Original Article

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Comparison of DAP Score with RENAL, PADUA and ABC in Prediction of Laparoscopic Partial Nefrectomy Results

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Abstract

Objective: Many nephrometric scoring systems (NSSs) have been published for use in estimating the outcome of laparoscopic partial nephrectomy (LPN). There are conflicting results about the predictive success of these systems. Here, we aimed to determine to what extent radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines (RENAL), preoperative aspects and dimensions used for an anatomical (PADUA), diameter-axial-polar (DAP), and arterial based complexity (ABC) scoring systems can be included in the treatment plan favoring LPN. We compared these NSSs for their power to predict surgical outcomes.

Materials and Methods: Sixty-two patients who underwent LPN at our clinic were included in this study. Postoperative complication rates, the number of blood transfusions, warm ischemia times (WIT), postoperative hospital stays (PHS), operation times (OT), pathology outcomes, and margin, ischemia, complications (MIC) achievement rates were recorded retrospectively. Total nephrometry scores were calculated from preoperative computed tomography and magnetic resonance imaging images and divided into risk groups. The correlation between nephrometry scores, and surgical outcomes was investigated.

Results: Median age [56.21 (31-80) years] of the patients, and median tumor size (38.89) (11-251) mm was determined. Surgical margin positivity (SMP) developed in 6 (9.7%) cases and major complications (Clavien ≥3) developed in 6 (9.7%) cases. Only DAP scores were statistically correlated with rates of MIC achievement, major complication, is blood transfusion, and PHS (p=0.008, 0.018, 0.011 and 0.006, respectively), while RENAL and PADUA scores with WIT and SMP (p=0.001, 0.002 vs p=0.002, 0.011, respectively), while ABC score with only WIT (p=0.002). None of these scores were correlated with OTs.

Conclusion: DAP score may be used when planning LPN, especially in predicting MIC achievement and major complication rates.

Keywords: DAP score, laparoscopic partial nephrectomy, nephrometry score, RENAL score, PADUA score

Introduction

The rate of incidental diagnosis of kidney masses is increasing with increasing use of imaging methods. These kidney masses usually do not go beyond the renal capsule at the time of diagnosis. The gold standard treatment method for operable T1a (<4 cm) tumors is partial nephrectomy (PN) (1). In non-randomized studies, cancer-specific survival rates of PN equivalent to those of radical nephrectomy (RN) have also been reported for T1b (4-7 cm) tumors (2). Minimally invasive techniques are popular approaches in PN.

Tumor size is not the only factor for PN indication in many kidney masses. The complexity of the tumor anatomy is the main factor in the decision-making process for PN, apart from patient-related factors in clinical practice. Nephrometric scoring systems (NSSs) were, and are being to evaluate this complexity. NSSs such as radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines (RENAL), preoperative aspects and dimensions used for an anatomical (PADUA), Centrality index (C-INDEX), diameter-axial-polar (DAP), arterial based complexity (ABC) are being used in chronological order in clinical practice (3,4,5,6,7). NSSs evaluate the difficulty of surgical management of masses using quantitative parameters.

In many studies conducted, current NSSs have been compared in terms of perioperative and postoperative variables in predicting surgical outcomes. Nevertheless, there is no consensus on which the scoring system is superior and most usable. This study

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aimed to determine which of the RENAL, PADUA, DAP and ABC scoring systems is superior in predicting laparoscopic partial nephrectomy (LPN) outcomes.

Materials and Methods

Patient Selection and DATA Collection

This study was conducted retrospectively, per the Helsinki Declaration and the ethics committee's approval numbered 2019/10-2 and dated 30.10.2019 in the urology clinic of University of Health Sciences, Bursa Yüksek İhtisas Training and Research Hospital. An informed consent form was obtained from all patients. Patients aged 18-80 years who underwent transperitoneal LPN in a urology clinic for renal masses between January 2016 and November 2019 were investigated. Only patients who had been operated on with the laparoscopic method were included in the study. Patients who had to undergo open nephrectomy and patients who had undergone RN were excluded from the study. Surgical procedures were performed by 4 different experienced surgeons. Two of these surgeons were experienced (minimum experience of 25 NSSs) and the other two were at the beginning of the learning curve (experince level <25 NSSs).

