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RESEARCH ON THE APPLICATION OF SINGLE-PORT RETROPERITONEAL LAPAROSCOPIC NEPHRECTOMY FOR BENIGN NON-FUNCTIONING KIDNEYS

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SUMMARY OF MEDICAL DOCTORAL THESIS

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INTRODUCTION

Non-functioning kidney is the result of many diseases such as renal vascular disease, renal parenchymal disease, or diseases of the excretory system. A unilateral non-functioning kidney may not be dangerous to the patients, but it may also be associated with one or more complications such as hypertension, fibrositis causing pain and especially bacterial pus stasis [111]. In case of a nonfunctioning kidney with complications, nephrectomy is the most radical treatment whether through open or laparoscopic surgery with minimal damage to the abdominal wall [118].

Laparoscopic nephrectomy can be performed by a transperitoneal or retroperitoneal approach. Retroperitoneal approach has the disadvantage of having fewer anatomical landmarks compared to intraperitoneal access. In addition, retroperitoneal laparoscopic surgery also has a narrow surgical field as it is limited by ribs superiorly and by iliac crest inferiorly, which leads to a decrease in the amplitude of instrument manipulation and limited surgical field especially in cases of large hydronephrosis or large renal tumors [124].

Despite the above-mentioned limitations, laparoscopic retroperitoneal surgery has many advantages in comparison with the transperitoneal approach. In addition to the reduced risk of bowel injury thanks to the intact peritoneum and the lower incidence of trocar site hernia, the retroperitoneal laparoscopic approach provides quick and direct access to the kidney. This is the most significant advantage of retroperitoneal laparoscopic surgery,as it allows the renal pedicle to be controlled rapidly without dissecting the colon, spleen, liver, and pancreas to expose the kidney. This is of great importance to patients who has a history of multiple intraperitoneal surgeries [124].

Laparoscopic nephrectomy has been proved to reduce postoperative pain, shorten the length of hospital stay, and optimize the aesthetic outcomes compared to traditional open surgery [34, 124]. However, standard laparoscopic surgery has not yet satisfied surgeons. Although the surgical process is acccomplished by only 3 small trocar incisions, the process of extracting the surgical specimen from the body through an auxiliary incision will undo surgeon’s efforts. This auxiliary incision increases the level of invasiveness as well as complication rate

of standard laparoscopic nephrectomy. That single-port laparoscopic (SPL) nephrectomy was developed was such a milestone when inserting every instrument through a single small incision and taking advantage of this small incision to remove the specimen out of the body. As single-port laparoscopic surgery does not have trocar incisions, complications related to trocar placement (damage to muscles, blood vessels, organs, intestines, pain and infection at the trocar site, etc.) do not exist as opposed to standard laparoscopy. The advantages of laparoscopic surgery are better aesthetic outcomes, reduced pain and quicker recovery time compared to standard laparoscopic surgery (Merseburger et al., 2013) [101].

With the desire for patients to benefit from the advantages of SPL as well as the advantages of retroperitoneal laparoscopic surgery, some other authors have combined the benefits of SPL with those of retroperitoneal laparoscopic surgery into a new method of laparoscopy – Single-port retroperitoneal laparoscopic surgery [29, 31, 32, 40, 48, 99, 101, 114, 116, 138, 149, 151, 161]. In Viet Nam, single-port retroperitoneal laparoscopic surgery was performed by Tran Ngoc Khanh and Le Dinh Khanh [5] in 2014 which showed a short operation time and better aesthetic results, but also raised many questions that require further elucidation such as: satisfaction level, pain level, subjects who benefit the most from single-port retroperitoneal laparoscopic surgery... In order to contribute to the evaluation of the outcomes of removing benign non-functioning kidney by single-port retroperitoneal laparoscopic surgery, we conduct this study: "**Research on the application of single-port retroperitoneal laparoscopic nephrectomy for benign non-functioning kidneys**" with these objectives

1. *1. To examine the clinical and para-clinical characteristics of patients with non-functioning kidney undergoing single-port retroperitoneal laparoscopic nephrectomy via the retroperitoneal approach.*
2. *2. To study some technical characteristics and evaluate the outcomes of single-port retroperitoneal laparoscopic nephrectomy for benign non-functioning kidneys.*

2. New contributions of the thesis

The thesis has contributed to the field of urology with clinical and paraclinical data of patients with non-functioning kidney in whom nephrectomy was indicated.

The thesis has shown the correlation between the renal parenchymal thickness on computed tomography scan and the corresponding residual glomerular filtration rate on radioisotope nephrogram. This, therefore, makes it possible to indicate nephrectomy based on renal parenchymal thickness in case radioisotope nephrogram has not been obtained.

As for the reality in Vietnam, except for a few big cities, most medical centers are lacking in radioisotope nephrograph, therefore, this correlation is the foundation of preoperative diagnosis of nonfunctioning kidney based on CT scan.

