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Laparoscopic Nephrectomies: A Breakthrough in a Sub-Saharan University Hospital in Dakar, Senegal: Results of a Global Health Surgery Collaboration

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Abstract

Background and Aim: The technique of laparoscopic nephrectomy represents a significant advancement in reducing perioperative complications, postoperative morbidity, and hospitalization durations. Despite the long learning curve and the costs associated with instrumentation, its development in Senegal is now a reality. **Objectives:** Our objective was to present the initial results of a series of laparoscopic nephrectomies performed at the Urology Department of Idrissa Pouye General Hospital. **Methodology:** This was a retrospective, descriptive study conducted at the Urology-Andrology Department of Idrissa Pouye General Hospital on patients who underwent laparoscopic nephrectomy from 2010 to 2024. We studied the epidemiological and clinical characteristics and compared our results with those in the literature. **Results:** Sixteen cases of laparoscopic nephrectomies were collected during the study period, with surgical indications being 44% for renal tumors and 56% for non-functional kidneys. Surgically, all interventions were performed via the transperitoneal route, with 2 cases converted to open surgery, and the average duration of the interventions was 234 minutes. The postoperative follow-up reveals no major or minor complications, with an average hospital stay of 5 days. **Conclusion:** Laparoscopic nephrectomy is a safe and validated surgical technique. It offers satisfactory results with zero mortality and reduced morbidity. Its continuous and sustainable practice depends on the willingness of decision-makers to invest in the acquisition, maintenance, and renewal of equipment, as well as training.

Keywords

Nephrectomy, Laparoscopy, Mini-Invasive Surgery, Urology, Sub-Saharan Africa, Global Surgery, Health Access, Health Equity

1. Introduction

Nephrectomy is a partial or total surgical removal of the kidney [1]. It can be performed laparoscopically or through open surgery. This surgical technique involves inserting trocars through small skin incisions, allowing the passage of a camera connected to a video system and surgical instruments such as forceps and scissors connected to an electrosurgical device. Apart from this configuration of access and vision, this technique allows the same maneuvers as open surgery. The fact that only small incisions are made, resulting in small scars, makes laparoscopy a minimally invasive procedure [2]. In recent decades, many urological procedures have been described and performed with varying success [3] [4]. Thus, in urology, the use of laparoscopy is increasingly noted for various indications such as varicocele repair, radical prostatectomy, adrenalectomy, renal cyst surgery, pyeloplasty, promontofixation, and nephrectomy. The advent of minimally invasive renal surgery techniques, initiated in the 1990s, has developed worldwide and has since seen major innovations, making them increasingly efficient. The benefits of this approach are evident with better visualization and dissection of tissues, better vascular control, reduced blood loss and pain, as well as shorter hospitalization and convalescence times [5]. Despite these advantages, laparoscopic nephrectomy has been slow to develop in our region due to challenges related to the acquisition and maintenance of equipment, gaps in health access and health equity, as well as the challenge of training urologists [6]. The objective of the study was to present our initial experience in transperitoneal laparoscopic nephrectomies, the results from a global health surgery collaboration between UK surgeons' team and our department team.

2. Materials and Methods

Our study was conducted at the Urology-Andrology Department of Serigne Mague ye GUEYE at Idrissa Pouye General Hospital in Dakar. This was a retrospective, descriptive study on cases of nephrectomies performed in the department from 2010 to 2024 using the laparoscopic approach. We included in our study all patients who underwent laparoscopic nephrectomy during the study period and whose medical records were complete. We excluded patients with incomplete medical records. We used the hospitalization registers of the urology department, anesthesia records, as well as the databases of the operating room and the medical information unit of HOGIP.

Demographic, clinical, and paraclinical data were collected using a pre-established form with the following study variables:

1) Demographic: age, sex, geographic origin, mode of admission.

