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VASCULAR VARIATIONS AND COMPLICATIONS IN RENAL TRANSPLANTATION- SINGLE CENTRE STUDY

Urology

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ABSTRACT

Objective : To study the vascular variations and complications in renal transplantation . **Methods:** It's a retrospective study of the patients who underwent consecutive allogenic renal transplantation at Government Kilpauk Medical College hospital,Chennai ,India ,during the period 2015 to 2017.Totally 26 patients of Male 18 (69%) and Female 8 (31%) recipients were enrolled in this study .The age group of the recipients were between 19years to 51years. Live related donor were 15 (57.69%) and brain dead donor were 11 (42.3% . **Results: Double renal arteries:** In 5 donar kidneys (19.23%) lower pole 2, hilar 2 and upper pole 1. Additional renal arteries anastomosed separately to inferior epigastric artery (2), pelvic branch of hypogastric artery(1), external iliac artery (2) and the upper pole artery which is very small diameter (1mm) was ligated without any untoward effect of graft function. **Early branching of main renal artery:** 2 donar kidneys (7.69%) out of which in one case faced difficulty in harvesting.**Atherosclerotic plaque of the recipient internal iliac artery:** 1 case , managed by endarterectomy.**Vascular complications :** Partial thrombosis of renal artery anastomosis 1(3.8%) managed by heparin therapy and responded well. Renal vein thrombosis 1(3.84%) with impending graft rupture and hypotension,managed by graft nephrectomy. Pseudoaneurysm of transplant renal artery with pelvic hematoma 1(3.84%) managed by excision of pseudoaneurysm and subcapsular nephrectomy.We observed that all the vascular complications occurred in cadaver donar renal transplantation. **Conclusion:** Vascular anatomical variations , multiple renal arteries should always be anticipated in renal transplantation and to be reimplanted at any cost and the early branching of renal artery is not a limitation .Transplant renovascular complications should be diagnosed at the earliest to salvage the graft kidney and to save patient life.

KEYWORDS

Pseudoaneurysm , Double renal artery, Endarterectomy, Subcapsular nephrectomy.

INTRODUCTION

Kidney is a highly vascular organ. In renal transplantation , establishment of good vascularity is an essential part of transplantation work which determines the graft function and patient survival. During the procedure of renal transplantation ,the donar kidney has to come across various ischemic periods such as warm ischemic time ,cold ischemic time and second warm ischemic time which is indicates the vascular anastamosis time. Being highly vascular organ and extreme sensitivity to ischemia ,minimizing the ischemic time ,improves the graft function and graft survival. This study highlights the various anatomical vascular variations and renovascular complications encountered in renal transplantation and the various vascular surgical techniques adopted to manage them.

MATERIALS AND METHODS

- Study Design :Retrospective Study
- Study Centre : Govt. Kilpauk Medical College Hospital,Chennai,India.
- Study Duration : January 2016 to December 2017
- Study Procedure: 26(Twenty six) patients who underwent consecutive allogenic renal transplant consisting of both live related donar and brain dead donars were enrolled in this study. The vascular anatomical variations and renovascular complications were analysed.

RESULTS

The results observed in this study are as shown in the tables

TABLE 1

Data	Numbers n=26	Percentage %
Male recipients	18	69%
Female recipients	8	31%
Live related donar	15	57.69%
Cadaver donar	11	42.3%

TABLE 2

Vascular anatomical variations	Numbers	Percentage
Double renal arteries	5	19.23%
Early branching of main renal artery	2	7.69%
Double renal veins	2	7.69%
Atheromatous plaque of recipient Internal Iliac Artery	1	3.84%

TABLE 3

Double renal arteries location	n=5 /26 19.23%	Management of double renal arteries
Upper pole	1	Ligation
Lower pole	1	Anastomosis to inferior epigastric artery
Lower pole	1	Anastomosis to branched hypogastric artery
Hilar	2	Anastomosis to external iliac artery

