. Int J Surg 2016; 25**:** 1.
62. Park HK, Kwak C, Byun SS, et al. Early removal of nasogastric tube after cystectomy with urinary diversion: does postoperative ileus risk increase? Urology 2005; 65**:** 905.
63. Nelson R, Edwards S and Tse B. Prophylactic nasogastric decompression after abdominal surgery. Cochrane Database Syst Rev 2007; CD004929.
64. Adamakis I, Tyritzis SI, Koutalellis G, et al. Early removal of nasogastric tube is beneficial for patients undergoing radical cystectomy with urinary diversion. Int Braz J Urol 2011; 37**:** 42.
65. Choi H, Kang SH, Yoon DK, et al. Chewing gum has a stimulatory effect on bowel motility in patients after open or robotic radical cystectomy for bladder cancer: a prospective randomized comparative study. Urology 2011; 77**:** 884.
66. Kouba EJ, Wallen EM and Pruthi RS. Gum chewing stimulates bowel motility in patients undergoing radical cystectomy with urinary diversion. Urology 2007; 70**:** 1053.
67. Karl A, Buchner A, Becker A, et al. A new concept for early recovery after surgery for patients undergoing radical cystectomy for bladder cancer: results of a prospective randomized study. J Urol 2014; 191**:** 335.
68. Buchner A, Grimm T, Schneevoigt BS, et al. Dramatic impact of blood transfusion on cancer-specific survival after radical cystectomy irrespective of tumor stage. Scand J Urol 2017; 51**:** 130.
69. Xu W, Daneshmand S, Bazargani ST, et al. Postoperative Pain Management after Radical Cystectomy: Comparing Traditional versus Enhanced Recovery Protocol Pathway. J Urol 2015; 194**:** 1209.
70. Chipollini J, Tang DH, Hussein K, et al. Does Implementing an Enhanced Recovery After Surgery Protocol Increase Hospital Charges? Comparisons From a Radical Cystectomy Program at a Specialty Cancer Center. Urology 2017; 105**:** 108.
71. Nabhani J, Ahmadi H, Schuckman AK, et al. Cost Analysis of the Enhanced Recovery After Surgery Protocol in Patients Undergoing Radical Cystectomy for Bladder Cancer. Eur Urol Focus 2016; 2**:** 92.
72. Semerjian A, Milbar N, Kates M, et al. Hospital Charges and Length of Stay Following Radical Cystectomy in the Enhanced Recovery After Surgery Era. Urology 2018; 111**:** 86.
73. Leow JJ, Reese SW, Jiang W, et al. Propensity-matched comparison of morbidity and costs of open and robot-assisted radical cystectomies: a contemporary population-based analysis in the United States. Eur Urol 2014; 66**:** 569.
74. Hu JC, Chughtai B, O'Malley P, et al. Perioperative Outcomes, Health Care Costs, and Survival After Robotic-assisted Versus Open Radical Cystectomy: A National Comparative Effectiveness Study. Eur Urol 2016; 70**:** 195.
75. Ng CK, Kauffman EC, Lee MM, et al. A comparison of postoperative complications in open versus robotic cystectomy. Eur Urol 2010; 57**:** 274.
76. Kader AK, Richards KA, Krane LS, et al. Robot-assisted laparoscopic vs open radical cystectomy: comparison of complications and perioperative oncological outcomes in 200 patients. BJU Int 2013; 112**:** E290.
77. Musch M, Janowski M, Steves A, et al. Comparison of early postoperative morbidity after robot-assisted and open radical cystectomy: results of a prospective observational study. BJU Int 2014; 113**:** 458.
78. Parekh DJ, Reis IM, Castle EP, et al. Robot-assisted radical cystectomy versus open radical cystectomy in patients with bladder cancer (RAZOR): an open-label, randomised, phase 3, non-inferiority trial. Lancet 2018; 391**:** 2525.

79. Collins JW, Patel H, Adding C, et al. Enhanced Recovery After Robot-assisted Radical Cystectomy: EAU Robotic Urology Section Scientific Working Group Consensus View. Eur Urol 2016; 70**:** 649.
80. Chang SS, Bochner BH, Chou R, et al. Treatment of Non-Metastatic Muscle-Invasive Bladder Cancer: AUA/ASCO/ASTRO/SUO Guideline. J Urol 2017; 198**:** 552.
81. Zainfeld D and Djaladat H. Enhanced recovery after urologic surgery-Current applications and future directions. J Surg Oncol 2017; 116**:** 630.
82. White JV, Guenter P, Jensen G, et al. Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). JPEN J Parenter Enteral Nutr 2012; 36**:** 275.
83. Fearon K, Strasser F, Anker SD, et al. Definition and classification of cancer cachexia: an international consensus. Lancet Oncol 2011; 12**:** 489.
84. Rosenberg I. Summary Comments. Am J Clinical Nutrition 1989; 50**:** 1231.
85. Fearon KC. Cancer cachexia: developing multimodal therapy for a multidimensional problem. Eur J Cancer 2008; 44**:** 1124.
86. Skipper A, Ferguson M, Thompson K, et al. Nutrition screening tools: an analysis of the evidence. JPEN J Parenter Enteral Nutr 2012; 36**:** 292.
87. Butterworth CE, Jr. The skeleton in the hospital closet. Nutrition 1994; 10**:** 442.
88. Guenter P, Jensen G, Patel V, et al. Addressing Disease-Related Malnutrition in Hospitalized Patients: A Call for a National Goal. Jt Comm J Qual Patient Saf 2015; 41**:** 469.
89. Patel V, Romano M, Corkins MR, et al. Nutrition Screening and Assessment in Hospitalized Patients: A Survey of Current Practice in the United States. Nutr Clin Pract 2014; 29**:** 483.
90. Lim SL, Ong KC, Chan YH, et al. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. Clin Nutr 2012; 31**:** 345.
91. Norman K, Pichard C, Lochs H, et al. Prognostic impact of disease-related malnutrition. Clin Nutr 2008; 27**:** 5.
92. Tobert CM, Hamilton-Reeves JM, Norian LA, et al. Emerging Impact of Malnutrition on Surgical Patients: Literature Review and Potential Implications for Cystectomy in Bladder Cancer. J Urol 2017; 198**:** 511.
93. Tobert CM, Mott SL and Nepple KG. Malnutrition Diagnosis during Adult Inpatient Hospitalizations: Analysis of a Multi-Institutional Collaborative Database of Academic Medical Centers. J Acad Nutr Diet 2018; 118**:** 125.
94. Weiss AJ, Fingar KR, Barrett ML, et al: Characteristics of Hospital Stays Involving Malnutrition, 2013: Statistical Brief #210. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville (MD), 2006.
95. McCauley SM. Malnutrition Care: Preparing for the Next Level of Quality. J Acad Nutr Diet 2016; 116**:** 852.
96. Malnutrition Quality Improvement Initiative. 2018. Malnutrition Quality Improvement Initiative website. http://mqii.defeatmalnutrition.today/. September 25, 2018.
97. Wischmeyer PE, Carli F, Evans DC, et al. American Society for Enhanced Recovery and Perioperative Quality Initiative Joint Consensus Statement on Nutrition Screening and Therapy Within a Surgical Enhanced Recovery Pathway. Anesth Analg 2018; 126**:** 1883.
98. Lewis SJ, Egger M, Sylvester PA, et al. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. BMJ 2001; 323**:** 773.
99. Williams JD and Wischmeyer PE. Assessment of perioperative nutrition practices and attitudes-A national survey of colorectal and GI surgical oncology programs. Am J Surg 2017; 213**:** 1010.

100. Allard JP, Keller H, Jeejeebhoy KN, et al. Malnutrition at Hospital Admission-Contributors and Effect on Length of Stay: A Prospective Cohort Study From the Canadian Malnutrition Task Force. JPEN J Parenter Enteral Nutr 2016; 40**:** 487.
101. Cerantola Y, Valerio M, Hubner M, et al. Are patients at nutritional risk more prone to complications after major urological surgery? J Urol 2013; 190**:** 2126.
102. Psutka SP, Carrasco A, Schmit GD, et al. Sarcopenia in patients with bladder cancer undergoing radical cystectomy: impact on cancer-specific and all-cause mortality. Cancer 2014; 120**:** 2910.
103. Tappenden KA, Quatrara B, Parkhurst ML, et al. Critical role of nutrition in improving quality of care: an interdisciplinary call to action to address adult hospital malnutrition. J Acad Nutr Diet 2013; 113**:** 1219.
104. Kondrup J, Rasmussen HH, Hamberg O, et al. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr 2003; 22**:** 321.
105. Karl A, Rittler P, Buchner A, et al. Prospective assessment of malnutrition in urologic patients. Urology 2009; 73**:** 1072.
106. Karl A, Staehler M, Bauer R, et al. Malnutrition and clinical outcome in urological patients. Eur J Med Res 2011; 16**:** 469.
107. Roth B, Birkhauser FD, Zehnder P, et al. Parenteral nutrition does not improve postoperative recovery from radical cystectomy: results of a prospective randomised trial. Eur Urol 2013; 63**:** 475.
108. Kyle UG, Kossovsky MP, Karsegard VL, et al. Comparison of tools for nutritional assessment and screening at hospital admission: a population study. Clin Nutr 2006; 25**:** 409.
109. Detsky AS, McLaughlin JR, Baker JP, et al. What is subjective global assessment of nutritional status? JPEN J Parenter Enteral Nutr 1987; 11**:** 8.
110. Field LB and Hand RK. Differentiating malnutrition screening and assessment: a nutrition care process perspective. J Acad Nutr Diet 2015; 115**:** 824.
111. Wolfe RR. The underappreciated role of muscle in health and disease. Am J Clin Nutr 2006; 84**:** 475.
112. McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr 2016; 40**:** 159.
113. Milne AC, Potter J, Vivanti A, et al. Protein and energy supplementation in elderly people at risk from malnutrition. Cochrane Database Syst Rev 2009; CD003288.
114. Marik PE and Zaloga GP. Immunonutrition in high-risk surgical patients: a systematic review and analysis of the literature. JPEN J Parenter Enteral Nutr 2010; 34**:** 378.
115. Zheng Y, Li F, Qi B, et al. Application of perioperative immunonutrition for gastrointestinal surgery: a meta-analysis of randomized controlled trials. Asia Pac J Clin Nutr 2007; 16 Suppl 1**:** 253.
116. Mocellin MC, Camargo CQ, Nunes EA, et al. A systematic review and meta-analysis of the n-3 polyunsaturated fatty acids effects on inflammatory markers in colorectal cancer. Clin Nutr 2016; 35**:** 359.
117. Drover JW, Dhaliwal R, Weitzel L, et al. Perioperative use of arginine-supplemented diets: a systematic review of the evidence. J Am Coll Surg 2011; 212**:** 385.
118. Bertrand J, Siegler N, Murez T, et al. Impact of preoperative immunonutrition on morbidity following cystectomy for bladder cancer: a case-control pilot study. World J Urol 2014; 32**:** 233.
119. Hamilton-Reeves JM, Bechtel MD, Hand LK, et al. Effects of Immunonutrition for Cystectomy on Immune Response and Infection Rates: A Pilot Randomized Controlled Clinical Trial. Eur Urol 2016; 69**:** 389.

