MedCrave
Step into the World of Research

Urology & Nephrology Open Access Journal

Review Article

Open Access

CrossMark

Live kidney donor: surgical aspect and outcome

Abstract

There is evidence that delayed graft function and acute rejection, can adversely influence not only the short-term but also long-term graft survival. Obviously, the risk of delayed graft function is considerably lower in living-donor transplants than in cadaver transplants. Also, the incidence of acute rejection is lower, not only in living-related transplants with a good human leukocyte antigen (HLA) match but even in living-unrelated transplants. The aim of this review was to evaluate the surgical procedures applied in live kidney donor transplantation and their outcomes with regards to global best practices. We searched for studies that reported on living kidney transplantation and kidney donor, surgical aspect and Outcome, from inception till 2018, and we preferred articles that were published in English. The following electronic databases were used: PubMed, Science Direct, Medline, Embase, Google Scholar and Cochrane database. Living kidney donor transplantation is better than kidney transplantation from a deceased donor because the transplanted kidney becomes active and functional immediately after transplantation, whereas in transplants derived from deceased donors, the reverse is usually the case due to shorter ischemic time by minimal ischemic damage of the allograft. The surgical procedures applied in live kidney donor transplantation, are constantly undergoing modification inorder to minimize postoperative complications, improve treatment outcomes and enhance patient's quality of life.

Keywords: donor, kidney, laparoscopy, nephrectomy, transplantation, safe, flexible, renal disease

Volume 7 Issue 6 - 2019

Abdalla Ali Deb,[1] Chidiebere Emmanuel Okechukwu,[2] Shady Emara,[3] Sami A Abbas[4]

[1]Locum Consultant Urologist in NHS, UK
[2]Physical activity and health promotion, Department of Biomedicine and prevention, Faculty of Medicine and Surgery, University of Roma Tor vergata, Italy
[3]Urology Fellow Western General Hospital, UK
[4]Consultannt Urologist, National Institute of Urology and Nephrology, Cairo, Egypt

Correspondence: Abdalla Ali Deb, Locum Consultant Urologist in NHS, UK, Email drabdodeeb@hotmail.com

Received: November 13, 2019 | **Published:** December 02, 2019

Abbreviations: HLA, human leukocyte antigen; MIDN, Mini-incision retroperitoneal donor nephrectomy, ODN, open donor nephrectomy; UNOS, united network for organ sharing; IPC, intermittent pneumatic compression; UFH, unfractionated heparin; ASTP, American Society of Transplant Physicians; CrCl, creatinine clearance rate; GA, general anaesthesia; PCA, patient-controlled analgesia; FDA, food and drug administration

Introduction

Live kidney donor is a safe, flexible, and low-risk procedure. The first successful experimental organ transplant was reported by Emerich Ullmann in 1902 in Vienna. He managed to autotransplant a dog kidney from its normal position to the vessels of the neck, which resulted in some urine flow up to 5 days.[1] The kidney can be obtained from either a living or cadaver donor. The basic criteria for a renal donor are absence of renal disease, absence of active infection, and an absence of transmissible malignancy. Whether the kidney is removed from a living donor or a brain-dead donor, the surgical goals were to minimize warm ischemia time, preserve renal vessels, and ureteral blood supply.[2] Presently, most of the kidney transplants in the world are performed with living donors. In a small but increasing percentage of cases, however, donors are genetically unrelated and include spouses, friends, or other emotionally related individuals. There is evidence that delayed graft function and acute rejection, can adversely influence not only the short-term but also the long-term graft survival.[3]

Obviously, the risk of delayed graft function is considerably lower in living-donor transplants than in cadaver transplants. Also, the incidence of acute rejection is lower, not only in living-related transplants with a good human leukocyte antigen (HLA) match but even in living-unrelated transplants. This is probably because the ischemia–reperfusion injury that may trigger rejection through the activation of innate immunity is less frequent and severe with living donation.[4] Moreover, brain death triggers a series of non-specific inflammatory events that increase the intensity of the acute immunologic host response after transplantation.[5] Study in rats confirmed that the long-term survival of brain-dead donor transplants was significantly less than that of living-donor transplants. Proteinuria and renal histologic lesions were more severe in rats receiving the transplant from brain-dead donors.[6]

Generally, patients being considered for donation should be healthy or have only mild diseases that do not cause functional limitations. Patients with jugular venous distension, recent infarction, premature atrial or ventricular contractions, important aortic Valvular stenosis, or poor general condition should be excluded due to the increased risk for cardiac complications. Diabetics are generally excluded because of the increased risk of postoperative complications in the short term and because of the potential risk of developing diabetic nephropathy in the long term. Patients with HIV infection should be excluded from living donation, since the virus is transmittable with the transplanted kidney. For the same reason, carriers of hepatitis viruses should also be excluded, with the possible exception of desperate cases in which both donor and recipient give informed consent. Evidence of an active infection should delay the transplantation until the infection is completely cured.[7] The aim of this review was to evaluate the surgical procedures applied in living kidney donor transplantation which are live donor nephrectomy and laparoscopic donor nephrectomy and there outcomes with regards to global best practices.

