

2018

The SAUDI CLINICAL MANAGEMENT GUIDELINES FOR RENAL CELL CARCINOMA

National Cancer Center (NCC)

Name	Institution	City	Section
Abdullah Alghamdi	Prince Sultan Military Medical City	Riyadh	Department of Urology
Sultan Alkhateeb	King Abdulaziz Medical City and King Saud bin Abdulaziz University for Health Sciences	Riyadh	Department of Surgery, Division of Urology
Khalid Alghamdi	Security Forces Hospital	Riyadh	Department of Surgery, Division of Urology
Shouki Bazarbashi	King Faisal Specialist Hospital and Research Center	Riyadh	Department of Oncology, Section of Medical Oncology, Oncology Center,
Esam Murshid	Prince Sultan Military Medical City	Riyadh	Department of Oncology, Oncology Center
Mohammed Alotaibi	King Faisal Specialist Hospital and Research Center	Riyadh	Departments of Urology and Oncology
Ashraf Abusamra	King Khalid Hospital, King Abdulaziz Medical City, Ministry of National Guard Health Affairs	Riyadh	Department of Surgery, Urology Section
Danny Rabah	King Saud University	Riyadh	Department of Surgery, College of Medicine and Uro-Oncology Research Chair
Imran Ahmad	King Faisal Specialist Hospital and Research Center	Riyadh	Departments of Urology and Oncology
Mubarak Al-Mansour	King Abdulaziz Medical City and King Saud bin Abdulaziz University for Health Sciences.	Jeddah	Department of Oncology
Ahmad Saadeddin	King Abdulaziz Medical City	Riyadh	Department of Oncology
Abdullah Alsharm	Comprehensive Cancer Center, King Fahad Medical City.	Riyadh	Department of Medical Oncology

List of Contributors

*Corresponding author:

Dr. Sultan Alkhateeb,

Department of Surgery, Division of Urology, King Abdulaziz Medical City, King Saud bin Abdulaziz University for Health Sciences, P.O. Box: 22490 (1446), Riyadh 11426, Saudi Arabia. E-mail: alkhateebsu@ngha.med.sa

Supportive team:-

Dr. Ahmed Alamry ,MD,MHA, FRCPC Secretary General Saudi Health Council, Riyadh

Dr. Yagob Almazrou Advisor at Saudi Health Council Saudi National Cancer Center - Saudi Health Council, Riyadh

Dr. Suliman Alshehri General Director for SNCC Saudi National Cancer Center – Saudi Health Council, Riyadh <u>s.alshehri@shc.gov.sa</u>

Ms. Rana Alqahtani, MPH, CPH Public Health Specialist Training and development Saudi Health Council, Riyadh <u>R.alqahtani@shc.gov.sa</u>



Disclosure of Benefit: All authors have no conflicts of interest; this work was not supported or funded by any drug company.

Author participation: All authors listed on this manuscript contributed significantly to the revision of literature, establishing the current guidelines, writing, and approving the final version of this manuscript.

The National Cancer Canter (NCC) at the Saudi health council (SHC) holds copyright for these materials. Please acknowledge authorship if you copy or disseminate them. The NCC-SHC would like to thank all those involved in preparation of these resources.

Abstract

This is an update to the previously published Saudi guidelines for the evaluation, medical, and surgical management of patients diagnosed with renal cell carcinoma (RCC). It is categorized according to the stage of the disease using the tumor node metastasis staging system 7th edition. The guidelines are presented with supporting evidence level, they are based on comprehensive literature review, several internationally recognized guidelines, and the collective expertise of the guidelines committee members (authors) who were selected by the Saudi Oncology Society and Saudi Urological Association upon the request and support of the National Cancer Center (NCC). Considerations to the local availability of drugs, technology, and expertise have been regarded. These guidelines should serve as a roadmap for the urologists, oncologists, general physicians, support groups, and healthcare policy makers in the management of patients diagnosed with RCC.

Key Words: Cancer, carcinoma, cell, guidelines, kidney, management, renal, Saudi Oncology Society, Saudi Urological Association

INTRODUCTION

Renal cancer represents the third common genitourinary cancer in Saudi Arabia after urinary bladder and prostate. It accounts for 3.4% of all male cancers and 2.0% of all female cancers. In 2010, a total of 167 cases were diagnosed in males and 117 cases in females. The age-standardized rate in males was 2.9/100,000 and in females was 2/100,000 populations.

