Section: Nephrology

Original Research Article

COMPARATIVE STUDY OF SHORT TERM MORBIDITY AND MORTALITY IN ESRD PATIENTS INITIATED ON DIALYSIS WITH AV ACCESS OR WITH CVC

Shivangi Gupta[1], Pratik Tripathi[2], Gaurav Khandelwal[3], Shaurya Mehta[4]

[1,2,3]*Department of Nephrology, National Institute of Medical Sciences and Research, Jaipur, Rajasthan, India.*

Received *: 19/08/2024*
Received in revised form *: 10/10/2024*
Accepted *: 25/10/2024*

Corresponding Author:
Dr. Shivangi Gupta,
NIMS Hospital, Shobha Nagar, Jaipur-Delhi Highway, Jaipur- 303121, Rajasthan, India.
Email: guptashivangi479@gmail.com

DOI: 10.70034/ijmedph.2024.4.206

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (4); 1120-1123

ABSTRACT

Chronic Hemodialysis requires a durable vascular access that includes AV fistula (AVF) or grafts (AVG), or central venous catheter (CVC). Multiple reports have documented the type of vascular access used for dialysis and associated risk of infection and mortality. We retrospectively studied all patients who initiated chronic haemodialysis treatment at our dialysis centre. In total, 74 patients were included in the study. Our aim was to study short term morbidity and mortality in ESRD patients initiated on hemodialysis with AV access or with CVC. Most frequent causes of ESRD were diabetes 28%, hypertension/vascular (28%), glomerulonephritis 7%, Autosomal dominant polycystic kidney disease (ADPKD) (6%), malignancy (5%), and obstructive/urologic problems (4%). Moreover, the most frequent causes of death were cardiovascular (50%), infectious (41.7%), and unknown in 8.3%. With the current data, our aim will still be to promote as much as possible the use of an arteriovenous access in our patients, unless the patient has severe heart failure or a limited prognosis due to very old age or severe comorbidities.

INTRODUCTION

Chronic hemodialysis patients have high mortality, mostly due to cardiovascular and infectious diseases, with part of this high mortality rate attributable to hemodialysis vascular access related complications.[1]

Hemodialysis requires a durable vascular access to the circulatory system. Main forms of vascular access (VA) includes AV fistula or grafts, or central venous catheter (CVC). The ideal VA must include minimal complication rate and supply sufficient longevity for use along with proper blood flow to deliver the prescribed dialysis dosage.

Multiple reports have documented the type of vascular access used for dialysis and associated risk of infection and mortality. Undoubtedly, the central venous catheter (CVC) is associated with the greatest risk of infection-related and all-cause mortality compared with the autogenous arteriovenous fistula (AVF) or synthetic graft (AVG). Their use is also associated with an inflammatory state and hence increased cardiovascular risk.[2]

Arteriovenous fistulas or grafts, on the other hand, are associated with cardiac remodeling and can induce or aggravate heart failure.[3] The AVF has the lowest risk of infection, longer patency rates, greater quality of life, and lower all-cause mortality compared with the AVG or CVC.

In general, it is accepted that the infectious risk of dialysis catheters outweighs the cardiac risk of AV fistulas or grafts. Hence the policy on vascular access in haemodialysis patients is to promote the use of an AV fistula or graft, unless there is severe heart failure, access induced limb ischemia or a limited prognosis.

The European dialysis working group (EUDIAL) recently proposed a patient-centered approach instead of a fistula first policy in the elderly, though still suggesting that an AV fistula should be the first choice for the majority of elderly patients.[4]

Creation and maintenance of an effective hemodialysis vascular access is essential for safe and adequate hemodialysis therapy. Unfortunately, access-related complications remain one of the most important sources of morbidity and cost among persons with end-stage renal disease (ESRD), with total annual costs exceeding $1 billion annually.

The type of hemodialysis vascular access used at dialysis initiation is associated with subsequent risk of infection and mortality.

Risk Factors for CVC Use-

Patients using a CVC at the start of dialysis tend to be female, are less likely to be obese or receive pre-ESRD erythropoietin, and are more likely to have ischemic heart disease, hypoalbuminemia and anemia prior to ESRD than those starting dialysis with a permanent form of vascular access (AVF or AVG).[5]

Patient characteristics independently associated with CVC use include older age, black race, female gender, ischemic heart disease, and peripheral vascular disease.

