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Surgical Management of Renal Cell Carcinoma

Comparisons of open versus laparoscopic approach

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Abstract:

***Objectives*:** Renal Cell Carcinoma (RCC) is one of the foremost urological malignancies. In Oman, an age-standardized incidence rate of 2.5 per 100,000 per year is reported. There is a trend towards early detection and use of minimally invasive technology for the treatment of RCC. Aim of our study was to report the changing trend in clinical presentation and RCC management, including to compare the outcomes of laparoscopic versus open nephrectomy in Oman. ***Methods*:** After ethical committee's approval, the bio-data for adult patients and peri-operative details were collected, who were diagnosed with RCC between 2011 and 2022. We analyze the variables, both continuous and categorical by Chi-square analysis. The p-value <0.05 was set as a level of significance. ***Results*:** Fifty-six patients underwent surgical treatment of RCC. Among them, 34 patients underwent laparoscopic nephrectomy (LN) and 22 open nephrectomy (ON). The mean age in the LN group was 53.82 years ± 13.44, and 56.2 years ± 15 (p-value 0.535) in ON group. Forty-seven patients were of Omani descent and 9 patients were expatiates. The mean tumor size was 6.25 ± 3.16 and 9.2 ± 5.20 cm for the LN and ON groups, respectively. More than 55% cases were incidentally diagnosed. Over the years there has been a

trend towards LN. ***Conclusion*****:** In our study, we found a trend towards early diagnosis with majority of cancers discovered incidentally. We also recognized that laparoscopic approach is more commonly employed in the surgical management with acceptable morbidity. These trends are in congruence with the global literature.

Keywords: nephrectomy, laparoscopic, open, renal cell carcinoma

Advances in Knowledge:

- Laparoscopic approach is the modern standard of care in the surgical management of kidney cancer.
- This report is the first large case series of laparoscopic nephrectomy from our part of the world. In this study the we report the increasing trend of incidentally discovered tumors which is in similarity with the trend in developed world. This study also compares the outcome of laparoscopic and open nephrectomy and confirms that laparoscopic approach is safe and oncological efficient modality for treatment of renal tumors.
- This study will help is establishing new standard of care and provide local reference for further studies from this part of the world.

Applications to patient care:

- This article has explored the safety and efficiency of minimally invasive approach for management of renal cancer for both large and small renal masses.
- This report confirms that both radical and partial nephrectomy can be safety performed in our local set up and thus the patients should be offered laparoscopic treatment as the first preference unless there is a specific contraindication. This article also highlights the importance of abdominal imaging and incidental diagnosis of renal mass.
- These tumors should not be overlooked as majority of solid renal masses identified on imaging are malignant and timely treatment has excellent cure rate.

Introduction:

Kidney cancer is ranked 3rd most common urological malignancy with a global incidence of 2.8/100000. Renal cell carcinoma (RCC) is the predominant type comprising nearly 8 of 10 renal tumors.[1] In Oman the age standardized incidence rate (ASR) for kidney cancer is 4.0 in

males and 1.9 in females. In the last three decades there has been a rising trend in the diagnosis of RCC in Oman. [2] International literature has attributed this rise due to increases use of diagnostic imaging with most cancers being diagnosed incidentally.[3] First laparoscopic nephrectomy was performed in 1991 and since then advancements in minimally invasive surgical techniques have made laparoscopic approach as the gold standard for surgical management of RCC.[3,4] Early diagnosis and effective surgical management has resulted in improved survival rates.[5] For small renal masses, partial nephrectomy (PN) is now the current standard but due to several anatomical and logistic factors still a large proportion of RCC are not amenable for PN.[6,7] This study aims to report a descriptive analysis of patient demographics, mode of clinical presentation, and surgical and immediate oncological outcomes. We also compared the safety and efficiency of laparoscopic and open nephrectomy for RCC.