2) Clinical data: reasons for consultation, physical examination results, indications, laparoscopic approach, notion of intraoperative conversion, complications, duration of the intervention, and peri- and postoperative morbidity using the Clavien Dindo Standards.

3) Paraclinical: biological data, imaging data, blood loss, and pathological examination of surgical specimens.

The nonfunctioning Kidney was defined as an atrophic kidney with less than 5% function secretion confirmed by ultrasound plus CT scan and nuclear scan. The opposite kidney was normal with a normal overall function. The collected data were recorded and processed in an Excel 2010 table, and we performed frequency and mean calculations for descriptive statistics.

2.1. Surgical Procedure

Patient Positioning: (**Figure 1**)

All patients were positioned in the right or left lateral decubitus position, depending on the side to be approached, under General Anesthesia with orotracheal intubation (GA + OTI) and antibiotic prophylaxis. Transurethral bladder catheterization was systematic, but the placement of a nasogastric tube was optional. The main operator was positioned on the opposite side of the kidney to be approached, and at the ventral level, the assistant positioned next to the operator, holding the camera. A second assistant was often necessary for instrument management.

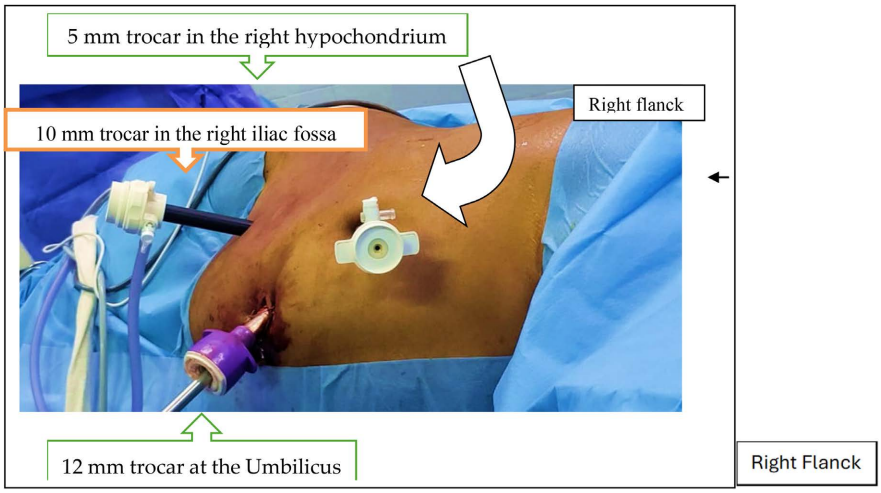

Figure 1. Location of trocars during a right laparoscopic nephrectomy.

Surgical Technic:

The transperitoneal approach was the only route used in our cohort. After disinfection and placement of sterile drapes, a first 10 mm or 12 mm trocar was inserted by "open laparoscopy" at the umbilical level through a para-rectal incision. The optics were then introduced through the trocar to verify that it was properly

placed in the peritoneal cavity. Insufflation was performed progressively to obtain a pneumoperitoneum with an average pressure of 12 mm Hg. A second 10 mm trocar was inserted under visual control at the outer third of the line joining the umbilicus to the anterior superior iliac spine, then a third 5 mm trocar was placed 2 finger widths below the subcostal line on the vertical line passing through the midclavicular line. The placement of a fourth 5 mm trocar was optional if additional retraction was needed.

The surgical procedure included different steps, depending on the side, with step-by-step dissection allowing access to the vascular pedicle. After dissecting the vessels until sufficient length was obtained for the placement of self-locking clips "Hem-o-lock" on the artery and renal vein, Clipping and sectioning of the ureter were performed, and the kidney was released at the upper poles and lateral-posterior surfaces. The kidney was extracted by extending the incision from the trocar positioned at the groin level by about 5 cm - 6 cm. The optional placement of a Redon drain, removal of the trocars under optical control, and closure of the access orifices completed the procedure. The surgical specimens were sent for pathological examination.

