Resource for Patients with Kidney Masses Considering Partial or Radical Nephrectomy

This resource explains the types of kidney masses, the risk factors associated with kidney cancer, how kidney cancer is staged, and the surgical treatment options for kidney masses (malignant or benign). We kindly ask that you review this document and then complete the questionnaire at the end by using the QR code provided. If a paper copy of the questionnaire is needed, please let your care provider know.

SOUTHERN ALBERTA INSTITUTE OF UROLOGY

Cancer du rein CANADA

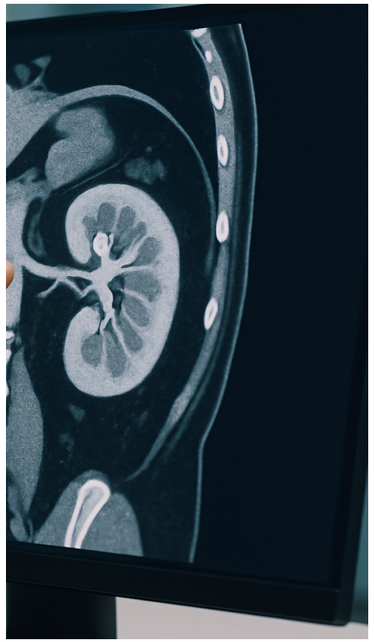
Kidney Cancer CANADA

Patient Educational Resource - by Kaiden Jobin & Dr. Geoffrey Gotto, MD, MPH, FRCSC

Understanding the Location and Function of the Kidneys

Where are the kidneys located?

THE KIDNEYS ARE LOCATED NEAR THE BACK OF THE ABDOMEN ON EITHER SIDE OF YOUR SPINE AND JUST BELOW YOUR RIBCAGE. Because they are near the back of the abdomen, there are commonly organs in front of them which will need to be moved or avoided during any surgery relating to the kidneys. Your right kidney is behind your liver, your gallbladder, and your intestines. Meanwhile your left kidney is behind your spleen, your pancreas, and your intestines. It is important to note the organs that each of your kidneys lie behind because these organs can be injured during surgery, although the chances of this are extremely small (<1%).



What is the function of the kidneys?

The kidneys function to remove waste products from the blood, some of the commonly discussed waste products that kidneys remove are urea and creatinine, creatinine is often used to measure how well your kidneys are functioning. It is important to note this because your creatinine may be increased (indicating a reduced kidney function) in the weeks to months following your surgery. Your doctor will monitor this carefully and make any necessary changes to your care. In addition, your kidneys function as part of your urinary system and allow the waste products from your blood to leave the body in the form of urine. Urine passes from your kidney, through your ureters, and then to your bladder where it is stored and excreted.

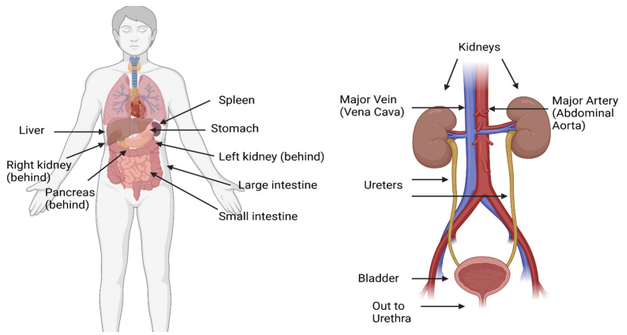


Figure 1. Abdomen with organs labelled and urinary tract with organs labelled

Types and Causes of Kidney Masses

What are the types of kidney masses?

BROADLY SPEAKING KIDNEY MASSES CAN BE BROKEN DOWN INTO MALIGNANT (CANCEROUS) OR NON-MALIGNANT (BENIGN) MASSES.