High rates of CVC use may occur for several reasons, including limited access to medical care for many patients in need of chronic hemodialysis, limited patient education regarding optimal access type, failure of an AVF to mature, inadequate surgical training of local surgeons in AVF construction, and delayed referral to a nephrologist.

Complications of CVC Use-

While CVCs have the advantage of immediate use for dialysis after placement, they are associated with lots of complications. Compared with patients who receive an AVF, patients with a CVC may experience poorer clearance of blood toxins secondary to unreliable blood flow, central vein scarring with subsequent vein occlusion, and antibiotic resistance.[6] Patients with a CVC may have higher rates of anemia, and require greater doses of intravenous iron and recombinant human erythropoietin compared with patients with AVFs or grafts.[7]

In addition, CVC use is associated with greater rates of infection, including bacteremia, endocarditis, septic shock, septic arthritis, and epidural abscess. CVC use is independently associated with an increased rate of infectious, cardiovascular and all-cause death compared with AVF use.[8]

Infection-Related Mortality- CVC use is strongly associated with an increased risk of infection-related mortality among both incident and prevalent ESRD patients, primarily as a result of CVC-related bacteremia and sepsis.[9]

Cardiovascular-Related Mortality- Beyond the increased risk of infection, CVC use has been linked to a greater risk of cardiovascular death compared with AVF use. It was found that AVF use 90 days after the initiation of hemodialysis is associated with a 31% reduction in cardiovascular mortality, independent of known risk factors, when compared with CVC use.[9]

All-Cause Mortality from CVC Use-

Compared with AVF use, incident and prevalent CVC use is associated with greater all-cause mortality among ESRD patients. Reports indicate that CVC use is associated with a 40–70% increased risk of death from any cause compared with AVF use.[5]

MATERIALS AND METHODS

We retrospectively studied all patients who initiated chronic haemodialysis treatment at the NIMS university, Jaipur, between 1/7/2023 and 30/6/2024. Chronic haemodialysis treatment was defined as every haemodialysis treatment initiated in patients with end stage renal disease (ESRD) with the intention of being a chronic treatment, as well as every haemodialysis treatment for acute renal failure that was continued for more than 6 weeks. We only included patients who have not been treated by renal replacement therapy (haemodialysis, peritoneal dialysis or transplantation) before.

Patients with emergency indication of hemodialysis, those with active infections at the time of initiation of hemodialysis, history of CVA and CAD within one month prior, poor peripheral vessels, fistula failure (both primary and secondary), and elderly patients with low life expectancy, were excluded.

Part of data was extracted such as date of birth, gender, date of initial dialysis, native kidney disease, comorbidities (diabetes mellitus, congestive heart failure, ischemic heart disease, cerebrovascular disease, peripheral vascular disease, and malignancy) and in case of death, cause of death. From the medical records, the following data were added: the vascular access type at start, any complications and final outcome at the end of observation (whether still on haemodialysis, deceased, opted for renal transplant, transferred to another centre, transferred to peritoneal dialysis, lost to follow-up, recovery of kidney function, decision to stop dialysis by the patient or nephrologist).

RESULTS

In total, 74 patients were included in the study. Mean age at initiation of dialysis was 69 years. Two thirds (67.5%) of patients were men.

Of the 74 patients 81% initiated dialysis with a catheter: 83% were temporary catheters,

17% were tunnelled cuffed catheters (TCC). All catheters were double lumen catheters. Only 19% initiated with an AV access (all with an AV fistula - none of the patient initiated with an AV graft): 40% were wrist fistulas (all radial artery-to-cephalic vein), 60% were upper arm fistulas (46% brachial artery-to-cephalic vein, 14% brachial artery-to-basilic vein). The mean time between the construction of the AV access and the initiation of dialysis was 259 days (median time 171 days, range from 17 to 2437 days).

Patients initiated dialysis with a catheter instead of an AV access for several reasons: almost half of the patients initiating dialysis with a catheter were patients without a regular follow-up (46%), as compared to patients initiating with an AV access, where almost all patients had a regular follow-up at the outpatient clinic. Most of these patients initiating

with a catheter had to start dialysis within 3 months after their first contact with a nephrologist.