2.2. Postoperative Follow-Up

Postoperative follow-up was initially ensured in the recovery room, then in hospitalization through clinical and biological evaluation. All patients were seen in consultation at one month, 3 months, and 6 months during their follow-up.

2.3. Surgeon's Team and Learning Process

First experiences with laparoscopy surgery started in 2010 with the Ivumed team (1 Hand assisted Nephrectomy). Then, other workshops with urologists from the French Urological Association were organized (Two nephrectomy cases). Since 2019, a steady learning process has been established with urologists from the UK. We organized a total of four workshops in October 2019, interrupted by the COVID-19 pandemic, and then resumed in March 2022, October 2022, and May 2024. Since then, the local team has become completely autonomous and has achieved 5 laparoscopic nephrectomy cases on its own, one case of conversion for bleeding due to extended perinephrite lesions.

3. Results

During the study period, from 2010 to 2024, we were able to collect 51 cases of laparoscopic surgery in urology, all indications combined, including 16 cases of nephrectomies, representing 31.3% of all laparoscopic cases (Table 1).

The average age was 44 years, with extremes of 8 and 71 years. The sex ratio (male/female) was 1.6. Sixty-nine percent of the patients came from the Dakar Region, while the others were from the Regions of Saint-Louis, Thiès, Kaolack, and Louga. Two patients only were referred from another facility; the other patients had come to the consultation on their own.

Table 1. List of clinical observations.

Number	Age (an)	Sex	Diagnostic	Side	Lap to open Conversion
1	64	Male	Kidney Tumor	Right	No
2	50	Male	Kidney Tumor	Left	No
3	71	Male	Kidney Tumor	Left	No
4	54	Male	Kidney Tumor	Left	No
5	28	female	Kidney Tumor	Left	No
6	53	female	Kidney Tumor	Left	No
7	48	female	Kidney Tumor	Left	No
8	8	Male	Destructed Kidney	Left	No
9	22	Male	Destructed Kidney	Right	No
10	40	Male	Destructed Kidney	Right	No
11	43	Male	Destructed Kidney	Right	No
12	30	female	Destructed Kidney	Right	Yes
13	60	female	Destructed Kidney	Left	No
14	50	female	Destructed Kidney	Left	No
15	50	Male	Destructed Kidney	Right	Yes
16	46	Male	Destructed Kidney	Left	No

Note: a. Sample of a Table footnote (*Table footnote is dispensable*).

The average time between the onset of symptoms and consultation was 2 years, with extremes of 6 months and 5 years. The medical history revealed a history of surgery in 9 patients, representing 56% of the sample, including 4 cases of median laparotomy, 1 case of lumbar incision, 1 case of low transverse Cesarean section, 1 case of femur fracture, 1 case of Transurethral Resection of the Prostate, and 1 case of Ureteroscopy. Comorbidity was found in 8 patients, representing 50% of the sample, including 3 cases of hypertension and, respectively 1 case of diabetes, stroke, heart disease, asthma, and sickle cell disease. CT scans, sometimes accompanied by scintigraphy, allowed the diagnosis of renal tumors in 44% of cases and non-functional kidneys in 56% of cases (**Figure 2**).

All interventions were performed via the transperitoneal route, including one by "Hand-assisted laparoscopy." The average duration of the intervention was 234 minutes, with extremes of 185 to 305 minutes. The mean duration of surgery is decreasing as the local team is progressing and as the equipment setup is improving. Two cases of intraoperative conversion to laparotomy were recorded due to the need to control bleeding. Drainage of the renal compartment was performed in 3 cases. Postoperative outcomes referring to Clavien Dindo standard reveal no major complications as bleeding, ileus abdominal pain, wound infection… and no intraoperative blood transfusion was required. The average hospital stay was 5 days, with extremes of 4 to 8 days. The pathological examination of the surgical

specimens showed 1 case of angiomyolipoma, 2 cases of renal oncocytoma, and 3 cases of renal cell carcinoma requiring follow-up in oncology.

