Original Article

Frequency of renal mass complexities among patients undergoing partial nephrectomy associated with perioperative blood loss.

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Abstract

Background: Partial nephrectomy has emerged as a standard treatment for managing small renal masses. RENAL Nephrometry score (RNS) is a widely used tool for assessing tumors, minimizing bias, and improving clinical outcomes. This study aimed to determine the frequency of various renal mass complexities based on the RENAL nephrometry score in patients undergoing partial nephrectomy and to compare the mean blood loss in these patients.

Methodology: The cross-sectional study was conducted at the Department of Urology, Sindh Institute of Urology & Transplantation, Karachi- Pakistan. Perioperative blood loss after partial nephrectomy was observed in all cases, and patients had their RENAL nephrometry score determined before surgery. The patient's baseline demographic data, including age, gender, and body mass index (BMI), was recorded using a pre-designed Proforma.

Results: According to the RNS, there were 33(52.4%) patients with moderate complexity, followed by 19(30.25%) and 11(17.4%) who had severe and mild complexity, respectively. Furthermore, there was a significant difference in the mean blood loss among the three groups (p=0.025). Among the cofounders, age, BMI, and male gender significantly affected mean blood loss in different RNS groups (p<0.05).

Conclusion: There was a high frequency of moderate renal complexity among the studied patients based on the RNS. A significant difference in the mean blood loss was observed among the patients with mild, moderate, and severe complexity.

Keywords

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Introduction

Renal cancer or renal cell cancer constitutes only about 2–3% of other cancers[1], with most cases occurring in Western European countries. Renal cell carcinomas (RCCs) are responsible for 80 to 85 percent of all intrinsic renal neoplasms and arise in the renal cortex[2]. The precise etiology is uncertain; elderly, obese, and hypertensive individuals are at higher risk. Moreover, patients with concurrent chronic renal failure, dialysis, polycystic kidney disease (PKD), renal stones, etc., are more vulnerable to developing renal cancer[3].

Several researchers have stated that exposure to specific chemical substances in the workplace raises the risk of RCCs. Cadmium, herbicides, asbestos, and trichloroethylene are examples of such chemicals[3]. Oncogenes (MET) and tumor suppressors (VHL, TSC) were the genes whose mutations resulted in RCC development[4]. There are various early clinical signs of disease occurrence; besides, they can cause a variety of non-specific and frequently misdiagnosed symptoms. Only 10% of the patients with RCC have the typical trio, including discomfort, hematuria, and flank mass, and such patients are likely to suffer an advanced form of the disease[5]. In recent years, the widespread use of diagnostic scans, combined with technological advancements, has accelerated the rate of kidney cancers being identified by chance and at initial phases[6,7]. Partial nephrectomy (PN) is supported and strongly recommended for kidney tumors. Its oncologic outcome is comparable to radical nephrectomy, preserves the kidneys' functional status, and lowers the mortality risk[7,8].

The anatomical parameters of the renal mass and the surgeon's expertise determine the viability of PN[9]. Several scoring methods provide additional information on endophytic proportion, size, and depth. These clinical approaches have been offered to assess surgical intricacy and get insights into projected peri- and postoperative treatment efficacy after PN. RENAL Nephrometry score (RNS) is a cumulative score that measures tumor technical complexity[10], and it is a useful tool for estimating perioperative blood loss during partial nephrectomy[11,12].

Early identification of RCC in early-stage renal disease (ESRD) has the advantage of reducing the likelihood of metastatic spread and, thus, death. Without other concerns, ESRD patients are not routinely examined for RCC[13]. Given the low efficiency of systemic medication treatments, surgical resection is the usual treatment for RCC once detected. The benefits of treating these lesions may not outweigh the drawbacks or potential complications of tumor resection in many patients[14,15].

Nephrectomy scores aid urologists in determining the relevant anatomical features, comparing outcomes, and developing appropriate reasoning and decision-making. Hence, the present study aimed to determine the frequency of various renal mass complexities based on RENAL nephrometry score in patients undergoing partial nephrectomy and its association with perioperative blood loss.

Methodology

This cross-sectional study continued from October 24, 2019, to April 23, 2020. The study was conducted at the Department of Urology, Sindh Institute of Urology & Transplantation, Karachi-Pakistan. Based on the least proportion of 16.3%[16] patients with a low score with a margin of error of 9% and 95% confidence level, a sample size of 63 was calculated. All male and female patients attending the study site for partial nephrectomy between 20 to 60 years of age were included. At the same time, patients assigned for re-do nephrectomy or combined procedures like cholecystectomy and a partial nephrectomy and those with excessive blood loss after surgery were excluded. The ethical review board of SIUT approved the study, Reference # SIUT-ERC-2019/A-148, and all ethical guidelines were followed. Before inclusion, written informed consent was taken from all patients, and patient confidentiality was maintained.

Perioperative blood loss after partial nephrectomy was observed in all cases. All patients had their RENAL nephrometry score determined before surgery. The patient's baseline demographic data, including age, gender, and body mass index (BMI), was recorded using a pre-designed Proforma. Statistical analysis was performed on SPSS version 20.0; quantitative variables such as age, weight, height, BMI, perioperative blood loss, and RNS were presented as mean and standard deviation. Qualitative variables like gender, nephrectomy side, and RNS complexity grade were presented as frequency and percentages.

