



EVALUATION OF RESULTS OF LAPAROSCOPIC DONOR NEPHRECTOMY

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New Delhi, India**ABSTRACT**

Context: Chronic kidney disease is a major cause of mortality and morbidity in the world today. Diseases like diabetes mellitus, hypertension and glomerulonephritis more commonly lead to CKD, which in later stages (stage V CKD) may require renal replacement therapy through hemodialysis, peritoneal dialysis or renal transplant. Renal transplantation offers best form of renal replacement therapy. It can be performed by open or laparoscopic methods. Laparoscopic donor nephrectomy is associated with decrease post operative pain, lesser duration of hospitalization, etc. for donors, thus, leading to more number of people opting for kidney donation and augmenting the donor pool. **Aims:** To assess the impact of laparoscopic donor nephrectomy on graft function in recipient of kidney transplantation and to evaluate the advantages of laparoscopic surgery on donor. **Settings and Design:** A prospective observational study conducted at a tertiary care hospital of New Delhi. **Methods and Material:** A total of 33 transplant pairs were studied. Results of laparoscopic donor nephrectomies were assessed by graft function and donor well being. We studied operative time, warm ischemia time, length of hospitalization, post operative pain and return to work in donors and graft function along with time taken by serum creatinine to normalize in recipients. Statistical analysis used: Data entry was done on Microsoft Excel and was analysed over SPSS version 21.0. **Results:** A short duration of hospitalisation, low analgesics requirement, lesser post-operative pain, early oral intake, small scar, less chances of wound infection and better cosmesis were seen with laparoscopic donor nephrectomy. We observed that mean duration of donor nephrectomy was 365±73.09 mins with blood loss of 150ml and first warm ischemia time of 6±0.92mins. Two patients had delayed graft function (DGF). Trend in serum urea and creatinine normalization and post-transplant urine outputs were similar to open donor nephrectomy group. **Conclusions:** Laparoscopic donor nephrectomy as a minimally invasive procedure is safe and effective. It leads to short hospitalisation, less post-operative pain, better cosmesis etc. for donor without affecting immediate or late graft function in recipient.

KEYWORDS : Laparoscopy, Donor, Kidney, Transplant etc.**INTRODUCTION**

Human kidneys are very vital organs of human body responsible for excretory functions. They also maintain fluid and electrolytes balance. Abnormality in its function may lead to acute or chronic kidney diseases.

Chronic kidney disease is a major cause of mortality and morbidity in the world today. Diseases like diabetes mellitus, hypertension and glomerulonephritis more commonly lead to CKD, which at end stage renal disease require renal replacement therapy. CKD is associated with an increased risk of cardiovascular disease and chronic renal failure. It is tenth leading cause of death. CKD is more prevalent in elderly population. Younger patients with chronic kidney disease typically experience progressive loss of kidney function, whereas, 30% of patients of CKD with age 65 years or more have stable disease^[1].

The kidney disease outcomes quality initiative (KDOQI) of the national kidney foundation (NKF) established the definition and classification of chronic kidney disease in 2002^[2] which were updated subsequently^[3, 4]. These guidelines define CKD as either kidney damage or decreased Glomerular filtration rate (GFR) of less than 60ml/min/1.73m² for at least 3 months. Irrespective of aetiology, once the loss of nephrons and reduction of functional renal mass reaches a certain point; remaining nephrons begin a process of irreversible sclerosis leading to progressive decline in the GFR.

CKD is grouped into 5 stages depending upon GFR. Stage 1 Persistent kidney damage (e.g. persistent proteinuria, abnormal urine sedimentation rate, abnormal blood and urine chemistry, abnormal imaging studies) with normal or relatively high GFR ($\geq 90\text{ml}/\text{min}/1.73\text{m}^2$)^[2]. Stage 2 Mild reduction in GFR (60-89ml/min/1.73m²) with kidney damage^[2]. Stage 3 moderate reductions in GFR (30-59ml/min/1.73m²)^[2]. Stage 4 severe reductions in GFR (15-29ml/min/1.73m²)^[2]. At this stage preparation for renal replacement therapy is started. Stage 5 Established kidney failure (GFR < 15ml/min/1.73m²)^[2] or end stage renal disease. Renal replacement therapy becomes mainstay of treatment for stage 5 diseases^[2].

Roughly over 2 million people require renal replacement therapy to sustain life worldwide, but it is likely to represent less than 10% of those who need it^[5].

