

ARTIGO ORIGINAL

# Vascular accesses for hemodialysis: current situation in the State of Ceará, Brazil

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## Abstract

**Introduction:** the ideal access for hemodialysis is represented by arteriovenous fistulas both as initial access and in use and are determinants of health care parameters for chronic renal patients.

**Objective:** to evaluate vascular access for hemodialysis.

**Methods:** this is a cross-sectional study, with a sample of 2513 individuals on hemodialysis in Ceará. Data were collected on age, sex, time of treatment, underlying disease, initial access and access in use. The data were divided into two groups, the interior of the state and the Metropolitan Region of Fortaleza, in the State of Ceará, and compared using the Student's Test ( $p < 0.05$ ).

**Results:** the most common age group was between 19 and 64 years (73%). Men prevailed in both regions, 713 (63%) in the countryside and 792 (57%) in the metropolitan area. The most common cause of Chronic Kidney Disease was Hypertension 306 (27%), followed by Disease of undetermined cause 295 (26%) in the countryside; in the metropolitan region, Diabetes Mellitus 356 (26%) was the main cause, followed by Hypertension and Disease of undetermined cause, each with 344 (25%),  $p = 0.001$ . In the countryside, 9% started treatment for fistula while in the metropolitan area 12%,  $p = 0.011$ . 79% of patients in the countryside used fistulas and 81% in the metropolitan area,  $p = 0.156$ .

**Conclusion:** arteriovenous fistulas are more frequent as initial accesses in the metropolitan region than in the interior, but there is an equivalence of fistulas in use in both regions. Catheter is the main initial access route. The evaluation of vascular accesses in Ceará showed that hemodialysis services are able to maintain good parameters of care for patients with chronic kidney disease.

**Keywords:** hemodialysis, double-lumen catheter, vascular access.

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## Authors summary

### Why was this study done?

To understand and characterize the attention to the chronic renal patient in the hemodialysis program in Ceará, especially when relating the early referral and the care with the initial vascular accesses and in use, it is necessary to analyze the vascular accesses.

### What did the researchers do and find?

Data was collected from hemodialysis clinics in Ceará by reviewing patients' medical records for their primary data (age, sex, underlying disease) and their vascular accesses (first access and the vascular access in use). We found that the percentage of initial accesses for hemodialysis is in disagreement with the objectives oriented by international normative institutions and that the number of accesses in use was in agreement with the same orientations. However, the results aligned with the world reality; where the patient does not have an early diagnosis of renal disease, nor an early referral to a hemodialysis service to have an arteriovenous fistula made, conditioning that the use of catheters as the first access is very prevalent to start the treatment. We compared two distinct regions, the metropolitan region of Fortaleza and the interior of Ceará. We observed that in the metropolitan region of Fortaleza there are more chances that the patients start dialysis treatment through fistulas compared to those from the interior; however, when the patient is inserted into the hemodialysis services when comparing the use of fistulas and catheters, this difference is no longer observed. This evidenced fact represents good attention and quality of the hemodialysis services in the state of Ceará.

### What do these findings mean?

The significance of the potential understanding of the first vascular access for hemodialysis, represents the level of primary and secondary care to the chronic renal patient, the understanding of the disease, the diagnosis, and early referral, the health dynamics for this specific public; as for the evaluation of the accesses in use, it represents the resolution capacity of the specialized services in hemodialysis in the state of Ceará. When comparing the two regions, we identify the divergences between two regions, we identify the need for the implementation of effective public policies, especially in the interior, for patient access to specialized services in Nephrology.

## INTRODUÇÃO

Chronic kidney disease (CKD) is an important global public health problem, a true epidemic that burdens society and the world economy<sup>1,2</sup>. The treatment of advanced CKD, referred to as end-stage chronic kidney disease (ESCKD) requires many financial resources both for both developed and developing countries<sup>3</sup>.

CKD consists of damage and progressive and irreversible loss of kidney function (glomerular, tubular and endocrine). The definition and classification of CKD has evolved over time, but current guidelines define this condition as impaired kidney function, demonstrated by a glomerular filtration rate less than 60 mL/min per 1.73m<sup>2</sup>, or markers of kidney damage, or both, of at least three months' duration, regardless of the underlying cause. In its most advanced stage, ESCKD, the kidneys are no longer able to maintain the normality of the patient's internal environment<sup>4</sup>.

