St. Peter's Hospital Cancer Care Center Annual Report 2013

Kidney Cancers

St Peter's Hospital
Cancer Care Center

St Peter's Health Partners

Mission Statement

The mission of St. Peter's Cancer Care Program is to provide quality cancer care. Guided by the spirit of the Sisters of Mercy, the values that provide direction to the program include:

- Ministry with compassion and caring to the physical, psychological and spiritual needs of cancer patients
- Respect for human life and the dignity of the individual

Dedicated to offering a continuum of services to support the optimal well-being of patients and their families, St. Peter's Cancer Care Program is committed to the promotion of:

- The art of caring, balanced with technology
- Continuous improvement and innovation
- Prudent use of resources
- Excellence through collaboration with existing community organizations
- Facilitation of access to care
- Community and professional education

St Peter's Hospital
Cancer Care Center
St Peter's Health Partners

Dear Colleague:

I am pleased to forward to you the St. Peter's Cancer Care Center's Annual Report for 2013 focusing on the diagnosis and treatment of kidney cancers.

Since 1985, St. Peter's has been continually accredited as a Comprehensive Community Cancer Program (CCCP) by the American College of Surgeons Commission on Cancer. In its most recent reaccreditation survey, the Commission specifically commended St. Peter's Program in the areas of clinical trial accrual, public reporting of outcomes and the quality of its data submission. The Cancer Center pursues a comprehensive quality improvement program, and engages in a range of prevention and early detection activities in the community.

St. Peter's program is fully comprehensive, encompassing state-of-the-art screening and diagnostics, and a full range of surgical, medical and radiological oncologic treatment options. Services include a wide range of external beam therapy and brachytherapy, as well as Novalis® Shaped Beam stereotactic radiosurgery and radiotherapy. St. Peter's full-service medical oncology practice offers evaluation and treatment of oncologic and hematologic conditions utilizing systemic therapies, genetic counseling and outpatient infusion.

Multidisciplinary treatment planning is supported by a wide range of ongoing cancer conferences.

If you would like additional information regarding the services offered at St. Peter's, call our Cancer Information Line (518-525-1547) or visit our website at www.sphcs.org/CancerCareCenter.

Finally, I would like to thank all those involved in making this publication possible.

Sincerely,

Wayne Holmen
Director, Cancer Care Services

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A SURVIVOR'S STORY: AN EARLY DIAGNOSIS

In the spring of 2006, Susan Frederick, then 46, was doing a lot of yard work and developed a terrible pain on her right side. When she visited her doctor and had a CT scan done, she was told that her pain was due to benign causes. However, a tiny mass (approximately 2 cm) was noticed on her left kidney.

A urologist suggested Frederick have the mass, believed to be a cyst, re-checked in a few months just to be sure. She was rescanned in July, and it had changed to a solid mass, which was very likely a cancer.

"I had no idea that it could ever be cancer," remembers Frederick. "I was shocked and scared. It was like my world crashed."

Frederick was referred to Theodore T. Chang, MD, of Capital Region Urology, and an attending surgeon at St. Peter's Hospital. Dr. Chang decided Frederick needed laparoscopic surgery to remove the mass.

"He told me I was very lucky that it was caught so early. It was slow-growing, so I didn't have surgery until October," said Frederick. "For those months in between, I went about my normal routine, but I thought about it constantly. I didn't sleep well."

Frederick found a lot of support in her husband and her mother, as well as Dr. Chang.

"Dr. Chang is wonderful. He's easy to talk to. I can ask him anything and he has a way of calming me down."

Dr. Chang removed the mass and the tissue surrounding it. Pathology confirmed it was papillary renal cell carcinoma. Dr. Chang is confident all of the cancer cells were removed, but Frederick will continue to be assessed annually for the rest of her life.

"It was fully encapsulated so I didn't need radiation or chemotherapy. I'm really lucky because it could have been horrible," said Frederick.

Frederick left the hospital two days later, and made some life-changing decisions.

"I retired five years early because I felt I never knew if it was going to come back. With the stress of it all, I decided I need to relax and enjoy my life a little more," said Frederick.

Now 54, Frederick spends summers at a camp in Sacandaga, and volunteers at the Saratoga County Animal Shelter walking dogs and helping with adoption clinics, which she says she really enjoys. Someday soon, Frederick and her husband hope to be able to spend a winter in Florida.

Frederick hopes her story will help encourage other people to see their doctor if they are having pain or think something just isn't right.

"I always go to the doctor because I'm into preventative things. I want to catch something quickly," said Frederick. "If you think there is something wrong, go find out. It probably saved my life. And if you have your health, you can deal with anything."

CANCER PROGRAM ACTIVITY REPORT

Arthur Sunkin, MD

Attending Physician
Cancer Committee Chair

Medical Oncology,
St. Peter's Cancer Care Center

St. Peter's Cancer Care Program continues to offer a comprehensive range of cancer care services to adults in the community and the region. In its most recent complete reporting year (2012), St. Peter's diagnosed and/or treated 2,368 new (analytic) cancer cases and participated in the care of an additional 731 (non-analytic) cases. St. Peter's Cancer Committee continues to provide direction and oversight to the program.

Among the recent accomplishments of the program are:

- Program Reaccreditation with Commendation by the American College of Surgeons Commission on Cancer
- Improved radiotherapy capacity with installation of a new linear accelerator and RapidArc® technology
- Expansion of the Medical Oncology practice
- Improvements in real-time visualization of radiology and pathology at tumor conferences, optimizing diagnostic interpretations and treatment planning

Cancer Program Goals for 2014

- Expand clinical trial opportunities through membership with the National Research Group
- Continued implementation of the MOSAIQ® Electronic Medical Record for Cancer Care
- Service line development across St. Peter's Health Partners

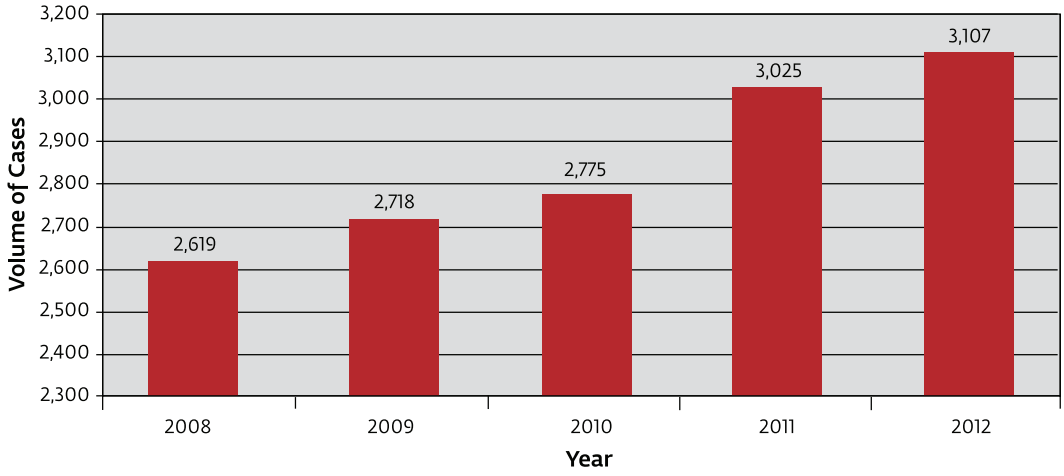
CANCER DATA MANAGEMENT ACTIVITY REPORT

Shannon Middleton, CTR

Cancer Registry
St. Peter's Cancer Care Center

The Cancer Data Management department maintains the Cancer Registry database in accordance with standards set forth by the Commission on Cancer. During 2012, the registry collected data on 3,107 new cases. This case volume represents an 82-case increase over the previous year's volume of 3,025. The following graph indicates the five-year growth in all accessioned cases.

5-Year Cancer Registry Activity



Registry data are submitted weekly to the New York State Central Cancer Registry, and annually to the Commission on Cancer's National Cancer Data Base.

St. Peter's Cancer Committee provides direction and oversight of registry activities. The lead certified tumor registrar guides the day-to-day operations of the staff, while the Quality Improvement manager oversees the department. All data abstraction on cases is performed by tumor registrars certified through the National Cancer Registrar's Association.

Cancer Registry Activities

The Cancer Committee uses registry data to determine areas of need, and to establish program goals and objectives. In addition, the Cancer Care Quality Improvement program relies on registry data to assess program-specific disease incidence and to document the efficacy of treatment outcomes. Community outreach efforts are also data-driven. The need for educational programs, screenings, and participation in regional events, as well as requirements for new technology, are supported by registry incidence data.

In addition to maintaining an up-to-date cancer database, the department also facilitates regular cancer conferences - multidisciplinary forums for prospective case presentation, AJCC staging discussion and treatment planning. Current conferences focus on breast, gastrointestinal tract, genitourinary tract, gynecological, hepatobiliary and thoracic sites. Surgeons, radiation and medical oncologists, diagnostic radiologists and pathologists, as well as other practitioners, attend cancer conferences. In 2012, 603 patient cases were discussed at 117 cancer conferences.