While the only way to prove a mass is malignant prior to surgery is through a biopsy, we are not able to prove a mass is benign with a biopsy alone. We can make assumptions based on how masses look on imaging studies. For masses that look more fluid filled (referred to as cysts) there are scoring systems in place which can determine the likelihood of the mass being malignant. You may have seen or heard of the Bosniak score associated with your mass if it is fluid filled, or cystic. The Bosniak score is given by a radiologist based on what can be seen through imaging.[1] This score gives some idea as to the chance a cystic mass is malignant and is associated with certain treatment recommendations. Please note the risks of malignancy indicated in the following table are likely overestimations of the actual risk.

Alternatively, masses can be comprised entirely of tissue (referred to as solid). These masses are more strongly associated with malignancy and are generally assumed to be cancer unless proven otherwise. Please note that having a solid mass does not necessarily mean that your mass is malignant. In general, among solid masses, the larger the mass the more likely it is to be malignant. Please note that you will not receive a Bosniak score for solid masses and this grading does not apply to them.

Bosniak Score	Approximate risk of malignancy	Recommended course of action
I	2%	Follow-up not recommended, only re-image or intervene surgically if symptomatic
II	10%	Follow-up not recommended, only re-image or intervene surgically if symptomatic
IIF	28%	Re-image every 6 months for the first year and then yearly – if there is no progression after 5 years can end surveillance
III	58%	Either active surveillance or surgical intervention are recommended depending on patient circumstances
IV	89%	Either active surveillance or surgical intervention are recommended depending on patient circumstances

Table 1. Source: Canadian Urological Association Guidelines [1]

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Types and Causes of Kidney Masses

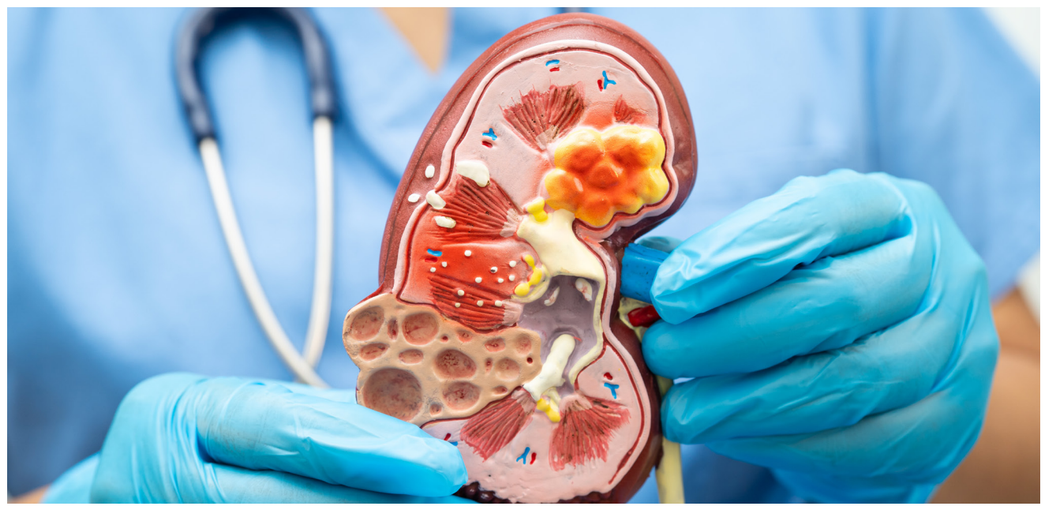
What are the risk factors and general treatment options for kidney masses?

What can cause a kidney mass to form?

In your individual case it is difficult to determine what exactly caused your kidney mass to form but there are certain risk factors that your care providers may assess for. Common risk factors for kidney cancer include: smoking, being overweght, having high blood pressure, a family history of kidney cancer (especially in a direct relative like mother, father, sibling), workplace exposures to harmful chemicals, and a handful of hereditary conditions (ie. Cowden syndrome, Birt-Hogg-Dube syndrome, and von Hippel-Lindau disease).[2] The risk factors for simple kidney cysts are slightly less clear. Some factors may include: history of kidney stones, advanced age, and increased levels of parathyroid hormone. [3]

What are my treatment options for a kidney mass?

