Glickman Urological & Kidney Institute

Cleveland Clinic

2016
Outcomes

Measuring Outcomes Promotes Quality Improvement

Measuring and understanding outcomes of medical treatments promotes quality improvement. Cleveland Clinic has created a series of Outcomes books similar to this one for its clinical institutes. Designed for a physician audience, the Outcomes books contain a summary of many of our surgical and medical treatments, with a focus on outcomes data and a review of new technologies and innovations.

The Outcomes books are not a comprehensive analysis of all treatments provided at Cleveland Clinic, and omission of a particular treatment does not necessarily mean we do not offer that treatment. When there are no recognized clinical outcome measures for a specific treatment, we may report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a relationship has been demonstrated between volume and improved outcomes for many treatments, particularly those involving surgical and procedural techniques.

In addition to these institute-based books of clinical outcomes, Cleveland Clinic supports transparent public reporting of healthcare quality data. The following reports are available to the public:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare and Medicaid Services (CMS) Hospital Compare (medicare.gov/hospitalcompare), and Physician Compare (medicare.gov/PhysicianCompare)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to transparent reporting of accurate, timely information about patient care reflects Cleveland Clinic's culture of continuous improvement and may help referring physicians make informed decisions.

We hope you find these data valuable, and we invite your feedback. Please send your comments and questions via email to:

OutcomesBooksFeedback@ccf.org.

To view all of our Outcomes books, please visit clevelandclinic.org/outcomes.

Dear Colleague:

Welcome to this 2016 Cleveland Clinic Outcomes book. Every year, we publish Outcomes books for 14 clinical institutes with multiple specialty services. These publications are unique in healthcare. Each one provides an overview of medical or surgical trends, innovations, and clinical data for a particular specialty over the past year. We are pleased to make this information available.

Cleveland Clinic uses data to manage outcomes across the full continuum of care. Our unique organizational structure contributes to our success. Patient services at Cleveland Clinic are delivered through institutes, and each institute is based on a single disease or organ system. Institutes combine medical and surgical services, along with research and education, under unified leadership. Institutes define quality benchmarks for their specialty services and report on longitudinal progress.

All Cleveland Clinic Outcomes books are available in print and online. Additional data are available through our online Quality Performance Reports (clevelandclinic.org/QPR). The site offers process measure, outcome measure, and patient experience data in advance of national and state public reporting sites.

Our practice of releasing annual Outcomes books has become increasingly relevant as healthcare transforms from a volume-based to a value-based system. We appreciate your interest and hope you find this information useful and informative.

Sincerely,

Delos M. Cosgrove, MD
CEO and President

what's inside

Chairman's Letter

Dear Colleagues,

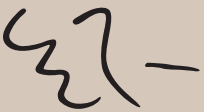
I appreciate your interest in Glickman Urological & Kidney Institute and taking the time to glance through our 2016 outcomes report. Each year we collect and analyze vital data, not just to satisfy our curiosity, but to ensure that we are indeed improving the quality of care we provide and quality of life for our patients. We remain devoted to excellence and innovation in all aspects of our work -- clinical care, research, and education. We believe our consistently high rankings by *U.S. News & World Report* (No. 1 or No. 2 in the nation since 2012) reflect this dedication and hard work.

Among our accomplishments in 2016:

- Developed a nomogram to predict the likelihood of kidney stone passage and help guide follow-up and intervention
- Established an oxidation-reduction potential assay using a novel galvanostatic technology as an effective method for measuring oxidative stress in semen and distinguishing normal men from those with male factor infertility
- Developed a technique to use a buccal mucosal graft in a salvage robotic laparoscopic pyeloplasty for managing recurrent ureteropelvic junction obstruction
- Performed laparoscopic vaginoplasty using a bowel segment in a young woman born without a vagina
- Developed new, reliable prostate cancer diagnostic tools
- Conducted studies demonstrating that salvage radiotherapy at low PSA after prostatectomy improves outcomes
- Published a seminal laboratory guide for reproductive professionals
- Constructed a new, state-of-the-art Cleveland Clinic East dialysis facility
- Welcomed nearly 1,000 guests at our 14th annual 2016 Minority Men's Health Fair

I welcome your feedback, questions, and ideas for collaboration. Please contact me via email at OutcomesBooksFeedback@ccf.org, and reference the Glickman Urological & Kidney Institute in your message.

Sincerely,



Eric A. Klein, MD
Chairman, Glickman Urological & Kidney Institute
Professor, Cleveland Clinic Lerner College of Medicine

Institute Overview

The Glickman Urological & Kidney Institute's activities encompass a unique combination of high-volume and challenging clinical cases, extensive basic and translational scientific efforts, and innovative laboratory research within an environment that nurtures the future leaders of its specialties. *U.S. News & World Report*'s "Best Hospitals" survey has ranked the institute's urology program as one of the top 2 programs in the United States every year since 2000. In 2016, the survey ranked the institute's urology and nephrology programs No. 2 in the nation.

The institute's 90 physicians and scientists offer expertise in every subspecialty area. In 2016, the faculty served a significant number of patients; published 374 peer-reviewed manuscripts, 61 book chapters, and 4 textbooks; and secured $8.2 million in research funding.

The institute provides a full range of urologic and kidney care for adults and children. Most physicians have subspecialty training in one or more of the following areas: bladder, prostate, kidney, and testicular cancer; bladder control; chronic urinary tract infections and obstructions; dialysis; hypertension; kidney disease; kidney transplantation; male fertility; pediatric urology and nephrology; prostate disease; sexual dysfunction/impotence; and genitourinary reconstruction.

These subspecializations enable institute physicians to gain valuable experience using the latest techniques, which fosters development of innovative procedures such as single-port laparoscopic and robotic surgery, autotransplantation for intractable kidney stone disease, focal therapy for prostate cancer, urethral reconstruction, and outpatient ureteral reimplantation. This environment also provides an opportunity to compile meaningful outcomes data, which ultimately allows institute physicians to better serve their patients.

Urological & Kidney Institute Overview	2016
Outpatient visits	96,474
Cases	8991
Dialysis treatments	19,695
Admissions	2060
Patient days	9291
Mean length of stay (days)	4.51

2016 Statistical Highlights

Surgical/Interventional Procedures	6307
Benign Prostatic Hypertrophy	
Photoselective vaporization	185
Transurethral resection	253
Endourology and Stone Disease	
Lithotripsy	297
Percutaneous renal surgery	282
Robotic pyeloplasty	42
Ureteroscopy	318
Female Urology	
InterStim® implants	274
Laparoscopic colpopexy	22
Sacrospinous ligament fixation	26
Vaginal prolapse repair	88
Vaginal sling procedures	200
Other procedures	324
Male Fertility	
Microsurgical testicular sperm extraction	98
Varicocele ligation	36
Vasovasostomy	28
Other procedures	4
Pediatric Surgeries	285
Prosthetics and Reconstruction	
Artificial sphincter	93
Penile prosthesis	117
Revisions/explants of genitourinary prosthetics	37
Tunical plication	22
Urethroplasty	82
Transplantation	
Kidney	240
Pancreas	12
Urologic Oncology	
Adrenal Cancer	
Laparoscopic adrenalectomy	31
Open adrenalectomy	5
Bladder Cancer	
Radical cystectomy with urinary diversion	214
Transurethral resection of bladder tumor	881
Other procedures	9
Kidney Cancer	
Laparoscopic nephroureterectomy	63
Laparoscopic radical nephrectomy	157
Laparoscopic/robotic partial nephrectomy	327
Open nephroureterectomy	7
Open partial nephrectomy	82
Open radical nephrectomy	89
Prostate Cancer	
Brachytherapy	284
Laparoscopic/robotic radical prostatectomy	648
Radical retropubic (open) prostatectomy	86
Other procedures	4
Testicular Cancer	
Retroperitoneal dissection	55

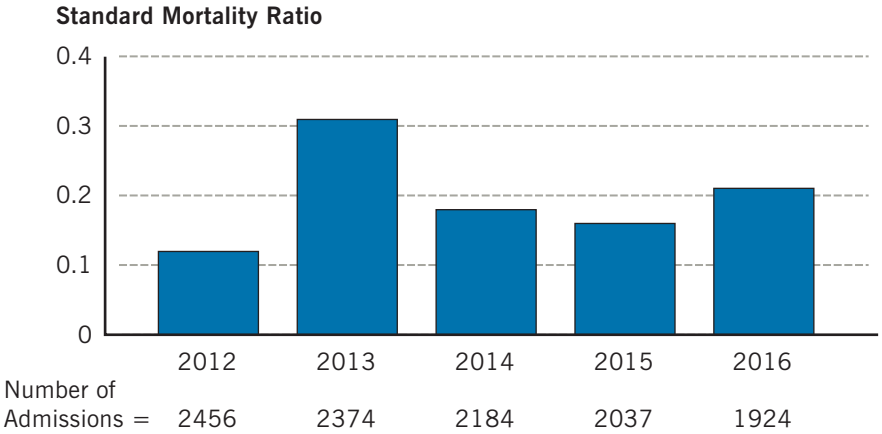
In-Hospital Mortality

In-hospital mortality for patients admitted for urology services at the Urological & Kidney Institute is compared with that of similar-sized major teaching hospitals nationwide using APR DRG[a] methodology. Demographics and secondary diagnoses are used to calculate expected rates based on risk of mortality. The standardized mortality ratio is calculated as observed/expected, and a value < 1 indicates that mortality is lower than expected given the case mix.

[a]The 3M™ All Patient Refined Diagnosis Related Groups (APR DRG) Classification System is used for adjusting data for severity of illness and risk of mortality. solutions.3m.com/wps/portal/3M/en_US/Health-Information-Systems/HIS/Products-and-Services/Products-List-A-Z/APR-DRG-Software

In-Hospital Mortality: Urology

2012 – 2016



Number of Admissions =	2012	2013	2014	2015	2016
	2456	2374	2184	2037	1924

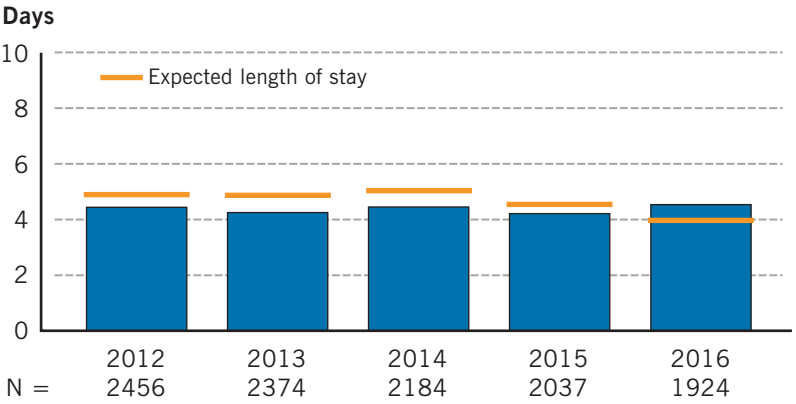
Length of Stay

Efficiency of care for patients at the Urological & Kidney Institute is assessed in part through hospital mean length of stay. Expected length of stay is calculated based on APR DRG[a] categories.

[a]The 3M™ All Patient Refined Diagnosis Related Groups (APR DRG) Classification System is used for adjusting data for severity of illness and risk of mortality. solutions.3m.com/wps/portal/3M/en_US/Health-InformationSystems/HIS/Products-and-Services/Products-List-A-Z/APR-DRG-Software

Hospital Mean Length of Stay: Urology

2012 – 2016



Chronic Kidney Disease Clinic

The Chronic Kidney Disease Clinic provides comprehensive medical care using a team approach for each patient, with a nephrologist, certified nurse practitioners, nursing staff, chronic kidney disease (CKD) educators, and a renal dietitian. More than 500 patients have been enrolled in the clinic. The Chronic Kidney Disease Clinic has several primary goals:

- To delay the progression of CKD with the aim of easing the burden of end-stage renal disease (ESRD)
- To reduce CKD morbidity and mortality through intensive cardiovascular risk management
- To optimize transition to renal replacement therapies, such as dialysis and kidney transplantation

Patients treated by the Chronic Kidney Disease Clinic are referred from Cleveland Clinic and non-Cleveland Clinic physicians for CKD evaluation and management. Patients' electronic medical records are included in the CKD registry database, which provides fertile ground for identifying appropriate candidates for enrollment in clinical research projects.

Patients included in the CKD registry have had at least 1 face-to-face outpatient encounter with a Cleveland Clinic health system healthcare provider and have had 2 estimated glomerular filtration rates (eGFRs) of < 60 mL/min/1.73 m^2 more than 90 days apart as of June 1, 2005, and/or ICD-9 code diagnoses for kidney disease. The demographics and comorbidities of the more than 124,000 patients included in the registry are summarized in the following table.

Characteristics of Chronic Kidney Disease Registry Patients Stratified by Disease Stage on Date of CKD Confirmation

2005 – 2016

Characteristic	Stage 3[a] (N = 96,745)	Stage 4[a] (N = 7826)	Stage 5[a] (N = 2378)	ICD-9 Code Diagnosis Only (N = 17,951)	Total (N = 124,900)
Age, mean ± SD	71.7 ± 11.6	72.1 ± 13.9	61.6 ± 15.5	64.8 ± 15.9	70.5 ± 12.8
Years in registry, mean ± SD	4.1 ± 3.4	3.3 ± 3.2	2.6 ± 2.8	1.7 ± 2.3	3.7 ± 3.3
Gender, N (%)					
Female	52,819 (54.60)	4247 (54.27)	1056 (44.41)	7364 (41.02)	65,486 (52.43)
Male	43,926 (45.40)	3579 (45.73)	1322 (55.59)	10,587 (58.98)	59,414 (47.57)
Ethnic group, N (%)					
Missing	0 (0)	0 (0)	0 (0)	999 (5.57)	999 (0.80)
White	84,760 (87.61)	6387 (81.61)	1546 (65.01)	11,561 (64.40)	104,254 (83.47)
Black	10,814 (11.18)	1340 (17.12)	754 (31.71)	4934 (27.49)	17,842 (14.29)
Asian	455 (0.47)	31 (0.40)	18 (0.76)	135 (0.75)	639 (0.51)
Other	716 (0.74)	68 (0.87)	60 (2.52)	322 (1.79)	1166 (0.93)
Comorbidities at inclusion, N (%)					
Diabetes mellitus	23,021 (23.80)	2353 (30.07)	798 (33.56)	8014 (44.64)	34,186 (27.37)
Hypertension	83,969 (86.79)	6432 (82.19)	2040 (85.79)	14,652 (81.62)	107,093 (85.74)
Coronary artery disease	20,712 (21.41)	1898 (24.25)	421 (17.70)	4219 (23.50)	27,250 (21.82)
Congestive heart failure	8491 (8.78)	1220 (15.59)	275 (11.56)	2555 (14.23)	12,541 (10.04)
Hyperlipidemia	75,978 (78.53)	5742 (73.37)	1589 (66.82)	12,754 (71.05)	96,063 (76.91)
Cerebrovascular disease	9202 (9.51)	822 (10.50)	168 (7.06)	1648 (9.18)	11,840 (9.48)

[a]CKD stage at confirmatory eGFR using the Chronic Kidney Disease Epidemiology Collaboration equation

The CKD electronic medical record database allows analysis of the institute's success rates in reaching prescribed guideline targets for anemia management, hyperlipidemia management, and CKD education. A recent analysis of these targets in more than 2000 CKD patients revealed excellent results. In aggregate, the protocol-driven, nurse-practitioner-run Chronic Kidney Disease Clinic showed superior performance vs a traditional general nephrology clinic. Additional studies are being designed to include patients with more advanced CKD whose disease is transitioning to ESRD.

Process-of-Care Measures for Chronic Kidney Disease Patients During 1-Year Follow-Up

2014 – 2015

Process-of-Care Measure	Nurse Practitioner 2014 (N = 455)	Nurse Practitioner 2015 (N = 548)	General Nephrology 2014 (N = 2126)	General Nephrology 2015 (N = 2222)	Odds Ratio[a] (95% CI) of Having Process of Care 2015
Laboratory, N (%)					
Hemoglobin	441 (96.9)	526 (96.0)	1683 (79.2)	1798 (80.9)	5.1 (3.3-8.0)
Serum calcium	446 (98.0)	537 (98.0)	1951 (91.8)	2050 (92.3)	3.5 (1.9-6.5)
Serum phosphorus	418 (91.9)	511 (93.2)	1264 (59.5)	1391 (62.6)	8.2 (5.8-11.6)
25(OH)D	422 (92.7)	503 (91.8)	1016 (47.8)	1117 (50.3)	11.0 (8.0-15.1)
Intact PTH	415 (91.2)	488 (89.1)	883 (41.5)	966 (43.5)	10.7 (8.0-14.2)
Lipid profile	330 (72.5)	381 (69.5)	1234 (58.0)	1295 (58.3)	1.6 (1.3-1.9)
Medication use, N (%)					
RAS blockers	240 (52.7)	282 (51.5)	1101 (51.8)	1165 (52.4)	1.0 (0.83-1.21)
Statin	323 (71.0)	389 (71.0)	1228 (57.8)	1273 (57.3)	1.6 (1.3-2.0)

PTH = plasma parathyroid hormone, RAS = renin-angiotensin system

[a]Logistic regression analysis adjusted for black race, Modification of Diet in Renal Disease estimated glomerular filtration rate at visit 1, and age at visit 1

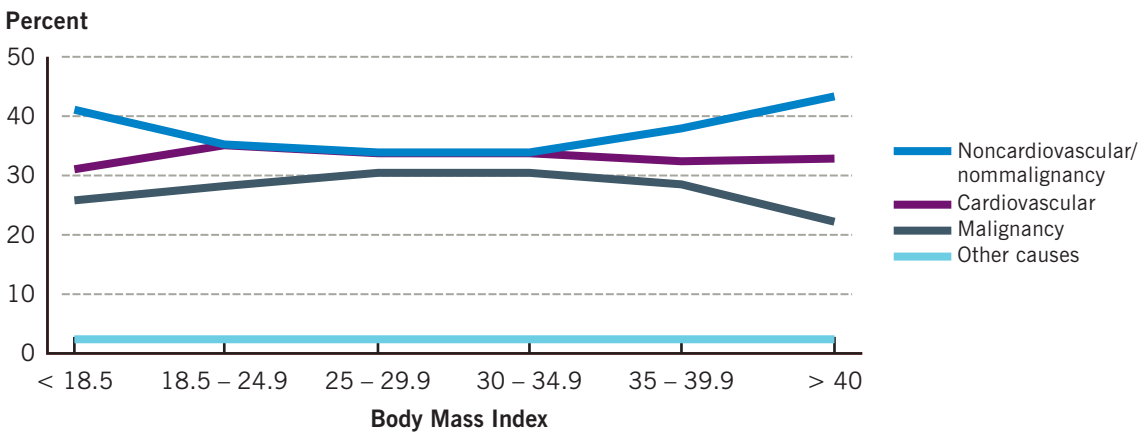
These data document the positive impact that the Chronic Kidney Disease Clinic's team approach has had on the effective management of medical issues relating to CKD. The clinic is working with other nationally recognized CKD centers to help establish benchmarks of care for CKD patients. A care path for optimal management of CKD patients is being developed.

Body Mass Index and Causes of Death in Chronic Kidney Disease[1]

In chronic kidney disease (CKD), a higher body mass index (BMI) is associated with lower mortality risk, but cause-specific death details are unknown across the BMI range. Institute researchers studied 54,506 CKD registry entries to examine cardiovascular, malignancy, and noncardiovascular/nonmalignancy causes of death across the BMI range using Cox proportional hazards and competing risk regression models. During a median follow-up of 3.7 years, 14,518 patients died. The proportions of various causes of death among those in different BMI categories are shown below.

Causes of Death Across Body Mass Index Categories in Chronic Kidney Disease (N = 14,518)

2005 – 2012

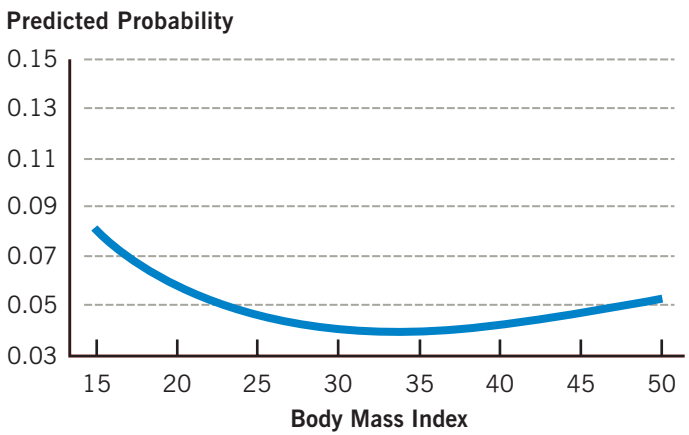


The multivariable model showed an inverted J-shaped association between BMI and cardiovascular-related, malignancy-related, and noncardiovascular/nonmalignancy deaths. Similar associations were noted for BMI categories of 25–29.9, 30–34.9, and 35–39.9 kg/m^2.

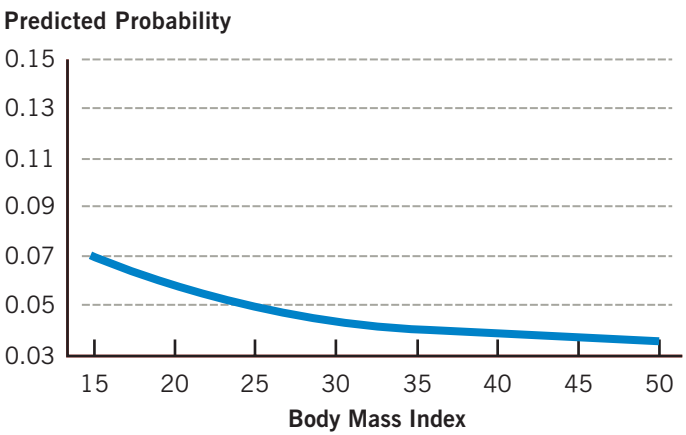
When compared with a BMI of 18.5–24.9, a BMI > 40 kg/m^2 was not associated with an increased probability of cardiovascular-related and noncardiovascular/nonmalignancy deaths in CKD. Sensitivity analyses yielded similar results even after excluding patients with diabetes and/or hypertension and adjusting for proteinuria.

Predicted Mortality From Competing Risk Models at 4 Years Based on Body Mass Index in Chronic Kidney Disease (N = 14,518)

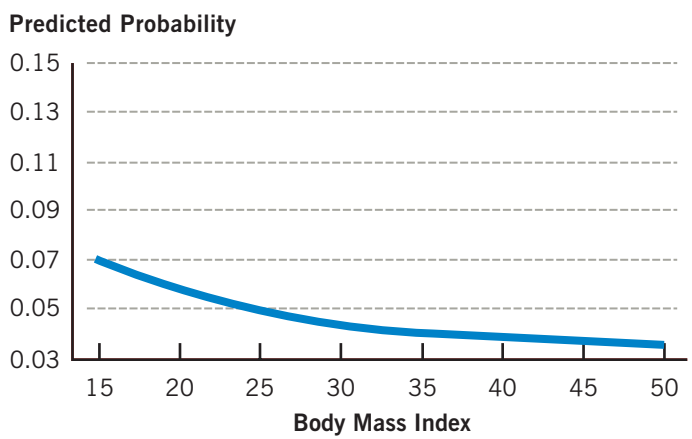
Cardiovascular Death



Malignancy Death



Noncardiovascular/Nonmalignancy Death



In CKD, compared with those who have a BMI of 18.5–24.9 kg/m^2, those who are overweight and those with class 1 and 2 obesity have a lower risk for cardiovascular-related, malignancy-related, and noncardiovascular/nonmalignancy-related deaths. Future studies should examine the associations of other measures of adiposity with outcomes in CKD.

Reference

1. Navaneethan SD, Schold JD, Arrigain S, Kirwan JP, Nally JV Jr. Body mass index and causes of death in chronic kidney disease. *Kidney Int*. 2016 Mar;89(3):675-682.

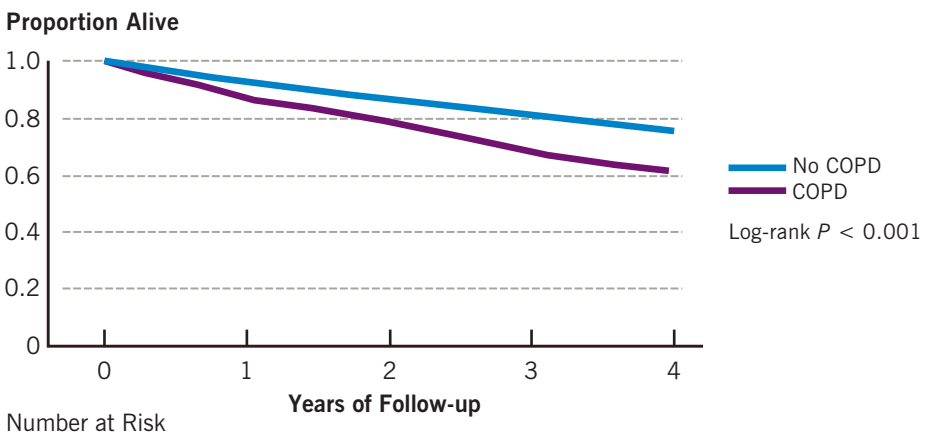
Mortality in Patients With Chronic Kidney Disease and Chronic Obstructive Pulmonary Disease[1]

Chronic obstructive pulmonary disease (COPD) is associated with higher mortality in the general population. Institute researchers studied the associations between COPD and death and reported cause-specific death data among 56,960 patients with stage 3 or 4 chronic kidney disease (CKD) followed at Cleveland Clinic. Associations between COPD and all-cause mortality and specific causes of death (respiratory, cardiovascular, malignancy, and death due to other reasons) were analyzed using Cox proportional hazards and competing risk models.

Of the 56,960 patients, 4.7% (N = 2667) had underlying COPD. Old age and presence of diabetes, hypertension, coronary artery disease, congestive heart failure, and smoking were associated with higher COPD risk. During a median follow-up of 3.7 years, 15,969 patients died. After covariate adjustment, COPD was associated with a 41% increased risk (95% CI 1.31-1.52) for all cause mortality and a fourfold increased risk (subhazard ratio 4.36, 95% CI 3.54-5.37) for respiratory-related deaths. Similar results were noted in a sensitivity analysis that was performed by defining COPD as the use of relevant ICD-9 codes and medications used to treat COPD.

Chronic Obstructive Pulmonary Disease Survival Impact in Chronic Kidney Disease

2005 – 2012



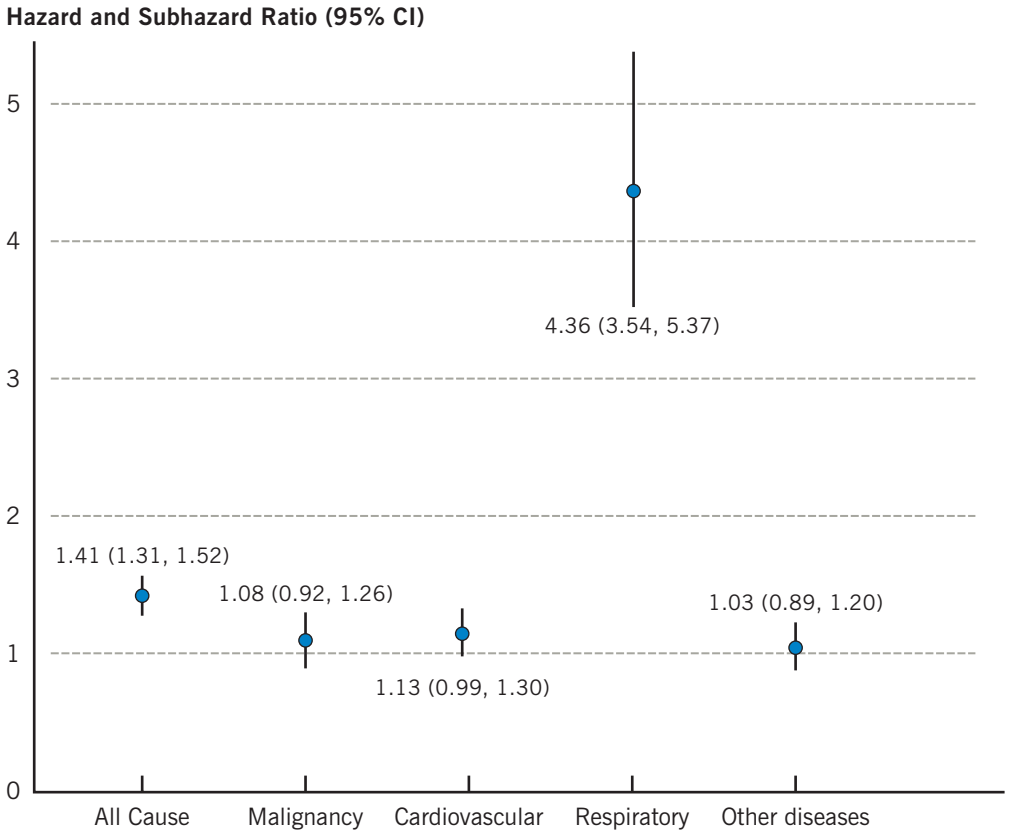
Number at Risk

N =					
No COPD	54,293	46,559	39,490	32,342	25,236
COPD	2667	2008	1559	1123	811

COPD = chronic obstructive pulmonary disease

Associations of Various Causes of Death in Those With Chronic Obstructive Pulmonary Disease and Chronic Kidney Disease

2005 – 2012



COPD is associated with a higher risk of death among those with CKD, and an underlying lung disease accounts for a significant proportion of deaths. These data highlight the need for further prospective studies to understand the underlying mechanisms and potential interventions to improve outcomes in this population.

Reference

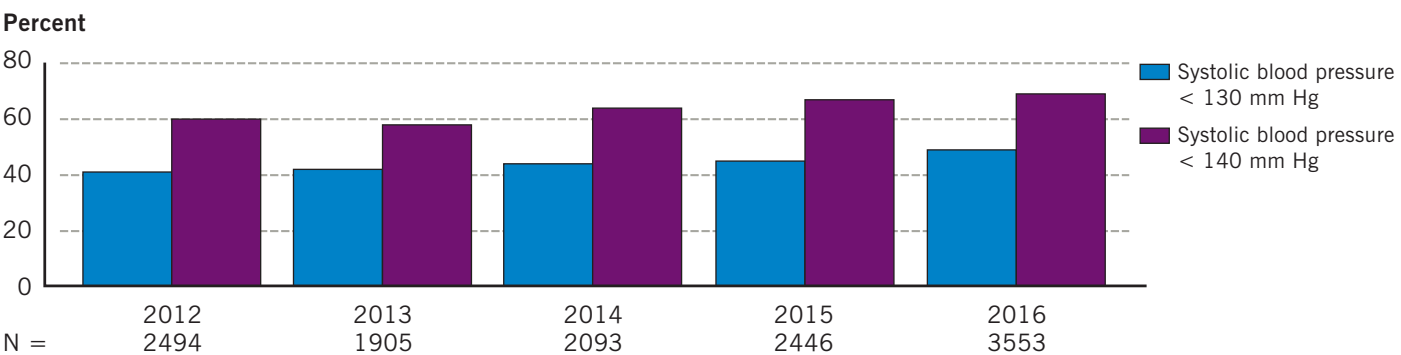
1. Navaneethan SD, Schold JD, Huang H, Nakhoul G, Jolly SE, Arrigain S, Dweik RA, Nally JV Jr. Mortality outcomes of patients with chronic kidney disease and obstructive pulmonary disease. *Am J Nephrol*. 2016;43(1):39-46.

