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Original Article

Cognitive Impairment in Renal Transplant Recipient: A Prospective Study

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Abstract

Introduction: Kidney transplant recipients, like patients on dialysis, have several risk factors for developing cognitive impairment such as comorbid illness, depression, and lower level of physical activity.

Materials and Methods: A total of 25 patients were included to analyze the cognitive status in chronic kidney disease patient before and after renal transplant (RT) (6–9 months after renal transplant). Demographic and clinical variables associated with cognitive impairment were also examined.

Results: The mean hemoglobin (Hb) before RT was 8.44 g, significant increase after RT 11.56 mgs. The mean blood urea decreased from 115.60 mgs to 31.60 mgs after RT. Serum creatinine significantly decreased after RT from 8.10 mgs to 1.30 mgs. Blood pressure (BP) after RT decreased to 123.6/80.40 mmHg. Statistically significant changes in attention, anterograde memory, verbal fluency, and word recognition after renal transplant, but there is no statistically significant in language domain.

Conclusion: There is a statistically significant increase in Hb level, decrease in serum creatinine and blood urea, and BP control after the renal transplant. Statistically significant changes in attention, anterograde memory, verbal fluency, and word recognition after renal transplant, but there is no statistically significant in language domain.

Key words: Cognitive function, Cognitive impairment, End-stage kidney disease, Kidney failure, Kidney transplantation, Renal transplant

INTRODUCTION

Renal disease is a gradually increasing common chronic illness affecting middle and older adulthood. Chronic kidney disease (CKD) affects 5–10% of the world population and is a universal health problem.[1] When compared with the general population, the prevalence of cognitive impairment is high in end-stage renal disease (ESRD). The overwhelming of cognitive impairment in CKD and patients undergoing hemodialysis is noticeable only in recent years. Severe cognitive impairment is synonymous in comparison to dementia.[2] DSM-V criteria duly state that dementia is a chronic cognitive impairment in two or more cognitive domains that substantially affect the daily function, representing a decline in the premorbid function and is not due to concomitant acute delirium. Although there is compromised cognition in patients undergoing dialysis, cumulative evidence shows that there is an increased risk for cognitive difficulties in individuals even in the early course of the disease before the occurrence of renal failure. Having said that the cognitive performance following successful renal transplant is unclear, it is usually believed that the cognitive features return to premorbid levels after successful renal transplantation. Short screening tests such as Mini-Mental State Examination (MMSE) and 3MS – an adjunct of MMSE, which contains four added subtests, are applied to test cognitive impairment and a maximum score of 100 points are given.[3,4] On the whole, these screening tests have limited sensitivity, particularly for vascular cognitive impairment. Hence, the prevalence

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of cognitive impairment in CKD is still underestimated.[5] In this study, the cognitive function in renal transplant recipient is assessed by various methods before and after (9 months) renal transplantation.

Aim

This study aims to study and analyze the cognitive status such as attention, language, memory, and lobar function in patients with CKD before and after renal transplantation.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Nephrology at Rajiv Gandhi Government General Hospital from May 2012 to January 2014. Patients were taken from the list, enrolled for renal transplantation, and undergone renal replacement therapy. They were enrolled in this study after getting a written consent to analyze the cognitive status in CKD patient before and after renal transplant (6–9 months after renal transplant).

Inclusion Criteria

Those who are admitted in the nephrology ward for renal transplant between 10 and 60 years of age.

Exclusion Criteria

Mentally retarded, organic psychosis, patient on antidepression, had an absence of acute illness (e.g., metastatic cancer), neurological disease, and other major organ failures (e.g., end-stage liver disease).

Methods/Analysis

Detailed history and neurological examination such as MMSE, detailed lobar function, Addenbrooke's cognitive examination-revised scale, Alzheimer's Disease Cooperative Study (ADAS) - cognitive behavior, and Wechsler Memory Scale will be done. Details regarding the treatment will be obtained from history and treatment records. Statistical analysis done using the standard method**;** Chi-Square tests, student *t*-test.

Assessment of Parameter

The following clinical assessment will be made before and after renal transplant surgery. It includes, Language, Memory, Detailed lobar function, Renal parameter, Blood pressure (BP), hemoglobulin.

