Renal Function after Partial Nephrectomy Versus Radical Nephrectomy for Renal Cell Carcinoma: A Comparative Study

Enamul Hoque1*; Shamim Hossain2; Mohammad Abdus Salam3; Muhammed Serajul Islam4; Akter kamal Perveg5; Mohammad Abdus Salam6; AK Al-Miraj7

1Medical Officer, Department of Urology, BSMMU, Dhaka. Bangladesh.
2Assistant Professor, Department of Urology, BSMMU, Dhaka. Bangladesh.
3Consultant, Department of Urology, BSMMU, Dhaka. Bangladesh.
4Medical officer, Department of Urology, BSMMU, Dhaka, Bangladesh.
5Medical officer, Department of Urology, BSMMU, Dhaka, Bangladesh.
6Founder President & CEO, Urology And Transplant Foundation of Bangladesh And Former Chairman & Professor of Uro-Oncology, BSMMU, Dhaka, Bangladesh.
7Research Assistant, Department of Vascular Surgery, BSMMU, Dhaka, Bangladesh.

*Corresponding Author(s): Enamul Hoque
Medical Officer, Department of Urology, BSMMU, Dhaka, Bangladesh.
Email: aminuli4343@gmail.com

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Abstract

Background: Renal Cell Carcinoma (RCC) is the third most common malignancy of the genitourinary system characterized by lack of early warning clinical manifestations (asymptomatic) and late triad of symptoms (flank pain, hematuria, and palpable renal mass). It accounts for approximately 2-3% of the adult malignancy and 90% to 95% of neoplasms arising from the kidney. With the improvement in imaging technique, small and asymptomatic RCC is easily diagnosed and treated but advanced RCC is difficult to treat because its inherent resistance to conventional chemotherapy and radiotherapy.

Objective: To compare the time-dependent changes of estimated Glomerular Filtration Rate (eGFR) after Partial Nephrectomy (PN) and Radical Nephrectomy (RN) for Renal Cell Carcinoma (RCC).

Type of study: Randomized controlled clinical trial.

Place of Study: Department of Urology, BSMMU and Comfort Nursing Home (Pvt.) Ltd. Dhaka, during the period of January, 2017 to September, 2018.

Method and Procedure: This prospective randomized controlled clinical trial study is conducted in the Department of Urology, BSMMU and Comfort Nursing Home (Pvt.) Ltd, Dhaka, from January, 2017 to September, 2018. Total 52 patients having renal cell carcinoma (<7cm) and normal

conventional techniques, available preoperative and postoperative serum creatinine and MDRD-eGFR measurements are included in this study, Preoperative MDRD-eGFR<30 ml/min/1.73m² or serum creatinine level >1.5 mg/dl before surgery is excluded from this study. After detailed explantation about the nature of the study to the participants and with written consent, 52 patients are randomly allocated into two groups by lottery method. In group-A 26 patients are enrolled for Partial Nephrectomy (PN) and in group-B, 26 patients are enrolled for Radical Nephrectomy (RN). The enrolled patients are evaluated after surgical intervention under general anesthesia with different surgeons in multiple institutes by measuring serum creatinine and MDRD-eGFR postoperatively 1, 3, 7 days, and 3 months for one year. MDRD-eGFR declining is assessed from the preoperative value to the 1st post-operative value at the end of follow-up. During follow up period, out of total 52 patients in both groups 2 patients in group-A and one patient in group-B did not come in regular follow up, one patient missing in each group and one patient died in group-B did not come in regular follow up, one patient missing in each group and one patient died in group-B. So total 23 patients in each group are followed up after operation.

Results: Demographic characteristics, BMI, pre- and post-operative symptoms and sign of the patients, most of the tumor characteristics (location, hydronephrosis and enhancement) are not statistically. Significant in both groups but statistically significant changes are found in tumor size (p=0.004) and tumor type (p=0.013). There is no significant difference in preoperative serum creatinine and eGFR in both groups but the time-dependent changes of eGFR after RN show plateau form initially and then gradually declining form the first post-operative day to the 12 post-operative months. In case of Partial Nephrectomy (PN), a lowest eGFR is observing in postoperative day 1 and gradually recovered to near preoperative level for 12 months. The mean (+SD) eGFR decreased more significantly in RN (group-B 18.56 ml/min) than PN patients (group-A 6.31 ml/min) from preoperative 4 to 12 months after operation and show statistically significant differences between and within both groups (p<0.001, <0.001 respectively).

Conclusion: Time dependent changes of estimated Glomerular Filtration Rate (eGFR) after Partial Nephrectomy (PN) is better than Radical Nephrectomy (RN) for Renal Cell Carcinoma (RCC). Partial Nephrectomy (PN) is therefore the better procedure for preservation of renal function.