Hypertension Control in Chronic Kidney Disease

The panel appointed to the Eighth Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure recommends a blood pressure (BP) goal of < 140/90 mm Hg in patients with chronic kidney disease (CKD).[1] Although improved BP control is known to attenuate CKD progression, the rates of control reported in the literature are low. Among 3213 participants with varying stages of CKD in the National Health and Nutrition Examination Survey IV, 37% had BP controlled to 130/80 mm Hg; using the less stringent target of < 140/90 mm Hg, 56% of participants with varying stages of CKD had controlled BP.[2] In an analysis of 10,813 participants with CKD from the Kidney Early Evaluation Program, only 13.2% had BP controlled to < 130/80 mm Hg, and 34% had BP controlled to < 140/90 mm Hg.[3] Elevated systolic BP accounts for the majority of inadequate control.

Hypertension Control in Chronic Kidney Disease

2012 – 2016



The Department of Nephrology and Hypertension searched electronic medical records of BP readings recorded at the last outpatient visit with a nephrologist in 2016. Among 3553 patients with an encounter diagnosis of moderately severe CKD (stages 3 and 4) and hypertension and at least 2 outpatient visits in 2016, 49% had systolic BP controlled to < 130 mm Hg, and 69% had systolic BP controlled to < 140 mm Hg. These control rates of hypertension in Cleveland Clinic CKD patients are higher than those published from cross-sectional studies.

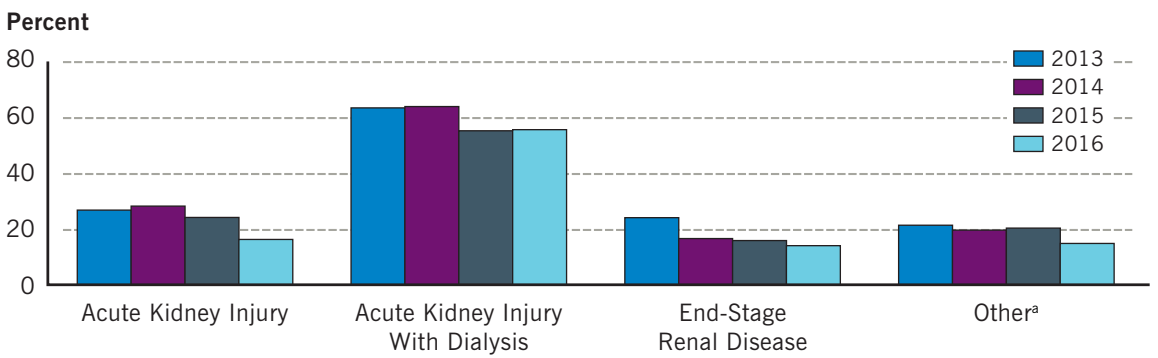
References

1. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014 Feb 5;311(5):507-520.
2. Peralta CA, Hicks LS, Chertow GM, Ayanian JZ, Vittinghoff E, Lin F, Shlipak MG. Control of hypertension in adults with chronic kidney disease in the United States. *Hypertension*. 2005 Jun;45(6):1119-1124.
3. Sarafidis PA, Li S, Chen SC, Collins AJ, Brown WW, Klag MJ, Bakris GL. Hypertension awareness, treatment, and control in chronic kidney disease. *Am J Med*. 2008 Apr;121(4):332-340.

The outcomes reported here are for patients who were seen on a regular nursing floor and subsequently transferred to the ICU, as well as new ICU renal consults.

In-Hospital Mortality Grouped by Consultation Reason

2013 – 2016

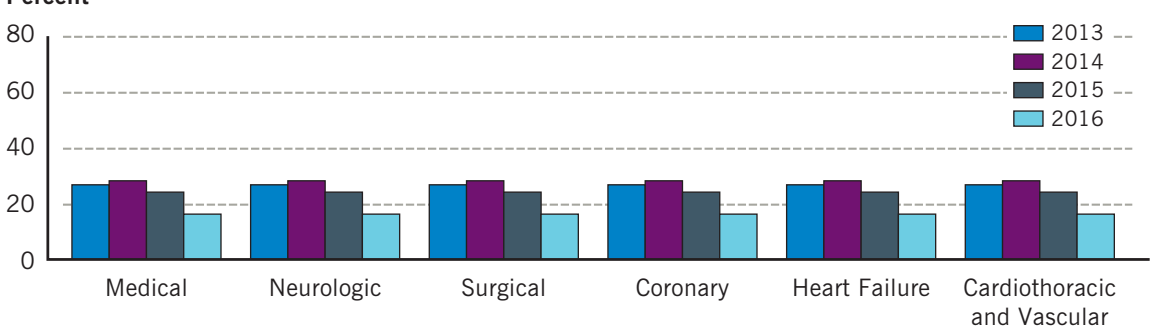


Number at Risk	Acute Kidney Injury	Acute Kidney Injury With Dialysis	End-Stage Renal Disease	Other[a]
N = 2013	374	599	595	93
N = 2014	344	615	669	101
N = 2015	337	620	706	104
N = 2016	366	660	797	89

[a]Includes electrolyte abnormalities, hypertension, proteinuria, hematuria, and nephrolithiasis

Incidence of Dialysis for Acute Kidney Injury by ICU Type

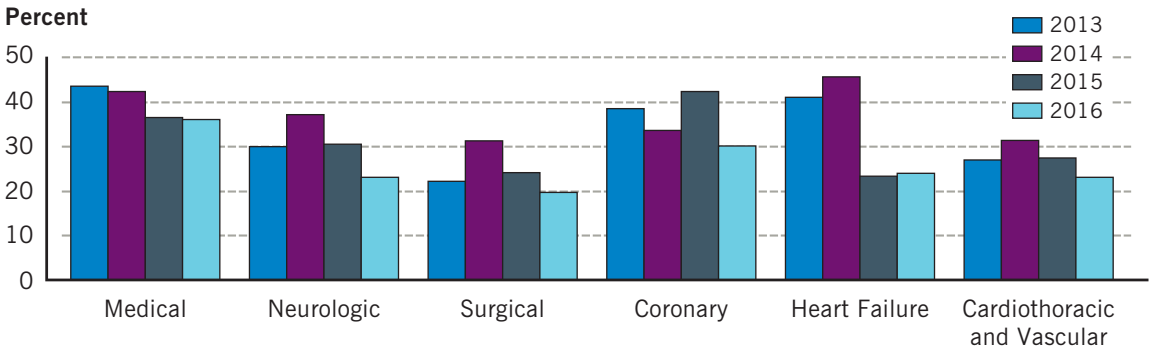
2013 – 2016



Number at Risk	Medical	Neurologic	Surgical	Coronary	Heart Failure	Cardiothoracic and Vascular
N = 2013	436	40	72	104	39	207
N = 2014	449	35	67	110	46	191
N = 2015	398	36	83	104	30	215
N = 2016	469	39	86	116	25	195

In-Hospital Mortality in Patients With Acute Kidney Injury by ICU Type

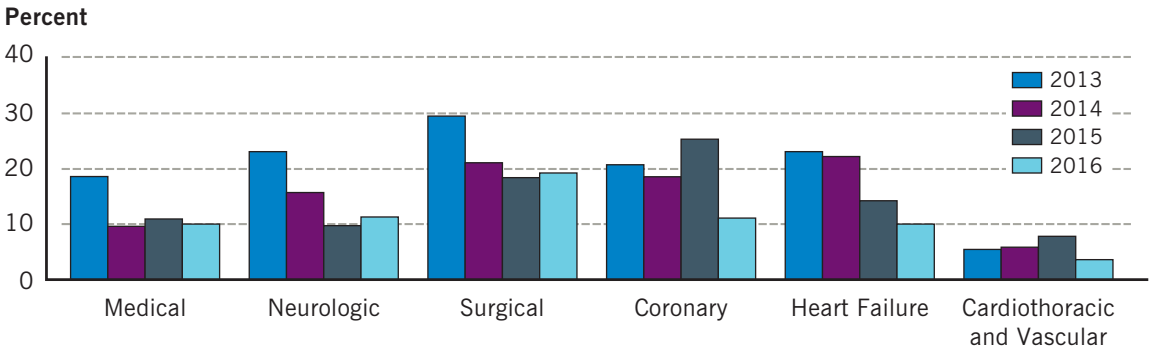
2013 – 2016



Number at Risk						
N =	436	40	72	104	39	207
N =	449	35	67	110	46	191
N =	398	36	83	104	30	215
N =	469	39	86	116	25	195

In-Hospital Mortality in Patients With End-Stage Renal Disease by ICU Type

2013 – 2016



Number at Risk						
N =	307	26	17	97	13	73
N =	300	32	38	86	18	85
N =	329	41	38	95	21	76
N =	398	44	26	99	20	82

Kidney and Pancreas Transplants

Kidney transplant program volume increased substantially in 2016 with a total of 162 kidney transplants, representing an increase of 16.5% from 2015. There were 137 kidney transplants, 6 simultaneous kidney-pancreas, 17 simultaneous liver-kidney, 1 simultaneous heart-kidney, and 1 kidney with a multivisceral transplant. There was 1 pancreas transplant. The program has continued to see significant demand for services with 1273 referrals for transplantation, an increase of 26.3% from 2015.

According to the most recent US Scientific Registry of Transplant Recipients report, Cleveland Clinic transplant rates exceeded expected values, and wait-list mortality was slightly lower than expected. Overall, patient and graft survival at 1 year were not different than expected.

Cleveland Clinic continues to have a high percentage of listed patients in active status and the shortest waiting time of centers in northeast Ohio. The median time to transplant in 2016 was 36.6 months — better than the 57.6 months for the local organ procurement organization, the 49.5 months for United Network for Organ Sharing region 10 (Ohio, Indiana, and Michigan), and the nationwide median transplant times with the 50th percentile of listed patients not reached.

The institute continues to support a robust living donor program. In 2016, there were 62 living donor kidney transplants, including 14 paired donations in affiliation with the National Kidney Registry, bringing total paired donations to 56 since program initiation in 2011. Additionally, there were 3 altruistic donors.

Kidney Transplant Program Summary

2016

	Cleveland Clinic
Deceased donor transplants, N	75
Living donor transplants, N	62
Total waiting list, N	663[a]
Active on waiting list, N	514[a]
New patient registrations, N	269[a]

[a]Data for July 2015 to June 2016 based on Scientific Registry of Transplant Recipients data available as of Oct. 31, 2016.

Kidney Wait-List Outcomes

July 2015 – June 2016

Rate	Observed	Expected
Kidney transplant rate for wait-list patients, %	21.1	18.4
Mortality rate while on wait-list, %	4.1	5.3

Source: Scientific Registry of Transplant Recipients, based on data available as of Oct. 31, 2016

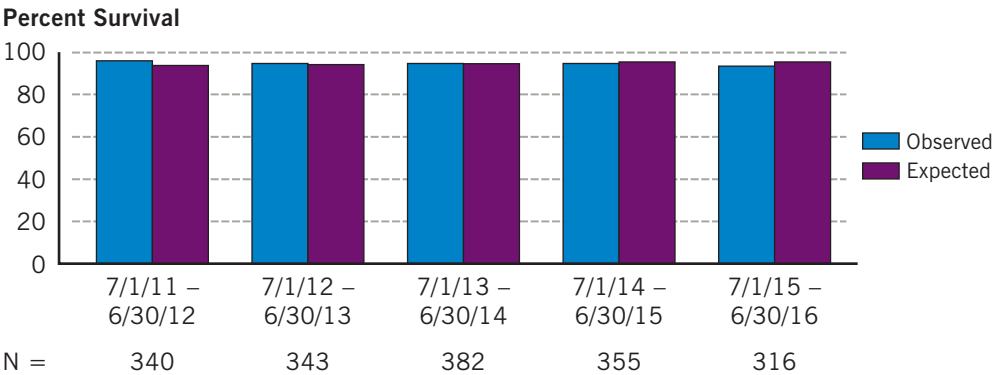
Posttransplant Outcomes at 1 Year

July 2014 – June 2015

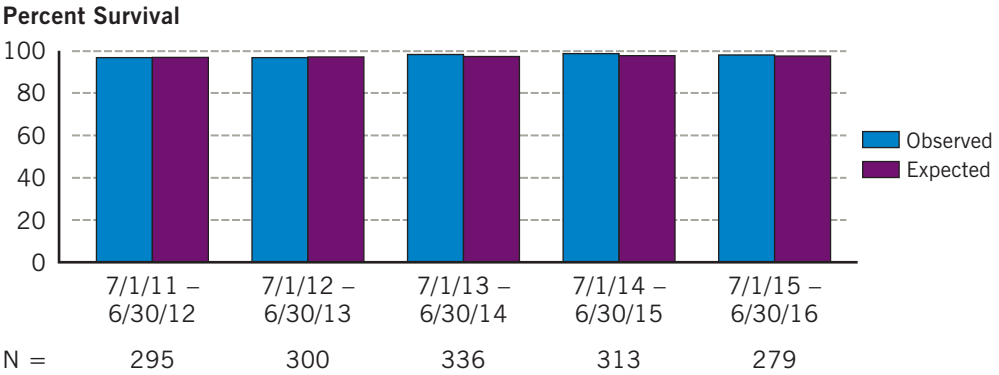
Survival	Observed	Expected
Adult graft survival (based on 316 transplants), %	93.61	95.61
Adult patient survival (based on 279 transplants), %	98.30	97.74
Pediatric graft survival (based on 7 transplants), %	100	
Pediatric patient survival (based on 6 transplants), %	100	

Source: Scientific Registry of Transplant Recipients, based on data available as of Oct. 31, 2016

Posttransplant Outcomes at 1 Year — Adult Graft Survival



Posttransplant Outcomes at 1 Year — Adult Patient Survival



The Urological & Kidney Institute maintains a strong commitment to developing new therapies for its patients and is participating in a National Institutes of Health trial to determine the efficacy of infliximab given at transplantation on 2-year kidney function and survival. The institute is also involved in several industry-sponsored studies of whether newer therapies given at the time of transplant will reduce delayed graft function, requiring dialysis that can prolong hospital stay.

Cleveland Clinic has also expanded the transplantation outreach program at the affiliated Akron General Hospital. This pretransplant evaluation clinic started in March 2015 and is held 1–2 days per month. Patients are now evaluated by a transplant coordinator, nephrologist, and social worker at a location more convenient for them. In 2016, 45 patients were evaluated.

Finally, the institute initiated a continuous improvement project to help improve performance in evaluating referrals. This will drive efficiency in the program.

Same Day Discharge After Robotic-Assisted Pelvic Floor Reconstruction

Discharge after a 1-night hospitalization is the currently accepted practice following robotic-assisted pelvic floor reconstruction (RAPFR). To assess whether same day discharge (SDD) affects the short-term safety of RAPFR relative to next day discharge, medical records for 7 overnight patients and 7 SDD patients were evaluated for any unscheduled Cleveland Clinic emergency department (ED) and/or office visits within 7 days of the RAPFR procedure. The charts of 14 women who underwent RAPFR procedures were retrospectively reviewed between May 2016 and September 2016. Patients in the SDD group were no more likely than the overnight group to require an unscheduled ED or office visit in the early postoperative period; in this cohort there were no unscheduled ED and/or office visits within 7 days of RAPFR. RAPFR procedures were well tolerated regardless of length of stay. SDD appears safe and feasible, with a significant decrease in treatment cost.

Feasibility of Same Day Discharge After Robotic-Assisted Pelvic Floor Reconstruction (N = 14)

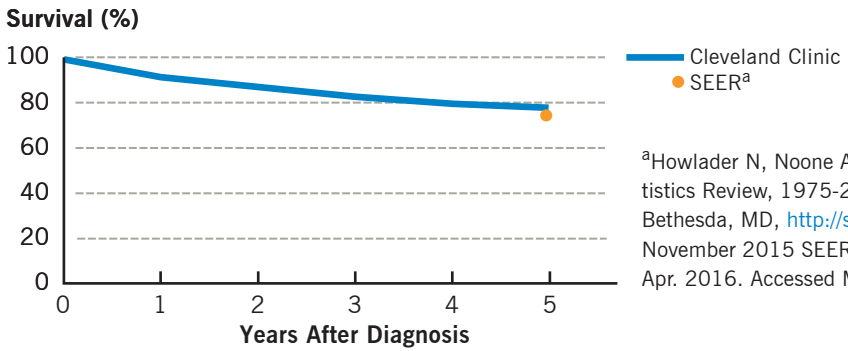
May 2016 – September 2016

Discharge Method (N)	Unscheduled Emergency Department Visits Within 7 Days of Procedure (N)	Unscheduled Office Visits Within 7 Days of Procedure (N)
Overnight (7)	0	0
Same day (7)	0	0

Renal Cell Carcinoma

Five-Year Overall Survival of Patients With All Stages of Renal Cell Cancer (N = 3593)

2007 – 2015

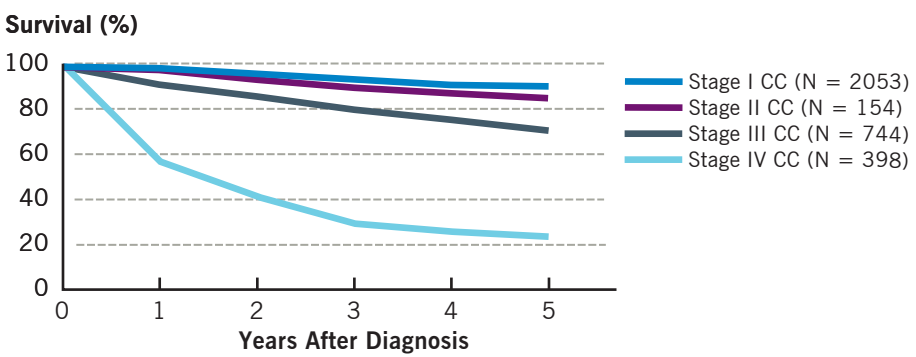


Number at Risk	3013	2485	1850	1796	672

[a]Howlader N, Noone AM, Krapcho M, et al. (eds). SEER Cancer Statistics Review, 1975-2013, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2013/, based on November 2015 SEER data submission, posted to the SEER website, Apr. 2016. Accessed March 21, 2017.

Five-Year Overall Survival of Patients With Renal Cell Cancer by Stage[a] at Diagnosis (N = 3349)

2007 – 2015



Number at Risk					
Stage I (N = 2053)	1830	1548	1148	720	445
Stage II (N = 154)	139	114	82	53	35
Stage III (N = 744)	623	512	356	205	108
Stage IV (N = 398)	210	134	76	47	25

CC = Cleveland Clinic

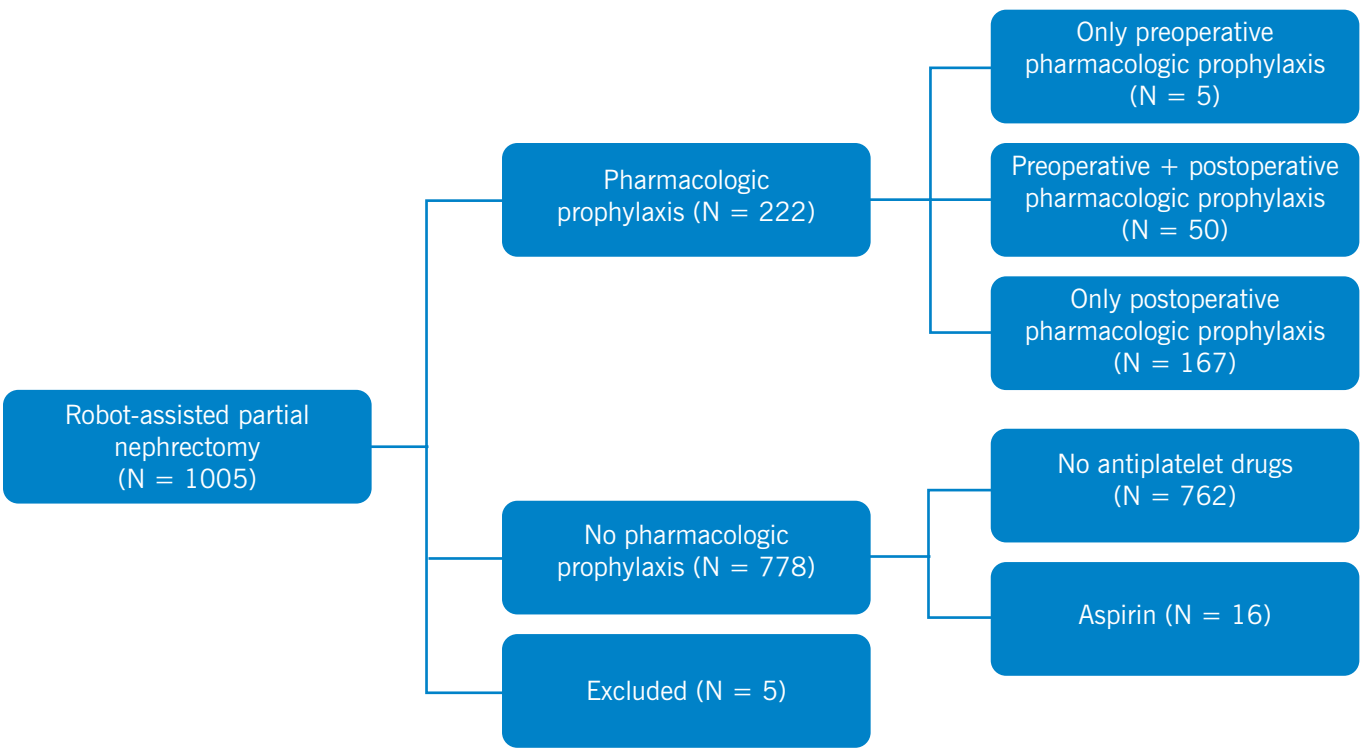
[a]American Joint Committee on Cancer (AJCC) stage 0–V renal cell carcinoma

Effects of Pharmacologic Venous Thromboembolism Prophylaxis After Robot-Assisted Partial Nephrectomy[1]

Urological & Kidney Institute researchers retrospectively examined 1005 robot-assisted partial nephrectomy database cases performed between 2006 and 2014 and documented clinical venous thromboembolism episodes occurring within 6 months of surgery. Patients who received pharmacologic venous thromboembolism prophylaxis (N = 222) and those who did not (N = 778) were compared in terms of perioperative outcomes, complications, and adverse hemorrhagic events (defined as the administration of 2 or more units of red blood cells, the need for vascular embolization, or any procedures related to blood loss).

Patient Selection by Pharmacologic Prophylaxis Status (N = 1005)

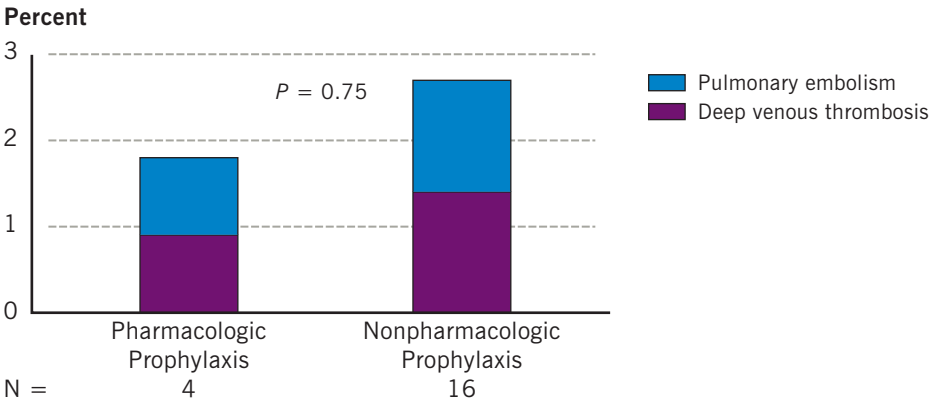
2006 – 2014



Rates of venous thromboembolism were comparable between the pharmacologic prophylaxis and no prophylaxis groups at 1.8% and 2.1%, respectively ($P = 0.75$). The administration of pharmacologic prophylaxis did not increase the rate of adverse hemorrhagic events. Isolated inpatient administration of pharmacologic prophylaxis after robot-assisted partial nephrectomy does not appear to protect against postoperative venous thromboembolism.

Summary of Venous Thromboembolism Events (N = 1000)

2006 – 2014



Reference

1. Kara O, Zargar H, Akca O, Andrade HS, Caputo P, Maurice MJ, Ramirez D, Stein RJ, Kaouk JH. Risks and benefits of pharmacological prophylaxis for venous thromboembolism prevention in patients undergoing robotic partial nephrectomy. *J Urol*. 2016 May;195(5):1348-1353.

High Irrigation Pressure and Inflammatory Response Syndrome After Percutaneous Nephrolithotomy[1]

Percutaneous nephrolithotomy (PCNL) is the procedure of choice for large kidney stones (> 2 cm). Continuous pressurized irrigation is used during the procedure to maintain visibility and adequate working space. The irrigation pressure used may be directly related to the development of systemic inflammatory response syndrome (SIRS) after PCNL with the attendant risk of progressing to urosepsis and septic shock. Institute investigators performed a randomized controlled trial to assess the effect of irrigation pressure on SIRS.

Between January 2014 and March 2016, 90 patients undergoing PCNL were randomized to low (80 mm Hg) or high (200 mm Hg) irrigation pressure. High pressure irrigation was associated with a higher risk of SIRS (46%) compared with low pressure irrigation (11%, $P < 0.0002$). On multivariate analysis, high irrigation pressure, paraplegia or neurogenic bladder, and nonquinolone perioperative antibiotics were predictive of postoperative SIRS. Although comparison between the high and low pressure groups indicated significantly better visualization during the procedure, there was no difference in stone free rates or complications.

This trial showed that high pressure irrigation during PCNL increases the risk of postoperative SIRS, with no significant improvement in outcomes.

High vs Low Pressure Surgical Outcomes and Complications (N = 90)

January 2014 – March 2016

	Low Pressure	High Pressure	*P* Value
Stone-free, N (%)	34 (81)	41 (91)	0.1
Mean residual stone diameter, mm (± SD)	0.9 ± 0.3	0.7 ± 0.4	0.7
Residual stones, N (%)			0.5
Computed tomography	15 (36)	11 (24)	
Fluoroscopy	22 (52)	25 (56)	
Plain KUB x-ray	4 (10)	8 (18)	
Renal ultrasound	1 (2)	1 (2)	
Intraoperative visualization, N (%)			0.0001
Excellent	0 (0)	6 (15)	
Good	8 (20)	21 (54)	
Fair	28 (68)	11 (28)	
Poor	5 (12)	1 (3)	
Clavien score, N (%)			0.3
I	39 (89)	42 (91)	
II	3 (7)	1 (20)	
IIIa	1 (2)	3 (7)	
IVa	1 (2)	0 (0)	
SIRS incidence, %	11	46	0.0002

KUB = kidney, ureter, and bladder, SIRS = systemic inflammatory response syndrome

Multivariate Analysis of Systemic Inflammatory Response Syndrome Predictors

January 2014 – March 2016

Characteristics	*P* Value
Age	0.8
Gender	0.7
Comorbidity (paraplegia, neurogenic bladder)	**< 0.001**
Irrigation pressure	**0.0008**
Stone composition	0.6
Perioperative quinolone	**0.0031**

Reference

1. Omar M, Noble M, Sivalingam S, El Mahdy A, Gamal A, Farag M, Monga M. Systemic inflammatory response syndrome after percutaneous nephrolithotomy: a randomized single-blind clinical trial evaluating the impact of irrigation pressure. *J Urol*. 2016 Jul;196(1):109-114.

Effects of Supplemental Calcium and Vitamin D in Recurrent Stone Formers

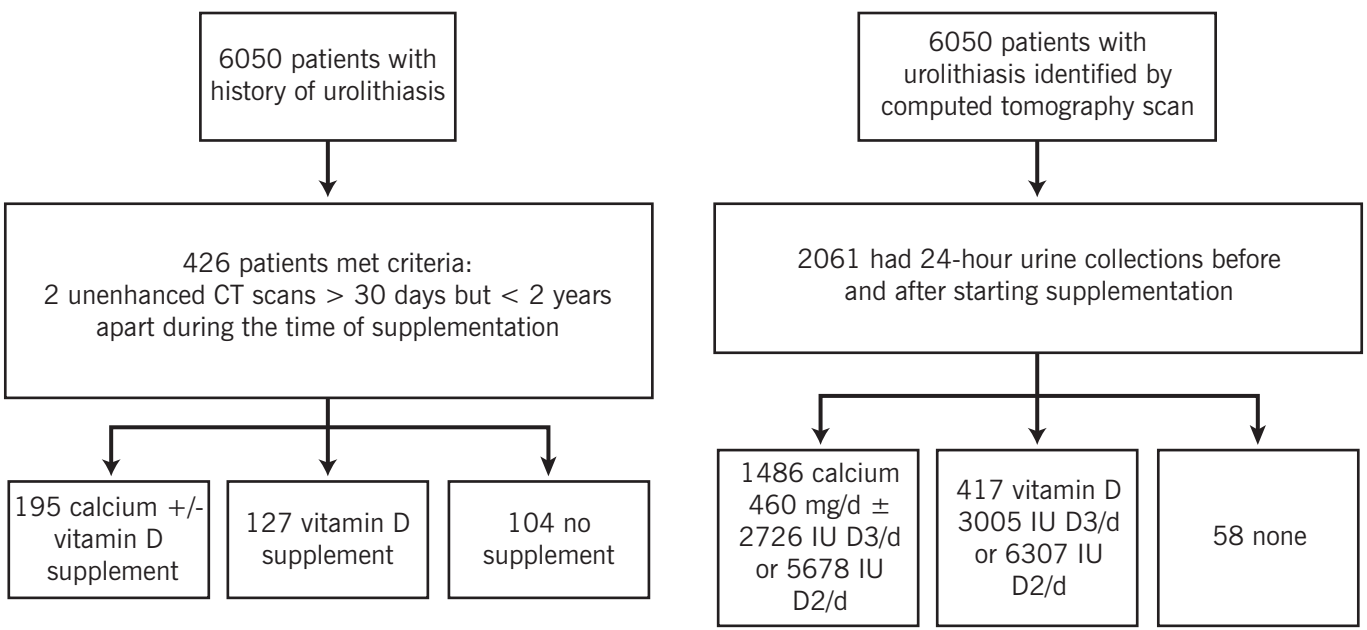
The institute studied the effects of calcium and vitamin D supplementation on kidney stone growth based on follow-up computed tomography (CT) scans and 24-hour urine composition.

Of 6050 current stone formers seen at Cleveland Clinic from 2003 to 2014, 426 who had at least 2 CT scans demonstrating kidney stones at least 30 days apart and in less than 2 years were included in the analysis. Patients who had a surgical intervention for a kidney stone between the two CT scans were excluded.

A total of 2061 patients who had at least 2 24-hour urine collections were included in the metabolic studies. The first 24-hour urine collection had to have taken place prior to initiation of calcium and/or vitamin D supplementation, and the second 24-hour urine collection had to have taken place at least 30 days after starting the supplementation.

Methods

2003 – 2014



Patients on calcium supplementation had a higher rate of stone formation than those on vitamin D supplementation alone. On average, the rate of stone formation for those on calcium was 7.8 mm/year compared with 3.3 mm/year ($P = 0.0105$). Multiple linear regression showed an inverse association between vitamin D3 and stone formation ($P = 0.049$).