RESULTS

A total of 25 patients were enrolled in this study after getting a written consent to analyze the cognitive status in CKD patient before and after renal transplant (6–9 months after renal transplant). The minimum age enrolled was 17 years and maximum age was 49 years. <30 years were 10 in numbers, 30–40 years 11 in numbers, and >40 years were 23 in numbers. In this study, of 25 patients, 20 (80%) were male and 5 (20%) were female. The total number of patients is 25, the cadaveric kidney was used in 11 patients (44%), and live donor kidney was used in 14 patients (56%).

The mean hemoglobin (Hb) before renal transplant (RT) was 8.44 and some of the patients were received injection erythropoietin before surgery. The mean Hb after RT was 11.564 and there is statistically significant, $P = 0.000$. The mean blood urea level before RT was 115.60 and the mean blood urea level after RT was 31.60, there is statistically significant, $P = 0.000$ was noted. The mean serum creatinine level before RT was 8.108 and the mean serum creatinine level after RT was 1.300, and there is statistically

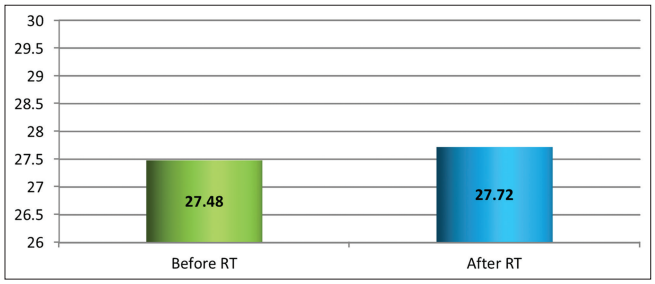

Figure 1: Mini-mental state examination - mean

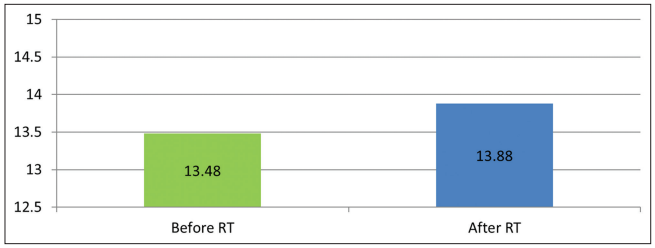

Figure 2: Attention and orientation - 15 points - mean

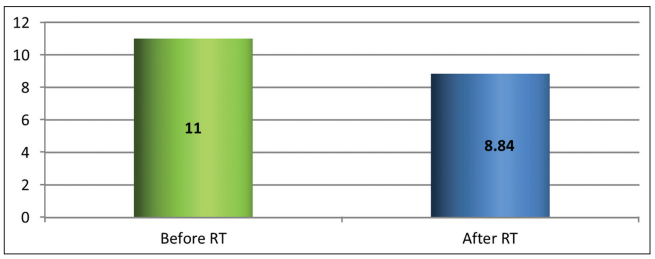

Figure 3: Time at completion: In maze test - mean

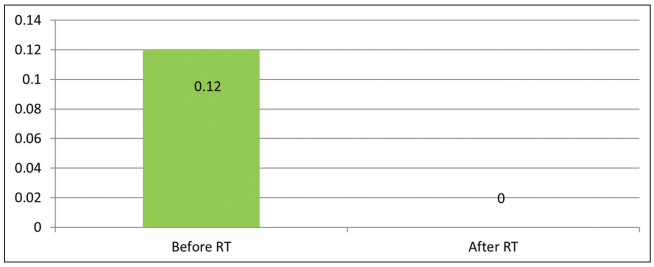

Figure 4: Number of errors in maze test - mean

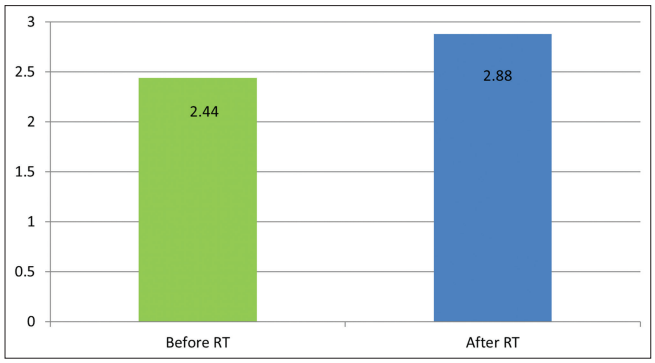

Figure 5: Memory before and after renal transplant word recall maximum 3 points

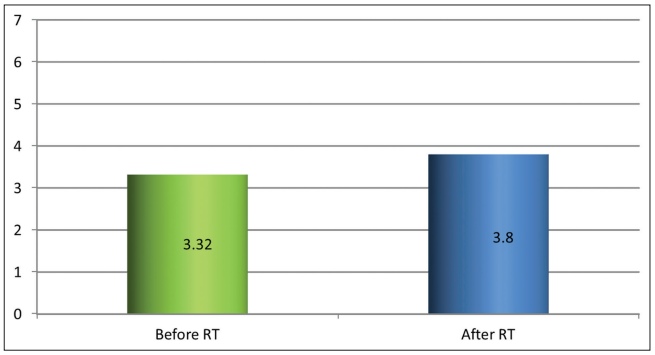

Figure 7: Delayed recall before and after renal transplant maximum 7 points mean

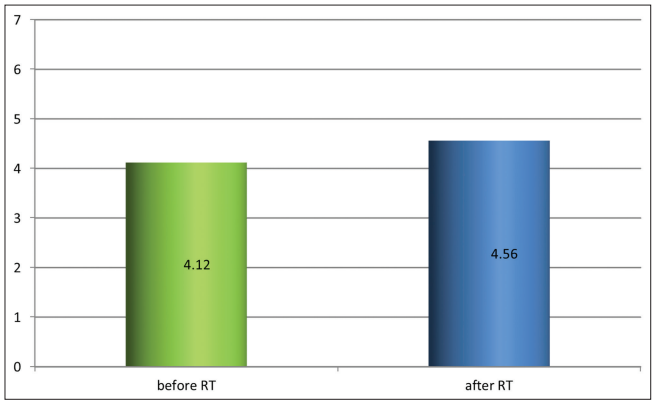

Figure 6: Anterograde memory before and after renal transplant maximum 7 points

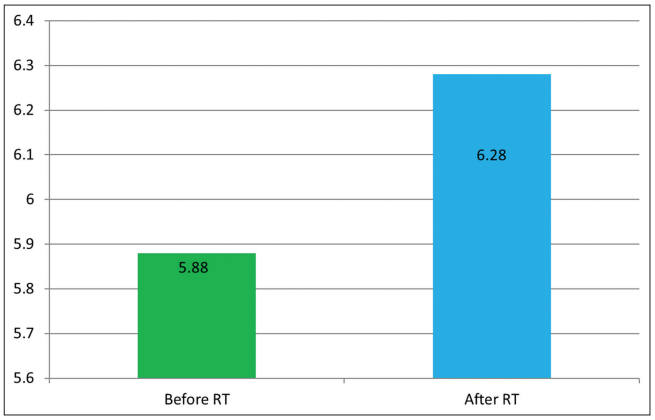

Figure 8: Word recognition - mean value