Quality of Cancer Data

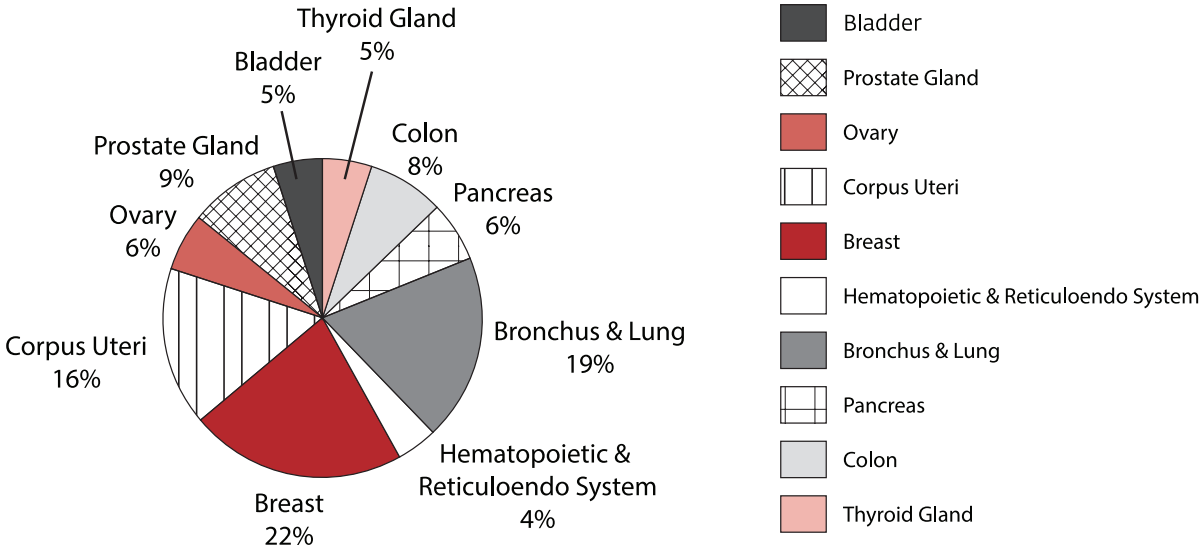
The quality of cancer data abstraction is monitored and reported regularly to the Cancer Committee. Registry quality monitoring activities include:

- Physician review of a minimum of 10 percent of annual analytic abstracts. These audits identify additional training and resource needs.
- Timeliness of case abstraction and completion is monitored and reported to both the Cancer Committee and the New York State Cancer Registry.
- Annual follow-up of at least 90 percent of all active cases to ensure that up-to-date health status and survival information is in the database.
- Regular coding edit checks for format accuracy. Inter-field edits ensure internal data consistency within records.
- Registrar attendance at continuing education and training sessions.

SPH Cancer Incidence 2012

Of the new cancer cases seen in 2012, breast cancer continues to be the most commonly occurring cancer at SPH representing 22 percent, followed (in descending order) by bronchus and lung (19 percent), corpus uteri (16 percent), prostate (9 percent), colon (8 percent), pancreas (6 percent), ovary (6 percent), bladder (5 percent), thyroid (5 percent), and hematopoietic and reticuloendo system malignancies (4 percent). Relative proportions of cancer sites are shown below:

Top 10 Sites 2012



Diagnosis, Radiology

Imaging of Renal Cell Carcinoma

Vardan Amirbekian, MD

Attending Physician
Department of Radiology
St. Peter's Hospital

Imaging offers a powerful tool for the evaluation of renal masses. Several imaging modalities can be used to assist in diagnosing cancers. Contrast-enhanced CT and MRI can provide accurate and reliable characterization of renal masses that are greater than 5 mm in size. Ultrasound is relatively accurate at classifying masses as cystic or solid, but has lower sensitivity and specificity when compared to CT and MRI. These days, the majority of renal cell carcinomas are discovered as incidental findings on imaging studies performed for non–urinary tract symptoms.

Earlier detection and treatment of renal cell carcinomas (RCC) leads to improved survival. In general, the size of a RCC correlates with the likelihood of disseminated/metastatic disease. RCCs that are less than 3 cm have a low likelihood of presenting with metastases. The risk of metastatic disease increases substantially for RCCs that are larger than 3 cm.

There are different cellular variants of RCC. The imaging features of the different cellular variants of RCC lead to different manifestations on imaging. Clear cell RCC is the most common subtype of RCC (70 to 75 percent of RCC) and tends to be hypervascular with a solid, avidly enhancing appearance on imaging (Figure 1). Papillary cell (10 to 15 percent of RCC) and chromophobe cell (5 percent of RCC) subtypes of RCC can be hypovascular, which leads to hypo-enhancement on imaging – a feature that may lead to a misdiagnosis of these lesions as cysts (Figure 2).

The vast majority of cystic renal lesions are benign. However, RCC can have a cystic appearance. The presence of enhancing soft tissue, thick septations and nodular components within a cystic renal mass should raise suspicion for RCC. Rapid growth of any renal lesion should also be viewed as a worrisome feature.

Radiologists play an important role in the clinical staging of RCC. Imaging can detect neoplastic lymphadenopathy, distal metastatic disease, and vascular invasion/extension of RCC, all of which may alter the clinical management of RCC. Interventional radiology provides cost-effective and minimally invasive tools in the management of renal masses. Interventional radiologists can biopsy most renal masses using minimally invasive percutaneous image-guided biopsy techniques, typically using ultrasound or CT for image guidance (Figure 3). Additionally, in collaboration with urologists, interventional radiologists can also treat smaller RCCs, typically in patients who are poor surgical candidates or in patients who have sub-optimal renal function. Interventional radiologists can use percutaneous minimally invasive ablation techniques, such as radio frequency (RF) ablation or cryoablation, to treat smaller RCCs (Figure 4). In conclusion, radiologists offer important tools in the evaluation and management of renal masses.

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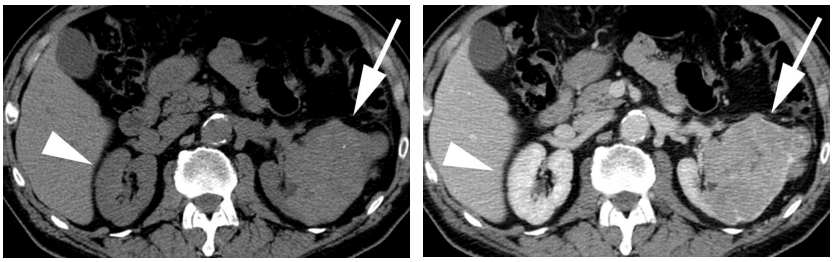

Figure 1
Pre-contrast (left image) and post-contrast (right image) CT images showing an enhancing left renal mass (white arrow) that was shown to be a clear cell renal cell carcinoma after surgical resection. Note the appearance of the normal right kidney (white arrowhead).

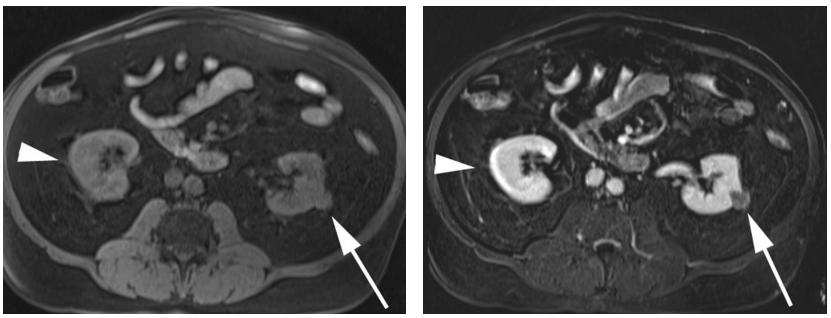

Figure 2
Pre-contrast (left image) and post-contrast (right image) MRI images showing a small, hypo-enhancing left renal mass (white arrow) that was shown to be a papillary-type renal cell carcinoma after biopsy. Note the appearance of the normal right kidney (white arrowhead).

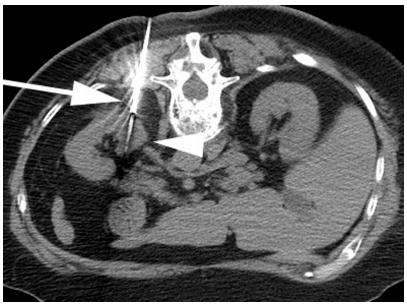

Figure 3
CT-guided biopsy of a left renal mass (white arrowhead) using a coaxial biopsy needle (white arrow). Pathology showed renal cell carcinoma.

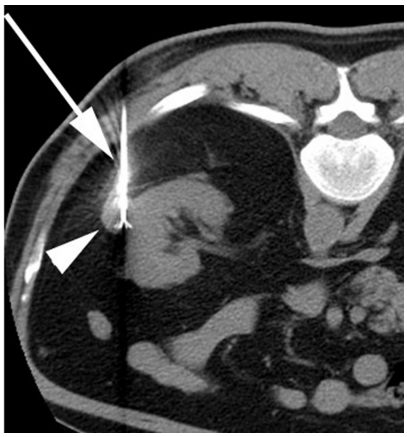

Figure 4
A small renal cell carcinoma (white arrowhead) being treated with radiofrequency (RF) ablation using an RF probe (white arrow).

