TRANSPERITONEAL LAPAROSCOPIC VERSUS OPEN NEPHRECTOMY FOR BENIGN NON FUNCTIONING KIDNEYS: A COMPARATIVE STUDY

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ABSTRACT: Laparoscopic nephrectomy has been established as the standard of care for the management of benign non-functioning kidneys and has gained worldwide popularity over the past decade. In this study we have compared the indications, contraindications, surgical techniques, results and complications of 25 cases of laparoscopic nephrectomy and compare it with 25 cases of open nephrectomy done for similar indications in our institution, Stanley medical college, Chennai 600001 during 2014 to 2015. Our study has demonstrated that laparoscopic nephrectomy compares favourably with open surgery with regards to decreased pain and shorter convalescence. Hospital stay has been decreased by 50%, and the time to full convalescence has been reported to be markedly less than with open removal. With growing expertise and experience current operative times have decreased dramatically and are comparable to those in the open group. The chosen technique usually depends on the surgeon's own choice as a result of his expertise and training. Laparoscopic nephrectomy should be offered to all patients with benign non functioning kidneys who is planned for elective nephrectomy, in place of open nephrectomy if feasible.

KEYWORDS: Nephrectomy, Kidney, Benign, Non-Functioning

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INTRODUCTION: Laparoscopy, as we all know, is now a well-recognized gold standard method of treating many surgical diseases of the abdomen. Laparoscopic nephrectomy⁽¹⁾ is now a well-accepted method of treating many benign and malignant conditions of the kidney.⁽²⁾ Many benign conditions of the kidney ranging from infection to chronic obstruction may result in renal failure, chronic pain and fever.⁽³⁾ These end results may require removal of kidney by surgical means.

The established operative open method of removal of kidney requires a longer convalescence, increased post-operative pain and longer postoperative stay. In 1990, Clayman et al performed the first laparoscopic nephrectomy for a 3cm renal mass in an elderly patient.⁽⁴⁾ This accomplishment represents one of the milestones in minimally invasive surgery because it provided the solution for removing a large solid organ without the need for an incision.

Indications among benign diseases planned for laparoscopic nephrectomy include chronic pyelonephritis, reflux nephropathy, pelviureteric junction obstruction with

non-functioning kidney, renal tuberculosis, multicystic dysplastic kidney, giant hydronephrosis causing symptoms like pain or discomfort, renovascular hypertension, acquired renal cystic disease in dialysis patients, xanthogranulomatous pyelonephritis, nephrosclerosis, symptomatic patients with autosomal dominant polycystic kidney disease, pyonephrosis and post kidney transplantation hypertension.⁽⁵⁾

In our study we are analysing all the parameters relating to transperitoneal laparoscopic nephrectomy for benign nonfunctioning kidney done in 25 patients and compare it with open nephrectomy done in patients with similar indications. surgeons experience is utmost importance.⁽⁶⁾

MATERIALS AND METHODS: Our study is a prospective study undertaken in our institution from February 2014 to February 2015. Ethical committee approval was obtained and around 50 patients with non-functioning kidney which are of benign etiology were chosen.

STUDY CENTRE: Department of urology, Government Stanley medical college and hospital, Chennai-600001.

STUDY DESIGN: This study was a prospective analytical comparative study wherein 25 patients undergoing transperitoneal laparoscopic nephrectomy for benign non functioning kidneys were chosen and the results were compared with 25 patients undergoing open simple nephrectomy for similar indications in our institution.

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INCLUSION CRITERIA:

1. Patients undergoing transperitoneal laparoscopic nephrectomy for benign diseases of the kidney.
2. Patients with non functioning kidney proven by radiological tests.

EXCLUSION CRITERIA: Malignant diseases of the kidney for which nephrectomy is done are excluded from the study.

PRE OPERATIVE WORK UP: History, Clinical examination-previous scars, systemic examination, Urine culture and sensitivity, Renal function tests, Ultrasound KUB, intravenous urogram, CT urogram, DTPA study.

METHOD: For laparoscopy group, consent for open conversion was obtained and merits and demerits were explained prior to the procedure. Surgical indications are PUJO.^(7,8,9) stone disease, XGP, iatrogenic stricture ureter.⁽¹⁰⁾ complex cysts.⁽¹¹⁾

TRANSPERITONEAL LAPAROSCOPIC NEPHRECTOMY:

Under general anesthesia, with prior antibiotic cover, with patient in lateral position with 15 degrees tilt posterior, with pathological side facing up, pneumoperitoneum created using veress needle and primary 10mm camera trocar.⁽¹²⁾ introduced at the level of umbilicus lateral to the rectus sheath. Under camera guidance, 10mm working trocar introduced at the level of iliac crest and 5mm trocar close to the costal margin, both in the midclavicular line. Additional 5 mm trocar.^{(13),(14)} was introduced at the level of epigastrium for liver retraction for right sided surgery.

