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Prevalence of Vascular Access in Hemodialysis Population in Senegal: A Multicenter Cross-Sectional Study

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Abstract

Introduction: A good vascular access is essential to provide chronic maintenance hemodialysis. The purpose of this study was to make an inventory of the vascular access in the prevalent hemodialysis patients of Senegal.

Material and methods: We report a cross-sectional multi-center study from June 1st to June 30th, 2018 conducted in all public and private hemodialysis units in Senegal. We included all patients with chronic Stage V kidney disease who had been on hemodialysis for at least 3 months.

Results: Four Hundred and Twelve (412) patients were included. The average age was 47.76 years (11-85 years). The first hemodialysis session was performed using a central venous catheter in 378 patients (91.75%). Two hundred and eighty-six patients (69.40%) had an Arteriovenous Fistula (AVF) as a current vascular access. Radiocephalic AVF was the most commonly used in 165 patients followed by brachiocephalic in 78 patients. Central Venous Catheter (CVC) was used in 126 patients (30.60%), 79 patients dialyzed with a tunneled catheter and 47 patients with a temporary CVC (26 jugular and 21 femoral catheters). Complications were found in 73 patients with AVF (21.3%) including 38 cases of thrombosis and 22 aneurysms. Only 3.97% of patients with CVC presented with an infectious complication.

Conclusion: A central venous catheter remains the initial vascular access for hemodialysis in Senegal due to late referral of End Stage Renal Disease (ESRD) patients. The challenges to initiate ESRD patients with an AVF include providing adequate education to all members of the Chronic Kidney Disease (CKD) team, early referral to nephrologists and surgeons.

Keywords: Vascular access; Hemodialysis; End Stage Renal Disease (ESRD); Chronic Kidney Disease (CKD)

Introduction

In patients with End-Stage Renal Disease (ESRD), hemodialysis treatment requires creation of a Vascular Access (VA). The vascular access type has an impact on the morbidity and mortality of the hemodialysis patient. A CVC remains the least preferred access due to its high incidence of infection and overall high cost of maintenance.

In 1960, described the first vascular access (Arteriovenous (AV) shunt), which was often complicated by infection and thrombosis [1]. In 1966, Brescia et al. [2] were the first to describe a surgically created an arteriovenous fistula by anastomosing the radial artery and cephalic vein.

The K-DOQI guidelines for hemodialysis recommend use of less than 20% of central vein catheters in the prevalent hemodialysis population [3]. However, this goal is not achieved in many centres and there is a great disparity between developed and developing countries. A first study conducted in Dakar, found that 89.2% of patients had a central venous catheter as a first VA for hemodialysis [4]. A second study in 2010, from Dakar, showed that 86.6% of patients had a temporary central catheter [5].

In recent years, the Senegalese government has allocated important resources to improve access to dialysis care by opening many hemodialysis units outside of the capital city. So

far, five cities had a new hemodialysis unit (Kaolack, Saint-Louis, Tambacounda, Touba and Ziguinchor) with a nephrologist with a significant increase in the dialysis population. Furthermore, surgeons from these areas were trained to create arteriovenous fistulas locally. However, having an ideal functional VA at the right time is still an issue for many patients on hemodialysis in Senegal.

This study aimed to describe the prevalence and types of VA in the prevalent chronic hemodialysis population in Senegal and to determine the prognostic associated factors.

Material and Methods

A cross-sectional multi-center study over a 1-month of period from June 1st to June 30th, 2018 was conducted in Senegal's public and private hemodialysis units. The centers were located in Dakar, Kaolack, Saint-Louis, Tambacounda, Touba and Ziguinchor. We included all ESRD patients regularly hemodialysis for at least 3-months. Only the types of vascular approaches and the complications that occurred during the one-month of period were taken into account. The data were collected using a survey form with 28 questions divided into five items:

- Socio-demographic data: Age, sex, marital status, type of care, professional activities, geographical origin
- Aetiology of ESRD
- Dialysis information: Dialysis duration, vascular access at first dialysis, current vascular access
- Types of VA: Transient or permanent vascular approach
- Complications of VA

The patient's medical and dialysis record were used to complete the information.

In absence of local ethical committee, we asked a free informed and written consent to all the participants before inclusion. Furthermore, collected data were processed and stored anonymously in respect with patients' confidentiality.

Data were analysed with Epi info version 7 software. In the descriptive part, the frequencies were calculated for qualitative variables and the averages for quantitative variables. In the analytical part, we used KHI2 test and Fisher test for the comparison of proportions according to their applicability conditions and Student's test for the comparison of averages. All tests were statistically significant when p-value was less than 0.05.

Results

We included 412 patients from different regions in the survey. The average age was 47.76 years (11-85 years). The most represented age group was between 50-60 years representing 27.91% of the study population **(Figure 1)**.