Performing single-port retroperitoneal laparoscopic nephrectomy is safe, feasible, and the learning curve was achieved after 15 patients. This method is associated with a number of advantages of retroperitoneal laparoscopic surgery for patients, including short operation time, intact peritoneum which helps avoid bowel injury and the applicability to patients with previous intraperitoneal surgery. The thesis also shows that a history of percutaneous renal drainage is not a contraindication to retroperitoneal laparoscopic nephrectomy. In addition, thanks to the fact that all instruments are inserted through one single incision on the abdominal wall through which the surgical specimen is extracted, this new method offers the advantages of less postoperative pain, quick recovery, improved aesthetic outcomes and high patient satisfaction.

3. Structure of the thesis

The thesis consists of 135 pages. Introduction: 2 pages, overview: 28 pages, research objects and methods: 26 pages, results: 31 pages, discussion: 45 pages, conclusion: 2 pages. In the thesis, there are 44 tables, 6 charts, 1 diagram and 10 figures. There are 166 references, including 12 in Vietnamese and 154 in English.

Chapter 1
LITERATURE REVIEW

1.1. DIAGNOSIS OF NON-FUNCTIONING KIDNEY

Clinical diagnosis

The common clinical symptom in patients with kidney failure is dull pain in the lower back. Renal colic can occur if a small proportion of the kidney filter function is still maintained. The level of pain is more noticeable in case of acute pyelonephritis or kidney abscess. Other symptoms may include dysuria, pyuria, and hematuria. Physical examination may detect large kidneys, which can be visible as a lumbar protrusion in certain cases, or kidney tenderness on palpation in case of nephritis. In addition, the examination can detect other complications of nonfunctioning kidney such as recurrent urinary tract infections, fever, hypertension or persistent pain [13].

However, these symptoms are not specific because they can occur in a pathological kidney with perfectly normal function. Therefore, clinical symptoms only help physcians detect the presence of kidney disease in order to promptly measure kidney function and select the optimal treatment to preserve the kidney function.

Diagnosis of nonfunctioning kidney by diagnostic imaging and determination of etiology

Large hydronephrosis with thin parenchyma on ultrasonography or large renal shadow on KUB suggest a reduced or loss of kidney function. CT scan helps to calculate the renal parenchymal volume on each side, which is the functional renal volume, thereby calculating the percentage of renal function on each side respectively [106, 150]. Thus, on the CTscan image, the thinner the renal parenchyma is, the smaller the parenchymal volume of that kidney, which is synonymous with a lower percentage of renal function [106, 150].

Diagnosis of poorly or non-functioning kidney

Although CT-scan can estimate glomerular filtration rate of each kidney, it depends on the quality of the computed tomograph as well as the copyrighted image processing software. The identification of a completely non-functioning kidney based on computed tomography is scarcely accurate because, similar to the venous urograph, contrast agent may appear in the excretory system in the late phase. Currently,

radioisotope renal scintigraphy is the most accurate method for diagnosing unilateral nonfunctioning kidney, enabling physicians to set up an appropriate treatment plan, which is to relieve the obstruction or remove the kidney.

1.2. METHODS OF THE REMOVAL OF NON-FUNCTIONING KIDNEY

Open nephrectomy was first performed by Simon in 1862. It was not until 1990 did Clayman and his colleagues successfully perform the first laparoscopic nephrectomy. As a minimally invasive surgical method, with reduced incision size, laparoscopic surgery has brought better perioperative results than open surgery such as less blood loss, quicker recovery time, and fewer complications, reduced postoperative pain level and shorter hospital stay [124].

Single-port laparoscopy is a less invasive method than standard laparoscopy. Through a single hole on the abdominal wall, laparoscopic instruments and scope are inserted into the body to perform surgery and after surgery, this incision is utilized to remove the specimen, all of which help ensure good aesthetic results, relieved pain and short hospital stay [101, 124]. The reduction from 3-4 trocars in standard laparoscopic surgery to 1 small skin incision in single-port laparoscopic surgery has minimized complications caused by trocar foramen (muscle-neuro-abdominal trauma, visceral and bowel trauma, trocar site hernia and infection). The reduction of abdominal wall trauma caused by trocar will help the patient have less postoperative pain, and facilitate quick recovery after surgery, which will shorten hospital stay. In addition, reducing the number of trocars will help improve the aesthetic outcomes for patients [21, 27, 124]. European Society of Veterinary Nephrology and Urology also has guidelines for the treatment of urological diseases by laparoscopic surgery and the aesthetic benefit of single-port laparoscopic surgery is also recommended with the highest level of evidence [101].

The advancements of laparoscopic surgery have not stopped there, nowadays, with the outstanding development of science, many improvements of benders, robotic technology to help doctors perform nephrectomy by laparoscopic surgery through natural holes without leaving scars [65].

1.3. HOW TO MODIFY TECHNIQUES WHEN USING STANDARD LAPAROSCOPIC TOOLS IN SINGLE-PORT LAPAROSCOPIC

Overcoming collisions between trocars and instrument handles: The position of trocars in standard laparoscopic surgery provides a favorable surgical triangle, and this triangle is mostly compromised when standard laparoscopic tools are applied to single-port laparoscopic surgery. The reason is that the laparoscopic instruments and lenses are placed through a skin incision, making them almost parallel and located relatively close to each other. Therefore, the disadvantage is that the vision is limited because the axis of the laparoscope is not flexible and is partially obscured by the instruments. Since these instruments are to each other, collision occurs both interiorly and exteriorly [124].