Introduction

Renal Cell Carcinoma (RCC) is the most common malignancy of the kidney and accounts for about 2-3 % of all adult neoplasms [1]. Overall, approximately 12 new cases are diagnosed per 100,000 population per year, with a male-to-female predomiance of 3:2. This is primarily a disease of older adults, with typical presentation between 50 and 70 years of age [2]. The incidence of renal tumors has risen over the last decades. Due to the progress in radiological imaging, the majority of renal tumors are detected incidentally (<50%) during diagnostic work-up for other patient complaints. The triad of symptom—flank pain, gross hematuria, and palpable mass only occur in the minority of patients (7-10 %) and are usually a sign of locally advanced disease [3]. Radical Nephrectomy (RN) has been the standard treatment for any Renal Cell Carcinoma (RCC) during the last 30 years. The role of open radical nephrectomy in the management of RCC has changed somewhat over the last decade [1]. Although radical nephrectomy (RNO) has long been the standard treatment for renal cell carcinoma (RCC), many studies have recently been documented the improved overall survival, better preservation of renal function, the safety and oncological efficacy of Nephron-sparing surgery (NSS) for RCC [3]. The current guidelines form the European Urology Association (EUA) and American Urology Association (AUA) have recommended NSS for RCCs smaller than 4cm. Despite these recommendations, RN is still widely performed for small tumors in individuals with a normal contralateral kidney [4]. Nephron-Sparing Surgery (NSS) with resection of the tumor only was usually reserved for patients with solitary kidney, bilateral tumors or chronic kidney disease. It has become the standard of surgery for patients with solitary kidney, bilateral tumors or chronic kidney disease. It has become the standard of surgery for patients presenting with renal tumors <4 cm in size (cT1a) with a healthy contralateral kidney due to good oncological long-term outcomes with a moderate perioperative complication rate. In selected cases NSS is considered as alternative treatment for 4-7 cm sized renal tumors (cT1b). For renal tumors >7 cm in size (cT2a), NSS can also be performed safely in properly selected patients with good short-term functional and oncologic outcomes. Both RN and NSS are therefore considered standard treatments for RCC and the main difference in outcome between these procedures is the preservatin of renal function [3]. Renal function after surgery for RCC has usually been assessed by using serum creatinine (Scr) level alone but Scr. is affected by factors affecting generation, including muscle mass and dietary intake. As a result, renal function tends to be overestimate in patients who are elderly or for some other reason have decreased muscle mass. Furthermore, it is difficult to evaluate Scr. level in both male and female patients because the normal ranges of serum creatinine differ between men and women. So e GFR is the most accurate index for assessing renal function ans the National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI) guidelines recommended using estimate glomerular with age, diabetes and hypertension [5]. In a study of 253 patients with RCC by Miyamoto et al. [6]. Have assessed the renal function using the eGFR and investigate the time dependent changes of the eGFR after the operation and found postoperative eGFR<60 ml /min is 23% and 57.6% in radical nephrectomy and nephron sparing surgery. The aim of this study is to evaluate the time-dependent changes or renal function of the patients after RN and PN for RCC by using MDRD equations for estimating eGFR from measuring creatinine level preoperatively and postoperatively 1,3,7 days, and 3 monthly for one year in the Bangladeshi population and the result of this study will emphasize more in renal preserving procedure for eligible patients with RCC.

Objective

General objective

• To compare renal functional status after partial nephrectomy and radical nephrectomy for renal cell carcinoma.

Specific objectives:

• To estimate serum creatinine among the patients undergoing partial nephrectomy and radical nephrectomy before operation.
• To estimate serum creatinine among the patients undergoing partial nephrectomy and radical nephrectomy after operation at different interval.

• To estimate eGFR among the patients undergoing partial nephrectomy and radical nephrectomy before operation.

• To estimate eGFR among the patients undergoing partial nephrectomy and radical nephrectomy after operation at different interval.

• To compare eGFR among the patients undergoing partial nephrectomy and radical nephrectomy after operation at different interval.

• To compare eGFR between partial nephrectomy and radical nephrectomy patients.

Materials and Methods

Type of study: Randomized controlled clinical trial.

Study period: January to September-2018.

Study place: Department of Urology Bangabandhu Sheikh Mujib Medical University (BSMMU) and Comfort Nursing Home (Pvt.) Ltd. Dhaka.

Study population: Patients having renal cell carcinoma (≤7cm) attending in the outpatient department of BSMMU hospital and Comfort Nursing Home (Pvt.) Ltd, Dhaka from January to September-2018, is included in this study and surgical intervention is done.

Inclusion criteria

✓ Age (35-75 years)
✓ A solitary renal mass, size ≤ 7cm (cT1a, cT1b)
✓ A radiographically normal contralateral Kidney

Exclusion criteria

✓ Patient with a preoperative serum creatinine level> 1.5 mg/dl
✓ Patient with a preoperative glomerular filtration rate <30 ml/min/1.73 m²
✓ Patient with a tumor in solitary kidney.
✓ Patient with bilateral or multiple renal tumors.
✓ Contralateral unhealthy kidney.
✓ Obese patients (BMI>30 Kg/M²)
✓ Pregnant patient
✓ Patient refusing consent
✓ Patient missing or dead during follow up

Sample size: Thus, 23 patients will be needed in each group (52).

