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ORIGINAL ARTICLE

Impact of Arteriovenous Fistula Creation on Progression of Chronic Kidney Disease

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ABSTRACT

Background: All guidelines recommend pre-emptive arteriovenous fistula (AVF) formation in late-stage chronic kidney disease (CKD) patients. New evidence shows that pre-emptive AVF can improve estimated glomerular filtration rate (eGFR) as well.
Aim: To evaluate the beneficial effect of AVF on improvement of eGFR in pre dialysispatients of CKD stage 5 disease.
Methodology: A total of one hundred CKD stage five pre-dialysispatients were included in this prospective cohort research from the Nephrology unit of Services Hospital Lahore (SHL). After receiving approval from the ethical review committee SHL, the study was performed from September 2021 to March 2022. Patients were separated into two groups. Fifty patients with arteriovenous fistula (AVF) were in Group AVF, whereas those in Group Non-AVF were only on conservative therapy as they opted for conservative treatment despite counseling about need for AVF and Renal Replacement Therapy (RRT) in future. Over the course of six months, both groups were monitored. The initial eGFR was measured immediately after the formation of AV fistula and monthly for next six months (Final eGFR).
Results: The median age of the study population was 37 years in which the sixty percent of the males. The most common comorbid condition was hypertension (96%) and the main reason for late-stage renal disfunction was diabetic nephropathy (45%). We found statistically significant improved eGFR in AVF group as compared to the non-AVF group ($p < 0.01$).
Conclusion: From the results of our study, it can be concluded that the creation of AVfistula in the pre-dialysis patient has a beneficial effect on improvement of eGFR and delaying the progression CKD.
Keywords: End Stage Renal Disease, AV fistula, Pre-Dialysis, e GFR, chronic kidney disease,

INTRODUCTION

The burden of chronic kidney disease in our population is increasing day by day[1]. More than 4000 new cases per annum of end-stage renal disease are reported in Pakistan [2]. Beyond this stage, life is sustained by renal replacement therapy only in the form of dialysis or transplant [3]. Timely placement of arteriovenous fistula is essential for these patients because it takes almost forty to sixty days to become fully functional motion of an arteriovenous fistula (AVF) has recently been proposed as a way to reduce CKD progression or even some studies it is noted that creation of AV fistula even improve the eGFR, as a result, delay hemodialysis[4]. Only a few therapies have been demonstrated to slow the course of CKD, including blood pressure management and proteinuria reduction[5]. A study whose design was observation showed an association between fistula formation and decline in renal function estimated GFR. 123 patients who have CKD with AVF formation had been reported a decline of eGFR from 5.9ml/min/1.73 pre and 0.46ml/min post AVF formation[6]. As a result, finding a new target to slow CKD progression is of utmost importance, especially since AVF is considered the best vascular access for chronic hemodialysis due to its superior durability and lower risk of adverse events when compared to a central venous catheter (CVC) or arteriovenous graft (AVG)[7].

In the present studywe evaluated the beneficial effect of AVF on improvement of eGFR in pre dialysis patients of CKD stage 5 disease.

METHODOLOGY

The current prospective cohort analysis was conducted at the Nephrology ward of Services hospitalLahore (SHL) from September 2021 to March 2022. A total of one hundred participants of chronic kidney disease stage 5 were included, which was further divided into two groups. In the first group, fifty pre-dialysis patients having AV fistula were recruited (Group AVF). Whereas in other group age and sex-matched patients without AV fistula were included (Group Non-AVF). Male and females of age greater than 18 years recruited after taken the informed written consent. Whereas all patients have any evidence of acute kidney injury e.g., Infections, acute coronary syndrome, obstruction, nephrotoxic drugs, hypotension, and dehydration were excluded from the study. This study was approved by the ethical review board of Services Hospital Lahore. GFR was calculated by CKD-EPI. The two groups were followed every month for six months. The routine laboratory parameters such as complete blood count (CBC), renal function tests (RFT) and e GFR were noted.We also documented the Co-morbid conditions and probable reason for CKD. The continuous variables were presented as median and interquartile range and comparison between the two groups by using a Mann-Whitney U test, categorical variable was shown as frequencies or percentages. The analysis was performed by using the software SPSS version 25 and a *P* value less than 0.05 remained the statistically significant.