The increase in the number of cases has been reported in the last decade in different sources<sup>5</sup>, and is related to the aging and demographic transition of the population, as a result of the improvement in life expectancy and the rapid process of urbanization. Diabetes (DM) and arterial hypertension are the main causes, while socioeconomic, racial and gender disparities are also determining factors<sup>6-8</sup>.

In developed countries, the prevalence is estimated between 10 and 13% in the adult population<sup>9</sup>. In developing countries, prevalence data are limited and heterogeneous<sup>9</sup>. In Brazil, estimates of the prevalence of this disease are uncertain, but it is estimated that 122,825 patients were undergoing dialysis in 2016<sup>10</sup>.

The incidence and prevalence of CKD also vary within countries by ethnicity and by social determinants of health, possibly due to epigenetic influence. Many people are asymptomatic or have nonspecific symptoms, such as lethargy, itching, or anorexia. Diagnosis is commonly made after fortuitous findings from screening tests (urine summary and blood tests) or when symptoms become severe<sup>11</sup>.

The treatment of patients with ESCKD, Renal Replacement Therapy (RRT), is based on hemodialysis (HD), peritoneal dialysis and kidney transplantation programs<sup>10,12,13</sup>.

HD is the most far-reaching therapy and aims to replace part of the kidney functions, removing toxic substances, excess water and mineral salts from the body, thus establishing a new situation of balance through the blood<sup>14</sup>.

The main indications for HD are: pericarditis, fluid overload or pulmonary edema refractory to diuretics, malignant hypertension unresponsive to antihypertensive drugs, progressive uremic encephalopathy or neuropathy with confusion, asterixis, myoclonus, seizures, bleeding diathesis attributable to uremia, refractory hyperkalemia, overt uremia and refractory metabolic acidosis<sup>15,16</sup>.

A vascular access is necessary to perform HD, which can be an arteriovenous fistula (AVF) or a two-lumen central vein catheter (CVC). Accesses can be temporary or permanent. Temporary access can range from several hours (single dialysis) to a few months (while waiting for AVF maturation). Temporary access is established by percutaneous insertion of a double-lumen CVC into a large vein (internal jugular, femoral, or less desirable, subclavian). The construction of a permanent vascular access allows repeated accesses for months to years<sup>17</sup>.

The ideal access allows a safe approach, provides adequate flow to perform HD and has a low complication rate<sup>18</sup>. Vascular access for HD in chronic patients should generally be AVFs and CVCs should be avoided<sup>17</sup>.

Problems regarding treatment planning for patients with renal failure may already occur in the pre-dialysis phase<sup>19,20</sup>. AVFs should be made at least six months before starting RRT, in stage IV of CKD in which the patient had a creatinine clearance below 30mL/min/1.73m<sup>2</sup>, as there may be failures, the need for a new manufacturing procedure, as well as the need for time for the AVF maturation to occur, (it usually occurs in a variable period from 4 to 12 weeks)<sup>21-24</sup>.

Maturation is a series of modifications that allow repeated punctures and the use of compressive dressings after removal of the collecting needle, without, however, obstructing the vein. After making the AVF, anastomosis between the vein and the artery, several phenomena take place, such as the enlargement of the artery and the increase in arterial blood flow. On the venous side, there is also dilation, arterIALIZATION, and an overall increase in blood flow through the AVF. Venous arterIALIZATION consists of venous parietal thickening caused by the proliferation of smooth muscle cells in the vascular wall, making the vein less susceptible to extrinsic compression<sup>25</sup>.

The CVCs to HD should be used in emergency situations for a short time or when an AVF is not available. CVCs are associated with venous thrombosis, infection or other complications, make it difficult to obtain new accesses and can, over time, influence the exhaustion of conventional venous accesses, making the acquisition of a new access a technically challenging procedure and increasing morbidity and mortality. Of the patient and, therefore, should be avoided<sup>26-29</sup>.

The choice of access is so important that it was one of the main causes of hospitalization among patients with chronic kidney disease in the United States, reaching 25% of all hospitalizations in the first year and 11% after the second year of hemodialysis treatment, generating a cost of more than one billion dollars a year<sup>13</sup>.