Methods

Search strategy

We searched for studies that reported on living kidney transplantation and kidney donor from inception till 2018, we preferred articles that are published in English. The following electronic databases were used: PubMed, Science Direct, Medline, Embase, Google Scholar and Cochrane database. We searched these databases by combining one or more of the following keywords: Live kidney donor, surgical aspect and Outcome, living kidney transplantation, kidney donor. We

assessed Full articles and extracted relevant data. We used the MeSH system to extract relevant research studies from PubMed.

Types of studies

Original articles, meta-analyses and systematic review.

Inclusion and exclusion

We selected specific articles that reported on live kidney donor, surgical aspect and Outcome, living kidney transplantation and kidney donor. Articles that are not specific and unclear were excluded. 54 studies were selected for this review.

Surgical aspects of donor nephrectomy

Live donor nephrectomy

Currently laparoscopic intraperitoneal donor nephrectomy has surpassed open donor nephrectomy in many kidney transplantation centers due to reports of reduced pain and shorter recovery time.[8]

Flank approach

There is little doubt that this approach is less morbid for obesed donors (≥100 kg) who require large incisions. However, proper preoperative counseling can allay many donor concerns, and the principle of 'leaving the best kidney with the donor' should apply regardless of which method is used to remove the donated kidney. An open surgical donor nephrectomy is indicated in a number of cases, particularly when the right kidney is to be removed, which has a short and at times thin-walled renal vein.[9] In addition, it is advantageous when the recipient is large and maximal renal vessel length is needed. In such cases a short renal vein or three or more renal arteries may compromise the recipient operation. The open surgical approach permits the safe removal of a cuff of donor vena cava, which extends vessel length and also allows for a thicker edge for suture placement in the recipient. The least morbid incision for open donor nephrectomy is the rib sparing extraperitoneal flank approach first described by Turner-Warwick.[10] This technique eliminates the psychologic concern of the donor regarding the loss of a rib, and minimizes the risks of incisional hernia and neuropraxia.[10]

Mini-incision retroperitoneal donor nephrectomy (MIDN)

The short hospital stay of 4.6 days also emphasizes quick recovery in MIDN patients. Open donor nephrectomy (ODN) patients were hospitalized almost twice as long as MIDN patients. Strictly, retroperitoneal access and placement of hooks pulls the peritoneal cavity away from the area of interest with two advantages: firstly, the peritoneum does not have to be opened, no small bowel can irritate the view by slipping into the operating field and consecutively the risk of injuries, adhesions, postoperative intestinal irritations, peritonitis and paralysis is reduced.[11] This is in good agreement with data on patient nutrition, mobilization and return to normal digestion. Secondly, the usage of hooks permits an optimization of the overview in a small access. This surely contributes to the quick recovery of patients in MIDN.[12] mini-incision for living donor nephrectomy is an attractive alternative to open donor nephrectomy ODN and reveals significant advantages in hospitalization and recovery from the procedure, low analgesic drug requirements and good cosmetic results to donors.[13]

Laparoscopic donor nephrectomy

Minimally invasive surgery was introduced into renal transplantation with the first Laparoscopic Live Donor Nephrectomy (LLDN) in 1995.[14] The LLDN procedure was described in Figures 1–13.

Figure 1 Port access under direct vision.

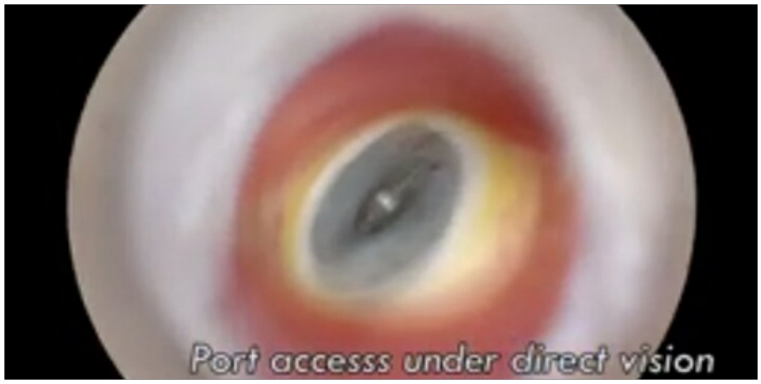

Figure 2 Deeper port access under direct vision.

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260

Figure 3 Reflection of colon.

Figure 4 Dissection of the ureter.

Figure 5 Clear view of the ureter.

Figure 6 Dissection of the renal hilum.

Figure 7 Visibility of the renal vein and renal artery.

Figure 8 Isolation of the pole of the kidney.

Figure 9 Lateralization of the Kidney.