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RESULTS

A total of one hundred individuals with CKD-5 were enrolled in this prospective study. The study population's median age was 37 (IQR=27.25-49), with 60% of males. Table 1 shows the male to female ratios in both groups. Table 2 shows the baseline characteristics that were observed at the commencement of the investigation. Both groups are comparable, as evidenced by the non-significant *P*-value. The most frequent comorbid condition in the study sample was hypertension, followed by diabetes (Fig. 1). Diabetic nephropathy was the most common cause of CKD in our research group, as indicated in Figure 2.

Table-1 Distribution of Gender between the groups:

Variable Constructs	Group – AVF (50)	Group Non-AVF (50)
Male	29 (58%)	31 (62%)
Female	31 (42%)	29 (38%)
Total	50 (100%)	50 (100)

P value 0.051

After the three months of follow-up period the comparison of creatinine showed in significant difference between the groups, but we noted significant improvement in e GFR in Group AVF as compare the group non-AVF ($p < 0.01$).

Table 2: Baseline characteristic between the two groups:

Variables	Total	Group AVF	Group Non AVF	P-value*
Age (Years)	37.00 (27.25-49.00)	36.50 (26.00-49.25	37.00 (28.75-47.50)	0.76
BMI (kg/m^2)	29.69 (28.64-31.80)	29.67 (28.69-31.74	29.74 (28.57-31.87)	0.99
Creatinine, mg/dl(initial)	4.51 (3.82-4.95)	4.60 (3.96-4.99)	4.35 (3.78-4.93)	0.52
eGFR mL/min(initial)	15.00 (13.00-17.00)	15.00 (13.00-17.25)	14.00 (12.00-17.00)	0.17

*Mann-Whitney Test

Table-3 Comparison of creatinine and eGFR between the groups:

Variables	Total	Group AVF	Group Non AVF	P-value*
Creatinine, mg/dl(Final)	4.40 (3.81- 4.78)	4.43 (3.92-4.76)	4.32 (3.64-4.82)	0.38
eGFR mL/min(Final)	20.00 (18.00- 22.75)	22.50 (20.00-25.00)	19.00 (17.00-20.00)	< 0.01

*Mann-Whitney Test

Figure-1 Distribution of comorbid condition in study population.

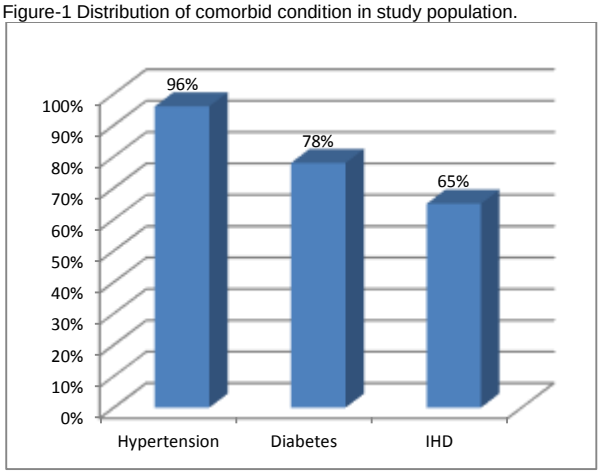
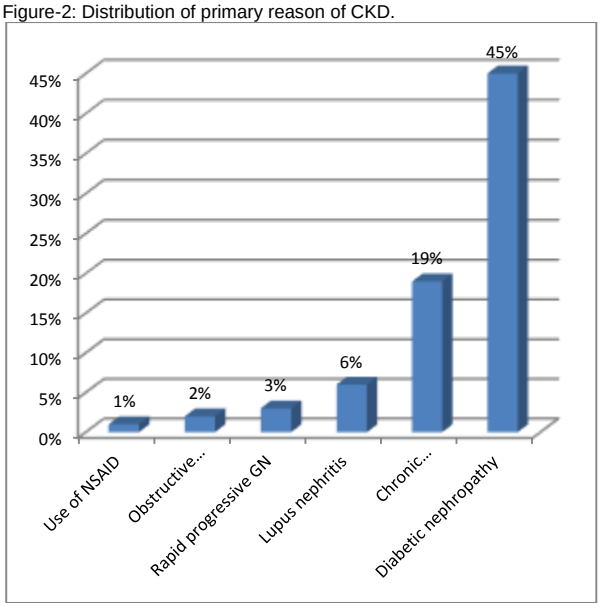


