·Clinical Research·

Transabdominal Radical Nephrectomy for Renal Cell Carcinoma: an Experience on 155 Patients

CHEN Xiao-Feng[1,2], ZHOU Fang-Jian[1,2], HAN Hui[1,2], QIN Zi-Ke[1,2], LIU Zhuo-Wei[1,2], YU Shao-Long[1,2], LI Yong-Hong[1,2], WANG Huan[1,2], HOU Guo-Liang[1,2]

[ABSTRACT] BACKGROUND & OBJECTIVE: Renal cell carcinoma (RCC) is a common urologic malignant tumor. Radical nephrectomy is the major treatment for RCC. Approaching route selection, lymphadenectomy selection, and lymphadenectomy extension are debated. This study was to summarize our experience on transabdominal radical nephrectomy for RCC. METHODS: A total of 155 RCC patients were treated with radical nephrectomy and regional lymphadenectomy between Oct. 1999 and Dec. 2005 in Cancer Center of Sun Yat-sen University. The duration of operation, the amount of bleeding, the duration of postoperative hospitalization, complications, and survival rates of the patients were reviewed. RESULTS: No patient died during operation. The median duration of operation was 155 min (range, 60–360 min). The median amount of bleeding was 200 ml (range, 50–10 000 ml). Sixteen patients received RBC transfusion with a mean of 11.5 units (1 unit of RBC is extracted from 200 ml whole blood). In 23 (14.8%) patients, the amount of bleeding was more than 500 ml; 5 of the 23 patients underwent inferior vena cava thrombectomy, with median bleeding of 1 100 ml (range, 100–6 000 ml). The median duration of postoperative hospitalization was 15 days (range, 6–46 days). The intraoperative complications, treated intraoperatively without sequelae, included 2 cases of spleen injury, 1 case of inferior vena cava and duodenal injury, and 2 cases of vessel injury. The postoperative complications, cured conservatively, included 1 case of heart failure and 2 cases of incomplete ileus. The patients were followed up for 1–78.6 months, with a median of 20.0 months. The 1-, 3-, and 5-year overall survival rates were 93.2%, 84.1%, and 74.8%, respectively. The 1-year overall survival rates were 100% for stage Ⅰ and stage Ⅱ patients, 88.2% for stage Ⅲ, and 53.8% for stage Ⅳ. The 3-year overall survival rates were 89.7% for stage Ⅰ, 95.5% stage Ⅱ, 75.6% for stage Ⅲ, and 44.9% for stage Ⅳ. The 5-year overall survival rates were 89.7% for stage Ⅰ, 86.8% for stage Ⅱ, and 0% for stage Ⅳ. CONCLUSIONS: Radical nephrectomy via transperitoneal route, with benefits of early ligating the renal vessels and easy to perform lymphadenectomy, has certain effect on RCC with less severe complications. It may be a standard surgical procedure for RCC.

KEYWORDS: Renal neoplasm/surgical operation; Transperitoneal route; Nephrectomy; Clinical analysis

1. State Key Laboratory of Oncology in South China, Guangzhou, Guangdong, 510060, P. R. China
2. Department of Urology, Cancer Center, Sun Yat-sen University, Guangzhou, Guangdong, 510060, P. R. China

Correspondence to: ZHOU Fang-Jian
Tel: 86-20-87343312
E-mail: zhoufaj86@263.net

Recived: 2006-06-21
Revised: 2007-01-30

1. Introduction

Renal cell carcinoma (RCC) is a common urologic malignant tumor. The incidence rate of RCC increases yearly. The best accepted treatment of localized renal cell carcinoma and locally advanced renal cell carcinoma is radical nephrectomy, but for metastatic renal cell carcinoma, surgical operation is just an adjunctive therapy, and only a few patients can be cured by surgical operation [1]. Whether abdominal incision or lumbar incision should be adopted in radical nephrectomy, or whether lymphadenectomy should be performed, and what is the lymphadenectomy extension if lymphadenectomy is performed, are controversial [2]. From Oct. 1999 to Dec. 2005, 155 RCC patients underwent radical nephrectomy and regional lymphadenectomy via abdominal incision in Cancer Center of Sun Yat-sen University. These 155 patients were pathologically staged based on 2002 AJCC-TNM system, the duration of operation, amount of bleeding, duration of postoperative hospitalization, complications, and survival rates of the patients were reviewed, and the experience of radical nephrectomy via abdominal incision was summarized.