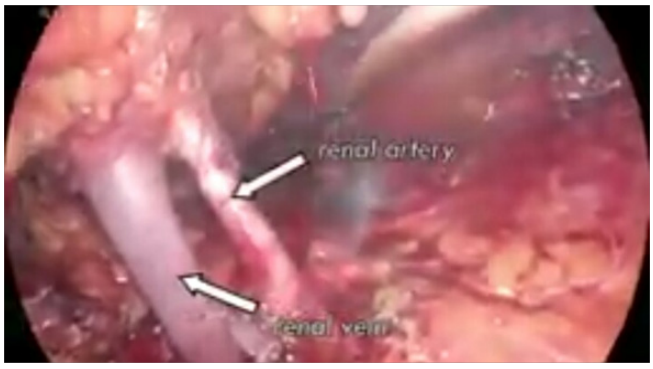

Figure 10 Clear visibility of the renal artery and renal vein.

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260

Figure 11 Ligation of the ureter.

Figure 12 Ligation and transection of renal hilium.

Figure 13 Drain insertion.

Hand-assisted right laparoscopic donor nephrectomy

As in open live donor nephrectomy, the left kidney is preferred for laparoscopic donor nephrectomy because of its longer renal vein, which facilitates the implantation process and because the liver does not need to be retracted when left nephrectomy is performed.[15] However, because the "better" kidney should always remain with the donor; occasionally the right kidney must be transplanted. Early experience with right laparoscopic donor nephrectomy was marked by a high incidence of venous thrombosis and graft loss which has since improved with experience and with technical modifications of the procedure.[15] many articles have been published demonstrating the safety and feasibility of right donor nephrectomies which has allowed transplant centers to maintain the benefits of the laparoscopic era while adhering to the fundamental principles of patient selection established during the open surgery era.[16]

Outcomes; Laparoscopic and open live donor nephrectomy

Since the first case by Kavoussi and Ratner in 1995, laparoscopic live donor nephrectomy is quickly establishing itself as the standard of care for living renal procurement. Compared with open surgery, laparoscopy provides the donor less postoperative pain, shorter hospital stays, better cosmetics, and more rapid return to normal activities. This is not surprising, as the results of laparoscopic nephrectomy for benign and malignant conditions compared with open nephrectomy have demonstrated thisc.[17] A survey conducted to evaluate 234 United Network for Organ Sharing (UNOS), listed kidney transplant programs to determine current living donor morbidity and mortality for open nephrectomy, hand-assisted LLDN, and standard LLDN.[18] The number of responding programs was 171, and morbidity was comparable between the different techniques. Complications requiring reoperation occurred in 0.4% of open cases, 1% of hand assisted LLDN, and 0.9% of standard LLDN cases. Complications that did not necessitate reoperation occurred in 0.3% of open cases, 1.0% of hand-assisted LLDN, and 0.8% of standard LLDN cases.[19] There were two reported mortalities following standard LLDN. Regarding graft function, kidneys procured laparoscopically have been shown to function well in the short and long term. The largest initial series from the University of Maryland and Johns Hopkins have demonstrated excellent long-term graft function in the recipient. No differences were observed in patient or allograft survival rates or long-term creatinine clearance rates when compared with open cases.[20]

Financial considerations

When analyzing the entire finances regarding LLDN, one must look past the initial operative and hospital costs. Studies have demonstrated the laparoscopic approach does not provide cost savings to the hospital, and in some reports may be more costly than open surgery.[21]

Preoperative considerations

General considerations

Living donation should be undertaken as a planned elective procedure. The prospective donor was commonly being admitted to hospital the day before surgery. It is important that they are admitted to and cared for within a ward that has nursing and medical staff experienced in the care of living kidney donors. Typically, this will be the transplant unit or sometimes a general surgical or urology ward with the relevant expertise. Admission of the prospective donor and recipient to the transplant ward has the advantage that it allows them to visit each other more readily after the transplant operation.[22] It is desirable that the donor operation is undertaken in an adjacent hospital facility as this minimizes disruption for the donor family and allows the donor and recipient to meet soon after surgery.[23]

Risks of aortogram

Occasionally, a complication occurs during the preoperative evaluation, most likely related to aortogram, which is now being used less frequently. Such complications include localized haematoma formation, femoral artery thrombosis or false aneyresm formation at the arterial puncture site, or more rarely reaction to the radiographic dye, such as an allergic response or acute tubular necrosis.[24]

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260

Risk and prophylaxis of venous thromboembolism

Preoperative assessment of the risk of venous thromboembolism and use of appropriate prophylaxis is a crucial aspect of peri-operative care. The use of thromboprophylaxis was probably limited. The risk factors for the development of venous thromboembolism are relatively well defined and those that are of most relevance to a healthy living donor and including: Increasing age <40 years annual risk, Obesity (BM1>30=3 x risk), Immobility (bed rest over 4 days), High dose estrogens (50 mg estrogen or more per day), Previous Deep-Vein Thrombosis (DVT) or Pulmonary Embolus (PE), Thrombophilia, Varicose veins =1.5 x risk, Type of surgery and anesthesia =10 x risk and Non-O blood groups =2-4 x risk in the absence of specific thromboprophylaxis.[25] So, potential donors who have a personal medical history of DVT/PE should not proceed to donation. Potential donors with a family history (first or second degree relative) of VTE should be screened to exclude significant thrombophilias.[26]