The most important nephrology institution in America, called NKF The National Kidney Foundation, through the KDOQI - Kidney Disease Outcomes Quality Initiative, guides that 50% of patients start HD for AVF30-33 and that HD services preserve 65% of patients performing HD by native FAVs<sup>34-37</sup>.

It is evident that an epidemiological study on vascular access for the reality in Ceará-Brazil is of fundamental importance for surgeons, nephrologists and nurses involved with chronic renal patients.

The objective of this study was to evaluate the quality of care for patients with chronic renal failure through hemodialysis accesses in the state of Ceará, addressing characteristics of the initial vascular access, which is a data of access to health services, and vascular access in use, which is data related to specialized medical care. The results obtained will make it possible to analyze the pre-dialysis care strategy and the quality control of Renal Replacement Therapy services through vascular access and, mainly, to know the reality of the region.

## METHODS

This is a cross-sectional study of primary data from patients in an HD program in the state of Ceará carried out

between January 2015 and January 2016.

The population consisted of all patients in an HD program in the state of Ceará. Data were collected from 2513 patients, approximately 55.1 and 2% of the estimated patients on HD in the state of Ceará and Brazil, respectively, in 2016. All patients or their guardians who signed the Free and Informed Consent Form were included.

The study took place in 18 HD clinics, nine in the countryside and nine in the Metropolitan Region of Fortaleza (RMF), capital of the state. Another eight clinics were excluded from the study for various reasons. The patients were separated into two distinct groups, those undergoing treatment in the interior and in the RMF.

The variables of age, sex, duration of treatment, underlying disease, initial vascular access and vascular access in use were analyzed. Data collection took place by obtaining the variables from the patients' medical records by medical students and by experienced physicians.

The total number of vascular accesses was evaluated according to their type and location.

Statistics were used to describe and summarize the data set. Absolute and relative values were used. The "t test" was used to compare the main data that are: age group, treatment time interval, underlying disease, frequency of initial and current accesses of patients in HD program. A confidence level of 95% and sampling error of 5% was considered.

The study was approved by the Ethics Committee of Faculdade de Medicina do ABC (Protocol nº 12262613.6.0000.0082).

## RESULTS

There were 2513 HD patients in the 18 clinics. Nine clinics were located in the countryside and nine in the RMF, 1128 patients located in the countryside and 1385 in the RMF. According to data from the Brazilian Society of Nephrology (SBN).

In all clinics, the most common age group was between 19 and 64 years old, productive age group - more than 73% of the sample.

The elderly public represented respectively 29% in the countryside and 24% in the RMF, 26% of the entire sample. There was a predominance of elderly people in the countryside.

And according to the distribution of patients in terms of age (table 1), the sample had a differentiated distribution, so much so that there was a significant difference in the samples between the groups studied (p=0.0017).

**Table 1:** Characteristics of the age group of patients on hemodialysis in the State of Ceará, Brazil, 2018.

| Age     | Interior  | RMF       | General Total | P*     |
|---------|-----------|-----------|---------------|--------|
|         | n=1128(%) | n=1385(%) | n=2513(%)     |        |
| ≤18     | 9(1)      | 19(1)     | 28(1)         | 0,0017 |
| 19 a 64 | 801(71)   | 1042(75)  | 1843(73)      |        |
| 65 a 80 | 255(23)   | 271(20)   | 526(21)       |        |
| ≥ 81    | 63(6)     | 53(4)     | 116(5)        |        |

Note: (%) - percentage, P value - significance index (<0.05) \* Student's t test

More male patients, 60% of the sample, were undergoing dialysis treatment, a fact evidenced in the different areas (table 2). There was a prevalence of men in the countryside, six percent more than in the RMF.

Most patients had less than three years on HD; 364 (32%) patients in the countryside and 441 (32%) patients in the RMF, a total of 805 (32%). All age groups were very homogeneous, with a similar distribution when compared to each other (table 3) ( $p=0.6275$ ).

It was found that, in the countryside, the cause that most led the patient to HD was hypertension, 306 (27%), followed by Disease of undetermined cause 295 (26%). In the RMF, DM was the most common cause with 356 (26%), followed by Hypertension and Disease of undetermined cause, each with 344 (25%), equally (table 4). Data showed differences in causes between interior and RMF and were significant differences ( $p>0.001$ ).