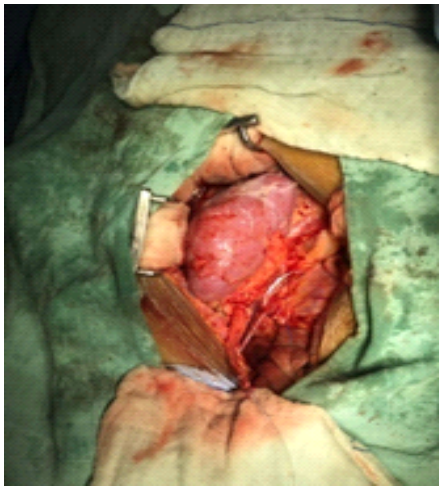

Figure 1.Showing double renal artery anastomosed to inferior epigastric artery

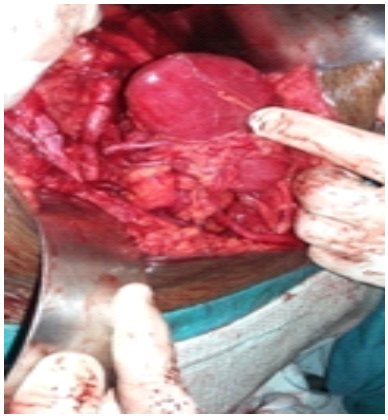

Figure 2. Showing double renal arteries implanted to branched hypogastric artery.

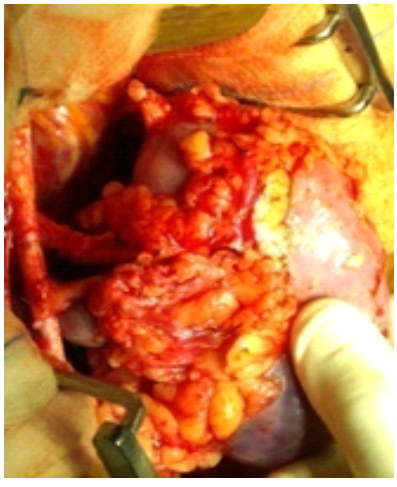

Figure 3. Showing double renal artery anastomosed to external iliac artery

Figure 4. Showing endarterectomy of recipient internal iliac artery

TABLE 4

Renovascular complications	Donar source	Number	%	Management
Partial renal artery thrombosis	Cadaver donar	1	3.84%	Heparin therapy
Renal vein thrombosis	Cadaver donar	1	3.84%	Graft nephrectomy
Pseudoaneurysm of transplant renal artery	Cadaver donar	1	3.84 %	Excision and graft nephrectomy
Perirenal hematoma with bleed (perioperative period)	Cadaver donar	1	3.84%	Exploration and ligation of hilar small veins
Injury of early branched donar renal artery	Live donar	1	3.84%	Reconstruction with inferior epigastric artery

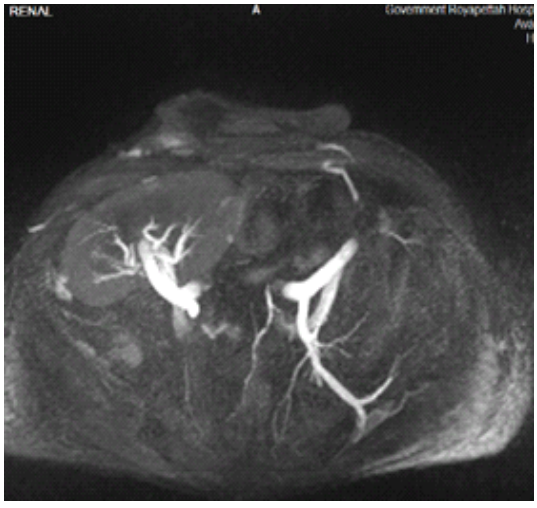

Figure 5. Showing partial thrombosis of transplant renal artery (Magnetic Resonance angiogram)

Figure 6. Showing peroperative appearance of transplant kidney with renal vein thrombosis

Figure 7. Showing Computed Tomogram angio of transplant renal artery pseudoaneurysm

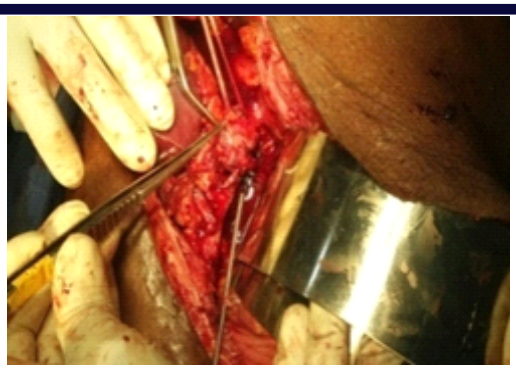

Figure 8. Showing(peroperative) transplant renal artery pseudoaneurysm

Figure 9. Showing donar kidney segmental discoloration following inadvertent injury of early branched renal artery

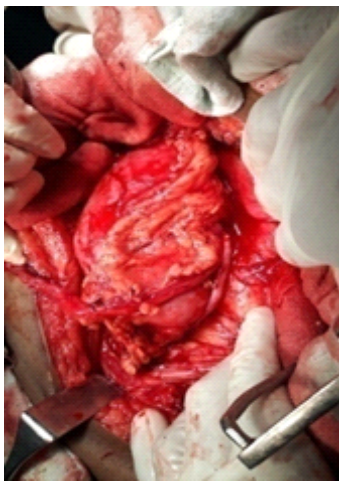

Figure 10. Showing inferior segmental artery reconstructed with saphenous vein graft bridge to inferior epigastric artery

