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Analysis of Complications After Nephrectomy Using Modified Clavien-Dindo Classification- A Retrospective Study

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Abstract
There is a paucity of a standardized post-operative complications grading system in urology. The Clavien-Dindo classification is a simple, convenient, reproducible, comprehensive and logical system for postoperative complications and an established valid system worldwide and applicable in many fields of surgery. Using this we carried out a retrospective analysis of patients undergoing nephrectomy. We performed a retrospective review of patients who had undergone nephrectomy between may 2010 and may 2013 at our institute patients data was collected and analyzed with respective preoperative data and perioperative complications. Patients with comorbid illness were graded by Charlson comorbid index. Post-operative complications were graded according to the Clavien-Dindo classification. A total of 154 patients underwent nephrectomy during the study period. 32 patients had comorbid illness sand 112 patients without comorbidities..107 patients had a malignancy and 47 had benign diseases. Grade I, II, IIIa, IIIb, IV and V were 37.5%, 42%, 6.82%, 7.97%, 4.5% and 1.13% respectively. The Clavien-Dindo classification is easy to use and effectively applied to categorize post-operative complications after nephrectomy.

Keywords: *BMI, clavien grading, comorbidities, complications, nephrectomy.*

I. Introduction

Improving the quality of healthcare delivery system has been a subject of importance worldwide. A huge emphasis has been placed on reducing post-operative complications and thus reducing costs and improving the delivery of care. There is a paucity of reporting post-operative complications in urology. Complication rates are often used to compare the success of renal surgical techniques.

The reported incidence of complications in renal surgery ranges from 2- 54 %, irrespective of surgical approach (10,11). In 1992, Clavien *et al*. proposed the Clavien classification system to grade post-operative complications (1, 2). A modified version of the system (Clavien-Dindo), (Table 1) was published in 2004 which looked at the therapeutic consequences to rank complications (3,4,5). The modified system is divided in to 7 grades (Grade I-V) with 2 subgroups for grade III and IV with grade V representing the death of a patient.

The Modified Clavien-Dindo classification is a simple, convenient, valid system used to grade the postoperative complications in many fields of surgery (6). The same classification system has recently been used by urologists to grade postoperative complications following radical prostatectomy, laparoscopic live donor nephrectomy, laparoscopic pyeloplasty, laparoscopic and open partial nephrectomy and most recently Transurethral Resection of Prostate (7,8,9,10). Nephrectomy is the common major surgery in urology; henceforth we retrospectively analyzed our data in all patients who underwent nephrectomy.

Table1: Modified Clavien – Dindo grading system

Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Acceptable therapeutic regimens are: drugs such as antiemetics, antipyretics, analgesics, diuretics and electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than those allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade III-a	Intervention not under general anaesthesia
Grade III-b	Intervention under general anaesthesia
Grade IV	Life-threatening complication (including CNS complications: brain haemorrhage, ischaemic stroke, subarachnoid bleeding, but excluding transient ischaemic attacks) requiring IC/ICU management
Grade IV-a	Single organ dysfunction (including dialysis)
Grade IV-b	Multi-organ dysfunction
Grade V	Death of a patient

II. Materials And Methods

We retrospectively analyzed patients who had undergone nephrectomy in SVIMS, Tirupathi, between May 2010 and May 2013. We included all patients undergoing open nephrectomy during the time period. The clinical data including age, gender, body mass index (BMI), Charlson comorbidity index (CCI), American Society of Anesthesiology Grade (ASA), operative time, blood loss and postoperative complications were analyzed.

The CCI was categorized, where minor comorbidities are defined as a CCI score of <2 and major comorbidities are >2. Complications occurring within 30 days postoperatively were noted. All complications were graded according to five grade modified Clavien- Dindo classification system.

All pathological data were collected. Data was recorded in an Excel spreadsheet, association of clavien grading and comorbidities were studied using chi-square analysis and Fischer exact tests. All P values were tailored and $P < 0.05$ was considered significant.