A Surgical Perspective

The Use of Surgery in the Treatment of Kidney Cancers

Theodore T. Chang, MD

Attending Surgeon
St. Peter's Hospital

Capital Region Urology

For many years, the traditional treatment for kidney cancer has been the surgical removal of the entire kidney, a procedure known as a radical nephrectomy. Radical nephrectomy using an open surgical technique was the treatment of choice for almost all surgically controllable kidney cancers until relatively recently. A patient's long-term survival is typically poor if the tumor cannot be surgically removed in its entirety. Therefore, the paradigm of surgical treatment of kidney cancer has shifted in several different ways over the last several years, and St. Peter's Hospital has been a regional leader in these changes.

The traditional open radical nephrectomy involves removing the entire kidney, along with the surrounding fatty tissue, adjacent lymph tissue and adrenal gland, which lies just above the kidney. These adjoining structures are removed because of the possibility that the kidney cancer may have spread into these areas. Surgery is commonly performed with an incision through the abdominal wall, the side or the back. Larger kidney cancers can also involve the main renal (kidney) vein and inferior vena cava (the body's largest vein, leading back to the heart), and may even require the assistance of a vascular or cardiac surgeon in addition to the urologist.

Laparoscopic Surgery

With the development of new techniques, technologies and instruments in the 1980s and 1990s, many open surgical procedures have been replaced by laparoscopic surgery. These new developments include the laparoscope itself (a telescope to look into the abdomen), better optics, more powerful light sources and smaller cameras. Laparoscopy has also been called "keyhole" or "band-aid" surgery since it involves several small incisions. Laparoscopic radical nephrectomy leads to less bleeding, less scarring and less pain, along with shorter hospitalizations and a faster return to normal activities. Although the laparoscopic technique has become the standard of care for most radical nephrectomies, there are still large and complex cancers which require open surgery.

The idea of removing only the cancerous portion of the kidney (partial nephrectomy) rather than the entire kidney (radical nephrectomy) began to take hold in the 1990s. According to data collected at the Cleveland Clinic and elsewhere, cancer control rates were equivalent when comparing the two surgical options. It was also shown that there are more long-term health issues (e.g., high blood pressure, heart problems and kidney failure) when removing an entire

kidney as opposed to just the diseased portion. The partial nephrectomy has become the standard of care for uncomplicated kidney cancers less than 4 cm in size, and occasionally for tumors up to 7 cm. Partial nephrectomy is especially important in patients who have only one working kidney, have other kidney disease, cancer in both kidneys or a type of kidney cancer that has a high risk of cancer in the other kidney.

Robotic-Assisted Laparoscopy

The next major advance in kidney cancer surgery came about when laparoscopy began to be used to perform partial nephrectomies. This is a very technically challenging surgical procedure which was first done by only a handful of very skilled and experienced laparoscopic surgeons. However, the development of robotic-assisted laparoscopy has made the surgery feasible for many other surgeons. While not technically a "robot" by the standard definition, but rather a master-slave system (i.e., the surgeon controls the machine), the procedure offers surgeons more precise control, three-dimensional visualization and the ability to suture within the body more easily. Robotic-assisted laparoscopic surgery has already become the standard of care for radical prostatectomies (prostate removal), made possible by advances in computers and engineering. As we gain more experience with robotic-assisted laparoscopic partial nephrectomies, it may become the standard of care for those procedures as well.

Less Risk and Greater Responses

Data has also shown that removing the adrenal gland is not always necessary during kidney cancer surgery. The adrenal gland, which sits just above the kidney but is a separate structure, can be left alone in many cases, with little risk of the kidney cancer having spread into the gland. We have learned that the adrenal gland is usually not affected by kidney cancer unless the tumor itself is large (greater than 5 cm) and/or located in the upper pole of the kidney near the adrenal gland itself. This lack of spread or involvement must be confirmed by imaging tests. Leaving the adrenal gland means less risk of adrenal insufficiency in the future.

Lastly, data has shown that surgically removing the kidney, even in the face of metastatic kidney cancer (when it has spread to other parts of the body), can improve the patient's response to other treatments such as chemotherapy and immunotherapy. This is most typically done when the patient is in otherwise good health. Nephrectomy in the face of metastatic disease was previously only done to ease symptoms such as pain and bleeding.

Surgical treatment has changed dramatically in the recent past with the development of laparoscopic and partial nephrectomy techniques, along with changes in the approach to kidney cancer. St. Peter's Hospital has been at the forefront of these advances, and will continue to evolve with new treatments for kidney cancer, doing our best to take excellent care of our patients.

Diagnosis, Pathology

Renal Cell Carcinoma, With Emphasis on Clear Cell Renal Cell Carcinoma (CCRCC)

Marie-Paule Jacob-Ampuero, MD

Pathologist
St. Peter's Health Partners Medical Associates, PC

Epidemiology

The incidence of kidney cancer over the last few years has increased by 3.1 percent per year, primarily due to detection of small asymptomatic tumors found incidentally during abdominal imaging studies.[1] Kidney cancer is more common in men than women (approximately 2:1). The average age at diagnosis is 60.

Malignant kidney cancers develop from either tubal epithelial cells of the kidney (renal cell carcinoma) or from the epithelial cells lining the renal pelvis (transitional cell carcinoma). Renal cell carcinoma accounts for more than 90 percent of adult kidney cancers (2004 WHO classification). The most common (90 to 95 percent) types of renal cell carcinomas are clear cell renal cell carcinoma (CCRCC), papillary renal cell carcinoma (PRCC) and chromophobe renal cell carcinoma (ChRCC).[2] It is important to note that CCRCC represents approximately 70 percent of all renal cell carcinomas.

Risk Factors

Kidney cancer can develop sporadically (randomly) or be inherited. There are three established risk factors for developing sporadic renal cell carcinoma: smoking, obesity and hypertension. At the molecular level, sporadic CCRCC involves the mutation of a gene called VHL (Von Hippel-Lindau) at chromosome 3p25, which predisposes a person to tumors of various organs. Additionally, VHL is the most common inherited disease predisposing to the development of CCRCC.

Pathologic Diagnosis

Initially, a percutaneous core needle biopsy is used to make a preoperative diagnosis. This method determines the subtype of the kidney tumor involved with an accuracy rate of 78 to 98 percent.[3] Once a diagnosis of cancer is obtained by a core biopsy, the tumor may be surgically removed by either a partial

or radical nephrectomy. The resected specimen is examined both grossly and microscopically. Grossly, CCRCC typically presents with a golden color due to the accumulation of lipid in the malignant cells (Figure 1). The tumor is typically a well-circumscribed mass with a capsule or pseudocapsule, and areas of hemorrhage, fibrosis, necrosis and cystic degeneration. Microscopically, the tumor has clear cytoplasm. Other kidney tumors that can have a clear cell cytoplasm include PRCC, ChRCC, translocation carcinoma (Xp11 and others), oncocytoma, unclassified renal cell carcinoma and epithelioid angiomyolipoma (a mixed epithelial and stromal tumor of the kidney). The most reliable diagnostic feature to distinguish CCRCC from other tumors with clear cell features is the tumor's rich vascular pattern (which contributes to the gross hemorrhagic appearance). The blood vessels are small and surround clusters of tumor cells, a pattern called alveolar pattern (Figure 2). The rich, vascular component can create areas of "blood lakes" in the tumor. In a small percentage of tumors, a sarcomatoid/spindle cell pattern is present.

Grading

The Fuhrman grading system is used for grading renal cell carcinomas. It is based on nuclear size, nucleolar prominence and nuclear membrane abnormalities. Renal cell carcinoma can be histologically heterogeneous with varying nuclear features in different sections of the tumor. Grading is based on the area with the worst nuclear features, even if it represents a minor component of the tumor. Increased nuclear grade is associated with worse prognosis.

Fuhrman Grading System

Grade 1: Round small nuclei (less than 10 um), inconspicuous or absent nucleoli

Grade 2: Slightly larger nuclei (15 um), nucleoli visible under higher magnification

Grade 3: Very irregular nuclei (20 um), prominent and large nucleoli

Grade 4: Bizarre and multiloculated nuclei (>20 um), prominent nucleoli and clumped chromatin

Staging

The TNM (tumor, nodes, metastasis) staging system of the American Joint Committee on Cancer (AJCC) is used for renal cell carcinomas. The pathologic staging is reported as pT (pathologic tumor characteristics), pN (whether lymph node metastases exists) and pM (whether metastatic tumor is present in a sample sent for pathologic evaluation). Of the pT staging, documentation of extension of the tumor beyond the kidney is one of the most important staging characteristics. Recent literature has suggested a worse outcome for those with renal sinus fat involvement as opposed to perinephric fat involvement[4] (Tables 1 and 2).