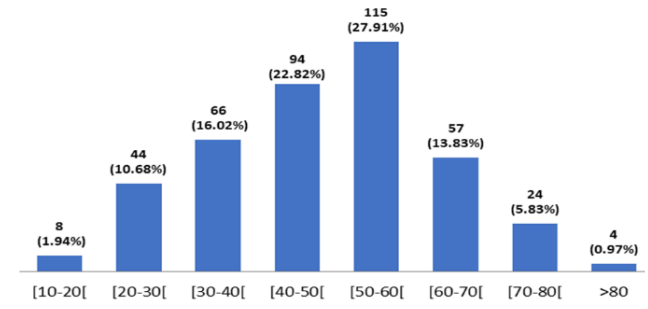

Figure 1: Patients' age distribution.

There were 207 women (50.2%) and 205 men (49.8%). The sex ratio was 0.99. Two common aetiologies for ESRD were nephrosclerosis and unknown cause, with 41.51% and 30.83% of patients respectively **(Figure 2)**.

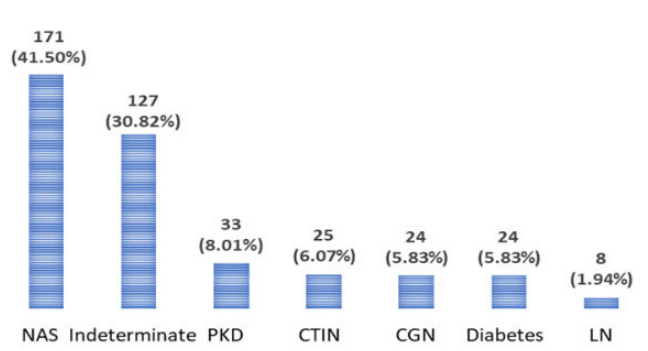

Figure 2: Aetiology of ERSD. Note: NAS: Nephroangiosclerosis; Indeterminate: Unknown aetiologies; PKD: Polycystic Kidney Disease; CTIN: Chronic Tubulointertitial Nephropathy; CGN: Chronic Glomerulonephritis; Diabetes: Diabetic nephropathy; LN: Lupus Nephropathy.

The average duration of hemodialysis patients was 36.95 months (3-204 months). The first hemodialysis session was performed with a central venous catheter in 378 patients (91.75%).

In the prevalent population, 286 patients (69.40%) had an Arteriovenous Fistula (AVF) as a permanent VA and 126 patients (30.60%) were dialysed *via* Central Venous Catheter (CVC) **(Figure 3)**.

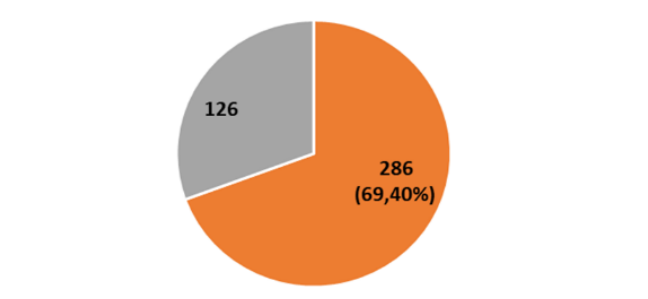

Figure 3: Type of vascular access in the prevalent hemodialysis patients. **Note:** (■): AVF; (■): Catheter.

In patients with a central venous catheter, 79/126 patients (62.7%) had a tunneled catheter, 26/126 patients (20.6%) had a temporary non-tunneled jugular catheter and 21/126 patients (16.7%) had a temporary non-tunneled femoral catheter **(Table 1)**.

Table 1: Vascular access type in the prevalent population.

Total prevalent population	**412**
AVF	286/412 (69.4%)
Central venous catheter	126/412 (30.6%)
Tunnelled	79/126 (62.7%)
Femoral non tunneled	21/126 (16.7%)
Internal jugular non tunneled	26/126

Native AVF were most common (99.3%) and only two patients had Areteriovenous Graft (AVG). The radio-cephalic AVF was the most frequently used in 165 patients (57.70%) followed by brachio-cephalic AVF in 78 patients (27.30%) and brachio-basilic AVF in 37 patients (12.90%) **(Figure 4)**.

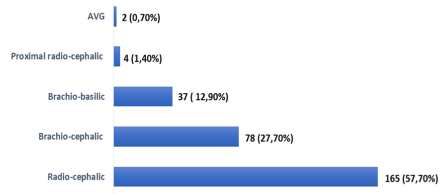

Figure 4: Distribution of patients by type of AVF.

The average duration of the use of central venous catheters was 7.66 months with a range of 1 month and 72 months. Average AVF survival was 30.54 months with range of 1 month and 207 months. Catheter infection was noted in 5 patients (3.97%) during the study period. All the infections were noted at the femoral site and the patients presented a fever, a suppuration of the insertion site and 3 haemocultures returned positive, isolating a *Staphylococcus aureus*.

AVF complications were found in 73 patients (21.3%). The most frequent AVF complication was thrombosis in 38 patients (52.1%) followed by aneurysm in 22 patients (30.1%), stenosis and infection were found in 7 (9.6%) and 4 (5.5%) patients respectively and finally hematoma in 2 (2.7%) patients **(Figure 5)**.