Sampling technique: Purposive sampling technique will be applied to collect the sample for this study who are admitted with the diagnosis of renal cell carcinoma in the department of urology, BSMMU and Comfort nursing home (Pvt.) Ltd in Dhaka are selected as per inclusion and exclusion criteria for the present study. After written informed consent, total 52 patients are recruited and divided into two groups by lottery method.

Study groups: There are two groups of study subjects.

Group-A: Patients who were undergone partial nephrectomy by open method.

Group-B: Patients who were undergone radical nephrectomy by open method.

✓ Preoperative variable: BMI of the patient
✓ Chronic disease/co-morbid disease-cardiovascular (HTN), DM.
✓ Serum creatinine (mg/dl)
✓ eGFR (ml/min/1.93m²)

Postoperative Variable (outcome Variable)

✓ Serum creatinine (mg/dl)
✓ eGFR (ml/min/1.73 m²)

Investigation

Diagnostic purpose

➤ USG of whole abdomen.
➤ Computed tomography scan with urogram and angiogram

Evaluation purpose

➤ Blood Hemoglobin level
➤ Urine R/M/E and C/S
➤ Serum electrolytes
➤ RBS
➤ CXR-P/A
➤ Serum Creatinine
➤ eGFR

Key steps of the procedure

➤ Patient was included in the study after fulfilling the selection criteria (inclusion and exclusion criteria).
➤ Informed written consent was taken by all patients after explaining about the study, different management options, the possibility of response and the complications related to the procedure.
➤ Preoperative general fitness of the patients was checked by physical examinations and investigations.
➤ Under standard procedure, partial nephrectomy in group-A patients and radical nephrectomy in group-B patients were performed.

Immediate postoperative follow up

In this study, patients were followed up early 1,3,7 days postoperatively by evaluating-

✓ Subjective complaints (History)
✓ Clinical examination
✓ Investigation
  o Urine R/M/E and C/S
**Hemoglobin level**  
**Serum creatinine**  
**eGFR**  

**Subsequent follow up: 3 monthly for 1 year.**
- History
- Clinical examination
- Investigation
  - Urine R/M/E and C/S
  - Hemoglobin level
  - Serum creatinine
  - eGFR

**Date collection**
- The study subjects were selected on the basis of inclusion criteria from the patients who underwent partial nephrectomy or radical nephrectomy in the Department of Urology, BSMMU and Comfort nursing home (Pvt.) Ltd in Dhaka.
- The demographic information, relevant medical history, examination findings and investigation reports of all the study subjects were recorded in the data collection sheet.
- Any patient facing complications during the procedure was excluded from study.
- Any patient who died during follow up was excluded.
- All patients were conducted over telephone as scheduled for follow up after initial treatment.
- The data sheet was filled up after taking brief history, review of records and variable documents form patients.

**Data analysis**
After compilation, the data was presented in the form of tables, figures and graphs, as necessary.
- Statistical analysis of the results was done by using computer based statistical software SPSS 20.0 version for windows operating system.
- Results are expressed as mean (±SD) and compared by Student’s unpaired (independent) and paired (dependent) t-test for continuous variables and Chi square test for categorical variables.
- A ‘p’ value of < 0.05 was considered as significant.

**Operational definition**

**Renal cell carcinoma:** Renal Cell Carcinoma (RCC) is a kidney cancer that originates in the lining of the proximal convoluted tubule, a part of the very small tubes in the kidney that transport waste molecules from the blood to the urine.

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**Radical nephrectomy:** The prototypical concept of RN encompasses the basic principles of early ligation of the renal artery and vein, removal of the kidney with primary dissection extremely to the Gerota fascia, excision of the ipsilateral adrenal gland, and performance of an extended lymphadenectomy form the crus of the diaphragm to the aortic bifurcation.

**Nephron sparing surgery:** An operation to remove a kidney tumor by removing only part of the kidney leaving healthy tissue.

**Creatinine:** It is a breakdown product of creatinine phosphate in muscle and is usually produced at a fairly constant rate by the body and excreted by kidneys in urine. The normal serum creatinine range for men is 0.6-1.3 mg/dL. The normal range for women is 0.5-1.2 mg/dl (Source: BSMMU biochemistry report, 2018).

**Chronic kidney disease:** Chronic Kidney Disease (CKD) is a progressive loss in kidney function over a period of months of years.
Endophytic tumor: An endophytic tumor was defined as less than 40% of the lesion extending off the surface of the kidney.

Exophytic tumor: Tumor that intending to grow outward beyond the surface epithelium from which it originates.

Hypertension: Medical guidelines define hypertension as a blood pressure higher than 130 over 80 millimeters of mercury (mmHg), according to guidelines issued by the American Heart Association (AHA) in November 2017.