After port placement, colon is retracted medially and ureter and gonadal vein identified at the medial aspect close to the peritoneal reflection and traced superiorly up to hilum. Ureter is doubly clipped and divided. Renal vein identified in the hilum and gonadal vein, adrenal vein, and lumbar veins identified and clipped with hem-o-lock clips and divided. On the right side, renal vein is devoid of such tributaries. Renal artery is identified behind the renal vein and delineated with the help of right angled forceps or Maryland grasper and doubly clipped and divided. Renal vein is doubly clipped and divided. Posterior and superior attachments of the kidney were released and kidney extracted in toto by extending the 10mm incision port at the iliac fossa. Hemostasis achieved and drain placed and pneumo deflated and ports closed with non-absorbable sutures. complications are bowel.⁽¹⁵⁾ vascular injury.⁽¹⁶⁾ pre peritoneal insufflations.⁽¹⁷⁾

SIMPLE OPEN NEPHRECTOMY: Under general anesthesia with patient in lateral position, with kidney rest elevated, 11th rib cutting incision is employed and muscle layers of the posterior abdominal wall opened and retroperitoneum entered. Gerota's fascia opened and ureter identified and ligated with 1-0 silk and divided. Hilum dissected and renal vein and its tributaries identified and branches doubly ligated with 2-0 silk. Renal artery is identified in the posterior aspect by flipping the kidney medially and doubly ligated and divided. Vein is divided after double ligature with silk. In case of short renal vein on the right side, 2 satinsky clamps placed at the insertion to inferior vena cava and divided. IVC is closed in 2

layers with 5-0 prolene. Other attachments surrounding the kidney were released and kidney removed in toto. Hemostasis achieved and drain placed and wound closed in layers using 1-vicryl for muscles and 2-0 ethilon for skin.

Intraoperative anaesthetic and trocar access related events, duration of surgery, blood loss, requirement of blood transfusion, duration of analgesics requirement, post-operative stay, time to resume normal activity and major admissions after surgery were noted down.

OBSERVATION AND RESULTS: Data analyses were done for 25 patients from laparoscopic nephrectomy group and 25 patients from open nephrectomy group.

SEX INCIDENCE: There were 15 male patients who underwent surgery in open group and 14 in laparoscopy group. Similarly there were 10 female patients who underwent surgery in open group and 11 in laparoscopy group. P value-0.774 by pearson's chi square test (Which is >0.001). This indicates that despite differences in numbers we are dealing with statistically similar groups in relation to sex.

INDICATIONS FOR SURGERY: Major indication for nephrectomy among benign nonfunctioning kidney was Pelviureteric junction obstruction with gross hydronephrosis, which was around 16 in open and 23 in laparoscopy group. Other indications were pyonephrosis (5 in open group and 2 in laparoscopy group), Xanthogranulomatous pyelonephritis (3 in open group and none in laparoscopy group) and Tuberculosis of the kidney (1 in open group and none in lap group).

P value-6.542 by pearson's chi square test, which is more than 0.001. This indicates that as far as indications for surgery are considered we are dealing with statistically similar groups.

SIDE OF THE SURGERY: Among the 25 cases done by open method, 16 were done on the left side and 9 on the right side. In laparoscopy group, 21 were on the left side and 4 were on the right side. P value by pearson's chi square test is 0.107, (More than 0.001) which indicates that we are dealing with statistically similar groups with regards to side of surgery.

AGE INCIDENCE: Mean age of patients in open group was 44 years and laparoscopy group was 38 years with P value 0.055 by independent samples t test (2 tailed t test for equality of means). P value is more than 0.001 which indicates that they both are statistically similar groups.

ACCESS RELATED INJURIES.⁽¹⁸⁾ Access related injuries were seen only with laparoscopy group, out of 25 patients, 3 patients had access related injuries. Two of them had omental injury due to adhesions following previous surgery. One of them had rectus muscle bleed from inferior epigastric artery with significant blood loss, which required around 3 units of blood transfusion. Open group, on the contrary did not have any access related injuries. P value is 0.074 (>0.001), not statistically significant.