Outside of the surgical field trocar heads may collide with each other and the larger the heads, the greater the collision. This collision is eliminated by using small-headed trocars and adjusting the depth of the trocars so that they are placed at different heights [162]. In addition, the instrument handles also collide with each other and collide with the laparoscopic lens, which makes the surgical process even more difficult. This is because the handles are close together at the same height and this problem can be alleviated by using instruments of different lengths. This is aimed for the handles to move on different heights and avoid collision with each other. An extra-long or ultra-short laparoscope with an in-line light source is also a solution to avoid conflicts between instruments and the laparoscope [45].

Inside of the abdomen, the collision of the tool heads also occurs due to the lack of triangulation, especially when the instrument is inserted from the outside. However, standard laparoscopic instruments are available, which can be applied in single-port laparoscopic surgery without significant costs as well as without training time to get used to the instruments after overcoming some of the above disadvantages [45, 124].

Restoring the principle of triangulation and creating tension during dissection:

One of the important factors when dissecting is the reacyive force to the target organ, the tension force is essential and favorable for

exposing the tissue layers around the target organ. Using curved single-port endoscopic instruments or specialized coupling allows surgeon to exert tension force more conveniently and easilier [45]. However, when using standard laparoscopic instruments to perform single-port laparoscopic surgery, these instruments will have parallel orientations and place close to each other. Therefore, if there is no remedial method, it is not possible to create tension [123, 124].

When instrument crossing manipulation has not been performed, the surgeon holds two instruments in both hands, a tensioner in the left hand and a tissue ablation device in the right hand. At this time, the two instruments are parallel and close to each other, so the amplitude of the instruments to the sides is very narrow and there will be no tension made. The practice of crossing the instruments to create tension on the target organ makes it easier to dissect the anatomical layers. The technique of crossing the instruments will make their amplitude wider to the sides, at this time the left hand will stretch the organ tissue on the right side while the right hand will perform ablation and dissection of the left organ tissue [123).

Adjusting the laparoscopic lens and dissecting the target accurately: Although crossing manipulation has been performed to restore the principle of triangulation and create tension, the surgical instruments still collide with the laparoscope esecially when the surgeon wants to change the dissection angle or increase the tension on the organ tissue to dissect the targeted tissue precisely. This collision is more noticeable when using an laparoscopic lens with a perpendicular light source [45]. At this time, the person holding the laparoscope must continuously adjust the lens axis as well as simultaneously rotate the 30º angle of the laparoscope continuously to find the optimal position. However, even if the scope is at its optimal position and viewing angle, conflict with the surgical instrument can still happen, in this case, "releasing" the scope freely according to the amplitude of the instrument will solve the problem. Thus, the continuous adjustment of the scope according to the movement of the main surgeon is very necessary to complete the surgery with standard straight devices, so the coordination of the surgical team is very important [107, 153].

Chapter 2
RESEARCH SUBJECTS AND METHODS

2.1. RESEARCH SUBJECTS

2.1.1. Inclusion criteria

- Non-functioning kidney.
- Or pathological kidney with severe functional impairment with an GFR <10ml/min (Hemal et al. 2010) [69] or a partial kidney percent function <10% (Naghiyev et al. 2017 [110]) on patients with good compensation of the contralateral kidney function (>60 ml/min).
- Presenting with complications such as pain unresponsive to treatment, urinary tract infection, hypertension.
- 16 years old and above, regardless of gender
- ASA index ≤ 3
- No contraindications to retroperitoneal laparoscopic surgery
- The patient consented to participate in the study

2.1.2. Exclusion criteria

- The patient has a pathology report of cancer
- Untreated urinary tract infection
- Acute pyelonephritis with or without sepsis, septic shock.

2.1.3. Time and Place

The study was carried out from January 2016 to December 2021 at Hue Central Hospital.

2.2. METHODS

2.2.1. Methods

2.2.1.1. Design

Prospective descriptive, controlled, interventional study.

2.2.1.2. Sample size

The study sample size was calculated according to the rate-determining research formula and p is the success rate. According to several authors, success rate of studies ranged from 93.8% to 100% [29,40,48,116,149]. We chose p of 96.9% which was the median value. Thus, p=0,969, n=46,2. Minimum sample size of study was n>= 47

2.2.2. Steps to conduct and identify the variables

2.2.2.1. General information and clinical symptoms:

Age, gender, address, occupation, ASA, surgical history

2.2.2.2. Blood tests

2.2.2.3. Urine tests

2.2.2.4 Diagnostic imaging tests: Radioisotope renography

2.2.2.5. Preoperative preparation: prepare the patient before surgery and determine factors concerning patients preoperatively

2.2.2.6. Perform single-port laparoscopic nephrectomy via a retroperitoneum approach and intraoperative monitoring

- Patient positioning and surgeon position

+ Patient positioning: After endotracheal anesthesia, stomach tube and urinary catheter are placed. Place the patient on the 90-degree lateral position similarly to open surgery

+ Main surgeon stands on the back side of patient to perform the operation. The assistant stands higher on the platform or sit on a lower chair than the surgeon to avoid hand collision. Scrub nurse stands on the opposite site.

