UNIVERSITY OF MEDICINE AND PHARMACY
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CHALLENGES AND SURGICAL APPROACH STRATEGIES IN PARTIAL NEPHRECTOMY

PHD THESIS SUMMARY

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2025

Table of contents

Introduction

The use of modern imaging techniques has led to more frequent detection of renal tumors at early stages, resulting in a gradual shift toward conservative treatment options. Partial nephrectomy has become the standard treatment for T1 stage renal tumors, often being used even for larger lesions. The choice of approach (open, laparoscopic, or robotic) remains a topic of discussion, influenced by anatomical, functional, oncological, and technical considerations.

Preoperative documentation of cases is essential for making optimal decisions regarding surgical intervention and their subsequent outcomes. During preoperative assessment, using an anatomical score to evaluate the complexity and potential complications of the surgical procedure can be extremely helpful for the surgeon, to determine the most suitable approach individualized for each patient. Postoperative complications are influenced by factors such as the surgical approach (open vs. minimally invasive), ischemia time, and the patient's preoperative parameters. Preoperative biological parameters, such as hemoglobin and creatinine levels, are significant predictors of postoperative results. Optimizing preoperative values, along with the use of non-invasive scoring systems, is necessary to reduce the risk of complications and improve long-term prognosis [1].

This thesis aims to contribute to the improvement of the decision-making process in partial nephrectomy by critically analysing the approach specifics and their impact on postoperative outcomes, to develop more transparent and more objective criteria for intraoperative decision-making.

The motivation for choosing this topic was prompted by the growth of conservative renal surgery in the era of personalized medicine. In an increasingly complex clinical environment, the surgeon must consider various factors to determine the best approach, including tumor characteristics, nephrometry scores, the patient's comorbidities, and the risk of perioperative complications.

The subject under discussion presents clinical and epidemiological relevance due to the increasing incidence of renal tumours detected at early stages, thanks to broader access to high-resolution imaging, which contributes to preserving renal parenchyma and preventing long-term chronic kidney disease. The limitations of the research conducted for the development of this thesis are represented by the relatively small number of patients

selected from a single centre and the variability in intraoperative decisions. This topic is current in a context where nephron-sparing surgery seeks to balance oncological and functional considerations, and a comparative analysis of the approach's particularities can provide valuable information for optimising indications.

By addressing these aspects, the thesis will make an original scientific contribution to the optimisation of therapeutic decisions in partial nephrectomy, tailored to the patient's anatomical and functional particularities, as well as to improving the quality of life of patients with localised renal tumours. Thus, the research aligns with the direction of consolidating evidence-based surgical practice, in accordance with current trends in modern urology.

I. CURRENT STATE OF KNOWLEDGE

Chapter 1. Theoretical Foundations of Parenchymal Renal Tumours

1.1. Diagnosis and screening of renal tumors

Renal neoplasms have a higher prevalence in the 50-70 age group, with a predominance in males. Partial nephrectomy has become the surgical standard whenever possible, and the laparoscopic approach has assumed an essential role as an alternative to open surgery.

The classic triad of haematuria, lumbar pain, and a palpable renal mass occurs in less than 10% of cases and is usually associated with advanced disease. Often, renal cancer is detected following systemic manifestations caused by paraneoplastic syndromes or, more frequently, incidentally (up to 60% of cases), during imaging examinations performed for non-specific symptoms [2, 3]. The integration of imaging and laboratory results allows both confirmation of the diagnosis of renal cancer and detailed planning of the surgical approach, estimation of the risk of complications, and selection of the optimal adjuvant treatment. Renal biopsy puncture is not routinely used, with well-established indications [4].

Screening for renal carcinoma in the general population is not feasible, as the incidence is relatively low, and the target population should be well defined [5, 6].

1.2. Classification of renal tumours

Renal tumours are divided into benign and malignant tumours, each with different tissue origins. According to the World Health Organization (WHO), the classification of renal tumours was updated in 2022, bringing significant updates to already established entities and including new distinct tumour entities [7].

Although the majority of renal cell carcinomas (RCC) display distinct morphological features that allow for relatively straightforward classification, there is significant morphological variability between cases. This heterogeneity can complicate the precise identification of the tumour type, especially in situations involving rare subtypes. In this context, the development of additional immunohistochemical and molecular tests is necessary, as they are essential for accurate typing as well as for establishing prognosis and an appropriate therapeutic strategy. At the same time, these tests contribute to a more reliable identification of poorly differentiated metastatic tumours of renal origin [8].

1.3 TNM Staging

The current TNM classification of renal cell carcinoma corresponds to the eighth edition of the Cancer Staging Manual, developed by the American Joint Committee on Cancer (AJCC) and published in January 2018 [9].