OPERATING TIME AND MEAN BLOOD LOSS: Mean operating time was 149.8 minutes by open method and 201.2 minutes by

laparoscopy with p value of $<0.001^{**}$ by independent samples t test which is statistically significant in that open method has a relatively shorter operating time compared to laparoscopy method.

Average blood loss was around 300 ml in open group when compared to 184 ml loss by laparoscopy with P value of $<0.001^{**}$ by independent samples t test, which is statistically significant reduced blood loss in laparoscopy group compared to open group.

MEAN OPERATING TIME, AVERAGE BLOOD LOSS (MILLILITRE), TIME TO START ORALS: All the above variables showed $P<0.001$ by independent t test for the equality of means.

BLOOD TRANSFUSION: 16 out of 25 people operated by open method required one unit of blood transfusion, on the contrary only 7 required blood transfusions in laparoscopy group. One in the lap group required 3 units due to rectus bleed.

POST OPERATIVE STAY: Average stay in the post-operative period for patients in open group was 4.8 days whereas in lap group it was 3.56 days. This was mainly dependent on indication for surgery as infective etiology like pyonephrosis, Xanthogranulomatous pyelonephritis and tuberculosis had a lengthy stay after surgery. In laparoscopy group, for whom conversion to open was made also had a lengthy stay in the post-operative period. People who had omental adhesions and related injury in lap group had delay in return of bowel activity and thereby longer stay. So a statistically significant P value could not be arrived as far as post-operative stay was considered. P value=0.007.

POST OPERATIVE COMPLICATIONS: Post-operative complications like fever, atelectasis were taken into consideration and compared with both groups. Both laparoscopy and open group had comparative post-operative fever with 14 in open group and 11 in lap group had fever for first 24 hours. 11 in the laparoscopy group did not have fever or atelectasis at all.

WOUND INFECTION: 11 out of 25 in the open group and 5 out of 25 in the laparoscopy group had wound infection. Among the 5 cases in laparoscopy group, 3 cases were associated with conversion to open for access related injury and bleeding while dissection. P value 0.069, (>0.001) which is not significant.

DURATION OF PAIN: Mean duration of pain and requirement of analgesics were around 3.6 days in the laparoscopy group, whereas in the open group it was 5.08 days which was statistically significant. P value <0.001 .

RETURN TO NORMAL ACTIVITY: It took 12 days on the average for laparoscopy group to return to normal activity owing to smaller incisions, less post-operative pain and analgesic requirement. On the contrary, open nephrectomy group took 17.5 days for returning to normal activity. This indicates statistically significant difference between both groups with P value <0.001 .

POST OPERATIVE MAJOR ADMISSION: Only one patient required admission among laparoscopy group for nephrocutaneous fistula following residual renal tissue left after lap nephrectomy. None had such major admission in open group.

DISCUSSION: Laparoscopy as a method of surgery for benign nonfunctioning kidneys is being offered at a lot of centers around the world in place of open nephrectomy in view of several advantages of laparoscopy. In a study by landman et al, comparison of open and laparoscopic nephrectomy revealed mean operating time of 146 min and 241 minutes respectively. Similarly in our study it was 149 minutes for open and 201 minutes for laparoscopic nephrectomy which is very much similar to the results obtained by landman. In the study by landman average length of stay was 5.1 days for lap and 8.5 days for open. Time to recovery was 30.8 days for laparoscopy and 145 days for open nephrectomy. Similarly in our study, length of post-operative stay was 4.8 days for open and 3.56 days for laparoscopy. Time to full recovery was 17.8 days for open and 12.8 days for laparoscopy. These results are very much comparable. The sample size in their study was 67 laparoscopic nephrectomies and 55 open nephrectomies. In our study sample size is relatively smaller, 25 in each category.

Eraky et al reported conversion rate of 8%, 9 cases from 167 cases of laparoscopic nephrectomy. In our study we had 4 cases being converted to open from 25 cases, a conversion rate of 16% which was much higher than the reports. The conversion in our study was one due to emergency bleeding and remaining three were elective conversions due to adhesions following inflammatory pathology like pyonephrosis and xanthogranulomatous pyelonephritis. Mean operating time by laparoscopy in their study was 186 minutes, in our study it was 201 minutes which was very much comparable.