120. Declercq P, De Win G, Van der Aa F, et al. Reduced length of stay in radical cystectomy patients with oral versus parenteral post-operative nutrition protocol. Int J Clin Pharm 2015; 37**:** 379.
121. Andersen HK, Lewis SJ and Thomas S. Early enteral nutrition within 24h of colorectal surgery versus later commencement of feeding for postoperative complications. Cochrane Database Syst Rev 2006; CD004080.
122. BED REST, thrombosis, and embolism. Lancet 1958; 1**:** 465.
123. Pashikanti L and Von Ah D. Impact of early mobilization protocol on the medical-surgical inpatient population: an integrated review of literature. Clin Nurse Spec 2012; 26**:** 87.
124. Hirsch CH, Sommers L, Olsen A, et al. The natural history of functional morbidity in hospitalized older patients. J Am Geriatr Soc 1990; 38**:** 1296.
125. Kalisch BJ, Lee S and Dabney BW. Outcomes of inpatient mobilization: a literature review. J Clin Nurs 2014; 23**:** 1486.
126. Gustafsson UO, Scott MJ, Schwenk W, et al. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS((R))) Society recommendations. World J Surg 2013; 37**:** 259.
127. Kalisch BJ, Landstrom GL and Hinshaw AS. Missed nursing care: a concept analysis. J Adv Nurs 2009; 65**:** 1509.
128. Smart NJ, White P, Allison AS, et al. Deviation and failure of enhanced recovery after surgery following laparoscopic colorectal surgery: early prediction model. Colorectal Dis 2012; 14**:** e727.
129. Castelino T, Fiore JF, Jr., Niculiseanu P, et al. The effect of early mobilization protocols on postoperative outcomes following abdominal and thoracic surgery: A systematic review. Surgery 2016; 159**:** 991.
130. Toogood PA, Abdel MP, Spear JA, et al. The monitoring of activity at home after total hip arthroplasty. Bone Joint J 2016; 98-B**:** 1450.
131. Walker DJ, Heslop PS, Chandler C, et al. Measured ambulation and self-reported health status following total joint replacement for the osteoarthritic knee. Rheumatology (Oxford) 2002; 41**:** 755.
132. Berrios-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg 2017; 152**:** 784.
133. World Health Organization. Global guidelines on the prevention of surgical site infection. 2016. World Health Organization website. http://www.who.int/gpsc/ssi-prevention-guidelines/en/. July 12, 2018.
134. Wound Ostomy and Continence Nurses Society. Clinical Guideline: Wound Management. Mt. Laurel, NJ: Wound Ostomy and Continence Nurses Society, 2016.
135. De Vries FE, Wallert ED, Solomkin JS, et al. A systematic review and meta-analysis including GRADE qualification of the risk of surgical site infections after prophylactic negative pressure wound therapy compared with conventional dressings in clean and contaminated surgery. Medicine (Baltimore) 2016; 95**:** e4673.
136. Dumville JC, Owens GL, Crosbie EJ, et al. Negative pressure wound therapy for treating surgical wounds healing by secondary intention. Cochrane Database Syst Rev 2015; CD011278.
137. Webster J, Scuffham P, Stankiewicz M, et al. Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention. Cochrane Database Syst Rev 2014; CD009261.
138. Salvadalena G, Hendren S, McKenna L, et al. WOCN Society and AUA Position Statement on Preoperative Stoma Site Marking for Patients Undergoing Urostomy Surgery. 2014. Wound, Ostomy and Continence Nurses Society website. https://c.ymcdn.com/sites/www.wocn.org/resource/resmgr/Publications/AUA_Stoma_Site_Marking_PS_(2.pdf. September 25, 2018.

139. Adult Ostomy Home Skills Kit. American College of Surgeons website. https://www.facs.org/education/patient-education/skills-programs/ostomy-program/adult-ostomy. September 25, 2018.
140. Vaarala MH. Urinary Sample Collection Methods in Ileal Conduit Urinary Diversion Patients: A Randomized Control Trial. J Wound Ostomy Continence Nurs 2018; 45**:** 59.
141. Wound Ostomy and Continence Nurses Society. Clinical Guideline: Management of the Adult Patient with a Fecal or Urinary Ostomy. Mt. Laurel, NJ: Wound Ostomy and Continence Nurses Society, 2017.
142. Wound Ostomy and Continence Nurses Society. Core Curriculum: Ostomy Management. Mt. Laurel, NJ: Wound Ostomy and Continence Nurses Society, 2016.
143. Taneja C, Netsch D, Rolstad BS, et al. Clinical and Economic Burden of Peristomal Skin Complications in Patients With Recent Ostomies. J Wound Ostomy Continence Nurs 2017; 44**:** 350.
144. Herlufsen P, Olsen AG, Carlsen B, et al. Study of peristomal skin disorders in patients with permanent stomas. Br J Nurs 2006; 15**:** 854.
145. Nichols TR and Inglese GW. The Burden of Peristomal Skin Complications on an Ostomy Population as Assessed by Health Utility and the Physical Component Summary of the SF-36v2((R)). Value Health 2018; 21**:** 89.
146. Gould CV, Umscheid CA, Agarwal RK, et al. Guideline for Prevention of Catheter-Associated Urinary Tract Infections 2009. 2009. Centers for Disease Control website. https://www.cdc.gov/infectioncontrol/pdf/guidelines/cauti-guidelines.pdf. July 13, 2018.
147. Averch TA, Stoffel J, Goldman H, et al. Cather-Associated Urinary Tract Infections: Definitions and Significance in the Urologic Patient. 2014. American Urological Association website. http://www.auanet.org/guidelines/catheter-associated-urinary-tract-infections. July 13, 2018.
148. Daggulli M, Soylemez H, Bodakci MN, et al. Determining standard criteria for tubeless PCNL. Urolithiasis 2014; 42**:** 281.
149. Paul EM, Marcovich R, Lee BR, et al. Choosing the ideal nephrostomy tube. BJU Int 2003; 92**:** 672.
150. Nakada S and Patel S. Placement and management of indwelling ureteral stents. 2013. Ultra Medica website. http://ultra-medica.net/Uptodate21.6/contents/UTD.htm?14/56/15242?source=related_link. July 13, 2018.
151. Denstedt JD, Wollin TA and Reid G. Biomaterials used in urology: current issues of biocompatibility, infection, and encrustation. J Endourol 1998; 12**:** 493.
152. Chew BH, Paterson RF, Clinkscales KW, et al. In vivo evaluation of the third generation biodegradable stent: a novel approach to avoiding the forgotten stent syndrome. J Urol 2013; 189**:** 719.
153. Liatsikos EN, Karnabatidis D, Katsanos K, et al. Ureteral metal stents: 10-year experience with malignant ureteral obstruction treatment. J Urol 2009; 182**:** 2613.
154. Lange D, Bidnur S, Hoag N, et al. Ureteral stent-associated complications--where we are and where we are going. Nat Rev Urol 2015; 12**:** 17.
155. Song G, Lim B, Han KS, et al. Complications after polymeric and metallic ureteral stent placements including three types of fistula. J Endourol 2015; 29**:** 485.
156. Chen HC, Shen SH, Wang JH, et al. Parallel second stent placement for refractory ureteral stent malfunction in malignant ureteral obstruction. J Vasc Interv Radiol 2011; 22**:** 1012.
157. Park HK, Paick SH, Kim HG, et al. The impact of ureteral stent type on patient symptoms as determined by the ureteral stent symptom questionnaire: a prospective, randomized, controlled study. J Endourol 2015; 29**:** 367.

158. Barrett K, Foell K, Lantz A, et al. Best Stent Length Predicted by Simple CT Measurement Rather than Patient Height. J Endourol 2016; 30**:** 1029.
159. Damiano R, Autorino R, De Sio M, et al. Does the size of ureteral stent impact urinary symptoms and quality of life? A prospective randomized study. Eur Urol 2005; 48**:** 673.
160. Bultitude MF, Tiptaft RC, Glass JM, et al. Management of encrusted ureteral stents impacted in upper tract. Urology 2003; 62**:** 622.
161. Kneedler JA, Moss R, Pfister JI, et al. Wound drain systems in perioperative nursing. Aurora, CO: Pfiedler Enterprises, 2015.
162. Penrose drain. 2012. Clinical Medicine website. http://acuclinic.com.au/pocit/PenroseDrain.htm. July 20, 2018.
163. Gan TJ, Habib AS, Miller TE, et al. Incidence, patient satisfaction, and perceptions of post-surgical pain: results from a US national survey. Curr Med Res Opin 2014; 30**:** 149.
164. Chou R, Gordon DB, de Leon-Casasola OA, et al. Management of Postoperative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. J Pain 2016; 17**:** 131.
165. Baker JA, Avorn J, Levin R, et al. Opioid Prescribing After Surgical Extraction of Teeth in Medicaid Patients, 2000-2010. JAMA 2016; 315**:** 1653.
166. Wunsch H, Wijeysundera DN, Passarella MA, et al. Opioids Prescribed After Low-Risk Surgical Procedures in the United States, 2004-2012. JAMA 2016; 315**:** 1654.
167. Hill MV, McMahon ML, Stucke RS, et al. Wide Variation and Excessive Dosage of Opioid Prescriptions for Common General Surgical Procedures. Ann Surg 2017; 265**:** 709.
168. Auffenberg GB, Dunn, R., Qin, Y., Winkleman, T., Dupree, J. PD58-05 Contributing to crisis? defining national patterns in opioid prescribing after outpatient vasectomy. J Urol 2017; 197**:** e1128.
169. Borza T, Dunn, R.L., Qui, Y., Winkelman, T.N. MP75-04 Variation in national opioid prescribing patterns following outpatient nephrolithiasis procedures. J Urol 2017; 197**:** e 1004.
170. Brummett CM, Waljee JF, Goesling J, et al. New Persistent Opioid Use After Minor and Major Surgical Procedures in US Adults. JAMA Surg 2017; 152**:** e170504.
171. American Urological Association. AUA list of 15 things physicians and patients should question. 2017. American Urological Association website. http://www.auanet.org/practice-resources/patient-safety-and-quality-of-care/choosing-wisely. July 13, 2018.
172. Elia N, Lysakowski C and Tramer MR. Does multimodal analgesia with acetaminophen, nonsteroidal antiinflammatory drugs, or selective cyclooxygenase-2 inhibitors and patient-controlled analgesia morphine offer advantages over morphine alone? Meta-analyses of randomized trials. Anesthesiology 2005; 103**:** 1296.
173. McDaid C, Maund E, Rice S, et al. Paracetamol and selective and non-selective non-steroidal anti-inflammatory drugs (NSAIDs) for the reduction of morphine-related side effects after major surgery: a systematic review. Health Technol Assess 2010; 14**:** 1.
174. Palumbo V, Giannarini G, Crestani A, et al. Enhanced Recovery After Surgery Pathway in Patients Undergoing Open Radical Cystectomy Is Safe and Accelerates Bowel Function Recovery. Urology 2018; 115**:** 125.
175. Matulewicz RS, Brennan J, Pruthi RS, et al. Radical Cystectomy Perioperative Care Redesign. Urology 2015; 86**:** 1076.
176. Ruetzler K, Blome CJ, Nabecker S, et al. A randomised trial of oral versus intravenous opioids for treatment of pain after cardiac surgery. J Anesth 2014; 28**:** 580.
177. Hudcova J, McNicol E, Quah C, et al. Patient controlled opioid analgesia versus conventional opioid analgesia for postoperative pain. Cochrane Database Syst Rev 2006; CD003348.