2 Materials and methods

2.1 Clinical data

In totoal 201 RCC patients were treated with surgical operation from Oct. 1999 to Dec. 2005. In these patients, 155 were performed radical nephrectomy plus regional lymphadenectomy via abdominal incision. Ninety-nine patients were male and 56 were female. There were 85 patients who suffered from tumor in the left kidney, and 70 in the right kidney. These patients were aged from 14-85 years old, with a median age of 52 years. The biggest tumor diameter was 11-145mm, and the median maximal diameter was 60 mm. There were 62 cases (40%) of asymptomafic renal carcinoma.

2.2 Operation method

2.2.1 Radical nephrectomy plus regional lymphadenectomy

The left hypogastric oblique incision was used. The operation was performed according to literature[3]. Radical nephrectomy and regional lymphadenectomy were finished in one step. The operation protocol for the left kidney was as follows: lateral peritoneum was cut open at the outer side of the descending colon, and the splenocolic ligament was cut off. Then, via the surface of Gerotas fascia, the descending colon and descending mesocolon were mobilized inwards to the middle line, thus abdominal aorta between suprarenal gland and the inferior pole of kidney was exposed. Gerotas fascia was cut open via the surface of the left renal vein, then the left renal vein was mobilized. After that, gonadal vein was ligated and cut off. Renal artery was exposed and ligated at the upper posterior side of the renal vein. The left renal vein was then ligated and cut off. The left renal artery was ligated again and cut off. The vagina vasorum was cut open via the surface of abdominal aorta. The lymphatic tissues and adipose tissues at the front, outer and posterior sides of abdominal aorta were mobilized, so that these lymphatic tissues together with the left kidney were totally ectomized. From the outer side of anadesma, the outer, posterior and upper sides of kidney were mobilized; then the blood vessels of the adrenal gland were ligated and cut off closely along vena cava via the upper inside of the kidney. After that, the neighboring tissues of the kidney was mobilized downwards, and the ureter and gonadal vein were ligated and cut off at the level of the branch of iliac vessel. Finally, the specimen was totally removed. When the right renal artery was explored, if the blood vessels of kidney pedicle were buried in swollen lymph nodes, the following should be done: posterior peritoneum was firstly cut open at the outer side of the ascending duodenum, then the ascending duodenum was retracted inwards, thus aorta behind it was exposed; after that, aorta and vena cava were mobilized closely along the right side of aorta; then the right renal artery was exposed at the upper posterior side of left renal vein, and ligated with silk suture.

2.2.2 Extended radical nephrectomy plus regional lymphadenectomy

The primary steps were the same as those of radical nephrectomy and regional lymphadenectomy. The invaded adjacent organs or adhered organs (such as intestines, the body and the tail of pancreas, spleen, and so on) were completely dissected. Isolated distant metastasis was also dissected at the same time.

2.2.3 Removal of the tumor thrombus from vena cava

The operation was performed according to the literature [4].

2.3 Follow-ups

Except conventional examinations during the follow-up, all the patients were performed abdominal CT examination in 1-3 months after operation. The patients with stage **I** RCC and the patients with stage **II** RCC were followed up every six months for three consecutive years, then once a year. Stage **III** and stage **IV** patients were followed up every three months for three consecutive years, then once a year. The end of the follow-up was Apr.30, 2006. Recurrent time was defined from the operation to the time when the recurrent focus was found. Survival time was defined from the operation to the date of death or to the end of the follow-ups.

2.4 Statistical analysis

SPSS 10.0 software was used to analyze the duration of operation, the amount of bleeding, duration of postoperative hospitalization and the survival rate. The survival rate was calculated by the Kaplan-Meier method, and variance test was performed by log-rank method. The statistical significance level was set as α=0.05.

3 Results

3.1 Results of operation

In totoal151 cases underwent operation via subcostaI oblique incision and 4 via upper midline abdominal incision. No patient died during operation. The duration of operation was 60~360 min (the median duration of operation was 155 min). The amount of operative bleeding was 50-10000ml. The median amount of bleeding was 200ml. Sixteen patients (10%) received RBC transfusion with a mean of 11.5 units (1 unit of RBC was extracted from 200 ml whole blood). In 23 (14.8%) patients, the amount of bleeding was more than 500 ml, with a range of 600-10000ml (the median amount of bleeding was 800ml), including 5 cases of spleen injury or vessel injury (the amount of bleeding range, 600-3000ml), 5 cases of vena cava thrombectomy (range, 600~6000ml, and the median amount of bleeding was 1100ml), 1 case of partial resection of inferior vena cava due to tumor infiltration (10000ml), 12 cases of extensive bleeding in the huge wound area.