If you do have a kidney mass that is concerning (i.e. Solid or with a high Bosniak score) there are a few options. If the mass is small enough (usually less than 2-4cm) or if your surgeon recommends avoiding procedures based on other health concerns, your mass may be surveyed with imaging (usually CT scans) until it grows, or the benefits of surgery outweigh any potential risks. However, there is a 40% chance of your mass being benign if it is less than 2cm and even those that are malignant tend to be slow growing and may not require intervention.[4] If your mass is between 2-4cm but surgery is not a good option based on other health concerns, another option may be to undergo thermal ablation where extreme cold or extreme heat are applied to the mass in order to kill the cells. This is usually not quite as effective as surgical removal of the mass but can still help prevent or slow malignant growth. For all masses larger than 4cm surgery is usually recommended, this does depend on the presence of other health conditions and individual preference as some people may not tolerate surgery or may not want to undergo surgery. Your surgeon may or may not biopsy your mass prior to surgery, this choice is primarily up to surgeon preference and should not be a cause for alarm either way. Please read below for further details on surgical options.



Surgical Management of Kidney Masses

What is a partial nephrectomy?

PARTIAL NEPHRECTOMY WILL GENERALLY BE RECOMMENDED FOR SMALLER MASSES AND THOSE IN MORE FAVOURABLE POSITIONS (IE. FURTHER AWAY FROM THE VEINS, ARTERY, AND URETER). It is important to discuss with your surgeon to see if a partial nephrectomy is possible in your case. A partial nephrectomy is commonly done using minimally-invasive techniques. This means that many (3-7+) small cuts will be made to introduce surgical instruments into the abdomen. This can be done laparoscopically (meaning the surgeon is directly moving surgical tools and a camera using short poles) or can be done robotically meaning the same thing except the surgeon will be operating the instruments using a console unit in the operating room.) The patient will first be put under general anesthetic and then will be turned on their side and secured in place. This helps with moving some of the organs in front of the kidney out of the way. The surgeon will then make small incisions (1-3cm) to introduce ports through which surgical instruments can be passed. They will then move through the organs and connective tissue in front of the kidney until they reach the kidney and are able to locate the mass and the renal artery(ies) and vein(s). Once a space is cleared around the mass, a clamp is placed on the renal artery(ies) to minimize bleeding. The mass is removed along with some of the healthy kidney tissue around it to ensure that parts of the mass are not left behind in case it is malignant. Finally, the remaining kidney tissue is repaired with sutures and the surface incisions are also closed with sutures.