III. Results

154 patients were included in the study with mean age 62.4 (18-79), with 98 being male and 56 females (table 1). Transfusion rate was 8.2% with mean operative time 162min (38-280). Patients with comorbidities were 42 and 112 without. Patients with CCI grade 1,2,3,4, 5 and > 6 seen in 24, 29, 3, 4, 1, 1 patients (table 3).

107 patients had malignancy with clear cell carcinoma most common (91.6%) and 47 patients had benign pathology with stone with pelonephritis was common. Complications according to Clavien – Dindo classification include Grade I, II, IIIa, IIIb, IV and V were 37.5%, 42%, 6.82%, 7.97%, 3.42% ,1.13% and 1.13% respectively (chart 1) with grade II complications were common. Wound infection was most common complication followed by anaemia. Death seen in 1 patient.

Patients with BMI >.25 had 57.4 % of complications followed by BMI 18-25 had 30.3% and BMI <18 had 12.3% (chart 2). Malignat patients with stage >T2 associated with more complications (chart 3). Patients with CCI more than 2 had more complications compared with CCI <2 (11.3% vs 20.4%) (Chart 4). Hospital was prolonged in patients with higher Clavien grades (chart 5).

Univariate analysis showed pathological T stage and comorbidites associated with statistically significant (0.012, 0.011), where as gender, age, BMI and simple with radical nephrectomy not significant(table 6).

Table 2: Analysis of patients' undergone nephrectomy

Variable	**Value**
Patients	154
Mean Age	62.4 (18-79)
Body mass index	25.3 (16-33)
Gender	
Male	98
Female	56
ASA grade >2	28
Operative time	162 min (38-280)
Blood loss	450ml (200-1300)
No of pts received transfusion	13 (8.2%)
Mean Transfusion volume	495 ml (330-1500)
Hospital stay	5.4 (3-23)

Table 3: Charlson comorbidity index (CCI)

Score	No of patients
0	92
1	24
2	29
3	3
4	4
5	1
>6	1

Table 4: Pathological status of Patients undergone Nephrectomy

PATHOLOGICAL STATUS	NO OF PATIENTS	PERCENTAGE
BENIGN	47	
Stone with pyonephrosis, nephritis	18	38.2
Neglected UPJO	11	23.4
Chronic pyelonephritis	10	21.3
Renal TB	5	10.6
Others	3	6.4
MALIGNANT	107	
Clear cell	98	91.6
Papillary	5	4.7
Chromophobe	1	0.94
Upper TCC	2	1.87
Sarcoma	1	0.94