- Surgical equipment and instruments

- Operating procedure: Including 7 steps

Step 1: Insert laparoscopic port and some technical modifications

Insert the SILS Port (Covidien) into the peritoneal cavity by using Hasson technique. The 2,5cm skin incision commences above the hip oblique line below rib 12th in the midaxillary line. Cut the subcutaneous tissue to expose the layers of the abdominal external oblique, internal oblique, and transverse muscles. Use curved Kelly forceps to separate through these muscle layers, minimizing neuromuscular damage, and expose the peritoneum. [24].

Figure 2.1. Make a 2.5-cm skin incision Use curved Kelly forceps to separate through these muscle layers in posterolateral abdominal wall (image of patient no.30).

Step 2: Use trocar to manipulate and some technical modifications in surgery

Switch trocars, eliminate collisions between trocars and between trocar handles. Use instruments with different lengths, hold the instrument as a palm grip, cross the instruments, adjust the laparoscope and precisely dissect the targeted tissue, apply less pressure to maintain control of the laparoscope according to the instrument amplitude (Figure 2.4).

Figure 2.4. Grip and cross the instruments, use instruments with different lengths, alleviate the collision between trocar handles (image from patient no.30)

Step 3: Dissect the renal pedicle

Step 4: Dissect the ureter and diagnose the cause of the disease

Step 5: Separate and dissect the artery, vein and ureter

Step 6: Dissect the kidney parenchyma

Step 7: Remove the specimen and finish the surgery

Figure 2.7. Remove surgical specimen through the laparoscopic port (Image from patient no. 38)

Figure 2.8. Drain through the incision, close the incision (Image from patient no.38)

- *Intraoperative monitoring:* The success rate of single-port retroperitoneal laparoscopic nephrectomy, intraoperative blood loss, intraoperative complications, operating time, operations- time chart.

2.2.2.7. Postoperative mornitoring and patients' recovery assessment

- Assess and manage postoperative pain

- Assess the patient's recovery with an enhanced recovery after surgery program

- *Postoperative complications:* Classification of postoperative complications according to modified Clavien grading system

- Length of hospital stay

2.2.2.8. Follow-up after surgery

- 1-month follow-up visit:

+ Clinical examination:

+ Measure the level of patient's satisfaction by Likert scale: Interview to survey the satisfaction level of patients with some of the following characteristics [96, 122]:

• Does this surgery harm your body?

• How would you rate your satisfaction with pain after surgery?

• How satisfied are you with the recovery after surgery?

• How would you rate your satisfaction with hospital stay?

• How would you rate your satisfaction with hospital charges?

- 6-month follow-up visit

+ Clinical examination: Examine the patient's general condition and record signs of incisional pain, incisional hernia, and wound healing.

+ Survey the patient's aesthetic opinion about the incision (scale of 10):

1	2	3	4	5	6	7	8	9	10
Very revoling		Revolting		Not revolting/ Not beutiful		Beautiful		Very beutiful	

• Aesthetic assessment of surgical incisions through the set of available images (scale of 10)

There are 2 images: scars of 2 nephrectomy methods, which are standard laparoscopic surgery and open surgery. Each incision on the image is graded by the patient on a 10-point scale [164].

	
Score for open surgery:	Score for standard laparoscopic surgery:

Figure 2.9. Patient was re-examined and scored the incision through the set of images [164].

• The patient scores his or her incision of single-port retroperitoneal laparoscopic nephrectomy: Score for single-port laparoscopic surgery

Figure 2.10. Patient scores single-port incision after 6 months (Image of patient no. 38)

Calculate the mean scores of the re-examined patients to evaluate the aesthetic score of single-port retroperitoneal laparoscopic nephrectomy.

+ Assess the level of patient's satisfaction: Using Likert scale:

Very Unsatisfied	Unsastified	Neutral	Sastified	Very sastified
1 point	2 point	3 point	4 point	5 point

Interview to survey the satisfaction of patients with some of the following characteristics [96, 122]:

• Are you satisfied with this incision?

• Do most people find your incision beautiful?

• Are you satisfied with the method of single-port laparoscopic surgery

• Will You still choose single-port laparoscopic surgery if needing a similar surgery again?

2.3. DATA ANALYSING AND PROCESSING

The data were processed by medical statistical method via Medcalc 20.0 statistical software

2.4.ETHICS IN RESEARCH

Approved by the ethics committee in medical research of Hue University of Medicine and Pharmacy

Chapter 3
STUDY RESULTS

3.1. CLINICAL AND PARA CLINICAL CHARACTERISTICS OF PATIENT WITH REDUCED KIDNEY FUNCTION AND LOSS OF KIDNEY FUNCTION

Clinical characteristics

- Average age: 62 ± 12.9. Male/Female ratio = 1.45/1. Avergae BMI: 19.9 ± 2.1 kg/m2.
- Patients with previous incision for minimal kidney drainage in the ipsilateral hip region accounted for 9.3%. These patients still had a successful single-port laparoscopic nephrectomy.
- 70.4% of patients was diagnosed with the disease over 12 months. Patient hospitalized with low back pain accounted for 81.5%. There were 7/54 patients with acute renal colic at admission, accounting for 13% (of which 3/7 patients with renal colic had accompanying gastrointestinal symptoms by urgent admission, accounting for 42.9%).
- Enlarged kidney was recorded in 57.4% of patients.