Nephrometry Scores and Surgical Technique

Computed tomography (CT)/magnetic resonance (MR) images of all patients obtained within 3 months preoperatively were examined. The maximum tumor size, depth, location, and laterality of the tumor were recorded. These images were examined in axial and coronal sections to calculate nephrometry scores from one urologist. All nephrometry scores were coded by dividing them into the total score and categorical risk groups according to the complexity level. RENAL scores were calculated based on the maximum tumor size, endophytic/exophytic ratio, distance of the tumor from the collecting system, and its location RENAL. The total RENAL score was assessed in low (4-6), moderate (7-9), and high (10-12) risk groups. The total PADUA score was also assessed in low (6-7), moderate (8-9), and high (10-14) risk groups. The anatomical features examined in this score were the location of the tumor relative to the polar line, exophytic rate, relationship with the renal sinus and collecting system, tumor size, and lateral or medial location of the tumor. The total DAP score was assessed in low (3-5) and high (6-9) risk groups. The DAP score was calculated on the basis of 3 parameters as tumor size, distance of the tumor from the center of the kidney in the axial section, and the distance of the tumor from the center of the kidney in the coronal section. Each parameter was scored between 1 and 3 points, and the DAP sum score ranged between 3 and 9 points.

ABC score was assessed in low (Category 1 and 2) and high (Category 3S and 3H) risk groups. Scores were also assigned to the groups according to the arterial branches to be dissected, including groups 1 (interlobular and arcuate arteries), 2 (interlobar arteries), 3S (segmental arteries), and 3H (renal artery, hilar arteries).

All surgeries were performed laparoscopically through the transperitoneal route. The mass was first exposed after the pneumoperitoneum was created with 4 trocars with the patient in the lateral decubitus position. Then, the pedicle was taken under control. The mass was marked with cautery and cut with scissors. Following renography the mass was removed, and placed in an endobag.

Preoperative and Perioperative Outcome Parameters

Operative demographic data were recorded. Follow-up visits were made at 3 and 6 months postoperatively. At each visit, the evaluation was performed by serum creatinine. Perioperative parameters such as warm ischemia time (WIT), postoperative hospital stay, number of blood transfusions, and operation times (OT) were recorded. WIT was evaluated separately as a numerical value, and the number of patients with WIT <20 min. Postoperative complications were evaluated according to the Clavien-Dindo complication classification system (8). Grade 3 and above group evaluation was recorded as a major complication. Pathological tumor size and histological subtypes were evaluated according to the World Health Organization (9), and tumor extent and stage were assessed according to tumor-node-metastasis classification (10). The surgical margin positivity (SMP) was also evaluated as a tumor extending beyond the parenchymal margin marked with ink. Besides, the margin, ischemia, complication (MIC) score was used to evaluate the optimal outcome success in PN (11), which takes negative surgical margin, WIT <20 min and absence of major complications into consideration. We assessed only patients whose pathology was reported as malignant according to the MIC achievement criteria.

Statistical Analysis

SPSS (Statistical Package for the Social Sciences) version 22.0 program and the Shapiro-Wilk test were used for the analysis of data. The Mann-Whitney U test was used for pairwise comparisons and the Kruskal-Wallis test to compare more than two groups. Pearson's chi-square test and Fisher's chi-square test were used for the comparison of categorical variables. Relationships between the variables were calculated by Spearman correlation analysis. The significance level of outcomes was set at $p<0.05$.