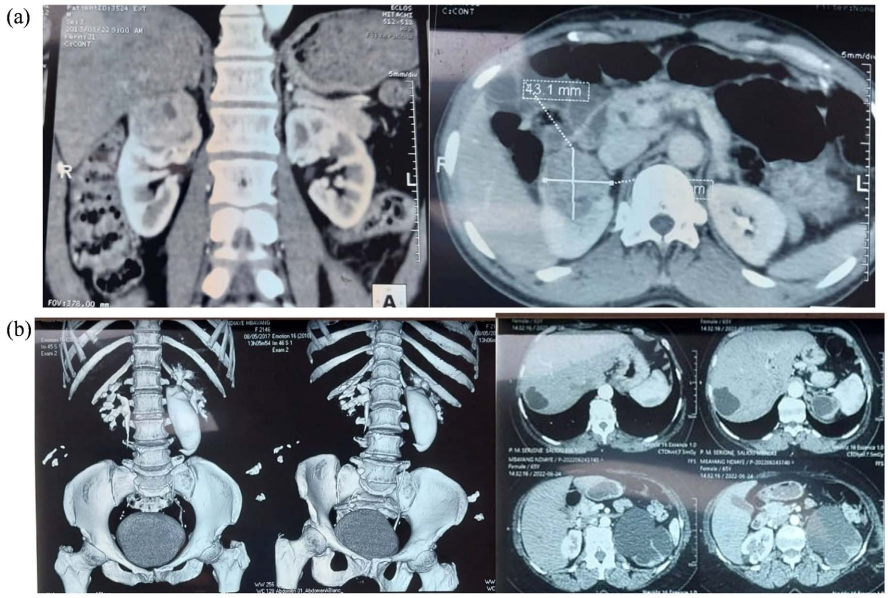

Figure 2. This is a figure showing the radiological presentation of patients (a) CT scan showing a right renal tumor; (b) Uro-CT scan showing a left UPJ obstruction complicated by stage IV hydronephrosis.

4. Discussion

Minimally invasive laparoscopic surgery is the gold standard for the management of renal tumors and other surgical renal conditions with few reported complications [7]. After the first cases of laparoscopic nephrectomy were performed in 1991 by Clayman [8], this technique, although common in some countries, has been slow to develop in our regions, due to the inadequacies of the technical platform and the lack of development of laparoscopic surgery in the training of urologists in Senegal. Indeed, acquiring the skills for this technique is delicate, with a long learning curve and the need for simulation equipment to create a secure environment where the learner can acquire these skills with confidence while minimizing risks to the patient. In our series, the average age of our patients remains below the average age found by some authors, such as Shuford M.D. *et al.* [9], who reported an average age of 62 years [34 - 87] in a cohort of 33 patients. However, the indications for this surgery remain valid regardless of the patient's age. Indeed, in elderly patients, despite their more frequent comorbidities, there is no added morbidity related to age, according to a study on laparoscopic nephrectomy in patients over 75 years old [10]. The same Considerations apply to paediatric patients, where the technique is considered safe and satisfactory [11].

The young age of patients in laparoscopy, however, poses an additional challenge that must be known, anticipated, and managed if necessary, particularly in terms of anatomical variations and anaesthetic specifics related to the young age

of the patient [12]. In addition to age, there are variations according to gender, with the advantage of the vaginal route for specimen extraction in females. Despite a sex ratio of 1.6, our surgical team, for its first experiences, chose exclusively to perform abdominal extraction of the surgical specimen, even though vaginal extraction is a proven technique without sexual side effects, with a clear advantage in terms of convalescence duration and postoperative morbidity [13].