Patients were pathologically staged after operation : 78 case of stage **I** (T1N0M0), 34 cases of stage **II** (T2N0M0), 28 cases of stage **III** (22 T3N0M0 and 6 T2-3N1M6) and 15 cases of stage **IV** (2 T4, 4 T2, 9M1). There were 100 cases of clear cell carcinoma, 4 cases of granular cell carcinoma, 4 cases of papillary adenocarcinoma, 11 cases of mixed renal cell carcinoma and 36 cases of undifferentiated renal cell carcinoma.

The duration of postoperative hospitalization was 6-46 days with a median of 15 days. No correlation was found between the pathological stage and the duration of postoperative hospitalization. But the pathological stage had both positive corrections to the duration of operation and the amount of bleeding (r=0.367 and 0.299, respectively, and Pvalue <0.001 and <0.001, respectively). The volume of the tumor had no correlation to the duration of postoperative hospitalization, the duration of operation and the amount of bleeding.

3.2 Intraoperative and postoperative complications

Ten patients underwent excision of adjacent organs; four patients underwent splenectomia and resection of the tail of the pancreas due to severe adhesion (1 case of T3aN0M0, 2 cases of T3bN0M0 and 1 case of T4N0M0), three patients was performed pure splenectomia (2 cases of spleen injury, one case of T2N0M0, 1 case of T3aN0M0, 1case of T3bN0M1 due to severe adhesions); one patient underwent partial colectomy due to severe adhesion; 1 patient underwent irregular hepatectomy due to hepatic metastasis; 1 patient underwent partial resection of vena cava; three patients had injured vessels during operation, including 1 case of laceration of inferior vena cava complicated with duodenum injury; 1 case of rupture of renal veins during operation; 1 case of rupture of accessory renal vein during operation. One patient had heart failure in the postoperative period, and was improved after the treatment; two patients suffered from incomplete bowel obstruction during the postoperative period. No case of wound disruption or secondary infection. No dead during the perioperative period.

3.3 Clinical effection

The patients were followed up for 1-78.6 months, with a median of 20.0 months. Among the patients, 122 achieved tumor free survived; 20 died of cancer (survival time:

3.0-42.6 months; mean:17.1 months); one patient died of other causes and 12 patients survived their tumors. The numbers of the patients who achieved tumor free survival, survived the tumor and died were 72, 1 and 5, respectively in stage I patients, were 31, 1 and 2 respectively in stage **II** patients ; were 19, 4 and 5 respectively in stage **III** patients; and were 0, 6 and 9 respectively in stage **IV** patients. The local recurrence rate was 2.8% (4/155).Recurrent patients were all stage **IV** patients. The disease recurred 3-20 months after the operation due to lymph node metastasis beyond the excision range. The 1-, 3-, and 5-year overall survival rates were 93.2% (145/155), 64.1%(131/155), and 74.8% (116/155), respectively. The 1-year overall survival rates were 100% for stage **I** (78/78) and stage **II** (34/34) patients, 88.2% (25/28) for stage **III**, and 53.8% (8/15) for stage **IV**. The 3-year overall survival rates were 89.7% (70/78) for stage **I** , 95.5% (33/35) for stage **II** , 75.6% (21/28) for stage **III**, and 44.9% (7/15) for stage **IV**. The 5-year overall survival rates were 89.7% (70/78) for stage **I** , 86.8% (30/34) for stage **II** , and 0% (0/15) for stage **IV** . No statistical difference was observed between stage **I** and stage **II** , stage **I** and stage **III**, stage **II** and stage **III**(P< 0.001, <0. 001 and <0.0018 respectively) (Figure 1). The longest follow-up time of stage **III** patients was less than 5 years, therefore the 5-year survival rate could not be calculated. No statistical significance of survival rate was observed in stage **I** , stage **II** (T1-2N0M0) and node-negative stage **III** (T3N0M0) (P=0.182) (Figure 2).