All cases of renal cell carcinoma (RCC) should preferably see or discussed in a multidisciplinary forum.

1. PRETREATMENT EVALUATION

1.1. Evaluation of suspicious renal mass:

- 1.1.1. History and physical examination
- 1.1.2. Blood count, renal, and hepatic profile
- 1.1.3. Computed tomography scan of chest, abdomen, and pelvis
- 1.1.4. Urine analysis
- 1.1.5. Urine cytology should be done if urothelial cancer is suspected

1.1.6. Indications of renal mass biopsy, suspicion of renal abscess, suspicion of metastases, suspicion of renal lymphoma, and prior to systemic therapy. Furthermore, strongly advocated before nonsurgical options (i.e., active surveillance, cry ablation, and radiofrequency ablation).

1.1.7. Brain imaging and bone scan should be done only if clinically indicated.

2. STAGING

The American joint commission on cancer staging tumor node metastasis 7th addition will be adopted [Appendix 1].

3. TREATMENT

3.1 Localized disease (t1a):

- 3.1.1 The recommended treatment is surgical excision preferably by partial nephrectomy (open, laparoscopic, or robotic) in all cases and especially in patients with solitary kidney, bilateral tumors, familial renal cell cancer, or renal insufficiency (evidence level-1 [EL-1])^[3-9]
- 3.1.2 Radical nephrectomy (preferably laparoscopic) should be reserved for cases where partial nephrectomy is not technically feasible after consultation with an experienced surgeon (EL-1)^[3-16]
- 3.1.3 Nonsurgical options (i.e., active surveillance, cry ablation, and radiofrequency ablation) are all inferior to surgical excision in terms of oncological outcome and are not recommended except in patients with significant comorbidities that interdict surgical intervention (EL-2).^[17-21]

3.2 Localized disease (T1b)

3.2.1 The recommended treatment is radical nephrectomy (preferably laparoscopic) (EL-1) [22-33].

3.2.2 Partial nephrectomy may be an option, especially in a patient with a solitary kidney, bilateral tumors, familial renal cell cancer, or renal insufficiency. However, this should only be performed by experienced surgeon in a high-volume center (EL-1)^[22-27]

3.2.3Nonsurgical options (i.e., active surveillance, cryoablation, and radiofrequency ablation) are not recommended.

3.3 Localized disease (T2)

- 3.3.1 The recommended treatment is radical nephrectomy (EL-1)^[22-27]
- 3.3.2 Partial nephrectomy and nonsurgical options (i.e., active surveillance, Cryoablation, and radiofrequency ablation) are not recommended.

3.4 Localized disease (T3)

- 3.4.1 The recommended treatment is radical nephrectomy with complete excision of all venous thrombus in the renal vein, inferior vena cava, and right atrium (EL-2)
- 3.4.2 These surgeries should only be performed in a tertiary care centers with the availability of cardiac, vascular or hepatic surgeon depending on the case (EL-2). [28,29]

3.5 Excision of the ipsilateral adrenal gland

3.5.1 Ipsilateral excision of the adrenal gland during radical nephrectomy is indicated in upper pole kidney tumors or in the presence of a concurrent radiologically detectable Adrenal gland lesion (s) (EL-2). ^[30-33]

3.6 Lymph node dissection

- 3.6.1 Resection of the regional lymph nodes (within Gerota's fascia) is an integral part of radical nephrectomy.
- 3.6.2 Resection of the nonregional lymph nodes provides no therapeutic advantages and it is used for staging purposes (EL-1).^[34]

3.7 Partial nephrectomy when doing this surgeon should aim to obtain adequate surgical margin and avoid tumor inoculation except in patients with Von Hippel–Lindau syndrome.^[35-37]