Methods:

After ethical committee's approval, hospital information system was used to identify all patients who presented to our institution with the diagnosis of renal cell carcinoma (RCC). between 2011 and 2022. In this retrospective study we excluded patients under the age of 12 and those with other kidney cancers like upper tract transitional cell carcinoma (TCC). The variables recorded included patient's biodata, mode of presentation, diagnostic modality, final histopathology and details of treatment received including the peri-operative outcomes. We analyze the variables, both continuous and categorical by Chi-square analysis. The p-value <0.05 was set as a level of significance. The intraoperative and postoperative complications were graded based on the Clavien-Dindo system.[8]

Results:

In this retrospective study 56 patients were included who were managed at the Sultan Qaboos University Hospital (SQUH) from January 2011 to December 2022. Thirty-four patients underwent laparoscopic nephrectomy, 25 underwent laparoscopic radical nephrectomy (LRN), and 9 patients had laparoscopic partial nephrectomy (LPN). On the other hand, 22 patients underwent open nephrectomy, 16 patients underwent open radical nephrectomy, and 6 patients had open partial nephrectomy (OPN). Forty-seven patients were of Omani descent and 9 patients were expatriates. There was no difference in the mean age of the patients. The demography,

gender distribution, laterality is described in Table 1. The mean tumor size was 6.25 cm ± 3.16 and 9.2 cm ± 5.20 for the laparoscopic and open groups, respectively. At the time of clinical presentation 55.3% of the cases were incidentally diagnosed, the other symptoms are detailed in Table 1. Fifteen patients underwent partial nephrectomy (9=LPN, 06=OPN) for polar tumors with the tumor location at the lower pole in 8 and upper pole in 7 patients respectively. The mean estimated blood loss (EBL) during surgery was lower in the laparoscopic approach compared to the open approach, 352 ml ± 401 vs. 513 ml ± 616, and surgery time was slightly shorter in the laparoscopic approach, with a mean of 205 min ± 73 vs. 217 min ± 161 for ON. However, as shown in Table 2. none of these differences were statistically significant. The complications were graded as per Clavien-Dindo system, four patients in the LN and five patients in ON had grade 1-2 complications. Grade 3-4 complications were observed in 3 cases of LN and 4 cases in ON, this difference was not statistically significant (p= 0.230). The difference in mean post operative duration of hospital stay was statistically significant in favor of laparoscopic approach, 5 days vs. 7 days (p-value = 0.04). Predominantly the RCC was of clear cell type in 34 cases (60.7%) and non-clear cell type in 22._Among non-clear cell RCC, 12 were chromophobe carcinoma, 7 were papillary carcinoma, 1 case of oncocytoma. There were 2 unique cases of primary squamous cell carcinoma. The final TNM staging is illustrated in Table 3. The nuclear grades are shown in Figure 1. where it can be seen that grade 2/3 accounted for almost 90%. The increasing in the trend towards the laparoscopic approach in the recent years is illustrated in Figure 2.

Discussion:

In the western hemisphere the diagnosis and treatment of RCC has significantly changed in recent times due to widespread use of imaging modalities and dispersion of minimally invasive technology.[9] In this report we looked into the patterns of presentation and changing trends of treatment of RCC in our part of the world. Oman cancer registry in 2019 reported on the Kidney cancer incidence in Oman with the cases almost doubling from 24 in 2011 to 53 in 2019.[2] This increase in incidence without increase in mortality is arguably a reflection of more cases being not only diagnosed incidentally but also at an early stage, a trend well established in other parts of the world.[10] We also found that 55.3 % of our patients were diagnosed incidentally. As seen in international literature, we also report early-stage cancer in the majority of our patients

with 48.2%, 225 and 16% cases are diagnosed as clinical stage T1, T2 and T3 respectively.[11] There were 2 rare cases of primary squamous cell carcinoma which has been reported by the authors.[12] The final pathological stage in our study is shown in Table 3. Most of the cases were early stage < T3a. Six patients had renal vein/IVC thrombus and required open IVC exploration. There were 2 patient who had metastatic disease and underwent cytoreductive nephrectomy. In all no patient of radical or partial nephrectomy had positive surgical margin requiring revision surgery.

