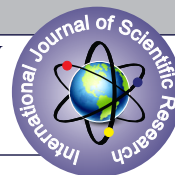


INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE STUDY TO ASSESS THE VALUE OF DOPPLER ULTRASONOGRAPHY (USG) AND RESISTIVE INDEX (RI) IN PREDICTING RENAL GRAFT FUNCTION AFTER RENAL TRANSPLANT (RT) AT OUR INSTITUTE MADRAS MEDICAL COLLEGE, CHENNAI.



Urology

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ABSTRACT

Introduction - Renal transplant(RT) is choice for patients with end stage renal failure. Detection of early RT complications plays a key role in its success and patient's survival. Ultrasonography (USG) doppler and Serum creatinine measurement are routine investigations for renal function after transplantation and detection of any complications.

Aim and objective - A) To find out the correlation between early changes in Graft size and Resistive index(RI) and graft function after 1 year.

B) To assess USG Doppler of graft performed in early stage after transplantation as valuable predictor for long term outcome.

Materials and Methods - This is a prospective study includes 35 recipients who underwent Renal Transplant(RT) from living donor. In all patients Doppler USG was done by single experienced radiologist who measure graft size and resistive index. Serum creatinine was done before RT , Post Operative Day(POD) 7 and 1 year after RT.

Results and Observations - Repeated Doppler USG shows significant increase in graft size.

A] Length (Initial : 95.2 ± 4.8 mm, POD 7: 106.2 ± 3.5 mm, 1 year post transplant 107 ± 2.3 mm $p < 0.003$)

B] A.P diameter (Initial 45.5 ± 4.2 mm, POD 7: 48.5 ± 3.2 mm, 1 year post transplant 49.2 ± 3.0 mm, $p < 0.002$)

C] Parenchymal / cortical thickness (Initial: 10.2 ± 0.9 mm, POD 7: 11.2 ± 0.5 mm, 1 year post transplant 11.4 ± 0.6 mm, $p < 0.001$)

The 1 year follow up in increase in graft size on Doppler finding was not significant with respect to POD 7 Doppler findings.

Conclusion - Renal graft size (viz. Length, A.P diameter and cortical thickness) shows significant increase in early RT period. The increase in graft size correlate significantly with serum creatinine at 1 year post RT. There was no correlation between resistive index (RI) and serum creatinine. Hence Doppler is very effective tool to evaluate graft function at early stage post RT, and it can help to predict long term outcome of graft.

KEYWORDS

Renal Transplant (RT) ,USG- Ultrasonography, RI- Resistive Index, S. Creatinine

Introduction

Renal transplant is one of the glorious victories of modern medicine to combat mortality and improve quality of life of patients with end stage kidney disease all around the globe. Renal transplant which was once available to economically upscale people is now possible for middle income groups also and bringing hope for all group of countries and its people. India is one of the highest number of renal transplant performing country along with USA, China and Brazil. World Kidney day celebrated on 8 march gives hope to all End Stage Kidney Disease (ESKD) patient for transforming transplant to routine treatment. The worldwide prevalence of Chronic Kidney Disease (CKD) is calculated to be around 8-16% as per various studies(1). Renal transplantation (RT) considered the treatment of choice for ESRD as it predicts longer survival and improved quality of life(2). Due to improved surgical advances and modifications and also because of post-Transplant immune suppression therapy. The success of any transplant depend on the graft related pattern and detecting them early to find complications . Ultrasound imaging is used to detect any alterations in shape and size, the flow patterns in the renal vessels including artery and vein and also to verify on the renal parenchyma and cortical thickness and cortico-medullary differentiation of the transplanted kidney. It is a very relevant, reproducible and safe modality without any associated radiation exposure or contrast related complications (As seen with a Computerized tomography), especially to identify and evaluate associated vascular complications that occur in 1-10% of renal transplantations(3). Doppler indices [Pulsatility index (PI) and resistive index (RI)] are measured by Doppler Ultrasound & these indices are the parameters to quantify possible changes in kidney circulation & Kidney hemodynamic status both at the level of renal hilum and at intra lobular artery level to identify and quantify and verify the flow patterns inside the parenchyma and assess overall function of transplanted kidney(4). It was shown in a study that measurement of RI shortly after transplantation can be utilized as an indicator for short-term renal functional outcome and success post-transplant. With given background: the objective of this study is A) To find out the correlation between early changes in Graft size and Resistive index (RI) and graft function after 1 year . B) To assess USG of graft performed in early stage after transplantation as valuable predictor for long term outcome.

Materials and Methods

A prospective observational study of thirty five patients [male = 30, female =5] who underwent renal transplantation at our institute of urology, Madras Medical College, Chennai for a duration of 1 year (January 2019- Dec 2019). Ethical approval was obtained from Institutional Ethics committee and Research Review board of the Institute. Valid informed consent was taken from study subjects. Selection of subjects was done by excluding patients who were diagnosed with acute rejection on first Doppler, primary graft non function and had complications like perinephric collection and thrombosis of renal vessels. All patients underwent Doppler ultrasonography for various graft size parameters viz kidney length, antero-posterior diameter, and parenchyma thickness, along with RI in the immediate transplant period. These parameters were recorded shortly after transplantation as well as on post operative day seven and again after 1-year of transplantation in recipients. The measurement of kidney size, and parenchymal thickness were performed using a grey scale sonography. [Fig.1] while RI measurement using duplex Doppler apparatus of the Renal hilum and at level of interlobar artery in the allograft recipient. $RI = \frac{PSV - EDV}{PSV}$ where PSV is peak systolic velocity

and EDV is end diastolic velocity which can be Calculated by real time USG Doppler [Fig.2]

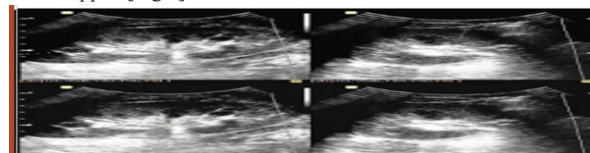


Fig 1: Graft length and graft parenchymal thickness measurement by grey scale sonography.