Patients on calcium with or without vitamin D supplementation had a decrement in urinary calcium with a mean of -5.1 mg/day before and after supplementation ($P = 0.021$). For those on vitamin D alone, there was a decrease in urinary calcium of -8.9 mg/day ($P = 0.011$). There were also statistically significant decreases in urinary oxalate excretion for those on calcium with or without vitamin D (-4.2 mg/day) and vitamin D alone (-3.1 mg/day) ($P < 0.0001$).

In conclusion, patients on calcium supplementation had higher rates of stone formation, and vitamin D supplementation may have beneficial effects on recurrent stone formers. In addition, 24-hour metabolic analyses showed significant changes in urinary calcium and oxalate excretion with vitamin D supplementation, suggesting a possible protective effect.

Role of Parenchymal Mass Reduction and Ischemia on Functional Recovery After Partial Nephrectomy[1]

Acute increase of serum creatinine (SCr) after partial nephrectomy (PN) is primarily due to parenchymal mass reduction or ischemia; however, only ischemia can impact subsequent functional recovery. The institute evaluated etiologies of acute kidney injury (AKI) after PN and their prognostic significance. From 2007 to 2014, 83 solitary kidneys managed with PN had necessary studies for detailed analysis of function and parenchymal mass before and after surgery. AKI was classified by risk/injury/failure/loss/end-stage grade and defined by either standard criteria (comparison to preoperative SCr) or proposed criteria (comparison to projected postoperative SCr based on parenchymal mass reduction). Subsequent recovery was defined as percent function preserved/percent mass saved.

Median duration of warm ischemia (N = 39) was 20 minutes and hypothermia (N = 44) was 29 minutes. Median parenchymal mass reduction was 11%. AKI occurred in 45 patients based on standard criteria and 38 based on proposed criteria, and reflected injury/failure (grade = 2/3) in 23 and 16 patients, respectively. On multivariable analysis, only ischemia time was associated with AKI occurrence ($P = 0.016$). Based on the proposed criteria, median recovery from ischemia was 99% in patients without AKI and 95%/90%/88% for patients with grades 1/2/3 AKI, respectively. The coefficient for association between AKI grade based on proposed criteria and subsequent functional recovery was -4.168 ($P = 0.018$). The main limitation of this study is a limited patient cohort.

Parenchymal mass reduction and ischemia both contribute to acute changes in SCr after PN. Classification of AKI by proposed criteria is significantly associated with subsequent functional recovery. However, more robust numbers will be needed to further assess the merits of the proposed criteria. While AKI is associated with suboptimal recovery, even patients with grade 2/3 AKI reached 88% to 90% of recovery expected.

Reference

1. Zhang Z, Zhao J, Dong W, Remer E, Li J, Demirjian S, Zabell J, Campbell SC. Acute Kidney Injury after Partial Nephrectomy: Role of Parenchymal Mass Reduction and Ischemia and Impact on Subsequent Functional Recovery. *Eur Urol*. 2016 Apr;69(4):745-752.

Robot-Assisted Partial Nephrectomy With Intracorporeal Renal Hypothermia Using Ice Slush

Cleveland Clinic urologists have introduced the concept of intracorporeal cooling of the kidney during robot-assisted partial nephrectomy (RAPN) to minimize ischemic damage.

Cases were included and selected for intracorporeal cooling if preoperative assessment estimated that warm ischemia time would be > 30 minutes, determined by whether the patient had a complex renal mass. Researchers retrospectively compared 28 cold ischemia patients with a matched group of 36 patients undergoing robot-assisted partial nephrectomy under warm ischemia.

Strategies for successful ice slush intracorporeal renal cooling include placement of an accessory port directly over the kidney, uniform ice consistency, modified syringes, sequential clamping of the renal artery and vein, protection of the neighboring intestine with a laparoscopic sponge, and complete mobilization of the kidney. Kidney temperature is monitored via a needle thermocouple device, and core body temperature is concurrently monitored via an esophageal probe in real time. Renal function was assessed by serum creatinine level, estimated glomerular filtration rate (eGFR), and mercaptoacetyltriglycine renal scan, both perioperatively and at 6-month follow-up. Cold ischemia during RAPN was found to be associated with a 12.9% improvement in preservation of postoperative eGFR. No difference was seen in eGFR between patients with cold ischemia and the matched group of warm ischemia patients at 6-month follow-up.

RAPN with intracorporeal renal hypothermia using ice slush is technically feasible and may improve postoperative renal function in the short term. This technique for intracorporeal hypothermia is cost-effective, simple, and highly reproducible.

Intraoperative Data (N = 28)

2013 – 2015

Variable	Mean	Median	Range
Estimated blood loss, mL	162	100	25 – 800
Operating time, min	209	200	120 – 395
Ischemia time, min	32	29	18 – 56
Time for slush placement, min	5.2	5	2 – 10
Coldest renal temperature, °C	14.8	13	10 – 26
Time to lowest renal temperature, min	10.2	10	3 – 20
Patient start temperature, °C	36.1	36	35 – 37
Patient coldest temperature, °C	35.5	35	35 – 37
Change in patient temperature, °C	0.3	0	0 – 1
Volume of ice slush, mL	640	650	400 – 800

Postoperative and Functional Data (N = 28)

2013 – 2015

Variable	Mean	Median	Range
Length of stay, days	3.2	3	2 – 7
Postoperative eGFR at 1 week, mL/min/1.73 m^2	60.9	63.5	16 – 103.4
Degree of eGFR preservation, 1 week, %	85.3	85	45 – 116
eGFR at 6 months, mL/min/1.73 m^2	65.1	62	33 – 108
Degree of eGFR preservation at 6 months, %	86.8	91	62 – 126
Degree of ipsilateral differential functional preservation at 6 months assessed by nuclear medicine renal scan, %	79.9	78	60 – 100

eGFR = estimated glomerular filtration rate

Reference

1. Ramirez D, Caputo PA, Krishnan J, Zargar H, Kaouk JH. Robot-assisted partial nephrectomy with intracorporeal renal hypothermia using ice slush: step-by-step technique and matched comparison with warm ischaemia. *BJU Int*. 2016 Mar;117(3):531-536.

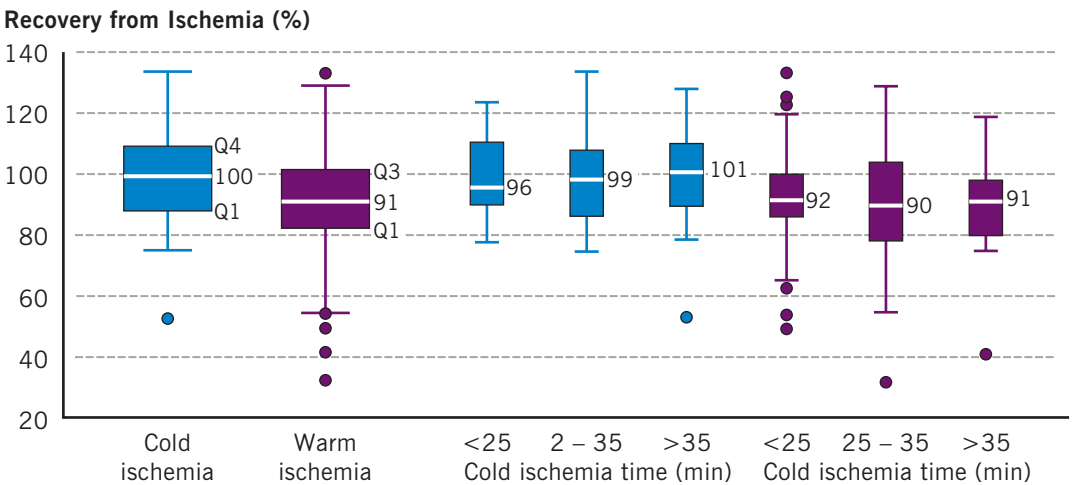
Functional Recovery From Extended Warm Ischemia After Partial Nephrectomy[1]

From 2007 to 2014, 277 patients managed with partial nephrectomy (PN) had appropriate studies to evaluate changes in function and mass within the operated kidney. Recovery from ischemia was defined as percent function saved/percent parenchymal mass saved. Acute kidney injury (AKI) was based on global renal function and defined as a ≥ 1.5-fold increase in serum creatinine above the preoperative level.

Hypothermia (median 27 minutes) was used in 112 patients and warm ischemia (median 21 minutes) in 165 patients. AKI strongly correlated with a solitary kidney ($P < 0.001$) and duration ($P < 0.001$) but not type ($P = 0.49$) of ischemia. Median recovery from ischemia in the operated kidney was 100% (interquartile range [IQR] = 88%–109%) for cold ischemia, with 6 patients (5%) noted to have < 80% recovery. For the warm ischemia group, median recovery from ischemia was 91% (IQR = 82%–101%, $P < 0.001$ compared with hypothermia), and 34 patients (21%) had recovery from ischemia < 80% ($P < 0.001$). For warm ischemia subgrouped by duration < 25 minutes (N = 114), 25–35 minutes (N = 35), and > 35 minutes (N = 16), median recovery from ischemia was 92% (IQR = 86%–100%), 90% (IQR = 78%–100%), and 91% (IQR = 80%–96%), respectively ($P = 0.77$).

Impact of Type and Duration of Ischemia on Functional Recovery (N = 277)

2007 – 2014



The box plots show median values with interquartile ranges (IQRs). Extreme values, defined as those more than 1.5 times the IQR away from either Q1 or Q3, are shown as individual points. The range of values is also shown excluding the extreme points. Hypothermia (blue) and warm ischemia (purple) cohorts are shown along with a breakdown of ischemic intervals.

The results suggest that AKI after PN correlates with duration but not with type of ischemia. However, subsequent recovery, which ultimately defines the new baseline glomerular filtration rate, is most reliable with hypothermia. Most patients undergoing PN with warm ischemia still recover relatively strongly from ischemia, even if extended to 35–45 minutes.

Reference

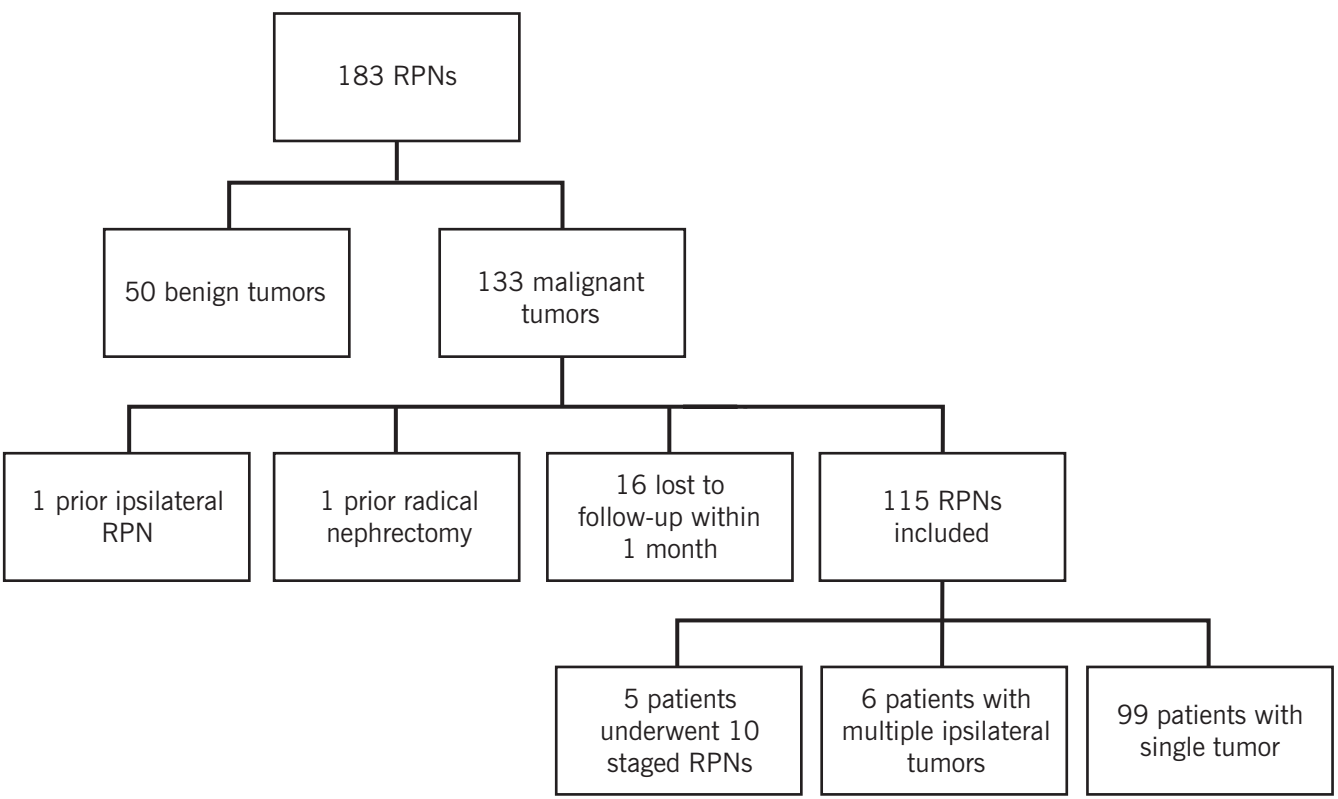
1. Zhang Z, Zhao J, Velet L, Ercole CE, Remer EM, Mir CM, Li J, Takagi T, Demirjian S, Campbell SC. Functional recovery from extended warm ischemia associated with partial nephrectomy. *Urology*. 2016 Jan;87:106-113.

Renal Cell Carcinoma: 5-Year Oncologic Outcomes After Transperitoneal Robot-Assisted Partial Nephrectomy[1]

Robot-assisted partial nephrectomy (RPN) is established as a minimally invasive nephron-sparing technique with excellent perioperative and intermediate oncologic outcomes. To determine the long-term outcomes associated with the procedure, consecutive patients undergoing RPN at Cleveland Clinic from June 2006 to March 2010 were prospectively selected from the RPN database. Patients with benign tumors, prior ipsilateral partial nephrectomy, prior radical nephrectomy, and those with follow-up of < 1 month were excluded.

Long-Term Robot-Assisted Partial Nephrectomy Outcomes Selection Process (N = 115)

June 2006 – March 2010



RPN = robot-assisted partial nephrectomy

Demographic and Preoperative Data for Patients Undergoing Robot-Assisted Partial Nephrectomy (N = 110)

June 2006 – March 2010

Variable	Value
Patients/robot-assisted partial nephrectomy procedures, N	110/115
Mean age, years (SD)	59.8 (11)
Males, N (%)	73 (66)
White, N (%)	106 (96)
Right side, N (%)	56 (51)
Mean body mass index, kg/m^2 (SD)	30.4 (6.9)
Median age-adjusted Charlson comorbidity index (IQR)	4 (3 – 5)
Median tumor size, cm (IQR)	2.6 (2.0 – 3.7)
Clinical stage, N (%)	
T1a	91 (79)
T1b	20 (17.4)
T2a	4 (3.6)
Median RENAL score (IQR)	7 (6 – 9)
Low score (4 – 6), N (%)	37 (32)
Moderate score (7 – 9), N (%)	60 (52)
High score (10 – 12), N (%)	18 (16)
Median preoperative eGFR, $mL/min/1.73m^2$ (IQR)	85.9 (67.8 – 96.1)

eGFR = estimated glomerular filtration rate, IQR = interquartile range, SD = standard deviation

Perioperative, Postoperative, and Pathologic Data (N = 115)

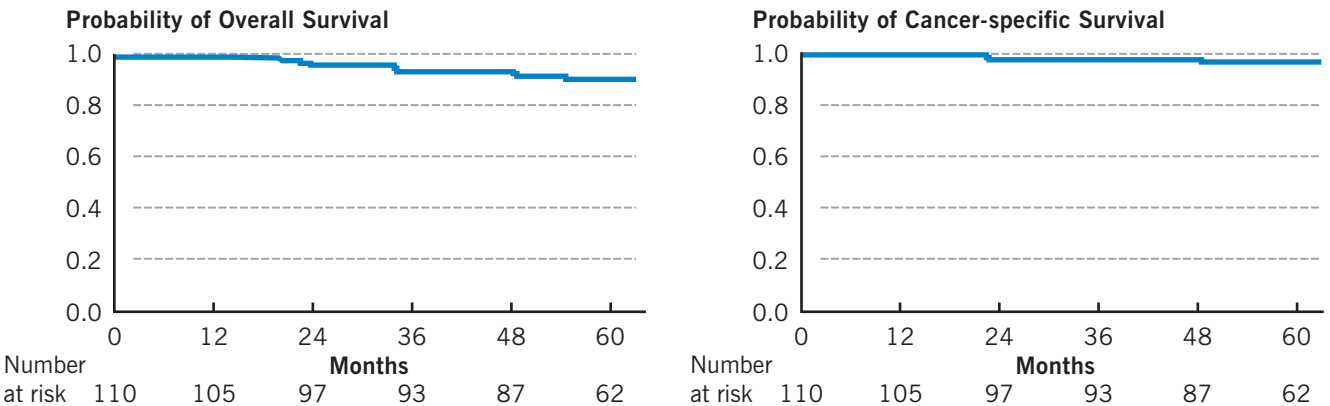
June 2006 – March 2010

Variable	Value
Median operative time, min (IQR)	180 (150 – 215)
Median estimated blood loss, mL (IQR)	200 (100 – 350)
Median warm ischemia time, min (IQR)	20 (16 – 27)
Intraoperative complications, N (%)	7 (6.1)
Postoperative complications, N (%) Clavien-Dindo I Clavien-Dindo II Clavien-Dindo IIIa	28 (24) 8 (28) 15 (54) 5 (18)
Median length of stay, days (IQR)	3 (3 – 5)
Median follow-up, months (IQR)	61.9 (50.9 – 71.4)
Median postoperative eGFR, mL/min/1.73m^2 (IQR)	69.6 (57.6 – 87.2)
Median eGFR preservation, % (IQR)	87.8 (74.9 – 98.1)
Chronic kidney disease upstaging, N (%)	21 (19.1)
Trifecta criteria met, N (%)	62 (53.9)
Histology, N (%) Clear cell Papillary Chromophobe Unclassified	 78 (68) 26 (23) 6 (5) 5 (4)
Pathologic T stage, N (%) T1a T1b T2a T3a	 90 (78) 18 (16) 2 (2) 5 (4)
Fuhrman grade ≥ 3, N (%)	24 (21)
Positive surgical margins, N (%)	2 (1.7)
Recurrence, N (%)	0 (0)
Metastasis, N (%)	2 (1.8)

eGFR = estimated glomerular filtration rate, IQR = interquartile range, SD = standard deviation

Survival of Patients Undergoing Robot-Assisted Partial Nephrectomy (N = 110)

June 2006 – March 2010



Univariate Logistic Regression Analysis of Variables Predicting Overall Mortality (N = 110)

June 2006 – March 2010

Variable	Odds Ratio	*P* Value
Age-adjusted Charlson comorbidity index	1.67	0.006
Absence of trifecta	4.72	0.06
Glomerular filtration rate preservation	1.01	0.5
RENAL score 4 – 6	1.0 (reference)	
RENAL score 7 – 9	1.82	0.5
RENAL score 10 – 12	2.19	0.4
Clear cell renal cell carcinoma	2.82	0.14
High Fuhrman grade	2.16	0.3

Reference

1. Andrade HS, Zargar H, Caputo PA, Akca O, Kara O, Ramirez D, Haber GP, Stein RJ, Kaouk JH. Five-year oncologic outcomes after transperitoneal robotic partial nephrectomy for renal cell carcinoma. *Eur Urol*. 2016 Jun;69(6):1149-1154.

Robot-Assisted vs Open Partial Nephrectomy for Completely Endophytic Renal Tumors[1]

Completely endophytic renal tumors have traditionally been treated using open partial nephrectomy (OPN) due to the complex dissection required for complete excision. Institute urologists have extended the technique of robot-assisted partial nephrectomy (RAPN) to include these complex cases, providing patients the advantage of improved cosmesis and enhanced recovery.

There were 1230 consecutive cases, consisting of 823 RAPN and 407 OPN, performed for renal mass between 2011 and 2015. Of these, data on 87 RAPN and 56 OPN cases for completely endophytic renal tumors were analyzed.

Demographics and Tumor Characteristics (N = 143)

2011 – 2015

Patient Variables	RAPN (N = 87)	OPN (N = 56)	*P* Value
Mean age, years (SD)	58.3 (11.8)	61.1 (11)	0.71
Surgical cases per year, N (%) 2011 2012 2013 2014 2015	 10 (11.5) 18 (20.7) 23 (26.4) 22 (25.3) 14 (16.1)	 13 (23.2) 16 (28.6) 11 (19.6) 10 (17.9) 6 (10.7)	0.19
White, N (%)	72 (82.8)	49 (87.5)	0.44
Male, N (%)	45 (51.7)	35 (62.5)	0.2
Solitary kidney, N (%)	5 (5.7)	12 (21.4)	**0.005**
Preoperative chronic kidney disease, N (%)	16 (18.6)	14 (25)	0.4
Median body mass index, kg/m^2 (IQR)	29 (25.4 – 33.3)	29.5 (25.7 – 35.7)	0.66
Median Charlson comorbidity index, (IQR)	1 (0 – 2)	1 (0 – 2)	0.15
Median preoperative eGFR, mL/min/1.73 m^2 (IQR)	84.7 (67.6 – 98.6)	78.9 (57.4 – 89.4)	0.14

eGFR = estimated glomerular filtration rate, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy, SD = standard deviation

Tumor Variables	RAPN (N = 87)	OPN (N = 56)	*P* Value
Median tumor size on CT, cm (IQR)	2.8 (2.1 – 3.7)	3.1 (3.3 – 4.6)	0.07
Median RENAL score (IQR)	9 (9 – 10)	9 (8 – 10)	0.35
RENAL complexity class, N (%) Low (4 – 6) Moderate (7 – 9) High (10 – 12)	 4 (4.6) 43 (49.4) 40 (46)	 5 (8.9) 23 (41.1) 28 (50)	0.43

CT = computed tomography, IQR = interquartile range, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Intraoperative and Postoperative Outcomes (N = 143)

2011 – 2015

Variable	RAPN (N = 87)	OPN (N = 56)	*P* Value
Intraoperative			
Mean operation time, min (SD)	185 (60.3)	206 (63.1)	0.06
Mean estimated blood loss, mL (SD)	175 (166.3)	341 (284.4)	**< 0.001**
Warm ischemia, N (%)	77 (88.5)	13 (14.4)	
Median (IQR) time, min	24 (18 – 29.7)	20.6 (16.7 – 21.7)	0.15
Cold ischemia, N (%)	10 (11.5)	41 (80.4)	
Median (IQR) time, min	28 (23.8 – 44.2)	34 (24.7 – 49.5)	0.28
Unclamped, N (%)	0 (0)	2 (3.6)	
Intraoperative transfusion, N (%)	0 (0)	4 (7.1)	**0.02**
Positive margin, N (%)	4 (5.4)	4 (8.7)	0.48
Postoperative			
Median length of stay, days, (IQR)	3 (2 – 4)	5 (4 – 6)	**< 0.001**
Postoperative transfusion, N (%)	5 (6)	7 (12.5)	0.18
30-day readmission, N (%)	2 (2.3)	5 (8.9)	0.11

IQR = interquartile range, SD = standard deviation

Intraoperative and Postoperative Complications (N = 143)

2011 – 2015

Complication, N (%)	RAPN (N = 87)	OPN (N = 56)	*P* Value
Intraoperative complications	1 (1.1)	1 (1.7)	0.75
Pleural injury requiring chest tube	0 (0)	1 (1.1)	
Renal artery injury	1 (1.1)	0 (0)	
Postoperative complications, Clavien grade I – V	18 (20.7)	20 (35.7)	0.08
Major complications, Clavien grade III – IV	4 (4.5)	5 (8.9)	0.85
Clavien grade II complications	12 (13.7)	14 (25)	
Transfusion	3 (3.4)	2 (3.5)	
Pneumonia	2 (2.3)	0 (0)	
Gross hematuria and clot retention	1 (1.1)	0 (0)	
Urinary tract infection	1 (1.1)	1 (1.7)	
Atrial fibrillation requiring treatment	4 (4.6)	2 (3.5)	
Deep venous thromboembolism	1 (1.1)	3 (5.5)	
Wound infection requiring antibiotics	0 (0)	5 (8.9)	
Ileus requiring total parenteral nutrition	0 (0)	1 (1.7)	
Clavien grade III complications	4 (4.5)	4 (7.2)	
Urine leakage requiring JJ stent	0 (0)	1 (1.7)	
Embolization (arteriovenous fistula hematuria)	3 (3.4)	2 (3.5)	
Acute kidney injury (oliguria)	0 (0)	1 (1.7)	
Ogilvie syndrome requiring colonoscopy	1 (1.1)	0 (0)	
Clavien grade IV complications	0 (0)	1 (1.7)	
Acute kidney injury requiring hemodialysis	0 (0)	1 (1.7)	

OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Pathologic Outcomes and Follow-Up Data (N = 143)

2011 – 2015

Variable	RAPN (N = 87)	OPN (N = 56)	*P* Value
Malignant disease, N (%)	74 (85.1)	47 (83.9)	0.85
Clear cell renal cell carcinoma	54 (73.0)	29 (61.7)	0.51
Papillary renal cell carcinoma	6 (8.1)	7 (14.9)	
Chromophobe renal cell carcinoma	7 (9.5)	6 (12.8)	
Mixed component renal cell carcinoma	2 (2.7)	3 (6.4)	
Other malignant diseases	5 (6.8)	2 (4.3)	
T stage, N (%)			
T1a	53 (71.6)	30 (63.8)	0.3
T1b	9 (12.2)	4 (8.5)	
T2a	1 (1.4)	0 (0)	
T3a	11 (14.9)	13 (27.7)	
Tumor grade, N (%)			
1 and 2	37 (56.1)	25 (61.0)	0.61
3 and 4	29 (43.9)	16 (39.0)	
Median (IQR)			
Follow-up, months	15.2 (7 – 27.2)	18.1 (8.2 – 30.9)	0.12
Postoperative 3rd day eGFR, mL/min/1.73m^2	70.1 (56.7 – 85.4)	62.2 (43.1 – 75.5)	**0.03**
Postoperative 3rd day % eGFR preservation	82.9 (70.4 – 100)	79.3 (65.4 – 98.4)	0.26
Latest eGFR, mL/min/1.73m^2	71 (54.6 – 90)	67 (45.7 – 78.9)	0.07
Latest follow-up % eGFR preservation	85.2 (76.4 – 93.3)	82.9 (73.1 – 91.9)	0.22
Oncologic outcomes, N (%)			
Local recurrence	0 (0)	0 (0)	
Metastasis	0 (0)	0 (0)	

eGFR = estimated glomerular filtration rate, IQR = interquartile range, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Reference

1. Kara O, Maurice MJ, Malkoc E, Ramirez D, Nelson RJ, Caputo PA, Stein RJ, Kaouk JH. Comparison of robot-assisted and open partial nephrectomy for completely endophytic renal tumours: a single centre experience. *BJU Int*. 2016 Dec;118(6):946-951.

Robot-Assisted Partial Nephrectomy Improves Outcomes in Obese Patients[1]

Obese patients are at high risk for surgical complications, particularly wound related complications. Institute researchers analyzed surgical complications for obese patients undergoing robot-assisted partial nephrectomy to assess the impact of the technique on operative and postoperative outcomes.

Otherwise healthy (Charlson comorbidity score ≤ 1 and bilateral kidneys) obese patients (body mass index > 30 kg/m^2) with small renal masses (< 4 cm) treated from 2011 to 2015 were included in the study. The primary outcomes were intraoperative transfusion, operating time, length of hospital stay, and postoperative complications.

These results show that at a high-volume center, the robot-assisted approach is associated with less blood transfusion, shorter operating time, faster recovery, and fewer perioperative complications compared with the open approach in obese patients undergoing partial nephrectomy for small renal masses.

Demographic Data and Tumor Characteristics (N = 237)

2011 – 2015

Patient Variables	RAPN (N = 177)	OPN (N = 60)	*P* Value
Median body mass index, kg/m^2 (IQR)	33.4 (31.4 – 39)	34.1 (32.6 – 40.2)	0.16
Obesity class, N (%) 30 – 34.9 kg/m^2 (class 1) 35 – 39.9 kg/m^2 (class 2) ≥ 40 kg/m^2 (class 3)	 107 (60.4) 38 (21.5) 32 (18.1)	 33 (55) 12 (20) 15 (25)	0.51
Mean age, years (± SD)	54.9 (± 11.4)	55.9 (± 11.0)	0.45
Male, N (%)	105 (59.3)	30 (50.0)	0.21
Smoking status, N (%)	23 (13)	7 (11.1)	0.78
Median preoperative eGFR, mL/min/1.73m^2 (IQR)	91.6 (78.2 – 101.1)	86.9 (72.8 – 102.4)	0.14
Tumor size, cm (IQR)	2.5 (2 – 3)	2.8 (2.4 – 3.1)	**0.02**
Multiple tumors, N (%)	11 (6.2)	2 (3.3)	0.39
Malignant tumor, N (%)	151 (85.3)	56 (93.3)	0.11
RENAL score, median (IQR)	7 (5 – 8)	7 (5 – 8)	0.36
High complexity tumor, N (%)	11 (6.2)	5 (8.3)	0.57

eGFR = estimated glomerular filtration rate, IQR = interquartile range, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy, SD = standard deviation

Primary Outcomes (N = 237)

2011 – 2015

Variables	RAPN (N = 177)	OPN (N = 60)	*P* Value
Median operating time, min (IQR)	180 (150 – 210)	207 (170 – 245)	**< 0.01**
Intraoperative blood transfusion, N (%)	2 (1.1)	6 (10.0)	**< 0.01**
Median length of stay, days (IQR)	3 (2 – 3)	4 (4 – 5)	**< 0.01**
Overall complications: Clavien I – V, N (%)	28 (15.8)	19 (31.7)	**0.01**
Major complications: Clavien III – V, N (%)	10 (5.6)	1 (1.7)	0.20

IQR = interquartile range, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Postoperative Complications in Detail (N = 237)

2011 – 2015

Complications	RAPN (N = 177)	OPN (N = 60)	*P* Value
Postoperative blood transfusion	4 (2.3)	3 (5)	0.27
Reoperation	2 (1.1)	0 (0)	0.40
Arrhythmia	5 (2.8)	1 (1.7)	0.62
Pneumonia	4 (2.3)	0 (0)	0.24
Deep venous thrombosis/pulmonary embolism	1 (0.6)	1 (1.7)	0.42
Ileus	4 (2.3)	1 (1.7)	0.72
Surgical site infection	2 (1.1)	7 (11.7)	< 0.01
Genitourinary complications			
Acute kidney injury	1 (0.6)	1 (1.7)	0.44
Urine leakage	0 (0)	2 (3.3)	**0.01**
Urinary tract infection	0 (0)	2 (3.3)	**0.01**
Angioembolization	2 (1.1)	0 (0)	0.40

OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Multivariable Regression Analysis for Predictors of Operating Time, Length of Stay, and Overall Complications (N = 237)

2011 – 2015

Variables	Operating Time			Length of Stay			Overall Postoperative Complications		
	Coefficient	95% CI	*P* Value	Coefficient	95% CI	*P* Value	Odds Ratio	95% CI	*P* Value
Age	0.32	-0.2 to 0.8	0.20	0.01	-0.01 to 0.03	0.37	1	0.9-1.0	0.44
Gender									
Male	Reference			Reference			Reference		
Female	-19.7	-32.6 to -6.7	< **0.01**	-0.04	-0.5 to 0.4	0.86	0.62	0.3-1.2	0.19
Obesity									
Class 1 – 2	Reference			Reference			Reference		
Class 3	10.6	-5.5 to 26.7	0.19	0.7	0.08-1.30	**0.02**	2.35	1.0-5.1	**0.03**
Tumor complexity									
Low/moderate	Reference			Reference			Reference		
High	1.19	-24.2 to 26.6	0.92	1.53	0.5-2.5	< **0.01**	2.27	0.7-7.2	0.16
Tumor size	10.4	2.1-18.8	**0.01**	0.29	-0.02 to 0.60	0.07	1.06	0.6-7.2	0.79
Surgical approach									
RAPN	Reference			Reference			Reference		
OPN	24.2	9.7-38.8	< **0.01**	1.65	1-2.2	< **0.01**	2.27	1.11-4.62	**0.02**

CI = confidence interval, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Secondary Outcomes (N = 237)

2011 – 2015

Variables	RAPN (N = 177)	OPN (N = 60)	*P* Value
Perioperative outcomes			
Median ischemia time, min (IQR)	19.5 (15 – 2.5)	27 (22 – 40)	**< 0.01**
Warm ischemia, N (%)	158 (89.3)	11 (18.3)	
Cold ischemia, N (%)	5 (2.8)	36 (60)	
Zero ischemia, N (%)	14 (7.9)	3 (5)	
Median estimated blood loss, mL (IQR)	150 (75 – 210)	300 (162 – 400)	**< 0.01**
30-day readmission, N (%)	8 (4.5)	6 (10)	0.12
Positive surgical margin, N (%)	7 (4)	2 (3.4)	0.82
Functional outcomes			
Median latest eGFR, mL/min/1.73m^2 (IQR)	77.7 (63.8 – 91.9)	70.9 (62.6 – 88.5)	0.28
Median latest % eGFR preservation, (IQR)	83.8 (75.7 – 93.7)	85.7 (75.9 – 99)	0.43
Chronic kidney disease upstage, N (%)	34 (19.2)	11 (18.3)	0.88
Follow-up times, months (IQR)	20.9 (0.9 – 49.9)	26.1 (2.6 – 78.7)	0.09

eGFR = estimated glomerular filtration rate, IQR = interquartile range, OPN = open partial nephrectomy, RAPN = robot-assisted partial nephrectomy

Reference

1. Malkoc E, Maurice MJ, Kara O, Ramirez D, Nelson RJ, Caputo PA, Mouracade P, Stein R, Kaouk JH. Robot-assisted approach improves surgical outcomes in obese patients undergoing partial nephrectomy. *BJU Int*. 2017 Feb;119(2):283-288.

