

# Assessment of complications after laparoscopic surgery of kidney tumors using Clavien-Dindo classification

## Authors' Contribution:

A – Study Design  
B – Data Collection  
C – Statistical Analysis  
D – Data Interpretation  
E – Manuscript Preparation  
F – Literature Search  
G – Funds Collection

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## ABSTRACT:

**Introduction:** Surgical procedures are accepted, basic method of treating kidney cancer.

**Aim:** The aim of the study was to assess postoperative complications according to the Clavien-Dindo classification after laparoscopic procedures in the treatment of kidney cancer.

**Material and methods:** A retrospective study involved 112 patients. The research was based on the analysis of data from the medical records of the clinic and the documentation of the urological polyclinic. Classification of postoperative complications according to Clavien and Dindo in the operated patients was assessed on a 7-point scale.

**Results:** Less severe complications occurred in 24 patients (21.4%). All the above-mentioned TNM transfusions. Grade IIIb complication occurred in one patient (0.9%) and required kidney removal.

**Conclusions:** The use of the Clavien-Dindo classification in the assessment of postoperative complications of laparoscopic renal procedures is a simple and objective diagnostic tool for establishing the postoperative condition of patients. The results of our examination of complications after laparoscopic renal surgery according to the Clavien-Dindo classifications are similar to those obtained in renowned urological centers.

## KEYWORDS:

Clavien-dindo classification, laparoscopic surgery, renal tumors

## ABBREVIATIONS

**BMI** – Body Mass Index

**C-D** – Clavien-Dindo classification

**NSS** – Nephron Sparing Surgery

**PCNL** – percutaneous nephrolithotomy

**pT1** – first stage of cancer

**pT2** – second stage of cancer

**RCC** – Renal Cell Carcinoma

**TNM** – Classification of Malignant Tumors

**TURP** – transurethral electro-resection of the prostate

**MU** – Medical University

**USK im. WAM-CSW** – University Clinical Hospital Military Memorial Medical Academy – Central Veterans' Hospital in Lodz

## INTRODUCTION

In the recent years, kidney cancer has been the seventh most prevalent malignancy and represented approx. 3.3% of all newly diagnosed cancers. Clear cell carcinoma (Renal Cell Carcinoma, or RCC) accounts for about 90%–95% of all kidney cancers [1]. In Poland, the incidence of renal malignancies appears mainly over 55 years of age (80%), whereby renal neoplasms affect both women (2.4%) and men (3.9%) are most often observed in the eighth decade of life [2]. Surgical procedures are a recognized, primary method of treating kidney malignancies. Acceptable methods of surgical treatment of kidney cancer according to the recommendation of scientific associations include radical or kidney-preserving procedures using the open, laparoscopic or Da Vinci surgical system. Techniques for

ablation of kidney tumors are accepted according to very strictly defined indications and are mostly experimental. The choice of treatment method for kidney cancer depends on numerous preoperative factors such as age, general condition of the patient, size and stage of the local tumor. When deciding on the treatment method, we take into account the possibility of various postoperative complications. In recent years, both surgery and urology has been using the scale proposed by Clavien in 1992 to evaluate these complications [3]. An amended version of the Clavien-Dindo (C-D) system was published in 2004 assessing the therapeutic consequences of the classification of possible complications [4]. This modified system was divided into seven classes (grades I to V) with two subgroups for grade III and grade IV and assessment V for death of a patient. The system is simple, convenient, repeatable, versatile and logical and has been used in numerous surgical fields. It is applied in countless urological procedures and was proposed as the current standard for assessing surgical complications for any endoscopic or open surgery to properly compare surgical techniques in renal surgery and evaluate treatment outcomes and complications; the implication of this system in renal surgery is important [8]. In urological practice, C-D classification was successfully applied in the assessment of procedures; transurethral electroresection (TURP), percutaneous nephrolithotomy (PCNL), radical prostatectomy and nephrectomy [5–7, 9].