Paraclinical characteristics

Table 3.12. Distribution of degree of hydronephrosis on an CT

Degree of hdronephrosis on an CT scan image	**n**	**%**
Grage 1	0	0
Grage 2	1	2,2
Grage 3	26	56,5
Grage 4	16	34,8
Atrophic kidney	3	6,5
TOTAL	**46**	**100**

- The proportion of Grade 3 and Grade 4 hdronephrosis was 91,3%

Table 3.12 Distribution of renal parenchymal thickness on CT

Renal parenchymal thickness on CT scan image (mm)	**n**	**%**	**Mean ± SD (Max – Min)**
0.5	19	41,3	1,4 ± 1,1 (0,5 – 5,0)
1	11	23,9	
2	8	17,4	
3	5	10,9	
4	2	4,3	
5	1	2,2	
TOTAL	**46**	**100**	

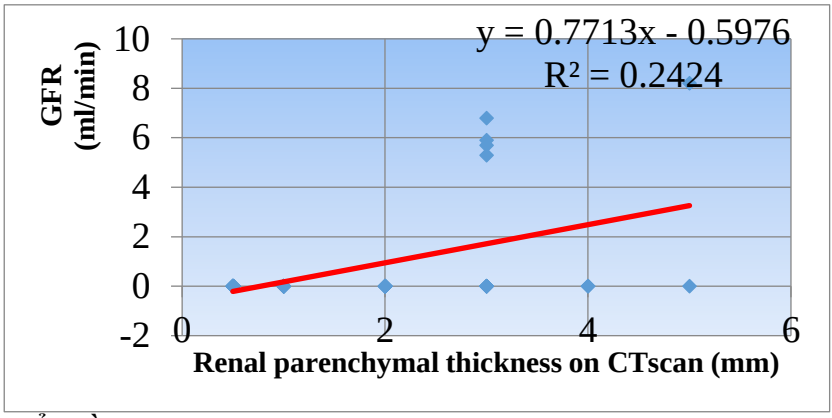
Renal parenchymal thickness on CT scan image was 1.4 ± 1.1 mm

Table 3.13. The GFR on the Radioisotope renography

Glomerular filtration rate (ml/min)	**n**	**%**	**Mean ± SD (Max – Min)**
0	48	88,9	0,62 ± 1,9 (0 – 8,2)
1 – 10	6	11,1	
> 10	0	0	
TOTAL	**54**	**100**	

All patients were examined with radioisotope renography. 100% of patients had a glomerular filtration rate of less than 10 ml/min. Up to 48/54 patients (88.9%) had a completely nonfunctioning kidney and 11.1% of patients had severely impaired kidney function (kidney was

still working but very poorly, GFR was below 10 ml/min or the percentage of partial renal function of less than 10%) accompanying with the complications nessecitating nephrectomy. The correlation between the renal parenchymal thickness on CTscan with GFR on Radioisotope renography was shown in the chart below:



Biểu đồ 3.2. Correlation between the parenchymal thickness and GFR ($p<0,05$, $R^2=0,2424$)

Characteristics of the kidney are determined after surgery

- 53.7% of patients have a renal volume of greater than 300 ml, these patients had their kidney aspirated to reduce the level of enlargment (including 3 patients with giant hydronephrosis, accounting for 5.6%). 38.9% of patients which did not receive aspiration in surgery have a volume of kidney <300 ml.
- There are 96. 3% patients with a parenchymal thickness of less than 5mm confirmed postoperatively. The average parenchymal thickness is 1.9 ± 1.3 mm. There is a correlation between the parenchymal thickness that is confirmed after surgery and eGFR of the removed kidney ($r= 0.4$, $p<0.05$).
- The kidney with 1 artery and 1 vein accounted for 61.1%. There are 13% of patients with abnormal vascular branches. Poorly or non-functioning kidney due to stones accounted for 75.9%.

SOME TECHNICAL CHARACTERISTICS AND RESULTS ASSESSMENT OF SINGLE-PORT LAPAROSCOPIC RETROPERITONEAL NEPHRECTOMY

Single-port laparoscopic retroperitoneal nephrectomy combines manipulative channels through a single port and utilizes this single hole for specimen collection. This method is feasible, safe, associated with good aesthetic result, low rates of complications, shorter hospital stay and high patient satisfaction.

Technical characteristics of single-port laparoscopic retroperitoneal nephrectomy

- Use the SILS Covidien port. Insertion of the hip oblique endoscopic port using the Hasson opening technique. The average endoscopic port placement time was 5.5 ± 1.5 minutes. Gate placement time was positively correlated with BMI (r = 0.62).
- Standard straight laparoscopic instruments cross each other to restore triangulation and increase tension during dissection. If there is still a clash between the scope and other laparoscopic instruments, the assistant "releases" the scope according to the movement of the main surgeon.
- The success rate of single-port laparoscopic surgery was 98.1%, the rate of conversion to standard laparoscopy was 1.9%. There was no case needed to be converted to open surgery.
- There were 80.8% of patients with direct access to the renal peduncle at the root successfully and 19.2% of patients were operated near the porta remis due to severe adhesions and inflammation. The patients with non-inflammatory kidney and little inflammation (accounting for 44.5%) all successfully entered the renal peduncle and successfully removed the parenchyma in the renal fascia. There is a relationship between renal pedicle dissection technique, parenchymal dissection technique and the level of adhesion inflammation ($P<0.05$).