178. George JA, Lin EE, Hanna MN, et al. The effect of intravenous opioid patient-controlled analgesia with and without background infusion on respiratory depression: a meta-analysis. J Opioid Manag 2010; 6**:** 47.
179. Grundmann U, Wornle C, Biedler A, et al. The efficacy of the non-opioid analgesics parecoxib, paracetamol and metamizol for postoperative pain relief after lumbar microdiscectomy. Anesth Analg 2006; 103**:** 217.
180. Hernandez-Palazon J, Tortosa JA, Martinez-Lage JF, et al. Intravenous administration of propacetamol reduces morphine consumption after spinal fusion surgery. Anesth Analg 2001; 92**:** 1473.
181. McNicol ED, Tzortzopoulou A, Cepeda MS, et al. Single-dose intravenous paracetamol or propacetamol for prevention or treatment of postoperative pain: a systematic review and meta-analysis. Br J Anaesth 2011; 106**:** 764.
182. Brett CN, Barnett SG and Pearson J. Postoperative plasma paracetamol levels following oral or intravenous paracetamol administration: a double-blind randomised controlled trial. Anaesth Intensive Care 2012; 40**:** 166.
183. Pettersson PH, Jakobsson J and Owall A. Intravenous acetaminophen reduced the use of opioids compared with oral administration after coronary artery bypass grafting. J Cardiothorac Vasc Anesth 2005; 19**:** 306.
184. Aubrun F, Langeron O, Heitz D, et al. Randomised, placebo-controlled study of the postoperative analgesic effects of ketoprofen after spinal fusion surgery. Acta Anaesthesiol Scand 2000; 44**:** 934.
185. DeAndrade JR, Maslanka M, Reines HD, et al. Ketorolac versus meperidine for pain relief after orthopaedic surgery. Clin Orthop Relat Res 1996; 301.
186. Gimbel JS, Brugger A, Zhao W, et al. Efficacy and tolerability of celecoxib versus hydrocodone/acetaminophen in the treatment of pain after ambulatory orthopedic surgery in adults. Clin Ther 2001; 23**:** 228.
187. Kara C, Resorlu B, Cicekbilek I, et al. Analgesic efficacy and safety of nonsteroidal anti-inflammatory drugs after transurethral resection of prostate. Int Braz J Urol 2010; 36**:** 49.
188. Mazaris EM, Varkarakis I, Chrisofos M, et al. Use of nonsteroidal anti-inflammatory drugs after radical retropubic prostatectomy: a prospective, randomized trial. Urology 2008; 72**:** 1293.
189. Trabulsi EJ, Patel J, Viscusi ER, et al. Preemptive multimodal pain regimen reduces opioid analgesia for patients undergoing robotic-assisted laparoscopic radical prostatectomy. Urology 2010; 76**:** 1122.
190. Routh JC, Graham DA and Nelson CP. Ketorolac is underutilized after ureteral reimplantation despite reduced hospital cost and reduced length of stay. Urology 2010; 76**:** 9.
191. Paech MJ, Kaye R, Baber C, et al. Recovery characteristics of patients receiving either sugammadex or neostigmine and glycopyrrolate for reversal of neuromuscular block: a randomised controlled trial. Anaesthesia 2018; 73**:** 340.
192. Li ALK, Wadsworth K, Siddiqui NT, et al. Does low-dose gapapentin reduce opioid use postoperatively?: A randomized controlled trial in women undergoing reconstructive pelvic surgery. Int Urogynecol J 2018; doi: 10.1007/s00192.
193. Reagan KML, O'Sullivan DM, Gannon R, et al. Decreasing postoperative narcotics in reconstructive pelvic surgery: a randomized controlled trial. Am J Obstet Gynecol 2017; 217**:** 325 e1.
194. Straube S, Derry S, Moore RA, et al. Single dose oral gabapentin for established acute postoperative pain in adults. Cochrane Database Syst Rev 2010; CD008183.

195. Azawi NH, Mosholt KS and Fode M. Unilateral Ultrasound-Guided Transversus Abdominis Plane Block After Nephrectomy; Postoperative Pain and Use of Opioids. Nephrourol Mon 2016; 8**:** e35356.
196. Elnabtity AM and Shabana WM. Unilateral versus bilateral ultrasound-guided transversus abdominis plane blocks during ureteric shock wave lithotripsy: A prospective randomized trial. Urol Ann 2016; 8**:** 265.
197. Qu G, Cui XL, Liu HJ, et al. Ultrasound-guided Transversus Abdominis Plane Block Improves Postoperative Analgesia and Early Recovery in Patients Undergoing Retroperitoneoscopic Urologic Surgeries: A Randomized Controlled Double-blinded Trial. Chin Med Sci J 2016; 31**:** 137.
198. Sternlicht A, Shapiro M, Robelen G, et al. Infiltration of liposome bupivacaine into the transversus abdominis plane for postsurgical analgesia in robotic laparoscopic prostatectomy: a pilot study. Local Reg Anesth 2014; 7**:** 69.
199. Matulewicz RS, Patel M, Jordan BJ, et al. Transversus Abdominis Plane Blockade as Part of a Multimodal Postoperative Analgesia Plan in Patients Undergoing Radical Cystectomy. Bladder Cancer 2018; 4**:** 161.
200. Nishimori M, Ballantyne JC and Low JH. Epidural pain relief versus systemic opioid-based pain relief for abdominal aortic surgery. Cochrane Database Syst Rev 2006; CD005059.
201. Popping DM, Elia N, Marret E, et al. Protective effects of epidural analgesia on pulmonary complications after abdominal and thoracic surgery: a meta-analysis. Arch Surg 2008; 143**:** 990.
202. Popping DM, Elia N, Van Aken HK, et al. Impact of epidural analgesia on mortality and morbidity after surgery: systematic review and meta-analysis of randomized controlled trials. Ann Surg 2014; 259**:** 1056.
203. Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. BMJ 2000; 321**:** 1493.
204. Warren-Stomberg M, Brattwall M and Jakobsson JG. Non-opioid analgesics for pain management following ambulatory surgery: a review. Minerva Anestesiol 2013; 79**:** 1077.
205. White PF. The role of non-opioid analgesic techniques in the management of pain after ambulatory surgery. Anesth Analg 2002; 94**:** 577.
206. White PF. Multimodal analgesia: its role in preventing postoperative pain. Curr Opin Investig Drugs 2008; 9**:** 76.
207. Benedetti F, Amanzio M, Casadio C, et al. Control of postoperative pain by transcutaneous electrical nerve stimulation after thoracic operations. Ann Thorac Surg 1997; 63**:** 773.
208. Gilbert JM, Gledhill T, Law N, et al. Controlled trial of transcutaneous electrical nerve stimulation (TENS) for postoperative pain relief following inguinal herniorrhaphy. Br J Surg 1986; 73**:** 749.
209. Hamza MA, White PF, Ahmed HE, et al. Effect of the frequency of transcutaneous electrical nerve stimulation on the postoperative opioid analgesic requirement and recovery profile. Anesthesiology 1999; 91**:** 1232.
210. Deng G, Rusch V, Vickers A, et al. Randomized controlled trial of a special acupuncture technique for pain after thoracotomy. J Thorac Cardiovasc Surg 2008; 136**:** 1464.
211. Kotani N, Hashimoto H, Sato Y, et al. Preoperative intradermal acupuncture reduces postoperative pain, nausea and vomiting, analgesic requirement, and sympathoadrenal responses. Anesthesiology 2001; 95**:** 349.
212. Ntritsou V, Mavrommatis C, Kostoglou C, et al. Effect of perioperative electroacupuncture as an adjunctive therapy on postoperative analgesia with tramadol and ketamine in prostatectomy: a randomised sham-controlled single-blind trial. Acupunct Med 2014; 32**:** 215.
213. Gould MK, Garcia DA, Wren SM, et al. Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 2012; 141**:** e227S.