TNM Components and Staging

Table 1

Primary Tumor (pT)	
pTX	Primary tumor cannot be assessed
pT0	No evidence of primary tumor
pT1	Tumor 7 cm or less in greatest dimension, limited to the kidney
pT1a	Tumor 4 cm or less in greatest dimension, limited to the kidney
pT1b	Tumor more than 4 cm but not more than 7 cm in greatest dimension, limited to the kidney
pT2	Tumor more than 7 cm in greatest dimension, limited to the kidney
pT2a	Tumor more than 7 cm but less than or equal to 10 cm in greatest dimension, limited to the kidney
pT2b	Tumor more than 10 cm, limited to the kidney
pT3	Tumor extends into major veins or perinephric tissues, but not into the ipsilateral adrenal gland and not beyond Gerota's fascia
pT3a	Tumor grossly extends into the renal vein or its segmental (muscle containing) branches, or tumor invades perirenal and/or renal sinus fat, but not beyond Gerota's fascia
pT3b	Tumor grossly extends into the vena cava below the diaphragm
pT3c	Tumor grossly extends into vena cava above diaphragm or invades the wall of the vena cava
pT4	Tumor invades beyond Gerota's fascia (including contiguous extension into the ipsilateral adrenal gland)
Regional Lymph Nodes (pN)	
pNX	Regional lymph nodes cannot be assessed
pN0	No regional lymph node metastasis
pN1	Metastasis in regional lymph node(s)
Distant metastasis (pM)	
pM1	Distant metastasis

Table 2

Stage Groupings			
Stage I	T1	N0	M0*
Stage II	T2	N0	M0
Stage III	T1 or T2	N0	M0
	T3	N0 or N1	M0
Stage IV	T4	Any N	Mo
	Any T	Any N	M1

*M0 is defined as no distant metastasis.

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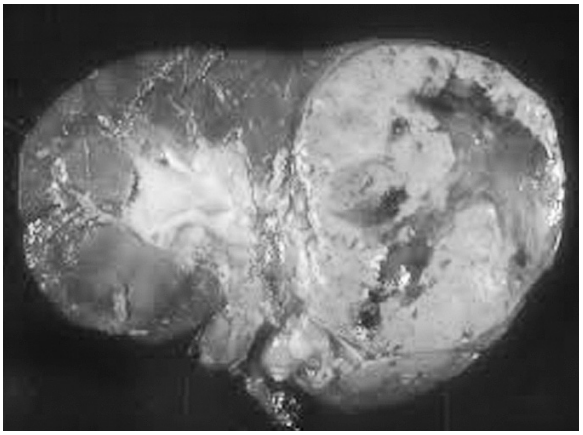
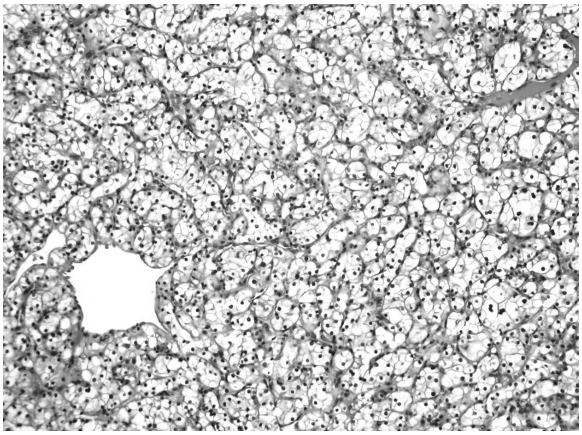
Figure 1



Would show a classic golden yellow color of CCRCC as seen on gross examination, but shown here in two-tone, as white.

Figure 2



CCRCC made with classic clear cell cytoplasm. Tumor clusters are surround by thin blood vessels.

Genetics

Hereditary Renal Cancer Syndromes

Erin E. Houghton, MS, CGC
Associate Director, Ferre Institute

Kidney cancers may be associated with numerous hereditary cancer syndromes. Early age of onset, family history of kidney or related tumors/cancers, and bilateral disease all suggest a risk for a hereditary renal cancer syndrome. The pathology of the tumor, as well as the presence/absence of other benign or malignant tumors in either the individual or family member, may help discern a renal cancer syndrome if a genetic risk is suspected. The following is a summary of several hereditary cancer syndromes that include a risk for renal cell carcinoma.

Hereditary Renal Cell Carcinoma (HRCC): HRCC may be inherited in a dominant or recessive manner, and includes nonpapillary, clear cell or adenocarcinoma of the kidney. No other cancers are known to be associated with this condition. Age of onset may be later.

Hereditary Leiomyomas and Renal Cell Cancer Syndrome (HLRCC): HLRCC is associated with skin and uterine leiomyomas. Renal cell carcinomas are typically papillary, but other pathologies have been described in some families. This syndrome is associated with mutations in the fumarate hydratase (FH) gene.

Von Hippel-Lindau Syndrome (VHL): VHL is associated with clear cell renal cell carcinoma, as well as numerous tumor types, including: hemangioblastomas of the brain, retina and spinal cord; pheochromocytomas; cysts of the pancreas; neuroendocrine tumors; endolymphatic sac tumors; and cysts of the epididymis and broad ligament. VHL is an autosomal dominant syndrome associated with mutations in the VHL gene.

Birt-Hogg-Dube Syndrome (BHD): BHD causes an increased risk for numerous types of benign skin tumors, pulmonary cysts and multiple pathologies of renal cell cancer. BHD is autosomal dominant and is associated with mutations in the FLCN gene.

Hereditary Papillary Renal Cell Cancer Syndrome: This autosomal dominant condition is known to be associated only with papillary renal cell carcinoma. Mutations in the MET gene are associated with this syndrome.

Tuberous Sclerosis Complex (TSC): TSC is a complex hereditary disorder that may involve abnormalities of the skin, brain, heart, lungs and kidneys. A risk for renal cell carcinoma exists. TSC is also autosomal dominant and involves mutations in the TSC1 and TSC2 genes.

PTEN Hamartoma Tumor Syndrome *(sometimes referred to as Cowden Syndrome)*: Cowden syndrome is associated with an increased risk for tumors (both benign and malignant) of the breast, endometrium and thyroid, among others. An increased risk for renal cell carcinoma exists as well. Mutations in the PTEN gene are responsible for this autosomal dominant syndrome.

Although less common, renal cell carcinoma has also been associated with Lynch syndrome and Li-Fraumeni syndrome. As with any inherited cancer syndrome, identification of an inherited renal cancer syndrome, and confirmatory genetic testing, can be important to understanding treatment options, additional cancer risks, and appropriate screening measures for the patient and their family members.

Medical Oncology

The Role of Systemic Therapies in the Treatment of Renal Cell Cancer

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Attending Physician

Medical Oncology/Hematology
St. Peter's Cancer Care Center

Epidemiology

Renal Cell Cancer (RCC) comprises approximately 90 percent of kidney tumors and 2 to 3 percent of all malignancies. The American Cancer Society estimated that in the United States, at least 65,150 patients (40,430 men and 24,720 women) would be diagnosed with kidney cancer in 2013[1]. However, recent advances in the surgical management of RCC and the development of novel therapies targeting molecular pathways have transformed the management of this disease. The five-year survival rate for kidney cancer has improved over time for localized disease (from 88.4 percent during 1992-1995 to 91.1 percent during 2002-2008) and for advanced disease (from 7.3 percent during 1992-1995 to 11.1 percent during 2002-2008)[1,2]. This article reviews the role of systemic therapies available for the treatment of RCC.

Renal Cell Cancer Staging

Like other malignancies, the extent of disease, known as staging, influences the prognosis and treatment options for patients with this disease. Three factors determine RCC staging: the size and extent of the primary kidney tumor (T stage), the involvement of lymph nodes by disease (N stage) and the spread of the tumor (metastasis) to other organs (M stage). [Table 1, Page 13]

Localized tumors (Stage IA, IB, II and III) are curable conditions generally treated with therapies directed to the tumor in the kidney as reviewed in the surgical article. Advanced stage tumors (Stage IV) are generally incurable, but treatable, conditions that can respond to the systemic therapies presented below.

Treatment Approach for Localized Disease (Stage IA, IB, II and III)

Surgery is the main treatment for localized RCC. As of 2013, systemic therapies have not been shown to reduce the risk of tumor relapse following surgery for Stage IA, IB, II and III disease. Therefore, enrollment in clinical trials evaluating novel therapies administered to patients with resected localized disease is encouraged. Otherwise, close surveillance following resection of the primary tumor is warranted, as up to 30 percent of patients with localized tumors experience relapse, with lung metastasis being the most common site of distant recurrence[3]. Most relapses occur within three years following surgical resection. Optimal surveillance protocols with physical examinations, blood work and imaging studies need to be individualized to the patient, taking into account stage of disease to estimate relapse risk.

Treatment of Advanced/ Metastatic Disease (Stage IV)

When RCC spreads beyond the kidney, it will most commonly spread to the lung, lymph nodes, bone, brain, liver and adrenal gland[3]. In general, systemic therapies in the form of pills or intravenously administered drugs are the primary therapies for patients with advanced RCC. However, surgical removal of the kidney (nephrectomy) prior to initiating these treatments may benefit some patients, particularly those healthy enough to tolerate surgery, and with metastasis confined to the lung[4].