**Table 2:** Distribution by sex of hemodialysis patients in the State of Ceará, Brazil, 2018

| Sex    | Backlands | RMF       | General total |
|--------|-----------|-----------|---------------|
|        | n=1128(%) | n=1385(%) | n=2513(%)     |
| Male   | 713(63)   | 792(57)   | 1505(60)      |
| Female | 415(37)   | 593(43)   | 1008(40)      |

Note: (%) – percentage.

**Table 3:** Distribution regarding the treatment time of patients on hemodialysis in the State of Ceará, Brazil, 2018

| Treatment time (years) | Backlands | RMF       | General Total | p*     |
|------------------------|-----------|-----------|---------------|--------|
|                        | n=1128(%) | n=1385(%) | n=2513(%)     |        |
| <1                     | 206(18)   | 265(19)   | 471(18,7)     | 0,6275 |
| ≥1 e <3                | 364(32)   | 441(32)   | 805(32)       |        |
| ≥3 e <5                | 228(20)   | 251(18)   | 479(19)       |        |
| ≥5 a <10               | 219(19)   | 262(19)   | 481(19,1)     |        |
| ≥10                    | 111(10)   | 166(12)   | 277(11)       |        |

Note: (%) - percentage, P value - significance index (<0.05) \* Student's t test.

**Table 4:** Distribution regarding the underlying disease of patients on hemodialysis in the State of Ceará, Brazil, 2018

| Disease                   | Backlands | RMF       | General Total | P*      |
|---------------------------|-----------|-----------|---------------|---------|
|                           | n=1128(%) | n=1385(%) | n=2513(%)     |         |
| DM                        | 205(18)   | 356(26)   | 561(22)       | P<0,001 |
| Hypertension              | 306(27)   | 344(25)   | 650(26)       |         |
| Undetermined              | 295(26)   | 344(25)   | 639(25)       |         |
| Polycystic Kidney Disease | 42(4)     | 55(4)     | 97(4)         |         |
| Chronic Glomerulopathy    | 126(11)   | 127(9)    | 253(10)       |         |
| Other causes              | 77(7)     | 68(5)     | 145(6)        |         |
| Post-renal                | 77(7)     | 91(7)     | 168(7)        |         |

Note: (%) - percentage, P value - significance index (<0.05) \* Student's t test.

Nine percent of the patients in the countryside started dialysis treatment by AVF and approximately 12% by RMF. Low rates of AVFs are evidenced as the initial access in both regions (table 5), but it was also observed that it is more common for the FMR patient to initiate HD through AVF ( $p=0.011$ ).

Eighty percent of patients were being treated for AVF; 79% in the countryside and 81% in the RMF (table 6). The small difference was not representative ( $p=0.156$ ).

Distal AVFs represented 530 (59.6%) of accesses in the interior against 644 (57.3%) in the RMF. The AVFs with interposition of synthetic material (PTFE-Polytetrafluoroethylene) represented 10 (1.1%) in the interior and 12 (1%) in the RMF (table 7).

There was a predominance of the right jugular vein both in the interior and in the RMF when commenting on CVC accesses and it was greater than 50% in the interior and represented one third of the patients in the RMF. The number of short-term CVCs was more than three times higher than the long-term ones. A greater number of CVCs in subclavian veins was identified in the RMF in Ceará. The number of long-term CVCs was higher in the RMF and represented 27.2%, while in the countryside, 19.4% (table 8).

**Table 5:** Distribution regarding the initial access of hemodialysis patients in the State of Ceará, Brazil, 2018

| Initial access type   | Backlands | RMF       | Total geral | p*    |
|-----------------------|-----------|-----------|-------------|-------|
|                       | n=1128(%) | n=1385(%) | n=2513(%)   |       |
| Catheter              | 1028(91)  | 1219(88)  | 2247(89)    | 0,011 |
| Arteriovenous fistula | 100(9)    | 166(12)   | 266(11)     |       |

Note: (%) - percentage, P value - significance index (<0.05) \* Student's t test.