Diabetes: A disease in which the body’s ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in when fasting. Less than 7.8 mmol/1 (140mg/dl) 2 hours after eating. In diabetes patient, blood sugar level in fasting condition- ≤7.0 mmol/1.2 hours after eating ≥11.1 mmol/1(≥7.0 mmol/1,2 hours after eating ≥11.1 mmol/1 (≥2mg/dl) (Source: BSMMU biochemistry report, 2018).

Kidney tumor: Renal cell carcinoma is the most common solid lesion within the kidney which originates form the proximal renal tubular epithelium and comprises different RCC types with specific histopathological and genetic characteristics [7]. From a clinical point of view. Three main types of RCC are important: clear cell (cRCC) 65%, papillary (pRCC-type 1 and II) 15% and chromophobe (chRCC) 10% generally, in all RCC types, prognosis worsens with stage and histopathological grade. Etiological factors include lifestyle such as smoking, obesity, hypertension and occupational exposure to specific carcinogens [8]. The 5-year overall survival for all types of RCC is 49%, which has further improved since 2006 probably due to an increase in incidentally detected RCCs as well as by the introduction of tyrosine kinase inhibitors. Sarcomatoid changes can be found in all RCC types and they are equivalent of high grade and very aggressive tumors [9].

Radical nephrectomy: Radical nephrectomy refers to complete removal of the kidney outside the Gerota fascia together with the ipsilateral adrenal gland and complete regional lymphadenectomy from the crus of the diaphragm to the aortic bifurcation [10]. Radical nephrectomy is reserved for renal tumors that are not amenable to partial nephrectomy. Indication for radical nephrectomy include tumors in nonfunctional kidneys, large tumours replacing the majority of renal parenchyma, tumours associated with detectable regional lymphadenopathy, or tumors associated with renal vein thrombus. Complication relating to RN includes damage during Suprahilar and Retrocrural lymphadenectomy-duodenum, pancreas, liver, spleen, superior mesenteric artery, celiac trunk, superior mesenteric autonomic plexus, and cisterna chil, Injury to the vasculature of the Gut. There are two surgical approach for radical surgery-Flank Approaches (Subcostal Flank Approach, Supracostal Flank Approach, Dorsal Lumbotomy Approach, Thoracoabdominal Approach), Anterior Approaches (Anterior Midline Approach, Anterior Subcostal Approach, Chevron Incision-Bilateral Anterior Subcostal Approach [2].

Partial Nephrectomy: Partial nephrectomy is the surgical removal of a kidney tumor along with a thin rim of normal kidney, with the aims of curing the cancer and preserving as much normal kidney as possible. Whenever preservation of functioning renal parenchyma is important, partial nephrectomy substitutes for radical nephrectomy. The first partial nephrectomy was performed in 1884 by Wells for the removal of a perirenal fibro-lipoma [11]. Partial nephrectomy to treat renal malignancy was first described in 1890 by Czerny [12]. In 1950, Vermooten reported that peripherally located, encapsulated renal tumors could be removed by partial excision of renal tissue Partial nephrectomy has now become a standard procedure for appropriately selected patients with renal cell carcinoma (RCC). Partial nephrectomy is indicated for cases in which a radical nephrectomy would render the patient a nephric with a subsequent immediate need for dialysis. Such cases include synchronous bilateral RCC, Tumors in a solitary kidney, Unilateral tumor with a poorly functioning opposite kidney(imperative indications), Unilateral RCC and those with a functioning opposite kidney with an uncertain future function in artery stenosis, hydropnephrosis, chronic pyelonephritis and systemic diseases such as diabetes and hypertension that result in arteriosclerosis and nephron-affected impairment, elective indication patients with small (4 cm or less in diameter) unilateral tumors with a healthy contralateral organ[13]. Several surgical techniques are available for performing partial nephrectomy in patients with renal tumors. Description of these techniques, including performing the incision, exposing the Kidneys, and closing the situs, are described in detail elsewhere [14]. The five main surgical processes include performing the incision, exposing the kidney, and closing the situs, are described in detail elsewhere (Monite JE and Novick AC, 1998). The five main surgical processes include enucleation of tissue, polar segmental nephrectomy, wedge resection, major transverse resection, and extracorporeal partial nephrectomy followed by renal auto-transplantation [15]. All of these techniques require steady vascular control and thorough hemostasis, avoidance of renal ischemia, complete tumour removal with free margins, and efficient closure of the intrarenal collecting system. Finally, an adequate postoperative renal function must be maintained since a functioning renal remnant of at least 20% of one normal kidney is necessary to avoid end-stage renal failure [15]. However, it is important not to compromise the extent of the surgical procedure to preserve renal function at the expense of an incomplete resection.