214. Rogers SO, Jr., Kilaru RK, Hosokawa P, et al. Multivariable predictors of postoperative venous thromboembolic events after general and vascular surgery: results from the patient safety in surgery study. J Am Coll Surg 2007; 204**:** 1211.
215. Caprini JA. Thrombosis risk assessment as a guide to quality patient care. Dis Mon 2005; 51**:** 70.
216. Caprini JA, Arcelus JI, Hasty JH, et al. Clinical assessment of venous thromboembolic risk in surgical patients. Semin Thromb Hemost 1991; 17 Suppl 3**:** 304.
217. Bergqvist D. Enoxaparin: a pharmacoeconomic review of its use in the prevention and treatment of venous thromboembolism and in acute coronary syndromes. Pharmacoeconomics 2002; 20**:** 225.
218. Bergqvist D, Burmark US, Flordal PA, et al. Low molecular weight heparin started before surgery as prophylaxis against deep vein thrombosis: 2500 versus 5000 XaI units in 2070 patients. Br J Surg 1995; 82**:** 496.
219. Alberts BD, Woldu SL, Weinberg AC, et al. Venous thromboembolism after major urologic oncology surgery: a focus on the incidence and timing of thromboembolic events after 27,455 operations. Urology 2014; 84**:** 799.
220. Bottaro FJ, Elizondo MC, Doti C, et al. Efficacy of extended thrombo-prophylaxis in major abdominal surgery: what does the evidence show? A meta-analysis. Thromb Haemost 2008; 99**:** 1104.
221. Rasmussen MS, Jorgensen LN and Wille-Jorgensen P. Prolonged thromboprophylaxis with low molecular weight heparin for abdominal or pelvic surgery. Cochrane Database Syst Rev 2009; CD004318.
222. Kakkar VV, Balibrea JL, Martinez-Gonzalez J, et al. Extended prophylaxis with bemiparin for the prevention of venous thromboembolism after abdominal or pelvic surgery for cancer: the CANBESURE randomized study. J Thromb Haemost 2010; 8**:** 1223.
223. Pariser JJ, Pearce SM, Anderson BB, et al. Extended Duration Enoxaparin Decreases the Rate of Venous Thromboembolic Events after Radical Cystectomy Compared to Inpatient Only Subcutaneous Heparin. J Urol 2017; 197**:** 302.
224. Schomburg J, Krishna S, Soubra A, et al. Extended outpatient chemoprophylaxis reduces venous thromboembolism after radical cystectomy. Urol Oncol 2018; 36**:** 77 e9.
225. Kukreja JE, Levey HR, Scosyrev E, et al. Effectiveness and safety of extended-duration prophylaxis for venous thromboembolism in major urologic oncology surgery. Urol Oncol 2015; 33**:** 387 e7.
226. Sun AJ, Djaladat H, Schuckman A, et al. Venous thromboembolism following radical cystectomy: significant predictors, comparison of different anticoagulants and timing of events. J Urol 2015; 193**:** 565.
227. VanDlac AA, Cowan NG, Chen Y, et al. Timing, incidence and risk factors for venous thromboembolism in patients undergoing radical cystectomy for malignancy: a case for extended duration pharmacological prophylaxis. J Urol 2014; 191**:** 943.
228. Quek ML, Stein JP, Daneshmand S, et al. A critical analysis of perioperative mortality from radical cystectomy. J Urol 2006; 175**:** 886.
229. Culkin DJ, Exaire EJ, Green D, et al. Anticoagulation and antiplatelet therapy in urological practice: ICUD/AUA review paper. J Urol 2014; 192**:** 1026.
230. Wolf JS, Jr., Bennett CJ, Dmochowski RR, et al. Best practice policy statement on urologic surgery antimicrobial prophylaxis. J Urol 2008; 179**:** 1379.
231. Wosnitzer MS and Greenfield JM. Antibiotic patterns with inflatable penile prosthesis insertion. J Sex Med 2011; 8**:** 1521.

232. Adamsky MA, Boysen WR, Cohen AJ, et al. Evaluating the Role of Postoperative Oral Antibiotic Administration in Artificial Urinary Sphincter and Inflatable Penile Prosthesis Explantation: A Nationwide Analysis. Urology 2018; 111**:** 92.
233. Vricella GJ, Finelli A, Alibhai SM, et al. The true risk of blood transfusion after nephrectomy for renal masses: a population-based study. BJU Int 2013; 111**:** 1294.
234. Sun M, Bianchi M, Trinh QD, et al. Hospital volume is a determinant of postoperative complications, blood transfusion and length of stay after radical or partial nephrectomy. J Urol 2012; 187**:** 405.
235. Henderson JM, Pitcher D, Steenkamp R, et al. Patient and disease factors predictive of adverse perioperative outcomes after nephrectomy. Ann R Coll Surg Engl 2016; 98**:** 314.
236. Carson JL, Triulzi DJ and Ness PM. Indications for and Adverse Effects of Red-Cell Transfusion. N Engl J Med 2017; 377**:** 1261.
237. Cata JP, Lasala J, Pratt G, et al. Association between Perioperative Blood Transfusions and Clinical Outcomes in Patients Undergoing Bladder Cancer Surgery: A Systematic Review and Meta-Analysis Study. J Blood Transfus 2016; 2016**:** 9876394.
238. Wang YL, Jiang B, Yin FF, et al. Perioperative Blood Transfusion Promotes Worse Outcomes of Bladder Cancer after Radical Cystectomy: A Systematic Review and Meta-Analysis. PLoS One 2015; 10**:** e0130122.
239. Vetterlein MW, Gild P, Kluth LA, et al. Peri-operative allogeneic blood transfusion does not adversely affect oncological outcomes after radical cystectomy for urinary bladder cancer: a propensity score-weighted European multicentre study. BJU Int 2018; 121**:** 101.
240. Park YH, Kim YJ, Kang SH, et al. Association between Perioperative Blood Transfusion and Oncologic Outcomes after Curative Surgery for Renal Cell Carcinoma. J Cancer 2016; 7**:** 965.
241. Linder BJ, Thompson RH, Leibovich BC, et al. The impact of perioperative blood transfusion on survival after nephrectomy for non-metastatic renal cell carcinoma (RCC). BJU Int 2014; 114**:** 368.
242. Carson JL, Guyatt G, Heddle NM, et al. Clinical Practice Guidelines From the AABB: Red Blood Cell Transfusion Thresholds and Storage. JAMA 2016; 316**:** 2025.
243. Docherty AB, O'Donnell R, Brunskill S, et al. Effect of restrictive versus liberal transfusion strategies on outcomes in patients with cardiovascular disease in a non-cardiac surgery setting: systematic review and meta-analysis. BMJ 2016; 352**:** i1351.
244. Chong MA, Krishnan R, Cheng D, et al. Should Transfusion Trigger Thresholds Differ for Critical Care Versus Perioperative Patients? A Meta-Analysis of Randomized Trials. Crit Care Med 2018; 46**:** 252.
245. Fominskiy E, Putzu A, Monaco F, et al. Liberal transfusion strategy improves survival in perioperative but not in critically ill patients. A meta-analysis of randomised trials. Br J Anaesth 2015; 115**:** 511.
246. American Society of Anesthesiologists Task Force on Perioperative Blood M. Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management*. Anesthesiology 2015; 122**:** 241.
247. Peters F, Ellermann I and Steinbicker AU. Intravenous Iron for Treatment of Anemia in the 3 Perisurgical Phases: A Review and Analysis of the Current Literature. Anesth Analg 2018; 126**:** 1268.
248. Perelman I, Winter R, Sikora L, et al. The Efficacy of Postoperative Iron Therapy in Improving Clinical and Patient-Centered Outcomes Following Surgery: A Systematic Review and Meta-Analysis. Transfus Med Rev 2018; 32**:** 89.

249. Keeler BD, Simpson JA, Ng O, et al. Randomized clinical trial of preoperative oral versus intravenous iron in anaemic patients with colorectal cancer. Br J Surg 2017; 104**:** 214.
250. Hughes MT and Smith TJ. The growth of palliative care in the United States. Annu Rev Public Health 2014; 35**:** 459.
251. World Health Organization. WHO Definition of Palliative Care. World Health Organization website. http://www.who.int/cancer/palliative/definition/en/. July 16, 2018.
252. Dumanovsky T, Rogers M, Spragens LH, et al. Impact of Staffing on Access to Palliative Care in U.S. Hospitals. J Palliat Med 2015; 18**:** 998.
253. Enck RE. The role of palliative surgery in hospice care. Am J Hosp Palliat Care 1991; 8**:** 3.
254. Wu JN, Meyers FJ and Evans CP. Palliative care in urology. Surg Clin North Am 2011; 91**:** 429.
255. Ok JH, Meyers FJ and Evans CP. Medical and surgical palliative care of patients with urological malignancies. J Urol 2005; 174**:** 1177.
256. Dunn GP, Martensen R, and Weissman D, eds. Surgical palliative care: a resident's guide. 2009. American College of Surgeons website. https://www.facs.org/~/media/files/education/palliativecare/surgicalpalliativecareresidents.ashx. February 26, 2018.
257. Baile WF, Buckman R, Schapira L, et al. Breaking bad news: more than just guidelines. J Clin Oncol 2006; 24**:** 3217; author reply 3217.
258. Ambuel B and Mazzone MF. Breaking bad news and discussing death. Prim Care 2001; 28**:** 249.
259. Hinshaw DB. Spiritual issues in surgical palliative care. Surg Clin North Am 2005; 85**:** 257.
260. Singer PA, Martin DK and Kelner M. Quality end-of-life care: patients' perspectives. JAMA 1999; 281**:** 163.
261. Milch RA. The surgeon-patient relationship in advanced illness. Surg Oncol Clin N Am 2001; 10**:** 25.
262. Rivet EB, Ferrada P, Albrecht T, et al. Characteristics of palliative care consultation at an academic level one trauma center. Am J Surg 2017; 214**:** 657.
263. Agency for Healthcare Research and Quality. Agency for Healthcare Research and Quality literacy universal precautions toolkit, second edition. 2017. Agency for Healthcare Research and Quality website. https://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/literacy-toolkit/index.html. July 17, 2018.
264. Abrams MA, Hung LL, Kashuba AB, et al. Health literacy and patient safety: Help patients understand. Reducing the risk by designing a safer, shame-free health care environment. 2007. Portal of Geriatrics Online Education website. https://www.pogoe.org/sites/default/files/Health%20Literacy%20-%20Reducing%20the%20Risk%20by%20Designing%20a%20Safe,%20Shame-Free%20Health%20Care%20Environment.pdf. July 17, 2018.
265. Weiss, BD. Health literacy and patient safety: Help patients understand. Manual for clinicians, Second edition. 2007. Florida State University College of Medicine website. https://med.fsu.edu/userFiles/file/ahec_health_clinicians_manual.pdf. July 17, 2018.
266. McGuire LC. Remembering what the doctor said: organization and adults' memory for medical information. Exp Aging Res 1996; 22**:** 403.
267. Krishnan N, Liu X, Lavieri MS, et al. A Model to Optimize Followup Care and Reduce Hospital Readmissions after Radical Cystectomy. J Urol 2016; 195**:** 1362.
268. Van De Graaff M, Beesley SJ, Butler J, et al. Partners in Healing: Postsurgical Outcomes After Family Involvement in Nursing Care. Chest 2018; 153**:** 572.
269. Moore C, Wisnivesky J, Williams S, et al. Medical errors related to discontinuity of care from an inpatient to an outpatient setting. J Gen Intern Med 2003; 18**:** 646.