significant, $P = 0.000$ was noted. The mean systolic BP level before RT was 142.40 and the mean systolic BP level after RT was 123.6 and there is statistically significant, $P = 0.000$ was noted. The mean diastolic BP level before RT was 90 and the mean diastolic BP level after RT was 80.40 and there is statistically significant, $P = 0.000$ was noted. The duration of dialysis varied from 1 month to 10 months depends on the availability of a kidney donor [Figure 1]. MMSE was conducted in all patients before and after RT and the mean difference was not statistically significant. The attention and orientation task was performed with ADAS scoring; there was a significant mean value which was statistically significant [Figure 2]. The maze test was used as executive function to test the sequence of test and time of completion, there is significant, *P*-value was noted in a number of error and time of completion [Figures 3 and 4]. The constructional praxis was tested with **a** circle, constructional praxis before and after RT was noted. There is no statistically significant ideational praxis noted before and after RT. Memory was tested with the following test. There is a significant *P*-value noted in the recall test. Memory was tested with a name and address and ask them to repeat the words, the significant *P*-value was noted after renal transplantation [Figure 5]. Delayed memory was tested with a name and address and ask them to repeat the words, the significant *P*-value was noted after renal transplantation [Figure 7]. There is no significant *P*-value noted when tested with retrograde memory (name of the chief minister or prime minister) [Figure 6]. Word recognition was tested with 10 words and noted significant *P*-value noted after RT [Figures 8 and 10]. Animals/mt were tested with each patient and noted significant *P*-value noted after RT. FAS test (words/mt) was tested with each patient and noted significant *P*-value noted after RT [Figure 9]. Visuospatial ability before RT and after RT was tested with copying cube, circle, and draw a clock face with the numbers on it, and there is no significant, *P*-value was noted [Figure 11]. Perceptual ability was noted with Counting dots and there is no significant, *P*-value was noted. Copying was tested and there is no significant *P*-value noted [Figure 12].