Chapter 2. Surgical management of parenchymal renal tumours

2.1. General considerations about renal surgery

Renal surgery constitutes a fundamental pillar of urology, aiming to treat renal conditions through conservative or radical interventions. The choice of surgical method is influenced by multiple variables, including the type of lesion, its localisation, remaining renal function, and the patient's overall health status. In recent decades, the refinement of minimally invasive techniques has revolutionised the surgical approach to renal pathology. Laparoscopic and robot-assisted procedures have established themselves as effective and safe alternatives to traditional open surgery, offering notable advantages. Laparoscopic interventions have significantly improved post-procedural quality of life compared to the classic approach, through minimal hospitalisation duration and early recovery [10, 11].

When the laparoscopic approach is preferred, the transperitoneal technique is more commonly used in practice because it creates a larger working space and reveals easily recognisable landmarks [12]. However, more recent data from the literature indicate that

the retroperitoneal approach does not increase the risk of complications or the need for additional surgical intervention compared to the transperitoneal technique [13].

2.2. Surgical anatomy of the kidney

A detailed understanding of kidney anatomy is essential in renal surgery, especially in conservative procedures such as partial nephrectomy, where the aim is to excise the tumour while preserving as much healthy parenchyma as possible.

The kidney presents close relationships with important anatomical structures that must be considered in the planning and execution of surgical interventions. The anterior surface of the right kidney is in contact with the liver, duodenum, and ascending colon, while the left kidney is adjacent to the stomach, pancreas, spleen, and descending colon. Posteriorly, both kidneys are in contact with the psoas major muscle and the quadratus lumborum muscle, and superiorly with the diaphragm. The subcostal, iliohypogastric, and ilioinguinal nerves traverse this region, being susceptible to injury during dissection [14, 15].

2.3. Partial Nephrectomy – indications and contraindications

The indications for partial nephrectomy are as follows [16]:

- Small renal tumours: under 4 cm (sometimes up to 7 cm), well localised and non-invasive
- Peripheral tumours: located at the upper or lower pole of the kidney, easily accessible
- Single kidney: to avoid dialysis
- Chronic kidney diseases, where preserving renal function is crucial: diabetes, hypertension, chronic kidney disease
- Benign symptomatic tumours: haemorrhagic angiomyolipomas
- Organ donors: in special cases, when partial harvesting is desired
- Severe infections: xanthogranulomatous pyelonephritis, pyogenic kidney
- Trauma: if haemostasis cannot be achieved otherwise
- Congenital anomalies: multilocular cystic kidney, displastic.

The relative contraindications of partial nephrectomy are [16, 17]:

- Global reduced kidney function, with an increased risk of postoperative renal failure
- Severe comorbidities that contraindicate general anaesthesia
- Partially unresectable bilateral tumours
- Invasive tumours affecting the main vessels or the pelvicaliceal system

- Deeply located tumours in the renal parenchyma, difficult to access without affecting the remaining renal function

2.4. Surgical approach strategies: open versus laparoscopic

According to the practice guidelines of the European Association of Urology (EAU), if the renal tumor is located at the edge of the kidney, isolated removal of the affected part becomes possible, thus allowing partial preservation of the kidney with clear long-term benefits and under the safest oncological conditions [16, 18]. Preoperative preparation and general anesthesia are similar steps regardless of the approach route. Access to the lumbar region for laparoscopy can be transperitoneal or retroperitoneal; consequently, patients will be positioned either in dorsal decubitus or lateral decubitus.

A significant factor in protecting the renal parenchyma is limiting ischaemia during the procedure. The options for renal hypoperfusion are warm ischaemia and cold ischaemia. Warm ischaemia has become standard in laparoscopic approaches and involves applying vascular clips without cooling the kidney, which can be achieved in several ways. The optimal duration of warm ischaemia to prevent renal function impairment is 25-30 minutes [19]. Cold ischaemia is often used in open surgery and involves cooling the kidney with cold saline or ice. The advantage of this method is that it extends the ischaemia time to 60-90 minutes without causing significant renal damage [20, 21].

Table II.1. Advantages and limitations of renal hypoperfusion techniques [22, 23].

Hypoperfusion techniques	**Advantages**	**Limitations**
Warm Ischemia	Easy to apply laparoscopically	Time is limited to less than 30 minutes
Cold Ischemia	Allows extension of the ischemia time and intervention	Technically difficult, rarely used in laparoscopy
Complete clamping	Simple and rapid	Extensive ischaemia with damage to the renal parenchyma
Selective clamp	Preserves venous drainage	Requires precise dissection
Segmental clamping	Provides superior results for preserving renal function	Requires advanced imaging and is more technically difficult
Off-clamp	Remarkable preservation of renal function	Limited indications for small, peripheral tumours

Table II.4. Comparison between laparoscopic partial nephrectomy via transperitoneal and retroperitoneal approaches.