270. Tam VC, Knowles SR, Cornish PL, et al. Frequency, type and clinical importance of medication history errors at admission to hospital: a systematic review. CMAJ 2005; 173**:** 510.
271. Cornish PL, Knowles SR, Marchesano R, et al. Unintended medication discrepancies at the time of hospital admission. Arch Intern Med 2005; 165**:** 424.
272. Marotti SB, Kerridge RK and Grimer MD. A randomised controlled trial of pharmacist medication histories and supplementary prescribing on medication errors in postoperative medications. Anaesth Intensive Care 2011; 39**:** 1064.
273. Schnipper JL, Kirwin JL, Cotugno MC, et al. Role of pharmacist counseling in preventing adverse drug events after hospitalization. Arch Intern Med 2006; 166**:** 565.
274. Bond CA and Raehl CL. Clinical pharmacy services, pharmacy staffing, and adverse drug reactions in United States hospitals. Pharmacotherapy 2006; 26**:** 735.
275. Mohanty S, Rosenthal RA, Russell MM, et al. Optimal Perioperative Management of the Geriatric Patient: A Best Practices Guideline from the American College of Surgeons NSQIP and the American Geriatrics Society. J Am Coll Surg 2016; 222**:** 930.
276. National Committee for Quality Assurance. Medication reconciliation post-discharge HEDIS measure. 2016. National Committee for Quality Assurance website. http://www.ncqa.org/report-cards/health-plans/state-of-health-care-quality/2017-table-of-contents/medication-reconciliation-post-discharge. July 17, 2018.
277. Moore C, McGinn T and Halm E. Tying up loose ends: discharging patients with unresolved medical issues. Arch Intern Med 2007; 167**:** 1305.
278. Kripalani S, Jackson AT, Schnipper JL, et al. Promoting effective transitions of care at hospital discharge: a review of key issues for hospitalists. J Hosp Med 2007; 2**:** 314.
279. Misky GJ, Wald HL and Coleman EA. Post-hospitalization transitions: Examining the effects of timing of primary care provider follow-up. J Hosp Med 2010; 5**:** 392.
280. Jencks SF, Williams MV and Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med 2009; 360**:** 1418.
281. Kaye DR, Syrjamaki J, Ellimoottil C, et al. Use of Routine Home Health Care and Deviations From an Uncomplicated Recovery Pathway After Radical Prostatectomy. Urology 2018; 112**:** 74.
282. Sanford DE, Olsen MA, Bommarito KM, et al. Association of discharge home with home health care and 30-day readmission after pancreatectomy. J Am Coll Surg 2014; 219**:** 875.
283. Ponzio DY, Park AG, Bhat SB, et al. Can We Reduce the Utilization of Home-Visiting Nurse Services After Primary Total Joint Arthroplasty? J Arthroplasty 2016; 31**:** 50.
284. Gore JL, Lai J, Gilbert SM, et al. Readmissions in the postoperative period following urinary diversion. World J Urol 2011; 29**:** 79.
285. Hu M, Jacobs BL, Montgomery JS, et al. Sharpening the focus on causes and timing of readmission after radical cystectomy for bladder cancer. Cancer 2014; 120**:** 1409.
286. Borza T, Jacobs BL, Montgomery JS, et al. No Differences in Population-based Readmissions After Open and Robotic-assisted Radical Cystectomy: Implications for Post-discharge Care. Urology 2017; 104**:** 77.
287. Lorentz CA, Gilbert K, Alemozaffar M, et al. Risk of Readmission After Uncomplicated Hospitalization After Radical Cystectomy. Clin Genitourin Cancer 2018;
288. James AC, Izard JP, Holt SK, et al. Root Causes and Modifiability of 30-Day Hospital Readmissions after Radical Cystectomy for Bladder Cancer. J Urol 2016; 195**:** 894.
289. Djaladat H, Katebian B, Bazargani ST, et al. 90-Day complication rate in patients undergoing radical cystectomy with enhanced recovery protocol: a prospective cohort study. World J Urol 2017; 35**:** 907.
290. American Urological Association. American Urological Association Guidelines. 2018. American Urological Association website.

http://www.auanet.org/guidelines?q=&filters=&ContentType=Clinical_Guidelines|. February 25, 2018.
291. National Comprehensive Cancer Network. National Comprehensive Cancer Network Guidelines for Treatment of Cancer by Site. 2018. National Comprehensive Cancer Network website. https://www.nccn.org/professionals/physician_gls/default.aspx#site. February 25, 2018.
292. European Association of Urology. European Association of Urology Oncology Guidelines. 2018. European Association of Urology website. http://uroweb.org/individual-guidelines/oncology-guidelines/. February 25, 2018.
293. Dalbagni G, Bochner BH, Cronin A, et al. A plea for a uniform surveillance schedule after radical cystectomy. J Urol 2011; 185**:** 2091.
294. Feuerstein MA, Atoria CL, Pinheiro LC, et al. Patterns of surveillance imaging after nephrectomy in the Medicare population. BJU Int 2016; 117**:** 280.
295. Kim EH, Vetter JM, Kuxhausen AN, et al. Limited use of surveillance imaging following nephrectomy for renal cell carcinoma. Urol Oncol 2016; 34**:** 237 e11.
296. Boorjian SA, Tollefson MK, Cheville JC, et al. Detection of asymptomatic recurrence during routine oncological followup after radical cystectomy is associated with improved patient survival. J Urol 2011; 186**:** 1796.
297. Merrill SB KM, Lehman EB, Lehman KK, Raman JD: Capturing Renal Cell Carcinoma Recurrences when Asymptomatic Improves Patient Survival. Boston, MA: American Urological Association 2017 Annual Meeting, 2017.
298. Strope SA, Chang SH, Chen L, et al. Survival impact of followup care after radical cystectomy for bladder cancer. J Urol 2013; 190**:** 1698.
299. Tarin TV, Sonn G and Shinghal R. Estimating the risk of cancer associated with imaging related radiation during surveillance for stage I testicular cancer using computerized tomography. J Urol 2009; 181**:** 627.
300. Su D, Faiena I, Tokarz R, et al. Comparative analysis of the risk of radiation exposure and cost of reduced imaging intensity for surveillance of early-stage nonseminomatous germ cell tumors. Urology 2015; 85**:** 141.
301. Koch L, Jansen L, Brenner H, et al. Fear of recurrence and disease progression in long-term (>/= 5 years) cancer survivors--a systematic review of quantitative studies. Psychooncology 2013; 22**:** 1.
302. Skaali T, Fossa SD, Bremnes R, et al. Fear of recurrence in long-term testicular cancer survivors. Psychooncology 2009; 18**:** 580.
303. Stiggelbout AM, de Haes JC, Vree R, et al. Follow-up of colorectal cancer patients: quality of life and attitudes towards follow-up. Br J Cancer 1997; 75**:** 914.
304. Boyajian RN, Grose A, Grenon N, et al. Desired elements and timing of cancer survivorship care: one approach may not fit all. J Oncol Pract 2014; 10**:** e293.
305. Thompson CA, Charlson ME, Schenkein E, et al. Surveillance CT scans are a source of anxiety and fear of recurrence in long-term lymphoma survivors. Ann Oncol 2010; 21**:** 2262.
306. Stewart SB, Thompson RH, Psutka SP, et al. Evaluation of the National Comprehensive Cancer Network and American Urological Association renal cell carcinoma surveillance guidelines. J Clin Oncol 2014; 32**:** 4059.
307. Stewart-Merrill SB, Boorjian SA, Thompson RH, et al. Evaluation of current surveillance guidelines following radical cystectomy and proposal of a novel risk-based approach. Urol Oncol 2015; 33**:** 339 e1.
308. Abdollah F, Suardi N, Capitanio U, et al. The key role of time in predicting progression-free survival in patients with renal cell carcinoma treated with partial or radical nephrectomy: conditional survival analysis. Urol Oncol 2014; 32**:** 43 e9.

309. Bianchi M, Becker A, Hansen J, et al. Conditional survival after nephrectomy for renal cell carcinoma (RCC): changes in future survival probability over time. BJU Int 2013; 111: E283.
310. Merrill RM and Hunter BD. Conditional survival among cancer patients in the United States. Oncologist 2010; 15: 873.
311. Skuladottir H and Olsen JH. Conditional survival of patients with the four major histologic subgroups of lung cancer in Denmark. J Clin Oncol 2003; 21: 3035.
312. Kutikov A, Egleston BL, Wong YN, et al. Evaluating overall survival and competing risks of death in patients with localized renal cell carcinoma using a comprehensive nomogram. J Clin Oncol 2010; 28: 311.
313. Merrill SB, Boorjian SA, Thompson RH, et al. Oncologic surveillance following radical cystectomy: an individualized risk-based approach. World J Urol 2017; 35: 1863.
314. Stewart-Merrill SB, Thompson RH, Boorjian SA, et al. Oncologic Surveillance After Surgical Resection for Renal Cell Carcinoma: A Novel Risk-Based Approach. J Clin Oncol 2015; 33: 4151.
315. Ellimoottil C, Boxer, R.J. Bringing surgical care to the home through video visits. JAMA Surg 2018; 153: 177.
316. Ellimoottil C, Skolarus T, Gettman M, et al. Telemedicine in Urology: State of the Art. Urology 2016; 94: 10.
317. Gettman, M., Rhee, E., Spitz, A. American Urological Association white paper on telemedicine in urology. 2016. American Urological Association website. http://www.auanet.org/guidelines/telemedicine-in-urology. July 17, 2018.
318. Viers BR, Lightner DJ, Rivera ME, et al. Efficiency, satisfaction, and costs for remote video visits following radical prostatectomy: a randomized controlled trial. Eur Urol 2015; 68: 729.
319. Hwa K and Wren SM. Telehealth follow-up in lieu of postoperative clinic visit for ambulatory surgery: results of a pilot program. JAMA Surg 2013; 148: 823.
320. Sharareh B and Schwarzkopf R. Effectiveness of telemedical applications in postoperative follow-up after total joint arthroplasty. J Arthroplasty 2014; 29: 918.
321. Finkelstein SM, MacMahon K, Lindgren BR, et al. Development of a remote monitoring satisfaction survey and its use in a clinical trial with lung transplant recipients. J Telemed Telecare 2012; 18: 42.
322. Rao R, Shukla BM, Saint-Cyr M, et al. Take two and text me in the morning: optimizing clinical time with a short messaging system. Plast Reconstr Surg 2012; 130: 44.
323. Pirris SM, Monaco EA, 3rd and Tyler-Kabara EC. Telemedicine through the use of digital cell phone technology in pediatric neurosurgery: a case series. Neurosurgery 2010; 66: 999.
324. Sidana A, Noori S and Patil N. Utility of smartphone camera in patient management in urology. Can J Urol 2014; 21: 7449.
325. Andino JJ, Guduguntla V, Weizer A, et al. Examining the Value of Video Visits to Patients in an Outpatient Urology Clinic. Urology 2017; 110: 31.
326. Powell RE, Henstenburg JM, Cooper G, et al. Patient Perceptions of Telehealth Primary Care Video Visits. Ann Fam Med 2017; 15: 225.
327. Kamei T, Yamamoto Y, Kajii F, et al. Systematic review and meta-analysis of studies involving telehome monitoring-based telenursing for patients with chronic obstructive pulmonary disease. Jpn J Nurs Sci 2013; 10: 180.
328. McLean S, Nurmatov U, Liu JL, et al. Telehealthcare for chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2011; CD007718.
329. Conway A, Inglis SC and Clark RA. Effective technologies for noninvasive remote monitoring in heart failure. Telemed J E Health 2014; 20: 531.
330. Dang S, Dimmick S and Kelkar G. Evaluating the evidence base for the use of home telehealth remote monitoring in elderly with heart failure. Telemed J E Health 2009; 15: 783.