## PURPOSE OF PAPER

The purpose of the study is to assess postoperative complications using a classification system according to Clavien-Dindo after laparoscopic procedures in the treatment of kidney cancer.

**Tab. I.** Modified classification of postoperative complications according to Clavien-Dindo.

DEGREE	DEFINITION
Grade I	Any deviations from the standard postoperative course of treatment, without the need for pharmacological treatment or surgical, endoscopic and radiological intervention. Pharmacotherapy with anti-emetics, analgesics, diuretics and electrolytes, and physiotherapy is acceptable. Infection of postoperative wound not requiring surgical care.
Grade II	Complications requiring pharmacotherapy with medications other than those listed for grade I complications. The need for transfusion of red blood cell concentrate or parenteral nutrition.
Grade III	Complications requiring surgical, endoscopic or radiological intervention.
Grade IIIa	Complications requiring surgical, endoscopic or radiological intervention without general anesthesia.
Grade IIIb	Complications requiring surgical, endoscopic or radiological intervention with general anesthesia.
Grade IV	Directly life-threatening complications, including complications associated with the central nervous system, requiring treatment in the intensive care unit.
Grade IVa	Single organ failure, including renal failure with the need for hemodialysis.
Grade IVb	Multiple organ failure.
Grade V	Death of patient.

## MATERIAL AND METHODS

A retrospective study conducted at the 1st Clinic of Urology of the Medical University in Łódź, USK WAM-CSW involved 112 patients with a kidney tumor who underwent laparoscopic surgery from January 2016 to December 2018. Laparoscopic radical nephrectomy was performed in 42 cases and organ preserving tumor resection was conducted (Nephron Sparing Surgery, or NSS) in 70 patients. Both laparoscopic methods were performed with transperitoneal access. All laparoscopic operations were performed under general anesthesia by two experienced urologists. The study was supported with the analysis of data from the clinic's medical records and the documentation of our hospital's urological outpatient clinic, where all patients are referred for postoperative follow-up within a month of surgery. Clinical and pathological data of operated patients were evaluated, which included: age, sex, TNM classification from 2002, type of cancer found, and in the case of RCC the Fuhrman grading, primary tumor size and comorbidities were determined. In the case of several complications in the same patient, all were assessed independently. Classification of postoperative complications according to Clavien and Dindo in the operated patients was evaluated on a 7-point scale presented in Tab. I. Hospital records from postoperative proceedings included in the medical history were supplemented with observations within a month after discharge from the hospital.

## RESULTS

All operated patients responded well to general anesthesia and surgery; only one case involved an intraoperative complication in the form of bleeding from the renal bed after tumor resection and the need for conversion pursuant to it. If the complication was possible as expected in the postoperative course, e.g. there was transient increase in creatinine level after NSS not leading to dialysis in a patient with only one kidney, then it was not included in the C-D scale. Malignant neoplasms in the kidney were found in 109 operated patients and they were benign in 3. The dominant tumor was clear cell renal cell carcinoma which accounted for 70% of pathomorphological diagnoses. The stage of local pT2 tumor was found in 12 cases, while in the remaining cases it was assessed as pT1. One patient underwent cytoreductive nephrectomy due to coexisting distant metastases. The obtained test results together with the clinical-pathological characteristics in 112 patients are summarized in Tab. II.

Kidney sparing surgery was also performed in the analyzed material in 25 patients when the size of the tumorous lesion exceeded the diameter of 45 mm. Within 30 days of follow-up after the performed procedures, there were 28 complications in 25 operated patients. The percentage of postoperative complications according to C-D was 22.3%, i.e. 25 out of 112 patients. Minor complications occurred in 24 (21.4%) patients, including 7.1% of grade I, and 15.2% of grade II. Complications in this area mainly included: infections, cardiologic and pulmonary conditions, neurological disorders, hematuria and anemia. All the above complications were conservatively managed by the administration of drugs and blood transfusions. Grade IIIb C-D complication in the first (0.9%) patient was a surgical intervention under general anesthesia due to postoperative bleeding after NSS and it required kidney removal. The precise specification of the complications is presented in Tab. III.