Characteristics	Transperitoneal approach	Retroperitoneal approach
Accesul la tumoră	An extended space, with good visibility, but with the need to mobilise intra-abdominal organs	Direct renal access, without mobilising the intraperitoneal organs
Vascular control time	Longer, because it requires extensive dissection	Shorter, because the renal vessels are easily accessible
Surgical time	Longer, depends on the case and the operator	Generally lower
Blood loss	Higher	Generally lower
Risk of organ damage	Higher, because the instruments are handled intra-abdominally	Minimal, because the peritoneal cavity is not accessed
Postoperative recovery	Rapid, if there are no complications due to the mobilization of intestinal loops	Rapid, in the absence of other complications
Average length of hospital stay	Brief, specific to laparoscopy	Brief, specific to laparoscopy
Indications related to characteristics of the tumors	Previous or central location	Posterior or lateral location
	Large tumors, with changes in anatomical relationships	Small tumours or obesity

Chapter 3. Surgical risk assessment and patient optimisation

Assessment of surgical risk and optimisation of the patient for partial nephrectomy in cases of renal tumours are essential steps to ensure the safety of the procedure and optimal oncological and functional outcomes. Preoperative documentation is a crucial stage in the management of surgical cases, having a direct impact on the choice of therapeutic strategy and postoperative course. In the context of renal surgery, where the decision between conservative (partial nephrectomy) and radical (total nephrectomy) approaches involves

multiple anatomical, functional, and oncological variables, a rigorous preoperative assessment is indispensable.

3.1. Nephrometric scores (PADUA, RENAL)

The European Association of Urology (EAU) guidelines on renal cell carcinoma management recommend the use of nephrometry systems to objectively assess the risks associated with nephron-sparing surgery (partial nephrectomy) for renal masses. These tools are essential for treatment planning, patient counselling, and comparing outcomes across different surgical series [16].

Among the most commonly used systems are the RENAL score (which analyses: tumour size, exophytic/endophytic character, proximity to the collecting system, anterior/posterior position, and location within the kidney) and the PADUA classification (which considers preoperative anatomical features and dimensions). Both were introduced in 2009 and have been validated through numerous studies as predictors of overall complications, warm ischaemia time, bleeding, or renal function impairment [24, 25].

3.2. Clavien-Dindo Classification

This classification is a standardised, objective, and reproducible instrument comprising 5 grades, intended for the assessment of postoperative complications by relating them to the type of therapeutic intervention.

The validity of the Clavien-Dindo classification was supported by a study conducted under the auspices of the European Association of Urology, in which over half of the respondents considered this classification appropriate for grading postoperative complications, thus highlighting its usefulness in urological practice [26].

3.3. Postoperative complications and prophylaxis

The most common complications encountered in practice are haemorrhage, urinary fistulas, renal failure, and postoperative infections [27].

3.4. Oncology results

Positive resection margins have a negative impact on post-nephrectomy recurrence; therefore, the surgical approach must be chosen after thorough preoperative documentation of each case.

Despite the increased risk of incomplete resection leading to positive surgical margins (PSM) on histological specimens, residual cells in the tumour bed may not be viable, for example, due to electrocoagulation, and thus may never cause local or distant recurrence of the disease. The correlation between PSM and overall survival, cancer-

specific survival (CSS), and recurrence-free survival (RFS) remains a subject of ongoing debate [28, 29].

II. PERSONAL CONTRIBUTIONS

Chapter 4. Working hypotheses and general objectives

In this work, I aim to compare the results obtained following partial nephrectomy via open and laparoscopic approaches. The research hypotheses are based on the premise that a series of anatomical, clinical, or technical factors can significantly influence the evolution and prognosis of patients. In this context, the established objectives aim to clarify these hypotheses.

Working hypotheses:

1) Laparoscopic surgery is a safe and effective alternative to open surgery, providing comparable oncological outcomes.
2) The type of surgical approach in partial nephrectomy influences the postoperative course and complications.
3) The risk of positive resection margins is influenced by the patient's and tumour's characteristics, the complexity of the procedure, and not only by the approach method.