331. Kotb A, Cameron C, Hsieh S, et al. Comparative effectiveness of different forms of telemedicine for individuals with heart failure (HF): a systematic review and network meta-analysis. PLoS One 2015; 10: e0118681.
332. Seto E. Cost comparison between telemonitoring and usual care of heart failure: a systematic review. Telemed J E Health 2008; 14: 679.
333. Rosner BI, Gottlieb M and Anderson WN. Effectiveness of an Automated Digital Remote Guidance and Telemonitoring Platform on Costs, Readmissions, and Complications After Hip and Knee Arthroplasties. J Arthroplasty 2018; 33: 988.
334. Low CA, Bovbjerg DH, Ahrendt S, et al. Fitbit step counts during inpatient recovery from cancer surgery as a predictor of readmission. Ann Behav Med 2018; 52: 88.
335. Rosenberg D, Kadokura EA, Bouldin ED, et al. Acceptability of Fitbit for physical activity tracking within clinical care among men with prostate cancer. AMIA Annu Symp Proc 2016; 2016: 1050.
336. Schmal H, Holsgaard-Larsen A, Izadpanah K, et al. Validation of Activity Tracking Procedures in Elderly Patients after Operative Treatment of Proximal Femur Fractures. Rehabil Res Pract 2018; 2018: 3521271.
337. Gordon AS, Adamson WC and DeVries AR. Virtual Visits for Acute, Nonurgent Care: A Claims Analysis of Episode-Level Utilization. J Med Internet Res 2017; 19: e35.
338. Food and Drug Administration. Guidance for industry use in medical product development to support labeling claims guidance for industry. Clin Fed Regist 2009; 1: 1.
339. Jensen RE, Snyder CF, Abernethy AP, et al. Review of electronic patient-reported outcomes systems used in cancer clinical care. J Oncol Pract 2014; 10: e215.
340. Wu AW, Kharrazi H, Boulware LE, et al. Measure once, cut twice--adding patient-reported outcome measures to the electronic health record for comparative effectiveness research. J Clin Epidemiol 2013; 66: S12.
341. Detmar SB and Aaronson NK. Quality of life assessment in daily clinical oncology practice: a feasibility study. Eur J Cancer 1998; 34: 1181.
342. Velikova G, Booth L, Smith AB, et al. Measuring quality of life in routine oncology practice improves communication and patient well-being: a randomized controlled trial. J Clin Oncol 2004; 22: 714.
343. Basch E and Abernethy AP. Supporting clinical practice decisions with real-time patient-reported outcomes. J Clin Oncol 2011; 29: 954.
344. Efficace F, Jacobs M, Pusic A, et al. Patient-reported outcomes in randomised controlled trials of gynaecological cancers: investigating methodological quality and impact on clinical decision-making. Eur J Cancer 2014; 50: 1925.
345. Cleeland CS, Wang XS, Shi Q, et al. Automated symptom alerts reduce postoperative symptom severity after cancer surgery: a randomized controlled clinical trial. J Clin Oncol 2011; 29: 994.
346. Basch E, Deal AM, Kris MG, et al. Symptom Monitoring With Patient-Reported Outcomes During Routine Cancer Treatment: A Randomized Controlled Trial. J Clin Oncol 2016; 34: 557.
347. Basch E, Deal AM, Dueck AC, et al. Overall Survival Results of a Trial Assessing Patient-Reported Outcomes for Symptom Monitoring During Routine Cancer Treatment. JAMA 2017; 318: 197.
348. National Cancer Institute. Patient-Reported Outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE™). 2018. National Cancer Institute website. https://healthcaredelivery.cancer.gov/pro-ctcae/. September 25, 2018.
349. Bruera E, Kuehn N, Miller MJ, et al. The Edmonton Symptom Assessment System (ESAS): a simple method for the assessment of palliative care patients. J Palliat Care 1991; 7: 6.
350. Hui D and Bruera E. The Edmonton Symptom Assessment System 25 Years Later: Past, Present, and Future Developments. J Pain Symptom Manage 2017; 53: 630.

351. Cleeland CS, Mendoza TR, Wang XS, et al. Assessing symptom distress in cancer patients: the M.D. Anderson Symptom Inventory. Cancer 2000; 89**:** 1634.
352. Cowan RA, Suidan RS, Andikyan V, et al. Electronic patient-reported outcomes from home in patients recovering from major gynecologic cancer surgery: A prospective study measuring symptoms and health-related quality of life. Gynecol Oncol 2016; 143**:** 362.
353. Cella D, Yount S, Rothrock N, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS): progress of an NIH Roadmap cooperative group during its first two years. Med Care 2007; 45**:** S3.
354. van der Meij E, Anema JR, Huirne JAF, et al. Using PROMIS for measuring recovery after abdominal surgery: a pilot study. BMC Health Serv Res 2018; 18**:** 128.
355. Northwestern University. HealthMeasures. 2018. HealthMeasures website. http://www.healthmeasures.net/search-view-measures. September 25, 2018.
356. Hollenbeck BK, Dunn RL, Wolf JS, Jr., et al. Development and validation of the convalescence and recovery evaluation (CARE) for measuring quality of life after surgery. Qual Life Res 2008; 17**:** 915.
357. Hedgepeth RC, Wolf JS, Jr., Dunn RL, et al. Patient-reported recovery after abdominal and pelvic surgery using the Convalescence and Recovery Evaluation (CARE): implications for measuring the impact of surgical processes of care and innovation. Surg Innov 2009; 16**:** 243.
358. Li AY, Filson CP, Hollingsworth JM, et al. Patient-Reported Convalescence and Quality of Life Recovery: A Comparison of Open and Robotic-Assisted Radical Cystectomy. Surg Innov 2016; 23**:** 598.
359. International Prostate Symptom Score. Urology Specialists, PC website. http://www.urospec.com/uro/Forms/ipss.pdf. September 25, 2018.
360. International Index of Erectile Function Patient Questionnaire. British Association of Urological Surgeons website. https://www.baus.org.uk/_userfiles/pages/files/Patients/Leaflets/iief.pdf September 25, 2018.
361. Sexual Health Inventory for Men. Urology SA website. http://www.urologysa.com.au/pdf/sexual-health-inventory-for-men-shim.pdf. September 25, 2018.
362. Expanded Prostate Cancer Index Composite. 2018. University of Michigan Medical School website. https://medicine.umich.edu/dept/urology/research/epic. September 25, 2018.
363. Wei JT, Dunn RL, Litwin MS, et al. Development and validation of the expanded prostate cancer index composite (EPIC) for comprehensive assessment of health-related quality of life in men with prostate cancer. Urology 2000; 56**:** 899.
364. Chipman JJ, Sanda MG, Dunn RL, et al. Measuring and predicting prostate cancer related quality of life changes using EPIC for clinical practice. J Urol 2014; 191**:** 638.
365. Chang P, Szymanski KM, Dunn RL, et al. Expanded prostate cancer index composite for clinical practice: development and validation of a practical health related quality of life instrument for use in the routine clinical care of patients with prostate cancer. J Urol 2011; 186**:** 865.
366. Narang GL, Pannell SC, Laviana AA, et al. Patient-reported outcome measures in urology. Curr Opin Urol 2017; 27**:** 366.
367. Coburn M, Fahlenkamp A, Zoremba N, et al. Postoperative cognitive dysfunction: Incidence and prophylaxis. Anaesthesist 2010; 59**:** 177.
368. Kim S, Duncan PW, Groban L, et al. Patient-Reported Outcome Measures (PROM) as A Preoperative Assessment Tool. J Anesth Perioper Med 2017; 4**:** 274.
369. Myles PS, Weitkamp B, Jones K, et al. Validity and reliability of a postoperative quality of recovery score: the QoR-40. Br J Anaesth 2000; 84**:** 11.

370. Gower ST, Quigg CA, Hunt JO, et al. A comparison of patient self-administered and investigator-administered measurement of quality of recovery using the QoR-40. Anaesth Intensive Care 2006; 34**:** 634.
371. Pace KT, Dyer SJ, Stewart RJ, et al. Health-related quality of life after laparoscopic and open nephrectomy. Surg Endosc 2003; 17**:** 143.

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DISCLAIMER

This document was written by the *Optimizing Urologic Surgical Outcomes: Postoperative* workgroup of the American Urological Association Education and Research, Inc., which was created in 2017. The Quality Improvement and Patient Safety (QIPS) Committee of the AUA selected the workgroup chair, and workgroup members were then selected by the chair. Membership of the workgroup included specialists in urology, anesthesiology, and nursing with extensive experience in postoperative care for urologic surgery. The mission of the workgroup was to develop a comprehensive qualitative assessment of care for patients undergoing postoperative surgery using existing literature and expert opinion where literature is not available.