Chart1: Complications according to Modified Clavien – Dindo grading system

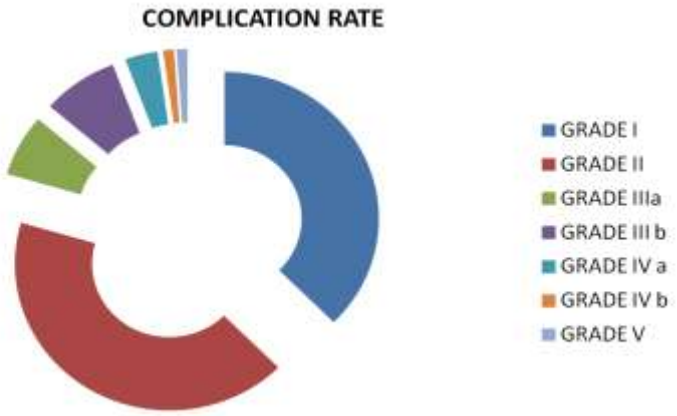

Table 5: Complications according to Modified Clavien -dindo grading system

Grade	complication	No.
Grade I (37.5%)		33
	wound infection	13
	Flank hematoma	3
	Chylous ascites	4
	Ileus	8
	Bradycardia	2
	leak from wound	3
Grade II		37 (42.05%)
	pneumonia	7
	UTI	5
	DVT	3
	Prolonged fever	6
	Anemia	12
	Sepsis	3
	Myocardial infarction	1
Grade III a		6 (6.82%)
	Retroperitoneal abscess requiring percutaneous drainage	2
	Ileus	4
Grade III b		7 (7.97%)
	wound dehiscence	4
	Abscess requiring relaparotomy	3
Grade IV a		3 (3.42%)
	pneumonia requiring ICU management	1
	Cerebrovascular accident	1
	Acute tubular necrosis	1
Grade IV b	multi organ failure	1 (1.13%)
Grade V	Death	1 (1.13%)

Chart 2: BMI and complication rates after Nephrectomy

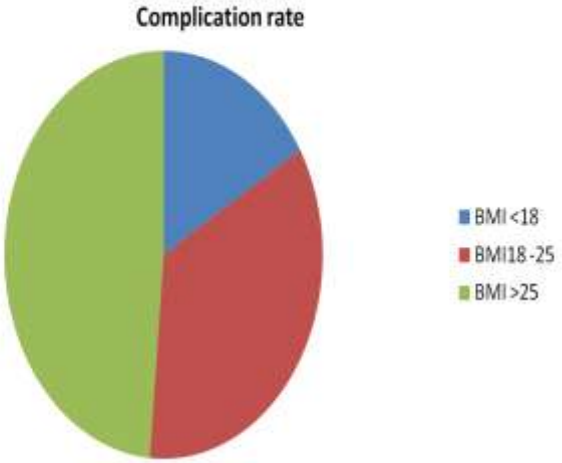

Chart 3: Complications according to Histological grades

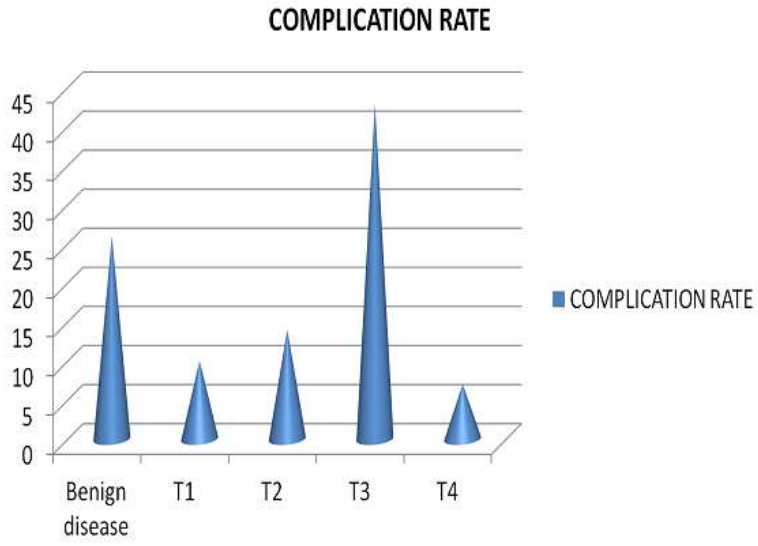

Chart 4: CCI with postoperative complications

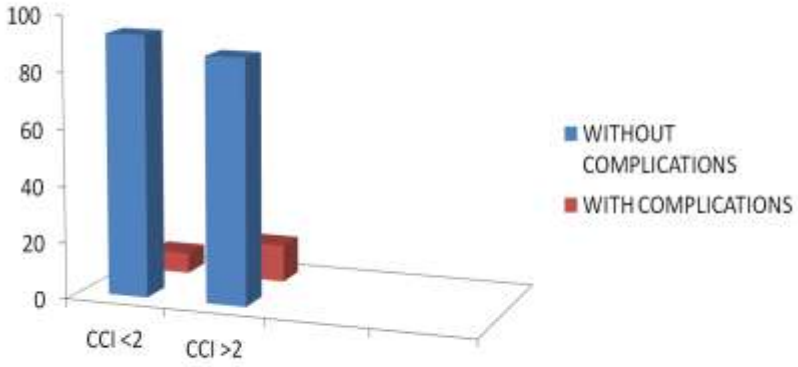

Chart 5: duration of hospital stay after nephrectomy in relation to complications