**Table 6:** Distribution regarding current access of hemodialysis patients in the State of Ceará, Brazil, 2018

| Current access        | Backlands | RMF       | Total geral | p*    |
|-----------------------|-----------|-----------|-------------|-------|
|                       | n=1128(%) | n=1385(%) | n=2513(%)   |       |
| Catheter              | 238(21)   | 261(19)   | 499(20)     | 0,156 |
| Arteriovenous fistula | 890(79)   | 1124(81)  | 2014(80)    |       |

Note: (%) - percentage, P value - significance index (<0.05) \* Student's t test.

**Table 7:** Distribution of arteriovenous fistulas of patients on hemodialysis in the State of Ceará, Brazil, 2018

| FAV location      | Backlands | RMF        | Total     |
|-------------------|-----------|------------|-----------|
|                   | n=890(%)  | n=1124 (%) | n=2014(%) |
| Radiocephalic     |           |            |           |
| Right             | 135(15,2) | 169(15)    | 304(15)   |
| Left              | 395(44,4) | 475(42,3)  | 870(43)   |
| Brachiocephalic   |           |            |           |
| Right             | 81(9,1)   | 137(12,2)  | 218(11)   |
| Left              | 193(21,7) | 262(23,3)  | 455(22,6) |
| Brachio basílica  |           |            |           |
| Right             | 22(2,5)   | 37(3,3)    | 59(3)     |
| Left              | 54(6,1)   | 32(2,8)    | 86(4,3)   |
| Axillary brachial |           |            |           |
| Right PTFE        | 4(0,4)    | 6(0,5)     | 10(0,5)   |
| Left PTFE         | 6(0,7)    | 6(0,5)     | 12(0,6)   |

Note: (%) – percentage.

**Table 8:** Distribution of catheters of patients on hemodialysis in the State of Ceará, Brazil, 2018

| Implant site and catheter type (n=499) | Backlands n=238(%) | RMF n=261(%) | Total n=499(%) |
|--|--------------------|--------------|----------------|
| short-term catheter                    |                    |              |                |
| right femoral                          | 39(16,4)           | 43(16,5)     | 82(16,4)       |
| left femoral                           | 17(7,1)            | 32(12,3)     | 49(9,8)        |
| right jugular                          | 106(44,5)          | 68(26,1)     | 174(34,9)      |
| left jugular                           | 25(10,5)           | 27(10,3)     | 52(10,4)       |
| right subclavian                       | 5(2,1)             | 15(5,7)      | 20(4)          |
| left subclavian                        | 0(0)               | 5(1,9)       | 5(1)           |
| long-term catheter                     |                    |              |                |
| right femoral                          | 9(3,8)             | 14(5,4)      | 23(4,6)        |
| left femoral                           | 3(1,3)             | 14(5,4)      | 17(3,4)        |
| right jugular                          | 22(9,2)            | 19(7,3)      | 41(8,2)        |
| left jugular                           | 2(0,8)             | 10(3,8)      | 12(2,4)        |
| right subclavian                       | 5(2,1)             | 5(1,9)       | 10(2)          |
| left subclavian                        | 5(2,2)             | 9(3,4)       | 14(2,8)        |

Note: (%) – percentage.

## DISCUSSION

Assessing the quality of care for patients with CKD through vascular access and clinical data of patients on a chronic hemodialysis program in Ceará allows us to know the population undergoing this treatment and infer about some aspects of the reality of pre-dialysis care and assistance specialist doctor offered.

Of the patients who made up the study population, 1843 (73%) were adults (between 18 and 64 years old) and 642 (26%) were elderly (65 years of age or older). An epidemiological census carried out in Brazilian hemodialysis clinics by Sesso in 2016 showed that 65.7% were adults and 33% were elderly<sup>10</sup>. In this scenario, there were no differences in age when compared to the national scenario exposed by Sesso in which the most patients were formed by young people.

It was identified that there were differences regarding the age group between the interior and the metropolitan region. There was a significantly higher percentage of elderly people in the countryside than in the metropolitan region ( $p=0.0017$ ). This fact drew attention in the sense that the elderly in the metropolitan region were less ill than those in the countryside, that is, they were better cared for because they lived in an area with likely more accessibility to health services than in the countryside.

The predominance of males in the population studied corroborates the results of other studies of patients with end-stage renal disease undergoing hemodialysis when comparing males and females<sup>10,38-40</sup>.