Females on estrogen treatment (contraceptive or hormone replacement therapy) should discontinue treatment at least one month before undergoing donor nephrectomy. Early mobilization should be encouraged after living donor nephrectomy.[27] Effective prophylaxis in patients undergoing elective major general surgery can be achieved by subcutaneous low-dose standard heparin (5000 IU, 8-12 hourly) or subcutaneous Low-Molecular-Weight Heparins (LMWH). The latter have been shown to be slightly more effective in general surgery without increasing the risk of haemorrhage.[28] Prophylaxis should continue for at least 5 days (the minimum duration in clinical trials) or until discharge from hospital if this is earlier. Mechanical methods for prophylaxis include graduated elastic compression stockings and Intermittent Pneumatic Compression (IPC) devices.[29] They are of proven efficacy in preventing DVT in moderate risk surgical patients but have not been shown in clinical trials to significantly reduce the risk of fatal pulmonary embolus. Above-knee stockings are preferred to below-knee for DVT prophylaxis. Since mechanical methods may be combined with low dose or low molecular weight heparin prophylaxis, their use in all kidney donors is recommended. If insertion of an epidural catheter is planned for post-operative pain control, a period of 4-6 hours should be allowed to elapse after giving Unfractionated Heparin (UFH) before inserting the catheter or delay the first dose until after insertion/surgery, in order to reduce the risk of bleeding.[30]

Prophylactic antibiotics

Living donor nephrectomy is a 'clean' surgical operation and the overall incidence of wound infection is usually less than 5%. The administration of prophylactic antibiotics would not be considered necessary by many centers although they are used routinely or selectively by some centers to minimize would infection. The decision about whether to use prophylactic antibiotics should be taken locally and is likely to be influenced by local audit of the incidence of wound infection.[31]

Complications during nephrectomy

Peri-operative mortality

The reported death rates are variable but one in 3000 is accepted as an accurate assessment of peri-operative mortality. The most common causes of death being pulmonary embolus, hepatitis and cardiac events (myocardial infarction and arrhythmias).[28]

Peri-operative morbidity

It has been classified into major and minor sub-groups. The mean overall complication rate was 32% and the major peri-operative complication rate was 4.4%. The estimated 'major complication' rate in a survey by Bay and Hebert was 1.8% whereas the American Society of Transplant Physicians (ASTP) survey reported that 22 out of 9692 (0.23%) kidney donors experienced potentially life-threatening or permanently debilitating' complications.[32] Donor nephrectomy is most commonly undertaken through a loin incision, although some surgeons prefer a trans-peritoneal approach. Irrespective of the type of incision, wound pain is a major source of anxiety for the donor.[33] Donor complications following laparoscopic live donor nephrectomy, of the 381 consecutive cases, 362 (95%) were left sided and 19 (5%) were right-sided laparoscopic donor nephrectomies. All 381 kidneys were procured and transplanted successfully with adequate renal artery and renal vein length to perform the recipient operation using standard techniques. Mean operative time was 253-55.7 minutes, estimated blood loss 334-690.3 ml, and warm ischemia time 4.9-3.4 minutes. Mean length of donor hospital stay was 3.3-4.5 days. Total complication rate was 16.5% for the series with 29 (7.6%) major complications and 34 (8.9%) minor complications. The open conversion rate was 2.1%, reoperation rate was 1.8%, and the transfusion rate was 3.4%. There were 7 patients who required reoperation with the following causes: epigastric artery injury requiring open ligation, incisional hernia at allograft delivery site requiring prosthetic mesh repair, ischemia of the left testicle requiring orchi- dopexy, postoperative bleeding requiring exploratory laparotomy, and duodenal injury requiring duodenojejunostomy.[34]

Donor blood transfusion

Living donors may occasionally require blood transfusion during the peri-operative period and all donors should be 'group and saved' before proceeding to theatre, so that blood is readily available if required. They should be warned, as part of the consent procedure, that blood transfusion may be needed. If available, prospective donors may be offered the opportunity to have autologous blood transfusion.[35]

Post-operative care

After nephrectomy, pulse, BP, pulse oximetry and urine output should be monitored regularly (hourly for the first 12 to 24 hours). Supplementary oxygen for 12 hours is routine. A major concern in the early post-operative period (up to 72 hours) is haemorrhage into the retroperitoneum after open nephrectomy and intraperitoneal haemorrhage after laparoscopic nephrectomy.[36] The indications for surgical re-exploration because of suspected haemorrhage will depend on clinical findings. Following laparoscopic nephrectomy, the presence of marked peritonism after 24 hours, or prolonged ileus may indicate damage to intraperitoneal organs (particularly intestinal damage) and careful consideration should be given to early re-exploration.[37]

Pain management post nephrectomy

Optimum pain management for the donor is essential to encourage early rehabilitation and uneventful post-operative recovery. This must be discussed with the donor during the assessment period to establish his/her expectations and understanding. The type of procedure, open or minimally invasive donor nephrectomy, may dictate analgesic requirements and hence the choice of pain relief that is used in the

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260

immediate post-operative period. Referral to the acute pain team, if there is one available, is helpful in optimizing assessment and management of pain.[38]