3.8 Postoperative follow-up after treatment we use the European Association of Urology Guidelines [Appendix 1].

3.9 Metastatic/advanced unrespectable disease:

- 3.9.1 Risk stratification for metastatic RCC
- 3.9.2 The Memorial Sloan-Kettering Cancer Center (MSKCC) risk classification for metastatic disease: ^[38] Risk factors are:
- 3.9.3 A Karnofsky performance status of <80%
- 3.9.4 Serum lactic dehydrogenase level >1.5 times the upper limit of normal
- 3.9.5 Corrected serum calcium >10 mg/dL (2.5 mmol/L)
- 3.9.6 Hemoglobin concentration below the lower limit of normal
- 3.9.7 No prior nephrectomy (i.e., no disease-free interval)
- 3.9.8 E ach of the above gives a score of one. Patients will be classified according to the total score as follow:
- 3.9.9 0: No risk factors: Good risk group
- 3.9.10 1, 2: Risk factors: Intermediate risk
- 3.9.11 3,4, 5: Riskfactors: High risk
- 3.9.12 Hengcriteria validates component of the MSKCC with the addition of
- 3.9.13 Neutrophils greater than the upper limit of normal
- 3.9.14 Platelets greater than the upper limit of normal.^[39]

Several scenarios could be faced in patients with metastatic disease. Accordingly, the following should be considered:

3.9.15 Potentially resectable primary with solitary metastasis or multiple resectable lung metastasis: Those patients should undergo primary nephrectomy and

resection of the metastatic lesion/s (EL-2). ^[40-42] Following complete resection no further therapy or "adjuvant therapy" is indicated (EL-3).

3.9.16 Potentially resectable primary and multiple nonresectable metastasis: Those patients should undergo resection of the primary tumor if in good performance status (EL-1), ^[43-52] then should start systemic therapy according to the following guidelines:

3.9.16. 1. Clear cell histology, good, and intermediate risk: Options of therapy include systemic therapy with either sunitinib (EL-1), bevacizumab and interferon α -2a or pazopanib (EL-1). Highdose interlukin-2in highly selected patients and centers

3.9.16. 2. Clear cell histology with poor risk: Temsirolimus is the preferred treatment (EL-1). Alternative options include sunitinib (EL-2)

3.9.16 3. Nonclear cell histology: Options of therapy include temsirolimus (EL-2), sunitinib (EL-2), or sorafenib (EL-2). Medullary and collecting duct carcinoma should be treated with platinum-based chemotherapy (EL-3).

3.9.17 Unresectable primary with or without metastatic disease: Those patients with good performance status should be offered systemic therapy according to their histology and MSKCC risk group as in item 4.8.2

3.91.17.1. Recurrent disease post primary nephrectomy: Treatment will depend if resectable or not:

3.9.17. 1.1. If resectable solitary metastasis: Surgical resection should be attempted (EL-2). No systemic therapy is of benefit following complete resection (EL-3)

- 3.9.17. 1.2. If nonresectable recurrence: Patient should be treated as metastatic disease according to their histology and MSKCCrisk groupand Heng criteria as in Item 3.9.1-3.
- 3.9.18. Second line therapy posttyrosine kinase inhibitors (TKIs) failure: Patients who fail 1st line TKI's should receive second-line therapy if in reasonable performance status, options of second line agents include everolimus (EL-1) or axitinib (EL-1)
- 3.9.19. Third line: Consider everolimus.

Financial support and sponsorship Nil.

Conflicts of interest: There are no conflicts of interest.