DISCUSSION

Kidney transplant is the best biological replacement for end stage renal disease and also economic.In this study the patients who underwent renal transplantation for end stage renal disease at our hospital were enrolled.Routine work up including ABO compataility,HLA cross matching and Compute tomogram angiogram of donar kidneys were done with induction immunosupression therapy, by nephrologist and the patients were referred to urologist for renal transplantation.Preoperative planning of vascular surgical techniques were done for all patients with vascular surgeon. The donars were live related and from brain dead donars, the organs allocated as per seniority list from state registry. The average cold ischemic time for cadaver donar is less than 6 hours .Vascular surgeons are routinely included in the transplant surgical team. The donar kidney harvesting is by open surgical method and recipient transplantation surgery is as usual, extraperitoneal right iliac fossa by Gibson pelvic incision. Recipient transplant bed preparation is done simultaneously while donar kidney is harvesting .All donar kidneys as soon as harvested were perfused with chilled heparinised ringer lactate solution till the venous effluent is clear.Cadaver donar kidneys will have hilar veins which may not be ligated during harvestation and is meticulously ligated with silk sutures to avoid hilar bleed after renal reperfusion.Generally systemic heparinisation is not administered during vascular anastamosis to avoid perioperative bleeding complications since end stage renal disease patients will have anemia and platelet dysfunction.Local irrigation with heparinised saline is made instead. Systemic heparinisation of 2500 units intravenous is given in case, external iliac artery is preferred for double artery implantation.Venous anastomosis to external iliac vein is done first by end to side method and arterial anastomosis second. Regarding venous anastamosis, we usually excise a ellipse of anterior vein wall of external iliac vein for end to side anastamosis , in order to prevent renal vein thrombosis due to vein wall coaptation during hypotension if any.Once venous anastomosis is done the renal vein is clamped with bulldog clamp and the external iliac vein clamp is removed so as to shorten iliac vein stasis.The main renal artery is then anastomosed to internal iliac artery as end to end method using 6/0 prolene . We prefer internal iliac artery for main renal artery anastomosis since anastomosis to external iliac artery may cause steal phenomenon during ambulation can cause ischemia of transplant kidney and also to avoid future limb complications.The accessory artery anastomosis is done after completing main vessel anastomosis and perfusing the kidneys ,thus limiting ischemic time .The anastomosis technique is standard 2 point technique .Average arterial anastomosis time is around 20 minutes and venous anastomosis time around 12 minutes.After completing the venous and arterial anastomosis we release the, renal vein clamp first and subsequently renal artery clamp during reperfusion in order to prevent graft congestion.All live donar graft kidneys showed immediate function with secretion of urine within minutes and few cadaver graft kidneys showed delayed function due to acute tubular necrosis due to cold ischemia and recovered after several days.All transplant recipients were subjected to color doppler scan of vascular anastomosis postoperatively,to find out any vascular abnormality and was started on triple immunosuppression therapy, tacrolimu,MMF and predisolone.

Vascular anatomical variations in our study: Table 2.

Accessory renal arteries are persistent embryonic arteries and the incidence ranges from 10 -15 % cases and they are all end arteries and hence it is mandatory to reimplant to prevent segmental renal ischemia and ureteral ischemic necrosis. The accessory arteries is anastomosed separately or in conjoint with main renal artery depending upon the size and location. In our study we encountered 5 patients with double renal arteries the prevalence is about 19.23 % . and the methods adopted to reconstruct is shown in (Table 3) and (Figures 1,Figure 2 and Figure 3) Polar artery supply if it is less than ¼ of total kidney, especially upper pole then it can be can be sacrificed,but the lower pole accessory renal artery should always to be reanastomosed to avoid ureteral ischemia .Branching of main renal artery at a distance of less than 1.5 or 2 cm from its origin is called early branching.Early branching of main renal artery can, result in complication while harvesting donar kidney . We had 2 cases of early branching of donar main renal artery identified by computed tomogram angiogram screening .During harvesting donar kidney with early branching , in one case we had difficulty and inadvertent injury of inferior segmental artery happened.Since inferior segmental artery supplies proximal ureter also ,we reconstructed it using great saphenous vein interposition graft with inferior epigastric artery successfully as shown in (Figure 9 and Figure 10) .We faced 2 cases with donar kidneys having double renal vein and the second smaller vein is ligated without any problems since intrarenal veins have no segmental venous organisation and anastomose freely through a vast plexus of venules.One recipient who is a chronic diabetes mellitus, had internal iliac artery atheromatous plaque compromising lumen and was managed by iliac endarterectomy, successfully as shown in (Figure 4) .

