
Quantitative research on kidney transplants over 10 years in Brazil

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Abstract

Chronic Kidney Failure is a chronic-degenerative disease that causes irreversible renal pathological changes, paralyzing the vital functions of the kidneys. This study aims to carry out a survey of the absolute number of kidney transplants in Brazil in the period from 2010 to 2020. This work is a bibliographic research of an explanatory nature and quantitative approach, where it is intended to quantify the absolute number of Chronic Kidney Patients in a period 10 years, who underwent kidney transplantation in Brazil. In this study it is possible to identify the continuous growth in the absolute number of transplants in Brazil, but although there has been an increase in the number of transplants, it still does not meet the expected growth so that it can better meet the needs of the Brazilian population, since today the kidney disease and underlying diseases, such as diabetes and systemic arterial hypertension, have been increasing the number of cases of the disease, and the public service must equally meet these needs, especially regarding financial investments and guidance from the multidisciplinary team, always focusing on primary care of health.

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Keywords: Renal Insufficiency Chronic. Kidney transplantation. Renal dialysis. Statistical analysis.

INTRODUCTION

As of 2002, the World Health Organization (WHO) recommends the implementation of surveillance for chronic non-communicable diseases, focusing on the most common risk factors for these diseases [1]. Thus, it is evident the importance of an active search for quality and training of health professionals to carry it out.

Acute Renal Insufficiency (ARI) is the sudden loss of the ability of your kidneys to filter waste, salts, and liquids from the blood, promoting hydroelectrolytic imbalance in the blood. However, it can be reversible. Everything depends on the clinical evolution of the patient and his ability to support Renal Replacement Therapy (RRT) [2].

Chronic Kidney Disease (CKD) is described as a lesion characterized by structural or functional changes in the kidneys, which may or may not reduce the glomerular filtration rate and may be manifested by pathological changes or signs of kidney damage in diagnostic tests, such as analysis of protein, urea, creatinine, in addition to the use of imaging tests such as ultrasound, X-ray and tomography [3].

In first world countries like the USA, the prevalence of patients with end-stage CKD increased from approximately 400.000 in 2000 to 636.905 in 2012, that is, it grew by around 59%, with an annual cost of around 6% of the Medicare. In Brazil, between 2010 and 2014, the estimated prevalence rate of patients on dialysis was 552 patients per million inhabitants. In 2014, 112.004 patients were on dialysis with a gross annual mortality rate of 19%. Of the prevalent patients, 91% were on haemodialysis and 9% on peritoneal dialysis, 32.499 (29%) were on the waiting list for transplantation, however, only 5.600 patients underwent kidney transplantation that year [2].

In studies carried out in Brazil with the objective of comparing the medical costs of kidney transplantation with other renal replacement therapies in the context of the Unified Health System (UHS), it was demonstrated that kidney transplantation generated savings per patient, of R\$37 thousand and R\$74 thousand in relation

to haemodialysis and peritoneal dialysis when the donor is deceased and R\$46 thousand and R\$82 thousand when the transplant comes from a living donor, respectively [2]. What is known is that such parameters show that transplantation is the most economical path among the renal therapies already portrayed in this study and with the best prognosis for the patient [4]. Therefore, kidney transplantation should be prioritized by the tertiary care health team as soon as the patient starts RRT.

The theme of choice will be studied due to the professional experience in the haemodialysis sector and the several times that I dialysed patients who had already received the kidney graft or who were anxious waiting for it, which made me realize the importance of studying in this area, being able to contribute to a better understanding of the multiprofessional team by collecting quantitative data on the number of patients in Brazil who received a kidney transplant, which means for the vast majority of patients survival, consequently improving their quality of life and the possibility of a certain freedom of the machine. Understanding the topic would make it possible to provide better quality and targeted care for such CKD patients, in addition to understanding the improvement of the Brazilian health system when it comes to kidney transplantation.

