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SERUM ALBUMIN LEVELS AS A PROGNOSTIC MARKER IN ARTERIOVENOUS FISTULA FAILURE IN CHRONIC KIDNEY DISEASE PATIENTS IN A TERTIARY CARE CENTRE – A CROSS-SECTIONAL STUDY

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ABSTRACT:
CKD is a significant community well-being concern in developing nations like India, where late diagnosis and insufficient resources result in unfavourable outcomes. Hemodialysis constitutes the primary renal replacement treatment, and arteriovenous fistulas (AVFs) are the optimal vascular access because of improved patency and reduced complications. Nevertheless, up to 40 per cent of patients have AVF failure due to poor maturation or early dysfunction. Negative acute-phase proteins like serum albumin indicate the nutritional and inflammatory conditions in CKD. Hypoalbuminemia is frequent because of malnutrition, inflammation and protein losses, and is linked to poor tissue repair, endothelial dysfunction and poor vascular integrity, which can have negative implications on AVF outcomes.

INTRODUCTION

Recent data show that low serum albumin (< 3.5 g/dL) is related to a much greater risk of AVF failure; it is proven to be a simple and inexpensive prognostic factor [1]. In addition to vascular access, hypoalbuminemia has a high-risk relationship with cardiovascular events, hospitalisation, and mortality of CKD and patients in the critical care unit [2,3]. The rationale behind this is based on the biological capacity of albumin to sustain oncotic pressure, the regulation of oxidative stress, as well as vascular repair, and predictive models indicate this potential in predicting AVF maturation [4,5]. Serum albumin is inexpensive and available routinely, making it exceptionally appropriate in terms of resource-limited settings in the context of risk stratification. This is a study that analyses association among baseline levels of serum albumin as well as AVF outcomes in CKD patients as part of the strategy to inform measures that could lead towards successfully completing dialysis and minimising the occurrence of complications [6]

RESULTS

Patients who exhibited hypoalbuminemia (<3.5 g/dL) had a greater number of adverse clinical and dialysis-related factors than patients with a normal level of serum albumin. The occurrence of combined hypertension and diabetes was much higher in the hypoalbuminemic group, and there was an increase in the length of dialysis and missed dialysis sessions. Evaluation in the laboratory showed that the levels of haemoglobin are significantly reduced and the levels of creatinine, urea, and phosphorus are higher in the patients with low serum albumin, which means that their nutritional and metabolic conditions are worse (Table 1). Most importantly, arteriovenous fistula (AVF) failure was very high in the hypoalbuminemic group (60%) than in patients who had normal levels of albumin (20%) (Table 2).

Table 1. Baseline Characteristics, Comorbidities, and Dialysis-Related Factors Stratified by Serum Albumin Level

Variable	Albumin <3.5 g/dL (n = 30)	Albumin ≥3.5 g/dL (n = 20)	p-range
'Age (years), mean ± SD'	59.1 ± 9.8	56.8 ± 11.3	0.42
Male sex, n (%)	20 (66.7)	12 (60.0)	0.64
Hypertension, n (%)	25 (83.3)	14 (70.0)	0.28
Diabetes mellitus, n (%)	18 (60.0)	8 (40.0)	0.17
Both HTN + DM, n (%)	14 (46.7)	4 (20.0)	0.04

Duration on dialysis >12 months, n (%)	12 (40.0)	3 (15.0)	0.05
Missed ≥2 dialysis sessions, n (%)	16 (53.3)	5 (25.0)	0.04

Table 2. Laboratory Parameters and Arteriovenous Fistula Outcomes by Serum Albumin Category

Parameter	Albumin <3.5 g/dL (Mean ± SD / n)	Albumin ≥3.5 g/dL (Mean ± SD / n)	p-value
'Haemoglobin' (g/dL)	8.4 ± 1.2	10.1 ± 1.3	0.001
Serum creatinine (mg/dL)	9.2 ± 1.6	7.8 ± 1.4	0.02
Blood urea (mg/dL)	140 ± 28	122 ± 25	0.03
Serum phosphorus (mg/dL)	5.6 ± 1.0	4.4 ± 0.8	0.01
AVF failure, n (%)	18 (60.0)	4 (20.0)	0.003

DISCUSSION

Aim of the research stood to establish an association among arteriovenous fistula (AVF) failure and serum albumin in patients undergoing chronic kidney disease (CKD) in hemodialysis. We discovered that there was a strong association between the state of hypoalbuminemia (below 3.5 g/dL) and the risk of AVF failure. This research has suggested that 60 per cent of the patients were hypoalbuminemic, and 60 per cent of the patients were experiencing AVF restenosis or failure, which validates the fact that serum albumin is an excellent prognostic variable in regard to the outcome of vascular access. The conclusion is in line with the conclusion of the research conducted by Okuhata et al. (2024) who described the less serum albumin level was significantly related through morbidity as well as mortality in the short-term of AVF failure [1]. They have also identified that the risk factor correlating with the possibility of restenosis after the original successful AVF is the presence of hypoalbuminemia which can be applied to our study that demonstrates that more patients by serum albumin below 3.5 g/dL failed at AVF. Uchikawa et al. (2014) had another finding that low serum albumin was the forecaster of derogatory cardiovascular incidents in CKD patients regardless to other predictors, which verifies an overall implication of hypoalbuminemia in the vascular pathology, one of which may be AVF dysfunction [2]. Fageria and Sharma (2022) also highlighted the reduction in serum albumin in non-survivors of an ICU cohort, which makes the reduction in levels of albumin a predictor of poor clinical outcomes [3]. Besides, it was also found in our research that hypoalbuminemic patients missed sessions of dialysis, and they had low haemoglobin levels and a rise in creatinine, urea and phosphorus levels. These findings demonstrate that hypoalbuminemia might serve as a surrogate of insufficient nutrition as well as systemic inflammation that may hamper AVF healing and maturation. According to Nakhaei et al. (2019), serum albumin is also among the best predictors of AVF non-maturation on the basis of predictive analytics [4]. Our study findings substantiate the application of serum albumin as a simple yet efficient predictive variable of AVF failure in patients with CKD, and must be taken into account during the preoperative evaluation and nutritional intervention regimes.

CONCLUSION

The paper confirms that hypoalbuminemia and arteriovenous fistula (AVF) failure are significantly correlated in chronic kidney disease patients. Lower levels of serum albumin (<3.5 g/dL) among the patient population were associated with increased AVF restenosis, poorer laboratory results, and a decreased level of dialysis compliance, indicating that albumin is a useful prognosis. $Serum albumin, as a cheap, convenient, and often available biomarker, can be a convenient screening test in estimating the high-risk patients and optimising nutrition, early clinical intervention to achieve superior vascular access outcomes and improve the effectiveness of hemodialysis.

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