Estimated GFR: Glomerular Filtration Rate (GFR) is accepted as the best overall measure of kidney function. Measuring GFR directly is considered the most accurate way to detect changes in kidney status, but measuring the GFR directly is complicated, requires experienced personnel, and is typically performed only in research settings and transplant centers [16]. The GFR can be estimated from serum creatinine concentration and demographic and clinical variables such as age, sex, ethnicity, and body size. Creatinine is a muscle waste product that is filtered form the blood by the kidneys and released into the urine at a relatively steady rate. When kidney function decreases, less creatinine is eliminated and concentrations increases in the blood. With the creatinine test, a reasonable estimate of the actual GFR can be determined but not the accurate result. The normal mean value for GFR in healthy young men and women is approximately 130mL/min per 1.73 m², and 120mL/min per 1.73m² respectively, and declines by approximately 1 mL/min per 1.73m² per year after 40 years of age [17]. For men, the equation of eGFR (mL/min/1.73m²)= 194 x (SCr) 1.094 x (age) 0.287 and for women it is multiplied by 0.739. GFR is related to Chronic Kidney Disease (CKD). Current guidelines define chronic kidney disease as kidney damage or a Glomerular Filtration Rate (GFR) less than 60 mL/min per 1.73 m² for 3 months or more, regardless of cause [18]. To facilitate detection of chronic kidney disease, guidelines recommend different equations to calculate eGFR. The following two are most common and require a person’s blood creatinine result, age, and assigned values based
upon sex and race. Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation (2009) recommended by the National Kidney Foundation for calculating eGFR in adults. Modification of Diet in Renal disease Study (MDRD) equation which is now widely accepted and many clinical laboratories are using it to report GFR estimates [19,20].

**Results & observations**

Distribution of patients by gender show (table-I), most of the patients in both groups are male. In group A 14 (60.9%) patients are male and 09 (39.1%) patients are female. In group-B, 15(65.2%) patients are male and 8(34.8%) patients are female (table-I), Mean (± SD) and range of age distribution of the patients in group -A is 48.91 ± 8.79 years, (35-65) years and in group-B is 50.70 ± 12.23 years, (35-74) years (table-1), Mean (±SD) BMI in group-A is 20.70±2.36 kg/m² and in group-B is 21.22 ± 6.36 kg/m² (table-I). There are no statistically significant differences in demographic characteristic (sex, age) and BMI between two groups (p= 0.760, 0.573, 0.714 respectively: table-I).

| Table 1: Patients characteristics in both groups (n= 46). |
|-----------------|-----------------|------------------|
| Group-A(Nephron-Sparing Surgery) | Group-B(Radical Nephrectomy) | P-Value |
| Sex | | |
| Male | 14 (60.9) | 15 (65.2) | 0.760 |
| Female | 9 (39.1) | 8 (34.8) | |
| Age (years) | | |
| Mean ± SD | 48.91 ± 8.79 | 5.70 ± 12.23 | 0.573 |
| Range (years) | | |
| 35-65 | 35-74 | |
| BMI (kg/m²) (mean±SD) | | |
| Mean±SD | 20.70 ± 2.36 | 21.22 ± 6.36 | 0.714 |

Chi square test and independent’ t’ test was done to measure the level of significance.

Table 2: Pre and post-operative symptoms & sign of the patients in both groups (n= 46).

<table>
<thead>
<tr>
<th>Pre-operative</th>
<th>Group-A</th>
<th>Group-B</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flank pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18(78.3)</td>
<td>16(69.6)</td>
<td>0.502</td>
</tr>
<tr>
<td>No</td>
<td>5 (21.7)</td>
<td>7 (30.4)</td>
<td></td>
</tr>
<tr>
<td>Hematuria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5 (21.7)</td>
<td>7 (30.4)</td>
<td>0.502</td>
</tr>
<tr>
<td>No</td>
<td>18 (78.3)</td>
<td>16 (69.6)</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6 (26.1)</td>
<td>5 (21.7)</td>
<td>0.730</td>
</tr>
<tr>
<td>No</td>
<td>17 (73.9)</td>
<td>15 (71.4)</td>
<td></td>
</tr>
<tr>
<td>Tumor size (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean±SD</td>
<td>4.28 ± 0.91</td>
<td>5.08 ± 0.89</td>
<td>0.004</td>
</tr>
<tr>
<td>Range (cm)</td>
<td>4.28 – 6.30</td>
<td>5.08 – 6.90</td>
<td></td>
</tr>
<tr>
<td>Tumor location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper pole</td>
<td>9 (39.1)</td>
<td>12 (52.2)</td>
<td>0.563</td>
</tr>
<tr>
<td>Lower pole</td>
<td>10 (43.5)</td>
<td>9 (39.1)</td>
<td></td>
</tr>
<tr>
<td>Tumor type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exophytic</td>
<td>19 (82.6)</td>
<td>5 (51.7)</td>
<td>0.013</td>
</tr>
<tr>
<td>Endophytic</td>
<td>4 (17.4)</td>
<td>13 (78.3)</td>
<td></td>
</tr>
<tr>
<td>Hydroureter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1 (4.3)</td>
<td>2 (8.6)</td>
<td>0.187</td>
</tr>
<tr>
<td>No</td>
<td>22 (95.7)</td>
<td>21 (91.3)</td>
<td></td>
</tr>
</tbody>
</table>
| Independent’ t’ test and Chi-square test was done to measure the level of significance.