Reno vascular complications: Table 4.

Arterial and venous thrombosis generally occurs within 2nd – 3rd postoperative days ,most often due to surgical technical error . Vascular thrombosis incidence ranges from 0.5 – 8 %. with arterial thrombosis around 0.2 % - 3.5 and venous thrombosis 0.3 -4 %.In vascular thrombosis there will be sudden cessation of urine output.We encountered one case of cadaver renal transplant showing delayed graft function ,for which we did colour Doppler scan of renal vessels showing partial thrombosis of renal artery and the same was confirmed

by magnetic resonance angiogram as shown in (Figure 5) .There is no total occlusion of renal artery and hence managed by unfractionate heparin therapy ,and responded well by gradual improvement if graft function as the clot resolved.Another cadaver renal transplant case with immediate graft function showed sudden cessation of urine output 48 hours after transplantation and doppler study showed renal vein thrombosis with swollen graft kidney with reversal of arterial.Clinically the patient was in hypotension and hence, resuscitation and immediate exploration done. On exploration the graft kidney appeared purple in color and nonviable with clot palpable in renal vein and hence subcapsular nephrectomy and ligation of renal vessel done to save patient life. Shown in (Figure 6) . Kidney damage is reversible only if renal warm ischemia is less than 30 mts, otherwise irreversible cortical necrosis occurs within minutes.

In one case of recipient who had nephrogenic ascites ,the peritoneum breached while preparing transplant bed and a drain was kept for prolonged period after transplantation since ascitic fluid was draining continuously.This patient after discharge ,presented on 32nd day with fever and ,pain lower abdomen with good urine output and normal serum creatinine ,On investigation had pseudoaneurysm of transplant renal artery with surrounding heamtoma as shown in (Figure 7). Subsequently patient pain worsened and developed hypotension and hence urgent exploration and excision of pseudoaneurysm and subcapsular nephrectomy done as shown in (Figure 8) and patient life was saved. Transplant pseudoaneurysm is very rare and is associated with local infection and the incidence ranges < 1% . Graft arterial false aneurysm with rupture needs urgent repair to save pt life and rarely graft is salvageable. In our case prolonged retroperitoneal drainage tube might have caused local infection in an already immunosupressed patient . Another case of cadaver renal transplant recipient with delayed graft function ,developed sudden massive fresh blood drainage in drainage tube with hypotension.Patient was resuscitated immediately and emergency exploration revealed ligature slip of hilar small veins with intact arterial and venous anastomosis.The hilar small veins which caused bleeding were ligated with silk sutures,but the patient in the postoperative period went for disseminated intravascular coagulation and expired in the perioperative period.In our study we observed that the renovascular complications is more in cadaver renal transplantation as shown in (Table 5)

TABLE 5

Donar source	Total number=26	Renovascular complications	%
Live related donar	15	1	0.06
Brain dead donar	11	4	0.36

The increased renovascular complications in cadaver renal transplant is due to ,harvesting of cadaver donar elsewhere by a different surgical team far away with prolonged cold ischemic time due to shifting of cadaver kidney from harvesting hospital which is far away to recipient surgery hospital. Complications can be minimized by optimizing the above pitfalls.

In our study ,about 21 cases were continuously followed for one year and the one year graft and patient survival is as shown in Table 6.

TABLE 6

Donar source	Recipients followed for one year=21	1 year Graft survival	1 year Patient survival
Live donar	13	13/13 =100%	13/13 =100%
Cadaver donar	8	6/8 = 75 % Two graft nephrectomy	6 / 8 = 75 % Two mortality with functioning kidneys

Two cadaver renal transplant recipients underwent graft nephrectomy for (1) pseudoaneurysm rupture and (2) graft renal vein thrombosis with impending rupture ,but both patient life was saved by immediate surgery .The mortality in cadaver renal transplant recipient patient is two who, died of sepsis (1) brain abscess and (2) s epticemia due to diabetic foot infection , with normal functioning of both transplant kidneys.

CONCLUSION

Vascular anatomical variations , multiple renal arteries should always be anticipated in renal transplantation and to be reimplanted at any cost and the early branching of renal artery is not a limitation . Presence of multiple renal arteries do not adversely affect graft survival.

Transplant renovascular complications should be diagnosed rapidly and treatment initiated to salvage the graft kidney and to save patient life.

No conflict of interest .

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