Reduced Opioid Prescribing After Scrotal and Subinguinal Surgery[1]

Excess prescribing of opioid pain medication increases medical costs and the potential for abuse. Urologists have a responsibility to treat postoperative pain, but there is little objective data to guide providers in procedure specific opioid prescribing practices. Cleveland Clinic researchers retrospectively analyzed opioid prescribing, usage, and postoperative pain in 20 patients undergoing scrotal or subinguinal surgery and developed a pain management protocol to guide opioid and adjunct analgesia prescribing.

Results showed that a median of 20 opioid tablets were prescribed for postoperative pain but that patients used only an average of 3.5 tablets. These data led to the development of a standardized protocol for pain management after scrotal, penile, and subinguinal surgery that includes preoperative education, reduced opioid prescribing, and an emphasis on using nonopioid pain control alternatives.

The analysis showed that a history of surgery or bilateral vs unilateral surgery did not affect opioid usage. Adjunct analgesia including nonsteroidal anti-inflammatory drugs and the use of ice, scrotal support, and scrotal elevation did not reduce opioid use, but were used by patients instead of additional opioids to treat increased pain. When adjuncts were used for increased pain, they were rated favorably by patients and were perceived as helpful. No combination of adjuncts was significantly more beneficial than another.

As a result, current practice is to tailor opioid prescriptions to patients' needs and, on average, no more than 4 tablets are initially prescribed. This standardized postoperative pain management protocol significantly reduced the total number of opioid tablets prescribed per patient from 20 to 10 tablets for an average savings of $68.50 per patient.

Reference

1. Starks C, Zampini A, Tadros NN, McGill J, Baker K, Sabanegh ES. Reduction in opioid prescribing using a post-operative pain management protocol following scrotal and subinguinal surgery. *Urol Pract*. In press. doi:doi.org/10.1016/j.urpr.2017.03.010.

Vasectomy Reversal Semen Analysis: New Reference Ranges Predict Pregnancy[1]

The Urological & Kidney Institute developed new semen analysis reference ranges to help predict pregnancy rates after vasectomy reversal (VR). Previous studies have analyzed factors influencing vasal patency after VR, such as obstructive interval and vasal fluid characteristics, but few studies have addressed postoperative pregnancy outcomes.

Center for Male Fertility researchers reviewed records of 139 patients who underwent VR from 2010 to 2014 to determine patient/spouse age, obstructive interval, intraoperative findings, procedure performed, postoperative semen results, and spontaneous pregnancy outcomes.

The mean obstructive interval was 9.5 ± 1.2 years.

Spontaneous pregnancy was achieved by 49.6% (69/139) of patients and was directly related to better intraoperative vasal fluid quality and postoperative sperm concentration, sperm motility, and strict morphology. The reference ranges for postoperative semen parameters of patients with spontaneous pregnancy were substantially lower than normal values published by the World Health Organization (fifth percentile: concentration > 15 million/mL, sperm motility > 40%, and normal morphology > 4%).[2] Spontaneous pregnancy was reported in 15%, 21.3%, and 14.8% of patients with sperm concentration < 5 million/mL, sperm motility < 10%, and normal morphology < 1%, respectively.

Semen Analysis Centiles (N = 139)

2010 – 2014

	5th (95% CI)	10th	25th	50th	75th	90th	95th
Volume, mL	0.74 (0.4-1.4)	1.28	1.62	2.5	3.4	4.5	5.9
Sperm concentration, million/mL	3.56 (0.1-5.89)	5.17	13.1	23.7	45.5	66.5	119.6
Total motility, %	4.45 (3-7.3)	5.9	13	25.5	37.7	54.2	63.2
Total motile count	0.58 (0.1-1.6)	0.82	4.7	14.8	42.7	92.3	152.2
Normal forms, %	0.0 (0.0-1)	1	1	3	5.75	10	14.1

These results suggest that fertility is restored in VR patients with much lower semen parameters than had previously been suggested by standard semen analysis ranges.

References

1. Majzoub A, Tadros NN, Polackwich AS, Sharma R, Agarwal A, Sabanegh E Jr. Vasectomy reversal semen analysis: new reference ranges predict pregnancy. *Fertil Steril*. 2017 Apr;107(4):911-915.
2. Cooper TG, Noonan E, von Eckardstein S, Auger J, Baker HW, Behre HM, Haugen TB, Kruger T, Wang C, Mbizvo MT, Vogelsong KM. World Health Organization reference values for human semen characteristics. *Hum Reprod Update*. 2010 May-Jun;16(3):231-345.

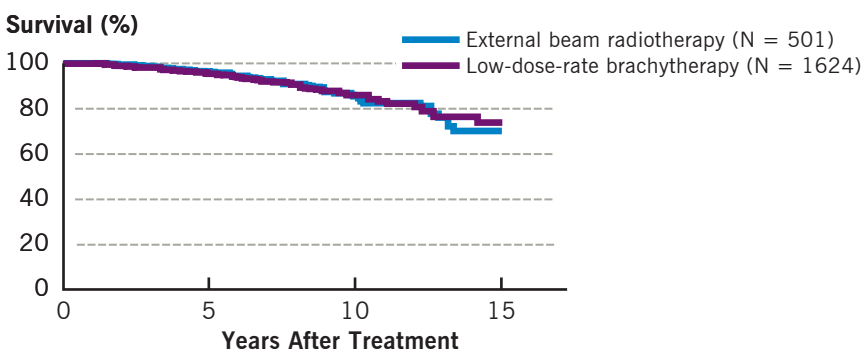
The Center for Urologic Oncology's prostate cancer program offers innovative, leading edge care for prostate cancer patients, including all treatment modalities for localized and locally advanced disease. Treatment options include open and robot-assisted prostatectomy, cryotherapy, and, in conjunction with the Department of Radiation Oncology, I-125 brachytherapy and Calypso®-based, image-guided, intensity-modulated external beam radiotherapy.

In the outcomes graphs that follow, patient groups are defined as:[1]

- Low risk: Gleason score ≤ 6, clinical stage ≤ T2a, and prostate specific antigen (PSA) level < 10 ng/mL
- Intermediate risk: Gleason score 7 and/or clinical stage T2b and/or PSA 10–20 ng/mL
- High risk: Gleason score ≥ 8 and/or clinical stage > T2b and/or PSA > 20 ng/mL

Biochemical Relapse Free Survival of Patients With Low-Risk Prostate Cancer by Treatment Type (N = 2125)

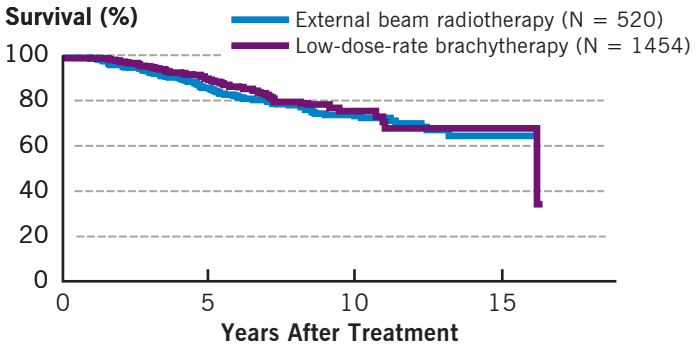
1996 – 2016



Number at Risk:			
External beam radiotherapy	330	130	14
Low-dose-rate brachytherapy	778	143	12

Biochemical Relapse Free Survival of Patients With Intermediate-Risk Prostate Cancer by Treatment Type (N = 1974)

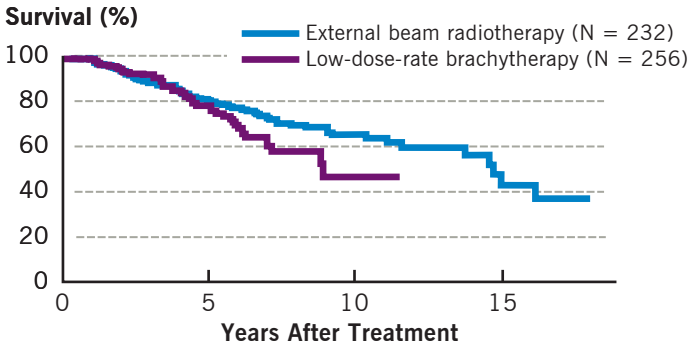
1996 – 2016



Number at Risk:			
External beam radiotherapy	273	109	5
Low-dose-rate brachytherapy	451	44	4

Biochemical Relapse Free Survival of Patients With High-Intermediate Risk Prostate Cancer by Treatment Type[a] (N = 488)

1996 – 2016

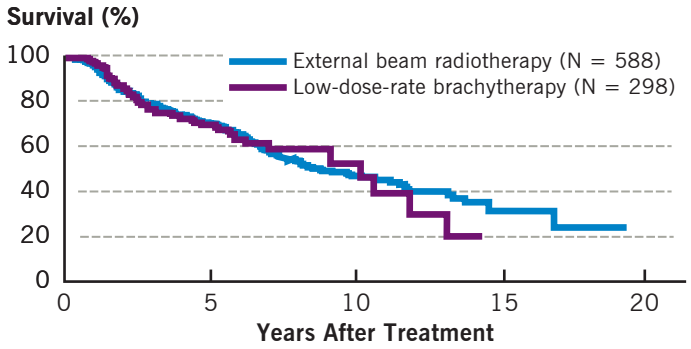


Number at Risk:			
External beam radiotherapy	131	48	10
Low-dose-rate brachytherapy	69	5	0

[a]High-intermediate risk is defined as having ≥2 intermediate risk factors.

Biochemical Relapse Free Survival of Patients With High-Risk Prostate Cancer by Treatment Type (N = 886)

1996 – 2016



Number at Risk:			
External beam radiotherapy	261	28	8
Low-dose-rate brachytherapy	73	8	0

Reference

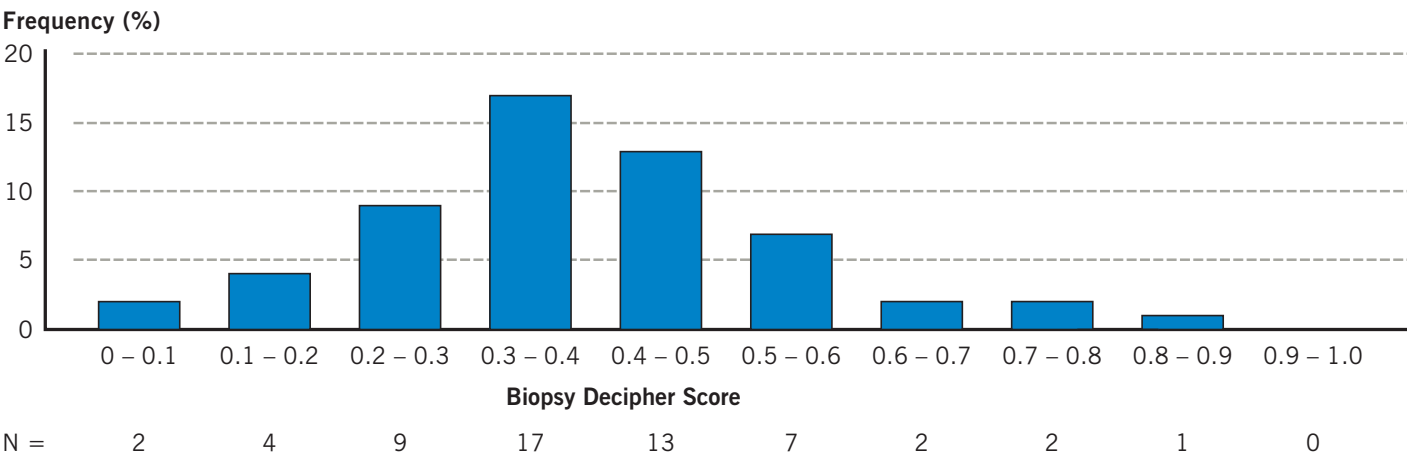
1. National Comprehensive Cancer Network (NCCN). Prostate Cancer. *NCCN Clinical Practice Guidelines in Oncology*. V.2.2007. Fort Washington, PA: NCCN; 2007.

Decipher® Genomic Classifier Predicts Metastasis Risk[1]

Institute researchers evaluated the ability of the Decipher genomic classifier to predict metastasis from analyses of diagnostic prostate needle biopsy tumor tissue specimens. There were 57 patients with available biopsy specimens identified from a cohort of 169 men treated with radical prostatectomy. With a median follow-up of 8 years, 8 patients experienced metastasis, and 3 died of prostate cancer. Using the Decipher test plus the National Comprehensive Cancer Network (NCCN) risk classification model had an improved C-index of 0.88 (95% CI, 0.77-0.96) compared with NCCN alone (C-index 0.75, 95% CI, 0.64-0.87).

Decipher Distribution (N = 57)

1997 – 2008

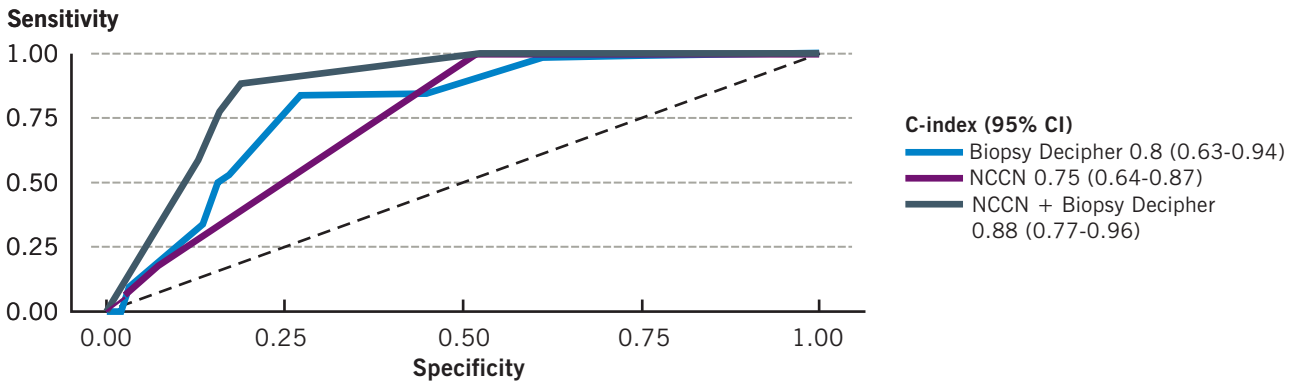


Reference

1. Klein EA, Haddad Z, Yousefi K, Lam LL, Wang Q, Choeurng V, Palmer-Aronsten B, Buerki C, Davicioni E, Li J, Kattan MW, Stephenson AJ, Magi-Galluzzi C. Decipher genomic classifier measured on prostate biopsy predicts metastasis risk. *Urology*. 2016 Apr;90:148-152.

Survival C-Index at 10 Years Post Radical Prostatectomy

1997 – 2008



NCCN = National Comprehensive Cancer Network

On multivariable analysis, Decipher was the only significant predictor of metastasis when adjusting for age, preoperative prostate specific antigen, and biopsy Gleason score (Decipher HR per 10% increase 1.72, 95% CI, 1.07-2.81, $P = 0.02$).

Decipher predicted the risk of metastasis at 10 years post radical prostatectomy. While further validation is required on larger cohorts, preoperative knowledge of Decipher risk derived from biopsy could indicate the need for multimodality therapy and help set patient expectations of therapeutic burden.

Pretreatment Nomogram to Predict Potency After Localized Prostate Cancer Treatment

Radical prostatectomy (RP), external beam radiotherapy (EBRT), and brachytherapy are commonly used treatments for localized prostate cancer and may negatively affect sexual function. Institute researchers evaluated predictors of posttreatment erectile dysfunction and developed a prognostic nomogram using prospective, patient-reported data using validated instruments. The predictive value of the nomogram may be helpful in counseling patients on posttreatment expectations.

Between 1999 and 2011, patient-reported data regarding treatment related effects on erectile function were obtained from 2647 patients. Patients were treated with RP (N = 1281), EBRT (N = 625), or brachytherapy (N = 741). Patient responses were obtained at baseline and 2 years after treatment, and the end point was erectile dysfunction at 2 years posttreatment.

At baseline, 1306 patients were potent and had complete data. Differences in baseline patient characteristics existed between the treatment groups. The erectile dysfunction rates at 2 years were 62%, 53%, and 41% for previously potent patients treated by RP, EBRT, and brachytherapy, respectively. Upon multivariable analysis, age, prostate specific antigen score, treatment modality, frequency of preoperative erections, diabetes, and hypertension were associated with posttreatment erectile dysfunction (all $P < 0.05$). A nomogram based on the predictive parameters had a C-index of 0.719, and predictions were well calibrated with observed outcomes.

Pretreatment Characteristics (N = 2647)

1999 – 2011

Characteristic	Prostatectomy (N = 1281)	EBRT (N = 625)	Brachytherapy (N = 741)	Total (N = 2647)	*P* Value[a]
Age, years (range)	61 (2 – 80)	70 (45 – 82)	67 (45 – 82)	65 (42 – 82)	< 0.001
Race, N (%)					< 0.001
White	1160 (90.6)	544 (87.0)	671 (90.6)	2375 (89.7)	
Black	53 (4.1)	60 (9.6)	41 (5.5)	154 (5.8)	
Other	68 (5.3)	21 (3.4)	29 (3.9)	118 (4.5)	
Married or with partner, N (%)	969 (75.6)	328 (52.5)	360 (48.6)	1657 (63.0)	< 0.001
PSA, ng/mL (range)	5.8 (0.02 – 50)	7.0 (0 – 50)	6.0 (0.6 – 50)	6.0 (0 – 50)	< 0.001
Biopsy Gleason score, N (%)					< 0.001
< 7	786 (61.4)	339 (54.2)	607 (81.9)	1732 (64.4)	
7	414 (32.3)	216 (34.6)	123 (16.6)	753 (28.4)	
> 7	81 (6.3)	70 (11.2)	11 (1.5)	162 (6.1)	
Stage, N (%)					< 0.001
T1	920 (71.8)	387 (61.9)	608 (82.1)	1915 (72.3)	
T2a	239 (18.7)	187 (29.9)	117 (15.8)	543 (20.5)	
T2b	79 (6.2)	35 (5.6)	9 (1.2)	123 (4.6)	
T2c	38 (3.0)	14 (2.2)	5 (0.7)	57 (2.2)	
T3	5 (0.4)	2 (0.3)	2 (0.3)	9 (0.3)	
Androgen deprivation therapy, N (%)	35 (2.7)	235 (37.6)	151 (20.4)	421 (15.9%)	< 0.001

EBRT = external beam radiotherapy, PSA = prostate specific antigen

[a]*P* value calculated by Kruskal-Wallis test for continuous variables and by chi-square test, or by Fisher exact test for categorical variables if expected frequency is less than 5 in some cells.

Pretreatment vs Follow-Up Erection Quality and Frequency (N = 1306[a])

1999 – 2011

	RP	EBRT	Brachytherapy	Total
Pretreatment Erection Quality[b], N (%)				
Firm enough for intercourse	795 (100)	217 (100)	294 (100)	1306
Erection Quality at 2 Years, N (%)				
No erection	199 (25.0)	50 (23.0)	30 (10.2)	279 (21.4)
Not firm enough for any activity	127 (16.0)	16 (7.4)	29 (9.9)	172 (13.2)
Firm enough for masturbation and foreplay only	151 (19.0)	38 (17.5)	50 (17.0)	239 (18.3)
Firm enough for intercourse	318 (40.0)	113 (52.1)	185 (62.9)	616 (47.2)
Pretreatment Erection Frequency[c], N (%)				
Never	10 (1.3)	24 (11.1)	20 (6.8)	54 (4.1)
Less than half	15 (1.9)	3 (1.4)	5 (1.7)	23 (1.8)
About half	52 (6.5)	21 (9.7)	20 (6.8)	93 (7.1)
More than half	141 (17.7)	46 (21.2)	59 (20.1)	246 (18.8)
At will	577 (72.6)	123 (56.7)	190 (64.6)	890 (68.1)
Erection Frequency at 2 Years, N (%)				
Never	317 (39.9)	65 (30.0)	57 (19.4)	439 (33.6)
Less than half	92 (11.6)	21 (9.7)	25 (8.5)	138 (10.6)
About half	76 (9.6)	29 (13.4)	47 (16.0)	152 (11.6)
More than half	132 (16.6)	30 (13.8)	42 (14.3)	204 (15.6)
At will	178 (22.4)	72 (33.2)	123 (41.8)	373 (28.6)

EBRT = external beam radiotherapy, RP = radical prostatectomy

[a]Patients with complete data

[b]Defined as quality of erections during the previous 4 weeks

[c]Defined as frequency of ability to get erections, when desired, during the previous 4 weeks

Univariable Comparison of Predictors for Erectile Dysfunction 2 Years After Treatment for Localized Prostate Cancer

1999 – 2011

Predictor	Potent (N = 566)	Impotent (N = 719)	*P* Value[a]
Androgen deprivation therapy, N (%)	34 (6.01)	63 (8.76)	0.08
Median age, years (IQR)	60.0 (55.0, 66.0)	63.0 (58.0, 68.0)	< 0.001
Median prostate specific antigen, ng/mL (IQR)	5.60 (4.10, 7.20)	6.00 (4.60, 8.50)	< 0.001
Median body mass index, kg/m^2 (IQR)	27.0 (25.0, 30.0)	28.0 (25.0, 31.0)	0.392
Short form 12 physical component score (IQR)	57.0 (54.0, 88.0)	57.0 (53.0, 76.0)	0.078
Short form 12 mental component score (IQR)	57.0 (52.0, 61.0)	58.0 (53.0, 67.0)	0.219
Treatment, N (%)			< 0.001
Brachytherapy	170 (30.0)	118 (16.4)	
External beam radiation therapy	102 (18.0)	114 (15.9)	
Radical prostatectomy	294 (51.9)	487 (67.7)	
Race, N (%)			0.822
Black	31 (5.5)	44 (6.1)	
White	18 (3.2)	20 (2.8)	
Other	517 (91.3)	655 (91.1)	
Pretreatment erection frequency score, N (%)			< 0.001
Never	18 (3.2)	35 (4.9)	
Less than half	1 (0.2)	22 (3.1)	
About half	16 (2.8)	76 (10.6)	
More than half	83 (14.7)	159 (22.1)	
At will	448 (79.2)	427 (59.4)	
Diabetes, N (%)	23 (4.06)	58 (8.07)	0.005
Myocardial infarction, N (%)	20 (3.53)	36 (5.01)	0.252

Predictor	Potent (N = 566)	Impotent (N = 719)	*P* Value[a]
Stroke, N (%)	12 (2.12)	12 (1.67)	0.7
Chronic obstructive pulmonary disease, N (%)	30 (5.30)	51 (7.09)	0.231
Depression, N (%)	40 (7.07)	63 (8.76)	0.314
Hypertension, N (%)	157 (33.2)	245 (41.8)	0.005
Gleason score, N (%)			< 0.001
Low	402 (71.0)	446 (62.0)	
Intermediate	149 (26.3)	229 (31.8)	
High	15 (2.65)	44 (6.12)	
Clinical stage, N (%)			0.541
T1	426 (75.3)	525 (73.0)	
T2a	112 (19.8)	145 (20.2)	
T2b	18 (3.18)	33 (4.59)	
T2c – T3	10 (1.77)	16 (2.23)	
Median prostate volume, cc (IQR)	38 (30, 50)	40 (31, 53)	0.017

[a] *P* value calculated by nonparametric Wilcoxon rank-sum test for continuous variables, and by chi-square test, or Fisher exact test if expected frequency is less than 5 in some cells, for categorical variables.

Multivariable Analysis — Prediction of Erectile Dysfunction 2 Years After Treatment for Localized Prostate Cancer

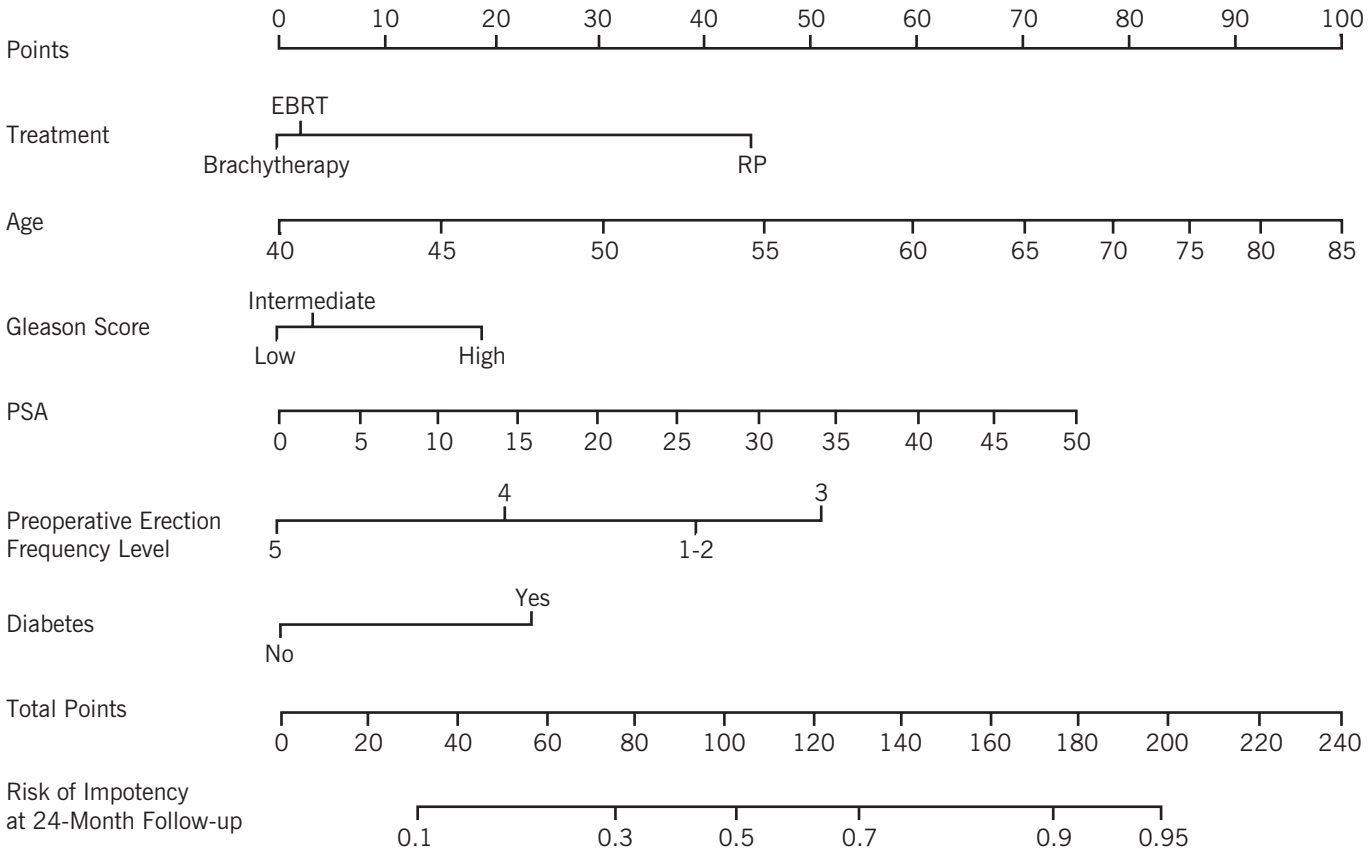
1999 – 2011

Factor	Q1	Q3	Odds Ratio[a]	95% Lower	95% Upper	*P* Value
Age, years	57	67	1.99	1.64	2.40	< 0.0001
Prostate specific antigen, ng/mL	4.38	8	1.18	1.07	1.30	0.0005
Treatment						
Brachytherapy				Reference		
External beam radiation therapy	n/a	n/a	1.07	0.71	1.60	0.7501
Radical prostatectomy	n/a	n/a	3.9	2.81	5.42	< 0.0001
Gleason score group						
Low				Reference		
Intermediate	n/a	n/a	1.10	0.84	1.44	0.4992
High	n/a	n/a	1.80	0.93	3.50	0.0815
Pretreatment erection frequency[b]						
Never – less than half				Reference		
About half	n/a	n/a	1.43	0.66	3.11	0.3635
More than half	n/a	n/a	0.58	0.31	1.06	0.0775
At will	n/a	n/a	0.30	0.17	0.53	< 0.0001
Diabetes	n/a	n/a	2.09	1.20	3.62	0.0089

[a]Continuous predictors were modeled as restricted cubic splines and the odds ratios were given as change from first quartile to third quartile.

[b]Erection frequency defined as frequency of ability to obtain erections adequate for intercourse, when desired, during previous 4 weeks.