DISCUSSION

A total of 25 patients were enrolled in this study after getting a written consent to analyze the cognitive status in CKD patient before and after renal transplant (6–9 months after renal transplant).

The mean Hb after RT was 11.564 and significant $P = 0.000$ was noted, there is significant Hb level increased after RT.

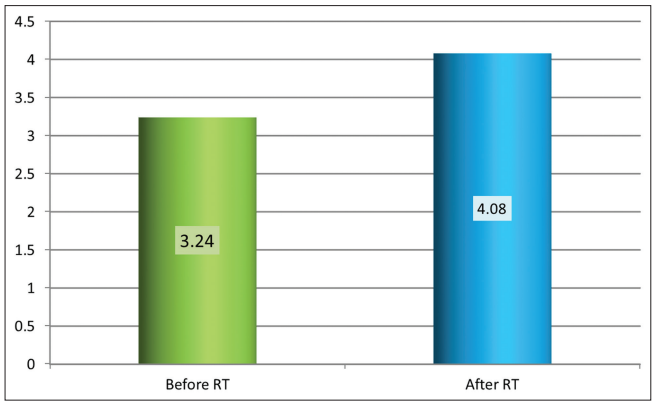

Figure 9: Animals/mt - mean value

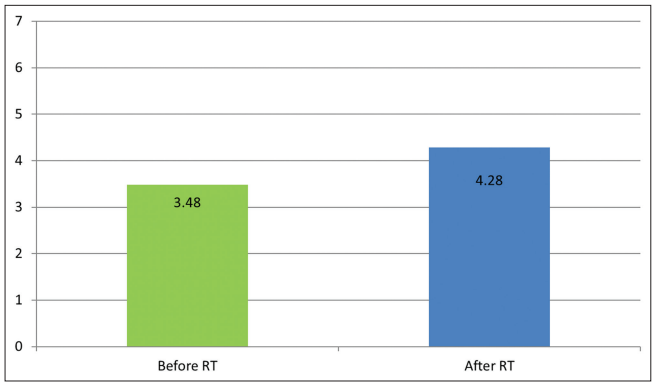

Figure 10: Words/mt before and after renal transplant maximum 7 points

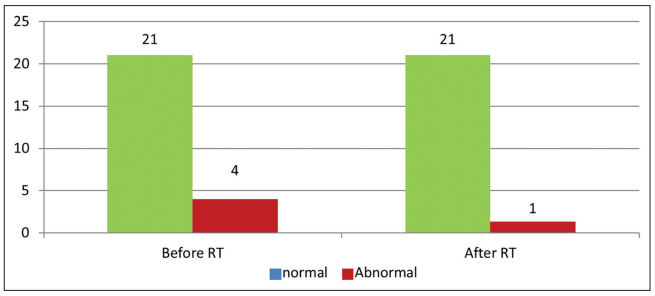

Figure 11: Visuospatial before and after renal transplant

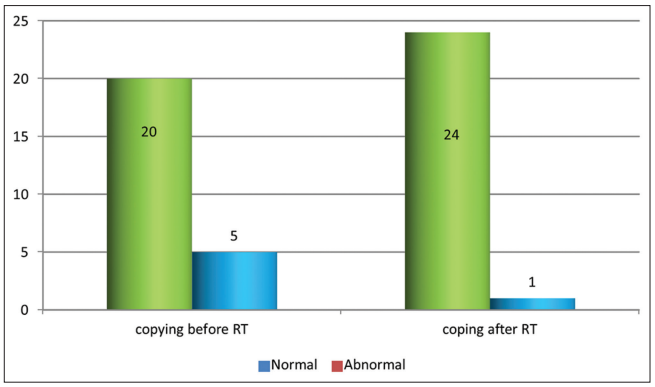

Figure 12: Copying before and after renal transplant

Usually, the Hb improved significantly by 3 months after RT; this corresponds to Iwamoto H.