General objectives:

1) Crearea unei baze de date cu pacienți proprii, realizată în mod prospectiv, care permite analiza multidimensională.
2) Highlighting the advantages of each surgical approach to partial nephrectomy.
3) Comparison of partial nephrectomy via open approach with laparoscopic technique through transperitoneal and retroperitoneal routes.
4) Assessment of non-metric score evaluation in predicting perioperative complications in partial nephrectomy.
5) Identification of factors influencing the prognosis of patients with parenchymal renal tumours, operated on through conservative laparoscopic treatment: factors related to the patient; factors related to the tumour; factors related to the type of surgical intervention.

6) Identification of risk factors influencing positive surgical margins in laparoscopic partial nephrectomy.
7) Applying an individualised surgical approach to each case, based on a prospective assessment of the clinical and paraclinical parameters specific to each patient.

Chapter 5. General methodology of the research

The research sample for the doctoral thesis included 105 patients who underwent partial nephrectomy, either laparoscopically or via the traditional approach (initially, a group of 103 patients diagnosed with renal tumours was analysed; subsequently, a further two patients were added).

The study was conducted at the Urology Clinic of the „Prof. Dr. Theodor Burghele' Clinical Hospital, from November 2021 to November 2024, and was carried out in accordance with the ethical principles of the most recent version of the Declaration of Helsinki. We obtained approval from the Ethics Committee for the conduct of the study and the publication of the results, and patient confidentiality was ensured.

The research material was prepared based on the following sources of information:

- the medical information contained in the computerised databases of the Urology Clinic of the 'Prof. Dr. Theodor Burghele" Clinical Hospital under the name 'Partial Nephrectomy'.
- patient observation sheets of those admitted to the Urology Clinic of the 'Prof. Dr. Theodor Burghele' Clinical Hospital
- the operator protocols of the Urology Clinic of the 'Prof. Dr. Theodor Burghele' Clinical Hospital
- the results of the anatomical-pathological analysis of the Department of Anatomical Pathology at the 'Prof. Dr. Theodor Burghele' Clinical Hospital
- the results of imaging analyses of the patients enrolled in the study (X-rays, ultrasounds, scintigraphy, MRI, CT) provided by the patients themselves or by the Radiology Department of the 'Prof. Dr. Theodor Burghele' Clinical Hospital;

The inclusion criteria for the research were:

- Indication for partial nephrectomy
- The clinical-biological status of the patient

- Feasibility of performing a conservative resection, via laparoscopic or open approach

The stages of the doctoral research were structured in such a way as to allow for a coherent progression of the project, from the collection of cases and literature review to the final drafting of the thesis. The process included defining the theme and objectives, prospectively including cases in the study, analysing the results and interpreting them within the context of specialised literature, publishing these findings, and formulating conclusions in relation to the hypotheses investigated.

The information regarding the variables monitored was recorded in the form of a database, using the Microsoft 365 programme. The primary processing of the data obtained from the research was carried out with Microsoft Excel. The statistical analysis was performed using IBM SPSS v 23.0, UMFCD licence. For continuous variables, the mean and standard deviation (SD) were reported, and for comparison, variances were used.

Limitations of the study:

- Low number of cases
- Single-centre study
- Experience and inter-operator variability

Chapter 6. The PADUA score as a predictor of intraoperative complications: a study on partial nephrectomy via open versus laparoscopic approach

6.1 Introduction

The Preoperative Aspects and Dimensions Used for an Anatomical (PADUA) score was defined as an algorithm based on anatomical characteristics and tumour size to predict surgical risk and perioperative complications in patients undergoing open partial nephrectomy. In this study, we extended the applicability of the PADUA score to laparoscopic partial nephrectomy, with the intention of analysing the results obtained.

6.2. Materials and Methods

In this study, from the total pool of cases, 94 patients who underwent partial nephrectomy for renal tumours were included, excluding cysts. Of these, 44 patients underwent laparoscopic surgery via transperitoneal or retroperitoneal approach, while 50 patients were operated on through an open lateral approach. The anatomical characteristics of the renal mass were evaluated preoperatively according to the PADUA classification.

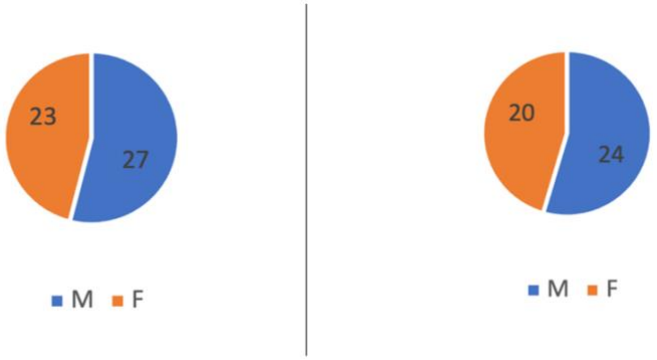
PADUA scores were grouped into three categories: low (6–7), medium (8–9), and high (≥10).