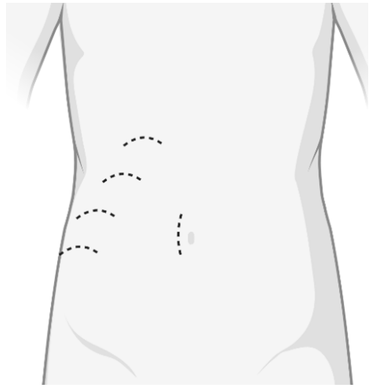


Figure 2. Incision sites for laparoscopic procedure

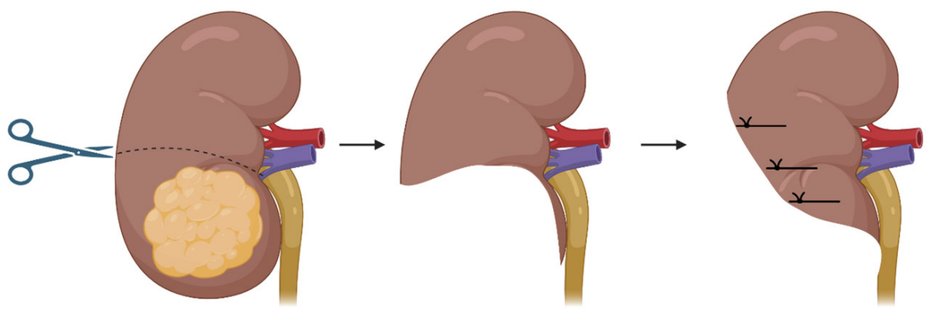


Figure 3. Procedure process for partial nephrectomy

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There is a small chance that the surgeons will need to perform an open partial nephrectomy, convert to a full nephrectomy, or re-operate if some of the mass is left behind. Another risk associated with partial nephrectomy is the risk of urine leakage. While this risk is low (around 2%) it can result in a longer hospital stay and additional interventions to stop the leak. In the case of converting to an open partial nephrectomy, this means that a full incision will be made to allow the surgeons direct access to the abdomen. This is generally done in the case of challenging bleeding or poor visualization, but can be done for several reasons involving patient safety. The risk of conversion is a reason some patients might select a full nephrectomy initially over attempting a partial nephrectomy as a full nephrectomy can be performed laparoscopically in most cases. The rate of conversion to an open procedure is approximately 3-5%.[4] Furthermore, it may be necessary to remove the entire kidney instead of part of the kidney, this is generally restricted to cases where bleeding is uncontrollable and is done to ensure patient safety. The rate of conversion to full nephrectomy is also approximately 3-5%.[5]

Finally, there is a small chance of re-operation in the case that your kidney mass is malignant and not all of the mass is successfully resected. There are procedures in place to prevent this; if the surgeon is unsure whether they have resected the entire mass, they have the option to get a pathologist to look at what was removed during surgery. The pathologist can then determine whether the tissue removed is malignant and whether surgeon got the entire tumor during the surgery (negative margins). However, in rare cases, recurrence of the mass in the same spot can occur. The risk of this is approximately 3-5%. [6] Despite this, there are benefits to receiving a partial nephrectomy over a total nephrectomy, this can include increased kidney function and decreased risks associated with needing dialysis in the future. Whenever it is surgically feasible it is generally recommended to manage smaller renal masses with partial nephrectomy in order to preserve kidney function and avoid future need for dialysis.[7]

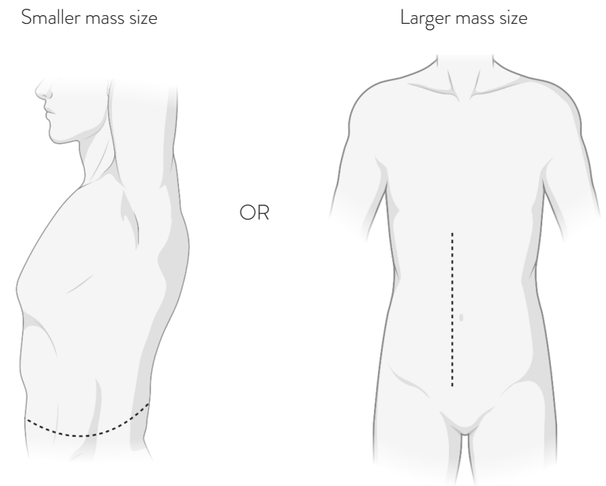

Figure 4. Incision locations for an open procedure

Surgical Management of Kidney Masses (continued)

What is a radical nephrectomy?