Intraoperative monitoring

- The mean operating time was 81.1 ± 26 minutes. There was a correlation between operating time with BMI and nephritis ($P<0.05$). The training curve was achieved and the intraoperative complications were reduced after 15 patients. The Operations-Time Chart is summarized through the chart below (n=54):

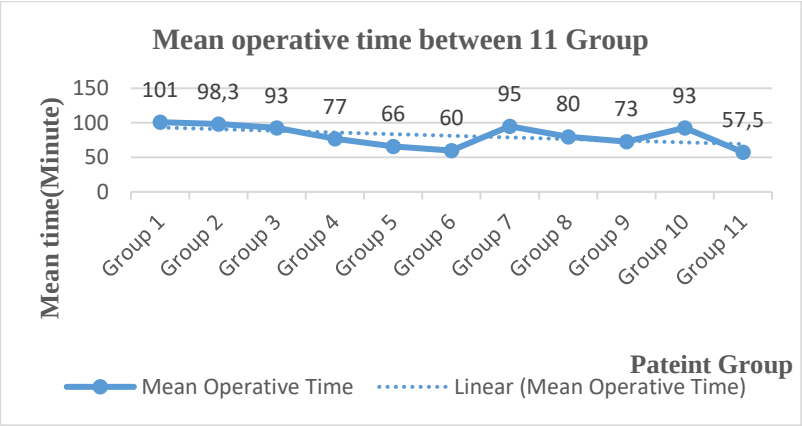


Chart 3.5. Time chart in SPL retroperitoneal nephrectomy

Postoperative follow-up

- The average level of pain at the incision right after surgery was 4.0 ± 1.3. Pain level was related to operating time (P<0.05). The duration of analgesia injection is 1.8 ± 0.9 days.

Table 3.37. The patient's recovery after nephrectomy (n=52)

Yếu tố phục hồi (giờ)	**n**	**Mean ± SD**	**Min**	**Max**
Time for the patient to sit up on their own in bed	52	8,5 ± 3,8	4	20
Time for recovery of bowel movements	52	17,2 ± 9,6	6	42
Drain removal time	52	36,5 ± 9,2	24	56
Patient's baseline self-activity	52	38,3 ± 4,8	32	54
Time for patient to return to normal activities	52	58.0 ± 5.0	52	74

Patients with longer draining time were associated with adherent nephritis. Postoperative complications were encountered in only 1 patient, which was surgical site infection, accounting for 1.9%. Mean length of hospital stay was 5.7 ± 1.3 days.

Follow-up

Table 3.42. Patient satisfaction (n=52)

Survey factor	Satisfaction score according to the Traditional Likert scale										
	1 pt		2 pt		3 pt		4 pt		5 pt		M ± SD
	n	%	n	%	n	%	n	%	n	%	
Surgery does not harm your body	0	0,0	2	3,8	2	3,8	25	48,1	23	44,2	4,3 ± 0,7
Are you satisfied with the pain after surgery?	0	0,0	0	0,0	1	1,9	18	34,6	33	63,5	4,6 ± 0,5
Are you satisfied with the recovery after surgery?	0	0,0	2	3,8	3	5,8	20	38,5	27	51,9	4,4 ± 0,8
Are you satisfied with your hospital stay?	0	0,0	1	1,9	2	3,8	26	50,0	23	44,2	4,4 ± 0,7
Are you satisfied with the hospital fees?	0	0,0	0	0,0	5	9,6	16	30,8	31	59,6	4,5 ± 0,7

92.3% of patients said that single-port laparoscopic surgery did not harm their body or was less invasive at 1 month.

Table 3.44. Patient satisfaction (n=35)

Survey Factor	Satisfaction score according to the Traditional Likert scale										
	1 pt		2 pt		3 pt		4 pt		5 pt		M ± SD
	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*	
You are satisfied with this incision	0	*0,0*	0	*0,0*	2	*5,7*	12	*34,3*	21	*60,0*	4,5 ± 0,6
Most people find your incision beautiful	0	*0,0*	1	*2,9*	2	*5,7*	12	*34,3*	20	*57,1*	4,4 ± 0,7
Are you satisfied with this method	0	*0,0*	0	*0,0*	3	*8,6*	8	*22,9*	24	*68,6*	4,6 ± 0,7
Do you still choose SP if need a similar surgery again	0	*0,0*	0	*0,0*	1	*2,9*	6	*17,1*	28	*80,0*	4,8 ± 0,5

- The average score of laparoscopic surgery scars of this surgery is 8.1 ± 1.0 points, corresponding to beautiful ranking. There were 94.3% of patients satisfied with the incision at their 6-month follow-up visit.
- 97.1% of patients would still opt for laparoscopic surgery if they had to do a similar surgery.