The perioperative data included the operative time, ischemia time, blood loss, perioperative complications, and the surgical margins on histological specimens.

The statistical analysis was performed using IBM SPSS, including the chi-square test and ANOVA. Statistical significance was set at $p < 0.05$.

6.3 Results

Regarding the distribution by sex, it was approximately equal (Figure 6.1). Of the 44 patients subjected to laparoscopy via transperitoneal or retroperitoneal approach, 54.5% are male and 45.5% are female. Among the 50 patients operated on through an open lateral approach, 54% are male and 46% are female.



	M	F
Open	27 (54%)	23 (46%)
Laparoscopic	24 (54.5%)	20 (45.5%)

Figure 6.1. Gender distribution for NP through open and laparoscopic approaches

The PADUA score was used to evaluate the complexity of renal tumour ablation via open and laparoscopic approaches. It was significantly correlated with BMI in the laparoscopic group (p=0.023), but not in the open group (p=0.202). Regarding complications, we found that the PADUA score was significantly correlated with postoperative complications in the laparoscopic group (p=0.013), but not in the open group (p=0.287).

Correlating the complications with the PADUA score, we found that in the open approach group there was no correlation between intraoperative complications (p=0.380) or postoperative complications (p=0.541) and the PADUA score. In the laparoscopic group, we found no correlation between intraoperative complications (p=0.287) and the PADUA

score; however, for postoperative complications, there was a statistically significant correlation, with a p-value of 0.013 (95% confidence interval).

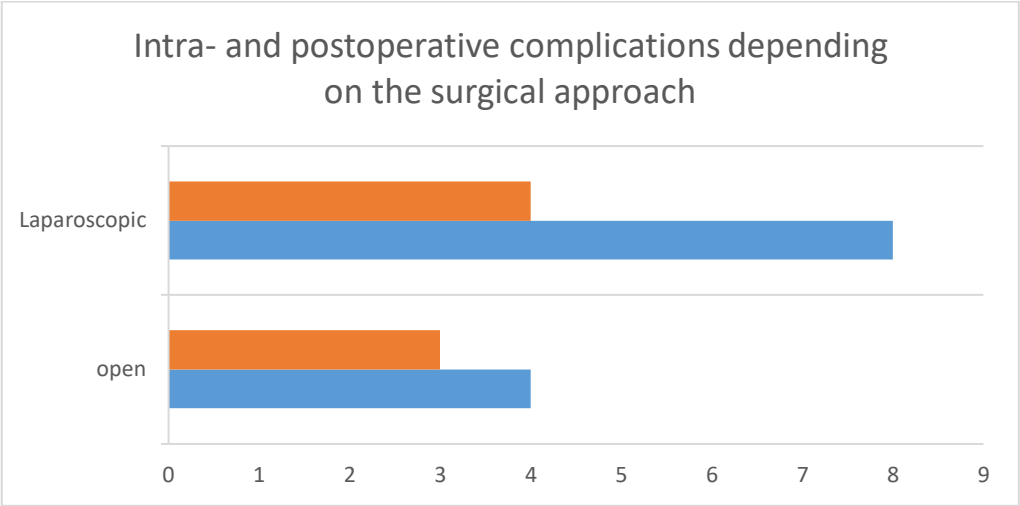


Figure 6.6. Intraoperative complications (blue) and postoperative complications (orange) depending on the approach route

6.4. Discussion

Some studies have shown results similar to our study [30], while others have found a correlation between the PADUA score and surgical time or ischemia time [31]. However, one aspect that has not been considered is the surgeon's expertise, which can influence this correlation.

The operative blood loss was similar in both groups: 282 mL for patients included in the open group and 270.45 mL for the laparoscopic group. Sharma and colleagues advocate for the same outcome, with a lower estimated blood loss for the laparoscopic approach compared to the open approach, and a significant reduction in postoperative complications at 30 days for the laparoscopic approach [32].

Obesity is associated with an increased risk of developing renal cancer; similarly, it is linked to a higher risk of chronic kidney disease [33]. Obesity is known to increase the complexity of surgery and complications due to excess adiposity, obscure anatomy, and adherent perirenal fat [34]. The laparoscopic approach has advantages over open surgery in terms of healing and morbidity in obese patients.

6.5. Conclusions

Intraoperative blood loss is lower in minimally invasive surgery, but the risk of local recurrence appears to be higher due to positive surgical margins. Additionally, ischemia time and operative time are longer in the laparoscopic approach given its complexity, but

these parameters did not have a significant correlation with the PADUA score, raising the idea that there are multiple confounding factors that need to be analysed.