A RADICAL NEPHRECTOMY CAN BE DONE LAPAROSCOPICALLY, AGAIN WITH SEVERAL SMALL INCISIONS AND SHORT POLES BEING USED TO MOVE SURGICAL TOOLS AND A CAMERA. ONE SLIGHTLY LARGER INCISION IS MADE TO EXTRACT THE KIDNEY DEPENDING ON ITS SIZE. However, this procedure is often done as an open procedure with one large incision if the mass is larger or more complex. The patient will first be put under general anesthetic and then positioned on their side. This helps with moving some of the organs in front of the kidney out of the way. The surgeon will then make several small (1-3cm) incisions to introduce surgical ports for instruments in a laparoscopic procedure or one large incision which may vary in size and location based on the size and complexity of the mass for an open procedure. They will then move through the organs and connective tissue in front of the kidney until they reach the affected kidney and the renal artery and vein. Once a space is cleared around the kidney and it is separated from surrounding connective tissue, the renal artery(ies) and vein(s) are controlled and divided to allow for the removal of the kidney and mass. The surrounding lymph nodes may also be removed depending on their size on imaging and their appearance during surgery. The advantage of a radical nephrectomy is that there is no risk of a need to re-operate on that same kidney because it is no longer present. If you are having a laparoscopic nephrectomy, there is still a risk of needing to convert to an open procedure. This risk is around 3-5%. [5] However, the disadvantage is that your kidney function will likely be permanently impaired. Some doctors may comment on you having a high creatinine or low GFR as these are measures of kidney function. Additionally, should anything happen resulting in the loss of function of your remaining kidney you would need to be on dialysis and may be placed on a transplant list. Despite this, those living with one kidney can live a very normal life and in individuals who opt to donate one of their kidneys life expectancy is similar to the general population.[8]

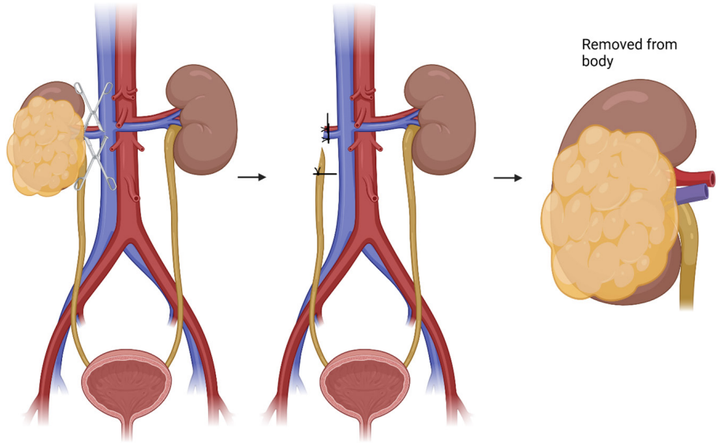

Figure 5. Procedure process for radical nephretomy

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What makes these procedures more complicated?

There are several aspects of these procedures which can make them more complicated. This section will not be exhaustive but generally your surgeon will tell you about any factors that make your case complicated. One factor is the position of your kidney mass, if your surgeon is attempting a partial nephrectomy but your mass is in a challenging position (ie. close to the vein(s), artery(ies), or the ureter) there may be a higher chance of needing to convert to a radical nephrectomy. Another factor is invasion of the renal vein, this will sometimes be referred to as a tumour thrombus. This makes the surgery more complicated as the surgeon will need to remove the tumour from the vein.

Finally, invasion of the lymph nodes can make the surgery more complicated. Lymph nodes are pockets of immune tissue which exist within most of the body. When these become affected by cancer they will need to be removed as well. As you can imagine this will take longer and increased time under anesthesia can increase the associated complications.

What are the general risks to these surgeries?

There are several risks associated with nephrectomy which you were told about when signing the consent form for your procedure. The following is a table which summarizes those risks for your reference.

Risk	General Chance of Occurring	How Would it Occur
Need for a blood transfusion [9]	**28% of open radical nephrectomies** **13% of open partial nephrectomies** **9% of laparoscopic radical OR partial nephrectomies**	Would only be done in cases of profuse bleeding where it was needed to ensure patient survival, it would not be done if the patient was not consented for it
Infection [10]	**3-5% in radical OR partial nephrectomies regardless of open OR laparoscopic**	Could occur from any type of contamination of the surgical field or from introduction of microbes into the wound post-surgically
Injury to other abdominal organs [11]	**>1% in all procedures**	As the kidneys are at the back of the abdomen other organs need to be moved out of the way to access them and can sometimes be injured
Dental damage associated with airway support [12]	**>1% in all procedures**	Can occur when the artificial airway needed to be put under general anesthesia is being introduced
Arrhythmias or thromboembolism associated with all surgery [12]	**>1% in all procedures**	These complications are risks of all surgery and are associated with being under general anesthesia, risks can be increased in patients with underlying heart conditions
Risks of death from anesthesia [12]	**1/50,000 in all procedures**	Can be from a variety of factors including lung-related issues, heart-related issues, or allergy to anesthetic – these events cannot be predicted prior to surgery