For Burelli *et al.*<sup>41</sup>, people residing in urban areas seek health services more to perform routine and preventive examinations, while in rural areas the main motivation for seeking care is diseases and in emergency regimes.

Burelli's study<sup>41</sup> and the male predominance in dialysis patients may explain the higher percentage of male patients undergoing treatment in the countryside (63%) than in the RMF (57%) ( $p=0.002$ ) and the national average (57%).

Comparative studies between genders show that men are more vulnerable to diseases, especially serious and chronic illnesses, and that they die earlier than women. In addition, authors point out that, unlike women, men do not seek primary care services and enter the health system at more complex levels of care<sup>41</sup>.

It is important to consider that, for every three deaths of adults, two are men. They generally live, on average, seven years shorter than women and have more heart disease, cancer, diabetes, higher cholesterol and blood pressure, all risk factors for chronic kidney disease. In this sense, it is essential that health professionals are aware of the general and specific problems that may affect this population and their care demands<sup>42-44</sup>.

The distribution regarding treatment time was uniform between the two regions in Ceará ( $p=0.627$ ), the data was measured because with the extension of life expectancy given to these patients by the dialysis treatment itself, the depletion of the venous system of the upper limb could lead to the need to create exceptional vascular accesses and could influence the research results<sup>45</sup>.

In the context of the search and understanding of the main underlying causes of CKD, which is seen as part of the increase in the global burden of non-communicable diseases and their complications, hypertension (26%) is among the non-communicable diseases and is the most common and affected cause. 27% of interior residents. A similar situation is the understanding that diabetes mellitus was the main cause of renal failure in the metropolitan region of Ceará, also with 26%<sup>46,47</sup>.

Marinho *et al.*<sup>48</sup>, in a systematic review study, observed an advanced industrialization in regions with a higher prevalence of chronic kidney disease, accompanied by an increase in the prevalence of diabetes, hypertension as an underlying disease, a result similar to that observed in Ceará and Brazil by Sesso (2016)<sup>10</sup>.

Disease of undetermined origin (25%) was the second cause of renal failure in Ceará. There was a high prevalence of cases both in the interior (26%) and in the metropolitan region (25%). Oliveira *et al.* (2011) suggested that most patients do not have access to nephrological monitoring during the early stages of CKD and the absence of renal biopsies may better define cases of diagnosis of undetermined disease<sup>39,49</sup>.

Rosa-Diez *et al.*<sup>49</sup> attribute the lack of early diagnosis to little exploration of kidney disease data in Latin American countries.

Still taking the parameters of Sesso (2016)<sup>10</sup>, SAH affects 34% of patients with CKD undergoing dialysis and is the main cause of CKD in Brazil, followed by DM (30%) and of undetermined origin (11%)<sup>10</sup>. In Ceará, a lower prevalence of SAH (26%) and DM (22%) was found as a cause of ESRD ( $p<0.001$ ).

The NKF/KDOQI recommends that 50% of patients start hemodialysis through fistulas<sup>30-33</sup>. In the data collected in Ceará, only 12% of the patients started hemodialysis due to fistulas, 10% in the countryside and 13% in the metropolitan region ( $p=0.011$ ), far below the desirable.

Despite the two regions maintaining a low rate, it was still shown that patients in the metropolitan region obtained better attention to pre-dialysis care than those in the countryside.

According to data from the United States Renal Data System, 80.3% of patients were using a catheter as the initial access for RRT in 2014, which has changed little since 2005. In 2015, it was reported that 22% of patients started dialysis in America without any specific nephrological follow-up and pre-dialysis care, reason for starting treatment through catheters<sup>3</sup>.

Despite the KDOQI recommendations, the United States also failed to achieve optimal fistula rates<sup>3</sup>.

The work of the Fistula First Catheter Last (FFCL) Workgroup Coalition is focused on supporting the community of renal patients and has a current goal that 68% of patients start treatment with fistulas, with at least half in use and the other half awaiting maturation<sup>50</sup>; goals very different from the reality of Ceará and there is no accurate and current data on the Brazilian reality.