In the laparoscopic group, a high PADUA score was significantly correlated with postoperative complications, whereas no statistically significant results were observed for the open approach. Additionally, a high body mass index (BMI) was correlated with a high PADUA score, indicating that obesity may increase the complexity of laparoscopic surgery in partial nephrectomy. The laparoscopic approach has multiple advantages, but it depends on the surgeon's expertise, which constitutes a limitation of the study.

Chapter 7. Factors leading to the conversion of laparoscopic interventions to open surgery in partial nephrectomy: a case series and literature review

7.1 Introducere

Among the factors that contribute to the conversion from laparoscopic to open surgery are: significant bleeding that makes it difficult to visualise the operative field or anatomical features, adhesions that hinder the progression of dissection, accidental injury to adjacent tissues or organs without the possibility of repair in the absence of haptic feedback, as well as patient-related factors such as increased BMI, coagulation disorders or other comorbidities, and not least, the experience of the surgical team.

Understanding the predictive factors and knowing the risks helps surgeons choose the most appropriate technique for each individual case, minimising the risk of postoperative complications. Although the rate of conversion to open surgical approach in minimally invasive procedures for renal tumours is low, some research indicates that approximately 20% of these conversions occur in emergency situations, while the rest are caused by various intraoperative circumstances [177].

The aim of this study is to evaluate the management of possible perioperative complications in the case of laparoscopic partial nephrectomy.

7.2. Patients and methods

Over a period of 3 years, between 2022 and 2024, I prospectively monitored the intraoperative complications occurring in cases of partial nephrectomy performed at the Urology Clinic of the 'Professor Dr. Theodor Burghele' Clinical Hospital. In total, I included 103 cases of partial nephrectomy, as follows:

✓ Group 1 - 48 interventions via laparoscopic approach

✓ Group 2 - 55 interventions via an open approach.

7.3. Results

In the analysed batches, the most common complications were related to intraoperative haemorrhage or adhesive syndrome, usually post-procedurally, which made it impossible to continue the intervention in some cases, leading to conversion. Additionally, although rare, there are significant postoperative complications that result in total nephrectomy. The conversion rate of approximately 4.2% for laparoscopic partial nephrectomy demonstrates an inherent technical challenge of the minimally invasive approach in certain cases.

In the entire sample, complications occurring during the surgical procedure were rare, recorded in only 5 patients (4.85% of the total). The vast majority of patients, 98 (95.15%), did not experience intraoperative complications, highlighting a favourable safety profile of the procedures.

Case report

A 56-year-old female patient, a smoker, known to have hypertension (HTN) and diabetes mellitus, overweight (BMI 25.95), with a history of haematuria for which she underwent urological consultation, ultrasound examination, and computed tomography, which revealed a right renal tumour mass measuring 4/3 cm, mediorenal, on the anterior valve, she is admitted to the clinic for specialised surgical treatment.

Preoperative findings show haemoglobin at 10.9 g/dl, creatinine at 1.04, and glomerular filtration rate (GFR) at 60.44 (G2). The patient is haemodynamically and respiratorily stable, with a blood pressure of 140/80 mmHg and a ventricular rate of 80 bpm. The non-invasive score is 10A, which increases the likelihood of complications. It has been decided to perform a partial nephrectomy via a laparoscopic retroperitoneal approach. Intraoperative findings include extensive adhesional syndrome and excessive perivisceral fat, which hinder the visualisation of the structures of interest. The renal artery is successfully clamped, but the tumour mass is difficult to visualise.

Considering the suspicion of a renal carcinoma that should be resected with safe margins within oncological limits, a decision is made to convert to an open approach.

The patient, being positioned in the left lateral decubitus, immediately undergoes an incision in the bed of the 12th rib and the procedure continues with excision of the tumour mass and reconstruction of the renal parenchyma. The case is notable for a shorter

operative time compared to the other cases presented, lasting 180 minutes, with an ischemia time of 25 minutes, which would not affect the function of the remaining nephrons.

Postoperative, the progression was slow; the patient required a transfusion of one unit of red blood cell mass, although the intraoperative estimated blood loss was approximately 300 ml. Due to these reasons, the case involved a hospital stay of 13 days, but with a favourable course at discharge, with haemoglobin at 9.3 g/dl and creatinine at 1.14. Under appropriate outpatient treatment, the patient returned at 30 days without complaints.

7.4. Discuții

The most common complication that led to the conversion of the laparoscopic procedure to an open approach in the cases analysed was adhesion syndrome, which made dissection of the planes difficult, followed by intraoperative bleeding that hindered optimal visualisation despite aspiration.