Since the first laparoscopic nephrectomy performed in 1991 the trend has now dispersed around the world with minimally invasive technique now established as the gold standard for surgical treatment of RCC.[13] We have looked at the adoption of LN at our institute and report a similar trend as seen in Fig 2. The temporal delay in the adoption of laparoscopic approach as compared to the western world is attributable to training of human resources and logistics. Recent trend at our center shows that open radical nephrectomy is only performed for cases with very large tumors or those with large renal vein thrombus or inferior vena cava thrombus. In our series there were 6 patients with T3b-c disease. On the other hand, for smaller RCC the current standard of care is partial nephrectomy, which has been proven to have excellent oncologic control without the morbidity of losing functional nephrons.[13] We performed partial nephrectomy in 15 cases, including 9 laparoscopic and 6 open. Currently nephron-sparing surgery is preferable with a laparoscopic/robotic approach,[14] However in certain anatomical locations, patient co-morbidity and availability of robotic assistance are major hurdles.[15] Currently we do not have access to robotic system and considered open partial nephrectomy as a safer alternative in these cases.[16]

To establish safety and efficacy of the laparoscopic approach we looked at the operative variables like duration of surgery (DOS), EBL, hospital stay and surgical complications and the laparoscopic approach with open approach. Table 2 illustrates the comparison of the two approaches. The mean size of the tumor was statistically different among the two groups (6.25 vs. 9.23 cm, p=0.02). The mean duration of surgery was slightly shorter in the laparoscopic group (205 vs 217.82 minutes) and EBL was also less in the laparoscopic group (351.7 ml vs. 512.9 ml), however, these differences were not statistically significant. As expected, the mean

duration of hospital stay was longer in the open approach, 5 days and 7 days for the laparoscopic and open approach respectively, and it is statistically significant (P-value = 004). Matheus et al. in a case series of 505 patients also reported similar findings.[17]

The surgical complications were graded according to the Clavien-dindo system. Three patients in the laparoscopic group developed complications whereas 5 patients developed complications in the open approach, however, this is not statistically significant (P-value = 0.230). There were two cases of conversion from pure laparoscopic to hand-assisted laparoscopic approach. The details of complications are shown in Table 2. Recent literature from a large cohort study also shows a lower complication rate for minimally invasive approach.[18]

The median follows up in this study was 40 months, with overall survival (OS) was 95%. In a recent study from a neighboring country similar survival has been reported by Junejo *et al.* [19]

Conclusions:

In our study, we found a greater number of patients diagnosed incidentally with small renal masses which is in concordance with the published literature. The surgical treatment of RCC at our center has shown a changing trend with an increasing number of patients being treated with laparoscopic approach for both radical and partial nephrectomy. The intra operative data and the complication rates also support the safety and efficacy of laparoscopic approach at our center. Thus, conclude that widespread use of imaging has resulted in diagnosis of early stage RCC and minimally invasive laparoscopic technique is the best approach to surgically manage kidney tumors.

Conflicts of Interest

The authors declare no conflict of interests.

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Author Contributions

Substantial contributions to conception and design, acquisition of data or analysis and interpretation of data were made by KMS, NNJ, NA and SA. Drafting of the article or critical revision were done by NNJ, NA, SA and KMS. All authors approved the final version of the manuscript.

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Table 1: Demography and baseline characteristics of all patients undergoing surgical treatment of Renal Cell Carcinoma (n=56)

Variables	**Frequency (%)**
Age in years	56
Gender	
Male Female	34 (60.71) 22 (39.29)
Region	
Oman Outside	47 (84) 09 (16)
Smoking	18 (32.14)
Body Mass Index	
Normal	18 (32.14)
Overweight	22 (39.28)
Obese (BMI >30)	16 (28.58)
Laterality	
Left Right	31 (55.35) 25 (44.65)
Clinical Presentation	
Incidental findings Gross hematuria Palpable mass Abdominal/Flank pain	31 (55.35) 03 (5.35) 05 (8.92) 17 (30.35)
Co-Morbidities	