Postoperative nutrition and discharge

Patient should receive a maintained i.v. crystalloid solution until oral fluid intake is being adequate and should be discharged when he void and being fit enough and his pain is well tolerated with oral analgesia.[39]

Recovery time

Structured interviews revealed that a majority of patients were back to their usual activity by the first postoperative week and back to work a little over one month after the operation.[40] Transplant units should have in place a written protocol detailing the peri-operative preparation and post-operative care of kidney donors. This should be reviewed annually and updated where necessary. The consent of the donor to undergo nephrectomy is made on the understanding that the operation will be performed by an experienced and competent surgeon and that all possible steps will be undertaken to reduce the incidence of peri-operative complications.[41]

Long term risk

Kidney donation is a relatively safe procedure with little morbidity and no mortality in most series and registries. Developing countries have and will continue to rely heavily on living kidney donation for some time. To date there are limited data from these regions on general health status and the development of comorbid factors among kidney donors.[42] This issue was addressed by starting a regular donor follow-up clinic; in this series, renal function at 5 to >30 years after donation was normal, even though there was an insignificantly high serum creatinine level and a lower Creatinine clearance rate (CrCl). Overall, 22% of donors became hypertensive and were under treatment. All the donors benefited psychologically from donation, were happy to have donated, and would donate again. This is consonant with the quality of life described after donation in the long-term follow-up of living kidney donors.[43] While some studies found that the rate of hypertension after unilateral nephrectomy to be as high as 25-74.5%, others failed to show any increase in BP after surgery. The frequency of hypertension in the present donor population was lower than that in the healthy adult population of Egypt (22% versus 26%); this is not unexpected, because the donors were positively selected for a normal BP.[44]

Although unilateral nephrectomy is associated with elevation of BP, some studies have not detected a higher risk of developing hypertension after kidney donation than in age-matched controls. Indeed, in one recent report, systolic BP decreased in hypertensive donors after LDT. In the present donors, the hypertensive population was older. Overweight and obese patients had a higher prevalence of hypertension. Although there was a lower GFR and higher prevalence of abnormal proteinuria in hypertensive patients, we were unable to establish a causeand- effect relationship.[45] The mean serum creatinine levels deteriorated insignificantly in some donors, there was little proteinuria, and the incidence of hypertension was similar to the age-matched general population.[44] The overall prevalence of proteinuria was 3.3%, but a higher grade of proteinuria (i.e. >300 mg/24 hours) was infrequent and only detected in 1.5% of the present donors, a frequency comparable with other series.[46] Greater proteinuria was more prevalent in donors who were also hypertensive. The importance of obesity for the living donor is its effect on renal function. Obesity without nephrectomy is associated with hypertension and proteinuria.[47]

Obesity as a risk factor for renal insufficiency after unilateral nephrectomy was studied by Praga et al,[48] in 73 patients from Spain, subjects who had a unilateral nephrectomy with no known disease in the contralateral kidney developed proteinuria and renal failure at 10-20 years after nephrectomy when they had a BMI of >30 kg/m^2 at the time of surgery.[48] Consequently, some authors suggested monitoring donors for their psychosocial variables. Almost all the present donors said that they would make the same decision again and would strongly encourage others to donate. There have been some reports of depression and disrupted family relationships after donation, even suicide after a recipient's death.[49]

Arrangements for follow-up

Early follow-up of the donor, within the first few weeks of surgery, is essential to ensure that he/she has made a satisfactory recovery from the operation. In the event of an unsuccessful transplant it is important to provide adequate emotional as well as physical support for the donor, including access to specialist psychological services. Donor should be followed up to facilitate the collection of data on long term morbidity and mortality. Lifelong follow-up is recommended, and this should be offered locally or at the transplant centre according to the wishes of the donor.[50]

General anesthetics

According to the Department of anesthesiology and intensive care, hospital Kuala Lumpur, guidelines on anesthetic management for renal transplant,[51] a mixture of normal saline with either lactated or acetated Ringer's solution seem to be the ideal fluid for use in renal transplant surgery. Mannitol has been found to be beneficial for use in renal transplant surgery and 200 -250 ml of 20% mannitol are used routinely for both donor and recipient. The use of advanced haemodynamic monitoring is encouraged for live kidney donor. The following anesthetic technique is usually applied in living kidney donor trasnsplation:

Kidney live donor

Anesthetic technique of general anaesthesia (GA) with Patient-controlled analgesia (PCA) morphine or GA with regional block (from TAP (Transversus Abdominis Plane), Quadratus Lumborum or Paravertebral Block).