Nomogram Predicting Risk of Erectile Dysfunction 2 Years After Localized Prostate Cancer Treatment



EBRT = external beam radiotherapy, PSA = prostate specific antigen, RP = radical prostatectomy

Reference

1. Zabell J, Sands MG, Litewin MS, Suarez JF, Regan MM, Saigal C, Kwan L, Gao T, Rabah D, Klein EA, Kattan MW, Stephenson AJ. Pre-treatment nomogram to predict potency after treatment for localized prostate cancer. *J Clin Oncol*. 2016 Jan;34(Suppl 2S):abstr 32. DOI: 10.1200/jco.2016.34.2_suppl.32

The Effect of Prostatectomy Technique on Genitourinary Toxicity[1]

The institute conducted an inception cohort study to assess the association of genitourinary (GU) toxicity with prostatectomy technique: open radical prostatectomy (RP), pure laparoscopic RP, and robotic-assisted laparoscopic RP. The primary end point was grade 3 or greater GU toxicity.

There were 1308 patients in the study, with a median follow-up of 55.6 months.

Patients were segregated into the 3 cohorts as follows: 732 open RP, 103 laparoscopic RP, and 473 robotic RP. There was no significant difference between the 3 techniques ($P = 0.6$). The most common toxicities were urinary obstruction (54.8% of all toxicities) and urinary incontinence (33.3% of all toxicities). Of the patients with a grade 3 or higher toxicity, 85% were grade 3.

Descriptive Statistics for High-Risk Radical Prostatectomy Patients (N = 1308)

1996 – 2012

	All Patients		Laparoscopic RP		Robotic RP		Open RP		
	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	*P* Value
Number of patients	1308	100	103	7.9	473	36.2	732	56.0	
Age, years	62	43 – 79	63	45 – 75	63	44 – 78	61.5	43 – 79	0.0285
Risk									
2 intermediate factors	582	44.5	47	45.6	223	47.1	312	42.6	
≥ 1 high-risk factor	725	55.5	56	54.4	250	52.9	420	57.4	
Clinical stage									< 0.0001
T1 or T2a	779	59.6	86	83.5	269	56.9	424	57.9	
T2b or T2c	489	37.4	17	16.5	194	41.0	278	38.0	
T3	40	3.1	0	0.0	10	2.1	30	4.1	
Initial PSA (ng/mL)									0.0004
< 4	134	10.2	4	3.9	58	12.3	72	9.8	
4 – 10	527	40.3	38	36.9	219	46.3	270	36.9	
11 ≤ 19	451	34.5	44	42.7	142	30.0	265	36.2	
≥ 20	196	15.0	17	16.5	54	11.4	125	17.1	

PSA = prostate specific antigen, RP = radical prostatectomy

	All Patients		Laparoscopic RP		Robotic RP		Open RP		
	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	*P* Value
Biopsy Gleason score									0.2294
6	70	5.4	5	4.9	17	3.6	48	6.6	
7	662	50.6	56	54.4	243	51.4	363	49.6	
8 – 10	576	44.0	42	40.8	213	45.0	321	43.9	
Neoadjuvant therapy									< 0.0001
No	1061	81.1	87	84.5	448	94.7	526	71.9	
Yes	247	18.9	16	15.5	25	5.3	206	28.1	
Years of treatment									< 0.001
1996 – 2000	208	15.9	3	2.9	0	0.0	205	28.0	
2001 – 2004	213	16.3	54	52.4	2	0.4	157	21.4	
2005 – 2008	347	26.5	45	43.7	119	25.2	183	25.0	
2009 – 2012	540	41.3	1	1.0	352	74.4	187	25.5	
Postoperative RT									0.0258
No/unknown	1065	81.4	90	87.4	397	83.9	578	79.0	
Yes	243	18.6	13	12.6	76	16.1	154	21.0	
Follow-up time, years	4.6	0.01 – 19.9	5.2	0.01 – 12.9	3.3	0.02 – 10.5	6.5	0.01 – 19.9	< 0.001
Grade ≥ 3 GU toxicity									
No	1007	77.0	80	77.7	409	86.5	518	70.8	
Yes	158	12.1	12	11.7	41	8.7	105	14.3	
Dead without toxicity	143	10.9	11	10.7	23	4.9	109	14.9	

GU = genitourinary, RP = radical prostatectomy, RT = radiotherapy

- continued

Descriptive Statistics for High-Risk Radical Prostatectomy Patients (N = 1308)

- continued

1996 – 2012

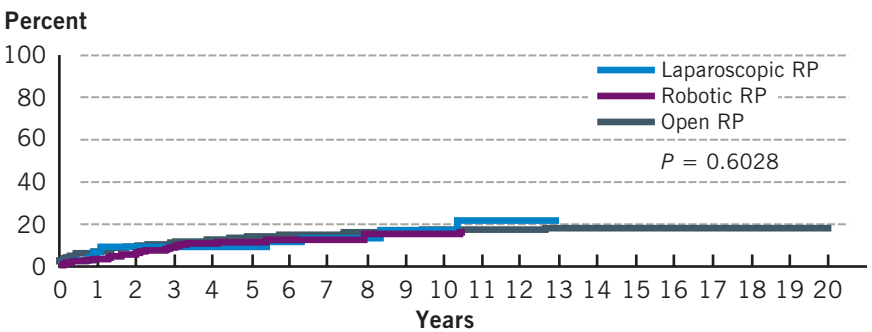
	All Patients		Laparoscopic RP		Robotic RP		Open RP		
	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	N/Median	%/Range	*P* Value
Grade ≥ 3 GU toxicities									
Anastomotic leak	1	0.6	0	0.0	0	0.0	1	1.0	
Fistula	6	3.8	0	0.0	2	4.9	4	3.8	
Hernia	2	1.3	0	0.0	1	2.4	1	1.0	
Incontinence	47	29.7	8	66.7	12	29.3	27	25.7	
Infection	12	7.6	0	0.0	4	9.8	8	7.6	
Necrotic tissue	1	0.6	0	0.0	1	2.4	0	0.0	
Obstruction	75	47.5	3	25.0	16	39.0	56	53.3	
Pain	1	0.6	1	8.3	0	0.0	0	0.0	
Renal failure	1	0.6	0	0.0	0	0.0	1	1.0	
RT cystitis	9	5.7	0	0.0	4	9.8	5	4.8	
Spermatocele	1	0.6	0	0.0	1	2.4	0	0.0	
Testicular infarct	1	0.6	0	0.0	0	0.0	1	1.0	
Urgency	1	0.6	0	0.0	0	0.0	1	1.0	

GU = genitourinary, PSA = prostate specific antigen, RP = radical prostatectomy, RT = radiotherapy

Cumulative Incidence for Grade ≥3 Genitourinary Toxicity (Excluding Secondary Malignancies) by RP Technique

1996 – 2012

Treatment		Laparoscopic RP	Robot-Assisted RP	Open RP
Number of Patients		103	473	732
1-yr	Number at risk	73	359	634
	Cumulative incidence	6.8	3.5	6.8
	95% CI (%)	1.5 – 12.1	1.8 – 5.3	4.9 – 8.6
5-yr	Number at risk	47	106	405
	Cumulative incidence	9.2	11.3	13.8
	95% CI (%)	3.1 – 15.3	7.9 – 14.8	11.2 – 16.5
10-yr	Number at risk	14	3	206
	Cumulative incidence	16.6	15.5	17.1
	95% CI (%)	6.5 – 26.2	8.1 – 22.9	14.0 – 20.2
15-yr	Number at risk	0	0	64
	Cumulative incidence	n/a	n/a	17.6
	95% CI (%)	n/a	n/a	14.4 – 20.9



Overall, toxicities were mild and were not different between the 3 RP techniques. Within the first 3 years, robot-assisted RP patients had fewer events, but this difference vanished with further follow-up.

RP = radical prostatectomy

Reference

1. Ciezki JP, Reddy CA, Haber GP, Kaouk J, Stephenson AJ, Berglund RK, Klein EA. The effect of prostatectomy technique on genitourinary toxicity. *J Clin Oncol*. 2017 Feb;35(Suppl 6S):abstr 100. DOI: 10.1200/JCO.2017.35.6_suppl.100

Genomic Prostate Score as a Predictor of Recurrence in Intermediate- and High-Risk Prostate Cancer[1]

The institute studied whether the 17 gene genomic prostate score (GPS) is an independent predictor of biochemical recurrence (BCR) and clinical recurrence (CR) in higher risk prostate cancer. Data from a prior development study of radical prostatectomies in 441 men with American Urological Association (AUA) low-, intermediate- and high-risk disease were analyzed.[2]

Broad, overlapping ranges of GPS values were observed across all AUA risk groups. A GPS of 20 units (scale 0–100) was strongly associated with BCR (HR 1.64, $P < 0.001$, q-value < 0.1%) and CR (HR 2.79, $P < 0.001$, q-value < 0.1%), after adjusting for AUA risk group. Intermediate-risk patients with a GPS > 40, who represented 41% of all intermediate-risk patients, had estimated 3-year BCR and 10-year CR risks similar to those seen in high-risk patients.

Rapid Metastasis-Corrected, 3-Year Biochemical Recurrence Risk and 10-Year Clinical Recurrence Risk for Intermediate- and High-Risk Patients (N = 206)

1997 – 2011

	Intermediate Risk (N = 104)			High Risk (N = 102)		
GPS Group	N, %	BCR Risk, %	CR Risk, %	N, %	BCR Risk, %	CR Risk, %
GPS ≤ 40	59	15.7	4.7	63	23.8	8.5
GPS > 40	41	33.5	16.9	37	47.8	34.9
All	100	22.7	9.6	100	32.9	18.2

BCR = biochemical recurrence, CR = clinical recurrence, GPS = genomic prostate score

Conversely, high-risk patients with a GPS ≤ 40, who represented 63% of all high-risk patients, had a 3-year BCR risk and a 10-year CR risk similar to those of men with intermediate-risk disease. High-risk patients with a GPS > 40 had a 3-year BCR risk of almost 50% and a 10-year CR risk of 35%. If these findings are confirmed in an independent cohort, GPS may provide improved risk stratification for BCR and CR in AUA intermediate- and high-risk prostate cancer.

References

1. Klein EA, Zhang N, Crager M, Maddala T, Febbo PG, Thomas S, Gormley M, Sokol Ricci D, Moscovita Falzarano S, Magi-Galluzzi C, Lawrence HJ. A 17-gene genomic prostate score (GPS) as a predictor of biochemical (BCR) and clinical recurrence (CR) in men with surgically treated intermediate- and high-risk prostate cancer (PCa). *J Clin Oncol*. 2016 Jan;34(Suppl 2S):abstr 104. DOI: 10.1200/jco.2016.34.2_suppl.104

2. Klein EA, Cooperberg MR, Maggi-Galluzzi C, Simko JP, Falzarano SM, Maddala T, Chan JM, Li J, Cowan JE, Tsiatis AC, Cherbavaz DB, Pelham RJ, Tenggara-Hunter I, Baehner FL, Knezevic D, Febbo PG, Shak S, Kattan MW, Lee M, Carroll PR. A 17-gene assay to predict prostate cancer aggressiveness in the context of Gleason grade heterogeneity, tumor multifocality, and biopsy undersampling. *Eur Urol*. 2014 May;66(3):550-560.

Comorbid Disease Burden Is Independently Associated With Higher Risk Disease at Prostatectomy in Patients Eligible for Active Surveillance[1]

Institute researchers studied the association between comorbidity burden and higher risk disease among men with prostate cancer eligible for active surveillance. The study sample included 29,447 cases, identified from the National Cancer Database, of low-risk (Gleason score ≤ 6, T1/T2a, prostate specific antigen [PSA] < 10 ng/mL) prostate cancer managed with prostatectomy from 2010 to 2011. The primary outcome was pathologic upgrading (Gleason score > 6) or up staging (T3–T4/N1). The association between Charlson comorbidity index score and upgrading/upstaging was analyzed.

A total of 449 (1.5%) men had Charlson scores > 1. At prostatectomy, 44% of cases were upgraded/upstaged. On multivariate analysis, Charlson score > 1, age ≥ 70 years, nonwhite race, higher PSA, and higher percentage of disease-involved cores were significantly associated with upgrading/upstaging. After further adjusting for age, race, PSA, and core involvement, Charlson score remained a significant predictor of upgrading/upstaging for younger white men. Specifically, white men < 70-years-old with a Charlson score > 1 had increased risk of upgrading/upstaging than men with a Charlson comorbidity index score ≤ 1 (OR 1.31, 95% CI 1.03-1.67, $P = 0.029$).

Patient Characteristics (N = 29,447)

2010 – 2011

	Charlson Comorbidity Index ≤ 1	Charlson Comorbidity Index > 1	*P* Value
Clinical Characteristics			
Age, years			< 0.001
Mean (range)	59.5 (33 – 90)	61.8 (41 – 76)	
Median (IQR)	60.0 (55, 65)	62.0 (57, 67)	
Race, N (%)			< 0.001
White	23,874 (82.3)	313 (69.7)	
Other	5124 (17.7)	136 (30.3)	
Demographic Characteristics			
Income level, N (%)			< 0.001
Low	2638 (9.55)	76 (17.5)	
Low middle	4215 (15.3)	82 (18.9)	
Middle	7415 (26.8)	124 (28.5)	
Upper middle	13,361 (48.4)	1563 (35.2)	
County, N (%)			0.372
Urban	4257 (15.5)	65 (15.1)	
Metropolitan	22,529 (82.1)	353 (82.1)	
Rural	651 (2.37)	12 (2.79)	
Preoperative Characteristics			
T stage, N (%)			0.536
1	26,314 (90.7)	412 (91.8)	
2	2684 (9.26)	37 (8.24)	
PSA (ng/mL)			0.062
Mean (range)	5.0 (0.1 – 9.9)	5.2 (0.1 – 9.9)	
Median (IQR)	4.8 (3.9, 6.0)	5.0 (4.1, 6.5)	
Positive cores (%)			0.595
Mean (range)	30.3 (1 – 100)	29.7 (5 – 100)	
Median (IQR)	25.0 (13, 42)	25.0 (13, 42)	

Multivariate Analysis of Factors Associated With Upgrading and/or Upstaging at Prostatectomy (N = 29,447)

2010 – 2011

	OR	95% CI	*P* Value
Age, years			< 0.001
< 70	1.0	(referent)	
≥ 70	1.32	1.20 – 1.45	
Charlson comorbidity index			0.002
≤ 1	1.0	(referent)	
> 1	1.35	1.11 – 1.64	
Race			0.001
White	1.0	(referent)	
Nonwhite	1.12	1.05 – 1.19	
Income level			0.511
Low	1.0	(referent)	
Low middle	0.94	0.85 – 1.03	
Middle	0.98	0.90 – 1.08	
Upper middle	0.98	0.89 – 1.07	
County			0.271
Urban	1.0	(referent)	
Metropolitan	0.95	0.88 – 1.02	
Rural	1.04	0.88 – 1.23	
Clinical T stage			0.982
1	1.0	(referent)	
2a	1.0	0.92 – 1.09	
PSA (ng/mL)			< 0.001
< 4	1.0	(referent)	
≥ 4	1.66	1.57 – 1.76	
Positive cores, %			< 0.001
< 33	1.0	(referent)	
33 – 67	1.51	1.43 – 1.61	
> 67	1.50	1.35 – 1.67	

Multivariate Analysis of Factors Associated With Upgrading and/or Upstaging at Prostatectomy by Age and Race Groups (N = 29,447)

2010 – 2011

	Age < 70, White (N = 22,487)		Age < 70, Nonwhite (N = 4985)		Age ≥ 70, White (N = 1700)		Age ≥ 70, Nonwhite (N = 275)	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Charlson comorbidity index		0.029		0.119		0.229		0.998
≤ 1	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
> 1	1.31 (1.03-1.67)		1.33 (0.93-1.92)		1.49 (0.78-2.83)		1.00 (0.32-3.10)	
PSA (ng/mL)		< 0.001		< 0.001		< 0.001		0.122
< 4	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
≥ 4	1.67 (1.57-1.77)		1.67 (1.46-1.91)		1.95 (1.51-2.52)		1.66 (0.87-3.17)	
Positive cores, %		< 0.001		< 0.001		< 0.001		0.383
< 33	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
33 – 67	1.54 (1.44-1.65)		1.42 (1.23-1.63)		1.60 (1.26-2.05)		1.39 (0.74-2.61)	
> 67	1.48 (1.32-1.67)		1.37 (1.07-1.75)		1.60 (1.04-2.46)		1.69 (0.63-4.50)	

Comorbidity burden is strongly and independently associated with pathologic upgrading/upstaging in men with clinically low-risk prostate cancer. This finding may help improve disease risk assessment and clinical decision making in men with comorbidities considering active surveillance.

Reference

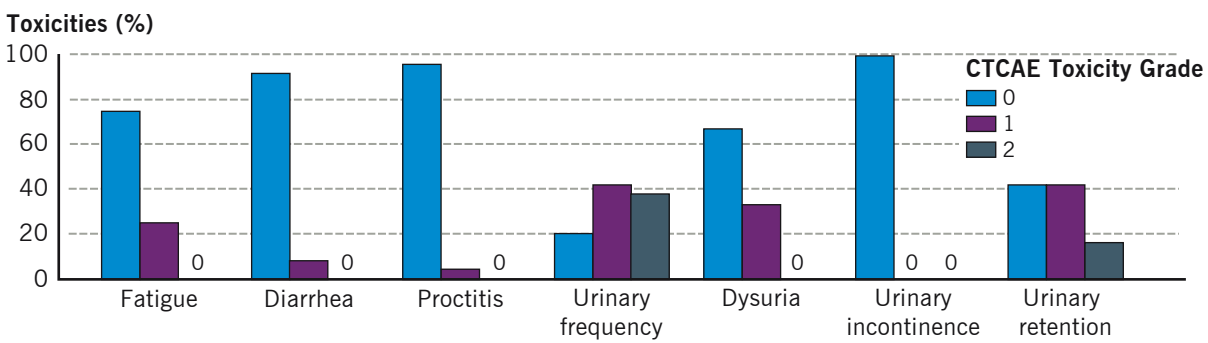
1. Maurice MJ, Zhu H, Kiechle JE, Kim SP, Abouassaly R. Comorbid disease burden is independently associated with higher risk disease at prostatectomy in patients eligible for active surveillance. *J Urol*. 2016 Apr;195(4 Pt 1):919-924.

Dose-Escalated Stereotactic Body Radiation Therapy for Patients With Intermediate- and High-Risk Prostate Cancer

Patients with intermediate- and high-risk prostate cancer were treated to a minimum dose of 36.25 Gy in 5 factions, with a simultaneous dose escalation to a dose of 50 Gy to the target volume away from a high-dose avoidance zone. Acute and late onset genitourinary and gastrointestinal toxicity outcomes were measured according to the 5-point (0-4) National Cancer Institute Common Terminology Criteria for Adverse Events toxicity scale, version 4.[1]

Acute Treatment-Related Adverse Events by Toxicity Type and Grade (N = 24)

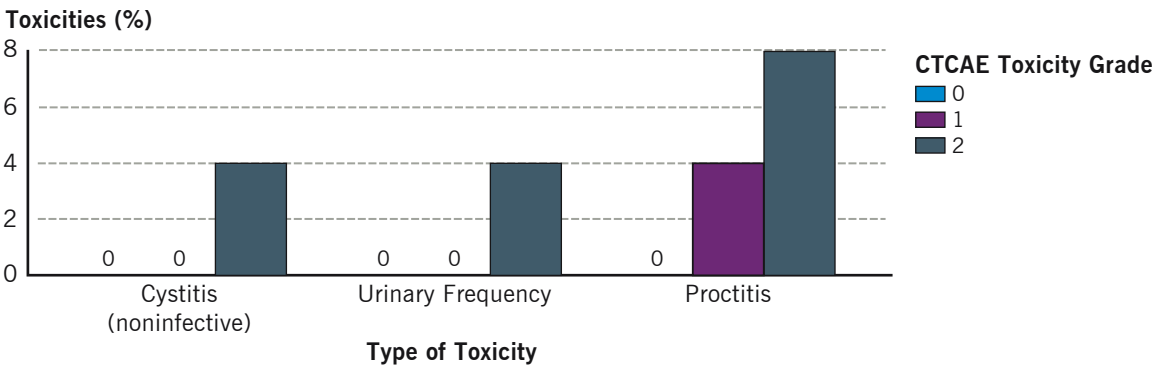
2011 – 2014



CTCAE = National Cancer Institute Common Terminology Criteria for Adverse Events toxicity scale, version 4.

Late-Onset Treatment-Related Adverse Events by Toxicity Grade (N = 24)

2011 – 2014



CTCAE = National Cancer Institute Common Terminology Criteria for Adverse Events toxicity scale, version 4.

Acceptably low rates of acute (< 90 days after treatment) and long-term (> 90 days after treatment) genitourinary and gastrointestinal toxicity can be achieved in patients with intermediate and high-risk prostate cancer treated without sacrificing biochemical control with stereotactic body radiation therapy.

Reference

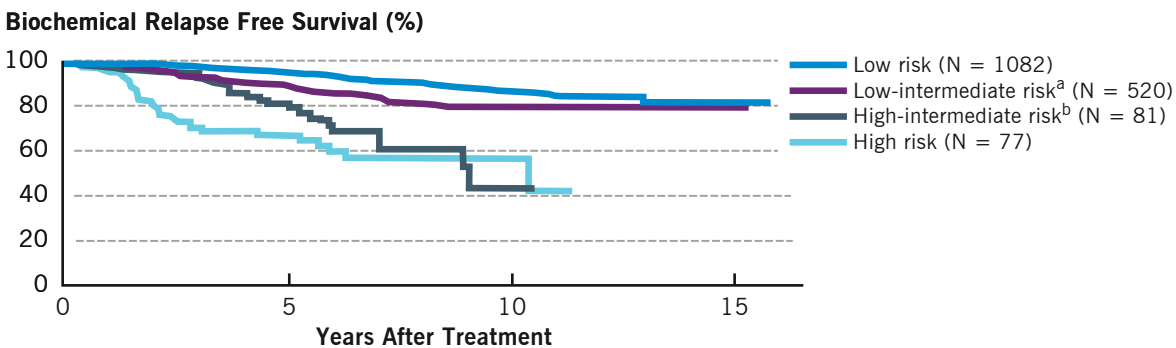
1. Kotcha R, Djemil T, Tendulark Rd, Reddy CA, Thousand RA, Vassil A, Stovsky M, Berglund RK, Klein EA, Stephans KL. Dose-escalated stereotactic body radiation therapy for patients with intermediate- and high-risk prostate cancer: initial dosimetry analysis and patient outcomes. *Int J Radiat Oncol Biol Phys*. 2016 Jul 1;95(3):960-964.

Long-Term Efficacy and Toxicity of Low-Dose-Rate ^{125}I Prostate Brachytherapy as Monotherapy in Prostate Cancer

A large cohort of prostate brachytherapy patients were followed up prospectively since the beginning of brachytherapy treatment at Taussig Cancer Institute.[1] Patients were treated with ^{125}I brachytherapy as monotherapy up to 144 Gy.

Biochemical Relapse Free Survival in Prostate Cancer Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy by Risk Group (N = 1760)

1996 – 2007



	5-Year		10-Year	
Patients (N)	Patients at Risk (N)	Survival (%) [95% CI]	Patients at Risk (N)	Survival (%) [95% CI]
All (1760)	1092	91.9 [90.5-93.3]	169	81.5 [78.8-84.3]
Low risk (1082)	700	95.3 [94.0-96.7]	125	86.7 [83.5-89.9]
Low-intermediate risk (520)	315	90.0 [87.3-92.8]	39	79.3 [74.1-84.4]
High-intermediate risk (81)	45	80.9 [71.5-90.3]	-	-
High risk (77)	32	67.5 [56.4-78.5]	-	-

CI = confidence interval

[a]Low-intermediate risk is defined as having only one intermediate risk factor.

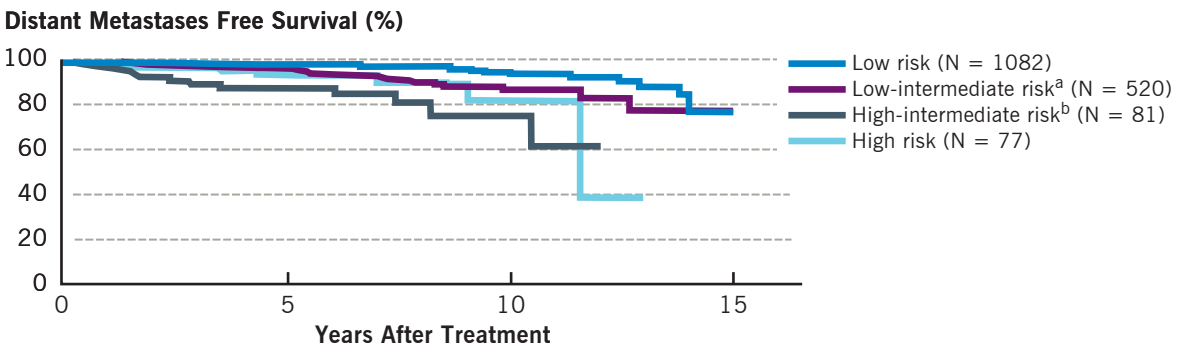
[b]High-intermediate risk is defined as having ≥ 2 intermediate risk factors.

Reference

1. Kittel JA, Reddy CA, Smith KL, Stephans KL, Tendulkar RD, Ulchaker J, Angermeier K, Campbell K, Stephenson A, Klein EA, Wilkinson DA, Ciezki JP. Long-term efficacy and toxicity of low-dose-rate 125I prostate brachytherapy as monotherapy in low-, intermediate-, and high risk prostate cancer. *Int J Radiat Oncol Biol Phys*. 2015 Jul 15;92(4):884-893.

Distant Metastases Free Survival in Prostate Cancer Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy by Risk Group (N = 1760)

1996 – 2007



	5-Year		10-Year	
Patients (N)	Patients at Risk (N)	Survival (%) [95% CI]	Patients at Risk (N)	Survival (%) [95% CI]
All (1760)	1160	97.8 [97.0-98.5]	206	91.5 [89.1-93.8]
Low risk (1082)	725	99.0 [98.4-99.7]	144	94.6 [92.0-97.2]
Low-intermediate risk (520)	339	96.9 [95.3-98.5]	50	88.0 [83.0-92.9]
High-intermediate risk (81)	51	94.2 [88.7-99.8]	-	-
High risk (77)	45	88.8 [81.5-96.1]	-	-

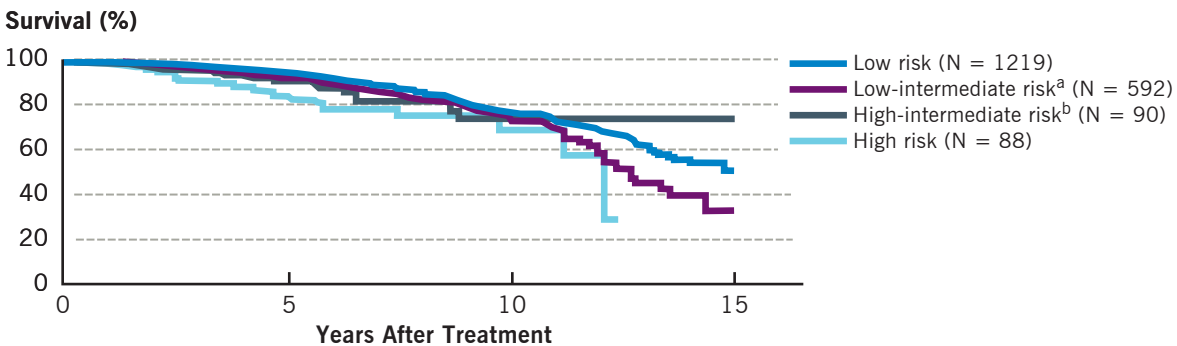
CI = confidence interval

[a]Low-intermediate risk is defined as having only one intermediate risk factor.

[b]High-intermediate risk is defined as having ≥ 2 intermediate risk factors.

Overall Survival in Prostate Cancer Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy by Risk Group (N = 1989)

1996 – 2007



	5-Year		10-Year	
Patients (N)	Patients at Risk (N)	Survival (%) [95% CI]	Patients at Risk (N)	Survival (%) [95% CI]
All (1989)	1443	93.7 [92.6-94.9]	356	76.1 [73.4-78.9]
Low risk (1219)	896	95.0 [93.7-96.3]	248	77.6 [74.2-80.9]
Low-intermediate risk (592)	425	92.8 [90.6-95.0]	87	74.1 [68.6-79.7]
High-intermediate risk (90)	65	91.1 [84.7-97.4]	11	75.4 [63.0-87.8]
High risk (88)	57	84.5 [76.5-92.6]	10	70.6 [56.7-84.4]

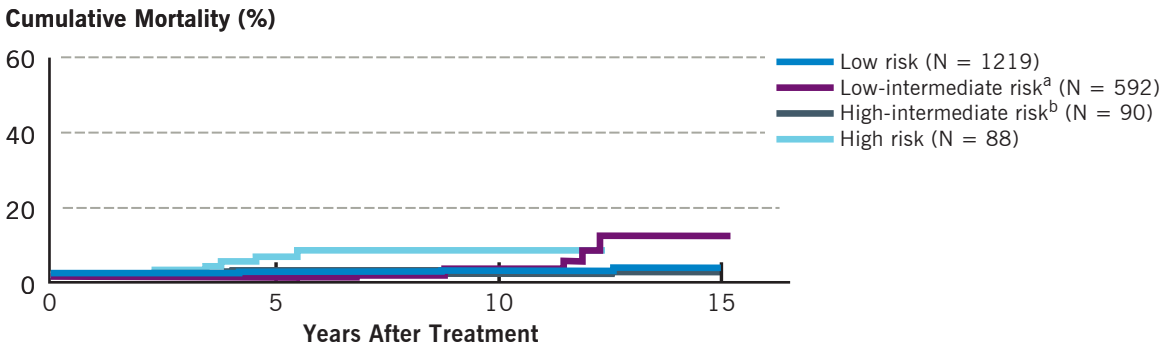
CI = confidence interval

[a]Low-intermediate risk is defined as having only one intermediate risk factor.

[b]High-intermediate risk is defined as having ≥ 2 intermediate risk factors.

Cumulative Incidence of Prostate Cancer Specific Mortality in Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy by Risk Group (N = 1989)

1996 – 2007



	5-Year		10-Year	
Patients (N)	Patients at Risk (N)	Survival (%) [95% CI]	Patients at Risk (N)	Survival (%) [95% CI]
All (1989)	1443	0.71 [0.32-1.10]	356	2.53 [1.53-3.53]
Low risk (1219)	896	0.29 [0.00-0.63]	248	2.07 [0.88-3.26]
Low-intermediate risk (592)	425	0.40 [0.00-0.96]	87	2.57 [0.69-4.45]
High-intermediate risk (90)	65	2.63 [0.00-6.23]	11	2.63 [0.00-6.23]
High risk (88)	57	6.51 [0.98-12.03]	10	8.05 [1.84-14.25]

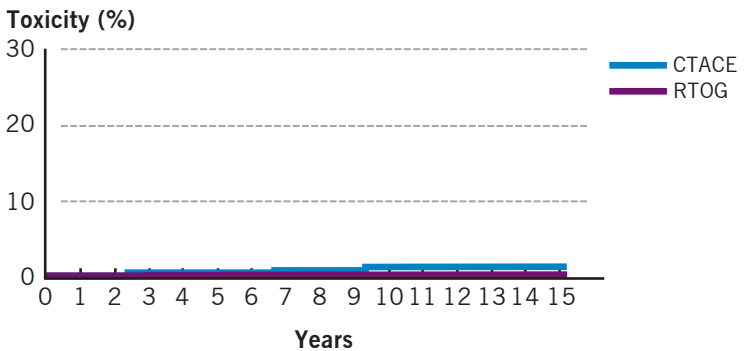
CI = confidence interval

[a]Low-intermediate risk is defined as having only one intermediate risk factor.