Hemal et al reported 185 laparoscopic nephrectomies of which 14 had conversion (9.72%), mean operating time of 100 min, blood loss of 133 ml and blood transfusion in 4 cases. In our study conversion rate was little higher at 16%, and operating time of 201 minutes, probably mainly due to beginning stages of advanced laparoscopic training and blood loss of 184 ml, and transfusion rate of 28% which are very much higher when compared to hemal's study. These parameters can be brought down as the experience of the surgeon increases.

In all the studies average length of stay was around 4.3 days for laparoscopic nephrectomy, which is very much similar to our study 3.56 days.

Minor and major complications were 15.9% and 4.5% in all the studies in the literature. In our study major complications were 16% and minor complications were 30.6% for laparoscopy group. These data's are little higher compared to western studies.

Gill et al reported 2% incidence of access related injuries like splenic laceration and pneumothorax among the 134 cases reported by laparoscopic nephrectomy for benign diseases. In our study 3 had access related injury to omentum and rectus muscle bleed among the 25 cases at the range of 12% incidence. Those cases reported by gill too had access related injuries at the beginning stages of laparoscopic nephrectomy.

Similarly in our study too in due course, the incidence of access related injuries may come down. Mc dougal reported mean operating time of 414 minutes for laparoscopic nephrectomy. With time and experience, the operating time has significantly come down. Even in those cases reported by Mc dougal, laparoscopy patients had less post-operative stay and less analgesic requirement. Even in our study, with mean operating time of 201 minutes, post-operative stay was around 3.56 days and analgesic requirement was there for 3.76 days which was very much lower compared to open nephrectomy.

In our study return to normal activity was 12.08 days for the laparoscopy group and 17.56 days for the open group. In various studies in the literature above convalescence and return to normal activity was around 7 to 28 days.

In our study post operative stay was around 4.8 days for the laparoscopy group and 3.6 days for the open group, which is quite similar to the studies available in the literature. The delay in post operative stay and recovery was mainly due to difference in pain threshold, presence of atelectasis/ fever, and blood loss during surgery and resulting blood transfusion, requirement of analgesics for a longer period, pre-existing medical illness etc.

Open surgical cases had a relatively longer recovery owing to pain, post-operative fever and delay in starting orals due to delayed return of bowel activity. Even the patients who had conversion to open in laparoscopy group had delayed recovery indicating incision scar and resulting pain play a very significant role in the convalescence.

Wound infection also had a very significant role. Surgery done for infective etiology like pyonephrosis and xanthogranulomatous pyelonephritis, both open and laparoscopy had incidence of wound infection. Though not statistically significant ($P=0.069$), open cases had more infection rate when compared to laparoscopy cases. These are in very much support to study by Hemal et al.

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Series	Number	Operating Time (min)	Blood loss ml	Open conv	Analgesia days	Mean stay	Convalescence
Hemal. ⁽¹⁹⁾	185	100	133	18	-	3	-
Gaur	38	133	83.5	6	2.4	2.7	13.3
Doubl	36	95	-	-	-	3.7	-
Eraky ^(19,20)	106	186	-	9	-	2.5	-
Rass weil	17	211	-	-	1	6.3	21
Ono	20	198	135	0	1	8	18.8
Parrra	12	145	140	1	4	3.5	14
Keely	79	146	-	4	-	4.7	-
Kerbl	20	355	200	1	1	3.6	28
Mcdou gal	9	248	235	0	1	3.5	7
Gas man	8	125	65	0	1	2.5	-
Our study laparo	25	201	184	4	5.08	3.56	12.08

Data analyses were done for 25 patients from laparoscopic nephrectomy group and 25 patients from open nephrectomy group.

			Surgery		Total
			Open	Lap	
Sex	Male	Count	15	14	29
		% within Sex	51.7%	48.3%	100.0%
		% within Surgery	60.0%	56.0%	58.0%
	Female	Count	10	11	21
		% within Sex	47.6%	52.4%	100.0%
		% within Surgery	40.0%	44.0%	42.0%
Total		Count	25	25	50
		% within Sex	50.0%	50.0%	100.0%
		% within Surgery	100.0%	100.0%	100.0%
Table 1					

Table 1

			Surgery	Total
		Open	Lap	
Pujo	Count	16	23	39
	% within Indication	41.0%	59.0%	100.0%
	% within Surgery	64.0%	92.0%	78.0%
Pyonephrosis	Count	5	2	7
	% within Indication	71.4%	28.6%	100.0%
	% within Surgery	20.0%	8.0%	14.0%
Xgpn	Count	3	0	3
	% within Indication	100.0%	.0%	100.0%
	% within Surgery	12.0%	.0%	6.0%
TB	Count	1	0	1
	% within Indication	100.0%	.0%	100.0%
	% within Surgery	4.0%	.0%	2.0%
Total	Count	25	25	50
	% within Indication	50.0%	50.0%	100.0%
	% within Surgery	100.0%	100.0%	100.0%