Table 2. Sources varied

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Expectations After Surgery

What are the potential short and long-lasting effects of the procedure?

IN THE DAYS FOLLOWING SURGERY YOU WILL VERY LIKELY EXPERIENCE SOME PAIN AND DISCOMFORT ALTHOUGH THE SURGICAL TEAM WILL DO THEIR BEST TO MANAGE YOUR PAIN. You will also wake up with a catheter from surgery and may not be very mobile for the first day or two, although low-intensity movement such as walking is encouraged. Depending on the extent of the procedure you can expect to be in the hospital for around 1-3 days with laparoscopic surgeries and around 2-5 days with open surgeries. It is recommended to take at least 2 weeks off regular activities, and you will need to avoid heavy lifting for 6 weeks after surgery. If you had a partial nephrectomy you may also notice some blood in your urine. This is normal but should be followed up on if it persists for more than 2 weeks. More long-lasting complications can include numbness, tingling, or painful sensations around the incision(s) with gentle touch related to nerve injury which is uncommon but can occur in isolated areas of skin following a larger procedure like this. Additionally, you may have long-lasting or even permanently decreased kidney function. While your unaffected kidney can take over some of the function of the affected kidney, it may not be enough to have normal results on tests of kidney function. If any healthcare provider tells you that you have an increased creatinine or decreased GFR this is not cause for immediate concern and you can remind them about your past nephrectomy.

What if the mass was kidney cancer?

Following your nephrectomy, whatever is removed will be sent for pathology to determine whether your mass was kidney cancer or not. If the mass was malignant you and your care provider can arrange for appropriate follow-up to ensure that recurrence is being monitored for on a regular basis. Additionally, in some cases your care provider can augment your surveillance period with some additional treatments to further prevent recurrence. Finally, it can be helpful to seek out support groups or counselling to manage the emotional challenges and stress of worrying that the cancer could come back, please ask your care provider for psychosocial supports if needed.

Kidney Cancer

What are the stages of kidney cancer?

While not every kidney mass will be malignant, the staging of the mass may change the treatment you receive for the mass. A table of the stages of kidney cancer are included below as well as how this may change follow-up and treatment.

Staging	Criteria for Stage[14]	Recommended follow-up post-surgically[15–17]
I	**The tumour is ≤7cm across in the largest dimension and is only in the kidney**	Yearly bloodwork, clinic visits, and chest x-rays **AND** CT scans at 24 months and 60 months
II	**The tumor is >7cm across in the largest dimension and is only in the kidney**	**IF LOW GRADE (IE. SLOWER GROWING TUMOR):** Bloodwork, clinic visits, and chest x-rays every 6 months for 3 years and then yearly afterward AND CT scans at 12, 36, 60, 84, and 108 months **IF HIGH GRADE (IE. FASTER GROWING TUMOR):** Same follow up as above as well as initiation of 1 year of adjuvant therapy 12 weeks after surgery, the only currently approved therapy is an immune checkpoint inhibitor therapy (Pembrolizumab)*
III	**The tumor has grown into a major vein or the tissue around the kidney but has not affected any nearby organs** **OR** **The main tumor is restricted to the kidney, but malignant cells have spread to nearby lymph nodes (ie. Metastasized)**	For the first 3 years bloodwork, clinic visits, and CT scan and chest x-rays every 6 months THEN bloodwork, clinic visits, and chest x-ray yearly **AND** CT scan every 2 years Patients here may also receive 1 year of adjuvant therapy starting 12-weeks after surgery with immune checkpoint inhibitor therapy (pembrolizumab)
IV	**The tumor is growing out beyond the kidney and is pressing against or affecting nearby abdominal organs** **OR** **Malignant cells have spread to distant organs or lymph nodes (ie. Metastasized)**	Bloodwork, clinic visits, and CT scan and chest x-rays every 3 months for first 6 months and then every 6 months up to 3 years **THEN** yearly after 3 years. Patients here may also receive some form of adjuvant therapy, the duration will vary depending on disease extent and consultation with an oncologist.
		* Some patients with low grade stage II cancer may also receive adjuvant therapy but this is much less common