As RCC does not usually respond to traditional chemotherapeutic agents, seven FDA-approved "targeted agents" have been developed for patients with advanced disease[5-11]. Each of these drugs attacks different molecular pathways which, if left uninhibited, enable the RCC to evolve and spread to other organs (Table 2). The selection and timing of these drugs depends upon the medical oncologist's evaluation of the specific tumor cell type (in general, clear cell versus non-clear cell) and the patient's medical history, as each drug has varied side effects.

High-dose interleukin-2 (IL-2) therapy is an FDA-approved cytokine immunotherapy that stimulates the cancer patient's immune response against their RCC. Although this therapy can achieve long-lasting complete or partial remissions in a small subset of patients, the clinical benefit is very modest compared to its significant toxicity[12]. This immunotherapy is usually administered at cancer centers with expertise in treating patients with this agent. Hospitalization may be required during drug administration to monitor and treat side effects. Other cytokine immunotherapies include interferon-alpha, which is FDA-approved to be given in combination with the targeted agent, bevacizumab[6]. To summarize, the benefits from immunotherapies are modest for a select group of patients with advanced RCC, requiring a detailed discussion with the medical oncologist experienced with cytokine therapies prior to considering this form of treatment.

Summary

While surgery is the mainstay treatment for localized RCC, systemic therapy plays a significant role in the medical management of patients with Stage IV RCC. Advanced RCC is an incurable, but treatable disease, with seven FDA-approved drugs available as described in Table 1, as well as immunotherapies for select patients. The goal of treatment of Stage IV RCC is palliative, balancing the toxicity of therapy with the benefit of slowing down progression of the cancer to optimize quality of life and potentially extend survival. The medical oncologist works with each patient to achieve this goal by developing a tailored systemic therapy.

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Table 2. Summary of Targeted Drugs FDA-Approved for Advanced RCC.

Drug	Pathway(s) Targeted *	Common Side Effects	FDA Approved Indication(s)
Sunitinib	Platelet-derived growth receptors, vascular endothelial growth factor receptor, FMS-like tyrosine kinase receptor	Neutropenia, anemia, thrombocytopenia, diarrhea, abdominal pain, rash, hypertension, fatigue, asthenia, hypothyroidism, liver disease	First line therapy for patients with relapse or medically unresectable predominantly clear cell Stage IV RCC. Possible first line therapy for non-clear cell Stage IV RCC if cannot tolerate Temsirolimus
Bevacizumab + Interferon a-2a	Bevacizumab targets and neutralizes vascular endothelial growth factor-A; Interferon-alpha stimulates immune response against cancer.	Hypertension, nephrotic syndrome, fatigue, malaise, hair loss, bleeding, asthenia, headache; Interferon-alpha can also cause depression, muscle aches, diarrhea, confusion, rash, flu-like symptoms	Combination as first line therapy treatment for patients with relapsed or medically unresectable predominantly clear cell Stage IV RCC

Table 2 (continued)

Drug	Pathway(s) Targeted *	Common Side Effects	FDA-Approved Indication(s)
Pazopanib	Platelet-derived growth factor receptors, vascular endothelial growth factor receptors, stem cell factor receptor, FMS-like tyrosine kinase receptor	Diarrhea, hypertension, hair color changes, nausea, decreased appetite, vomiting, fatigue, weakness, abdominal pain, headache, leukocytopenia, leukocytopenia, thrombocytopenia, shortness of breath, liver disease	First line therapy for patients with relapsed or medically unresectable predominantly clear cell Stage IV RCC Second line therapy after cytokine therapy
Temsirolimus	Inhibitor of the mammalian Target of Rapamycin protein	Rash, mouth sores, pain, fluid retention, throbocytopenia, neutropenia, hyperlipidemia, hypercholesterolemia and hyperglycemia, asthenia, kidney damage	First line therapy for patients with relapse or medically unresectable predominantly non-clear cell Stage IV RCC Second line therapy after cytokine or tyrosine kinase inhibitor therapy
Sorafenib	Inhibitor of multiple isoforms of intracellular serine/thereonine kinase, RAF, epithelial growth factor receptor, vascular endothelial growth factor receptors	Hypertension, fatigue, diarrhea, abdominal pain, rash, alopecia, lymphocytopenia, thrombocytopenia, decreased appetite	First line therapy for patients with relapse or medically unresectable predominantly clear cell Stage IV RCC. Possible first line therapy for non-clear cell Stage IV RCC if cannot tolerate Temsirolimus Second line after cytokine therapy or prior tyrosine kinase inhibitor therapy
Everolimus	Inhibitor of the mammalian Target of Rapamycin protein	Mouth sore, rash, acne, fatigue, fever, fluid retention, thrombocytopenia, neutropenia, hyperlipidemia, hypercholesterolemia and hyperglycemia, hypertention, nausea, decreased appetite, anemia	Second or subsequent therapy after progression on tyrosine kinase inhibitor therapy
Axitinib	Selective inhibitor of vascular endothelial growth factor receptors, stem cell factor receptor, platelet-derived growth factor receptors	Hypertension, fatigue, rash, dysphonia, diarrhea	Second or subsequent therapy after progression of disease

*Adapted from Hihaly, Z., Sztubinszki, P., Surowiak, P., et. al. A Comprehensive Overview of Targeted Therapies in Metastatic Renal Cell Carcinoma. Current Cancer Drug Targets, 2012; 12: 858, Figure I.

Quality Improvement Study
Partial Nephrectomy

Partial Nephrectomy for Renal Cell Carcinoma: Risk Factors for Acute Post-Operative Hemorrhage, and Impact on Subsequent Hospital Course and Complete Nephrectomy Rate. An Analysis of 200 Consecutive Cases.†

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Introduction

Clinical guidelines recommend partial nephrectomy (PN) as the preferred method of surgical excision of the small renal tumor whenever feasible[1]. PN has comparable cancer cure rates to that of radical nephrectomy in this setting[2], and decreased risk of chronic kidney disease[3]. A recognized devastating complication following partial nephrectomy is acute post-operative hemorrhage (APOH) from the reconstructed kidney. APOH rates as high as 21.6 percent have been reported in the peer-reviewed literature on this subject[4]. Risk factors for hemorrhage following PN remain poorly elucidated, as does the impact of hemorrhage on subsequent hospital stay. Identification of risk factors for hemorrhage may lead to a better understanding of, and reduction of, this complication. In a recent investigation at St. Peter's Hospital, we sought to determine risk factors for acute post-operative hemorrhage after partial nephrectomy utilizing a prospectively managed patient database. We also evaluated the impact of APOH on subsequent hospital stay.

Study

A prospectively managed database was utilized, comprised of patients undergoing open partial nephrectomy at our institution. Clinicopathologic factors assessed for their relationship to APOH included patient age and gender, history of diabetes, smoking, hypertension and coronary artery disease, American Society of Anesthesia Score (ASA), R.E.N.A.L. nephrotomy score, tumor size, pathologic result, cancer margin status, operative time and intra-operative blood loss. The impact of APOH on subsequent hospital course was evaluated and compared to the entire cohort.

We identified patients with and without APOH. For the purposes of this investigation, APOH was defined as acute post-operative

drop in hemoglobin (8g/dl), and radiographic CT scan evidence of either peri-nephric retroperitoneal hematoma or blood within the renal collecting system of the operated kidney. APOH could be associated with acute hypotension (i.e., systolic BP < 100 mmHg), gross hematuria and increasing flank pain, but this was not required for the diagnosis of APOH. Evaluated subsequent hospital course outcome measures included blood transfusion, renal angiography procedure with or without selective renal embolization, and completion nephrectomy. This was evaluated statistically[5].

In assessing the impact of APOH on subsequent hospital course, measured variables were length of stay (LOS) <3 days versus >3 days; transfusion as none versus >1 unit of packed red blood cell (PRBC); no angiographic embolization versus angiographic embolization regardless of number of procedures performed for each patient; and completion nephrectomy as either performed or not performed.

Data was analyzed from 200 consecutive patients operated on prior to July 30, 2012. APOH was identified in seven patients. Table 1 presents the clinicopathologic features for the APOH cohort and the non-APOH cohort. The clinicopathologic factors that were found to be associated with increased risk of APOH were male gender (p=0.03) and hypertension (p=0.006). R.E.N.A.L. nephrotomy score, age, diabetes, smoking, coronary artery disease, American Society of Anesthesia Score (ASA), tumor size, pathologic result, cancer margin status, operative time, and intra-operative blood loss did not correlate with APOH.

Table 2 illustrates the impact of APOH on subsequent hospital course. Compared to the entire cohort, APOH resulted in an increased hospital length of stay (median, five days; range, two to 11 days. p=0.001), increased transfusion requirement (median six units; range, one to 16 units. p=0.001), greater risk of selective angiographic embolization (median, two procedures; range, zero to three procedures. p=0.001), and greater risk of completion nephrectomy (n=2. p=0.001). There were no deaths in either cohort.