The mean blood urea level before RT was 115.60 and the mean blood urea level after RT was 31.60, there is statistically significant, $P = 0.000$ was noted; this is correlated with the Reinhardt *et al.* study in post-renal transplant, there is a significant reduction in blood urea level except in few patients with impaired graft function.[6]

The mean serum creatinine level before RT was 8.108 and the mean serum creatinine level after RT was 1.300 and there is statistically significant, $P = 0.000$ was noted. This is correlated with the Reinhardt *et al.* study in post-renal transplant; there is a significant reduction in serum creatinine level except in few patients with impaired graft function.[6]

The mean systolic BP level before RT was 142.40 and the mean systolic BP level after RT was 123.6 and there is statistically significant, $P = 0.000$ was noted. The mean diastolic BP level before RT was 90 and the mean diastolic BP level after RT was 80.40 and there is statistically significant, $P = 0.000$ was noted. There is a significant reduction in the BP after RT about 30% of patient taking regular anti-HT drugs even after RT. This is correlated with the previous pilot study (Saxena and Sharma).[7]

Cognitive function compromise has been reported by Teschan *et al.*[8] and Kurella *et al.*[9] It depends on underlying dialysis treatment duration.

Earlier, ESRD patients who undergo hemodialysis procedure continuously may lead to cognitive impairment which is known as dialysis-associated dementia. This was first noted by Alfrey *et al.*[10] This dialysis-associated dementia could be most often prevented using water purification technique, thereby preventing aluminum toxicity. Hemodialysis results in decreased cerebral blood flow and changes in hematocrit level and other comorbid cerebrovascular disease associated with cognitive compromise.[11]

Poor executive function has been improved in RT patients when compared to the patient on dialysis. This correlates with the previous study by Smith *et al.*[12] and Matthews and Klove.[13] In the above study, executive function tested by trail making test, simple digit modality test, and written test. In our study, the executive function has been tested by maze test (number of error and time of completion), Stroop test, and trail making test resulting in statistically significant value noted after renal transplantation by means of less number of error and early completion. In both studies, the extent of residual cognition that is present in

early CKD is not mentioned which may persist following renal transplantation.

Matthews and Klove *et al.*[13] across sectional comparison suggest that improvement of attention and memory but not in executive function following RT. Griva *et al.*[14] found that there is an improvement in attention for RT in comparative dialysis participant (transplant patients showed 32% improvement on simple addition test in the second visit), but it was not statistically significant. There is no available to compare the cognition in early CKD and post-RT. In our study, attention was tested with digit forward, digit backward, spell backward, simple calculation, Go-no-go test, vigilance test. The results showed statistically significant $P = 0.000$ in our study as compared to Uchida *et al.* and Matthews and Klove *et al.*[13]

The important question concern whether the renal transplantation improves one to the state of premorbid baseline cognition ability. For this question, one must compare the performance of renal RT patients to that of healthy controls.

Griva *et al.*[14] study showed the memory remains equivocal after RT. Bermond *et al.*[15] study indicating the poorer memory after RT but lack of study control group. The small size renal RT participants and the control group stated the null difference noted in the study. The general belief that cognitive function will improve after successful RT, but there is no evidence to support this.

CONCLUSION

There is a statistically significant increase in Hb level, decrease in serum creatinine and blood urea, and BP control after the renal transplant. Statistically significant improvement in attention task (digit forward, digit backward, spell backward, simple calculation, Go-no-go test, and vigilance test) and memory (recall, anterograde memory, retrograde memory, verbal fluency, and word recognition) is statistically after renal transplant when compared with before renal transplant. However, there are no significant changes in the retrograde memory and language domain. The sample size was small and needs to study in large groups in various cognitive domains and long-term follow-up to determine the cognitive improvement.

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