Preoperative hydration

I. 100 ml/hr crystalloids starting from 2200 the night before surgery (4/2/1 formula)

II. IV bolus colloids 5ml/kg before induction

III. Caution with induction dose of propofol especially in hypertensive patients

IV. Invasive haemodynamic monitoring limited to arterial line only

V. Start Mannitol infusion 0.5 g/kg after induction up to the time of nephrectomy

VI. Intra-operative infusion of 20ml/kg/hr crystalloids

VII. Target MAP of normal or plus 20% of patient's normal

VIII. IV bolus colloids 5ml/kg before institution of pneumo-peritoneum

IX. Aim for a Perfusion Pressure to a value of IAP added to the MAP

X. If suggested infusion volumes are unable to improve Perfusion Pressures, low dose Dopamine infusion (1-2 ug/kg/min) should be initiated

XI. Aim for urine output of at least 100 ml/hr

XII. IV Dexamethasone 8 mg/ml.

Kidney recipient

I. Technique of choice will be GA with PCA fentanyl (with or without supplemental regional block from TAP, or Quadratus Lumborum Block)

II. IV hydrocortisone, chlorpheniramine, antibiotics and immunosuppressant will be administered from the ward

III. Caution with induction doses of propofol for recipients. Titration to response is necessary to avoid excessive, protracted period of hypotension

IV. IV infusion of Thymoglobulin to be started after central line insertion

V. (to be infused over 4-6 hours) for recipients at high immunological risk

VI. Arterial line to be inserted. (Advanced Haemodynamic Monitoring i.e Flow tract is encouraged)

VII. Infusion of non-potassium containing crystalloids is to be initiated.

Goals of therapy

I. Central venous pressure (CVP) >12-15 mmHg (7-9 mmHg for restrictive heart)

II. Systolic BP of >130

III. Mean Arterial BP of > 80

IV. Total IV fluids of at least 30-50 ml/kg/hr

V. Stroke Volume Variation of <15% (to be interpreted appropriately in combination with other parameters)

VI. Higher infusion rates should be given during ischaemic phase (at the time of donor clamping)

VII. Graft turgidity as assessed by surgeon: To run 250 ml of crystalloids initial bolus and assess, for further boluses if required until turgidity improves

VIII. Serial monitoring of acid base and electrolyte status

IX. Mixtures of Ringers Lactate or Balanced Crystalloids may be required if worsening acidosis is seen with large volumes of saline

X. In refractory hypotension, not responsive to crystalloid load (especially after induction and after reperfusion) colloids may be used to optimize intravascular volume

XI. Vasopressors to be used after volume therapy has been optimized. Boluses of ephedrine or phenylephrine may be given for refractory hypotension during initial stages prior to transplantation

XII. Intravenous (IV)infusion of 20% Mannitol 0.5g/kg to be initiated 30 minutes prior to unclamping

XIII. IV Methylprednisolone 500mg to be infused at the start of anastomosis (over 30 minutes) and completed before arterial unclamping

XIV. Post reperfusion hypotension to be managed accordingly (based on kidney turgidity- will be communicated by urologist)

XV. Depending on volume status (as per set goals of therapy- see no. 6 recipient protocol) or SVR/SVRI or CO/CI (if requiring vasopressors/inotrope), adequate volume will usually pre-empt the use of vasopressors

XVI. IV frusemide

XVII. Total intra-operative fluid administration should be about 30-50ml/kg/hr

XVIII. Aim for early extubation.

Future trends in kidney transplantation

With regards to the continuous development of surgical methods, modern innovations and techniques are evolving. open-surgery techniques are being replaced by laparoscopic and robotic surgery in advanced renal transplantation center. The major limitation of these advanced surgical procedures are the high cost of facilities and equipment, maintenance and few experts in the field. the master-slave robotic surgical system da VINCI approved by Food and Drug Administration (FDA) have become a promising area in the future and have improved laparoscopic procedure.[52] The application of Robotic surgery involves two operational stages of kidney transplantation process which are Robotic donor nephrectomy (kidney removal from a living donor) and complete kidney replacement. Robotic surgery gives access to treatment for stage III obese patients which are highly complicated in other surgical procedures. Robotic surgery creates an avenue for advanced telemedicine surgical procedures, in which transplants can be performed from anywhere in the world regardless of distance.[53,54]

The use of robotic-assisted kidney transplantation is rare due to the cost of equipment, maintenance and few experts in the field. Currently there are very few medical centers worldwide with state of the art equipment's and facilities to carry out these procedures. Robotic surgical procedures are expensive, and few medical professionals are able to operate the machines and perform the procedure. Further studies are needed to explore the area of robotic-assisted renal transplants and the best procedures and techniques involved in the use of this machine. There is need to train more medical and biomedical professionals worldwide through postdoctoral training, technical and biomedical training on robotic-assisted renal transplants this will enable more discoveries and effectiveness in robotic renal donor nephrectomies and kidney replacements , and general advances in kidney transplantations.

Conclusion

Living kidney donor transplantation is better than kidney transplantation from a deceased donor because the transplanted kidney becomes active and functional immediately after transplantation, whereas in transplants derived from deceased donors, the reverse is usually the case due to shorter ischemic time by minimal ischemic damage of the allograft. The surgical procedures applied in live kidney donor transplantation, are constantly undergoing modification

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260

inorder to minimize postoperative complications, improve treatment outcomes and enhance patient's quality of life. The application of Laparoscopic procedure in live donor nephrectomy is effective and reliable. However minimal invasive surgical techniques are increasing gaining recognition as an alternative surgical procedure to Laparoscopy.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