Sesso *et al.* (2008)<sup>10</sup> found that 34% of patients who started hemodialysis used fistulas. The other 66% were referred to the nephrologist to immediately start

hemodialysis through a catheter<sup>51</sup>. The findings in Ceará were lower than the national ones for 2008 and there are not such comprehensive data for comparison.

Silva *et al.*<sup>51</sup>, in Minas Gerais (2011), showed that 31% had a fistula as an initial access, data even higher than in Ceará. He also identified that in his sample, if these patients were not diagnosed one year before starting hemodialysis, they would be 3.4 times more likely to start therapy with a temporary catheter.

Not having health insurance increased this probability of starting catheter therapy by almost 1.56 times, and patients living in the northeast were 2.9 times more likely to start hemodialysis through a catheter<sup>51</sup>.

Silva *et al.*<sup>51</sup> concluded that patients with health plans have more access to start treatment with active fistula due to early referral to the nephrologist and vascular surgeon, and were assisted in 80% of the cases. Patients from the Unified Health System (SUS) sought emergency medical services and started catheter dialysis in dialysis emergency<sup>52,53</sup>.

The conclusion of the study by Silva *et al.*<sup>51</sup> may be suggested for the population of Ceará due to the high number of admissions to a dialysis program through catheters, that is, the need for immediate vascular access associated with the late diagnosis of end-stage renal disease<sup>54,55</sup>.

The United Kingdom Renal Registry reports 38.4% admissions through fistulas<sup>56</sup>; in Australia and New Zealand, 40% and 25%, respectively. Health authorities in Australia and New Zealand consider the results to be inadequate and are aware of the need to improve<sup>57</sup>. Data still far superior to those of Ceará, whether in the countryside or in the metropolitan region.

Al-Jaishi *et al.*<sup>58</sup>, Canada, refer to late referral, health system barriers, long waiting times for appointments in surgical centers as the main causes of initial access to dialysis through catheters.

The NKF-DOQI also recommends that 65% of patients on a regular hemodialysis program undergo treatment through fistulas<sup>59</sup>. Ceará exceeded the recommendation and 80% of patients are on a dialysis program through fistulas with no differences between the two areas studied ( $p=0.156$ ).

In this context, it is assumed that most patients start treatment inappropriately through catheters and are led to the creation of a fistula after admission to a service with specialized professionals. Thus, the dialysis services in Ceará are able to maintain a rate above the advisable.

There is a differentiated attention and a concern of the dialysis centers, different from when the patient is unattended by the specialized teams.

Linard *et al.*<sup>13</sup>, in a study involving 2559 patients and 23 hemodialysis clinics in Brazil, observed that 93.4% used fistulas. The use of catheters ranged from 0% to 21.7% between clinics. Among the states, it varied from 1.0% in Rio Grande do Sul to 11.3% in Bahia. Among geographic regions, from 3.0% in the South region to 11.1% in the Northeast region.

Sesso *et al.*<sup>10</sup> found that catheters were the access for 20.5% of hemodialysis patients through a dialysis census of the Brazilian Society of Nephrology.

Finally, the results since 2003 were not different from those found in Ceará when compared to the national scenario, but they were different for the southern regions of the country, mainly Rio Grande do Sul.

The variations found can perhaps be explained by the fact that there are structural differences between the units and the profile of patients treated in some clinics, especially hospitals, being patients with acute renal failure, which increases the use of catheters for hemodialysis, as these patients arrive at the unit in dialysis urgency and without a definitive access route<sup>13</sup>.

Data from 2014 from the United States Renal Data System still had a prevalence of 63.4% of patients with fistulas in use<sup>3</sup>. It is assumed that there is still better acceptance of fistulas by Brazilians than by Americans, which is the reason for the better rates and that the catheter would be of use almost restricted to waiting periods for a definitive vascular access<sup>13</sup>.

The DOPPS V-The Dialysis Outcomes and Practice Patterns Study, conducted by America and participating countries, found that the frequency of fistulas ranged from 49% in Canada to 92% in Russia<sup>60</sup>.

In some countries, the data are conflicting. In India, there was a decrease in patients with fistulas from 92 to 56% between 2003 and 2013, unlike other countries such as Spain and the United States<sup>61</sup>.

In addition to Russia, a high percentage of fistulas was established in Japan (91%), China (87%), Turkey (83%), Australia and New Zealand (82%), while in most European countries this percentage is less than 80%<sup>60</sup>.