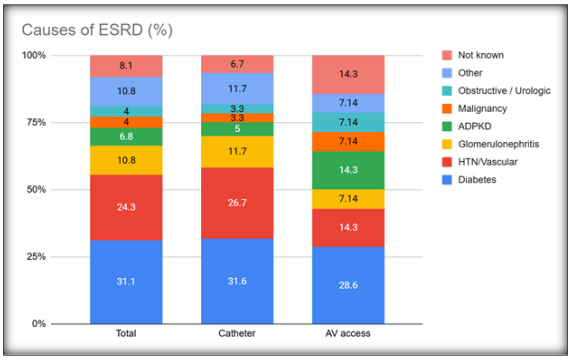

Figure 1: Comparison of causes of ESRD among patients

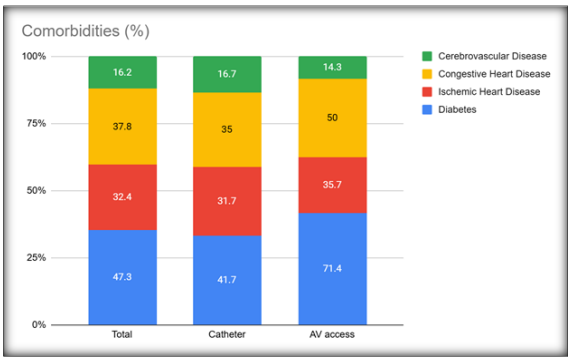

Figure 2: Comparison of distribution of comorbidities among patients

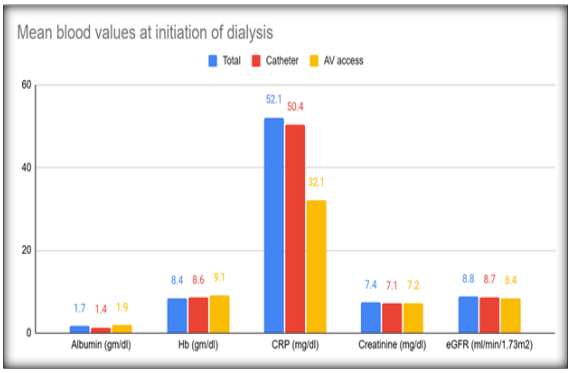

Figure 3: Mean blood values at the initiation of hemodialysis

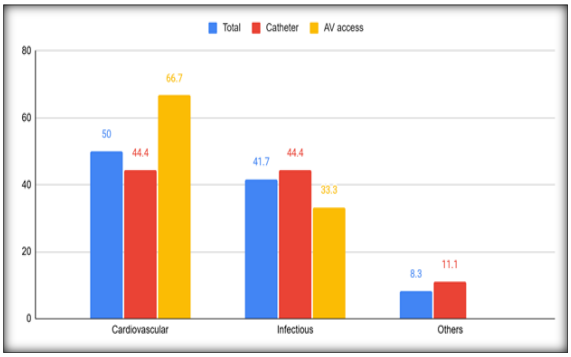

Figure 4: Causes of Death among patients with initiation of hemodialysis with catheter versus those with AV access

And thus, the most frequent causes of ESRD were diabetes 28%, hypertension/vascular (28%), glomerulonephritis 7%, Autosomal dominant polycystic kidney disease (ADPKD) (6%), malignancy (5%), and obstructive/urologic problems (4%).

Moreover, the most frequent causes of death were cardiovascular (50%), infectious (41.7%), and unknown in 8.3%.

DISCUSSION

The prognosis of hemodialysis has made a vast improvement over time. These progresses were mostly attributed to the introduction of erythropoietin, calcitriol, and new dialysis techniques. However, the life quality and overall survival of hemodialysis patients are still inferior to those of kidney transplantation.[10] Here, out of various risk factors that contribute to the mortality of hemodialysis patients, impact of vascular access was studied.

Currently, the international clinical practice guidelines recommend a "fistula first" approach based on the best long-term outcomes, lowest mortality, and lowest health care costs of AVF compared with AVG and CVC. Several observational studies with elderly patients also demonstrated superior survival rates in those using AVF compared with AVG and CVC.[11]

Recently, Lee et al,[12] suggested tradeoffs in vascular access selection in elderly patients initiating HD. They suggested that the use of AVF, compared with the use of AVG, is less likely to be successful after initiation, more likely to require interventions to make it functional, and associated with longer CVC dependence. In contrast, AVG requires fewer interventions to maintain patency after successful access creation. Hence, the optimal type of vascular access for elderly patients undergoing HD is still controversial, and several factors make selection of the best type of access difficult.