References

1. Nankivell BJ, Borrows RJ, Fung CLS, et al. Natural history, risk factors, and impact of subclinical rejection in kidney transplantation. *Transplantation*. 2004;78:242–249.
2. Gulati M, Dermendjian H, Gómez AM, et al. 3.0 tesla magnetic resonance angiography (mra) for comprehensive renal evaluation of living renal donors: Pilot study with computerized tomography angiography (cta) comparison. *Clin Imaging*. 2016;40:370–377.
3. Rana A, Gruessner A, Agopian VG, et al. Survival benefit of solid-organ transplant in the united states. *JAMA Surg*. 2015;150:252–259.
4. Land WG. The role of postischemic reperfusion injury and other nonantigen-dependent inflammatory pathways in transplantation. *Transplantation*. 2005;79(5):505–514.
5. Carlessi R, Lemos NE, Dias AL, et al. Exendin-4 attenuates brain death–induced liver damage in the rat. *Liver Transpl*. 2015;21:1410–1418.
6. Sally MB, Malinoski DJ, Zaldivar FP, et al. A porcine model to study the effect of brain death on kidney genomic responses. *Clin Transl Sci*. 2018;2:208–216.
7. Lentine KL, Kasiske BL, Levey AS, et al. KDIGO Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors. *Transplantatio*n. 2017;101(8S Suppl 1):S1–S109.
8. Held PJ, McCormick F, Chertow GM, et al. Would government compensation of living kidney donors exploit the poor? An empirical analysis. *PloS one*. 2018;13(11):e0205655.
9. Ali O, Sener A. Optimal surgical strategies in living kidney donation. *Can Urol Assoc J*. 2016;10:258.
10. Ozgor F, Tepeler A, Basibuyuk I, et al. Supracostal access for miniaturized percutaneous nephrolithotomy: Comparison of supracostal and infracostal approaches. *Urolithiasis*. 2018;46(3):279–283.
11. Neipp M, Jackobs S, Becker T, et al. Living donor nephrectomy: Flank incision versus anterior vertical mini-incision. *Transplantation*. 2004;78:1356–1361.
12. Silvinato A, Bernardo WM, Santos LS. Living donor nephrectomy. *Rev Assoc Med Bras*. 2018;64(12):1061–1068.
13. Hosgood SA, Nicholson ML. Organ retrieval and preservation. *Surgery (Oxford)*. 2017;35:346–352.
14. Kumar A, Chaturvedi S, Gulia A, et al. Laparoscopic live donor nephrectomy: Comparison of outcomes right versus left. *Transplantation proceedings*. 2018;50(8):2327–2332.
15. Harrison M, Abrahams MD, Maxwell V, et al. Pure laparoscopic right donor nephrectomy: Step-by-step approach. *J Endourol*. 2004;18(3):221–225.
16. Wang K, Zhang P, Xu X, et al. Right versus left laparoscopic living-donor nephrectomy: A meta-analysis. Exp Clin *Transplant*. 2015;13(3):214–226.
17. White WM, Kaouk JH. *Difficulties in laparoscopic and robotic living donor nephrectomy*. In: Difficult conditions in laparoscopic urologic surgery: Springer. 2018:373–384.
18. Stoumpos S, Jardine AG, Mark PB. Cardiovascular morbidity and mortality after kidney transplantation. *Transpl Int*. 2015;28(1):10–21
19. McAdams-DeMarco M, Law A, King E, et al. Frailty and mortality in kidney transplant recipients. *Am J Transplan*. 2015;15(1):149–154.
20. Gaston RS, Kumar V, Matas AJ. Reassessing medical risk in living kidney donors. *J Am Soc Nephrol*. 2015;26(5):1017–1019.
21. Ellison TA. *Economic evaluation in kidney transplantation*. In: Johns Hopkins University. 2015.
22. Kortram K, Ijzermans JN, Dor FJ. Perioperative events and complications in minimally invasive live donor nephrectomy: A systematic review and meta-analysis. *Transplantation*. 2016;100(11):2264–2275.
23. Di Carlo HN, Darras FS. Urologic considerations and complications in kidney transplant recipients. *Adv Chronic Kidney Dis*. 2015;22(4):306–311.
24. Rudow DL, Warburton KM. Selection and postoperative care of the living donor. *Med Clin North Am*. 2016;100(3):599–611.
25. Ibrahim HN, Foley RN, Reule SA, et al. Renal function profile in white kidney donors: The first 4 decades. *J Am Soc Nephrol*. 2016;27(9):2885–2893.
26. Lam NN, Lentine KL, Levey AS, et al. Long-term medical risks to the living kidney donor. *Nat Rev Nephrol*. 2015;11:411.
27. Di Nisio M, Porreca E, Candeloro M, et al. Primary prophylaxis for venous thromboembolism in ambulatory cancer patients receiving chemotherapy. *Cochrane Database Syst Rev*. 2016;12(12):CD008500.
28. Klarenbach S, So H, Manns B, et al. Economic Evaluation of Unfractionated Heparin versus Low-Molecular-Weight Heparin to Prevent Venous Thromboembolism in General Medical and Non-Orthopedic Surgical Patients. *Ottawa (ON): Canadian Agency for Drugs and Technologies in Health*. 2017.
29. Shalhoub J, Norrie J, Baker C, et al. Graduated compression stockings as an adjunct to low dose low molecular weight heparin in venous thromboembolism prevention in surgery: A multicentre randomised controlled trial. Eur J *Vasc Endovasc Surg*. 2017;53(6):880–885.
30. Encke A, Haas S, Kopp I. The prophylaxis of venous thromboembolism. *Dtsch Arztebl Int*. 2016;113(31–32):532–538.
31. Vistoli F, Perrone V, Amorese G, et al. *Kidney transplant recipient surgery*. Kidney transplantation, bioengineering and regeneration. 2017. p. 111–125.
32. Imai N, Shibagaki Y, Yazawa M, et al. Follow-up rates of living kidney donor in japan: A single center study. *Indian J Nephrol*. 2016;26(6):423–426.
33. Shockcor NM, Sultan S, Alvarez-Casas J, et al. Minimally invasive donor nephrectomy: Current state of the art. *Langenbecks Arch Surg*. 2018;403(6):681–691.
34. Kavoussi LR. Laparoscopic donor nephrectomy. *Kidney Int*. 2000;57(5):2175–2186.
35. Burns T, Turner K. Kidney transplantation for australian renal nurses. *Ren Soc Australas J*. 2018;14:96.