Chapter 4
DISCUSSION

4.1. CLINICAL, SUBCLINICAL CHARACTERISTICS OF PATIENTS WITH REDUCED AND LOSS OF KIDNEY FUNCTION

Clinical:

A history of Percutaneous Renal Drainage or Percutaneous Nephrolithotomy (PCNL) is not a contraindication to single-port laparoscopic retroperitoneal nephrectomy: Our study has 9.3% of patients with a history of PCNL or Percutaneous Renal Drainage. For patients with a history of Percutaneous Renal Drainage or PCNL, even though only small traces are left on the skin, there is always inflammation of the renal parenchyma with the posterior abdominal wall (where the renal drain goes through). However, this is not a big obstacle for single-port laparoscopic retroperitoneal nephrectomy. In these cases, Hasson's technique is favorable for the removal of renal parenchymal adhesions from the posterior abdominal wall and is a suitable and safe technique. According to Patel (2020) [124] Percutaneous Renal Drainage is not a contraindication to single-port laparoscopic retroperitoneal nephrectomy, but we should not put the endoscopic port close to the site of previous renal drainage.

Laparoscopic retroperitoneal surgery is preferred over Transperitoneal approach for patients who have a history of intraperitoneal surgery: for patients with a history of intraperitoneal surgery, according to Audebert (2000) [18], the rate of bowel adhesions at the umbilicus can reach 50% after laparotomy with midline incision and 23% in case of transverse incision [18]. When the intra-abdominal organs are adhered due to previous operations, the act of dissection of these adhesions increases the risk of organ bleeding and bowel perforation, moreover, anatomical distortions due to adhesions also make it more challenging to clearly expose organs during dissection. Because of such disadvantages and difficulties, previous documents considered the history of abdominal surgery as a relative contraindication to laparoscopic surgery [66].

Therefore, some important points should be considered when performing laparoscopic surgery on patients with previous abdominal surgery. Firstly, single-port laparoscopic retroperitoneal nephrectomy should be prioritized because there is no difference in operating time,

bleeding or hospital stay between patients with laparotomy and no laparotomy [159]. The second is that the first troca should be placed far from the scar of the previous surgery. Finally, the first trocar should be placed according to the Hansson method or used optical trocar to prevent bowel damage [66].

Patient has a history of abdominal surgery in our study accounted for 7.4%. These patients had absolutely no retroperitoneal inflammation, so surgery was conducted smoothly.

Subclinical:

Determination of renal parenchymal thickness

In addition to detecting stones and grading of fluid retention, CT scan also has other advantages such as detecting abnormalities of urinary system anatomy, inflammatory lesions around the kidney, distinguishing urinary stone composition and measuring renal parenchymal thickness [102].

CT scan in 46 patients: 100% of patients had renal parenchymal thickness of ≤ 5mm, in which, 65.2% of patients had renal parenchymal thickness of no more than 1 mm. The mean renal parenchymal thickness was 1.4 ± 1.1 mm. This explains the high number of patients with completely nonfunctioning kidney in our study.

Our study (Figure 3.2) shows the correlation between parenchymal thickness on CT with Glomerular filtration rate (GFR) on renal scintigraphy of pathological kidneys similar to the study of Morrisroe in 2010 [106] and Singh in 2021 [150].]. Therefore, on CT images, the thinner the renal parenchymal, the lower the functional renal volume, leading to a decrease in the percentage of partial renal function of that kidney [106, 150]. Zengin et al (2015) [166] suggested that when the renal parenchyma is as thin as paper, the kidney completely loses its function and then no contrast is seen in the excretory system.

Apart from detecting abnormalities in anatomy and for accurate diagnosis of associated pathology, CT scan also measures GFR simply, easily and can replace Radioisotope renography. [75, 106, 111].

The limitation of this study is the CT scan has not been taken for all patients and the quality of the computed tomograph is not high. The CT scanner also did not come with integrated software to calculate the percentage of functional renal volume on each side to calculate the corresponding GFR.

4.2. SOME TECHNICAL CHARACTERISTICS AND ASSESSMENT OF LAPAROSCOPIC RETROPERITONEAL NEPHRECTOMY

Technical characteristics of laparoscopic retroperitoneal nephrectomy

The unclear display image and the sudden decrease in surgical field during endoscopic aspiration causes blur in lens and prolong urine collection time through the endoscope. Therefore, in our opinion, the aspiration of urine to collapse the kidney should be done by Hasson method, after aspirating the collapsed kidney, we use gauze to dry the surgical field before placing the SILS Port. As a result, the aspiration is faster and the surgical field is not blurred with the endoscopic lens as in the endoscopic aspiration.

The exchange of 10 mm trocar for renal vascular clamping is done simply and quickly. This situation applies to patients with large veins that cannot be clamped by hem-o-lok through the 5mm trocar, accounting for 57.7% in our study. However, there are 2 patients who have changed trocar but the diameter of the vein is still larger than the size of the largest Hem-o-lok. We used thread to reduce the vein diameter before clamping (3.8% of the cases).

Intraoperative follow-up

The average surgical time is similar to that of author Chen [29] and faster than other authors when performing single-port laparoscopic surgery due to benign pathologies.