Although there are numerous studies in the specialised literature analysing the postoperative complications of laparoscopic partial nephrectomy, a score that considers both the patient's characteristics and intraoperative risk factors has not yet been established [36, 37].

7.5. Conclusions

The study concludes that laparoscopic partial nephrectomy is a challenge, and management must be individualised. Conversion during laparoscopic renal procedures is a rare but significant event, influenced by the complexity of the procedure and the patient's characteristics, emphasising the importance of case selection and surgical experience.

Chapter 8. Considerations contributing to positive surgical margins in partial nephrectomy

8.1. Introduction

It is useful to study the relationship between positive safety margins, the risk of recurrence, and the impact on survival after partial nephrectomy.

The aim of the study was to evaluate the surgical and oncological outcomes in cases with positive surgical margins after partial nephrectomy performed via laparoscopic and open approaches.

8.2. Pacienţi şi metode

This is a prospective observational analytical study, conducted at a single centre, between 2022 and 2024. We included two new cases, in addition to the 103 cases of partial nephrectomy previously presented, in order to expand the results to a larger sample size. Of the 105 cases, the groups are approximately evenly distributed, with 49 cases for laparoscopic PN and 56 cases for open PN.

The location for conducting research activities, patient recruitment, and investigation was the 'Professor Dr. Theodor Burghele' Clinical Hospital, Bucharest. The measures regarding compliance with bioethical standards in doctoral research included the patient's informed consent and the approval of the Institutional Ethics Committee.

8.3. Results

The study considers the analysis of positive surgical margins after partial nephrectomy for renal carcinoma, emphasising the importance of achieving negative surgical margins, which would likely improve clinical outcomes.

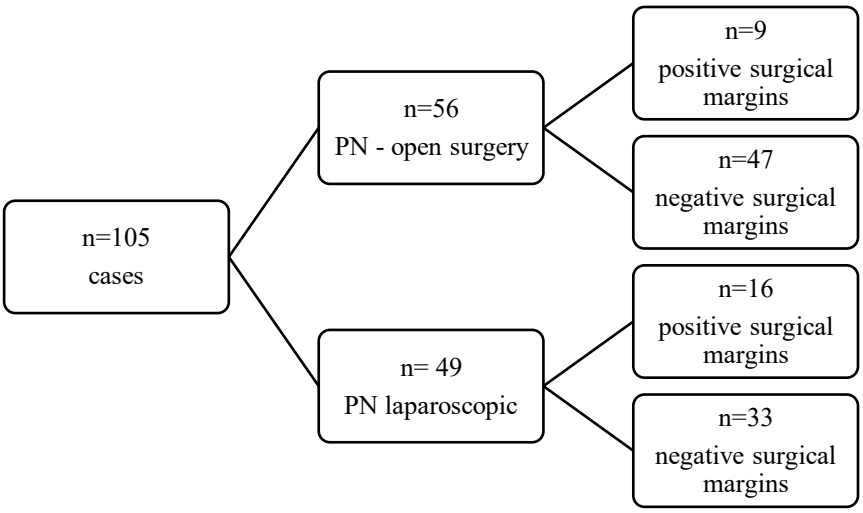


Figure 8.1. The sample size included in the descriptive analysis

Among all cases, the presence of a malignant tumor or an oncocytoma, whether associated with other tumors or not, was confirmed in 89 patients, requiring surgical treatment. This highlights the importance of an intervention that ensures complete resection of the tumor.

In the subset of patients operated on laparoscopically, a significant proportion of cases exhibited positive surgical margins, indicating a relatively high rate of non-oncological radicality in this context. This fact may be influenced not only by the technique itself but also by the surgeon's experience, the intention to preserve as much

renal parenchyma as possible, or the tumour's localisation. A careful analysis of the tumour's location revealed that most specimens with positive resection margins originated from tumours located at the level of the posterior renal valve in the case of laparoscopic PN, namely 9 out of 16 cases, with the rest being situated mediorenally or on the anterior valve.

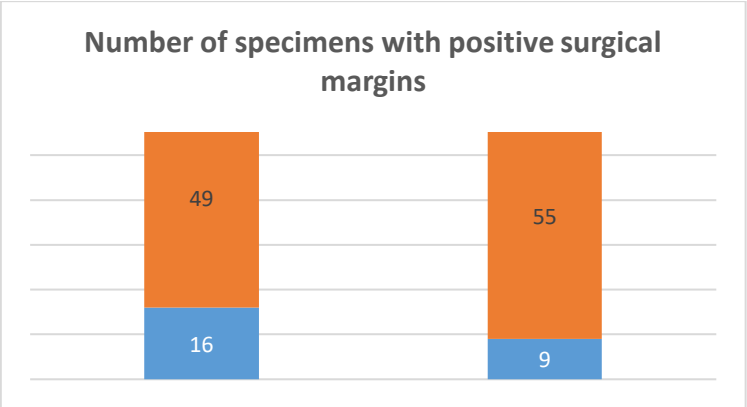


Figure 8.2. The number of specimens with positive surgical margins following histopathological examination, out of a total of 105 cases of partial nephrectomy.