Funding of the workgroup was provided by the AUA. Workgroup members received no remuneration for their work. Each member of the Workgroup provides an ongoing conflict of interest disclosure to the AUA.

While the white paper does not necessarily establish the standard of care, AUA seeks to recommend and encourage compliance by practitioners with current best practices related to the subject addressed by the paper. As medical knowledge expands and technology advances, the white paper will be reviewed to ensure its continued accuracy and relevance. White papers do not represent absolute mandates but are provisional proposals for treatment under the specific conditions described in each document. For all these reasons, the white papers do not pre-empt physician judgment in individual cases.

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Although white papers are intended to encourage best practices and potentially encompass available technologies with sufficient data as of close of the literature review, they are necessarily time-limited. White papers cannot include evaluation of all data on emerging technologies or management, including those that are FDA-approved, which may immediately come to represent accepted clinical practices.

For this reason, the AUA does not regard technologies or management which are too new to be addressed by this white paper as necessarily experimental or investigational.

Appendix 1.

Nutritional Risk Screening (NRS 2002)*

Table 1 Initial screening			
1	Is BMI <20.5?	Yes	No
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed. **No**: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 2 Final screening			
Impaired nutritional status		**Severity of disease (≈ increase in requirements)**	
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. *Chronic hemodialysis, diabetes, oncology*
Moderate **Score 2**	Wt loss >5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* *Severe pneumonia, hematologic malignancy*
Severe **Score 3**	Wt loss >5% in 1 mth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* *Intensive care patients (APACHE>10).*
Score:	+	**Score:**	**=Total score**
Age	if ≥70 years: add 1 to total score above	**=age-adjusted total score**	
Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated **Score <3**: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

NRS-2002 is based on an interpretation of available randomized clinical trials. *indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in italics are based on the prototypes given below. Nutritional risk is defined by the present nutritional status and risk of impairment of present status, due to increased requirements caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are (1) severely undernourished (score=3), or (2) severely ill (score=3), or (3) moderately undernourished + mildly ill (score 2 +1), or (4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease

Score=1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.

Score=2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.

Score=3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

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‘Malnutrition Universal Screening Tool’

BAPEN is registered charity number 1023927 www.bapen.org.uk

‘MUST’

‘MUST’ is a five-step screening tool to identify **adults,** who are malnourished, at risk of malnutrition (undernutrition), or obese. It also includes management guidelines which can be used to develop a care plan.

It is for use in hospitals, community and other care settings and can be used by all care workers.

This guide contains:

- A flow chart showing the 5 steps to use for screening and management
- BMI chart
- Weight loss tables
- Alternative measurements when BMI cannot be obtained by measuring weight and height.

The 5 ‘MUST’ Steps

Step 1

Measure height and weight to get a BMI score using chart provided. *If unable to obtain height and weight, use the alternative procedures shown in this guide.*

Step 2

Note percentage unplanned weight loss and score using tables provided.

Step 3

Establish acute disease effect and score.

Step 4

Add scores from steps 1, 2 and 3 together to obtain overall risk of malnutrition.

Step 5

Use management guidelines and/or local policy to develop care plan.

Please refer to *The ‘MUST’ Explanatory Booklet* for more information when weight and height cannot be measured, and when screening patient groups in which extra care in interpretation is needed (e.g. those with fluid disturbances, plaster casts, amputations, critical illness and pregnant or lactating women). The booklet can also be used for training. See *The ‘MUST’ Report* for supporting evidence. Please note that ‘MUST’ has not been designed to detect deficiencies or excessive intakes of vitamins and minerals and is of **use only in adults.**

Step 1 – BMI score (& BMI)

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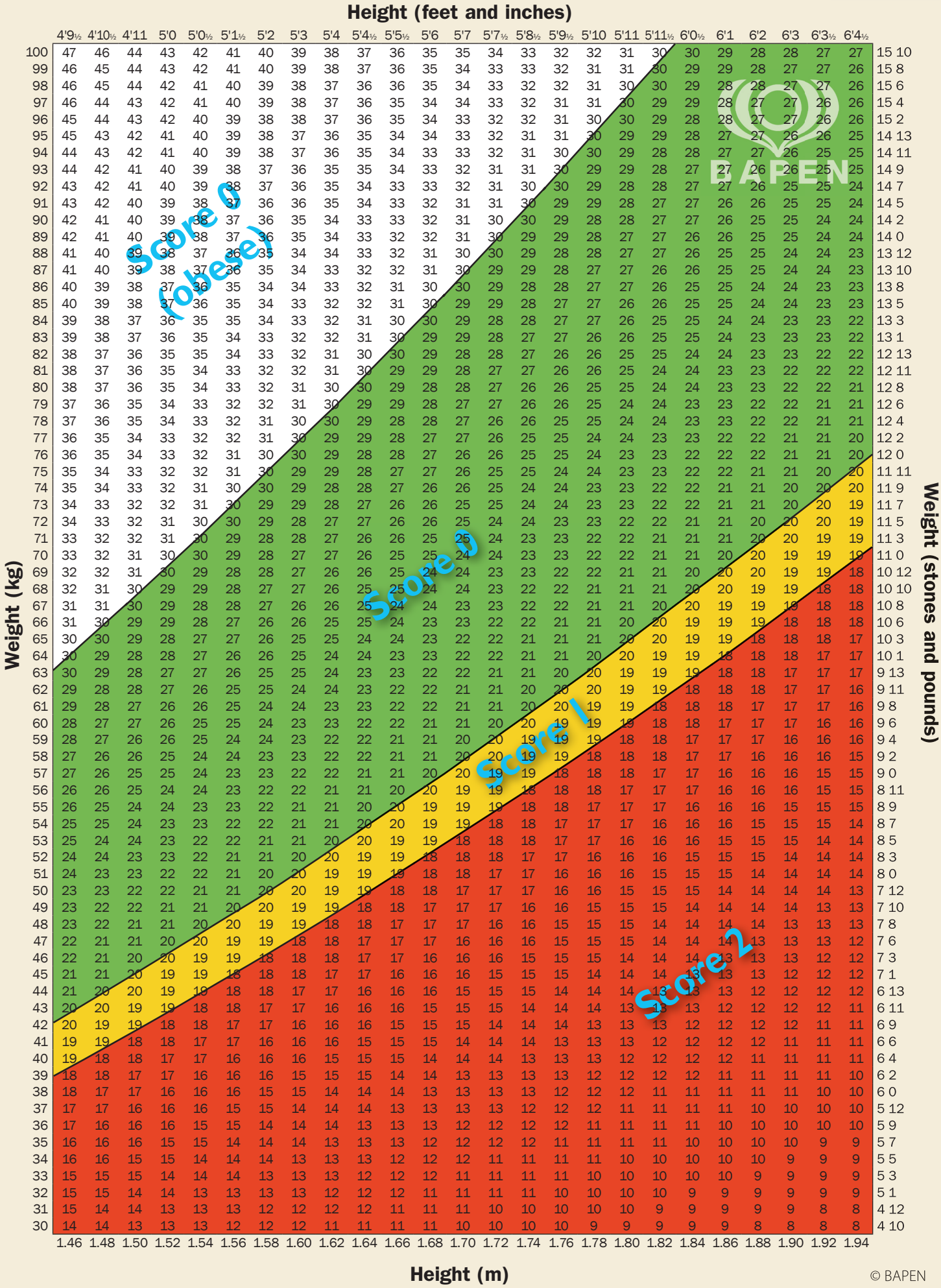

Note : The black lines denote the exact cut off points (30,20 and 18.5 kg/m²), figures on the chart have been rounded to the nearest whole number.

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Step 1 + Step 2 + Step 3

Step 1 — BMI score

BMI kg/m²	Score
>20 (>30 Obese)	= 0
18.5-20	= 1
<18.5	= 2

Step 2 — Weight loss score

Unplanned weight loss in past 3-6 months

%	Score
<5	= 0
5-10	= 1
>10	= 2

Step 3 — Acute disease effect score

If patient is acutely ill **and** there has been or is likely to be no nutritional intake for >5 days
Score 2

If unable to obtain height and weight, see reverse for alternative measurements and use of subjective criteria

Acute disease effect is unlikely to apply outside hospital. See 'MUST' Explanatory Booklet for further information

Step 4

Overall risk of malnutrition

Add Scores together to calculate overall risk of malnutrition
Score 0 Low Risk Score 1 Medium Risk Score 2 or more High Risk

Step 5

Management guidelines

0 Low Risk
Routine clinical care

- Repeat screening
  Hospital – weekly
  Care Homes – monthly
  Community – annually
  for special groups
  e.g. those >75 yrs

1 Medium Risk
Observe

- Document dietary intake for 3 days
- If adequate – little concern and repeat screening
  - Hospital – weekly
  - Care Home – at least monthly
  - Community – at least every 2-3 months
- If inadequate – clinical concern – follow local policy, set goals, improve and increase overall nutritional intake, monitor and review care plan regularly

2 or more High Risk
Treat*

- Refer to dietitian, Nutritional Support Team or implement local policy
- Set goals, improve and increase overall nutritional intake
- Monitor and review care plan
  Hospital – weekly
  Care Home – monthly Community – monthly

* Unless detrimental or no benefit is expected from nutritional support e.g. imminent death.

All risk categories:

- Treat underlying condition and provide help and advice on food choices, eating and drinking when necessary.
- Record malnutrition risk category.
- Record need for special diets and follow local policy.

Obesity:

- Record presence of obesity. For those with underlying conditions, these are generally controlled before the treatment of obesity.

Re-assess subjects identified at risk as they move through care settings

See *The 'MUST' Explanatory Booklet* for further details and *The 'MUST' Report* for supporting evidence.

