Validation of R.E.N.A.L nephrometry scoring system in planing surgical intervention in patients with localized renal mass

Ashraf Mohamed abd el-Aal, Khaled abd elhamid elgamal, Hisham Mohamed Farouk, Islam sayed nouh, Mohamed abd elazem hassanin

**Background:** Preoperative anatomical scoring system is helpful to comparison between management options and assessment of postoperative consequences in patients with small renal cancers. This study aimed to assess the value of the R.E.N.A.L. nephrometry score (RNS) in predicting perioperative outcomes in patients with renal tumor

**Methods:** thirty three patients who had localized renal tumor managed by open surgery between February 2018 to February 2020. Patients were divided into three groups according to their RNS (low, moderate, and high). Clinical characteristics with perioperative variables, complications, and RNS were compared to assess the differences between the three groups. Multivariable logistic regression analysis was used to analyze the risk factors of postoperative complications.

**Results:** According to the RNS, there were 18, 10, and 5 patients in the low, moderate, and high RNS groups, respectively. There were significant differences in estimated blood loss, warm ischemia time, operation time, perioperative creatinine clearance change , and number of patients with complications among the three groups. The values for EBL, WIT, OT, PCCC, and NPC for patients in the high RNS group were higher than those for patients in the low RNS group. After adjustment for OT, WIT, and EBL, RNS was statistically significantly associated with the risk of postoperative complications in a multivariable logistic regression model (odds ratio = 1.541, 95% confidence interval: 1.059–2.242, *P* = 0.024).

**Conclusions:** The RNS is a valuable tool for evaluating the complexity of renal tumor anatomy. It can aid surgeons in preoperative decision‑making concerning management therapy. Future multicenter, large sample size studies are warranted for evaluating its predicting performance of perioperative outcomes.

**Key words:** Laparoscopic Partial Nephrectomy; R.E.N.A.L. Nephrometry Score; Renal Cell Carcinoma

**Introduction**

The use of partial nephrectomy continues to increase. In 2005, approximately 27% of patients with tumors less than 4 cm underwent partial nephrectomy, with the majority undergoing radical nephrectomy. Nowadays, partial nephrectomy (PN) is the current gold standard treatment for small localized renal tumors. **(1)**

The nephrometry score is an imaging-based (computerized tomography or magnetic resonance image) scoring system for assessing the complexity of renal tumors by enabling quantification of anatomical characteristics. **(2)**

We conducted a prospective study on 33 patients with renal tumors who underwent open surgery in benha university, with the aim of evaluating the efficacy of RNS in predicting perioperative outcomes.

**Patients and methods**

Clinical data were obtained, approved with written informed consent from all patients was taken before operation. From February 2018 to February 2020, 33 patients suspected of having RCC provisionally by imaging , were admitted and treated in the Department of Urology, benha university. Patients with bilateral or multiple tumors or metastasis were excluded from this study.

Patients’ data including age, sex, body mass index (BMI), comorbidities, symptoms, laterality of renal tumors, preoperative creatinine, and hemoglobin levels were collected and recorded. Intraoperative data included total OT, warm ischemia time (WIT), and estimated blood loss (EBL). Postoperative data included complications, length of hospital stay, postoperative creatinine and hemoglobin levels, tumor pathology and margins, follow‑up period, and outcomes.

**Surgical technique**

Following general anesthesia, patients were placed in lateral position

Trans costal incision done with dissection till kidney retroperitoneal. The renal vessels were dissected free, and the renal artery was then clamped with bulldog clamps to facilitate excision and suturing. Intraoperative decision either to do radical or nephron sparing surgery . Methylene blue injection was performed to determine if suturing was sufficiently tight, to minimize the occurrence of postoperative urine leakage. All patients were operated by the same team who were aware by the score system .

**Results**

According to the RNS system, among the 33 patients , tumor complexity was low in 18 (53.2%) patients, moderate in 10 (36.0%) patients, and high in 5 (10.8%) patients. The demographic characteristics of the patients are shown in Table 1. The mean age of the patients was 48.2 years and the mean BMI was 27.9 kg/m2. twelve patients were asymptomatic, and symptoms experienced by other patients included hematuria (nine cases) and pain (thirteen cases). seventeen patients had renal tumors on the left side while sixteen patients had them on the right. Regarding comorbidities, five (35.3%) patients had hypertension and five (15.1%) patients had diabetes mellitus. overall mean OT was 122 min (range: 103–135 min), the overall mean postoperative hospital stay (PHS) was 5 days (range: 2-6 days), and the overall mean EBL was 400 ml (range: 50–100 ml). However, there were significant differences in EBL (P = 0.026), WIT (P = 0.001), OT (P = 0.032), perioperative creatinine clearance change (PCCC) (P = 0.045), and the number of patients with complications (NPC) (P = 0.002) among the three groups. The values of EBL, WIT, OT, PCCC, and NPC for patients in the high tumor complexity group were greater than those for patients in the low complexity group [Table 1].