Results

Ninety-three patients who met the inclusion criteria were included in the study. From this retrospective study, 10 patients who did not come to their postoperative controls, 9 patients with missing data, and 12 patients who switched to open surgery during LPN were not included. The remaining 62 patients who underwent LPN were included in the study.

The median age of the 62 patients was 56.21 (31-80), and the female/male ratio was 22/40. The median tumor size measured by CT was 38.89 (11-251) mm. The median tumor size in the pathology specimen was 38.57 (11-242) mm. SMP developed in 6 (9.7%) patients.

Table 1: Median scores and pathological characteristics.

The median postoperative hospital (PHS) was 4 (2-16) days. Median WIT was recorded as 20 (11-35) min. Two patients were operated using non-clamp technique. Median OT was recorded

Table 1. Demographic, pathological and radiological data of the patients	
n=62	
Age (year) (median) (min-max)	56.21 (31-80)
Gender (n%)	
Female	22 (35.5)
Male	40 (64.5)
Side (n%)	
Right kidney	33 (53.2)
Left kidney	29 (46.8)
Tumor size (mm) (median) (min-max)	38.89 (11-251)
Renal score (median) (min-max)	6 (4-10)
Padua score (median) (min-max)	8 (6-13)
Dap score (median) (min-max)	5 (3-9)
Malign tumors (n%)	49 (79)
Pathology (n%)	
Angiomyolipoma	5 (8.1)
Oncocytoma	3 (4.8)
Cyst	1 (1.6)
Chronic pyelonephritis	4 (6.5)
RCC clear cell	43 (69.4)
RCC papillary	5 (8.1)
RCC chromophobe	1 (1.6)
STAGE (n%)	
STAGE 1a	35 (71.4)
STAGE 1b	12 (24.5)
STAGE 2a	2 (4.1)
Tumor size (In the pathology specimen) (mm) (median) (min-max)	38.57 (11-242)
Surgical margin positivity (n%)	6 (9.7)

Table 2. Perioperative variables	
Operation time (minutes) (median) (min-max)	200 (110-255)
Warm ischemia time (minutes) (median) (min-max)	20 (11-35)
Warm ischemia time (minutes)	
<20 minutes	39 (63)
>20 DK minutes	21 (33)
Non clamp	2 (4)
Postoperative hospital stay (day) (median) (min-max)	4 (2-16)
For malign tumors	
MIC success (n%)	27 (55.1)
MIC failure (n%)	22 (44.9)
MIC: Margin, ischemia, complications	

as 200 (110-255) min. MIC achievement criteria for malign tumors were met in 27 (27/49: 55.1%) patients (Table 2).

According to the Clavien classification of surgical complications complications were observed in 22 (35.4%) patients within the first month postoperatively. Complications were grade 1 (8%) in 5, grade 2 (17.7%) in 11, grade 3a (6.5%) in 4, and grade 3b (3.2%) in 2 patients. Double J stent was required due to opening of the collecting system in 3 patients with grade 3a complications. In one patient, the hematoma was evacuated from the bladder by performing cystoscopy. Postoperative angioembolization was required in 2 patients with grade 3b complications. No patient developed grade 4 or 5 complications.

Table 3: The distribution of patients' nephrometry scores according to risk groups and total scores.

All nephrometry scores were correlated with each other and continuously variable surgical outcomes (WIT, OT, PHS). DAP score was statistically significantly correlated with WIT and PHS ($p<0.001$, $p=0.021$). While the RENAL score was statistically significantly correlated with WIT ($p<0.001$), no statistically significant correlation was found with PHS ($p=0.157$). PADUA score was statistically significantly correlated with WIT ($p<0.001$). ABC score was statistically significantly correlated with WIT ($p<0.001$), no correlation was found with PHS ($p=0.155$). None of the scores were statistically significantly correlated with OT (Table 4).