REFERENCES

- 1. Abouassaly R, Lane BR, Novick AC. Active surveillance of renal masses in elderly patients. J Urol 2008; 180:505-8; discussion 508-9.
- 2. Adam R,Chiche L, Aloia T, Elias D, Salmon R,Rivoire M,*et al.* Hepatic resection for non-colorectal nonendocrine liver metastases: Analysis of 1,452 patients and development of a prognostic model. Ann Surg 2006; 244:524-35.
- 3. Berger A, Brandina R, Atalla MA, Herati AS, Kamoi K, Aron M, *et al.* Laparoscopic radical nephrectomy for renal cell carcinoma: oncological outcomes at 10 years or more. J Urol 2009; 182:2172-6.
- 4. Blackley SK, Ladaga L, Woolfitt RA, Schellhammer PF. *Ex situ* study of the effectiveness of enucleation in patients with renal cell carcinoma. J Urol 1988; 140:6.
- 5. Blom J H, van Poppel H, Maréchal JM, Jacqmin D, Schröder FH, de Prijck L, Sylvester R;EORTC Genitourinary Tract Cancer Group.Radical nephrectomy with and without lymph-node dissection: Final results of European Organization for Research and Treatment of Cancer(EORTC) randomized phase 3 trial 30881. Eur Urol 2009; 55:28-34.
- 6. BurgessNA, Koo BC, Calvert RC, Hindmarsh A, Donaldson PJ, Rhodes M. Randomized trial of laparoscopic v open nephrectomy. J Endourol 2007; 21:610-3.
- 7. Cancer Incidence Report, Saudi Arabia, 2010. Available from: http://www.chs.gov.sa. [Last accessed on 2015 Nov 15].
- 8. Chen DY, Uzzo RG.Optimalmanagement of localized renal cell carcinoma: Aurgery, ablation or active surveillance. J Natl Compr Canc Netw 2009; 7:635-42; quiz 643.
- 9. Choueiri TK, Plantade A, Elson P, Negrier S, RavaudA, Oudard S, *et al.* Efficacy of sunitiniband sorafenibin metastatic papillary and chromophobe renal cell carcinoma. JClin Oncol 2008; 26:127-31.
- 10. Dash A, Vickers AJ, Schachter LR, Bach AM, Snyder ME, Russo P. Comparison of outcomes in elective partial vs radical nephrectomy for clear cell renal cell carcinoma of 4-7 cm. BJU Int 2006; 97:939-45.
- 11. Eastham JA. Do high-volume hospitals and surgeons provide better care in urologic oncology? Urol Oncol 2009; 27:417-21.
- 12. Escudier B,Pluzanska A, Koralewski P, Ravaud A, Bracarda S, Szczylik C,*et al.* Bevacizumab plus interferon alfa-2a for treatment of metastatic renal cell carcinoma: A randomized, double-blind phase III trial. Lancet 2007; 370:2103-11.
- 13. Flanigan RC,Salmon SE,Blumenstein BA,Bearman SI,Roy V, McGrath PC, *et al.* Nephrectomy followed by interferon alfa-2b compared with interferon alfa-2b alone for metastatic renal-cell cancer. N Engl J Med 2001; 345:1655-59.
- 14. Gabr AH, Gdor Y, Strope SA, Roberts WW, Wolf JS Jr. Patient and pathologic correlates with perioperative and long-term outcomes of laparoscopic radical nephrectomy. Urology 2009; 74:635-40.
- 15. Gill IS, Kavoussi LR, Lane BR, Blute ML, Babineau D, and Colombo JR Jr, *et al.* Comparison of 1,800 laparoscopic and open partial nephrectomies for single renal tumors. J Urol 2007; 178:41-6.
- 16. Gong EM, Orvieto MA, Zorn KC, Lucioni A, Steinberg GD, Shalhav AL. Comparison of laparoscopic and open partial nephrectomyin clinical T1 a renal tumors. J Endourol 2008; 22:953-7.
- 17. Greene FL, Page DL, Fleming ID, FritzAG, BalchCM, Haller DG, *et al.* editors, American Joint Committee on Cancer Staging Manual. 6th Ed. New York, NY: Springer; 2002.
- 18. Hemal AK, Kumar A. A prospective comparison of laparoscopic and robotic radical nephrectomyfor T1-2N0M0 renal cell carcinoma. WorldJUrol2009; 27:89-94.