Renal replacement therapy (RRT) replaces normal blood filtering

function of kidneys. It is used in renal failure occurring either due to acute kidney injury or chronic kidney disease. Haemodialysis, peritoneal dialysis and renal transplantation are various modalities of renal replacement therapy. These treatment options help in extending the life expectancy of patient, but these are not curative. Renal transplantation is best form^[6, 7] of renal replacement therapy as it increases longevity and enables patients to have better quality of life. Scarcity of organs is huge obstacle in the path of renal transplant. Due to terrible disproportion in demand and supply of organs for transplantation, only a meager 5000-6000 kidney transplants are performed in our country annually. Kidneys for transplantations can be obtained either from a living or deceased Donor. Majority of these transplants in our country are performed from live related donors.

Since its inception in 1906 the donor nephrectomies are performed by open supra eleventh flank incision^[9,11]. Open donor nephrectomies are associated with practically negligible 1st warm ischemia time, shorter duration of surgery, etc. However, the ease of this operation is also associated with significant post operative pain (due to kidney position and severe retraction of two adjoining ribs by strong metallic retractors), prolonged hospitalization and poor cosmetic result.

Clayman et al performed first Laparoscopic donor nephrectomy in 1991 and concluded that it is highly donor friendly and negates the disadvantages of open surgery^[14, 15]. But certain centres do not prefer laparoscopic method because of its long learning curve, entry into coelomic cavity, longer first warm ischemia time and smaller length of artery & vein harvested. In spite of all these difficulties, large number of centres in the world prefer to do donor nephrectomy laparoscopically. It has certainly resulted in enhanced number of people opting for kidney donation. Laparoscopic donor nephrectomy is slowly but steadily marching towards becoming gold standard.

Subjects and Methods:

An observational study conducted from 1 November 2015 to 31 March 2017 at department of General surgery, PGIMER and Dr. Ram Manohar Lohia Hospital, New Delhi. All donors with single renal artery and renal vein were included in the study. 33 kidney transplant pairs were studied, in whom, donor nephrectomy was done by open method in 24 pairs and laparoscopically in 8 pairs. One donor nephrectomy was converted from laparoscopic to open method due to dense adhesion leading to non progression of dissection. Recipients were followed up at post operative day 6 and at one month. Results of

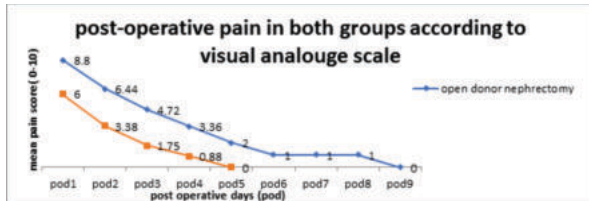
laparoscopic donor nephrectomies were assessed by graft function and donor well being. We studied operative time, warm ischemia time, length of hospitalization, post operative pain and return to work in donors and graft function, time taken by serum creatinine to normalize in recipients.

RESULTS

Mean age of donors in open donor nephrectomy group (ODN) was 39.4±8.95 yrs and in laparoscopic donor nephrectomy (LDN) was 46.50±9.03 yrs and that of recipients in ODN was 29.2±10.29yrs and in LDN was 33±9.66 yrs (p=0.36). Majority of donors were females (64% in ODN vs. 75% in LDN) and majority of recipients are males (88% in ODN vs. 75% in LDN).

Impact on donor characteristics:

Laparoscopic donor nephrectomy was significantly associated with longer duration of surgery (365±73.09mins in LDN vs. 208±69.59mins in ODN). Mean intra-operative blood loss in ODN is 128ml, as compared to LDN having blood loss of 150ml (median). One case of laparoscopic donor nephrectomy was associated with renal vein tear leading to blood loss of around 800ml; vein repaired during bench dissection. LDN was significantly associated (p value 0, T test) with longer first warm ischemia time (6±0.92mins) as compared to ODN (2.88±0.88mins). No episodes of renal ischemia were noted in intra-operative period. Post operative pain in donors were assessed using visual analogue scale and compared in two groups (ODN vs. LDN). We found that the LDN is significantly associated with less post operative pain (both in duration and intensity) as compared to classical ODN.



Mean duration of analgesics use (4 days in LDN as compared to 7.08 days in ODN) as well as duration of parenteral analgesics (2.12±0.35days in LDN vs. 4±1.11days in ODN) and oral analgesics (1.88±0.64days vs. 3.08±0.76days in ODN) use was less in LDN and difference was statistically significant. LDN was associated with shorter duration of hospitalisation (5.8±1.72 days vs. 8.56±1.75 days in ODN, p value 0.0006) and early initiation of oral intake (p value 0.0002). Patients with LDN had better cosmesis in form of small scar and associated with less incidents of wound infection (0 in laparoscopic vs. 3 in open donor nephrectomy). Post-operative ileus was present among 5 cases of ODN but not in any case of LDN.