Table 3. Sources varied

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Summation

Staging examples and additional resources

Please note that the treatment and follow-up recommendations on the previous page are for the most common type of kidney cancer (called clear cell renal cell carcinoma). If you have another type of kidney cancer your follow-up will depend on recommendations from your surgeon and/or from an oncologist. In general, less common types of kidney cancer will receive similar surveillance to what is shown above but adjuvant therapy will not be used because current trials do not demonstrate any decreased recurrence or improved survival benefits.

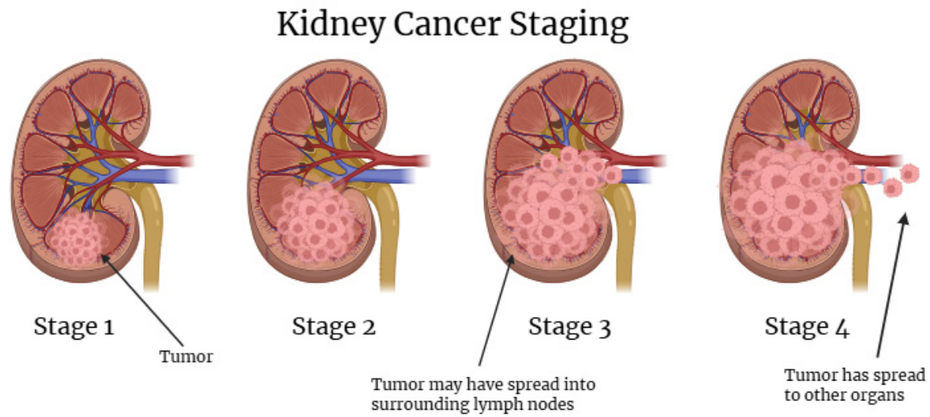

Figure 6. Kidney Cancer Staging Examples[13]

Reliable and Helpful Resources for Learning More

KIDNEY CANCER CANADA: Has several helpful resources for support groups, patient information, and decision guides if debating between partial or radical nephrectomy

AMERICAN CANCER SOCIETY – KIDNEY CANCER PAGE: Has very detailed patient information and information about ongoing clinical trials

CANADIAN CANCER SOCIETY – KIDNEY CANCER PAGE: Has very detailed patient information

CANADIAN UROLOGIC ASSOCIATION: More appropriate for healthcare professionals but contains guidelines and summaries of existing research studies that clinical decision making is based on