Step 2 – Weight loss score

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Current weight

kg	Score 0 Wt loss < 5% — Weight loss in last 3 to 6 months: Less than (kg)	Score 1 Wt loss 5 - 10% — Weight loss in last 3 to 6 months: Between (kg)	Score 2 Wt loss > 10% — Weight loss in last 3 to 6 months: More than (kg)
30	1.6	1.6 - 3.3	3.3
31	1.6	1.6 - 3.4	3.4
32	1.7	1.7 - 3.6	3.6
33	1.7	1.7 - 3.7	3.7
34	1.8	1.8 - 3.8	3.8
35	1.8	1.8 - 3.9	3.9
36	1.9	1.9 - 4.0	4.0
37	1.9	1.9 - 4.1	4.1
38	2.0	2.0 - 4.2	4.2
39	2.1	2.1 - 4.3	4.3
40	2.1	2.1 - 4.4	4.4
41	2.2	2.2 - 4.6	4.6
42	2.2	2.2 - 4.7	4.7
43	2.3	2.3 - 4.8	4.8
44	2.3	2.3 - 4.9	4.9
45	2.4	2.4 - 5.0	5.0
46	2.4	2.4 - 5.1	5.1
47	2.5	2.5 - 5.2	5.2
48	2.5	2.5 - 5.3	5.3
49	2.6	2.6 - 5.4	5.4
50	2.6	2.6 - 5.6	5.6
51	2.7	2.7 - 5.7	5.7
52	2.7	2.7 - 5.8	5.8
53	2.8	2.8 - 5.9	5.9
54	2.8	2.8 - 6.0	6.0
55	2.9	2.9 - 6.1	6.1
56	2.9	2.9 - 6.2	6.2
57	3.0	3.0 - 6.3	6.3
58	3.1	3.1 - 6.4	6.4
59	3.1	3.1 - 6.6	6.6
60	3.2	3.2 - 6.7	6.7
61	3.2	3.2 - 6.8	6.8
62	3.3	3.3 - 6.9	6.9
63	3.3	3.3 - 7.0	7.0
64	3.4	3.4 - 7.1	7.1

kg	Score 0 Wt loss < 5% — Weight loss in last 3 to 6 months: Less than (kg)	Score 1 Wt loss 5 - 10% — Weight loss in last 3 to 6 months: Between (kg)	Score 2 Wt loss > 10% — Weight loss in last 3 to 6 months: More than (kg)
65	3.4	3.4 - 7.2	7.2
66	3.5	3.5 - 7.3	7.3
67	3.5	3.5 - 7.4	7.4
68	3.6	3.6 - 7.6	7.6
69	3.6	3.6 - 7.7	7.7
70	3.7	3.7 - 7.8	7.8
71	3.7	3.7 - 7.9	7.9
72	3.8	3.8 - 8.0	8.0
73	3.8	3.8 - 8.1	8.1
74	3.9	3.9 - 8.2	8.2
75	3.9	3.9 - 8.3	8.3
76	4.0	4.0 - 8.4	8.4
77	4.1	4.1 - 8.6	8.6
78	4.1	4.1 - 8.6	8.7
79	4.2	4.2 - 8.7	8.8
80	4.2	4.2 - 8.9	8.9
81	4.3	4.3 - 9.0	9.0
82	4.3	4.3 - 9.1	9.1
83	4.4	4.4 - 9.2	9.2
84	4.4	4.4 - 9.3	9.3
85	4.5	4.5 - 9.4	9.4
86	4.5	4.5 - 9.6	9.6
87	4.6	4.6 - 9.7	9.7
88	4.6	4.6 - 9.8	9.8
89	4.7	4.7 - 9.9	9.9
90	4.7	4.7 - 10.0	10.0
91	4.8	4.8 - 10.1	10.1
92	4.8	4.8 - 10.2	10.2
93	4.9	4.9 - 10.3	10.3
94	4.9	4.9 - 10.4	10.4
95	5.0	5.0 - 10.6	10.6
96	5.1	5.1 - 10.7	10.7
97	5.1	5.1 - 10.8	10.8
98	5.2	5.2 - 10.9	10.9
99	5.2	5.2 - 11.0	11.0

Alternative measurements and considerations

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Step 1: BMI (body mass index)

If height cannot be measured

- Use recently documented or self-reported height (if reliable and realistic).
- If the subject does not know or is unable to report their height, use one of the alternative measurements to estimate height (ulna, knee height or demispan).

Step 2: Recent unplanned weight loss

If recent weight loss cannot be calculated, use self-reported weight loss (if reliable and realistic).

Subjective criteria

If height, weight or BMI cannot be obtained, the following criteria which relate to them can assist your professional judgement of the subject's nutritional risk category. Please note, these criteria should be used collectively not separately as alternatives to steps 1 and 2 of 'MUST' and are not designed to assign a score. Mid upper arm circumference (MUAC) may be used to estimate BMI category in order to support your overall impression of the subject's nutritional risk.

1. BMI

- Clinical impression – thin, acceptable weight, overweight. Obvious wasting (very thin) and obesity (very overweight) can also be noted.

2. Unplanned weight loss

- Clothes and/or jewellery have become loose fitting (weight loss).
- History of decreased food intake, reduced appetite or swallowing problems over 3-6 months and underlying disease or psycho-social/physical disabilities likely to cause weight loss.

3. Acute disease effect

- Acutely ill and no nutritional intake or likelihood of no intake for more than 5 days.

Further details on taking alternative measurements, special circumstances and subjective criteria can be found in *The 'MUST' Explanatory Booklet*. A copy can be downloaded at www.bapen.org.uk or purchased from the BAPEN office. The full evidence-base for 'MUST' is contained in *The 'MUST' Report* and is also available for purchase from the BAPEN office.

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Alternative measurements: instructions and tables

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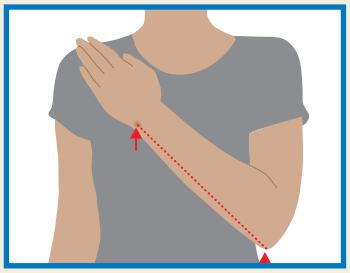
If height cannot be obtained, use length of forearm (ulna) to calculate height using tables below.
(See The 'MUST' Explanatory Booklet for details of other alternative measurements (knee height and demispan) that can also be used to estimate height).

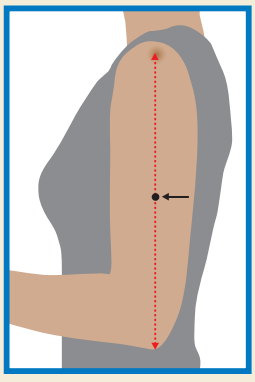
Estimating height from ulna length



Measure between the point of the elbow (olecranon process) and the midpoint of the prominent bone of the wrist (styloid process) (left side if possible).

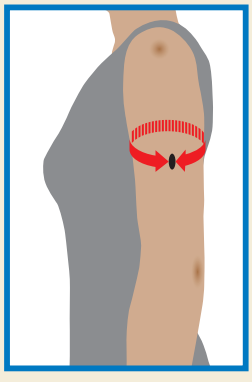
Height (m)	men (<65 years)	1.94	1.93	1.91	1.89	1.87	1.85	1.84	1.82	1.80	1.78	1.76	1.75	1.73	1.71
	men (≥65 years)	1.87	1.86	1.84	1.82	1.81	1.79	1.78	1.76	1.75	1.73	1.71	1.70	1.68	1.67
	Ulna length (cm)	32.0	31.5	31.0	30.5	30.0	29.5	29.0	28.5	28.0	27.5	27.0	26.5	26.0	25.5
Height (m)	Women (<65 years)	1.84	1.83	1.81	1.80	1.79	1.77	1.76	1.75	1.73	1.72	1.70	1.69	1.68	1.66
	Women (≥65 years)	1.84	1.83	1.81	1.79	1.78	1.76	1.75	1.73	1.71	1.70	1.68	1.66	1.65	1.63
Height (m)	men (<65 years)	1.69	1.67	1.66	1.64	1.62	1.60	1.58	1.57	1.55	1.53	1.51	1.49	1.48	1.46
	men (≥65 years)	1.65	1.63	1.62	1.60	1.59	1.57	1.56	1.54	1.52	1.51	1.49	1.48	1.46	1.45
	Ulna length (cm)	25.0	24.5	24.0	23.5	23.0	22.5	22.0	21.5	21.0	20.5	20.0	19.5	19.0	18.5
Height (m)	Women (<65 years)	1.65	1.63	1.62	1.61	1.59	1.58	1.56	1.55	1.54	1.52	1.51	1.50	1.48	1.47
	Women (≥65 years)	1.61	1.60	1.58	1.56	1.55	1.53	1.52	1.50	1.48	1.47	1.45	1.44	1.42	1.40

Estimating BMI category from mid upper arm circumference (MUAC)



The subject's left arm should be bent at the elbow at a 90 degree angle, with the upper arm held parallel to the side of the body. Measure the distance between the bony protrusion on the shoulder (acromion) and the point of the elbow (olecranon process). Mark the mid-point.

Ask the subject to let arm hang loose and measure around the upper arm at the mid-point, making sure that the tape measure is snug but not tight.



If MUAC is <23.5 cm, BMI is likely to be <20 kg/m^2.
If MUAC is >32.0 cm, BMI is likely to be >30 kg/m^2.

The use of MUAC provides a general indication of BMI and is not designed to generate an actual score for use with 'MUST'. For further information on use of MUAC please refer to *The 'MUST' Explanatory Booklet.*

Appendix 3. Risk Index for VTE for General and Vascular Surgery Patients

(Score < 7 –low risk; 7-10 – medium risk; >10 – high risk)[214]

Table 5. Venous Thromboembolic Event Complication Risk Index for General and Vascular Surgery Patients

Risk factor	Risk score points
Operation type other than endocrine	
Respiratory and hemic	9
Thoracoabdominal aneurysm, embolectomy/ thrombectomy, venous reconstruction, and endovascular repair	7
Aneurysm	4
Mouth, palate	4
Stomach, intestines	4
Integument	3
Hernia	2
ASA physical status classification	
3, 4, or 5	2
2	1
Female gender	1
Work RVU	
> 17	3
10−17	2
Two points for each of these conditions	2
Disseminated cancer	
Chemotherapy for malignancy within 30 d of operation	
Preoperative serum sodium > 145 mmol/L	
Transfusion > 4 U packed RBCs in 72 h before operation	
Ventilator-dependent	
One point for each of these conditions	1
Wound class (clean/contaminated)	
Preoperative hematocrit ≤ 38%	
Preoperative bilirubin > 1.0 mg/dL	
Dyspnea	
Albumin ≤ 3.5 mg/dL	
Emergency	
Zero points for each of these conditions	0
ASA physical status class 1	
Work RVU < 10	
Male gender	

ASA, American Society of Anesthesiologists; RBC, red blood cell; RVU, relative value unit.

* Permission Pending/ from Rogers et al.