## DISCUSSION

Assessment of postoperative complications is a generally recognized means of comparing the results of surgical treatment, but it must be emphasized that the occurrence of intraoperative complications also affects the subsequent postoperative course of the operated person. For kidney surgery, no consensus could be achieved on the manner of reporting, resulting in a broad range of types and frequencies of reported complications. Furthermore, a variety of surgical techniques used in kidney surgery and the continuous development of new ones require a standardized manner of reporting complications to facilitate comparison. Criteria introduced by surgeons Clavien and Dindo have been used in everyday practice for many years as an objective method for accurate and comprehensive reporting of postoperative complications, also after urological procedures [8, 17]. In the framework of these criteria, an objective, but already modified, system is used to assess postoperative complications. In the study assessing complications according to C-D in open kidney cancer surgery, the authors demonstrated a significant number of these complications in the observation of 198 patients operated on radically or using NSS [7]. Minor grade I and II complications occurred in 22% and concerned mainly infections and neurological problems. More severe grade III and IV complications were observed in 8% and in 4% deaths, i.e. grade V of the C-D classification. There was no correlation between the occurrence of complications and the type of radical surgery or NSS. The

authors noted the statistical dependence of the occurrence of complications on the coexisting severe systemic diseases and the local stage of cancer [7]. In further publications, open kidney procedures were compared with laparoscopic ones [10, 11]. Xu et al. [10] in their retrospective review of 843 operated patients found fewer complications by performing nephrectomy after laparoscopic surgery in only 19.3% of 88, compared to 30.4% of the open method in 526. Minor complications constituted the overwhelming majority and involved as much as 18.2%, while grade III merely 1.1% in the laparoscopic group with a substantial difference in relation to open procedures 27.2% and 2.9%, respectively in terms of the grade of complications. The number of complications after NSS was similar in both groups 35.7% of 42 laparoscopic procedures and 36.6% of 187 open procedures, except that no serious complications were observed in the laparoscopic subgroup and 3.7% in the open subgroup. They found a correlation between the increase in the incidence of grade II complications and intraoperative blood loss and obesity. Reifsnnyder et al. [11] in their last prospective study compared in the assessment of the C-D classification 107 patients who underwent laparoscopic nephron-sparing surgery and 82 patients undergoing open NSS. They found no statistical difference in the frequency of complications between these methods, although they observed a difference in their occurrence in 17.8% after laparoscopic surgery and in 26.8% after open intervention. Garg et al. [12] also conducted a prospective randomized trial comparing laparoscopic nephrectomy with transperitoneal access with retroperitoneal access in cases of a kidney deprived of its function. Of 62 cases, 3 were excluded and 5 underwent conversion. A total of 11 (17.7%) postoperative complications were reported in the C-D classification and no differences were found depending on the access used. These results are controversial; unlike other studies, there were no reports of complications requiring intervention due to cardiological or neurological ailments, fever, urinary retention, etc. In further prospective studies on the assessment of complications after laparoscopic renal procedures with the C-D classification, the authors present substantially different results in their works [13, 14]. Falkowski et al. [13] obtained a smaller number of complications of 25.5% after laparoscopic procedures of milder degree (I° and II°) and did not observe any complications in more severe degrees. On the other hand, Agrawal [14] presented noticeably worse results in his study, with 45 (46%) complications in 103 patients, including minor grade complications (I° and II°) in 35% and severe complications (III° and IV°) in 11% of patients. The authors clarify this situation by qualifying a substantial proportion of patients for surgery in chronic situations, inflammatory changes in the course of staghorn urolithiasis or tuberculosis with adhesions and perirenal changes. An interesting report is the work of Khan et al. [15], who presented an assessment of C-D complications for open and laparoscopic nephrectomy and nephroureterectomy for patients over 75 years of age. As many as 39 (72%) complications were found in 54 patients in this retrospective study – 10 in grade I, 16 in grade II and 13 in grade III and IVa; most often they concerned cardiovascular, neurological and wound infection. The risk factors for complications were high body mass index (BMI), tumor pT ≤ 3 and concomitant serious diseases. Assessment of C-D complications after NSS surgery with surgery with robotic assistance (Da Vinci) was also the subject of multicenter research by Spana et al. conducted in 450 patients [16]. The authors observed a relatively low number of complications only in 71 (15.8%) patients of which most included bleeding and urinary