[b]High-intermediate risk is defined as having ≥ 2 intermediate risk factors.

Late Grade ≥3 Gastrointestinal Toxicity in Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy (N = 1989)

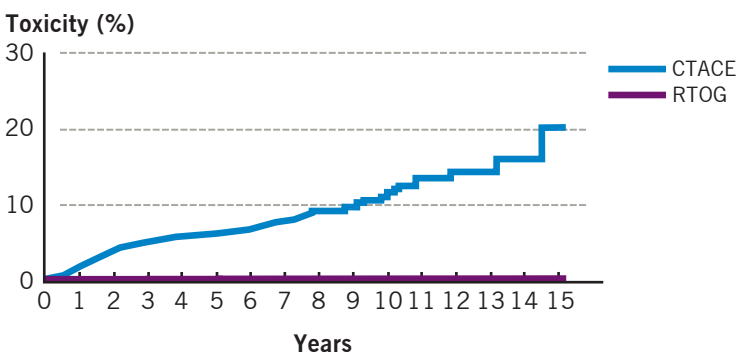
1996 – 2007



CTACE = National Cancer Institute common terminology criteria for adverse events toxicity scale, version 4, RTOG = Radiation Therapy Oncology Group

Late Grade ≥3 Genitourinary Toxicity in Patients Treated With Low-Dose-Rate ^{125}I Prostate Brachytherapy (N = 1989)

1996 – 2007



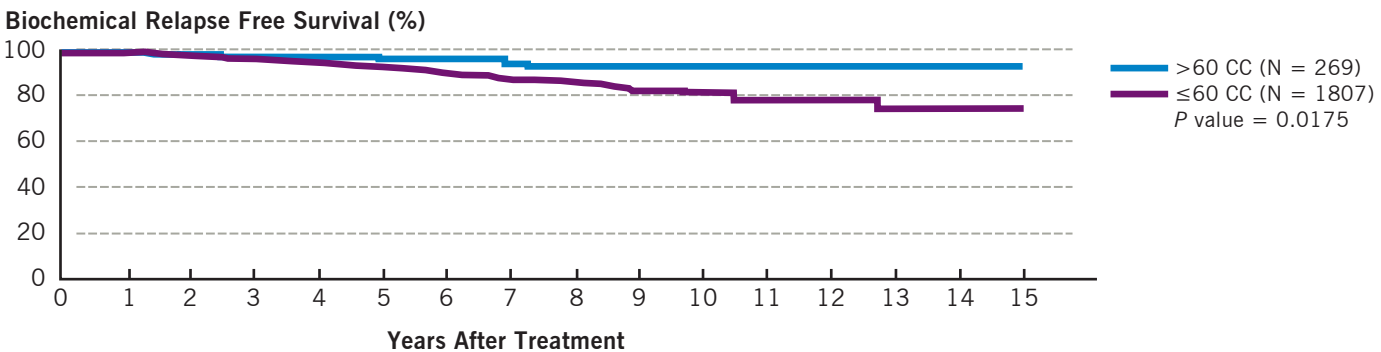
CTACE = National Cancer Institute common terminology criteria for adverse events toxicity scale, version 4, RTOG = Radiation Therapy Oncology Group

Overall, results show that prostate brachytherapy is effective and has low rates of late toxicity when performed as monotherapy.

A large cohort of patients with stage T1-T2Nx M0 low- and intermediate-risk prostate cancer who underwent low-dose-rate permanent prostate brachytherapy (PPB) with ^{125}I was followed up prospectively in a registry to determine the efficacy and toxicity of PPB based on prostate size.[1]

Biochemical Relapse Free Survival in Patients With Stage T1a-T2Nx M0 Low- and Intermediate-Risk Prostate Cancer Treated with Permanent Prostate Brachytherapy Alone Without Androgen Deprivation Therapy by Gland Volume (N = 2076)

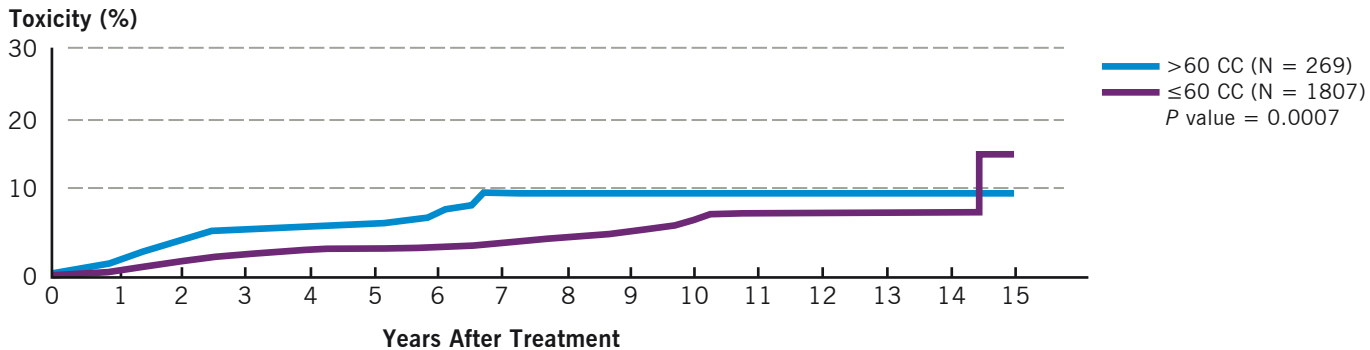
1996 – 2012



> 66 CC	269	240	198	153	116	92	68	45	26	18	7	4	2	1	1
≤ 66 CC	1802	1577	1259	962	717	501	348	229	149	86	51	30	15	6	1

Late Grade ≥3 Genitourinary Toxicity in Patients With Stage T1a-T2Nx M0 Low- and Intermediate-Risk Prostate Cancer Treated with Permanent Prostate Brachytherapy Alone Without Androgen Deprivation Therapy by Gland Volume (N = 2076)

1996 – 2012



> 66 CC	269	238	201	166	140	118	83	64	34	21	10	4	1	1	1
≤ 66 CC	1807	1622	1340	1079	887	693	499	365	237	146	90	58	34	18	9

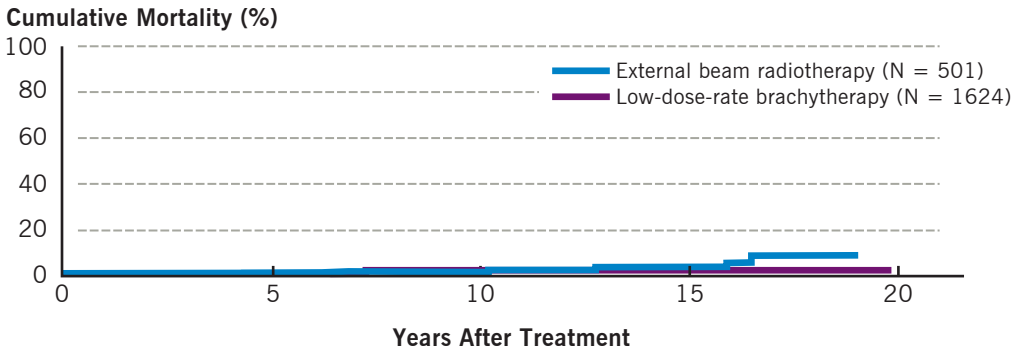
Long-term data indicate PPB implantation of large prostates > 60 cc results in favorable bRFS outcomes and is associated with increased, but acceptable, rates of Grade 3 and higher late genitourinary toxicities.

Reference

1. Pham YD, Kittel JA, Reddy CA, Ciezki JP, Klein EA, Stephans KL, Tendulkar RD. Outcomes for prostate glands > 60 cc treated with low-dose-rate brachytherapy. *Brachytherapy*. 2016 Mar-Apr;15(2):163-168.

Cumulative Mortality Due to Prostate Cancer of Patients With Low-Risk Prostate Cancer by Treatment Type[a] (N = 2125)

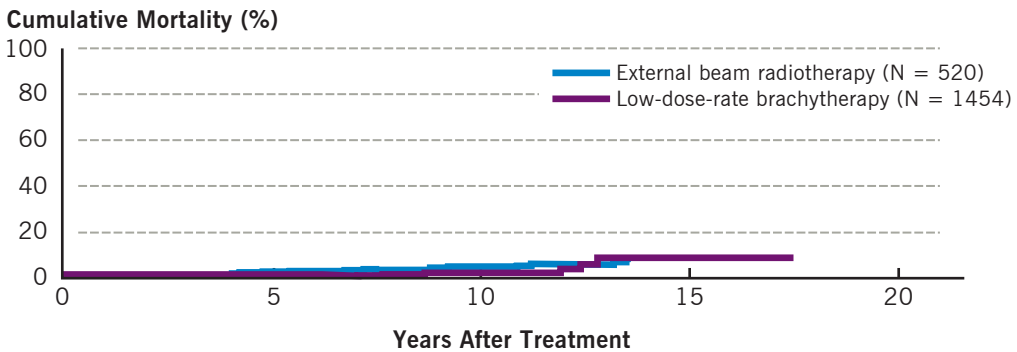
1996 – 2016



Mortality Rates (Number of Patients)			
External beam radiotherapy	0.9 (381)	1.7 (208)	3.1 (36)
Low-dose-rate brachytherapy	0.3 (918)	2.1 (223)	2.4 (27)

Cumulative Mortality Due to Prostate Cancer of Patients With Intermediate-Risk Prostate Cancer by Treatment Type[a] (N = 1974)

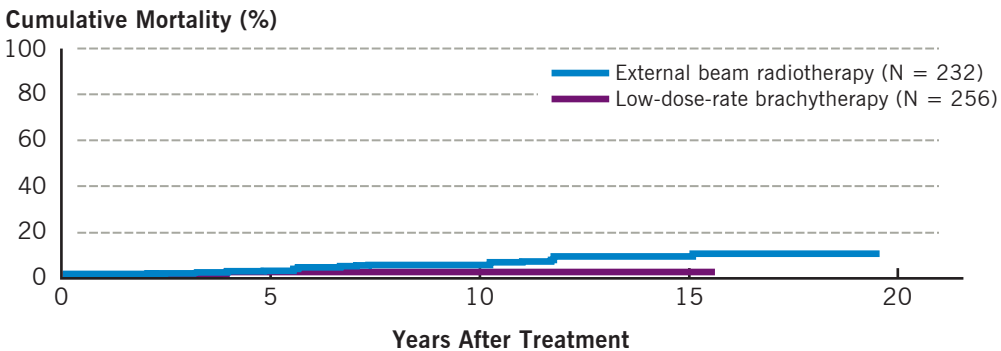
1996 – 2016



Mortality Rates (Number of Patients)			
External beam radiotherapy	2.0 (359)	5.0 (181)	8.5 (19)
Low-dose-rate brachytherapy	0.2 (550)	2.5 (86)	8.2 (5)

Cumulative Mortality Due to Prostate Cancer of Patients With High-Intermediate Risk Prostate Cancer by Treatment Type[a,b] (N = 488)

1996 – 2016

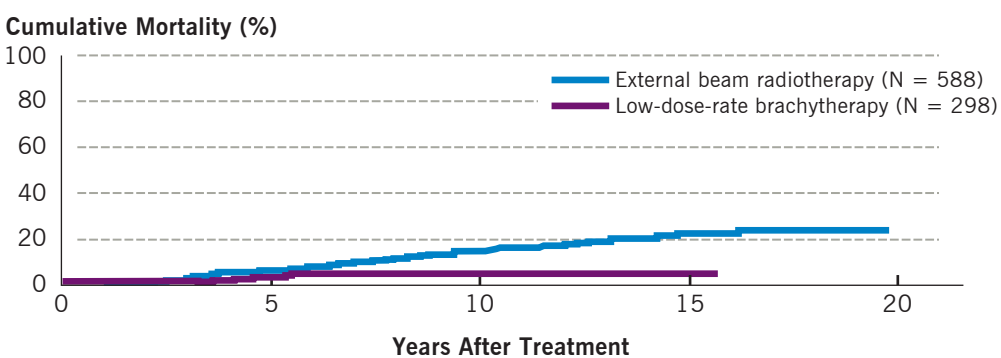


Mortality Rates (Number of Patients)			
External beam radiotherapy	2.9 (178)	5.1 (96)	9.7 (31)
Low-dose-rate brachytherapy	2.1 (103)	2.1 (21)	2.1 (2)

[b]High-intermediate risk is defined as having ≥2 intermediate risk factors

Cumulative Mortality Due to Prostate Cancer of Patients with High Risk Prostate Cancer by Treatment Type[a] (N = 886)

1996 – 2016

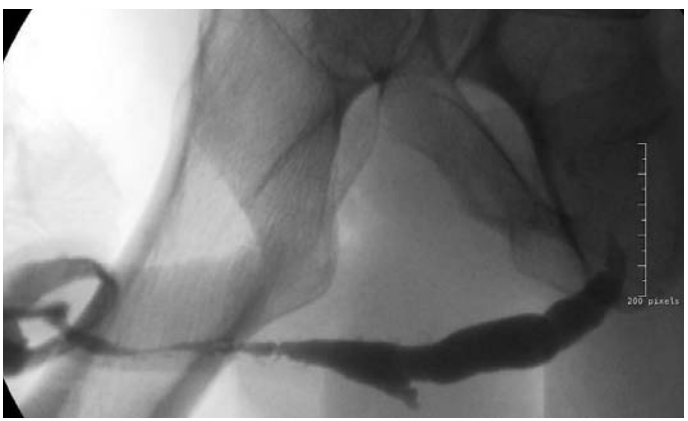


Mortality Rates (Number of Patients)			
External beam radiotherapy	6.2 (409)	14.6 (207)	21.8 (44)
Low-dose-rate brachytherapy	3.8 (126)	5.3 (22)	5.3 (1)

Urethral Stricture Repair Related to Hypospadias

Institute urologists have extensive experience in the treatment of urethral stricture disease, including management of complex strictures such as those in adults with a history of hypospadias.

From 2002 to 2014, 51 hypospadias patients underwent urethral stricture repair with a staged approach using oral mucosa, which institute surgeons prefer for the majority of these cases. A total of 50 of the patients have completed all stages of the repair.

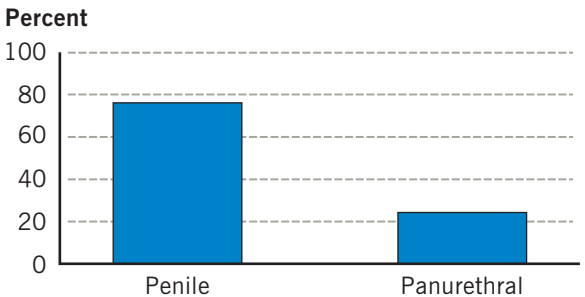


Retrograde urethrogram for a 48-year-old male with a history of childhood hypospadias repair and multiple subsequent dilations, showing severe stricture and distal urethral fistula

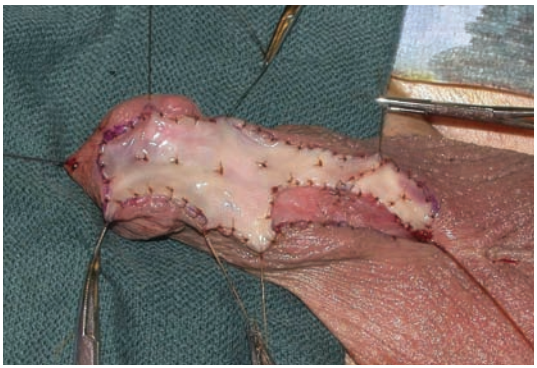
Oral mucosa is widely accepted as the first choice material for urethral substitution and is associated with high rates of graft success and healing. Oral mucosa is most often harvested from the inner cheeks, and occasionally from the lingual region for the second stage procedure. When necessary and if available, genital skin can also be incorporated into the repair. The institute recommends waiting 4–6 months between the first and second stages to allow for maturation, vascularization, and softening of the graft.

Stricture Location (N = 51)

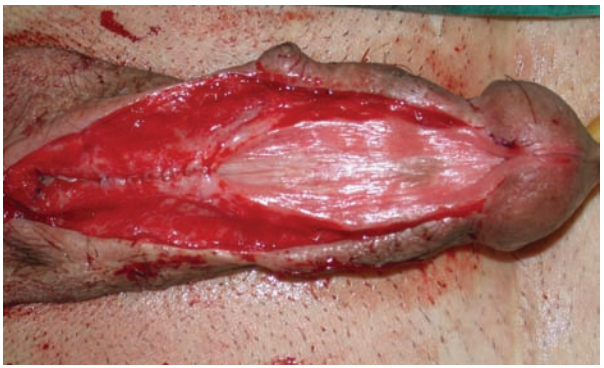
2002 – 2014



A majority (87%) of patients had undergone prior open repair, with many (41%) having had 2 or more previous repairs. During the first stage, the median length of buccal mucosal graft(s) required was 7 cm, which correlated with stricture length. Approximately 25% of patients experienced complications including wound separation, infection, stricture recurrence, and bleeding, most of which were relatively minor. Eight patients (16%) required a revision procedure, including urethral meatal improvement, urethrocutaneous fistula repair, and repeat urethroplasty. At a median follow-up of 17 months, almost all patients (98%) were able to void without obstructive symptoms.



First stage buccal graft urethroplasty in a 31-year-old male, status post hypospadias surgery with mid-shaft urethral stricture and urethral hair.



Second stage closure in a 38-year-old male with a history of multiple childhood hypospadias procedures and recurrent stricture with urinary retention.

Stricture length, location, and prior surgical history did not affect surgical outcomes. Based on these results, patients with complex urethral stricture disease related to hypospadias with associated prior repairs have a high rate of successful reconstruction with staged oral mucosa graft urethroplasty.

Penile Prostheses in Solid Organ Transplant Recipients

Solid organ transplantation, with its associated immunosuppression, has generally been considered a relative contraindication to penile prosthesis placement due to a perceived increased risk of complications. Glickman Urological & Kidney Institute urologists have extensive experience in prosthesis implantation in difficult or challenging patient populations, including those with a history of transplantation.

From 1999 to 2015, 26 patients with a history of heart, liver, kidney, and kidney-pancreas transplants underwent penile prosthesis implantation. Outcomes were compared with an age-matched nontransplant penile implant cohort. There were no cases of prosthesis infection in either group. Peripheral vascular disease, stroke, and diabetes were more common in the transplant patients. There were no significant differences in reoperation rates based on type of organ transplanted or between patients with or without organ transplant. There were no differences in reoperation rate by implant model (2-piece vs 3-piece) used.

Penile prosthesis implantation outcomes in transplant patients do not differ from those in nontransplant patients, and 2-piece and 3-piece implants have similar outcomes in these patients. The results indicate that penile prostheses are a safe option for treating erectile dysfunction in solid organ transplant recipients.

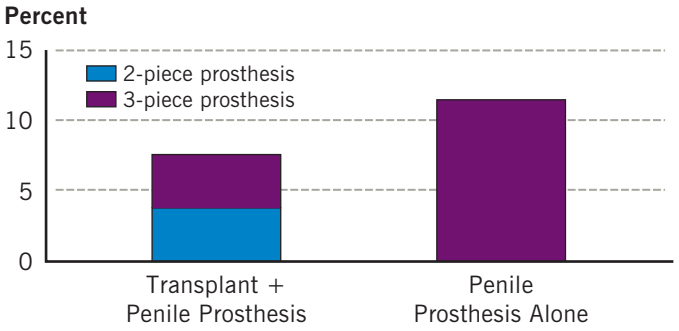
Penile Prosthesis Implantation Outcomes in Patients With and Without Solid Organ Transplant (N = 26)

1999 – 2015

	Transplant + Prosthesis	Prosthesis Alone	*P* Value
Age, years	53.7	56.4	0.26
Body mass index, kg/m^2	30.3	30.2	0.92
Reoperation rate, %	7.7	11.5	1.00
Prosthesis infection rate, %	0.0	0.0	1.00
Prior history of, %			
Prostate surgery	7.7	15.4	0.39
Rectal surgery	3.9	3.9	1.00
Hyperlipidemia	69.2	69.2	1.00
Hypertension	92.3	76.9	0.25
Heart disease	57.5	30.8	0.09
Peripheral vascular disease	**26.9**	**3.9**	**0.02**
Stroke	**19.2**	**0.0**	**0.05**
Diabetes	**84.6**	**53.6**	**0.02**

Reoperation Rate by Implant Model for Penile Prosthesis in Patients With and Without Solid Organ Transplant (N = 26)

1999 – 2015



Institute Quality Improvement Initiatives

Glickman Urological & Kidney Institute is committed to continuous quality and patient safety improvement, and to ensuring that patients receive optimal care. The following performance measurements are examples of the institute's areas of focus and results.

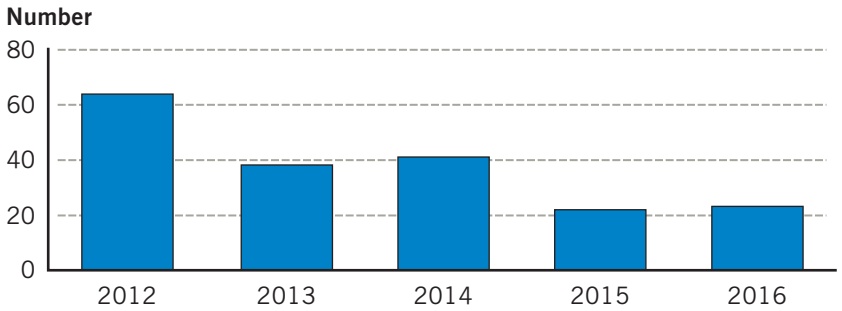
Patient Safety Indicators

Patient safety indicators (PSIs) were developed by the Agency for Healthcare Research and Quality primarily for quality improvement purposes. They are coded based on documentation in the medical record, are publicly reported, and are used to compare hospital performance. PSIs are potentially avoidable complications and iatrogenic events occurring during hospitalizations. The Urological & Kidney Institute quality review team works closely with front-line care providers and staff, ensuring case review of each PSI and timely provider feedback to sustain improvement.

The PSI 90 measure is a weighted composite of 10 patient safety indicators. Since 2012, the institute has achieved a 64% reduction in the total number of PSI 90 occurrences. This was accomplished through a combination of improved clinical performance and diligent educational and documentation improvement initiatives.

Patient Safety Indicator: Occurrences

2012 – 2016

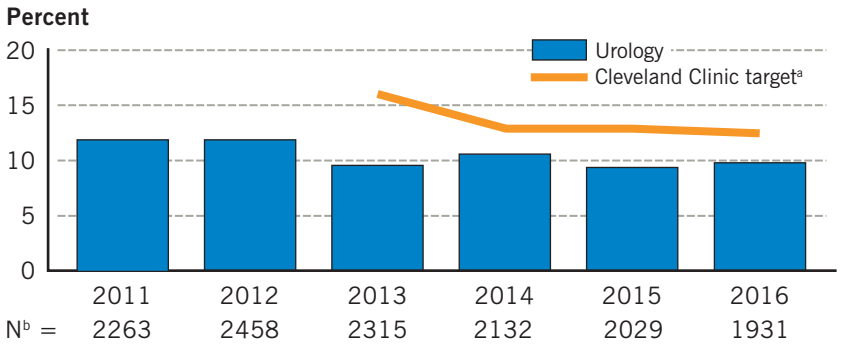


Hospital Readmission

The Centers for Medicare & Medicaid Services' Hospital Readmissions Reduction Program focuses on reducing preventable, expensive, and excessive 30-day hospital readmissions among patients with acute myocardial infarction, pneumonia, heart failure, chronic obstructive pulmonary disease, total hip/knee replacement surgery, and coronary artery bypass graft surgery. The Urological & Kidney Institute has devoted process improvement efforts to reduce readmissions for these conditions and for all cause 30-day readmissions. The quality improvement team reviews monthly readmissions to identify trends offering opportunities for improvement. Readmission reduction efforts have primarily involved engaging patients and improving communication between patients and care providers, focusing on medication reconciliation, enhanced patient and caregiver education, completion of discharge summaries within 48 hours of discharge, and timely follow-up appointments after discharge. Since 2012, urology readmissions have decreased by 17%.

Readmission: All Cause 30-Day

2011 – 2016



[a]Cleveland Clinic began implementing a readmission target in 2013.

[b]Number of discharges

Increasing Safe Discharge Efficiency for Urology Unit Patients

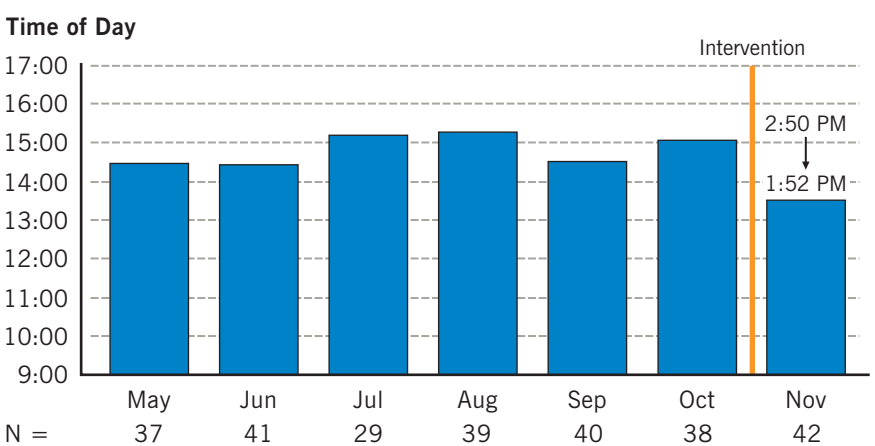
With increasing patient numbers, demand for hospital beds sometimes exceeds capacity, leading to delays in patient transfer, hospital readmissions, postanesthesia care unit overcrowding, and patient dissatisfaction. The Joint Commission, acknowledging the importance of patient flow, emphasizes that hospitals measure bed supply and the efficiency of patient care areas, report measurements to leadership, and use data to drive improvements in patient flow processes.[1]

The complex inpatient discharge process, which requires the collaboration of physicians, nurses, patients, care managers, pharmacists, and ancillary service staff, represents an opportunity to address patient flow efficiency while involving all parties who participate in patient care. To this end, the institute formed a resident-led team to identify and improve discharge efficiency. A retrospective review of elective renal surgery patients identified as having routine hospital stays from May 2016 to October 2016 revealed an average discharge time of 3 PM. A multipronged intervention was developed and carried out for this patient cohort during November 2016, aiming to improve discharge times.

A physician discharge checklist was incorporated into the resident sign-out system, and a discharge planning order in the electronic medical record communicated discharge plans to floor nurses. Nurses used this information to plan and carry out required discharge at earlier times. A patient discharge checklist was also developed and distributed postoperatively to allow patients to actively engage with the discharge process.

Average Discharge Time for Urology Unit Renal Surgery Patients (N = 266)

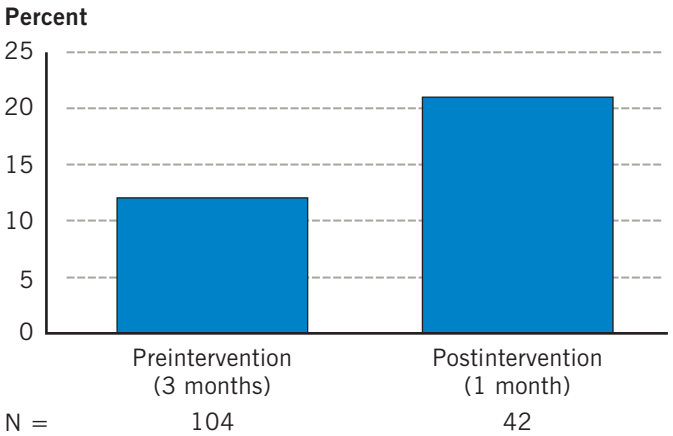
May 2016 – November 2016



During the 1-month intervention period, average discharge time improved by approximately 1 hour, and discharges occurring by noon increased from 12% to 21%. The institute continues to examine the discharge process to identify additional interventions that can further improve the process.

Percentage of Urology Unit Renal Surgery Patients Discharged by Noon

May 2016 – November 2016



Reference

1. The Joint Commission. Leadership in Healthcare Organizations: A Guide to Joint Commission Leadership Standards. Published Nov. 19, 2009. jointcommission.org/leadership_in_healthcare_organizations/. Accessed Feb. 17, 2017.

Surgical Site Infections

Surgical site infections (SSIs) are known to increase patient morbidity and mortality, readmission rates, length of stay, and cost of healthcare delivery for patients who incur them. The Centers for Medicare & Medicaid Services (CMS) increasingly allocates payment penalties for treating complications deemed preventable, such as SSIs. The Hospital Value Based Purchasing Program uses quality data from the Hospital Inpatient Quality Reporting Program to provide financial incentive (pay for performance) to hospitals performing well in areas of quality and patient safety, and SSIs are a point of interest for these programs.

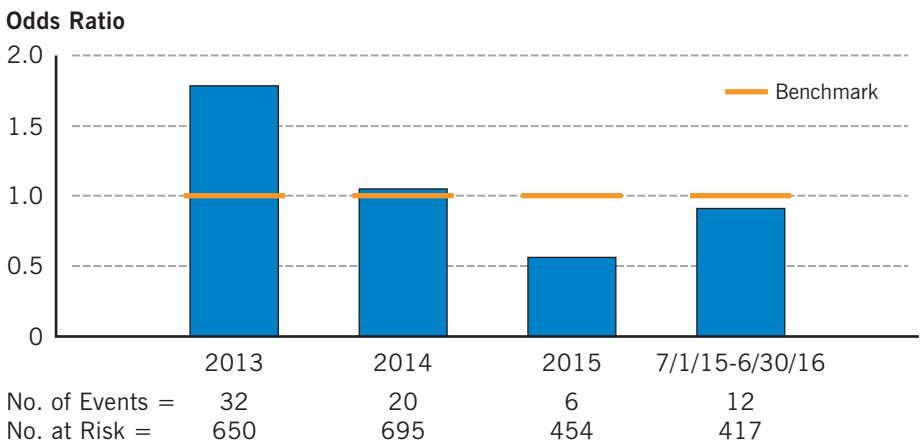
Cleveland Clinic is a member of the American College of Surgeons National Surgical Quality Improvement Program® (NSQIP), an outcomes-based, data-driven, risk-adjusted surgical quality improvement program. Participation benefits include the identification of quality improvement trends, opportunities, and targets, and the ability to compare outcomes nationally to drive quality improvement in patient care.

In 2013, NSQIP initiated targeted data collection for 3 urologic procedures: cystectomy (all), prostatectomy (sampled at ~ 40%), and nephrectomy (sampled at ~ 40%). After thorough cleaning, the data are analyzed and odds ratios (ORs) produced in biannual reports for each participating facility. An OR > 1 indicates that the hospital is experiencing more postoperative adverse occurrences than expected. Conversely, an OR < 1 indicates results better than expected based on patient characteristics and the complexity of the procedures performed. Urology SSI ORs revealed an opportunity to focus on improving performance and quality of care.

To reduce SSIs, the institute initiated the following measures in April 2014: discussing preoperative and intraoperative antibiotic dosing and redosing during the preoperative huddle; ensuring recommended surgical preparation dry time, glove change, and wound irrigation prior to skin closure; and using a separate set of sterile closing instruments. During a 3-year period, these interventions have reduced the risk-adjusted SSI rate by almost 50%. This reduction has led to decreased morbidity and improved outcomes. Refer to page 88 for additional NSQIP performance data.