The variation in the geographic origin of our patients confirms the reference position of our center but also and especially the need to democratize access to minimally invasive surgery in other regions of the country, even though significant progress has been made in recent years regarding the presence of urologists in remote areas of the country [14]. The delay in consultation of our patients, already found by other authors Ndoye M. *et al.* [15], explains the predominant painful symptomatology in most of our patients or even renal function impairment, often indicative of locally advanced disease, while elsewhere the discovery of renal masses occurs in more than 50% of cases incidentally [16]. These late discoveries, on the one hand, limit the indications for radical and curative renal surgery but also and especially limit the indications for the laparoscopic approach, even though some authors have proven the safety of the technique in cases of advanced renal cancer with improved survival, postoperative morbidity, with the only limitation being a higher level of difficulty [17]. The indications for laparoscopic nephrectomy for benign conditions, particularly for destroyed kidneys, represented the majority of cases in our series. These data are comparable to those of Henri R. *et al.* [18], who also found more cases of benign conditions. The peculiarity in our countries would be the frequency of chronic infectious diseases such as tuberculosis, pyonephrosis, and staghorn calculi, leading to complete kidney destruction, aggravated by delays in appropriate management, but also by the uncontrolled use of antibiotics. The use of laparoscopy in this surgery is much more complex, exposing to greater morbidity with longer operative times. In these indications, the retroperitoneal approach, although less practiced [19], is preferable as it allows faster direct access to the renal pedicle while limiting intraoperative digestive incidents. Moreover, in case of major difficulty, the hand-assisted variant is a good alternative that allows for a reduction in operative times. Still, in these indications of laparoscopic nephrectomy for destroyed infectious kidneys, the conversion rate seems higher [20]. The high comorbidity rate found in our patients did not constitute a contraindication in itself; however, these elements must be taken into account in the preoperative evaluation and during surgery to limit their impact, especially since they negatively influence the occurrence of peri-and postoperative complications, as reported by several authors, including Bensalah K. *et al.* [7]. In terms of intervention duration, our results are comparable to those of Dauleh *et al.* [21], who also reported 243 minutes for transperitoneal laparoscopic nephrectomies, far ahead of Macdougall [22], who reported a duration of 336 minutes. The same applies to the hospitalization durations found, which were longer than those of Dauleh, with an average of 3 days, but shorter than those of Ono, which

reached an average of 10 days [23]. Thus, our study, like those in the literature, confirms that laparoscopy remains a safe technique that offers certain advantages compared to open surgery, even in cases of destroyed infectious kidneys, with indeed shorter intervention durations (90.60 ± 15.99 vs. 133.64 ± 10.57 minutes; p = 0.001), shorter hospitalization durations (3.40 ± 0.12 vs. 5.48 ± 0.16 days; p = 0.001), and lower complication rates (12% vs. 36%) [24].

This study finally highlights the importance of team collaboration in reducing the gap in access to technology in urology. The role of non-private health organizations, the role of scientific societies, as well as the personal involvement of surgeons in developing connections and maintaining a collaborative bridge between countries and institutions, is something to be magnified, shared, and undoubtedly useful for learners from each side. This study has limitations as the sample size is very small with the main reasons being open surgery is still predominant with regards to big tumor and inoperable cases by using laparoscopy. The retrospective collection of variables made it difficult to assess more variables as the accurate blood loss quantity and the size of tumors.

5. Conclusion

Laparoscopic nephrectomy is a safe and validated surgical technique. The indications overlap with those retained in open surgery, with lower mortality and morbidity. It is a minimally invasive surgery that requires a good knowledge of kidney anatomy and supervised learning of the technique, as well as the presence of teams trained in the technique. Sub-Saharan Africa is lagging behind the recent advancement in minimally invasive surgery. Reducing disparities in access to new techniques in surgery should be an objective of the global surgery calendar in countries in need. This achievement through international collaboration is a good learning case.

Ethical Approval

Study approved by the hospital Ethics committee.

Patient Consent

Consent form was obtained for each patient.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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