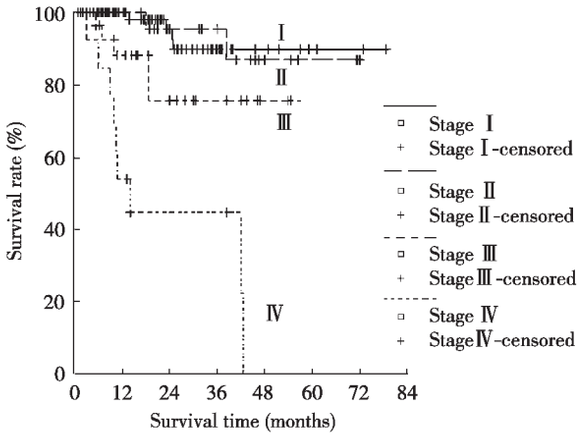

Figure 1 Survival curves of the renal cell carcinoma (RCC) patients of stages Ⅰ-Ⅳ after radical nephrectomy (RN)

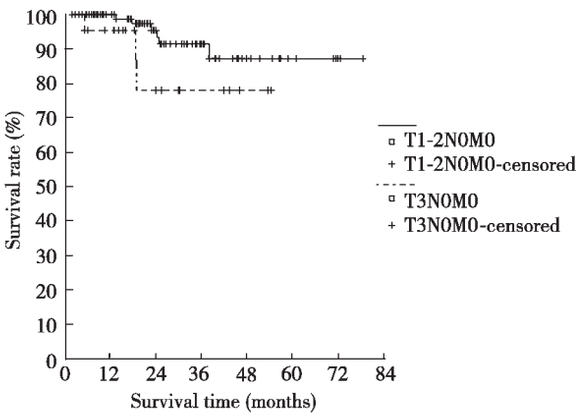

Figure 2 Survival curves of the RCC patients of stage T1-2N0M0 or T3N0M0 after RN

4. Discussion

Radical nephrectomy is the standard treatment method for localized renal cell carcinoma and locally advanced renal cell carcinoma. The patients with metastatic renal carcinoma accompanied with severe symptoms, such as severe hematuria, should be performed with palliative nephrectomy. Because renal cell carcinoma is not sensitive to radiotherapy or chemotherapy, the isolated distant metastasis should be dissected at the same time of nephrectomy or after operation.

Radical nephrectomy has various choices of incision. Lumbar incision or 11th intercostal incision is mostly used in China. The disadvantage of lumbar incision is that renal vessals are not easily to be exposed, especially for the fat patients. Besides that, clearing lymph node is also difficult. Abdominal incision or thoracico-abdominal incision is convenient to expose kidney pedicle and to process the renal vessel first, and to increase the surgical resection extent. However, the amount of bleeding is large and the spleen is easy to be injured during the operation on the left kidney; postoperative recovery of intestinal function is slow and the duration of postoperative hospitalization is extended[5].

Swanson *et al.*[5] reported that the amount of bleeding of radical nephrectomy was 150-7000ml; the mean amount of bleeding of the patients with complications was 2095ml; the mean amount of bleeding of the patients free of complications was 944ml. The amount of bleeding of 49 patients with renal vein

and/or inferior vena cava tumor thrombosis was 250-8500ml, with a median amount of 950ml. These patients received RBC transfusion with a mean of 6 units (ranged from 0-22 units) [6]. The mean amount of bleeding of the patients with retro-hepatic vena cava tumor thrombosis was 650-4675ml. The mean RBC transfusion was 2-10 units [7]. In those patients who lost blood less than 10% of the total blood volume (500ml), the blood loss could be compensated by the transfer of interstitial fluid into blood circulation. Those patients could be free of hypovolemia, and blood transfusion was not necessary. In our study, the median amount of bleeding in 155 patients was 200ml. Only 22 patients (14.8%) lost more than 500ml blood. Sixteen patients (10.0%) received blood transfusion. Chan *et al.* reported 54 RCC pT1/2NxMx patients performed extraperitoneal radical nephrectomy via lumbar incision, The amount of bleeding in the operation was 50-1400ml, with a median amount of 200ml, 11 (20%) of which needed blood transfusion. We believe that via transperitoneal approach, the surgical field can be fully exposed; if the tissues are dissected according to the anatomic levels, and renal vessels are processed firstly, and less amount of bleeding can be attained; and only a small amount of complicated cases would need blood transfusion. If the tumor is in a high pathologic stage, or reanal vessels are buried in the swollen lymph nodes; or the tumor is adhered to the adjacent organs, leading to the disappear of normal anatomic layers; or collateral circulation in the affected kidney is increased, the amount of bleeding may increase. Furthermore, injured spleen or vast vessels would also increase the amount of bleeding during the operation. In operation for the left renal tumor, if renal hilum and renal vessels are hard to be mobilized, they can be dissected along the lateral side of abdominal aorta at the level of the inferior pole of the kidney in an upward way, then the initiation part of the renal artery is exposed and ligated; in operation for the right renal tumor, the right renal artery can be mobilized and ligated between abdominal aorta and vena cava. In this way, the bleeding during operation can be decreased. If the affected kidney is badly adhered to the adjacent organs, difficult separation would cause large amount of bleeding and affect the positive rate of incisal margin. On condition that the normal physiological function is not affected, the involved organs should be resected.