Impact on graft function:

Ischemia of kidney was present in one LDN and 2 cases of ODN. Renal graft functions were comparable in both groups.

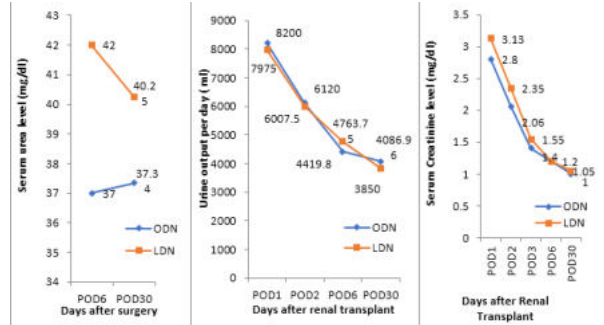
Renal Graft function	ODN	LDN	P value
Immediate graft function	14(56%)	6(75%)	0.431
Slow graft function	5(20%)	0	0.302
Delayed graft function	4(16%)	2(25%)	0.616

In post operative period, complications were more in ODN as compared to LDN but no significance difference noted. The cases of suture line infection and urinary leak were managed conservatively with parenteral antibiotics and regular aseptic dressings. 4 cases required post operative dialysis in ODN group. Post-operative ileus is seen among 5 cases of ODN but not in any case of LDN.

Post-operative clinical complications in recipient:

Post-operative complications	ODN	LDN	P value (fisher's exact test)
Suture line wound infection	3	1	1.00
Urinary leak	2	0	
Post-operative dialysis	4	0	0.550
Numbness in thigh	6	3	0.651
Lymphocele	2	0	
Number of re-admissions	3	2	0.583
Acute tubular necrosis	5	1	

One recipient in ODN group underwent cardiac arrest (VT) and was cardioverted with 200 joule shock rhythm and was later sent home with good graft function and without any disability.



Flow charts: trend of serum urea, urine output and serum creatinine level in post transplant period

There was no significant difference in both groups (ODN and LDN) in terms daily urine output, fall of serum urea and serum creatinine toward normalisation as P value is above 0.05 in all.

In our study we found out that serum creatinine normalization occurred earlier in recipients from ODN (median time 3 days) compared to in recipients from LDN (median time 5 days). No significant (p 0.38) association was seen in days spent before drain removal in recipients whether donor nephrectomy was done by open (7.8±3.06 days) or laparoscopic method (6.88±2.95 days).

Two mortalities were noted in recipients of ODN. One patient was a case of renal osteodystrophy with secondary hypoparathyroidism with growth retardation. Patient had good initial graft function with adequate urine output, later he developed diffuse acute tubular necrosis leading to acute graft rejection and patient was put on maintenance haemodialysis but he ultimately developed sepsis with multi organ failure and expired. Second patient had no graft function from immediate post operative period and on investigation she was found to have stenosis /thrombosis in graft renal artery, endovascular stenting was done, but patient developed acute tubular necrosis of graft kidney, and was put on haemodialysis. Patient remains hemodynamically unstable in post operative period and died on post operative day 20.

DISCUSSION

Most of the participants who underwent LDN were in the age group of 50-60 years (50%), whereas, in ODN it was highest in age group of 30-40 years (44%). Nearly one-third of recipients were in 20-30 years and 30-40 years age group (28% each) in ODN as compared to 50% recipients in 20-30 years age group in LDN. Majority of donors were females^[17].

The first successful case of LDN was reported by Ratner et al^[15] in 1995. Laparoscopic donor nephrectomies are associated with several concerns. Firstly, donor undergoing nephrectomy is healthy individuals subjected to a major surgical operation entirely for benefit of another individual, so donor's safety is prime concern. Secondly, kidneys harvested through LDN should provide excellent short and long term renal function in transplant recipients.

In our study, mean operative duration was longer in LDN (365±73.09mins in LDN vs. 208±69.59mins in ODN). These results were comparable to study conducted by Leventhal et al in 2000^[19] (operative duration: LDN 276mins vs. ODN 186mins) and Simforoosh et al in 2005^[21] (270±58.5mins in LDN vs. 152.2±33.9mins in ODN). The mean operative duration was shorter in both (ODN and LDN) groups in above mentioned studies compared to our study; this we suppose might be due to our less experience with laparoscopic donor nephrectomy and its long learning curve.