Discussion

It was estimated that there would be more than 65,150 new cases of kidney cancer (renal celland renal pelvis) in the United States in 2013, and the incidence is increasing[6,7]. Greater than 70 percent of newly detected renal cell tumors are incidentally detected, often less than 4 cm[8], and potentially amenable to either surveillance (lesions <2 cm), emerging percutaneous treatments (i.e., radiofrequency ablation; cryosurgery), compete nephrectomy and partial nephrectomy[9]. For those patients felt to be best-managed with surgical excision, clinical guidelines recommend partial nephrectomy (PN) as the preferred method of surgical excision of the small renal tumor whenever feasible[1]. PN has comparable cancer cure rates to that of radical nephrectomy in this setting[2], and decreased risk of chronic kidney disease[3]. Despite this, investigators have reported that PN appears to be underutilized in the United States, even in patients with pre-existing renal insufficiency who may benefit most from PN[9]. Investigators utilizing the National Cancer Data Base recently

reported a decrease in the median tumor size of Stage 1 tumors from 4.1 to 3.6 cm between 1993 and 2004[10], indicating that many of these tumors may be amenable to partial nephrectomy. However, a recent analysis utilizing the Surveillance, Epidemiology and End Results program during that same time period showed that in the U.S., only 35.2 percent of patients with T1a (<4 cm) renal masses received partial nephrectomy between 1999 and 2006[11]. That same study revealed that only 50 percent of tumors <2 cm were treated with partial nephrectomy, and 48 percent of tumors between 2 and 4 cm were treated with partial nephrectomy[12].

There is increasing evidence that surgically induced chronic kidney disease[13,14] following complete nephrectomy is associated with increased risk of cardiovascular disease including death[15,16], and metabolic adverse consequences including anemia, acidosis and osteoporosis[17,18], and associated significant adverse health consequences.

The reason for underutilization of partial nephrectomy compared to radical nephrectomy for management of the T1a (<4 cm) and select T1b (4 to 7 cm) renal mass is unclear, and is beyond the scope of the current discussion. Investigators have suggested that the explanation may be multifactorial, including physician and patient factors, and that the decision making requires complex multi-perspective reasoning[19].
It is generally recognized that partial nephrectomy is a complex procedure requiring surgical expertise, a dedicated operating room team and advanced surgical technology; and that partial nephrectomy is associated with increased surgical risk both intra-operatively and post-operatively, the most devastating being post-operative hemorrhage. The present study sought to identify risk factors for APOH after partial nephrectomy. There is no published U.S. national standard for APOH following partial nephrectomy, but the results of APOH after partial nephrectomy in our study is favorable. APOH was a rare event (3.5 percent) in our study of 200 consecutive patients. In our study, APOH increased the hospital length of stay, the transfusion rate, the need for ancillary procedures and, most importantly, the complete nephrectomy rate (which was 29 percent in the APOH cohort, compared to 2 percent in the non-APOH group). Furthermore, we sought to identify risk factors associated with APOH, so that such knowledge may allow preemptive risk reduction in the future. Based upon the findings of the present study, it appears advisable that all hypertensive patients be treated under the care of a cardiologist to maximize hypertension management for at least one month prior to partial nephrectomy. In addition, it is recommended that patients receive aggressive peri-operative care to maintain normotensive status throughout the intraoperative and post-operative period. Whereas, in the past, all patients received PRN supplemental medications for hypertension, it is now recommended that medication (usually beta-blockade) be administered as a standing order with hold parameters (i.e., Systolic BP <100 mmHg or HR < 60 bpm) to avoid hypertensive episodes. We attempt to maintain a mean arterial pressure of 70 to 80. It is anticipated that the institution of these steps into a perioperative pathway[20] will further reduce the APOH risk following partial nephrectomy.

† *Portions of this article were originally published in the International Journal of Clinical Medicine, December 2013.*

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Table 1

Clinical Features of Patients With and Without Acute Post-Operative Hemorrhage

	APOH Cohort	Non-APOH Corhort	
Pt. No.	7	193	
Age (years)	60 (54-73)	58 (28-84)	p=NS
Tumor Size (cm)	3.1 (2.2-7.5)	2.8 (0.6-11)	p=NS
Gender			p=0.03
Male	7 (100%)	115 (59%)	
Female	-	78 (41%)	
Tumor Side			p=NS
Left	3 (42%)	92 (48%)	
Right	4 (57%)	101 (52%)	
Hypertension	7 (100%)	96 (49%)	p=0.006
Diabetes	1 (14%)	23 (12%)	p=NS
Smoking	3 (42%)	84 (43%)	p=NS
CAD	1 (14%)	22 (11%)	p=NS
ASA	2 (2-3)	2 (2-3)	p=NS

APOH=acute post operative hemorrhage; Pt. No.=patient number; ASA=American Society of Anesthesiology score; Age, tumor size and ASA are expressed as the median and range; NS=statistically not significantly different.

Impact of Acute Post-Operative Hemorrhage on Subsequent Hospital Course

	APOH Cohort	Non-APOH Corhort	
Length of Stay			p=0.001
≤3 days	1 (14%)	140 (72%)	
>3 days	6 (85%)	53 (27%)	
Transfusion			p=0.001
none	1 (14%)	184 (95%)	
≥1 unit PRBC	6 (85%)	9 (5%)	
Renal Angiography			p=0.001
none	2 (28%)	-	
≥1 procedure	5 (72%)	193 (100%)	
Completion Nephrectomy			p=0.001
yes	2 (28%)	4 (2%)	
no	5 (72%)	189 (98%)	

APOH=acute post-operative hemorrhage; PRBC=packed red blood cells; Renal angiography denotes angiogram of the bleeding kidney with or without attempted embolization.

Community Outreach and Education

Promoting Prevention and Awareness

Diane Keasbey, RN, OCN

Community Outreach Nurse
St. Peter's Cancer Care Center

The National Cancer Institute estimated that approximately 65,150 new cases of kidney cancer would be diagnosed in 2013. Studies have found the risk factors for developing kidney cancer include:

- **Smoking:** Smoking tobacco is an important risk factor for kidney cancer. People who smoke have a higher risk than nonsmokers. The risk is higher for those who smoke more cigarettes, or smoke for a long time.
- **Obesity:** Being obese increases the risk of kidney cancer.
- **High blood pressure:** Having high blood pressure may increase the risk of kidney cancer.
- **Family history of kidney cancer:** People with a family member who had kidney cancer have a slightly increased risk of the disease. Also, certain conditions that run in families, such as Von Hippel-Lindau (VHL) Syndrome, can increase the risk of kidney cancer.

Tobacco use and obesity are not only the leading risk factors for kidney cancers, but also the leading causes of other cancers and cancer-related deaths. There are more than 7,000 chemicals in tobacco smoke, with at least 69 of those chemicals known to be carcinogens, or cancer-causing agents.

Because of these statistics, the Community Outreach Nurse (CON) at St. Peter's Cancer Care Center works diligently to educate the community on the dangers of smoking and "how to" strategies to increase smoking cessation. The CON also works to help people incorporate other healthy lifestyle changes that will decrease obesity and lower blood pressure.

The CON is involved in outreach at various elementary, middle and high schools, colleges, health fairs, events at St. Peter's Cancer Care Center, and other facilities and venues within the Capital District.

The CON also works collaboratively with other community organizations such as the New York State Department of Health Tobacco Control Program, the Capital District Tobacco-Free Coalition and the Healthy Capital District Initiative. These organizations provide resources for local facilities and educators to utilize while providing outreach and education within the community. Some of these support resources include a toll-free smoker quit-line, printed materials, and an online website for patients and families.

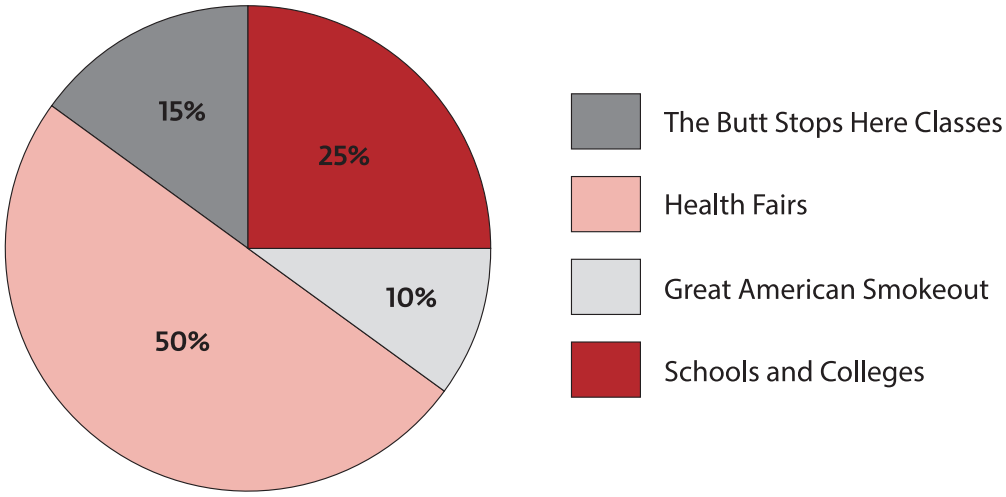
In addition to these activities, the CON helps to facilitate The Butt Stops Here Program that meets every Tuesday at St. Peter's Cancer Care Center, as well as meetings at our

partner facility, St. Mary's Hospital in Troy. This group provides smoking cessation counseling, support for others trying to quit, and nicotine replacement.