This study aims to analyse the number of patients who underwent kidney transplantation in the period 2010 to 2020 in Brazil, considering the importance and meanings of a study aimed at analysing the evolution or worsening in the number of kidney transplants being used as a parameter in the which concerns educational measures and investments in nephrology aiming at a constant increase in the absolute number of kidney transplants in Brazil.

MATERIAL AND METHODS

This study will be carried out by means of a bibliographic research of an explanatory nature and a quantitative approach, where it is intended to quantify the number of patients with Chronic Kidney Disease in a period of 10 years, who underwent Kidney Transplantation in Brazil.

There was a need to use this method, as this way, it is possible to count, order and measure to establish the frequency and distribution of a phenomenon to search for possible patterns and still test

hypotheses, using instruments for scientific proof. data and results obtained [5].

The work developed followed the precepts of the exploratory study, through a bibliographic research, which is developed through material already prepared, consisting of books and scientific articles [6]. The search started in January 2019, where articles not available for free, incomplete studies and monographs were excluded.

After selecting the articles, the titles and abstracts of the publications were previously read, and the inclusion and exclusion criteria of the studies were applied. The articles were organized in chronological order and translated to be submitted for data analysis.

This computer program enables different types of analysis of textual data, from quite simple ones, such as basic lexicography to multivariate analysis. It organizes the distribution of vocabulary in an easily understandable and visually clear way [7].

Through this program, word classes were formulated, which, from the repetition of the most frequent words in the analysed articles, formed the topics of this work [7].

All quantitative data regarding the number of transplants were extracted from the Brazilian Organ Transplant Association [8].

The main limitation of the growth in the number of transplants is the identification of potential donors and their prompt communication to the state transplant centres. In this sense, GM Ordinance 1.752, of September 23, 2005, established that all hospitals with more than 80 beds must have an Intra-Hospital Commission for Donating Organs and Tissues for Transplants (IHCDOTT), but less than 10% of Brazilian hospitals that fall into this category have active teams. These teams are crucial to awaken and establish the culture of organ donation within the hospital community, and to assist neurologists, neurosurgeons, and intensivists in the donation process.

RESULTS

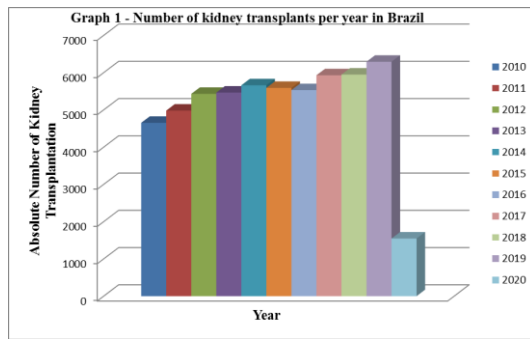
Starting the study, as shown in Table 1, the absolute numbers of kidney transplants in the period from 2010 to 2020 were obtained, using the Brazilian Organ Transplant Association as a source.

Table 1. Number of kidney transplants in Brazil

Base Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Absolute number of kidney transplantation in Brazil	4654	4982	5431	5465	5661	5591	5531	5930	5949	6293	1548

Source: [8]

In Figure 1, it is possible to observe the absolute number of kidney transplants in relation to the period portrayed, thus observing a significant growth in transplant rates in the country, having only one drop in the year 2020.



Source: [8].

In 2010, 4.664 kidney transplants were performed (close to the goal of 4.800), an increase of 8% in relation to 2009, among the goals imposed by ABTO was in 2011 with the objective of surpassing the absolute number of 5200 kidney transplants, but it was not achieved, as we can see in Table 1, but even with the result below expectations, kidney transplantation continued to grow annually in Brazil, as also seen in Graph 1.

Now, in 2011, after a careful analysis of data, ABTO together with the Ministry of Health, identified the need to correct problems related to the number of organ transplants when considered together with the states of the Federation due to geographical disparities.

Also, according to ABTO, the geographic discrepancy can be contextualized in relation to kidney transplantation, with three states having more than 40 transplants per million inhabitants, while eight states have less than ten.