Diabetes Mellitus Hypertension Chronic Kidney disease	21 (37.5) 19 (33.93) 03 (5.35)
ASA* Score	
1	18 (32.14)
2	22 (39.28)
3	15 (26.78)
4	01 (1.78)

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Table 2: Comparison of patient characteristics and surgical outcomes of patient undergoing laparoscopic and open procedure for treatment of Renal Cell Carcinoma

Mean (SD)	**Laparoscopic n=34**	**Open n=22**	**p-value**
Age in years	53.82 (13.44)	56.23 (15)	0.535
Tumor size in cm	6.25 (3.16)	9.23 (5.2)	0.022
Estimated blood loss in ml	351.76 (400.98)	512.95 (616.2)	0.405
Surgery time in min	205 (73.37)	217.82 (161.87)	0.355

Table 3: TNM staging of patient undergoing laparoscopic and open procedure for treatment of Renal Cell Carcinoma (n=56)

Primary Tumor (pT)	**Frequency**	**Percentage**
T1a	11	19.64
T1b	18	32.14
T2	09	16.07
T3a T3b- pT3c	08 06	14.28 10.71
T4	02	3.57
Regional Lymph Nodes (N)		
N0	54	78.57
pN1	02	3.57
Distant Metastasis (M)		
M0	54	96.43
M1	02	3.57

p= pathological stage

Figure 1. Distribution of histological grade of Renal Cell Carcinoma

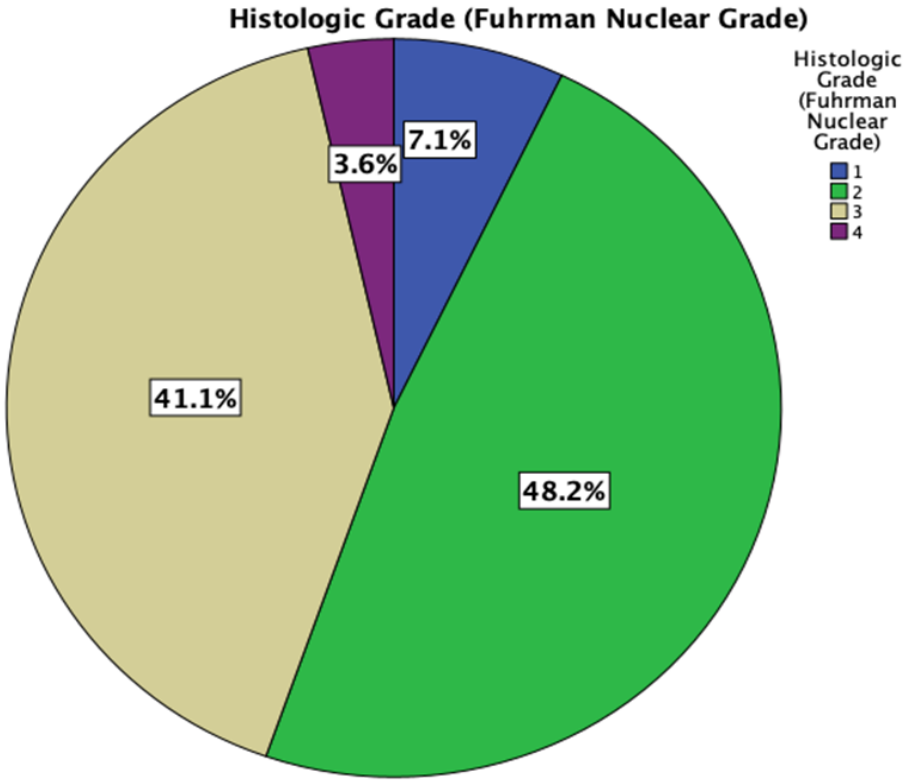

Figure 2: Changing trend in the management of Renal Cell Carcinoma at our center