- 19. Hemal AK, Kumar A, Kumar R, Wadhwa P, Seth A, Gupta NP. Laparoscopic versus open radical nephrectomy for large renal tumors: A long-term prospective comparison. J Urol 2007; 177:862-6.
- 20. Heng DY, Xie W, Regan MM, Warren MA, Golshayan AR, Sahi C, *et al.* Prognostic factors with metastatic renal cell carcinoma treated with vascular endothelial growth factor-targeted agents: Result from a large, multicenter study. JClin Oncol 2009; 27:5794-9.
- 21. Hofmann HS, Neef H, Krohe K, Andreev P, Silber RE. Prognostic factors and survival after pulmonary resection of metastatic renal cell carcinoma. Eur Urol 2005; 48:77-81; discussion 81-72.
- 22. Hudes G, Carducci M, Tomczak P, Dutcher J, Figlin R, Kapoor A, *et al*. Temsirolimus, interferon alfa, or both for advanced renal-cellcarcinoma. N Engl J Med 2007; 356:2271-81.
- 23. Joudi FN, Konety BR. The impact of provider volume on outcomes from urological cancer therapy. J Urol 2005; 174:432-8.
- 24. Kavolius JP, Mastorakos DP, PavlovichC, Russo P, Burt ME, Brady MS. Resection of metastatic renal cell carcinoma. JClin Oncol 1998; 16:2261-6.
- 25. KimSP, Thompson RH, Boorjian SA, Weight CJ, Han LC, Murad MH, *et al.* Comparative effectiveness for survival and renal function of partial and radical nephrectomy for localized renal tumors: A systematic review and meta-analysis. J Urol 2012; 188:51-7.
- 26. Kuczyk M, Münch T, Machtens S, Bokemeyer C, Wefer A, Hartmann J, *et al.* The need for routine adrenalectomy during surgical treatment for renal cell cancer: the Hannover experience. BJU Int 2002; 89:517-22.
- 27. Kuczyk M,Wegener G, Jonas U. The therapeutic value of adrenalectomyin case of solitary metastatic spread originating from primary renal cell cancer. Eur Urol 2005; 48:252-7.
- 28. Kunkle DA, Uzzo RG. Cryoablation or radiofrequency ablation of the small renal mass: A meta-analysis. Cancer 2008; 113:2671-80.
- 29. Lane BR, Tiong HY, Campbell SC, Fergany AF, Weight CJ, *et al.* Management of the adrenal gland during partial nephrectomy. J Urol 2009; 181:2430-6; discussion 2436-7.
- 30. LauWK, Blute ML, Weaver AL, TorresVE, Zincke H. Matched comparison of radical nephrectomy vs nephron-sparing surgery in patients with unilateral renal cell carcinoma and anormal contralateral kidney. MayoClin Proc 2000; 75:1236-42.
- 31. Lee CT, KatzJ, Shi W, Thaler HT, Reuter VE, Russo P. Surgical management of renal tumors 4 cm. or less in a contemporary cohort. J Urol 2000; 163:730-6.
- 32. Leibovich BC,Blute M,Cheville JC,Lohse CM,Weaver AL,Zincke H. Nephron sparing surgery for appropriately selected renal cell carcinoma between 4 and 7 cm results in outcome similar to radical nephrectomy. J Urol 2004; 171:1066-70.
- 33. Luo JH,ZhouFJ, Xie D, ZhangZL, LiaoB,ZhaoHW, *et al.* Analysis of long-term survival in patients with localized renal cell carcinoma: Laparoscopic versus open radical nephrectomy. World J Urol 2010; 28:289-93.
- 34. Marshall FF, Taxy JB, Fishman EK, Chang R. The feasibility of surgical enucleation for renal cell carcinoma. J Urol 1986; 135:231.
- 35. Mickisch GH, Garin A, van Poppel H, dePrijck L, Sylvester R; European Organization for Research and Treatment of Cancer(EORTC)Genitourinary Group. Radical nephrectomy plus interferon-alfa-based immunotherapy compared with interferon alfa alone in metastatic renal-cell carcinoma: A randomized trial. Lancet 2001; 358:966-70.
- 36. Motzer RJ, Hutson TE, Tomczak P, Michaelson MD, Bukowski RM, Rixe O, *et al.* Sunitinib versus interferon alfa in metastatic renal-cell carcinoma. N Engl J Med 2007; 356:115-24.
- 37. Motzer RJ, Mazumdar M, Bacik J, Berg W, Amsterdam A, Ferrara J. Survival and prognostic stratification of 670 patients with advanced renal cell carcinoma. JClin Oncol 1999; 17:2530-40.