Tumor size of kidney of the patients shows (Table III), mean (±SD) tumor size in group-A 4.28 ±0.91, cm, range 2.6-6.30 cm and in group-B 5.08 ± 0.89 cm, range 2.9-6.3cm (Table V). Most
of the renal tumors are exophytic 19 (82.6%) and rest of the tumors are endophytic 4 (17.4%) In Group-A (Table III), and in group-B, 5(21.7%) of renal tumors are exophytic and 18 (78.3%) are endophytic (Table V). There are statistically significant differences in tumor size and in tumor type between two groups (p<0.004, 0.013 respectively). In group-A, renal tumors are located in 9 (39.1%) of the patients in the upper pole, 10 (43.5%) in lower pole and 4 (17.4%) in the interpolar (Table III), in group-B, tumors located in 12 (52.2%) of the patients in the upper pole, 9 (39.1%) in the lower pole and 2 (8.7%) in the interpolar (table-III). In majority of the patients had no hydronephrosis in the kidney a diagnosis which are group-A 22 (95.7%) group-B 21 (91.3%) and minorities of the patients have hydronephrosis (Table III) in group-A all the tumors have contrast enhancement and in group-B 21 (91.3%) had contrast enhancement and 2 (8.7%) had no contrast enhancement (Table III). There are no statistically significant differences in tumor location, hydronephrosis and in tumor contrast enhancement between two groups (p= 0.563., 0.187, 0.489 respectively, Table III).

Table 4: Serum creatinine status before and time depended changes after operation (at different follow up) in both groups (n= 46).

<table>
<thead>
<tr>
<th>Serum creatinine</th>
<th>Group-A</th>
<th>Group-B</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before operation</td>
<td>1.02 ± 0.24</td>
<td>1.07 ± 0.22</td>
<td>0.432</td>
</tr>
<tr>
<td>After Operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st POD</td>
<td>1.23 ± 0.28</td>
<td>1.34 ± 0.35</td>
<td>0.236</td>
</tr>
<tr>
<td>At 3rd POD</td>
<td>1.17 ± 0.25</td>
<td>1.32 ± 0.29</td>
<td>0.067</td>
</tr>
<tr>
<td>At 7th POD</td>
<td>1.16 ± 0.19</td>
<td>1.29 ± 0.29</td>
<td>0.087</td>
</tr>
<tr>
<td>After 3 months of POD</td>
<td>1.11 ± 0.23</td>
<td>1.35 ± 0.27</td>
<td>0.002</td>
</tr>
<tr>
<td>After 6 months of POD</td>
<td>1.14 ± 0.17</td>
<td>1.33 ± 0.21</td>
<td>0.225</td>
</tr>
<tr>
<td>After 9 months of POD</td>
<td>1.13 ± 0.16</td>
<td>1.37 ± 0.20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>After 12 months of POD</td>
<td>1.13 ± 0.16</td>
<td>1.38 ± 0.18</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum creatinine changes (before op vs after 12 months of POD)</td>
<td>0.11 ± 0.08</td>
<td>0.31 ± 0.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>p-value (before op vs after 12 months of pOD)</td>
<td>0.002</td>
<td>0.003</td>
<td></td>
</tr>
</tbody>
</table>

Independent ’t’ test was done between groups and dependent’ t’ test was done within group to measure the level of significance.

During evaluation of patient’s serum creatinine status before operation shows (Table IV) mean (±SD) serum creatinine in group-A 1.02 ± 0.24 mg/dl and in group-B 1.07 ± 0.22 mg/dl (Table IV) but there is no significant difference preoperatively (p= 0.432). After operation, time depended changes of serum creatinine status of the patients at 1st, 3rd and 7th POD in group-A, 1.23 ± 0.28, 1.17 ± 0.25, 1.16 ± 0.19 mg/dl and in group-B, 1.34 ± 0.35, 1.32 ± 0.29, 1.29 ± 0.29 mg/dl respectively (table-IV) but there are no significant differences in serum creatinine status at 1st, 3rd and 7th POD between two groups (p = 0.236, 0.067, 0.087 respectively; Table IV)). At 3, 6, 9 and 12 months follow up period after operation, time depended mean (±SD) serum creatinine status changes in group-A, 1.11 ± 0.23, 1.14±0.17, 1.13 ± 0.16 mg/dl and in group-B, 1.35 ± 0.27, 1.33 ± 0.21, 1.37 ± 0.20, 1.38 ± 0.18 mg/dl respectively (table-IV) but statistically significant differences present in serum creatinine status in 3,6,9 and 12 months POD between significant differences present in serum creatinine status in 3, 6, 9 and 12 months POD between significant differences present in serum creatinine status in 3,6,9 and 12 months POD between two groups p= 0.002, 0.002, <0.001, <0.001 respectively, (Table IV). The mean (± SD) serum-creatinine status changes from preoperative to 12 months after operation in group-A, 0.11 ± 0.08 mg/dl and in group-B 0.31 ± 0.04 mg/dl which shows statistically significant differences is serum creatinine status between and within the groups (p<0.001, 0.002, 0.003 respectively, Table IV).