A report from the ERA-EDTA Registry - European Renal Association - European Dialysis and Transplant Association, pointed out that the percentage of prevalent fistulas decreased from 66 to 62% and the use of catheters increased from 28 to 32%<sup>62</sup>. In a study in Serbia, the percentage of fistulas in use is 89 to 93%<sup>60</sup>. The only data similar to Serbia are data from Macedonia, with 89% of patients prevalent with AVF<sup>63</sup>.

In this context, the rate of fistulas in use in Ceará is higher than that guided by the NKF/DOQI, lower than those found in European and Asian countries. If we make a comparison between economically similar countries, such as India, the state of Ceará-Brazil exceeds the rates of fistulas in use found by Hashidi *et al.*<sup>61</sup> in this country.

In addition to the number of vascular accesses being in accordance with international guidelines and there being no differences between the accesses in use between interior and RMF, it is also reported that the location with the highest prevalence was radiocephalic, above 43% in both regions.

There is no way to define the patency rate of a primary fistula due to the lack and discontinuity of data in Ceará, but the United States Renal Data System's guidance is to make fistulas, preferably the most distal and in the upper extremities whenever possible<sup>3</sup>.

Also in Ceará, the preference was given to making fistulas in the following sequence whenever possible: primary radiocephalic fistula, primary brachiocephalic elbow, superficialized brachial basilica in the arm, and as a last option, fistulas with graft, inside than expected in the international literature<sup>64</sup>.

As for the puncture site, there was consistency with the international literature. The preferred insertion site for catheters was the right internal jugular vein, and it was most significantly identified in the interior. Subclavian access was avoided.

The subclavian vein catheter is more associated with central venous stenosis<sup>65-67</sup>. Significant subclavian vein stenosis usually precludes use of the entire ipsilateral arm for vascular access and may cause vascular insufficiency. Thus, implantation of catheters in this vein should be avoided, even as temporary accesses<sup>64</sup>.

## CONCLUSION

In the final model, there is a deficiency in pre-dialysis care that results in the failure to establish an arteriovenous vascular access for patients with terminal chronic disease in Ceará, whether in the countryside or in the metropolitan region.

Hemodialysis services in Ceará are able to implement an adequate vascular access program after the patient is under specific care.

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## Resumo

**Introdução:** o acesso ideal para hemodiálise é representado por fístulas arteriovenosas tanto como acesso inicial quanto em uso e são determinantes de parâmetros de atenção à saúde do paciente renal crônico.

**Objetivo:** avaliar os acessos vasculares para hemodiálise.

**Método:** trata-se de estudo transversal, com amostra de 2513 indivíduos em hemodiálise no Ceará. Foram coletados os dados da idade, sexo, tempo de tratamento, doença de base, acesso inicial e acesso em uso. Os dados foram divididos em dois grupos, interior do estado e Região Metropolitana de Fortaleza, no Estado do Ceará e comparados através do Teste de Student ( $p < 0,05$ ).

**Resultados:** a faixa etária mais comum era entre 19 a 64 anos (73%). Os homens prevaleciam nas duas regiões, 713(63%) no interior e 792(57%) na zona metropolitana. A causa mais comum de Doença Renal Crônica era por Hipertensão 306(27%), seguida de Doença de causa indeterminada 295(26%) no interior; já na região metropolitana, Diabetes Mellitus 356(26%) era a principal causa, seguida por Hipertensão e Doença de causa indeterminada, cada uma com 344(25%),  $p=0,001$ . No interior, 9% iniciaram o tratamento por fístula enquanto na área metropolitana 12%,  $p=0,011$ . 79% dos pacientes do interior usavam fístulas e 81% na área metropolitana,  $p=0,156$ .

**Conclusão:** as fístulas arteriovenosas são mais frequentes como acessos iniciais na região metropolitana do que no interior mas há uma equivalência de fístulas em uso nas duas regiões. Cateter é a principal via de acesso inicial. A avaliação dos acessos vasculares no Ceará demonstrou que os serviços de hemodiálise conseguem manter bons parâmetros de atenção ao portador de doença renal crônica.

**Palavras-chave:** hemodiálise, cateter duplo-lúmen, acesso vascular.

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