In 2012, ABTO and the Ministry of Health stated that Brazil, in the international context, presented an absolute number of kidney transplants - 5431, where the country, at the present time, was in 20th position in the number of kidney transplants in the world. However, there was still a disparity between the five geographic regions of the country. The greatest number of transplants is concentrated in the south and southeast regions, which concentrate more than half of the Brazilian population, where the programs have been established for a longer time, and which are working in harmony with the other regions to correct this disparity, following the development of the parents.

In 2019, Brazil became the second country in the world in terms of number of transplants, and to consolidate this achievement, the role of the Ministry of Health, state governments, entities and health professionals in the entire donation and transplants. Analysing the data in Graph 1, it is possible to identify the growing number of kidney transplants performed in the years 2010 to 2019 in Brazil, with a drop in 2020. It is understood that this progression is related to campaigns to encourage donation of organs, which are increasingly linked in the media, the ease of information and the qualification of professionals to encourage organ donation.

Still on the results achieved, it can be said that the growth in donation, in the use of grafts, in the number of transplants and in the commitment to be accountable to society as a whole, makes it clear that the path to be followed for the use of 100 % of deceased donor agencies is still large and investments in teams and media and communication are infinitely greater, but possible to achieve when facing the efforts of professionals and public agencies to achieve these goals.

Regarding the fall in kidney transplant surgery for the year 2020, with elective surgeries suspended, to avoid acquiring COVID-19 during the surgery.

As for kidney donations, it was noted that, due to SARS-CoV-2, there was a 16% drop in transplants, making a comparison between March 2019 and 2020, which, at the end of this established quarter, can be seen, the influence of COVID-19 on kidney transplants.

DISCUSSION

It is now known that the number of CKD in haemodialysis has been gradually increasing, even with the disclosure of the severity and the

consequences of an inadequate lifestyle or even mass dissemination in all the media of World Kidney Day.

CKD is more common than you might think: one in ten Brazilians has some degree of kidney damage. Chronic non-communicable diseases are the main cause of death in the country, and kidney disease is in this group, as well as diabetes mellitus and hypertension, its main causes. All of these diseases are more common, unfortunately, in people with less education. These pathologies require self-care and, therefore, educating is essential to improve and delay their complications [9].

In the 2017 Census, on the scenario of dialysis treatment in the country, a sample of 291 RRT Units was analysed, the estimated total number of patients undergoing dialysis is 126.583. Each year around 35.000 new patients enter the program. About six thousand are transplanted [2].

Unfortunately, the mortality rate is high and remains constant, due to the potential risks of infection, morbidities, and constant consequences of poor control of risk factors for Kidney Disease (KD) and its nitrogen compounds [9].

In view of the study reported above, the authors show that the number has been growing disorderly in patients with RRT and that the active search for quality could mitigate these numbers, thus avoiding the increase in the rate of mortality and morbidity and mortality related to CKD.

Untreated CKD progresses to end-stage renal failure, leading to high morbidity and mortality, mainly due to high cardiovascular risk, worsening quality of life and high costs for the health system [10]. Thus, it is clear the importance of prevention, early diagnosis and control of diseases called risk factors for Chronic Kidney Failure (CKF). Renal Insufficiency (RI) and its treatment are public health problems worldwide, having a significant impact on social and financial burdens, resulting from the high rates of patients with renal dysfunction [11].

Renal function replacement therapy is divided into dialysis and kidney transplantation. Dialysis is obtained by filtering the blood in the extracorporeal circuit, where it is called Haemodialysis (HD), or even by applying a dialyzer in the abdominal cavity, the so-called peritoneal dialysis [12].

Such therapies are the most found and should be analysed by the nurse the need and management of resources since the expenses

with such therapies have been increasing significantly [13], due to the lower risks when comparing Peritoneal Dialysis and Haemodialysis with the use arteriovenous fistula or double lumen catheter.