Useful resources that support smoking cessation and healthful lifestyles for those with kidney cancers are listed below:

- American Cancer Society; www.cancer.org; 1-800-227-2345; 518-220-6960.
- Capital District Tobacco-Free Coalition; www.smokefreecapital.org; 518-459-2388.
- National Cancer Institute; www.cancer.gov; www.betobaccofree.gov; 1-800-4-CANCER (1-800-422-6237).
- NYS Smokers' Quitline; www.nysmokefree.com; 1-866-NY-QUITS (1-866-697-8487).
- NYS Department of Health; www.health.ny.gov; Strategic Plan for Overweight and Obesity Prevention.
- Kidney Cancer Association; www.kidneycancer.org; 1-800-850-9132.

Education and Prevention



Statistical Analysis for St. Peter's Hospital

Renal Cancers

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Report Parameters

This report presents an overview of the St. Peter's Hospital (SPH) experience in diagnosing and treating kidney cancer, and examines how this experience compares with other hospitals, both state and nationwide. The primary data source for this report is the database of cancer cases encountered and documented at SPH, which is maintained by St. Peter's Cancer Data Management Department in its Cancer Registry. Cancer registrars in this department collect data on all identified cases of cancer that are diagnosed and/or treated at the institution. Data is compiled according to the Facility Oncology Registry Data Standards (FORDS) established by the cancer program's accrediting body, the American College of Surgeons Commission on Cancer (ACoS-CoC).

FORDS establishes criteria for designating cases as either analytic or non-analytic. Analytic cases have a significant proportion of their diagnosis and/or treatment performed at the reporting institution. Only analytic cases were counted in compiling case volumes for this report. Depending on the context of comparison, data may encompass various time periods. Date ranges throughout this report are clearly identified.

Data submitted to the Commission on Cancer (CoC) by accredited programs across the country are aggregated into National Cancer Data Base (NCDB) Benchmark Reports. These site-specific reports encompass data from years 2000 through 2011. For this report, aggregates of all 12 years' data were used to obtain a meaningful local sample size.

For the 12-year period evaluated, an average of 1,632 hospitals across the U.S. reported a total of 339,115 cases of kidney and renal pelvis cancers, hereafter referred to as kidney cancer. During that same period, an average of 76 hospitals within New York state reported 19,604 cases, while St. Peter's reported 468 cases. Proportional (relative percent) rather than numerical data have been used in much of this report to allow comparison between these disparately sized data cohorts.

Kidney Cancer at St. Peter's

St. Peter's Cancer Registry began tracking cancer cases in 1985. Cases between 2003 (current reference year) and 2012 (the last complete year of data collected), are currently being followed. St. Peter's Cancer Care Center diagnosed/treated 606 kidney cases between 2003 and 2012. The volume of analytic cases is broken down by stage, as shown on the next page. Stage 0 is also known as cancer

in-situ, or non-invasive cancer. There are some histological grades of cancer that are not necessary to stage according to the American Joint Committee on Cancer (AJCC) guidelines. These grades are denoted by N/A throughout the report. The largest proportion of cases present as Stage I disease, followed by Stage III disease. Of the 47 unknown cases, 10 are categorized as Class of Case 00, which indicates the patient had an initial diagnosis at SPH and all treatment, or a decision not to treat, was performed at another facility. This reduces the actual number of unknown cases to 37, or 6.1 percent.

Table 1

Stage at Diagnosis	0	I	II	III	IV	N/A*	Unknown
Volume of Analytic Cases	17	313	44	93	90	2	47
Percent by Stage	2.8%	51.7%	7.3%	15.3%	14.9%	0.3%	7.8%

**N/A represents cancers by histology that are not necessary to stage by AJCC guidelines.*

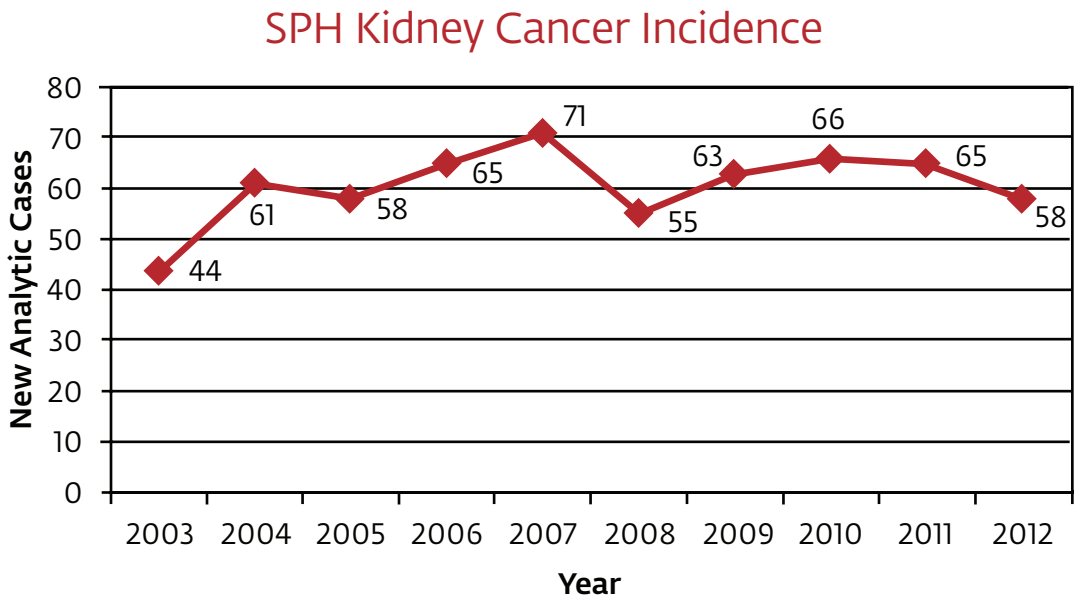

Figure 1

In the most recent 10-year period, including the most recent complete year of data (2012), new analytic cases of kidney cancer have shown an inconsistent trend over the years; however, a linear trendline fits to the data in a slightly upward direction. The average change over the 10-year period was 4.8 percent, mostly taking into account the large increase between 2003 and 2004, and leveling out the dip between 2007 and 2008. The incidence data for the 10-year historical period are depicted in Figure 1.

Incidence by Year of Diagnosis

Between 2000 and 2011, newly diagnosed cases of kidney cancer had a scattered trend for SPH with an increase in 2006, a decrease in 2008, and an increase again in 2010. Both NY and the U.S. saw a steady climb through the 12-year period (Table 2).

Table 2

Diagnosis Year	Kidney Cancer by Diagnosis Year		
	SPH %	NY %	US %
2000	7.1	6.5	6.3
2001	5.6	6.8	6.7
2002	8.1	6.9	7.0
2003	6.0	7.5	7.4
2004	7.1	7.8	7.9
2005	8.3	7.8	8.3
2006	10.3	9.0	8.8
2007	10.7	9.4	9.3
2008	7.3	9.8	9.5
2009	7.7	9.6	9.8
2010	11.1	10.2	9.5
2011	11.0	10.0	9.6

Demographic Factors

Incidence by Age at Diagnosis

The slight majority of patients are diagnosed with kidney cancer between the ages of 60 to 69, but there is a cluster-split for all three cohorts among the 50-, 60- and 70-year-old patients, all within a 20 percent diagnostic range. The smallest percentages fall out to the 20s and 90s for all three cohorts (Table 3).

Table 3

Age at Diagnosis	Kidney Cancer by Age		
	SPH %	NY %	US %
<20	--	1.4	1.0
20-29	1.1	0.6	0.7
30-39	4.1	3.1	3.2
40-49	9.6	11.0	11.1
50-59	26.9	21.1	22.0
60-69	28.0	26.9	26.8
70-79	21.8	24.0	23.5
80-89	7.7	10.7	10.9
90+	0.9	1.3	1.1

Overall Survival for Kidney Cancers

Figure 2 shows the relative survival for cases of kidney cancer diagnosed at SPH between 2004 and 2008. The overall five-year survival rate for kidney cancer at SPH is 70.2 percent. Survival data at SPH is dependent on follow-up data obtained through the return-mailed letters to patients and physicians, and various sources of vital status indicators.