Table 3. Patient-based distribution of scoring systems		
	Risk Group	**n (%)**
RENAL	**Low** **Intermediate** **High**	36 (58) 18 (29) 8 (13)
PADUA	**Low** **Intermediate** **High**	27 (4.6) 23 (37.1) 12 (19.3)
DAP	**Low** **High**	38 (61.3) 24 (38.7)
ABC	**Low** **High**	38 (61.3) 24 (38.7)
RENAL: Radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines, PADUA: Preoperative aspects and dimensions used for an anatomical, DAP: Diameter-axial-polar, ABC: Arterial based complexity		

Table 4. Correlation between continuously variable surgical outcomes and nephrometry scores			
	WIT	**PHS**	**OT**
RENAL score	r=0.482*	r=0.182	r=0.236
PADUA score	r=0.490*	r=0.225	r=0.212
DAP score	r=0.542*	r=0.292*	r=0.195
ABC score	r=0.446*	r=0.183	r=0.147
RENAL: Radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines, PADUA: Preoperative aspects and dimensions used for an anatomical, DAP: Diameter-axial-polar, ABC: Arterial based complexity, WIT: Warm ischemia times, OT: Operation times, PHS: Postoperative hospital stays, *p<0.05 (Spearman correlation test was used)			

Table 5. Mean scores and p values according to SMP, MIC success, general complication, major complication and presence of transfusion								
	RENAL	p	PADUA	p	DAP	p	ABC	p
SMP								
+	8.17±1.72	**0.007**	9.83±1.72	0.02	6.17±0.41	0.069	2.33±0.52	0.950
-	6.02±1.53		8.07±1.53		5.26±1.59		2.28±0.73	
MIC success								
+	6.00±1.66	0.187	7.96±1.76	0.089	5.00±1.71	0.014	2.15±0.77	0.167
-	6.64±1.70		8.68±1.43		5.8±1.14		2.45±0.59	
General complication								
+	6.59±2.06	0.386	8.18±1.59	0.822	6.00±1.90	0.073	2.29±0.69	0.485
-	6.07±1.79		8.13±1.83		5.04±1.55		2.13±0.84	
Major complication								
+	7.50±1.76	0.076	9.00±1.41	0.146	7.00±1.41	0.009	2.5±0.84	0.297
-	6.07±1.84		8.05±1.77		5.13±1.63		2.14±0.79	
Presence of transfusion								
+	6.91±2.21	0.234	8.55±1.75	0.373	6.73±1.79	0.005	2.36±0.81	0.346
-	6.06±1.77		8.06±1.76		5.0±1.52		2.14±0.8	

RENAL: Radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines, PADUA: Preoperative aspects and dimensions used for an anatomical, DAP: Diameter-axial-polar, ABC: Arterial based complexity, MIC: Margin, ischemia, complications, SMP: Surgical margin positivity, Mann-Whitney U test was used

In terms of the correlation between nephrometric scores and categorical outcomes (MIC achievement, complication, SMP), only the DAP score was statistically significantly correlated with MIC achievement, major complications, and transfusion rates (p=0.014; 0.009; 0.005). Only RENAL and PADUA scores were statistically significantly correlated with SMP (p=0.007; p:0.02, respectively). None of the scores were statistically significantly correlated with the presence of general complications (Table 5).

When the scores were divided into risk groups, WIT and all nephrometry scores were found to be statistically significantly correlated (p values for RENAL, PADUA, DAP, ABC scores were 0.001, 0.002, <0.001, 0.002, respectively). The presence of major complications, PHS and MIC achievement were statistically significantly correlated with only the DAP score (p=0.018, p=0.006, p=0.008). RENAL, PADUA and DAP scores were significantly correlated with SMP (p=0.002; p=0.011; p=0.003). Only the DAP score was statistically significantly correlated with perioperative blood transfusion (p=0.011). The presence of general complications and OT did not significantly correlate with any nephrometry score (Table 6).