- Motzer RJ, Escudier B, Oudard S, Hutson TE, Porta C, Bracarda S, *et al.* Phase 3 trial of everolimus for metastatic renal cell carcinoma: Final results and analysis of prognostic factors. Cancer 2010; 116:4256-65.
- 39. Motzer RJ, Escudier B, Oudard S, Hutson TE, PortaC, Bracarda S, *et al.* Efficacy of everolimusin advanced renal cell carcinoma: A double-blind, randomized, placebo-controlled phase III trial. Lancet 2008; 372:449-56.
- 40. O'Malley RL, Berger AD, KarnofskyJA, Phillips CK, Stifelman M, Taneja SS. A matched-cohort comparison of laparoscopic cryoablation and laparoscopic partial nephrectomy for treating renal masses. BJU Int 2007; 99:395-8.
- 41. O'Malley RL, Godoy G, Karnofsky JA, Taneja SS. The necessity of adrenalectomy at the time of radical nephrectomy: A systematic review. J Urol 2009; 181:2009-17.
- 42. OudardS, Banu E, Vieillefond A, Fournier L, Priou F, Medioni J, *et al.* Prospective multicenter phase II study of gemcitabine plus platinumsaltformetastatic collecting duct carcinoma: Results of aGETUG (Groupe d'Etudes des TumeursUro-Genitales) study. JUrol2007; 177:1698-702.
- 43. Peycelon M, Hupertan V, Comperat E, Grenard-Penna R, Vaessen C, Conort P, *et al.* Long-term outcomes after nephron sparing surgery for renal cell carcinoma larger than 4 cm. J Urol 2009;181:35-41.
- 44. Piltz S, Meimarakis G, Wichmann MW, Hatz R, Schildberg FW, Fuerst H. Long-term results after pulmonary resection of renal cell carcinoma metastases. Ann ThoracSurg 2002; 73:1082-7.
- 45. Rais-Bahrami S, Guzzo TJ, Jarrett TW, Kavoussi LR, Allaf ME. Incidentally discovered renal masses: Oncological and perioperative outcomes in patients with delayed surgical intervention. BJU Int 2009; 103:1355-8.
- 46. Rini BI, Halabi S, Rosenberg JE, Stadler WM, Vaena DA, Ou SS, *et al.* Bevacizumab plus interferon alfa compared with interferon alfa monotherapy in patients with metastatic renal cell carcinoma: CALGB 90206. JClin Oncol 2008; 26:5422-8.
- 47. Rosenthal CL, Kraft R, Zingg EJ. Organ-preserving surgery in renal cell carcinoma: Tumor enucleation versus partial kidney resection. Eur Urol 1984; 10:222.
- 48. Simmons MN, Weight CJ, Gill IS. Laparoscopic radical versus partial nephrectomy fortumors>4 cm: Intermediate-term oncologic and functional outcomes. Urology 2009; 73:1077-82.
- 49. Sternberg CN, Davis ID, Mardiak J, Szczylik C, Lee E, Wagstaff J, *et al.* Pazopanibin locally advanced or metastatic renal cell carcinoma: Results of a randomized phase III trial.J Clin Oncol 2010; 28:1061-8.
- 50. Strouse JJ, Spevak M, Mack AK, Arceci RJ, SmallD, Loeb DM. Significant responses to platinum-based chemotherapy in renal medullary carcinoma. Pediatr Blood Cancer 2005; 44:407-11.
- 51. TanHJ,NortonEC, YeZ, Hafez KS, Gore JL, Miller DC.Long-term survival following partial vs radical nephrectomy among older patients with early stage kidney cancer. JAMA 2012; 307:1629-35.
- 52. Thompson RH,Siddiqui S, Lohse CM, Leibovich BC, Russo P, Blute ML. Partialversus radical nephrectomyfor4 to 7 cm renal cortical tumors. JUrol 2009; 182:2601-6.
- 53. Van Poppel H, DaPozzo L, Albrecht W, Matveev V, Bono A, Borkowski A, et al. A prospective, randomizedEORTC intergroup phase 3 study comparing the oncologic outcome of elective nephron-sparing surgery and radical nephrectomy for low-stage renal cell carcinoma. Eur Urol 2011; 59:543-52.
- 54. Weight CJ, Larson BT, Gao T, Campbell SC, Lane BR, Kaouk JH, et al. Elective partial nephrectomy in patients with clinical T1brenal tumors is associated with improved overall survival. Urology 2010; 76:631-7.

55. WeightCJ, LieserG, LarsonBT, Gao T, Lane BR, Campbell SC, et al. Partial nephrectomyisassociated with improved overall survival compared to radical nephrectomy in patients with unanticipated benign renal tumors. Eur Urol 2010; 58:293-8.

APPENDIX

Risk profil	eTreatment	Surveillance							
		6 months 1	l year	2 years	3 years 4	years	5 years	After 5	
								years	
Low	RN/PN	US	СТ	US	СТ	US	СТ	Discharge	
Intermediat	eRN/PN/cryoablation/RFA	СТ	US	СТ	US	СТ	СТ	CT alternate 2 years	
High	RN/PN/cryoablation/RFA	СТ	СТ	СТ	СТ	СТ	СТ	CT alternate years	

Appendix 1: Surveillance following surgery adapted from European Association of Urology

CT: Computed tomography, RN: Radical nephrectomy, PN: Partial nephrectomy, RFA: radiofrequency ablation, US: Ultrasound