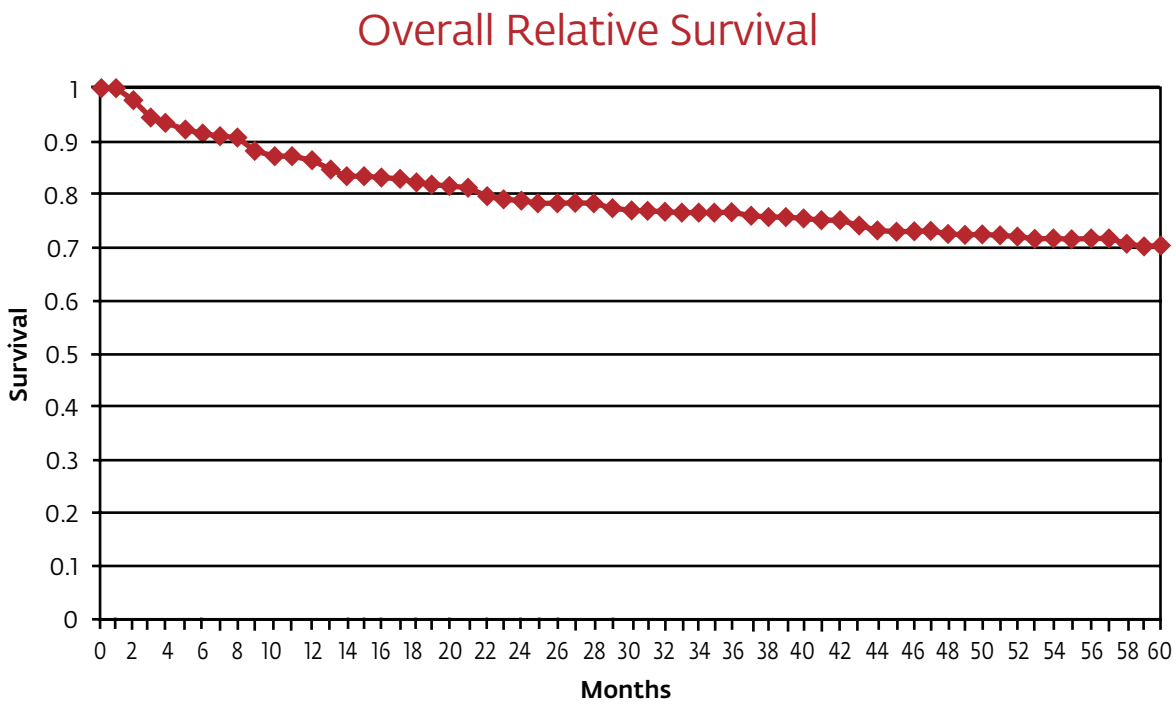

Figure 2

Incidence by Race

As a proportion of overall cases, the Caucasian population is most heavily affected by kidney cancer. Caucasians represent a higher proportion of total patient numbers in the St. Peter's population than is reported in both the state and the nation. The African American population presenting with kidney cancer to SPH is 2.1 percent. However, at the state and national level, the burden of kidney cancer on the African American population is approximately 11 percent. The Hispanic population presents to St. Peter's with 0.6 percent of cases, while the incidence of kidney cancer for this population at the state and national levels is 7.4 and 5.7 percent, respectively. Other/Unknown populations are depicted in Table 4.

Table 4

Race	Kidney Cancer by Race		
	SPH %	NY %	US %
Caucasian	96.3	75.4	79.5
African American	2.1	11.8	11.4
Hispanic	0.6	7.4	5.7
Other/ Unknown	1.9	5.5	3.4

Incidence by Gender

In comparing incidence by gender, males have a predominately higher proportion of kidney cancer across all three cohorts, approximately 3:2. It is a proven risk factor that men have a higher likelihood of developing kidney cancer than women (Table 5).

Table 5

Gender	Kidney Cancer by Gender		
	SPH %	NY %	US %
Male	63.0	63.3	61.8
Female	37.0	36.7	38.3

Incidence by Insurance Coverage

The largest proportion of patients seen at SPH has private insurance/managed care. Medicare is the largest group for NY and the U.S. The largest percentage of patients who are uninsured is in the U.S. cohort, which is 2.9 percent. Medicaid percentages are the highest in NY at 7.0 percent, dropping to 4.6 percent in the U.S., and 2.4 percent at SPH (Table 6).

Table 6

Insurance	Kidney Cancer by Insurance Type		
	SPH %	NY %	US %
Not Insured	0.4	1.4	2.9
Private Insurance/ Managed Care	55.6	43.1	41.4
Medicaid	2.4	7.0	4.6
Medicare	40.2	44.3	45.7
Other Gov't Insurance	0.2	2.8	3.1
Unknown	1.3	1.4	2.4

Disease-Related Factors

Morphology

Morphology refers to the histological classification of the cancer tissue, and a description of the course of development that a tumor is likely to take: benign or malignant behavior. The designation is based on a microscopic diagnosis of morphology by a pathologist. "Not otherwise specified (NOS)," is a categorization which is used in accordance with the College of American Pathologists' current protocols.

Table 7

Histology	Kidney Cancer by Histology		
	SPH %	NY %	US %
Transitional Cell Carcinoma, NOS	4.9	3.6	3.9
Papillary Transitional Cell Carcinoma	7.1	5.5	4.9
Papillary Adenocarcinoma, NOS	10.3	10.6	8.6
Clear Cell Adenocarcinoma, NOS	40.8	29.9	30.2
Renal Cell Carcinoma	24.6	36.4	40.5
Renal Cell Carcinoma, Chromophobe Type	3.6	5.0	3.5
Other Specified Types	8.8	9.0	8.5

According to the NCDB, the two predominant histologies of kidney cancer are clear cell adenocarcinoma and renal cell carcinoma, NOS. At SPH, greater than 40 percent of kidney cancers present as clear cell adenocarcinomas, whereas, more than 40 percent of kidney cancers in the U.S. present as renal cell carcinomas. The two least common forms of kidney cancer across all three cohorts are transitional cell carcinoma, NOS; and renal cell carcinoma, chromophobe type (Table 7).

Stage at Diagnosis

Cancer stage at diagnosis is a strong predictor of disease outcomes. Proper clinical staging of cancer allows the physicians to determine appropriate treatment options. The Cancer Registry monitors the use of stage in treatment planning, and records physician-assigned clinical and pathologic staging in the registry database. Certified tumor registrars are able to assign clinical stage based on the available information in the medical record if a clinical stage is not assigned by a physician. In cases where clinical information related to stage is absent or unavailable, a stage designation of "unknown" is assigned.

Incidence by Stage

The data below demonstrates relative frequency of kidney cancers by stage at time of diagnosis for reporting years 2000 to 2011 from NCDB data.

Table 8

Stage at Diagnosis	Kidney Cancer by Stage		
	SPH %	NY %	US %
0	2.6	2.0	1.8
I	45.1	56.7	53.5
II	8.8	8.8	9.2
III	12.6	12.3	12.4
IV	10.9	11.8	13.3
NA	0.2	0.6	0.5
UNK	19.9	7.9	9.2

A review of stage data (Table 8) reveals that a larger percent of unknown stage is reported at SPH than in the comparable state and national cohorts. The largest percentage of patients present with Stage I disease across all three geographic groups. Stage IV is the second largest group for the U.S. However, Stage III is the second largest group for SPH and NY. The smallest groups of patients present with in-situ, or Stage 0 disease, across all three cohorts.

Treatment

Incidence by First Course of Surgery

The most frequently performed first course treatment for kidney cancer is surgery. Table 9 shows the various types of first-course surgeries performed for kidney cancer. The highest percentage of first course surgical treatment is radical nephrectomy, which is discussed in the surgical article on Pages 9 and 10.

Table 9

First Course Surgery	Kidney Cancers by First Course Surgery		
	SPH %	NY %	US %
None	13.5	13.4	14.7
Local Tumor Destruction	0.9	1.8	2.4
Local Tumor Excision	1.3	2.2	2.2
Partial or Subtotal Nephrectomy	27.4	27.7	18.8
Complete/ Total/Simple Nephrectomy	16.0	14.8	11.7
Radical Nephrectomy	37.8	38.1	47.1
Any Nephrectomy	1.7	0.9	1.3
Nephrectomy, NOS	1.3	0.9	1.8
Surgery, NOS	0.2	0.1	0.2

The second most common surgical treatment is partial or subtotal nephrectomy, followed by complete/total/simple nephrectomy. The percentages are very small for any local tumor control performed surgically. The patterns are fairly consistent across all three cohorts, except in the U.S. where radical nephrectomy is higher than partial or subtotal nephrectomy.

Summary

To summarize the observations and conclusions of this data analysis:

- St. Peter's reported 606 cases of kidney cancer between 2003 and 2012.
- Since the year 2003, new analytic cases of kidney cancer have shown an erratic trend with an average change of 4.8 percent.
- More than 26.8 percent of patients diagnosed with kidney cancer are between the ages of 60 and 69, in all three cohorts. Few patients are diagnosed at a very young or very elderly age. Most patients are diagnosed between 50 and 79 years of age.
- The overall five-year survival rate for kidney cancer is 70.2 percent for patients diagnosed at St. Peter's Hospital between 2004 and 2008.
- Men have a predominately higher risk than women (3:2) of developing kidney cancer.
- SPH has the largest percentage of patients with private insurance/managed care at 55.6 percent. However, NY state and the U.S. have the highest percentage of patients using Medicare at 44.3 percent and 45.7 percent, respectively.
- The most common histologies found in kidney cancers in all three cohorts are clear cell adenocarcinoma, NOS and renal cell carcinoma.
- A review of stage data reveals that a much larger percent of unknown stage is reported at SPH than in the comparable state or national cohorts. The largest percentage of patients present with Stage I disease across all three geographic groups.
- The highest percentages of patients having surgery as first course surgical treatment undergo radical nephrectomy across all three cohorts.

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