Comparison between perioperative blood loss and complexity grade of RNS was determined using one-way ANOVA. Stratifying confounders such as age, gender, BMI, and side of nephrectomy were done. Post-stratification, ANOVA was applied to assess the association between these confounders and average blood loss in different complexity groups. P-value ≤ 0.05 was taken as a significant difference.

Results

A total of 42 patients (42 males and 21 females) with partial nephrectomy were treated at the study site. The mean age of the patients was 49.7 ± 9.3 years, BMI was 27.1 ± 5.2 kg/m^2, and the mean preoperative blood loss was 270.1 ± 18.3 ml. There were 11(17.4%) mild, 33(52.4%) moderate, and 19(30.2%) severe complexity renal lesions as per the renal Nephrometry Score (RNS).

Table 1: Comparison of preoperative blood loss with grades of renal complexity.

Grades of renal complexity	n	Preoperative blood loss (ml) Mean±SD	p-value
Mild	11	288.5±19.3	
Moderate	33	275.4±20.2	0.025*
Severe	19	267.8±18.5	

*p<0.05 is considered significant.

There was a significant difference in the mean blood loss concerning age and BMI among different RENAL nephrometry score groups (p<0.05). In comparison, the side of nephrometry had no significant effect on the perioperative outcomes.

Table 2: Effect of age, gender, BMI, and side of nephrometry on perioperative blood loss after open partial nephrectomy in different RNS (complexity) groups.

Variables		Grades of renal complexity [n; Mean ± SD]			p-value
		Mild	Moderate	Severe	
Age Group	20-40 years (n=38)	6; 266.6±18.5	22; 305.6±21.3	10;271.1±19.1	0.0001*
	> 40 years (n=25)	5; 274.4±17.8	11; 299.7±18.4	9; 276.9±16.5	0.010*
BMI	18–24 kg/m^2 (n=26)	4; 268.9±18.2	16; 292.6±21.1	6; 261.1±19.0	0.007*
	> 24 kg/m^2 (n=37)	7; 264.6±17.1	17; 287.7±18.3	13; 272.3±16.1	0.008*
Gender	Male (n=42)	8; 271.2±18.8	25; 285.6±20.2	9; 269.3±17.2	0.050*
	Female (n=21)	3; 274.6±18.3	8; 278.1±19.2	10;268.9±15.9	0.547
Side of Nephrometry	Right (n=38)	7;270.2±18.6	19;82.2±19.7	12;267.2±17.8	0.087
	Left (n=25)	4;71.3±17.5	14;269.4±18.3	7;281.3±18.8	0.382

*p<0.05 is considered significant.

Discussion

The present data suggest that age, BMI, and gender significantly affect the perioperative outcomes (average blood loss) after open partial nephrectomy in different RNS groups. The observed mean age of the patients undergoing partial nephrectomy was 49.7±9.3 years. Similar studies also reported a mean age of 59 years, 53.8±12.6 years, and 58±11.9 years[12,16,17]. In this study, 60.3% of patients had surgery for the right kidney, while 39.7% had left kidney surgery. In contrast, Haynet al. [12] reported that 53% of their patients had left kidney surgery, and Bertolo et al.[18] reported in their study that 51% had right kidney surgery, whereas 49% had left kidney surgery. Most patients presenting for the treatment at the study site were males (66.7%). Similar to our findings, Hayn et al.[17], Park et al.[16], Bertolo et al.[18], and Yoo et al.[19] also reported a high frequency of male patients who required open partial nephrectomy.

We observed a mean preoperative blood loss of 270.1±18.3 ml. Similarly, Park et al.[16] reported the blood loss as 263.7±140.1 ml. As per the renal nephrometry score, 17.4% of patients had mild complexity, 52.4% had moderate, and 30.2% had severe complexity. Simhan et al.[17] also reported that 28% of patients had mild complexity, whereas 55.6% had moderate and 16.4% had severe complexity. Jimenez-Romero et al.[20], in their study, reported that 66.6% of patients had mild complexity, 22.2% had moderate, and 11.1% had severe complexity.

The current study data shows that high tumor complexity is directly related to the probability of significant postoperative problems necessitating a subsequent intervention, despite the lack of external confirmation. Partial nephrectomy has been a routine treatment for minor renal tumors in the recent decade, providing oncologic management comparable to radical nephrectomy while preserving the functional status of the kidney and indications of comparable survival. The size of resectable tumors has gotten bigger over time, indicating that NSS's limits are constantly being tested[21]. Most notably, high-complexity stratification was linked to a higher risk of problems

in our group, but intermediate complexity was not, implying that more research is needed to confirm our nephrometric complexity stratification system.

To date, local literature is scarce concerning the usefulness of renal nephrometry score for determining the renal mass complexity among patients undergoing partial nephrectomy. Although the current study demonstrated the frequency of different complexity grades, certain limitations must be considered. Firstly, this was a single-center study with small sample size; hence the outcomes cannot be generalized. Further, large-scale studies, including data from various healthcare facilities in Pakistan, are recommended to corroborate the current study's findings.

Conclusion

It is concluded from the study results that RNS is a valuable tool for assessing the grades of renal complexity. There was a high frequency of moderate renal complexity among the studied patients based on the RNS. A significant difference in the mean blood loss was observed among the patients with mild, moderate, and severe complexity.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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