References

1. Richard PO, Violette PD, Bhindi B, Breau RH, Gratton M, Jewett MAS, et al. *2023 UPDATE – Canadian Urological Association guideline: Management of cystic renal lesions.* Can Urol Assoc J. 2023 May 30;17(6):162–74.
2. *Risk Factors for Kidney Cancer | How Do You Get Kidney Cancer?* [Internet]. [cited 2025 Jan 21]. Available from: https://www.cancer.org/cancer/types/kidney-cancer/causes-risks-prevention/risk-factors.html
3. Sakız D, Sencar ME, Çalapkulu M, Ünsal İÖ, Kızılgül M, Uçan B, et al. *Prevalence and associated risk factors of simple renal cysts in primary hyperparathyroidism.* Horm Athens Greece. 2023 Mar;22(1):107–12.
4. Razdan S, Okhawere K, Wilson M, Nkemdirim W, Korn T, Meilika K, et al. *Conversion to Open Radical or Partial Nephrectomy Associated with Unplanned Hospital Readmission After Attempted Minimally Invasive Approach.* J Laparoendosc Adv Surg Tech A. 2022 Aug;32(8):823–31.
5. Wang Y, Wilder S, Butaney M, Hijazi M, Gandham D, Van Til M, et al. *Conversion to Radical Nephrectomy From Robotic Partial Nephrectomy Is Most Commonly Due to Anatomic and Oncologic Complexity.* J Urol. 2024 May;211(5):669–76.
6. Chung JH, Song W, Kang M, Sung HH, Jeon HG, Jeong BC, et al. *Risk factors of recurrence after robot-assisted laparoscopic partial nephrectomy for solitary localized renal cell carcinoma.* Sci Rep. 2024 Feb 23;14(1):4481.
7. Richard PO, Violette PD, Bhindi B, Breau RH, Kassouf W, Lavallée LT, et al. *Canadian Urological Association guideline: Management of small renal masses – Full-text.* Can Urol Assoc J. 2022 Jan 27;16(2):E61-75.
8. Reese PP, Boudville N, Garg AX. *Living kidney donation: outcomes, ethics, and uncertainty.* Lancet Lond Engl. 2015 May 16;385(9981):2003–13.
9. Vricella GJ, Finelli A, Alibhai SMH, Ponsky LE, Abouassaly R. *The true risk of blood transfusion after nephrectomy for renal masses: a population-based study.* BJU Int. 2013 Jun;111(8):1294–300.
10. Wei M, Yang W, Xu W, Liu G, Xie Y, Dong J, et al. *The role of antimicrobial prophylaxis in laparoscopic nephrectomy for renal cell carcinoma.* BMC Urol. 2024 Mar 13;24(1):60.
11. Caputo PA, Kaouk J. *Management of complications arising from the treatment of small renal masses.* Int J Surg. 2016 Dec 1;36:583–7.
12. Harris M, Chung F. *Complications of General Anesthesia.* Clin Plast Surg. 2013 Oct 1;40(4):503–13.
13. *Kidney Cancer (Renal Cancer) Signs, Symptoms* | Saint John's Cancer Institute - Santa Monica, CA [Internet]. Urology. [cited 2025 Jan 29]. Available from: https://www.saintjohnscancer.org/urology/conditions/kidney-cancer/
14. *Kidney Cancer Stages | Renal Cell Carcinoma Staging* [Internet]. [cited 2025 Jan 23]. Available from: https://www.cancer.org/cancer/types/kidney-cancer/detection-diagnosis-staging/staging.html
15. Lalani AKA, Kapoor A, Basappa NS, Bhindi B, Bjarnason GA, Bosse D, et al. *Adjuvant therapy for renal cell carcinoma: 2023 Canadian Kidney Cancer Forum consensus statement.* Can Urol Assoc J. 2023 Apr 25;17(5):E154-63.
16. Choueiri TK, Tomczak P, Park SH, Venugopal B, Ferguson T, Chang YH, et al. *Adjuvant Pembrolizumab after Nephrectomy in Renal-Cell Carcinoma.* N Engl J Med. 2021 Aug 19;385(8):683–94.
17. Kassouf W, Siemens R, Morash C, Lacombe L, Jewett M, Goldenberg L, et al. *Follow-up guidelines after radical or partial nephrectomy for localized and locally advanced renal cell carcinoma.* Can Urol Assoc J. 2009 Feb;3(1):73–6.

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KAIDEN JOBIN

Kaiden Jobin is a medical student at the Cumming School of Medicine in Calgary who previously did a master's degree in neurosciences. His interest in helping to develop this resource stems from his experience when his wife underwent a nephrectomy for renal cell carcinoma in 2022 and he noted a lack of available resources about the process for patients.

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