Table 5: eGFR status before and time depended changes after operation (at different follow up) in both groups (n=46).

<table>
<thead>
<tr>
<th>eGFR</th>
<th>Group-A</th>
<th>Group-B</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before operation</td>
<td>7.22 ±14.48</td>
<td>73.17±17.74</td>
<td>0.671</td>
</tr>
<tr>
<td>After operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st POD</td>
<td>64.39 ±16.05</td>
<td>57.78 ±11.50</td>
<td>0.116</td>
</tr>
<tr>
<td>At 3rd POD</td>
<td>67.52 ±15.24</td>
<td>57.43 ±10.23</td>
<td>0.012</td>
</tr>
<tr>
<td>At 7th POD</td>
<td>67.96 ±13.66</td>
<td>60.13 ±13.08</td>
<td>0.053</td>
</tr>
<tr>
<td>After 3 months of POD</td>
<td>69.65 ±14.81</td>
<td>56.61 ±11.58</td>
<td>0.002</td>
</tr>
<tr>
<td>After 6 months of POD</td>
<td>68.39 ±13.61</td>
<td>55.91 ±9.49</td>
<td>0.001</td>
</tr>
<tr>
<td>After 9 months of POD</td>
<td>68.52±12.52</td>
<td>54.83 ±10.44</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>After 12 months of POD</td>
<td>68.91 ±12.86</td>
<td>54.61 ±10.86</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Decrease in eGFR (ml/min)</td>
<td>6.31 ±1.62</td>
<td>18.56 ±6.88</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>p-value (before op vs after 12 Months of POD)</td>
<td>&lt;0.001</td>
<td>0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Independent’ t test was done between groups and dependent’ t’ test was done within group to measure the level of significance.

During evaluation of patient’s eGFR status before operation shows (Table V) mean (±SD) eGFR in group-A, 75.22 ± 14.48 ml/min and in group-B, 73.17 ± 17.74 ml/min (table-V) but there are no significant differences preoperatively (p=0.671). After operation, the time depended changes of eGFR status of the patients at 1st POD in group-A, 64.39±16.05 ml/min and in group-B, 57.78 ± 11.50 ml/min (Table V) but there are no significant differences in eGFR status at 1st POD between two groups (p=0.116, table-V). At 3rd, 7th POD and 3,6,9,12 months follow up period after operation, time depended mean (± SD) eGFR status changes in group-A, 67.52 ± 15.24, 67.96 ± 13.66, 69.65 ±14.81, 68.39 ± 13.61, 68.91 ± 12.86 ml/min and in group-B, 57.43 ± 10.23, 60.13 ± 13.08, 56.61 ± 11.58, 55.91 ± 9.49, 54.83 ± 10.44, 54.61 ± 10.86 ml/min respectively; Table V) but statistically significant differences present in eGFR status in 3rd, 7th POD and 3,6,9,12 months follow up period between two groups. At 3rd, 7th POD and 3,6,9,12 months follow up period after operation, time depended mean (± SD) eGFR status changes in group-A, 67.52 ± 15.24, 67.96 ± 13.66, 69.65 ±14.81, 68.39 ± 13.61, 68.91 ± 12.86 ml/min and in group-B, 57.43 ± 10.23, 60.13 ± 13.08, 56.61 ± 11.58, 55.91 ± 9.49, 54.83 ± 10.44, 54.61 ± 10.86 ml/min respectively; Table V) but statistically significant differences present in eGFR status in 3rd, 7th POD and 3,6,9,12 months follow up period between two groups. Independent ’t’ test was done between groups and dependent’ t’ test was done within group to measure the level of significance.
the groups (p<0.001, <0.001, 0.001 respectively; Table V).