It is generally considered that the operation via transperitoneal approach has a strong effect on physiological functions of abdominal organs, which would take a longer time for postoperative recovery of the intestinal function compared to lumbar incision [9]. The incidence rate of abdominal organ injury is as high as 20.7%, mainly of which were spleen injury (12.4%) and blood vessel injury (8.3%) [5]; The 30-day postoperative mortality is 2.04%; if the patient has renal vein or inferior vena cava carcinoma, the incidence rate of complications will be as high as 44.9%, and intraoperative mortality and in and postoperative mortality within 30 days could reach 8.2%[6]. In the 155 patients of our study, the rate of abdominal organ injury was 3.2%, and the incidence rate of severe postoperative complication was 1.9% (3/155). No death occurred in the perioperative period. The complication rate of radical nephrectomy by extraperitoneal approach via lumbar incision was 15% (8/54) [8]. We propose that the key point to prevent the complication of the operation is to understand the anatomic structures and meticulous operation. In our study, the 2 cases of spleen injury were both caused by inexperience of transabdominal radical nephrectomy. The surgical field can be fully exposed via subcostal incision, and all the procedures can be performed in a visible state, thus to avoid blind procedures, which would decrease the incidence rate of intestinal obstruction.

Swanson *et al.* reported 193 cases of transabdominal radical nephrectomy. The duration of operation was 80-30 min (the median time was 160 min). The patients with complications had a longer duration of operation. However, in the other group of 1373 cases underwent radical nephrectomy, the mean duration of operation was 205 min[10]. The duration of operation of transabdominal radical nephrectomy via lumbar insicion was 99-409 min (median enduration was 190 min) [8]. In our study, the duration of operation was 60-360min (median time was 155 min), which was similar to the literatures. In the patients with higher stage of RCC, the difficulty of operation increased. Either the adjacent organs were resected, or the range of lymphadenectomy were extended. Therefore, the operation took longer time with larger

amount of bleeding, but the duration of postoperative hospitalization was not be affected.

In the clinical treatment, when the patients with RCC visit the doctor, 25% have suffered from distant metastasis. The overall survival rate of RCC patients is low. The 3-year survival rate is 61.0%-74.0%, and the 5-year survival rate is 37%-68.7%[11,13]. Pathological stage, pathological grade, cell type, volume of the tumor, necrosis are the factors affecting prognosis of RCC, among which pathological stage is the most important factor. The 5-year postoperative survival rate of stage Ⅰ and stage Ⅱ were 91% and 74%, respectively[14]. The 5-year survival rate of the patients with tumor thrombus in vena cava was 48%-68%[15,16]. The 5-year survival rate of the patients with lymph node metastasis but without distant metastasis was 52%. However, the 5-year survival rate of metastatic renal cell carcinoma was only 7%[11].