36. Bakosi E, Bakosi E, Shapiro R. *Kidney transplantation: Overview*. Anesthesia and perioperative care for organ transplantation: Springer. 2017:263–274.

37. Puri V, Colquhoun S. *Emergencies after solid organ transplant: Liver transplantation*. Surgical emergencies in the cancer patient: Springer. 2017:355-370.

38. Capdevila X, Moulard S, Plasse C, et al. Effectiveness of epidural analgesia, continuous surgical site analgesia, and patient-controlled analgesic morphine for postoperative pain management and hyperalgesia, rehabilitation, and health-related quality of life after open nephrectomy: A prospective, randomized, controlled study. *Anesth Analg*. 2017;124(1):336–345.

39. Bergman S, Feldman LS, Mayo NE, et al. Measuring surgical recovery: The study of laparoscopic live donor nephrectomy. *Am J Transplant*. 2005;5(10):2489–2495.

40. Deshmukh SM, Gill IS. *The evolution of laparoscopic donor nephrectomy: Has it now become the gold standard?* Laparoscopic donor nephrectomy: Springer. 2017. p. 1–12.

41. Telha KA, Al Kataa MA, Al-Kohlany KM, et al. Surgical complications of open nephrectomy in living related donors in yemen: A prospective study. *Turk J Urol*. 2017;43(4):549–552.

42. Slinin Y, Brasure M, Eidman K, et al. Long-term outcomes of living kidney donation. *Transplantation*. 2016;100(6):1371–1386.

43. Suwelack B, Wörmann V, Berger K, et al. Investigation of the physical and psychosocial outcomes after living kidney donation-a multicenter cohort study (solkid-safety of living kidney donors). *BMC Nephrol*. 2018;19(1):83.

44. Ibrahim HN, Foley R, Tan L, et al. Long-term consequences of kidney donation. *N Engl J Med*. 2009;360(5):459–469.

45. Garg AX, Nevis IF, McArthur E, et al. Gestational hypertension and preeclampsia in living kidney donors. *N Engl J Med*. 2015;372:124–133.

46. Fehrman-Ekholm I, Elinder CG, Stenbeck M, et al. Kidney donors live longer. *Transplantation*. 1997;64(7):976–968.

47. Lew QLJ, Jafar TH, Talaei M, et al. Increased body mass index is a risk factor for end-stage renal disease in the chinese singapore population. *Kidney Int*. 2017;92(4):979–987.

48. Praga M, Morales E. The fatty kidney: Obesity and renal disease. *Nephron*. 2017;136(4):273–276.

49. Mandal AK, Cohen C, Montgomery RA, et al. Should the indications for laparascopic live donor nephrectomy of the right kidney be the same as for the open procedure? Anomalous left renal vasculature is not a contraindication to laparoscopic left donor nephrectomy. *Transplantation*. 2001;71(5):660–664.

50. Budiani-Saberi DA, Delmonico FL. Organ trafficking and transplant tourism: A commentary on the global realities. *Am J Transplant*. 2008;8(5):925–929.

51. Kim SJ, Choi BJ, Lee SC. Overview of single-port laparoscopic surgery for colorectal cancers: past, present, and the future. *World J Gastroenterol*. 2014;20(4):997–1004.

52. Tzvetanov I, Giulianotti PC, Bejarano-Pineda L, et al. Robotic-assisted kidney transplantation. *Surg Clin North Am*. 2013;93(3):1309–1323.

53. Santomauro M, Reina GA, Stroup SP, et al. Telementoring in robotic surgery. *Curr Opin Urol*. 2013;23(2):141–145.

Citation: Deb AA, Okechukwu CE, Emara S, et al. Live kidney donor: surgical aspect and outcome. *Urol Nephrol Open Access J.* 2019;7(6):133–141. DOI: 10.15406/unoaj.2019.07.00260