Figure-2: Distribution of primary reason of CKD.



DISCUSSION

This is a prospective cohort study in which the eGFR was compared between the two groups. the first group was in pre dialysis CKD-5 stage with AV fistula while the second group was included patients of CKD-5, but they did not have AV fistula and was on conservative treatment. We compared the eGFR between the two groups after a period of six months of formation of AV fistula. The results showed statically significant improvement of final eGFR in AVF group as compared to the control group. Our results were inconsistent with the results of a matched cohortstudy. Patients with arteriovenous fistula development had a significantly reduced risk of renal function decrease when compared to a peritoneal dialysis group. The yearly decline averaged 1.7ml/min/1.73m2[8]. Another Swedish study indicated that kidney function deteriorated less after AVF development than before (-5.6 vs. -1.6 ml/min/1.73m2 /year, p0.01)[9]. Several more studies have yielded similar results that showed preservation or decreases in the progression of renal dysfunction[10-12].

The physiological explanation for how the functional AVF helps to improve kidney function is that certain local and remote changes in microcirculation occur in late-stage CKD patients' such as contralateral forearm, resulting in decreased peripheral resistance, Systolic and diastolic blood pressure, increased stroke volume, left ventricular ejection fraction, and cardiac output[13]. The endothelium undergoes functional and structural alterations as a result of the local sheer wall stress and hemodynamic consequences of the working fistula. Arterial stiffness appearsto be associated with the progression of CKD[14]. The stiffening of the renal vascular beds causes dysregulation and additional loss of renal function, resulting in a vicious loop that decreases the glomerular filtration rate[15]. As a result, when an AVF is formed later on, endothelial cells react to the sheer wall stress downstream of the fistula by reducing arterial stiffness. This might explain the stabilization or slowing of renal function loss, as well as the probable delay in starting hemodialysis following the development of a functioning AV fistula[13]. Another reason for the slower advancement of chronic renal disease in individuals who received an arteriovenous fistula in a timely manner is that these patients adhere to their treatment regimen[16].

AVF is the recommended vascular access for hemodialysis, despite any potential influence on eGFR. Multiple studies have linked central venous catheter (CVC) to an increased risk of death from cardiovascular and infectious diseases[17,18]. Native fistulas have been linked to reduced hospitalizations owing to infectious illnesses, septicemia, and central vein stenosis[19]. As a result, the vast majority of pre-dialysis patients with progressive CKD should be referred for vascular access creation when their eGFR is between 15-20ml/min/1.73m2[20]. Only 25% of incident patients started hemodialysis with an AVF, according to CHOOSE data from 2001[21]. In the United States in 2017, 16.8% of patients began dialysis with a fully established AVF, whereas 15% began with a growing AVF through a catheter[22,23]. So, our study recommends timely creation of fistula. The limitation of study is small sample size which reduces the power of study. Further studies needed with large sample size in our population to validate the beneficial effect of AV fistula in pre dialysis patients.

CONCLUSION

In conclusion, this study revealed that pre-dialysis individuals having chronic kidney disease stage 5, improved their eGFR after the AVF was created, compared to patients with Stage 5 CKD who were just on conservative therapy. Our findings suggest a link between the development of AVF and delaying in the progression of chronic kidney disease and stabilizing the eGFR in these patients.

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