Most patients under conservative treatment, that is, those in which the kidneys still have some function, receive little information about what would be chronic renal failure and its treatments, which according to the patients themselves, such lack of information can interfere with adherence to its treatment and, consequently, in the progression of the disease. In addition to being the patient an important information and teaching tool for his family, mainly because they are most of the underlying diseases for KD with a high heritability index [14], [15].

Even though Brazil has an aging population, inadequate lifestyle habits since childhood and an increase in diseases called risk factors for CKD, there is no real view of the consequences of lack of control in the rates of such diseases or even with the uncontrolled care with children's food, since kidney disease is said to be “silent”, as symptoms appear late, thus being an aggravating factor, with an increasing number of individuals with great impairment regarding kidney function without knowledge of it. Therefore, when the problem is discovered, there is already significant and unfortunately irreparable kidney damage. This country, portrayed in this research, still does not have, as it should, effective public measures to control the increase in people with some degree of renal dysfunction. This data shows, therefore, the importance of further studies in the area and government investment, thus bringing results regarding the healthy aging of the population and reduction of expenses with patients undergoing dialysis treatment.

In haemodialysis, diffusion, osmosis, and ultrafiltration occur. The toxins and residues present in the blood are extracted by diffusion, that is, when the molecules move from an area of greater concentration in the blood to an area of less concentration in the dialysate, the excess water is removed from the blood by osmosis (moves from an area with a higher concentration of solute, the blood, to an area with a lower concentration of solute, the dialysate). Ultrafiltration is performed by applying negative pressure or an aspiration force to the dialysis membrane, this process is more efficient at removing water than osmosis, as patients with kidney disease generally cannot excrete

water, this force is necessary to remove the liquid, reaching water balance [16], [17].

During the procedure, the solutes move from the blood to the dialysis solution and vice versa, removing slag and excess liquid from the blood and maintaining the balance of electrolytes and consequently homeostasis [18].

During a haemodialysis session, approximately 120 liters of water are used, the substances present in this water can have direct access to the bloodstream of patients, so it is important to control the purity of the water used [19]. With an efficient control of the purity of the water we guarantee an efficient dialysis and reduction of the risks of contamination of the patient in question.

The access routes used in haemodialysis are: Double Lumen Catheter (DLC), permcath (exclusive for patients with CRF, especially those with vascular problems and coagulation disorders), arteriovenous fistula (subcutaneous anastomosis of an artery with a vein, used only in patients with CRF) and prostheses (used when patients' vessels are unsuitable for anastomosis or when attempts have been made in all upper limbs to make the AVF) [20], [21].

The artificial kidney would be the haemodialysis machine, which consists of a blood pump, a system for providing dialysis solution and safety monitors for the appropriate blood circuit and dialysate circuit. The blood pump moves blood from the access site through the dialyzer and back to the patient [22].

Although haemodialysis does not cure kidney disease and does not compensate for the loss of endocrine or metabolic activities of the kidneys, it is essential for patients with chronic renal failure, as it prevents early death (FREITAS, 2014). Despite haemodialysis referring death and lost time, it is also an important instrument to bring well-being to the patient with various symptoms related to a kidney disease.

The frequency and duration of dialysis must be established in order to maximize solute clearance, maintain the hydroelectrolytic and basic acid balance. Patients using this therapy should generally undergo treatment for the rest of their lives or until a successful kidney transplant is performed. In general, treatment occurs three times a week, for at least 3,5 to 4,5 hours/ session [18].

There is in the imagination of CKD that after kidney transplantation, he will never return to haemodialysis under any

circumstances and would still have the benefit of not being a Chronic Kidney Patient [23]. However, understand the need to follow the guidelines, maintain contacts with the health team, commit to the treatment and proper use of medications, as well as dietary and self-care limitations, thus avoiding graft loss [24]. But for the patient to become aware of all his duties as a patient in order not to return to haemodialysis, a multidisciplinary team-patient-family must be walked together.