Discussion

With evolution of imaging modalities (USG, CT/MRI), small and asymptomatic RCC is early diagnosed and the fucntinal and oncological outcome of NSS have increased. Currently, therer is controversy regarding the clinical efficacy of NSS and RN in reat-
ing localized RCC. According to EAU guideline (2014), nephron sparing surgery is the first treatment option for cTla tumor (<4 cm) and a viable option for cTb lesion (>4cm) when technically feasible [21]. In this prospective study, preoperative and post-
toperative time dependent changes of renal function up to 12 months after NSS (Group-A) and RN (Group-B) are assessed by measuring eGFR using MDRD formula as renal function tends to be overestimated by using seru creatinine which is affected by several factors affecting creatinine generation. Is this study, the risk factors for the development of new onset of CKD (eGDFR<60 ml/min) after operation are observed but univaritate or multi-

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After operation, time-dependent changes of serum creatinine status of the patients at 1st, 3rd and 7th POD are less pronounced in group-A than group-B (figure-I) and have no significant differences in both groups (p>0.05) but at 3, 6, 9 and 12 months, the changes remain stable up to 12 months in group-A but increases gradually in group-B (figure-I) and have no significant differences in both groups (p>0.002). Similar result was documented by Miyamoto et al. [6], in post-operative serum creatinine level between two groups (NSS= 96 mg/dl, RN= 1.24 mg/dl; p<0.001). From preoperative to 12 Months after operation, mean creatinine status differences is less in group-A (.11 mg/dl) than in group-B (.31 iong/dl) and have statistically significant differences in between and within the groups (p= 0.002, 0.003 respectively). Comparable result found by Clark et al. [32], in a Prospective study in which creatinine clearance dropped more in RN (0.56 ml/min, 31.6%) than NSS (0.09 ml/min, 6.1%) and p<0.001. Hakim and Ringden et al. [33], documented that the removal of one kidney from a patient with two normally functioning kidneys results in functional adaptation and compensatory hypertrophy of the remaining kidney. Creatinine clearance increases to 70 to 75% of the preoperative creatinine clearance within several weeks post operatively. Several studies have followed patineets for more than 10 oyears after door nephrectomy and found than cratinine clearance remini ded stable. In preoperative period, mean eGFR is more in group-A (75.22 ml/min) than in group-B (73.17 ml/min) due to small tumor size and more functioning renal parenchyma and have no significant (p>0.671) Similar eGFR results were observed in the studies (71.4 vs 71.3 ml/min, p>0.05) by Miyamoto et al. (2012) and (80.2 vs. 78.2 vs. 78.2 ml/min; P>0.05) by pignot et al (2014 The time depended changes mean eGFR status at 1st POD is not significant (P= 0.116) but at 3rd, 7th POD and 3,6,9,12 months, it becomes significant in both groups (P<0.001)) because of more residual functioning renal parenchyma present after NSS. Comparable result are noted by Mariuudott et al. [4], in which significant differences was observed postoperatively and after 60 months (56 vs. 44 ml/min, p< 0.001; 59 vs. 45 ml/min; p<0.001). The mean eGFR decreased more significantly in gorup-B (18.56 ml/min) than group-A (6.31 ml/min) from preoperative to 12 months after operation and have significant difference (p<0.001; Table V). The current results differ from the study by miyamoto et al. [6], in which eGFR decrease by 9.27 ml/min in NSS and 25.1 ml/min (p<0.0002) in RN due to large tumor size is NSS and large sample size (152 patients). The time-dependent changes of eGFR after RN show plateau from initially and then gradually declining form the first postoperative day to the 12 postoperative months. In case of NSS, a lowest eGFR is observing in postoperative day 1 and gradually recovered to near preoperative level for 12 months (Anderson et al. [24], reported that compensatory hypertrophy was completed I week after donor nephrectomy and Tanaka et al. [34], reported 2 to 4 weeks after RN. Krebs et al. [31], reported that eGFR in NSS patients were higher than RN in postoperatively. The compensatory hypertrophy after donor nephrectomy has previously been believed to be beneficial but compensatory hyperfiltration due to arterial vasodilatation with increased flow and eventually proteinuria, azotemia and hypertension but does not lead to long term decrease in renal function [24]. At the end of dicussion, the present study suggested that although compensatory hypertrophy occurs in the early postoperative day in RN than NS, renal functional outcome is more stable in NSS than RN due to functioning residual renal parenchyma.

**Conclusion**

Time dependent changes of estimated Glomerular Filtration Rate (eGFR) after partial nephrectomy is better than Radical Nephrectomy (RN) for Renal Cell Carcinoma (RCC) in 12 months follow up period. PN has minimal impact on post-operative renal function measured by eGFR whereas RN is associated with significantly greater renal function decline. PN is therefore the better procedure for preservation of renal function.

**Limitations of the study**

1. Small sample size
2. Lack of longer follow up (only 12 months)
3. Surgery is performed by multiples surgeons.
4. Associated risk factors are not evaluated by logistic regression analysis.
5. Patients with renal failure (eGFR<30ml/min), obese patients and pregnant women are not included in the present study.

**Recommendations**

Observing time depended changes of eGFR of the present study. It can be said that partial nephrectomy has preserved renal function more than radical nephrectomy. With this view in mind following recommendation are put for consideration of future researchers as well as relevant authority.

1. Regular practice of partial nephrectomy in patients with localized RCC in our country.
2. Large sample size should be taken for further study.
3. Longer follow up should be given.
4. Intervention should be done by single surgeon.
5. Meta-analysis for further evaluation of renal function.

**References**