Discussion

NSSs help surgeons who are hesitant to make decisions favoring nephron-sparing surgery for renal masses. The most successful system for predicting perioperative outcomes has not yet been determined. Many authors have compared scoring systems in dual, triple, or quad combinations and obtained different results (12,13). We conducted an analysis comparing four NSSs. According to the results of our study, the DAP score was superior to RENAL and PADUA scores, which are the best known and most used scores in predicting MIC achievement and complications.

In the literature, there are different definitions for the term trifecta (14,15). We used the MIC score defined by Buffi et al. (11). Twenty-seven (55.1%) of 49 patients with malignant pathology in our study met the MIC achievement criteria. Among these criteria, the rates of surgical margin negativity, WIT of <20 min, and lack of major complications were recorded as 90.3%, 63%, and 90.3%, respectively. The rates obtained from our study were slightly lower than the reference study consisting of 99 patients who had undergone robot-assisted PN (surgical margin: 93%, ischemiea: 83%, complication: 90%, MIC: 76%) (11). Since the cases in our series were performed using the laparoscopic method, the achievement rate of MIC was lower. The difficulties in the suturing and reconstruction stages in the laparoscopic technique reduce the MIC achievement rates compared to the robotic technique (16). Only the DAP score was correlated with MIC achievement rates in our study. The study by Borgmann et al. (13) is the only study evaluating the MIC achievement rate of the DAP score. In this study, DAP score was not found to be a predictor of MIC achievement in univariate or multivariate logistic regression analysis. A study was published showing that DAP score is a predictor of the trifecta, although the authors used a different definition for trifecta (14,17). For the first time, our study has demonstrated the correlation between MIC achievement, which is the criterion showing the optimal surgical success of DAP score and provides information to the literature.

In our study, consistent with the literature, the overall, and major complication rates were 35.4% and 9.7%, respectively, while none of the nephrometry scores were correlated with overall complication rates. Only the DAP score was significantly correlated with major complications and blood transfusion rates. A limited number of external validation studies of the DAP scoring system have been performed for predicting complications both in the index study and other studies, especially the decrease in GFR and its correlations with WIT have been demonstrated (5,18). Only in one study of robotic series, DAP was shown to be a predictor of major complications (19). As far as we know,

firstly our study has shown that DAP score is a predictor of major complications seen in laparoscopic series.

During PN, the risk of SMP remains a matter of concern. In the literature, its incidence ranges from 0% to 7% (20). Although its effect on cancer recurrence and mortality is controversial, it is imperative to avoid SMP as much as possible. The rate of SMP was determined as 9.7% in our study. Besides, RENAL, PADUA, and DAP scores could predict SMP in our study. The RENAL score showed the best correlation with SMP. According to our estimation, the reason for the success of the RENAL score in this regard may be its assessment of parameters such as the depth of the tumor, its relationship with the collecting system, or renal sinus, which are strongly correlated with SMP.

A high nephrometry score almost always directly affects WIT, which reflects tumor complexity. Although the cut-off value of WIT in terms of long and short-term maintenance of renal function varies between 20 and 25 minutes, it has also been reported that WIT even up to 40 min does not cause loss of renal function (21). In our study, when 2 patients in whom arterial clamping was not performed were excluded, the mean WIT was found to be 20 (11-35) min. Besides, all four NSSs were correlated with increased WIT. Nevertheless, the DAP score showed the best correlation. WIT essentially reflects the difficulty of surgical resection. The DAP score showed the best correlation with WIT in our series because of the influence of the C-INDEX score in creating the DAP score. The C-INDEX score was revealed in a laparoscopic series, which was also significantly correlated with WIT in this study (p=0.004) (6).

A shorter PHS is a benefit of the minimally invasive approaches. The median PHS of the patients in our series was 4 (2-16) days. PHS is essentially correlated with the presence of some postoperative complications. Although major complications are more frequent, the development of any complication is expected to prolong PHS. The DAP score, which is the only predictor of the major complication rate, was the score that correlated with PHS in our study. Since patient-related factors other than tumor characteristics may affect the PHS, conflicting results have been reported in the literature.