Urology Surgical Site Infections: Risk-Adjusted Data

Jan. 2013 – June 2016



Source: facs.org/quality-programs/acs-nsqip

Cystectomy Optimization Project

The Cystectomy Optimization Project is a multidisciplinary, multimodal approach to improve the perioperative management of radical cystectomy by improving patient outcomes and reducing readmission rates, length of stay, and overall surgical management costs. Toward this goal, Cleveland Clinic has adopted an evidence-based, multidisciplinary enhanced recovery after surgery (ERAS) program. The ERAS model incorporates early patient engagement with patient centered preoperative education, minimized preoperative fasting, minimally invasive techniques, goal-directed use of intraoperative fluids, minimized opioid administration, and immediate postoperative ambulation and oral nutrition.

ERAS Patient Centered Preoperative Education

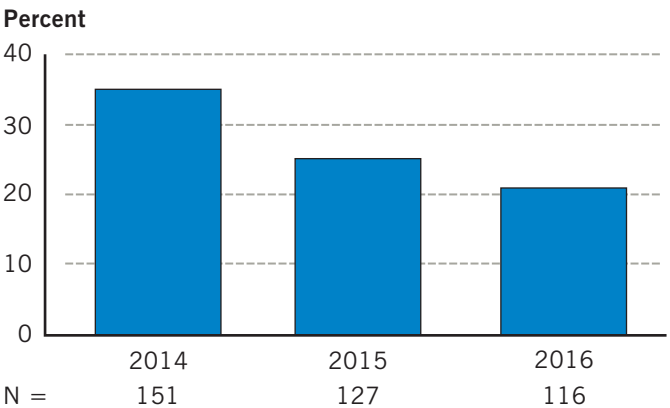
Preoperative patient education has been a longstanding part of the Urological & Kidney Institute approach to radical cystectomy. Despite this, there was an opportunity to improve alignment with patient expectations. A streamlined approach now includes preoperative distribution of educational packets, and tailored postoperative instruction sheets have been specifically developed for patients using short-term rehabilitation facilities. All radical cystectomy patients meet preoperatively with stoma nursing staff for operative planning and initial teaching sessions. Patients are referred to Cleveland Clinic's Internal Medicine Preoperative Assessment, Consultant and Treatment Center for preoperative optimization and coordination of care.

ERAS Perioperative Management

Traditional dogma calls for fasting and bowel prep prior to radical cystectomy, and evidence for and against this practice continues to evolve. However, the institute recommends avoiding their use prior to routine cystectomy. Building evidence suggests that prolonged fasting may exacerbate underlying malnutrition and contribute to delayed wound healing and return of bowel function. The institute has adopted a protocol of fasting 6 hours prior to surgery, with clear electrolyte and carbohydrate rich fluids allowed up to 2 hours prior to surgery. Alvimopan, a μ-opioid antagonist, is administered prior to surgery. During surgery, a goal-directed fluid administration protocol is implemented to decrease overall fluid volume. Oral gastric tubes are used only during surgery, and the use of nasogastric tubes is discouraged for routine cases. Minimally invasive robot-assisted cystectomy with intracorporeal diversion is the preferred approach, resulting in decreased blood loss. Postoperatively, alvimopan administration is continued until return of bowel function and stoma teaching, discharge planning, ambulation, and a clear liquid diet are started on postoperative day 1. Postoperative narcotics are prescribed cautiously, with oral administration preferred without the routine use of patient controlled IV administration.

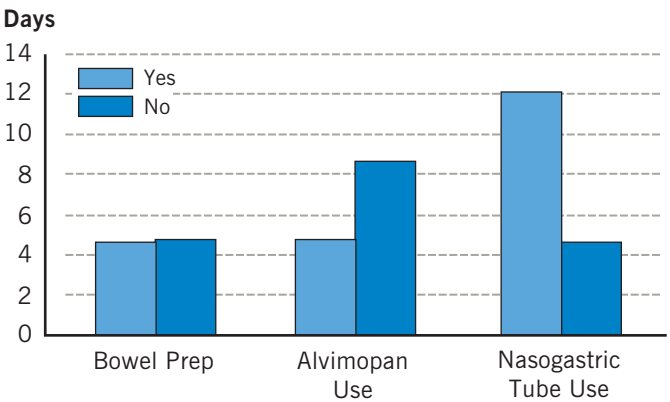
Decline in Cystectomy Readmissions

2014 – 2016



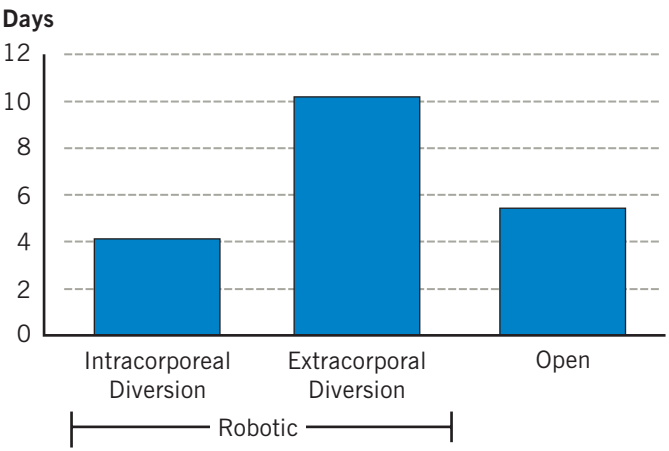
Bowel Preparation, Alvimopan, and Nasogastric Tube Usage and Length of Stay (N = 41)

August 2016 – December 2016



Cystectomy Length of Stay (N = 41)

August 2016 – December 2016



ERAS Postoperative Management

Tailored education materials are provided at discharge, and patients are scheduled for an office or virtual visit to occur within 4 days of discharge. Dehydration is a common occurrence after cystectomy and is a frequent cause for readmission. Under the ERAS, patients are automatically scheduled with a 24-hour infusion center to treat postoperative dehydration in an outpatient setting. The infusion center is available for acute care as well as scheduled care.

Surgical Quality Improvement

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®) objectively measures and reports risk-adjusted surgical outcomes based on a defined sampling and abstraction methodology. These outcomes data reflect Cleveland Clinic's urology surgery ACS NSQIP performance benchmarked against 464 participating sites.

Urology Surgery Outcomes

July 2015 – June 2016

Outcome	N	Observed Rate (%)	Expected Rate (%)
30-day morbidity	419	9.31	9.91
Pneumonia	419	0.24	1.20
Renal failure	419	0.95	1.39
Urinary tract infection	418	2.39	2.75
Surgical site infection	417	2.88	3.23
Return to operating room	419	1.91	2.41
Readmission	419	8.11	8.10

In addition to overall urology ACS NSQIP outcomes data, data specific to the following procedures are provided (with the number of sites participating in benchmarking outcomes shown in parentheses): prostatectomy (76), nephrectomy (73), and cystectomy (52).

Prostatectomy Outcomes

July 2015 – June 2016

Outcome	N	Observed Rate (%)	Expected Rate (%)
30-day morbidity	167	4.19	4.51
Urinary tract infection	167	1.20	1.61
Surgical site infection	167	1.20	1.18
Sepsis	167	1.20	0.53
Readmission	167	5.39	4.16

Nephrectomy Outcomes

July 2015 – June 2016

Outcome	N	Observed Rate (%)	Expected Rate (%)
30-day mortality	177	0.00	0.84
30-day morbidity	177	4.52	7.70
Cardiac event	177	0.56	1.03
Pneumonia	177	0.00	1.50
Unplanned intubation	177	0.56	1.14
Ventilator > 48 hours	177	0.00	0.60
Deep vein thrombosis/pulmonary embolism	177	0.56	1.21
Renal failure	177	0.56	1.37
Urinary tract infection	176	0.00	1.63
Surgical site infection	176	1.70	1.80
Sepsis	176	2.27	0.90
C. difficile colitis	177	0.56	0.41
Return to operating room	177	1.13	1.96
Readmission	177	3.39	6.70

Cystectomy Outcomes

July 2015 – June 2016

Outcome	N	Observed Rate (%)	Expected Rate (%)
30-day morbidity	75	32.00	27.67
Cardiac event	75	1.33	1.88
Pneumonia	75	1.33	1.74
Venous thromboembolism	75	5.33	3.16
Renal failure	75	4.00	2.72
Urinary tract infection	75	10.67	7.20
Surgical site infection	74	9.46	11.69
Sepsis	75	20.00	10.32
C. difficile colitis	75	0.00	3.26
Return to operating room	75	4.00	4.52
Readmission	75	25.33	19.77

Source: facs.org/quality-programs/acs-nsqip

Patient Experience — Glickman Urological & Kidney Institute

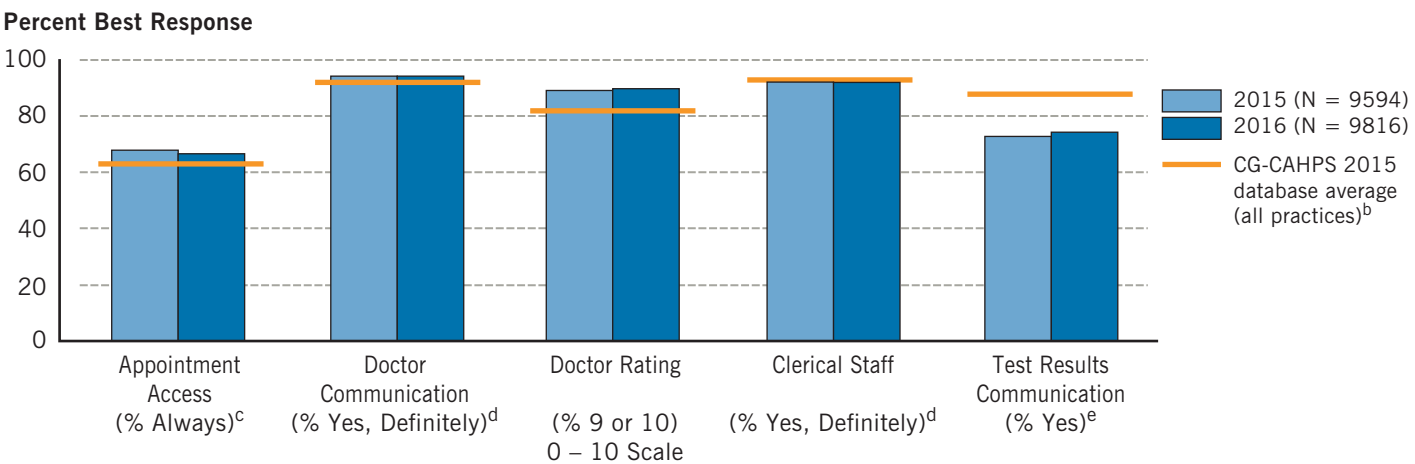
Keeping patients at the center of all that Cleveland Clinic does is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, caregivers have the power to impact every touch point of a patient's journey, including their clinical, physical, and emotional experience.

Cleveland Clinic recognizes that patient experience goes well beyond patient satisfaction surveys. Nonetheless, sharing the survey results with caregivers and the public affords opportunities to improve how Cleveland Clinic delivers exceptional care.

Outpatient Office Visit Survey — Glickman Urological & Kidney Institute

CG-CAHPS Assessment[a]

2015 – 2016



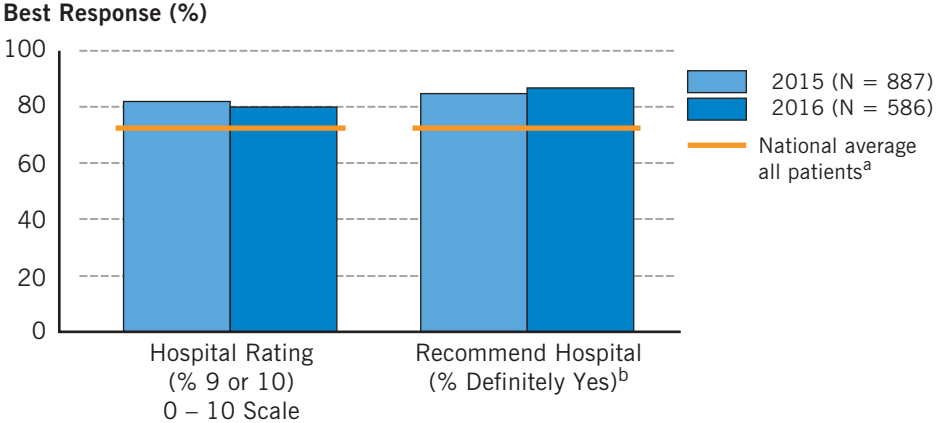
[a]In 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality (AHRQ) and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients' perspectives of outpatient care.
[b]Based on results submitted to the AHRQ CG-CAHPS database from 2829 practices in 2015
[c]Response options: Always, Usually, Sometimes, Never
[d]Response options: Yes, definitely; Yes, somewhat; No
[e]Response options: Yes, No

Source: Press Ganey, a national hospital survey vendor

Inpatient Survey — Glickman Urological & Kidney Institute

HCAHPS Overall Assessment

2015 – 2016



[a]Based on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare
[b]Response options: Definitely yes, Probably yes, Probably no, Definitely no

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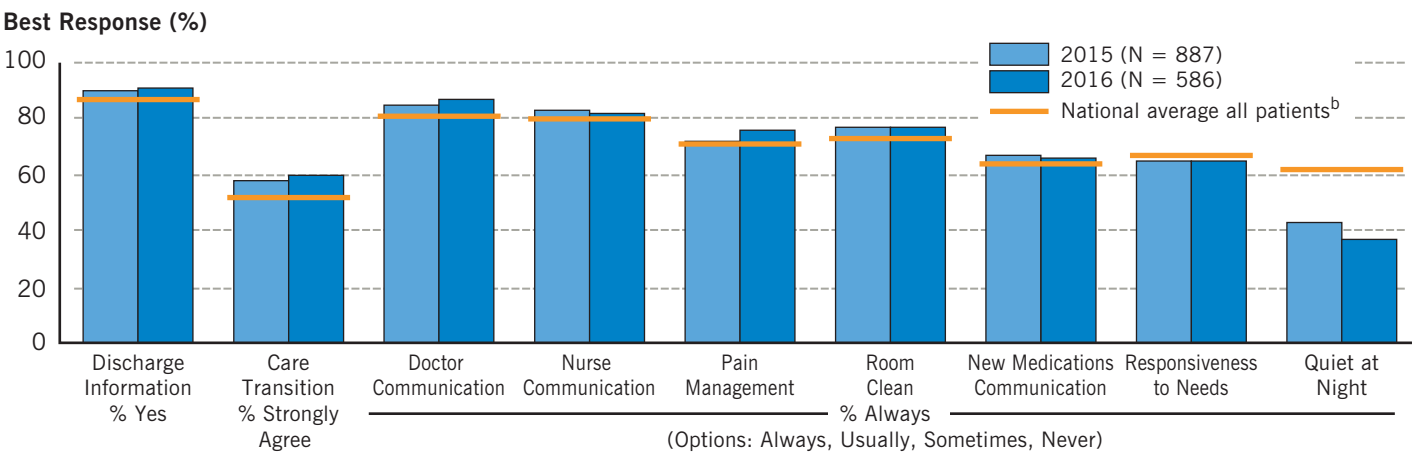
HCAHPS Domains of Care[a]

2015 – 2016



[a]Except for "Room Clean" and "Quiet at Night," each bar represents a composite score based on responses to multiple survey questions.
[b]Based on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

Source: Press Ganey, a national hospital survey vendor, 2016

Cleveland Clinic — Implementing Value-Based Care

Overview

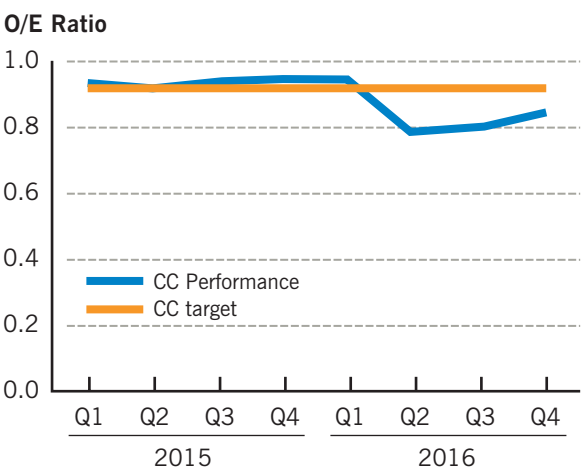
Cleveland Clinic health system uses a systematic approach to performance improvement while simultaneously pursuing 3 goals: improving the patient experience of care (including quality and satisfaction), improving population health, and reducing the cost of healthcare. The following measures are examples of 2016 focus areas in pursuit of this 3-part aim. Throughout this section, "Cleveland Clinic" refers to the academic medical center or "main campus," and those results are shown.

Real-time data are leveraged in each Cleveland Clinic location to drive performance improvement. Although not an exact match to publicly reported data, more timely internal data create transparency at all organizational levels and support improved care in all clinical locations.

Improve the Patient Experience of Care

Cleveland Clinic Overall Mortality Ratio

2015 – 2016

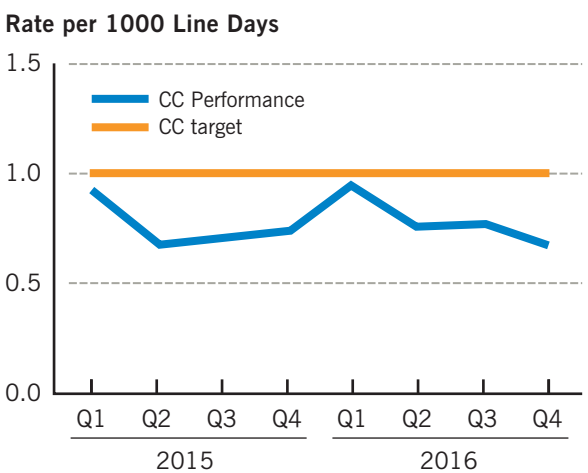


Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.

Cleveland Clinic's observed/expected (O/E) mortality ratio outperformed its internal target derived from the Vizient 2016 risk model. Ratios less than 1.0 indicate mortality performance "better than expected" in Vizient's risk adjustment model.

Cleveland Clinic Central Line-Associated Bloodstream Infection, reported as Standardized Infection Ratio (SIR)

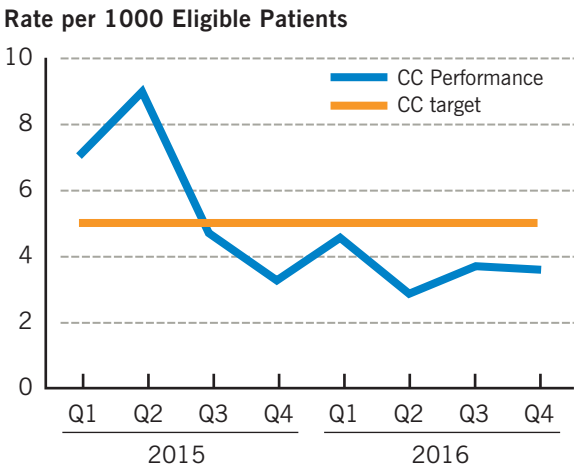
2015 – 2016



Cleveland Clinic has implemented several strategies to reduce central line-associated bloodstream infections (CLABSIs), including a central-line bundle of insertion, maintenance, and removal best practices. Focused reviews of every CLABSI occurrence support reductions in CLABSI rates in the high-risk critical care population.

Cleveland Clinic Postoperative Respiratory Failure Risk-Adjusted Rate

2015 – 2016

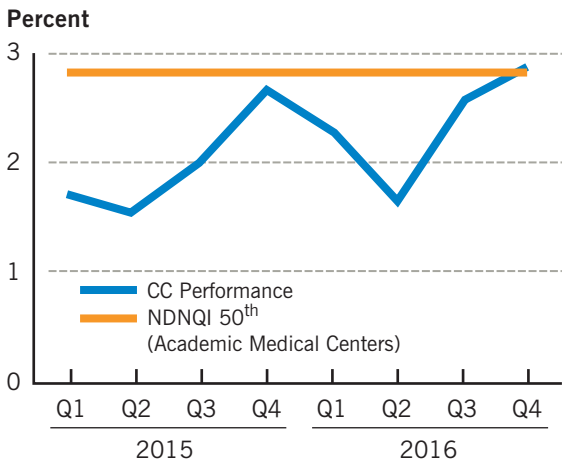


Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.

Efforts continue toward reducing intubation time, assessing readiness for extubation, and preventing the need for reintubation. Cleveland Clinic has leveraged the technology within the electronic medical record to support ongoing improvement efforts in reducing postoperative respiratory failure (AHRQ Patient Safety Indicator 11). Prevention of respiratory failure remains a safety priority for Cleveland Clinic.

Cleveland Clinic Hospital-Acquired Pressure Ulcer Prevalence (Adult)

2015 – 2016



Source: Data reported from the National Database for Nursing Quality Indicators® (NDNQI®) with permission from Press Ganey.

A pressure ulcer is an injury to the skin that can be caused by pressure, moisture, or friction. These sometimes occur when patients have difficulty changing position on their own. Cleveland Clinic caregivers have been trained to provide appropriate skin care and regular repositioning while taking advantage of special devices and mattresses to reduce pressure for high-risk patients. In addition, they actively look for hospital-acquired pressure ulcers and treat them quickly if they occur.

Cleveland Clinic strategies to mitigate the risk of these pressure injuries include routine rounding to accurately stage pressure injuries, monthly multidisciplinary wound care meetings, and ongoing nursing education, both in the classroom and at the bedside.

Cleveland Clinic — Implementing Value-Based Care

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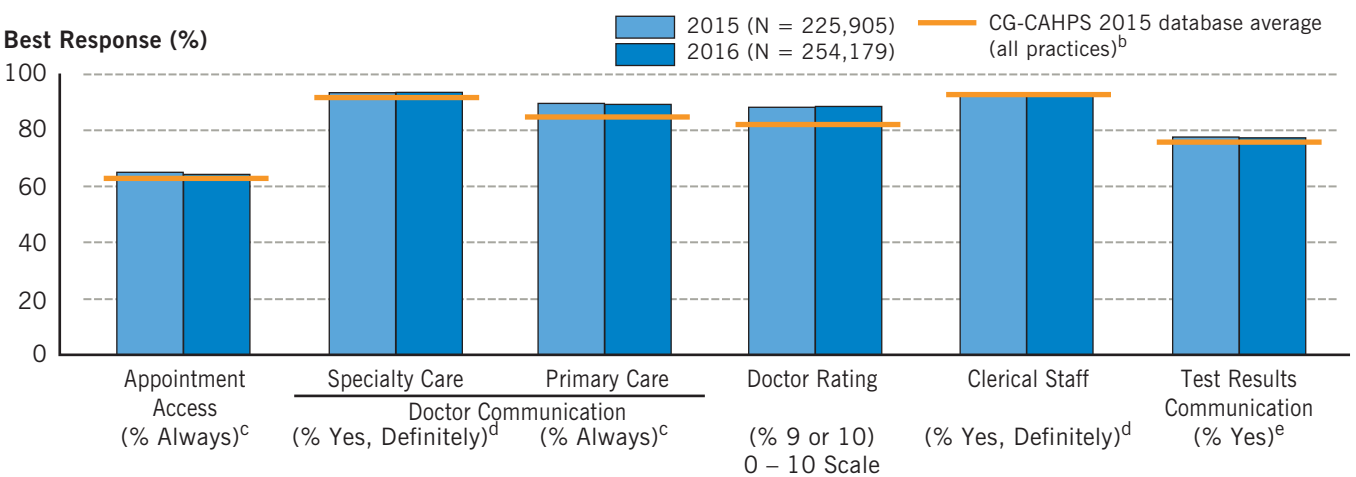
We know that patient experience goes well beyond patient satisfaction surveys. Nonetheless, by sharing the survey results with our caregivers and the public, we constantly identify opportunities to improve how we deliver exceptional care.

Outpatient Office Visit Survey — Cleveland Clinic

CG-CAHPS Assessment[a]

2015 – 2016



[a]In 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality (AHRQ) and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients' perspectives of outpatient care.
[b]Based on results submitted to the AHRQ CG-CAHPS database from 2829 practices in 2015
[c]Response options: Always, Usually, Sometimes, Never
[d]Response options: Yes, definitely; Yes, somewhat; No
[e]Response options: Yes, No

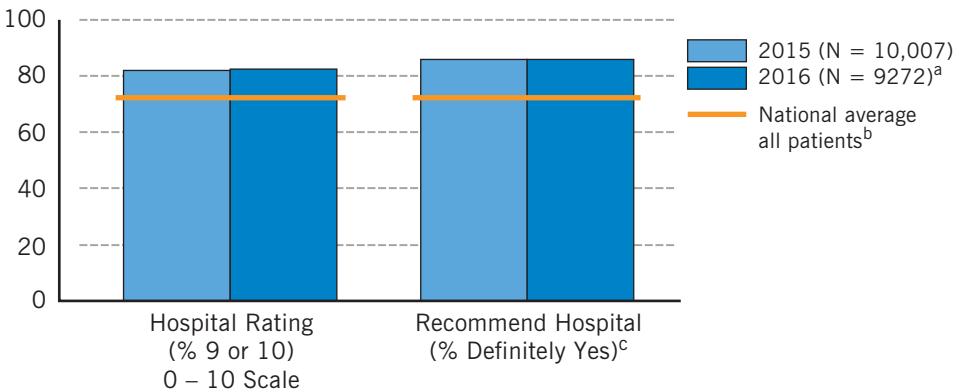
Source: Press Ganey, a national hospital survey vendor

Inpatient Survey — Cleveland Clinic

HCAHPS Overall Assessment

2015 – 2016

Best Response (%)



[a]At the time of publication, 2016 ratings have not been reported by the Centers for Medicare & Medicaid Services and ratings are not adjusted for patient mix.
[b]Based on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare
[c]Response options: Definitely yes, Probably yes, Probably no, Definitely no

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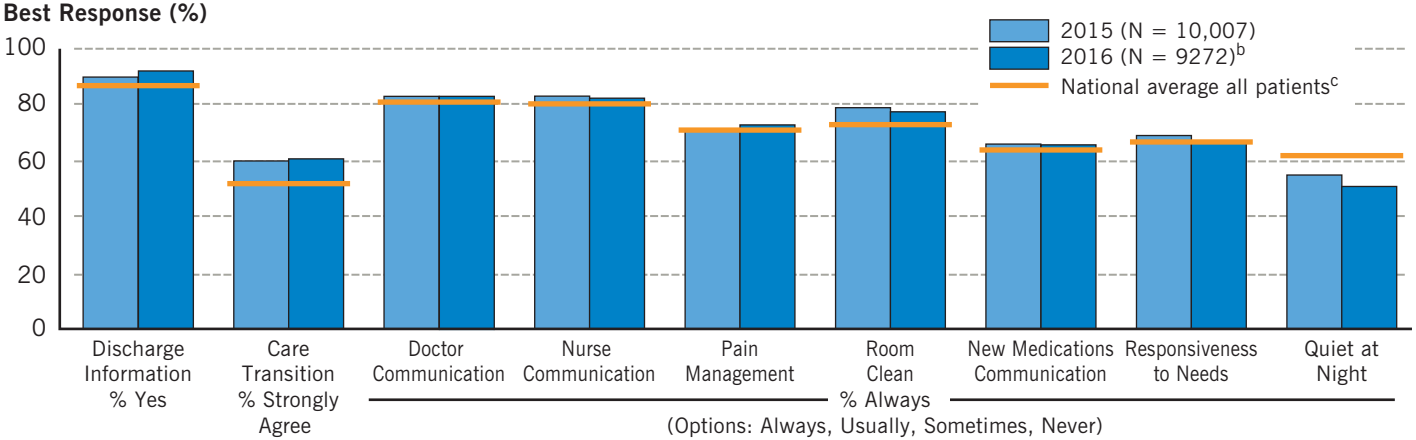
HCAHPS Domains of Care[a]

2015 – 2016

Best Response (%)



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[b]At the time of publication, 2016 ratings have not been reported by the Centers for Medicare & Medicaid Services and ratings are not adjusted for patient mix.
[c]Based on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

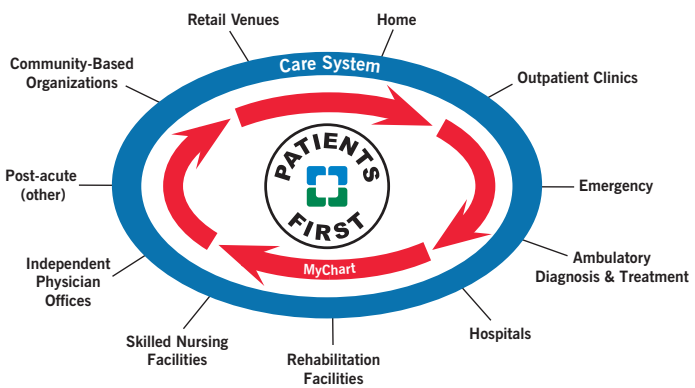
Source: Centers for Medicare & Medicaid Services, 2015; Press Ganey, a national hospital survey vendor, 2016

Focus on Value

Cleveland Clinic has developed and implemented new models of care that focus on "Patients First" and aim to deliver on the Institute of Medicine goal of **S**afe, **T**imely, **E**ffective, **E**fficient, **E**quitable, **P**atient-centered care. Creating new models of Value-Based Care is a strategic priority for Cleveland Clinic. As care delivery shifts from fee-for-service to a population health and bundled payment delivery system, Cleveland Clinic is focused on concurrently improving patient safety, outcomes, and experience.

What does this new model of care look like?

Integrated Care Model



The Cleveland Clinic Integrated Care Model (CCICM) is a value-based model of care, designed to improve outcomes while reducing cost. It is designed to deliver value in both population health and specialty care.

- The patient remains at the heart of the CCICM.
- The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in different settings. The care system represents integration of care across the continuum.
- Critical competencies are required to build this new care system. Cleveland Clinic is creating disease- and condition-specific care paths for a variety of procedures and chronic diseases. Another facet is implementing comprehensive care coordination for high-risk patients to prevent unnecessary hospitalizations and emergency department visits. Efforts include managing transitions in care, optimizing access and flow for patients through the CCICM, and developing novel tactics to engage patients and caregivers in this work.
- Measuring performance around quality, safety, utilization, cost, appropriateness of care, and patient and caregiver experience is an essential component of this work.

Improve Population Health

Cleveland Clinic Accountable Care Organization Measure Performance

2016

National Percentile Ranking

90th	• Falls Screening • Heart Failure • Ischemic Vascular Disease • BMI Screening • Tobacco Screening
80th	• Coronary Artery Disease • Diabetes • Breast Cancer Screening • Pneumonia Vaccination
70th	• Colorectal Cancer Screening • Influenza Vaccination • Blood Pressure Screening • Hypertension
50th	• Depression Screening

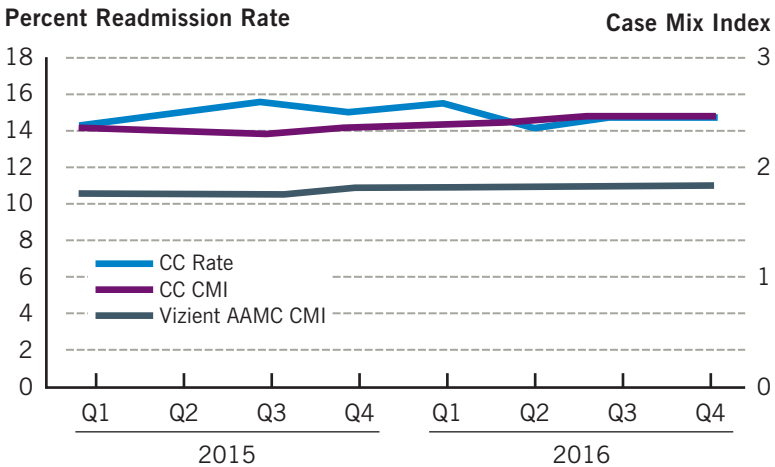
Higher percentiles are better

As part of Cleveland Clinic's commitment to population health and in support of its Accountable Care Organization (ACO), these ACO measures have been prioritized for monitoring and improvement. Cleveland Clinic is improving performance in these measures by enhancing care coordination, optimizing technology and information systems, and engaging primary care specialty teams directly in the improvement work. These pursuits are part of Cleveland Clinic's overall strategy to transform care in order to improve health and make care more affordable.