In elderly patients undergoing HD, the geriatric barriers to dialysis that make selection of vascular access type difficult should be taken into consideration. These include the impact of age, functional status, vessel suitability for access creation, maturation, complications, expected access survival, the competing risk of death for dialysis initiation, and the burden of comorbidity.[13]

Limitations of Study

This study has several limitations. First, due to the retrospective study design, a substantial number of patients with missing data of vascular access or comorbidity, were excluded from the analysis. Furthermore, selection bias cannot be excluded that clinician is likely to have selected particular vascular access type based on patient characteristics. For instance, clinicians tend to use AVF in patients with less comorbidities and with expectation to

survive long. In this respect, the results could be driven by those characteristics as opposed to solely by vascular access types. Thus, we made multiple adjustment models and classified subjects according to comorbidity burden to minimize this bias.

Moreover, impact of AV graft could not be assessed and also, peritoneal dialysis like other modalities were not included. Finally, the rate of mortality in our cohort could have been underestimated, because death reports are collected voluntarily, and the causes of death were extracted from patient records.

CONCLUSION

Until more data is made available, our aim will still be to promote as much as possible the use of an arteriovenous access in our patients, unless the patient has severe heart failure or a limited prognosis due to very old age or severe comorbidities.

With the current data, however, we feel more comfortable to continue our current policy to promote AV access in the majority of our patients.

REFERENCES

1. Kramer A, Pippias M, Noordzij M, et al. The European renal association - European Dialysis and transplant association (ERA-EDTA) registry annual report 2015: a summary. Clin Kidney J. 2018; 11:108-22.
2. Aslam S, Vaida F, Ritter M, Mehta RL. Systematic review and meta-analysis on management of hemodialysis catheter-related bacteremia. J Am Soc Nephrol. 2014; 25:2927-41.
3. Banerjee T, Kim SJ, Astor B, Shafi T, Coresh J, Powe NR. Vascular access type, inflammatory markers, and mortality in incident hemodialysis patients: the choices for healthy outcomes in caring for end-stage renal disease (CHOICE) study. Am J Kidney Dis. 2014; 64:954-61.
4. Lomonte C, Basile C, Mitra S, et al. Should a fistula first policy be revisited in elderly haemodialysis patients? Nephrol dial transplant 2018.
5. Xue JL, Dahl D, Ebben JP, Collins AJ. The association of initial hemodialysis access type with mortality outcomes in elderly Medicare ESRD patients. Am J Kidney Dis. 2003; 42:1013-1019.
6. Taylor GD, McKenzie M, Buchanan-Chell M, Caballo L, Chui L, Kowalewska-Grochowska K. Central venous catheters as a source of hemodialysis-related bacteremia. Infect Control Hosp Epidemiol. 1998; 19:643-646.
7. Oguzkurt L, Tercan F, Torun D, Yildirim T, Zumrutdal A, Kizilkilic O. Impact of short-term hemodialysis catheters on the central veins: a catheter venographic study. Eur J Radiol. 2004; 52:293-299.
8. Kairaitis LK, Gottlieb T. Outcome and complications of temporary haemodialysis catheters. Nephrol Dial Transplant. 1999; 14:1710-1714.
9. Dhingra RK, Young EW, Hulbert-Shearon TE, Leavey SF, Port FK. Type of vascular access and mortality in U.S. hemodialysis patients. Kidney Int. 2001; 60:1443-1451.
10. Tordoir, J. et al. EBPG on Vascular Access. Nephrology, dialysis, transplantation: Official publication of the European Dialysis and Transplant Association - European Renal Association.22(Suppl 2), 1188-117 (2007).
11. Clinical practice guidelines for vascular access. American journal of kidney diseases: the official journal of the National Kidney Foundation 48 Suppl 1, S248-273 (2006).
12. Lee, T., Qian, J., Thamer, M. & Allon, M. Tradeoffs in Vascular Access Selection in Elderly Patients Initiating Hemodialysis with a Catheter. American journal of kidney diseases: the official journal of the National Kidney Foundation 72, 509-518 (2018).
13. Viecelli, A. K. & Lok, C. E. Hemodialysis vascular access in the elderly-getting it right. Kidney international 95, 38-49 (2019)5