Table 2

		Surgery		Total
		Open	Lap	
Side	Left	Count	16	21
		% within Side	43.2%	56.8%
		% within Surgery	64.0%	84.0%
	Right	Count	9	4
		% within Side	69.2%	30.8%
		% within Surgery	36.0%	16.0%
Total	Count	25	25	50
	% within Side	50.0%	50.0%	100.0%
	% within Surgery	100.0%	100.0%	100.0%

Table 3

	Surgery	N	Mean	Std. Deviation	P value
Age in years	Open	25	44.00	10.344	0.055
	Lap	25	38.04	11.040	

Table 4

AGE INCIDENCE

P value- 0.055

			Surgery		Total
			Open	Lap	
Access Injuries	Present	Count	0	3	3
		% within Access injuries	.0%	100.0%	100.0%
		% within Surgery	.0%	12.0%	6.0%
	Absent	Count	25	22	47
		% within Access injuries	53.2%	46.8%	100.0%
		% within Surgery	100.0%	88.0%	94.0%
Total		Count	25	25	50

Table 5

ACCESS RELATED INJURIES

P value-0.074

	Surgery	N	Mean	Std. Deviation	P value
Operat time (min)	Open	25	149.80	20.025	<0.001**
	Lap	25	201.20	16.411	
Blood loss (ml)	Open	25	305.00	105.198	<0.001**
	Lap	25	184.00	106.380	

Table 6

OPERATING TIME

P value- <0.001

BLOOD LOSS

P value-<0.001

	Surgery	N	Mean	Std. Deviation	Std. Error Mean	P value
Time for orals (hrs)	Open	25	39.92	6.770	1.354	.000
	Lap	25	24.48	10.284	2.057	.000
Blood transfusion (units)	Open	25	.64	.490	.098	.100
	Lap	25	.36	.700	.140	.109
Post op stay (days)	Open	25	4.80	.707	.141	.007
	Lap	25	3.56	2.103	.421	.009
Fever/atelectasis	Open	25	30.64	14.671	2.934	.000
	Lap	25	13.32	15.013	3.003	.000

Table 7

TIME TO START ORALS

P value-<0.001

			Surgery		Total
			Open	Lap	
Wound infection	Present	Count	11	5	16
		% within Wound infection	68.8%	31.3%	100.0%
		% within Surgery	44.0%	20.0%	32.0%
	Absent	Count	14	20	34
		% within Wound infection	41.2%	58.8%	100.0%
		% within Surgery	56.0%	80.0%	68.0%
Total		Count	25	25	50
		% within Wound infection	50.0%	50.0%	100.0%
		% within Surgery	100.0%	100.0%	100.0%

Table 8

WOUND INFECTION
P value- 0.069

	Surgery	N	Mean	Std. Deviation	Std. Error Mean	P value
Pain (days)	Open	25	5.08	.572	.114	
	Lap	25	3.76	1.451	.290	0.000
Return to normal activity	Open	25	17.56	2.293	.459	
	Lap	25	12.08	2.216	.443	0.000

Table 9

PAIN DURATION
P value- 0.<0.001

	Surgery	N	Mean	Std. Deviation	Std. Error Mean	P value
	Open	25	5.08	.572	.114	
	Lap	25	3.76	1.451	.290	0.000
	Open	25	17.56	2.293	.459	
	Lap	25	12.08	2.216	.443	0.000

Table 10

RETURN TO NORMAL ACTIVITY
Pvalue-<0.001

Pearson's chi square Test			Surgery		Total	
			Open	Lap		P value
Major admission	Present	Count	0	1	1	
		% within Major admission	.0%	100.0%	100.0%	0.312
		% within Surgery	.0%	4.0%	2.0%	
	Absent	Count	25	24	49	
		% within Major admission	51.0%	49.0%	100.0%	
		% within Surgery	100.0%	96.0%	98.0%	
Total		Count	25	25	50	
		% within Major admission	50.0%	50.0%	100.0%	
		% within Surgery	100.0%	100.0%	100.0%	

**POST OP
MAJOR
ADMISSIONS**
P value- 0.312