OT affect the surgical outcomes and reducing this time helps decrease the rates of perioperative complications. The correlation between nephrometry scores and OT has been investigated and a significant correlation between OT and nephrometry scores has been demonstrated (13,22). Contrary to the literature findings, in our study none of the nephrometry scores were significantly correlated with OT. To our knowledge, factors such as patient characteristics, surgical history, difficulty of hilar dissection affect OT more than tumor size and location. In particular, the thickness of perinephric fatty tissue and adherent perirenal adipose tissue significantly and adversely affects the dissection process and thus OT. Khene et al. (23) reported that patients with adherent perirenal adipose tissue had a more significant blood loss, prolonged OT, and conversion to RN. Macleod et al. (24), as for that, showed that the thickness of the perinephritic fatty tissue, especially in the medial and posterior, increased OT. The Mayo Adhesive Probability score predicts the presence of adherent perinephritic fatty tissue based on radiological and clinical data (25). Therefore, it would be more logical to use a

Table 6. Correlation of nephrometric risk groups with surgical outcomes

	RENAL				PADUA				DAP			ABC		
	Low (n=36)	Intermediate (n=18)	High (n=8)		Low n=27	Intermediate n=23	High n=12		Low n=38	High n=24		Low n=38	High n=24	
WIT (mean ± SD)	19±5	23±5	26±7	**p=0.001**	18±5	23±6	23±6	**p=0.002**	19±5	25±6	**p<0.001**	19±5	24±6	**p=0.002**
OT (mean ± SD)	181±38	204±18	188±37	p=0.066	178±41	196±24	198±30	p=0.13	186±38	193±29	p=0.556	184±39	195±26	p=0.302
Complication clavien >0 (n%)	9 (25)	8 (44)	5 (62.5)	p=0.545	7 (25)	11 (47)	4 (33)	p=0.266	10 (26)	12 (50)	p=0.157	10 (26)	12 (50)	p=0.506
Complication major (n/%)	1 (2.7)	4 (22)	1 (12.5)	p=0.072	1 (3.7)	3 (13)	2 (16.6)	p=0.355	1 (2.6)	5 (20.8)	**p=0.018**	1 (2.6)	5 (20.8)	p=0.068
Blood transfusion (n%)	4 (11.1)	4 (22.2)	3 (37.5)	p=0.176	3 (11.1)	6 (26)	2 (16.6)	p=0.383	3 (7.8)	8 (33.3)	**p=0.011**	4 (10.5)	7 (29.1)	p=0.162
PHS (mean ± SD)	4±2	5±4	5±2	p=0.286	4±2	5±3	5±2	p=0.221	4±1	6±4	**p=0.006**	4±2	5±3	p=0.322
MIC success (n%)	17 (47.2)	8 (44.4)	2 (25)	p=0.454	13 (48.1)	9 (39.1)	5 (41.6)	p=0.173	20 (52.6)	7 (29.1)	**p=0.008**	16 (42.1)	11 (45.8)	p=0.517
SMP (n%)	1 (2.7)	2 (11.1)	3 (37.5)	**p=0.002**	1 (3.7)	1 (4.3)	4 (33)	**p=0.011**	0 (0)	6 (25)	**p=0.003**	4 (10.5)	2 (8.3)	p=0.543

RENAL: Radius, exophytic/endophytic properties of the tumor, nearness of tumor to the deepest portion to the collecting system or sinus, anterior/posterior descriptor and the location relative to the polar lines, PADUA: Preoperative aspects and dimensions used for an anatomical, DAP: Diam-eter-axial-polar, ABC: Arterial based complexity, WIT: Warm ischemia times, OT: Operation times, PHS: Postoperative hospital stays, MIC: Margin, ischemia, complications, SMP: Surgical margin positivity, SD: Standard deviation, Mann-Whitney U, Kruskal-Wallis, chi-square and Fisher's Exact tests were used

nephrometry score that also considers perinephric fatty tissue thickness to predict OS.