Currently, whether lymphadenectomy should be performed in radical nephrectomy is controversial. Skinner et al.[17] believes that lymphadenectomy can clear the metastasis, thus cure part of the patients. Survival analysis of radical nephrectomy plus extended lymphadenectomy indicates that, in comparison with the patients with locally advanced renal cell carcinoma and without lymph node metastasis and distant metastasis, the survival rate of the patients with localized renal cell carcinoma is not significantly difference[12]. In our study, the differences of the survival rate between stage Ⅰ and stage Ⅱ patients and stage Ⅲ patient were statistically significant. However, renal cell carcinoma with lymph node metastasis but without distant metastasis is not usually observed, with an incidence rate of 5%-26%[3,12,20]. Only this kind of patients can benefit from lymphadenectomy. In the clinical treatment, regional lymphadenectomy does not increase the complication and the mortality rate of RCC patients, and thus has no effect on the duration of operation and the amount of bleeding. Moreover, regional lymphadenectomy contributes to postoperative staging and improving the survival rate of locally advanced renal cell carcinoma. Therefore, we believe that regional lymphadenectomy should be performed as the standard method during radical nephrectomy.

References

[1] Ma J H. Diagnosis and treatment of renal cell carcinoma [M]. Beijing: Chinese Medical Association, Urology Branch, 2005, 6-8. [Book in Chinese]

[2] Gu F L, Renal carcinoma [M]// Wu J P. Urology. Jinan: Publishing House of Science and Technology, Shangdong, 2004: 887-918. [Book in Chinese]

[3] Hinman F. J R. Atlas of urologic surgery [M]. Second edition. Philadelphia: W.B.Saunders Company, 2002: 1016-1026.

[4] Li X F, Zhou F J, Qiu S P, et al. Diagnosis and treatment of renal cell carcinoma with vena cava tumor thrombi [J]. Ai Zheng, 2004, 23 (9): 1074-1076. [Article in Chinese]

[5] Swanson D A, Borges P M. Complications of transabdominal radical nephrectomy for renal cell carcinoma [J]. J Urol, 1983, 129(4): 704-707.

[6] Parekh D J, Cookson M S, Chapman W, et al. Renal cell carcinoma with renal vein and inferior vena caval involvement: clinicopathological features, surgical techniques and outcomes [J]. J Urol, 2005, 173(6): 1897-1902.

[7] Gonzalez-Fajardo J A, Fernandez E, Rivera J, et al. Transabdominal surgical approach in the management of renal tumors involving the retrohepatic inferior vena cava [J]. Ann Vasc Surg, 2000, 14(5): 436-443.

[8] Chan D Y, Cadeddu J A, Jarrett T W, et al. Laparoscopic radical nephrectomy: cancer control for renal cell carcinoma [J]. J Urol, 2001, 166(6): 2095-2100.

[9] Imamoglu M A, Bakirtas H, Sagnak L, et al. A comparison of two different incisional approaches in the surgical treatment of renal cell carcinomas [J]. Int Urol Nephrol, 2002, 33(1): 7-11.

[10] Corman J M, Penson D F, Hur K, et al. Comparison of complications after radical and partial nephrectomy: results from the National Veterans Administration Surgical Quality Improvement Program [J]. BJU Int, 2000, 86(7): 782-789.

[11] Giuliani L, Giberti C, Martorana G, et al. Radical extensive surgery for renal cell carcinoma: long-term results and prognostic factors [J]. J Urol, 1990, 143(3): 468-474.

[12] Frank I, Blute M L, Cheville J C, et al. An outcome prediction model for patients with clear cell renal cell carcinoma treated with radical nephrectomy based on tumor stage, size, grade and necrosis: the SSIGN score [J]. J Urol, 2002, 68(6): 2395-2400.

[13] Robson C J, Churchill B M, Anderson W. The results of radical nephrectomy for renal cell carcinoma. 1969 [J]. J Urol, 2002, 167(2 Pt 2): 873-877.

[14] Tsui K H, Shvarts O, Smith R B, et al. Prognostic indicators for renal cell carcinoma: a multivariate analysis of 643 patients using the revised 1997 TNM staging criteria [J].

J Urol, 2000,163(4):1090-1095.

[15] Babu S C, Mianoni T, Shah P M, et al. Malignant renal tumor with extension to the inferior vena cava [J]. Am J Surg, 1998,176(2):137-139.

[16] Swierzewski D J, Swierzewski M J, Libertino J A. Radical nephrectomy in patients with renal cell carcinoma with venous, vena caval, and atrial extension [J]. Am J Surg, 1994,168(2):205-209.

[17] Skinner D G, Colvin R B, Vermillion C D, et al. Diagnosis and management of renal cell carcinoma. A clinical and pathologic study of 309 cases [J]. Cancer, 1971,28(5):1165-1177.