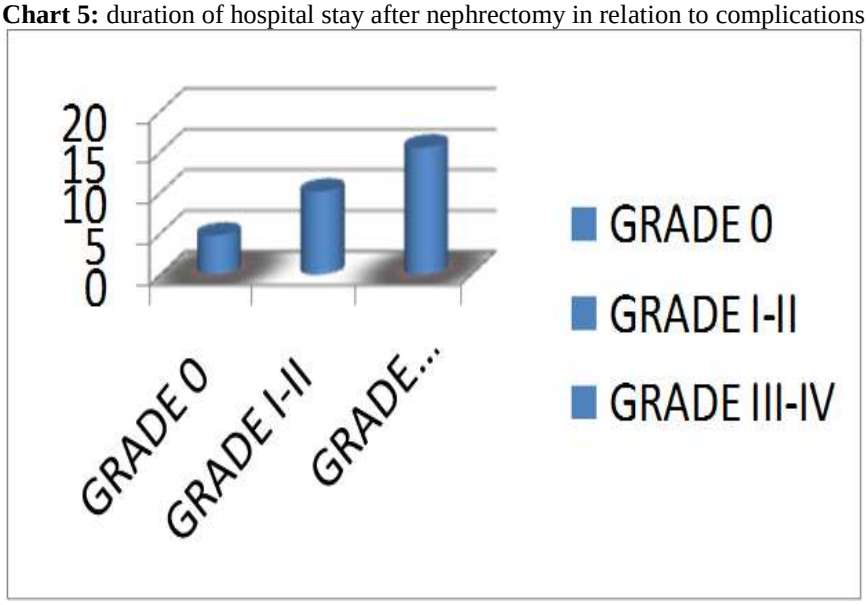

Table 6: Univariate analysis for prediction of complications according to modified clavien - dindo grading system

Variable	P
Pathological T stage	0.012
Age	0.349
Gender	0.068
CCI	0.011
Body mass index (<25 vs >25)	0.095
Simple vs radical nephrectomy	0.212

IV. Discussion

Procedure specific complications are an important indicator for measuring quality in health care. Various studies have reported complications in kidney operations. Stephenson et al showed Overall 55% and 31% of complications were grade I and grade II, respectively with 0.8% of deaths in a large cohort of 1049 patients after nephrectomy(12). Pauline et al showed overall complication rate of 34% with 64% grade I and II complications. Major complications were noted more in patients with major comorbidities (16% vs7%)(13). Our study showed total complication rate 46 %, mostly grade 2 complication accounting for overall 42.05% complications. Similarly, Grade 3 and 4 complications accounted for 14.77% and 4.55% respectively. Most common complications were wound infection, pneumonia and ileus. Minor complications are important as they cause prolonged hospital stay, morbidity to the patient.

In our study a higher BMI was associated with an increased percentage of complications, though not statistically significant. Kapoor *et al*. in their study demonstrated a longer operative time but comparable complications rate between obese and non-obese patients(18). In addition to comorbidities BMI was important risk factor for postoperative complications. Patients with CCI >2 associated with major complications when compared with patients with no complications (13.2% vs 7.25%). Patients with major complications often associated with prolonged hospital stay. Patients with higher tumor grade (>T2) associated with major complication rate.

V. Conclusions

The Modified Clavien-Dindo classification is easy to use and effectively applied to categorize postoperative complications after nephrectomy. The most frequent complications were grade I and II. Major complications occur in patients with multiple comorbid diseases. Comorbid scores can be used in risk stratification of complications, hence can be considered during decision making and counseling of the patient before surgery. The surgery should be performed on selected patients with comorbid disease, and measures need to be taken to prevent these complications.

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