RENAL and PADUA scores have been used most prevalently. In a meta-analysis of 51 published studies conducted on nephrometry scores in 2019, the ability of all nephrometry scores to predict surgical outcomes was examined (26). Due to this meta-analysis, RENAL and PADUA scores, which are the first-generation scores, were found to be more successful than other scoring systems. Despite that, some results in our study contradict the results of this meta-analysis. In our study, as supported by some publications, DAP score was superior to RENAL and PADUA scores in general and especially in estimating MIC achievement rates. Yoshida et al. (27) stated that the DAP score was more predictive of WIT and median blood loss than the RENAL score, while Naya et al. (28) stated that the DAP score showed a better correlation with the choice of surgical method (laparoscopic/open) than the RENAL score. Indeed, DAP score is "simply the enriched" version of the RENAL score. Namely, in the index study in which the DAP score was defined, by removing parameters with low predictivity such as "position relative the polar lines" and "anterior/posterior location" in the RENAL score from the system and integrating it with the C-INDEX score, DAP score has been optimized and made easier to calculate (5). Besides, the cut-off values in the tumor size parameter were changed as they were thought to be too stringent. These moves explain why the DAP score is superior to the RENAL score.

In our study, ABC and PADUA scoring systems had partially lower predictivity relative to DAP and RENAL systems in foreseeing perioperative outcomes. In line with our results, the study of Antonelli et al. (22), the ABC NSS has not been shown to be superior to the RENAL and PADUA systems in terms of predicting perioperative outcomes. The ABC scoring system may include tumors of different complexity in the same category. This system needs to be better defined, in terms of other anatomical characteristics (for example; such as tumor size, distance from the collecting system, and renal sinus). We think that some parameters of the PADUA NSS, such as polar location and renal contours, reduce the predictive feature of this score. Our opinion was also supported by Minervini et al. (29) They investigated the predictive values of the parameters of the score separately and the PADUA score evaluated and showed that only endophytic/exophytic ratio, renal sinus invasion, collecting system invasion, and tumor size had significant predictive values. Ficarra et al. (30) who defined the PADUA system in 2009, tried simplifying this scoring system, and 10 years later, in 2019, they developed a new scoring system called Simplified Padua Renal. In this publication, parameters as the polar location and collecting system invasion were excluded from the system, and their novel 4-parameter system was found to be similar to the original PADUA system in predicting complication(s). Therefore, parameters with low predictivity should not be included in the criteria of the PADUA scoring system.

Study Limitations

Predominant strength of our study is the demonstration of the higher predictive value of DAP scoring system in foreseeing the MIC achievement rate relative to the first-generation NSSs. However, retrospective design of the study, and small number of patients were the limitations of our study. Nevertheless, in the literature, series with a larger number of patients have compared nephrometry scores in cases undergoing open, laparoscopic or robotic methods in various combinations. Since we believe that surgical technique may affect the results independently of nephrometry scores, only laparoscopic surgery patients were included in our study. Hence, we think that although our study group consisted of a small number of patients, it was more homogeneous. As another study limitation, the surgeries were performed by different surgeons. We conceive that the experience of the surgeon seriously affects the results. Accordingly, performing all operations by a single experienced surgeon may provide a more objective evaluation of the predictive value of nephrometry scores.

Conclusions

In conclusion, DAP score is a strong predictor of pre-LPN MIC achievement and complications.

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Ethics

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Authorship Contributions

Critical Review: M.K., Concept: Ö.E., S.Z., Design: Ö.E., Supervision: Ö.E., S.Ç., S.Ö., S.A., Data Collection or Processing: Ö.E., Analysis-Interpreation: E.Ö., Literature Review: M.K., Writing: E.Ö., S.Ç., S.Ö., S.Z., S.A.

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