Reduce the Cost of Care

Cleveland Clinic All-Cause 30-Day Readmission Rate to Any Cleveland Clinic Hospital

2015 – 2016

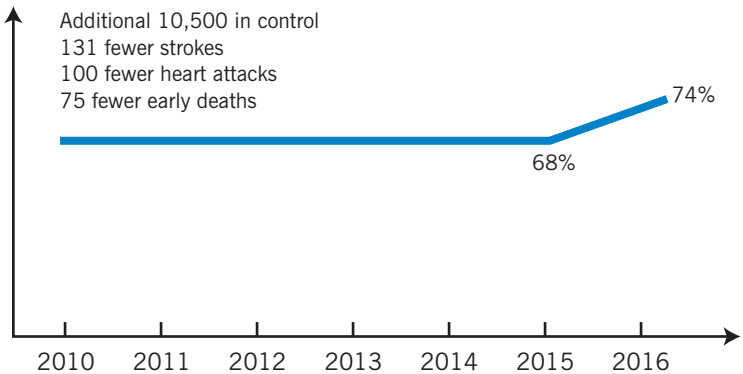


CMI = case mix index

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.

Cleveland Clinic monitors 30-day readmission rates for any reason to any of its system hospitals. Unplanned readmissions are actively reviewed for improvement opportunities. Comprehensive care coordination and care management for high-risk patients has been initiated in an effort to prevent unnecessary hospitalizations and emergency department visits. Sicker, more complex patients are more susceptible to readmission. Case mix index (CMI) reflects patient severity of illness and resource utilization. Cleveland Clinic's CMI remains one of the highest among American academic medical centers.

Accountable Care Organization (ACO) Improving Outcomes and Reducing Costs



Cleveland Clinic was one of the top performing new ACOs in the United States (for 2015 performance as determined in 2016) due to efficiency, cost reduction, and improvements in effectiveness of chronic disease management such as treating hypertension, reducing preventable hospitalizations through care coordination, and optimizing the care at skilled nursing facilities through its Connected Care program.

For example, a system-wide effort to improve the control of blood pressure for patients with hypertension was begun in 2016 and resulted in an additional 10,500 patients with blood pressure controlled. This will translate to many fewer strokes, heart attacks, and preventable deaths.

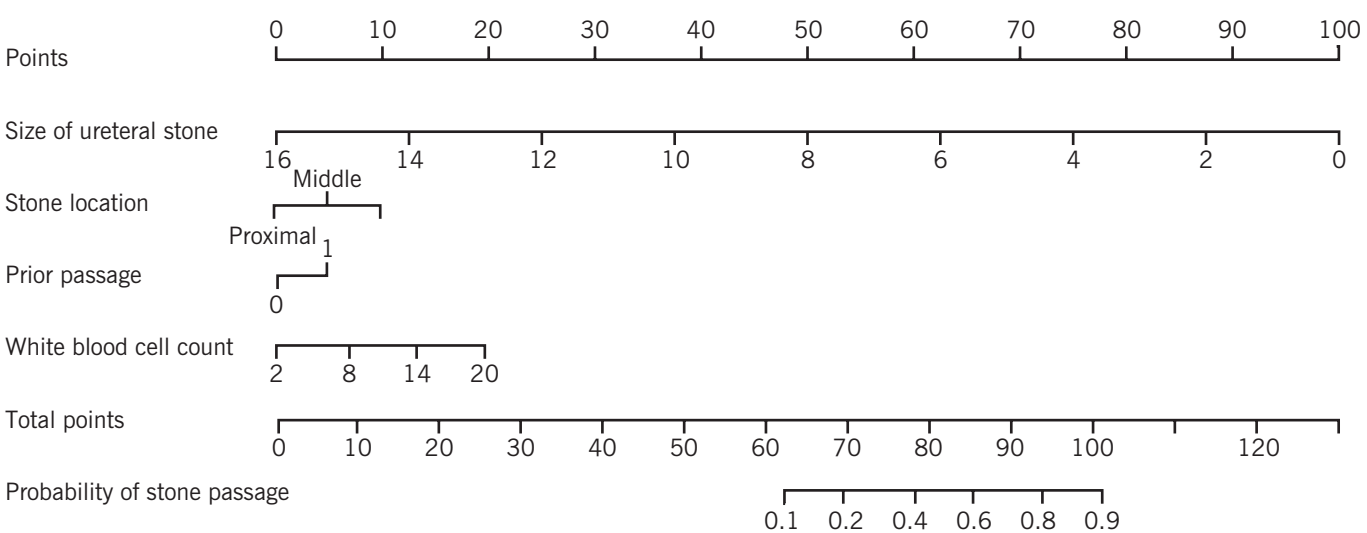
A Nomogram for Predicting Ureteral Stone Passage

Will my stone pass? This is the question paramount in patients' minds after renal colic subsides. Glickman Urological & Kidney Institute researchers developed a nomogram based on a review of 1146 patients, using variables chosen for clinical and statistical significance that were validated internally with a bootstrapping technique.

A review was conducted of emergency department visits within the health system that had an ICD-9 diagnosis of urolithiasis, an associated CT scan, and a discharge with medical expulsive therapy from 2010–2013. On univariable analysis, patients who passed stones tended to have smaller stones (3.6 mm vs 5.2 mm, $P < 0.001$), stones in the distal ureter (73% vs 41%, $P < 0.001$), and significantly higher white blood cell counts (9.49 vs 8.57, $P < 0.001$). There were no associations between age (49 years vs 50 years, $P = 0.831$) or gender (among males: 64% vs 62% $P = 0.451$) and stone passage. In the multivariable model, stone size (per 1 mm increase; OR 0.49; 95% CI 0.43-0.57; $P < 0.001$), stone location ($P < 0.0001$), prior history of stone passage (OR 1.74; 95% CI, 1.04-2.93; $P = 0.036$), and white blood cell count (per 1000/μL increase; OR 1.12; 95% CI, 1.04-1.21; $P = 0.001$) were significantly associated with spontaneous stone passage. The model was validated internally (bootstrap-adjusted concordance index, 0.80) and demonstrated excellent calibration.

For emergency department patients presenting with ureteral stones amenable to observation, this nomogram can guide early follow-up or intervention for those with a low probability of stone passage, improving patient satisfaction and preventing costly emergency department returns.

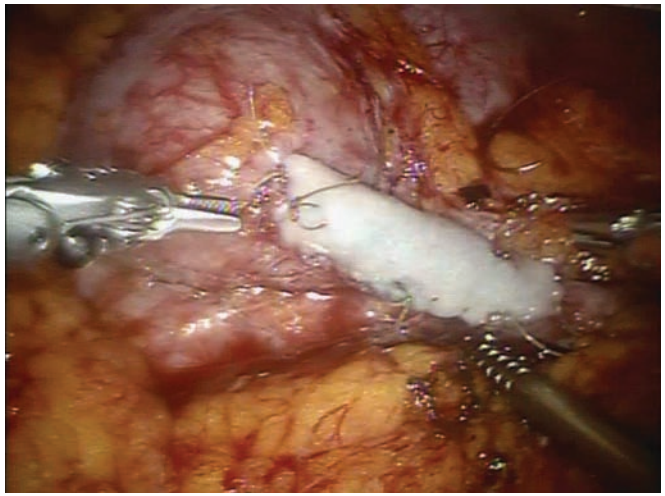
Nomogram for Predicting the Probability of Stone Passage



Robotic-Assisted Salvage Pyeloplasty With Buccal Mucosal Onlay Graft

The surgical management of recurrent ureteropelvic junction (UPJ) obstruction is challenging, with a high rate of recurrence leading to progressively complex repairs. Glickman Urological & Kidney Institute surgeons have used a buccal mucosal graft (BMG) in a salvage robotic laparoscopic pyeloplasty for managing recurrent UPJ obstruction in 2 adults, both of whom had failed at least 2 prior pyeloplasties and subsequent endoscopic management.

During the procedure, the UPJ and ureter are exposed, the stricture is incised and spatulated into healthy tissue on both ends, and a BMG is harvested and placed as an anterior onlay to augment the strictured segment. Short term outcomes are promising and without complications. Early results suggest that this approach can provide a tension-free repair with minimal mobilization of the kidney, renal pelvis, and ureter, even in cases with significant fibrosis. This technique is an attractive alternative in the management of recurrent UPJ obstruction and may help obviate the need for more invasive surgical repair.

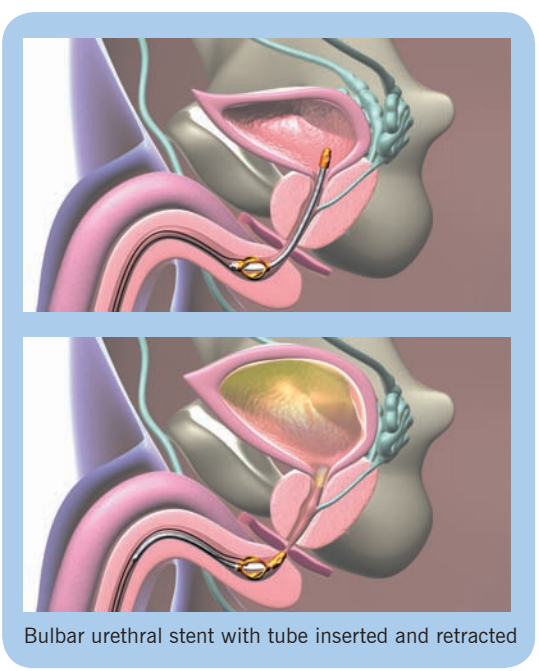


Buccal mucosa onlay graft sutured into place, bridging the UPJ and augmenting the stricture

Bulbar Urethral Stent

Institute urologists invented the bulbar urethral stent, a novel device made of 2 silicone tubes with one inside the other that are placed in the bulbar urethra with an anchoring device. The stent has 2 strings that exit the urethral meatus and is designed so that pulling one string will advance the inner tube through the prostatic urethra to enter the bladder and drain it. Pulling the other string will retract the inner tube back to its original position in the bulbar urethra.

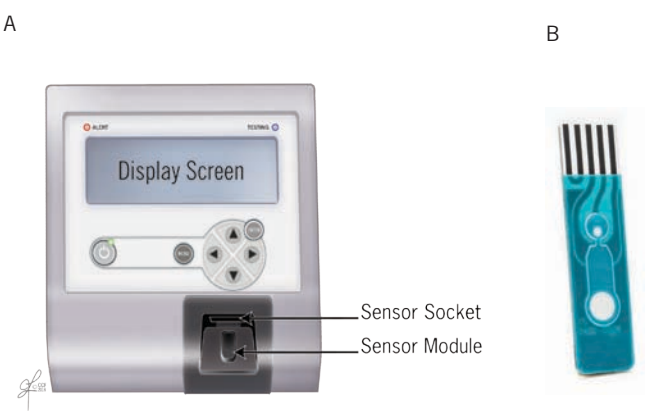
Unlike other temporary prosthetic stents, the bulbar urethral stent has no balloon in the bladder and no tube in the prostatic urethra and is indicated for the treatment of urinary retention due to benign prostatic hyperplasia with obstruction as well as urinary retention due to atonic neurogenic and nonneurogenic bladder.



Bulbar urethral stent with tube inserted and retracted

Clinical Utility of Novel Oxidation-Reduction Potential Assay in Male Factor Infertility[1]

Institute researchers have established an oxidation-reduction potential assay (ORP) using a novel galvanostatic technology as an effective method for measuring oxidative stress in semen and distinguishing normal men from male factor infertility patients. ORP captures a reliable, complete, and rapid picture of oxidative stress in a given semen sample, providing a functional component not contained within the semen analysis. Identification of abnormal levels of oxidative stress can enhance clinical understanding related to poor sperm function, especially in idiopathic and unexplained male infertility cases, and help optimize treatment strategies for male factor infertility.



Galvanostatic assay system components: analyzer (A) and sensor (B)

Reference

1. Agarwal A, Sharma R, Roychoudhury S, Du Plessis S, Sabanegh E. MiOXSYS: a novel method of measuring oxidation reduction potential in semen and seminal plasma. *Fertil Steril.* 2016 Sep 1;106(3):566-573.e.10.

Radioactive vs Nonradioactive Iothalamate in GFR Measurement

Assessment of kidney function is best reflected by the glomerular filtration rate (GFR). Radioactive iothalamate is commonly used as a tracer for GFR measurement, but the handling of radioactive material is cumbersome and challenging for many institutions. Institute researchers compared GFR measurements using radioactive iothalamate (measured by gamma counting) and nonradioactive iothalamate (measured by liquid chromatography-tandem mass spectrometry).

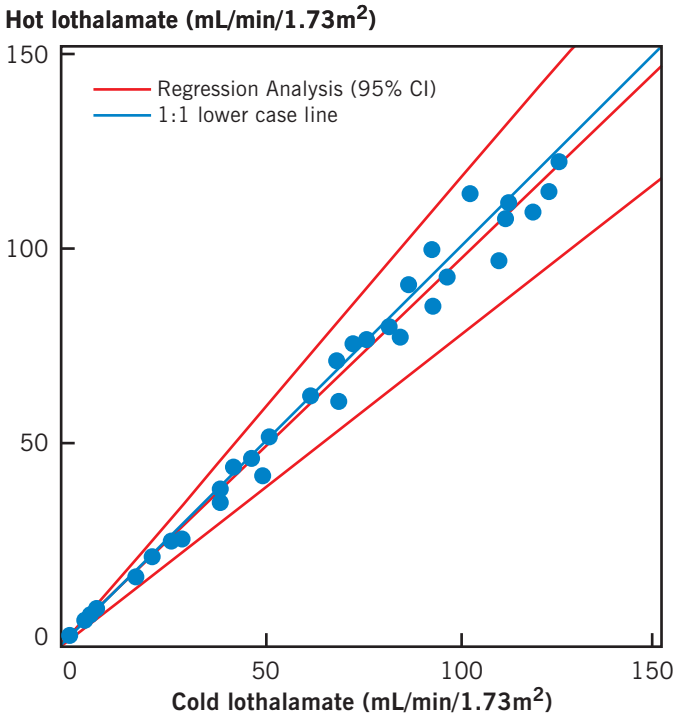
Patients received simultaneous subcutaneous injections of ^{125}I sodium iothalamate and iothalamate meglumine 60%. A total of 36 patients were enrolled between October 2011 and January 2013; 18 were males (50%). Mean age was 50.9 ± 15.8 years. GFR measurement ranges were 1.67–125.33 mL/min with a mean of 62.874 ± 38.427 mL/min for the radioactive iothalamate and 1.45–122.96 mL/min with a mean of 61.073 ± 37.852 mL/min for the nonradioactive iothalamate.

The correlation coefficient of the 2 measurement methods was 0.99 with a bias of -1.81 (-2.9%).

The study shows an excellent correlation between renal clearances of radioactive and nonradioactive iothalamate. In addition to being radiation free, this method is practical and avoids the need for a 24-hour urine collection.

Correlation Coefficient of the Measurement Methods

October 2011 – January 2013



	Deming Regression Analysis
Slope (95% CI)	0.985 (0.942 to 1.028)
Intercept (95% CI)	-0.854 (-4.023 to 2.315)
Standard Error Estimate	4.755

Contact Information

Urology Appointments/Referrals

216.444.5600 or

800.223.2273, ext. 45600

Nephrology Appointments/Referrals

216.444.6771 or

800.223.2273, ext. 46771

On the Web at
clevelandclinic.org/glickman

Staff Listing

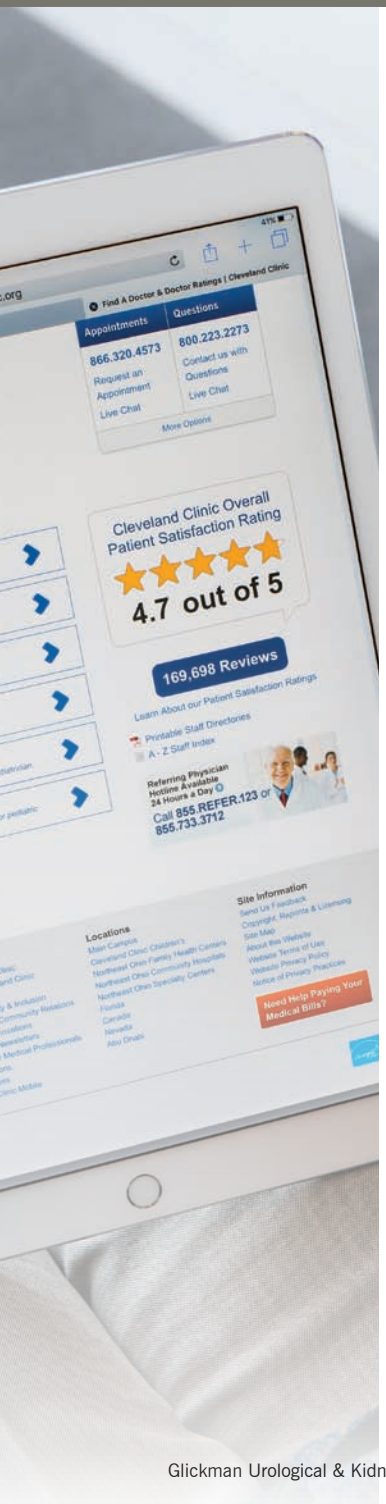
For a complete listing of Cleveland Clinic's Glickman Urological & Kidney Institute staff, please visit clevelandclinic.org/staff.

Publications

Glickman Urological & Kidney Institute staff authored ***172*** publications in 2016 as indexed within Web of Science.

Locations

For a complete listing of Glickman Urological & Kidney Institute locations, please visit clevelandclinic.org/glickman.



Additional Contact Information

General Patient Referral

24/7 hospital transfers or physician consults

800.553.5056

General Information

216.444.2200

Hospital Patient Information

216.444.2000

General Patient Appointments

216.444.2273 or 800.223.2273

Referring Physician Center and Hotline

855.REFER.123 (855.733.3712)

Or email refdr@ccf.org or visit clevelandclinic.org/refer123

Request for Medical Records

216.444.2640 or
800.223.2273, ext. 42640

Same-Day Appointments

216.444.CARE (2273)

Global Patient Services/ International Center

Complimentary assistance for international patients and families

001.216.444.8184 or visit clevelandclinic.org/gps

Medical Concierge

Complimentary assistance for out-of-state patients and families

800.223.2273, ext. 55580, or email medicalconcierge@ccf.org

Cleveland Clinic Abu Dhabi

clevelandclinicabudhabi.ae

Cleveland Clinic Canada

888.507.6885

Cleveland Clinic Florida

866.293.7866

Cleveland Clinic Nevada

702.796.8669

For address corrections or changes, please call

800.890.2467

About Cleveland Clinic

Overview

Cleveland Clinic is an academic medical center offering patient care services supported by research and education in a nonprofit group practice setting. More than 3500 Cleveland Clinic staff physicians and scientists in 140 medical specialties and subspecialties care for more than 7.1 million patients across the system annually, performing nearly 208,000 surgeries and conducting more than 652,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and 185 nations. Cleveland Clinic's CMS case-mix index is the second-highest in the nation.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1400-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 44 buildings on 167 acres. Cleveland Clinic has more than 150 northern Ohio outpatient locations, including 10 regional hospitals, 18 full-service family health centers, 3 health and wellness centers, an affiliate hospital, and a rehabilitation hospital for children. Cleveland Clinic also includes Cleveland Clinic Florida; Cleveland Clinic Nevada; Cleveland Clinic Canada; Cleveland Clinic Abu Dhabi, UAE; Sheikh Khalifa Medical City (management contract), UAE; and Cleveland Clinic London (opening in 2020). Cleveland Clinic is the largest employer in Ohio, with more than 51,000 employees. It generates $12.6 billion of economic activity a year.

Cleveland Clinic supports physician education, training, consulting, and patient services around the world through representatives in the Dominican Republic, Guatemala, India, Panama, Peru, Saudi Arabia, and the United Arab Emirates. Dedicated Global Patient Services offices are located at Cleveland Clinic's main campus, Cleveland Clinic Abu Dhabi, Cleveland Clinic Canada, and Cleveland Clinic Florida.

The Cleveland Clinic Model

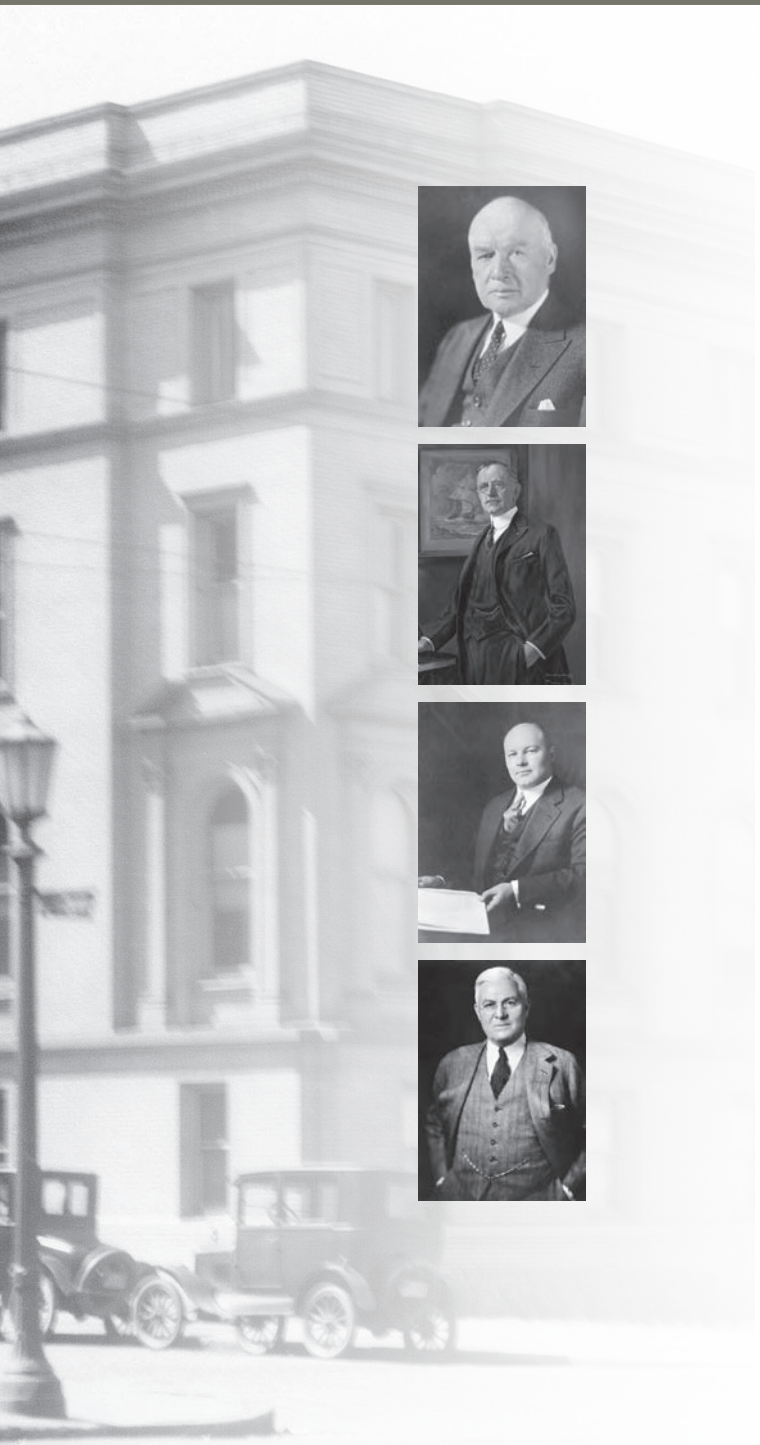
Cleveland Clinic was founded in 1921 by 4 physicians who had served in World War I and hoped to replicate the organizational efficiency of military medicine. The organization has grown through the years by adhering to the nonprofit, multispecialty group practice they established. All Cleveland Clinic staff physicians receive a straight salary with no bonuses or other financial incentives. The hospital and physicians share a financial interest in controlling costs, and profits are reinvested in research and education.

Cleveland Clinic Florida was established in 1987. Cleveland Clinic began opening family health centers in surrounding communities in the 1990s. Marymount Hospital joined Cleveland Clinic in 1995, followed by regional hospitals including Euclid Hospital, Fairview Hospital, Hillcrest Hospital, Lutheran Hospital, Medina Hospital, South Pointe Hospital, and affiliate Ashtabula County Medical Center. In 2015, the Akron General Health System joined the Cleveland Clinic health system.

Internally, Cleveland Clinic services are organized into patient-centered integrated practice units called institutes, each institute combining medical and surgical care for a specific disease or body system. Cleveland Clinic was among the first academic medical centers to establish an Office of Patient Experience, to promote comfort, courtesy, and empathy across all patient care services.

A Clinically Integrated Network

Cleveland Clinic is committed to providing value-based care, and it has grown the Cleveland Clinic Quality Alliance into the nation's second-largest, and northeast Ohio's largest, clinically integrated network. The network comprises more than 6300 physician members, including both Cleveland Clinic staff and independent physicians from the community. Led by its physician members, the Quality Alliance strives to improve quality and consistency of care; reduce costs and increase efficiency; and provide access to expertise, data, and experience.



Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine is known for its small class sizes, unique curriculum, and full-tuition scholarships for all students. Each new class accepts 32 students who are preparing to be physician investigators. In 2015, Cleveland Clinic broke ground on a 477,000-square-foot multidisciplinary Health Education Campus. The campus, which will open in July 2019, will serve as the new home of the Case Western Reserve University (CWRU) School of Medicine and Cleveland Clinic's Lerner College of Medicine, as well as the CWRU School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs.

Graduate Medical Education

In 2016, nearly 2000 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida in our continually growing programs.

U.S. News & World Report Ranking

Cleveland Clinic is ranked the No. 2 hospital in America by *U.S. News & World Report* (2016). It has ranked No. 1 in heart care and heart surgery since 1995. In 2016, 3 of its programs were ranked No. 2 in the nation: gastroenterology and GI surgery, nephrology, and urology. Ranked among the nation's top five were gynecology, orthopaedics, rheumatology, pulmonology, and diabetes and endocrinology.

Cleveland Clinic Physician Ratings

Cleveland Clinic believes in transparency and in the positive influence of the physician-patient relationship on healthcare outcomes. To continue to meet the highest standards of patient satisfaction, Cleveland Clinic physician ratings, based on nationally recognized Press Ganey patient satisfaction surveys, are published online at clevelandclinic.org/staff.

Resources

Referring Physician Center and Hotline

Call us 24/7 for access to medical services or to schedule patient appointments at 855.REFER.123 (855.733.3712), email refdr@ccf.org, or go to clevelandclinic.org/Refer123. The free Cleveland Clinic Physician Referral App, available for mobile devices, gives you 1-click access. Available in the App Store or Google Play.

Remote Consults

Anybody anywhere can get an online second opinion from a Cleveland Clinic specialist through our MyConsult service. For more information, go to clevelandclinic.org/myconsult, email myconsult@ccf.org, or call 800.223.2273, ext. 43223.

Request Medical Records

216.444.2640 or 800.223.2273, ext. 42640

Track Your Patients' Care Online

Cleveland Clinic offers an array of secure online services that allow referring physicians to monitor their patients' treatment while under Cleveland Clinic care and gives them access to test results, medications, and treatment plans. my.clevelandclinic.org/online-services

Dr**Connect** (online access to patients' treatment progress while under referred care): call 877.224.7367, email drconnect@ccf.org, or visit clevelandclinic.org/drconnect.

MyPractice Community (affordable electronic medical records system for physicians in private practice): 216.448.4617.

eRadiology (teleradiology consultation provided nationwide by board-certified radiologists with specialty training, within 24 hours or stat): call 216.986.2915 or email starimaging@ccf.org.

Medical Records Online

Patients can view portions of their medical record, receive diagnostic images and test results, make appointments, and renew prescriptions through My**Chart**, a secure online portal. All new Cleveland Clinic patients are automatically registered for My**Chart**. clevelandclinic.org/mychart

Access

Cleveland Clinic is committed to convenient access, offering virtual visits, shared medical appointments, and walk-in urgent care for your patients. clevelandclinic.org/access

Critical Care Transport Worldwide

Cleveland Clinic's fleet of ground and air transport vehicles is ready to transfer patients at any level of acuity anywhere on Earth. Specially trained crews provide Cleveland Clinic care protocols from first contact. To arrange a transfer for STEMI (ST-elevation myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage), or aortic syndrome, call 877.379.CODE (2633). For all other critical care transfers, call 216.444.8302 or 800.553.5056.

CME Opportunities: Live and Online

Cleveland Clinic's Center for Continuing Education operates the largest CME program in the country. Live courses are offered in Cleveland and cities around the nation and the world. The center's website (ccfcme.org) is an educational resource for healthcare providers and the public. It has a calendar of upcoming courses, online programs on topics in 30 areas, and the award-winning virtual textbook of medicine, The Disease Management Project.

Clinical Trials

Cleveland Clinic is running more than 2200 clinical trials at any given time for conditions including breast and liver cancer, coronary artery disease, heart failure, epilepsy, Parkinson disease, chronic obstructive pulmonary disease, asthma, high blood pressure, diabetes, depression, and eating disorders. Cancer Clinical Trials is a mobile app that provides information on the more than 200 active clinical trials available to cancer patients at Cleveland Clinic. clevelandclinic.org/cancertrialapp

Healthcare Executive Education

Cleveland Clinic has programs to share its expertise in operating a successful major medical center. The Executive Visitors' Program is an intensive, 3-day behind-the-scenes view of the Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a 2-week immersion in challenges of leadership, management, and innovation taught by Cleveland Clinic leaders, administrators, and clinicians. Curriculum includes coaching and a personalized 3-year leadership development plan.
clevelandclinic.org/executiveeducation

Consult QD Physician Blog

A website from Cleveland Clinic for physicians and healthcare professionals. Discover the latest research insights, innovations, treatment trends, and more for all specialties. consultqd.clevelandclinic.org

Social Media

Cleveland Clinic uses social media to help caregivers everywhere provide better patient care. Millions of people currently like, friend, or link to Cleveland Clinic social media — including leaders in medicine.

Facebook for Medical Professionals
facebook.com/CMEclevelandclinic

Follow us on Twitter
@cleclinicMD

Connect with us on LinkedIn
clevelandclinic.org/MDlinkedin

Cleveland Clinic

Every life deserves world class care.

Graphic design and photography were provided by
Cleveland Clinic's Center for Medical Art and Photography.

9500 Euclid Avenue, Cleveland, OH 44195

clevelandclinic.org

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