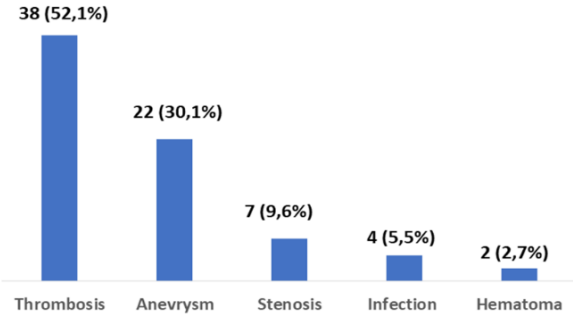

Figure 5: Distribution of patients by type of AVF complications.

There was no statistically significant association between the occurrence of complications and type of AVF (p=0.142) or duration of AVF (p=0.095).

However, there was a statistically significant relationship between duration of hemodialysis and the occurrence of complications.

Discussion

Vascular access related complications remain a major cause for morbidity and mortality in the hemodialysis population. With the rise in the availability of chronic maintenance hemodialysis in Senegal, the need to assess the quality of care has become a priority. Our study takes the first step to understand the epidemiology and assess the prevalence practice pattern across major regions in Senegal. The dialysis population in our study is young with 327 (79.36%) patients being less than 60-year-old with average age of 47.76 years and is comparable to previous smaller single center studies reported by Leye [6] in 2004, Rakmi [7] in 2009, Jebbari [8] in 2010, Okyere [9] in 2021 and Kane [10] in 2011 as 56 years, 51.3 years, 47.78 years, 46 years and 50.2 years, respectively.

Similar studies from West and Central African countries such as Algeria by Bensalem [11] in 2009 and Abidjan by Gnionsahe [12] in 2002 found an average age of 48 years and 42.6 years respectively.

The dialysis population in the developing countries is relatively younger compared to that observed in the developed countries. Some of the possible reasons for this difference could be high birth rate, overall younger population and lack of preventive care in the developing countries. In 2009, Robert reported the average age of the dialysis population in France as 70 years [13], where early detection of risk factors, diagnosis of treatable nephropathies and longer life-span delays the development of chronic kidney disease.

In our study, 69.4% of patients were dialyzed with AVF and 30.6% with a central venous catheter. Hamdan et al. in 2019 found similar results as in our study with an AVF rate of 69.3% [14]. In France, in 2013, 78% of patients were dialyzed with an AVF and 18% with tunnelled catheters [15].

In our study, amongst the patients being dialysed with a central venous catheter, the tunnelled catheter preferred compared to the non-tunnelled catheters (62.7% *vs.* 37.3%) The internal jugular catheter was the preferred site for a non-tunnelled catheter as compared to femoral (20.6% *vs*. 16.7% respectively). Our results reflect a change in practice pattern as compared to an early study reported by Kane [10] who found 72.3% of patients used a non-tunnelled femoral catheter. The increased use of tunnelled catheter and internal jugular site for CVC placement is a result of dialysis and vascular access focused education and training received by the nephrologists along with the efforts made by the healthcare facilities and government to procure catheters for a lower price.

Even though the majority of our patients-initiated therapy with a CVC, a permanent AVF was created in majority of our patients (28%-69%). The reasons for this practice are very similar to the challenges described in the developing countries, such as late referral to a nephrologist and poor follow up compliance. Moreover, AVF creation is centralized in a single vascular surgery service for the whole country resulting in long scheduling delays.

Thrombosis was the most common AVF complication followed by aneurysm with 52.1% (38 patients) and 30.1% (22 patients), respectively. Early AVF failure was seen in 23/38 (31.5%) patients with thrombosis, which is comparable to that reported by Kane [10] and Coulibaly [5]. The other AVF complications found in our study were 9.6% stenosis, 5.5% infection and 2.7% hematoma, respectively in 7 patients, 4 patients and 2 patients. For AVF, the only factor associated with the occurrence of AVF complications found in our study was hemodialysis vintage. However, the duration of AVF, etiology of ESRD, age, sex and site of AVF, type of AVF and place of dialysis were not correlated with the occurrence of complications and the hemodialysis vintage can explain frequent vessel trauma from multiple cannulation and possible development of aneurysmal dilatation. Further, the monitoring of AVF in the dialysis unit remains suboptimal.

Conclusion

The study helps understand the practice pattern in Senegal and identifies key limitations in providing quality care to our patients. Even though the challenges of late referral and poor monitoring of AVF are not unique to Senegal, there is enough room for improvement despite limitations in available resources. On a positive note, the ongoing focused education on the selection and management of a vascular access has resulted in the reduction in the use of non-tunneled CVC and awareness of transitioning to an AVF as soon as possible.

A suggested change in the practice pattern in Senegal, to improve the percentage of patients being dialyzed with an AVF are:

- Set up an evaluation and selection committee for patients eligible for an FAV confection according to the initial nephropathy and the stage of chronical renal failure.
- Set up a venous capital preservation strategy in all patients with kidney impairment avoiding venipuncture in the arm and forearm by using veins on the dorsum of the hand
- Prefer using tunneled over non-tunneled catheter whenever indicated and resources allow.
- Develop surgical skills in regional hospitals and decentralize AVF surgery

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