Regarding postoperative complications, multivariable logistic regression analysis indicated that the RNS was statistically significantly associated with the risk of occurrence of postoperative complications (P = 0.024)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Low score (25) | | Moderate score (9) | | High score (6) | | Statistical test (FET) | P value |
| No | % | No | % | No | % |
| Age | 44 |  | 47 |  | 55 |  |  |  |
| Sex  Male  Female | 12  6 | 66.6  33.3 | 6  4 | 60  40 | 3  2 | 60.0  40.0 | 0.54 | 0.812 |
| BMI | 27.1 |  | 28.1 |  | 29.3 |  |  |  |
| Smoking | 10 | 55.5 | 6 | 66.7 | 3 | 33.3 | 1.61 | 0.48 |
| Pain | 6 | 33 | 4 | 40 | 2 | 40 | 1.45 | 0.54 |
| Haematuria | 2 | 11 | 4 | 40 | 3 | 60 | 10.08 | 0.004\*\* |
| Accidentally | 10 | 55.5 | 2 | 20 | 0 | 00 | 6.83 | 0.022\* |
| DM | 3 | 16.6 | 1 | 10 | 1 | 20 | 3.08 | 0.19 |
| HTN | 2 | 11.1 | 2 | 20 | 1 | 20 | 0.86 | 0.80 |
| US  L  R | 8  10 | 44  66 | 5  5 | 77.8  50 | 4  1 | 66.7  20 | 1.34 | 0.59 |
| Blood transfusion | 1 | 5 | 4 | 40 | 4 | 80 | 4.05 | 0.13 |
| Stenting | 0 | 0 | 2 | 20 | 3 | 60 | 4.68 | 0.084 |
| **Post-op follow up** | | | | | | | | |
| Stent | 0 | 0.0 | 1 | 10 | 1 | 20 | 3.22 | 0.38 |
| Infection | 3 | 16 | 2 | 20 | 2 | 40 | 1.6 | 0.51 |
| Leak | 0 | 00 | 1 | 10 | 1 | 20 |  |  |
| Clear RCC | 14 | 77 | 10 | 100 | 4 | 80 | 6.17 | 0.032\* |
| Chromophope RCC | 4 | 23 | 0 | 00 | 1 | 20 | 6.17 | 0.032\* |

Table 1 : differences between three groups.

**Discussion :**

Despite the longer operative time and more blood loss in PN compared with radical nephrectomy, PN has become the standard treatment of small renal masses due to a better functional volume preservation. The detection of small renal masses has increased in the recent years. **(84)**

We retrospectively analyzed 33 patients with renal tumors treated byopen surgery. According to the RNS, 18 patients had low‑complex tumors, 10 patients had moderate complex tumors, and 5 patients had high‑complex tumors. Statistical analyses revealed that there were significant differences in OT, EBL, and WIT between the three groups. The OT, EBL, and WIT increased with increasing tumor complexity. The OT, EBL, and WIT in the high‑complex group were significantly higher than those in the low‑complex group. These data suggest that renal tumors with high complexity required increased cross‑clamp time and are associated with more blood loss compared with those with low complexity. There were 9 cases with perioperative complications in our study. There was a significant difference in the morbidity of complications between the three groups. The morbidity of complications in the high‑complex group was higher than that in the low‑ or moderate‑complex group. Multivariable regression analysis revealed that RNS is a risk factor that predicts the occurrence of perioperative complications. Previous studies have obtained similar results and demonstrated that the RNS is a useful tool in predicting the risk of complications in patients undergoing PN and laparoscopic renal cry ablation.[3-6] Moreover, in patients who underwent robot‑assisted PN, Schiavina et al. reported that RNS was significantly associated with predicting prolonged WIT and high‑grade postoperative complications.[7]

The mean follow‑up period in our study was 6 months, and we identified two cases of postoperative metastasis. Mouracade et al. showed that high R.E.N.A.L. score increases the risk of disease recurrence after PN and R.E.N.A.L. score can predict local recurrence.[8] Nagahara et al. reported that the RNS was an independent predictor of postoperative recurrence in patients with nonsmall localized RCC treated by PN.[9] However, Mufarrij et al. showed that nephrometry‑graded tumor complexity was not related to the surgical outcomes of patients who underwent RAPN, suggesting that the nephrometry system may be not suitable for predicting surgical outcomes,[10] while Wang et al. modified the quantization parameters of the RNS system and demonstrated that the modified RNS system has a good effect in evaluating the operation difficulty of retroperitoneal PN.[11]

The limitation of our study lies in the relatively small sample size , our results were based on the experience of a single surgeon In addition, the mean follow‑up period was 6 months. This relatively short follow‑up period may not exactly reflect the postoperative conditions of the patients

In conclusion, we investigated the efficacy of clinical application of the RNS system for the prediction of peri‑operative outcomes. The RNS is a standardized and feasible classification system for the evaluation of renal tumors. RNS can be used to evaluate tumor complexity and can aid surgeons in preoperative decision‑making concerning management therapy.

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**Conflicts of interest**

There are no conflicts of interest.

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