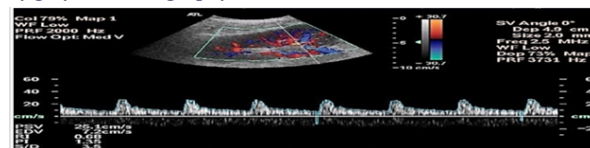


Fig. 2: Doppler and color perfusion of post transplant renal allograft.

Statistical Analysis

All statistical analyses were performed using SPSS, software version trial version 23. Repeated measure ANOVA measurements were applied to identify the relation between kidney size, parenchymal thickness, and RI and serum creatinine in three time-intervals to identify how the parameters change post-transplant with respect to early transplant status during the 1-year follow-up period.

Results

The average renal length was Initially in post transplant : $95.2 \pm 4.8\text{mm}$, 1-week post-transplant $106.2 \pm 3.5\text{mm}$ and after 1 year post transplant was $107 \pm 2.3\text{mm}$ respectively. There was a significant increase in renal length just 1-week post-transplant (average increase, $6.0 \pm 1.5\text{mm}$, $P < 0.003$). During the 1-year post-transplant period assessment, the renal length continued to increase, at a much slower rate 1-year after transplantation in contrast with 1-week post-transplant and the change in parameter was not significant. A similar pattern of changes was observed for antero- posterior and parenchymal thickness parameters. The corresponding values in A.P diameter (Initial $45.5 \pm 4.2\text{mm}$, POD 7 : $48.5 \pm 3.2\text{mm}$, 1 year post transplant $49.2 \pm 3.0\text{mm}$, $p < 0.002$) and Parenchymal or cortical thickness (Initial ; $10.2 \pm 0.9\text{mm}$, POD 7; $11.2 \pm 0.5\text{mm}$, 1 year post transplant $11.4 \pm 0.6\text{mm}$, $p < 0.001$) [Table 1].

The RI values at POD 7 and 1 year post transplant was not significant. There was no significant association between graft size change [Fig 1] and resistive index neither in early nor 1 year post RT. The serum creatinine levels 1 year post transplant was significant lower than POD 7 post transplant.

Table 1: Graft size on USG on Doppler at different follow up periods

Graft size on USG Doppler	Initial	POD 7	1 year after transplant	P value
Length [mm]	95.2 ± 4.8	106.2 ± 3.5	107 ± 2.3	<0.003
AP Diameter [mm]	45.5 ± 4.2	48.5 ± 3.2	49.2 ± 3.0	<0.002
Parenchymal/Cortical Thickness [mm]	10.2 ± 0.9	11.2 ± 0.5	11.4 ± 0.6	<0.001
S . Creatinine [mg/dl]	2.05 ± 1.13	1.99 ± 0.85	1.37 ± 0.55	0.002
RI	0.65 ± 0.05	0.68 ± 0.05	0.69 ± 0.06	0.642

Discussion

In renal allograft recipients, evaluation of graft survival is done based on measurement of kidney length, volume or parenchymal thickness and can be done by 2-dimensional ultrasonography (US), as it is easily available bedside and easy operability by the operator with no radiations or any contrast related complications. Emamian (7) et al demonstrated that renal length in all adult volunteers predicted least observer variability as opposed to measurements of parenchymal thickness & volumetric estimations and implied that length measurement is the parameter to be considered as opposed to volume estimation.

In our study significant increase in renal size (Including length, anterior-posterior diameter, and parenchymal thickness) in (1 week) post-transplant period. Similar result was seen in Shivalingaiah et al (8), and Mean R.I value at POD 7 and 1year at $\text{GFR} \geq 60$ and $\text{GFR} < 60$ were 0.68 ± 0.07 and 0.79 ± 0.07 . S.creatinine before transplant was 2.03 ± 1.15 and after 1 year was 1.35 ± 0.57 it was found significant .No significant correlation between graft size change and resistive index (RI) or Serum creatinine and RI in early or 1 year post RT. Similar findings from within India at Bangalore (7) and outside India at Tehran , Iran(9) was seen. The mean RI at 1-year post-transplant was 0.50 - 0.80 and findings of Mean RI values did not significantly vary between the 1 week and 1-year post transplant.

Conclusion

Renal graft size (viz. Length, A.P diameter and parenchymal/cortical thickness) shows significant increase in early RT period. The increase in graft size correlate significantly with serum creatinine 1 year post RT. There was no correlation between resistive index (RI) and serum creatinine. Hence Doppler is very effective tool to evaluate graft function at early stage post RT , and it can help to predict long term outcome of graft.

Financial support : NIL

Conflict of interest : NIL

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