In study conducted by Leventhal et al in 2000^[19] blood loss during laparoscopic & open donor nephrectomies were 165ml in LDN vs. 175ml in ODN. But in our study blood loss was more in LDN (150ml) in comparison to ODN. One case of LDN was associated with massive bleeding (800ml) due to renal vein tear.

In our study, kidney was exposed to longer first warm ischemia time (6±0.92mins) in LDN as compared to (2.88±0.88mins) in ODN^[21,22] similar to result obtained by Simforoosh et al in their study in 2005^[21] in which they found that warm ischemia time was more in LDNs (8.7mins in laparoscopic vs. 1.87mins in ODN).

Post-operative pain was compared between open and laparoscopic donor nephrectomy using visual analogue scale. Visual analogue scale ranges from values between 0-10. Post operative pain was found to be significantly less in laparoscopic donor nephrectomy, both in intensity as well duration leading to less analgesics requirement in post operative period. Mean duration of analgesics use (4 days in LDN as compared to 7.08 days in ODN) as well as duration of parenteral analgesics (2.12±0.35days in LDN vs. 4±1.11days in ODN) and oral analgesics (1.88±0.64days vs. 3.08±0.76days in ODN) use were less in LDN and difference was statistically significant. Clayman et al in 1991^[14], Flower et al in 1997^[17], Leventhal et al in 2000^[19] and Wilson et al in 2011^[22] also showed similar results.

Donors in LDNs group had shorter hospitalisation (5.8±1.72days in LDN vs. 8.56±1.75 days in ODN), early initiation of oral intake (1.38±0.74days in LDN vs. 3±0.70 days in ODNs), small scar (better cosmesis) and there was no wound infection (0 in LDN vs. 3 in ODN). Findings in our study were in line with the results of study done by Wilson et al in 2011^[22] and Simforoosh N et al in 2005^[21] and Leventhal et al in 2005^[19] and Siqueira et al in 2002^[24] in which they found that LDN was associated with reduced analgesia use, shorter hospitalisation and fast recovery to work.

We found that 6 out of 8 cases (75%) of LDN showed instant graft function, compared to, 14 out of 25 cases (56%) in ODN. 5 out of 25 cases showed SGF (20%) in ODN, but none in case of laparoscopic cases; and 4 out of 25 (16%) cases show DGF in open and 2 out of 8 cases (25%) show DGF in LDNs. All kidneys removed laparoscopically functioned immediately, no recipient required post operative dialysis. In ODN, 4 cases required post operative dialysis. The result was comparable to results of study by Leventhal et al.

Initial SGF have been shown to be associated with LDNs^[25,26]. In our study, results of graft function were comparable in both Laparoscopic and open donor nephrectomy. Results of renal graft function through LDNs can neither be supposed to be superior or inferior to ODNs. Results were comparable in recipients in both groups (ODN and LDN)^[9,27].

Mean serum creatinine level at post-operative day 1,2,3,6 and 30 days are similar in both groups (open and laparoscopic). In follow up period at 6th and 30th day after operation serum creatinine levels were 1.2 and 1 respectively in laparoscopic group as compared to 1.2 and 1.05 in ODN group. Mean serum creatinine at 6th and 30th day was within normal ranges. The trend of average daily urine excretion and reduction of serum urea and serum creatinine, a move toward normalisation was similar in both laparoscopic and open donor nephrectomies^[28].

We found out that serum creatinine normalization occurred earlier in recipients of ODNs (median time 3 days) compared to in recipients of LDNs (median time 5 days).

LDN have been criticised as a procedure leading to high incidence of urinary leakage in the recipient. Nogueira et al^[18] reported uretral necrosis in tune of 4.5%. Ratner et al^[15] reported 9.1% uretral complication rate. In our study, urinary leak was not seen in LDN but seen in two cases of ODN. The reason for this might be due to our active attempt to preserve periureteral soft tissue with the kidney. Inability to assess long term impact of surgery on donor and graft function is a limitation of the present study. This may be attributed to the short follow up period.

CONCLUSION & RECOMMENDATIONS

Laparoscopic donor nephrectomy as minimally invasive procedure has certain advantages for donor like short duration of hospitalisation, low analgesics requirement, lesser post-operative pain, early initiation of oral intake, small scar and better cosmesis.

Though laparoscopic donor nephrectomy is associated with longer duration of surgery and first warm ischemia time, still it does not affect the outcome of renal transplant.

Renal graft functions, trend in serum urea and serum creatinine normalization and post-transplant urine outputs are comparable to that of the transplants performed through open donor nephrectomy

A longer follow up study with large sample size and different study design like randomised study may be planned to improve the validity and strength.

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