8.4. Discussion

Patients in whom the histopathological result showed the presence of positive margins on the resected specimen were informed that they would require more intensive surveillance, both clinically and radiologically. Although the occurrence of a recurrence is not certain, only through optimal surveillance can cases with an increased risk of secondary local therapies be detected [38, 39].

Therefore, radical nephrectomy or re-resection of the margins can lead to overtreatment in many cases. On the other hand, protection against recurrence is not guaranteed by negative surgical margins, being reported in up to 1.5% of cases belonging to this patient category [40].

8.5. Conclusions

Regarding the highlighting of cases with positive resection margins in the histopathological examination and the analysis of the causes and consequences of incomplete tumour resection, the results obtained are consistent with the data in the literature. We found that approximately twice as many specimens from laparoscopic surgery had positive surgical margins compared to tumours resected via open approach, with these patients being monitored more intensively both clinically and through imaging.

Chapter 9. Conclusions and Personal Contributions

9.1. General conclusions

Laparoscopic partial nephrectomy is a safe minimally invasive alternative that offers multiple benefits, such as a reduced length of hospital stay, decreased blood loss, a rapid postoperative recovery, and patients resuming their activities in a relatively short period.

The main objectives of laparoscopic partial nephrectomy are to excise the tumour with margins of healthy renal tissue, maintain effective haemostasis, and preserve renal function, while also ensuring a favourable aesthetic appearance and immediate healing.

Laparoscopic partial nephrectomy can be performed via transperitoneal or retroperitoneal approach, each having advantages and limitations that must be known.

The retroperitoneal technique represents an optimal approach method for the treatment of localized renal cancer and is characterised by a low incidence of complications and oncological outcomes comparable to those of the classic procedure.

The transperitoneal approach offers a larger working space, allowing for an extended angle and superior manoeuvrability of the laparoscopic instrument. Additionally, the anatomical orientation is more familiar to surgeons, even though it involves a higher risk of intra-abdominal complications.

Although open nephrectomy appears to have a shorter operative time and is not influenced by the characteristics of the tumour or the patients, this technique more frequently involves postoperative complications and a slower recovery. On the other hand, the open approach remains valuable in complex cases or with large tumours, offering the advantage of direct accessibility and better intraoperative control, especially in centres where laparoscopic technology is limited.

An essential element for preserving renal function is related to the management of intraoperative ischaemia. Limiting the duration and type of ischaemia is fundamental to prevent irreversible damage to the renal parenchyma and should preferably be kept under 25–30 minutes.

9.2. Personal contributions

This thesis has achieved its scientific research objectives through a rigorous analysis of approach strategies in partial nephrectomy, highlighting both the advantages and the technical-economic limitations of each surgical technique analysed. The study demonstrated that the laparoscopic approach, although involving increased consumption of

material resources and requiring a significant learning curve, can offer substantial clinical benefits.

However, certain issues remain unresolved, such as the lack of consensus regarding objective criteria for selecting the optimal approach based on tumour and patient characteristics, as well as the difficulty in standardising the technique amidst anatomical variability and surgical experience. In this context, I have contributed personally through a multidimensional assessment of predictive indicators that can influence therapeutic decision-making.

In chapter 6 (pages 50-68), I demonstrated that in laparoscopic approaches there is a statistically significant correlation between an increased PADUA score and the prediction of complications; however, this non-parametric system must be associated with clinical and paraclinical features, as well as oncological risks.

In chapter 6 (pages 54-62), I established that the BMI of patients is a predictor for the occurrence of complications and delayed recovery, indicating that obesity can increase the complexity of laparoscopic surgery in partial nephrectomy.

In chapter 7 (pages 71-158), I demonstrated that the tumour size and its localisation on the posterior valve could influence laparoscopic surgical management.

In chapter 8 (pages 144-158), I analysed the factors leading to positive resection margins on histopathological examination after partial nephrectomy, depending on the type of surgical intervention. I found approximately twice as many positive surgical margins in laparoscopic surgery compared to open approach, with these patients being monitored more intensively both clinically and through imaging.

Overall, the work contributes in terms of the approach to individualised surgical treatment for each case, based on the prospective assessment of clinical and paraclinical parameters specific to each patient.

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