In this study, an assistant and instructor performed surgery in the first 30 cases. Figure 3.5 shows that the surgery time decreases gradually as skills are achieved after 15 patients and continues to decrease further until patient number 30.

From patient 31 (starting from patient group 7), the investigator performed a retroperitoneal single-port laparoscopic nephrectomy with 2 assistants. Figure 3.5 shows the skills also gained after 15 patients operated with the first assistant. After that, the time chart of surgery increased significantly in patient group 10. The reason was due to the participation of the second assistant. Changing the second assistant takes time to get used to the skills required for single-port laparoscopic surgery. In which, the skill of adjusting the endoscopic lens according to the surgeon is very important.

Thus, the continuous adjustment of the assistant's lens according to the operation of the surgeon is necessary to complete single-port laparoscopic surgery by standard straight tools. This testifies that the synchronous coordination of the surgeon crew and assistants is very important [107, 153].

Postoperative follow-up

We did not use morphine for pain relief, so the patients in this study did not suffer the side effects of Morphine, including slow recovery of bowel movements and addiction.

The average length of hospital stay of our patients in this research is 5.7 ± 1.3 days, equivalent to Ryu [138] and much longer than in Chueh [31] and Singh [151]. However, we allowed patients to be discharged when they no longer have pain in the incision, without postoperative complications or solved complications, when the patient has performed the basic functions in daily life by themself such as eating, drinking, using the toilet, taking a shower, clothes changing, walking on their own and controling the basic activities. If based on the drainage period and the use of painkillers for patients, our patients can be discharged after an average of 2 days postoperatively, equivalent to the research of Chueh [31] and Singh [151].

Follow-up

92.3% of patients think that the single-port laparoscopic surgery has not damaged their bodies, 98.1% of patients are satisfied with the level of postoperative pain and 90.4% are satisfied with the postoperative recovery. Some patients who are not satisfied with the minimum invasion of single-port laparoscopic surgery are young female patients. The reason for the high rate of price satisfaction in our research is the use of hem-o-lok to control blood vessels which is more cost-effective than the use of vascular stapler [98]. In addition, removing the specimen from the body in all patients did not require specialized instruments, but only common ones. The technique of retroperitoneum pumping with handmade balloons and the use of straight instruments of the standard laparoscopic surgery kit also help to save costs on this research.

If there is a similar surgery, 97.1% of patients will still choose the method of single-port laparoscopic surgery and 2.9% of patients remain neutral (this patient had to pay high costs due to the need of vascular stapler). This indicates that the patient satisfaction rate is high with the single-port laparoscopic surgery and decide to select it if they are once again hospitalized.

CONCLUSION

1. Clinical and subclinical characteristics of patients with reduced or loss of function kidneys

Clinical

- The average age is 62 ± 12.9 years old. Male/female = 1.45/1. The average BMI is 19.9 ± 2.1 kg/m2.
- History of old incision with minimal kidney drainage in the hip area on the same side is 9.3%. These patients still have a successful single-port laparoscopic nephroectomy.
- Renal parenchyma thinness on CTscan is 1.4 ± 1.1 mm and is correlated with GFR.
- Radioid kidney function diagnostic is conducted in all patients.
- There are 38.9% of patients who do not have urinary catheterizaion in surgery have the kidney volume <300 ml.

2. Some technical characteristics and evaluation the results of the single-port laparoscopic retroperitoneal nephroectomy

The single-port laparoscopic retroperitoneal nephroectomy can combine some few channels to operate through a single hole and also get the specimens. The results show that this method is feasible, safe, associated with good aesthetic result, low rates of complications, shorter hospital stay and high patient satisfaction.

- The average surgery time is 81.1 ± 26 minutes. There is a correlation between operating time and BMI and nephritis (P <0.05). The training curve was achieved and the complications rate in the surgery was reduced after 15 patients.
- The average level of pain in the surgery is 4.0 ± 1.3. Pain level is related to surgery time (P <0.05). Time of using pain-relief is 1.8 ± 0.9 days.
- The average length of hospital stay is 5.7 ± 1.3 days.

Follow-up

- 92.3% of patients think that the single-port laparoscopic retroperitoneal surgery has not damaged their bodies and the level of invasion is low at their one-month follow-up visit.
- The average score of this surgery scarring is 8.1 ± 1.0 points, corresponding to beautiful ranking. 94.3% of patients are satisfied with the incision when re-examined after 6 months.
- There are 97.1% of patients still decide to choose single-port laparoscopic retroperitoneal surgery if they have to undergo a similar surgery.

LIST OF PUBLICATION BASED ON THIS THESIS

1. Ngo Thanh Liem, Nguyen Khoa Hung, Hoang Van Tung (2021), single-port laparoscopic nephroectomy with standard straight instruments. Vietnam Medical Journal. 509. VUNA - December 2021. P0. 144-150.
2. Ngo Thanh Liem, Nguyen Khoa Hung, Hoang Van Tung (2018), single-port laparoscopic nephroectomy: Minimally invasive, safe and aesthetic technique. Journal of Medicine and Pharmacy - 10th University of Science Conference - University of Medicine and Pharmacy - Hue University, 6 (8), December 2018. Pp. 23-26.