**Tab. II.** Results obtained in examined patients after the performed procedures.

VARIABLE	NUMBER	%
Number of patients, n	112	100
Average age, years	64	
Average tumor size, mm	39	
<b>GENDER</b>		
Women	40	36
Men	72	64
<b>HISTOPATHOLOGICAL RESULT</b>		
Clear cell carcinoma	78	70
Papillary cancer	14	12
Chromophobe cancer	8	7
Oncocytoma	6	5
Transient cell carcinoma	3	3
Other malignant types	0	0
Other benign types	3	3
<b>PURPOSE OF SURGICAL TREATMENT</b>		
Recovery	111	99
Cytoreduction	1	1
<b>TYPE OF LAPAROSCOPIC PROCEDUR</b>		
Nephrectomy	42	37
NSS	70	63
<b>FUHRMAN GRADE</b>		
1	4	5
2	61	78
3	11	14
4	2	3
<b>TNM CLASSIFICATION</b>		
pT1	100	89
pT2	12	11
pT3	0	0
pT4	0	0
<b>METASTASES</b>		
Mx/Mo	111	99
M1	1	1
<b>TUMOR DIAMETER</b>		
<4 cm	67	60
>4 cm	45	40
<b>COMPLICATIONS BY MODIFIED CLAVIEN–DINDO SCALE</b>		
Grade I	8	29
Grade II	19	68
Grade IIIa	0	0
Grade IIIb	1	3
Grade IVa	0	0
Grade IVb	0	0
Grade V	0	0

NSS – nephron sparing surgery

fistulas. Among them, 76% were 1st and 2nd grade complications and 34% were 3rd and 4th grade complications; in the latter there were 3 (0.6%) conversions and 7 (1.6%) nephrectomies. The above reports demonstrate that this classification is easy to apply to assess all complications after kidney surgery for cancer treatment. The

**Tab. III.** Found complications according to modified Clavien-Dindo scale.

COMPLICATIONS BY CLAVIEN-DINDO SCALE	NUMBER OF PATIENTS, N (%)	PROCEDURE
Wound infection	2 (1.8)	Conservative treatment
Fever	5 (4.5)	Conservative treatment
Hip pain	1 (0.9)	Conservative treatment
GRADE II		
Neurological episode	4 (3.6)	Conservative treatment
Cardiological episode	2 (1.8)	Conservative treatment
BP increase	3 (2.7)	Conservative treatment
Dyspnoe	2 (1.8)	Conservative treatment
Hematuria	2 (1.8)	Conservative treatment
Anemization	3 (2.7)	RCC transfusion
Intestinal peristalsis disorders	1 (0.9)	Conservative treatment
Pulmonary edema	1 (0.9)	Conservative treatment
Corneal abrasion	1 (0.9)	Conservative treatment
GRADE IIIB		
Bleeding after NSS	1 (0.9)	Nephrectomy

NSS – nephron sparing surgery

BP – blood pressure

RCC – red cell concentrate

results of our tests – 22.3% of complications after laparoscopic procedures – are close within their limits to the very good outcomes obtained by Xu – 19.3%, Falkowski – 25% or Reifsnnyder – 17.8%,

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## CONCLUSION

The use of the modified Clavien-Dindo classification in the assessment of postoperative complications of laparoscopic renal surgery is a simple and objective diagnostic tool for the postoperative status of patients. The obtained results of our examination of complications after laparoscopic kidney cancer surgery according to the Clavien-Dindo classification are similar to those achieved in reputable urological centers.

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