This type of treatment is not a cure for DR, but rather promotes a better quality of life, reducing symptoms, especially regarding the relationship between transplantation and machine independence [25]. The loss of the transplanted organ proves to be a difficult experience, often signifying the loss of hope and may even generate feelings related to the fear of death due to the need to return to dialysis [26].

Kidney transplantation is an important therapeutic option for patients with chronic renal failure, both medically, socially, and economically. It is indicated when there is chronic renal failure in the terminal phase, being the patient on dialysis or even in the pre-dialysis phase (pre-emptive), considering creatinine clearance $<20 \text{ ml/min/1.73 m}^2$ body surface. Pre-emptive kidney transplantation can be offered to all kidney transplant candidates, but particularly to diabetic patients (to reduce the incidence of vascular, cardiac, ocular, and neurological complications typical of diabetes) and in children under the age of 10 years (to avoid impairment in growth, renal osteodystrophy and, mainly, due to dialysis difficulties) [27], [28].

To perform a kidney transplant, there are some bureaucracies, such as state and regional lists, where when there is a fully compatible donor, he can integrate this list. The place on the list is determined by the compatibility between the donor and the recipient. Once the compatibility requirement is satisfied, another determining factor in the choice of recipient is the urgency of the transplant. In the case of kidney transplantation, the total impossibility of access for dialysis (haemodialysis or peritoneal dialysis) is an urgency, if there is still a tie, that is, two patients with the same compatibility, the waiting time and other characteristics are used as tiebreaker criteria [29].

Currently, there are few contraindications for kidney transplantation. The patient's age is no longer a contraindication, as it was until a few years ago, as transplants have already been carried out

in new-borns, including premature infants, which also occurs in selected patients over the age of 70 [30].

The contraindication for kidney transplantation in patients with malignancy is based on the increased risk of metastases potentially induced by immunosuppression [31]. The transplant will only be considered if there is no evidence of cancer persistence.

The recommended waiting time between tumour treatment and transplantation will depend on the type of cancer. Renal neoplasia is not an absolute contraindication for transplantation. The conduct in these cases should be to treat the tumour and wait two years. If there is no recurrence, it can be transplanted without greater risks [31].

Primary oxalosis is a metabolic disease that always relapses in the graft but is no longer considered a contraindication for kidney transplantation since there are prophylactic therapeutic schemes or even the association with liver transplantation with good results. Therapeutic measures that prevent oxalate deposition include preoperative dialysis to remove the oxalate pool, after transplanting force diuresis, administer pyridoxine (which decreases oxalate by increasing the conversion of glyoxylate to glycine). In this case, the therapy of choice is double liver-kidney transplantation, as it correlates with better results in terms of graft survival, according to a meta-analysis study [32], [33], [34].

Patients with acute infection should be excluded from transplantation until complete recovery of the condition, due to the risks caused by immunosuppression, we still have patients with acute or active kidney disease, such as rapidly progressive glomerulonephritis, lupus nephropathy, vasculitis, or patients with focal glomerulosclerosis of rapid evolution, they must be transplanted in a phase of inactivity of the disease, due to the possible recurrence of the disease in the graft [2].

The clinical and financial aspects must be based on quality of life as another factor to be considered when comparing the types of renal replacement therapy. Some studies carried out had the objective of comparing the level of quality of life between haemodialysis patients enrolled and not enrolled on the waiting list for kidney transplantation and showed that patients who were not waiting for a transplant evolved more frequently to death in the 12-month period. In addition, the adjusted mean scores for quality of life were lower among patients who did not expect transplantation in six dimensions, namely: functional

capacity, limitation due to physical aspects, pain, social aspects, limitation due to emotional aspects and mental health [35].

The analysis of survival, cost and quality of life characterize kidney transplantation as the best alternative from a financial and clinical point of view, a fact that should assist in the formulation of public policies related to organ transplants in Brazil. However, the reality experienced is the lack of access to transplantation, either due to the long waiting list, or due to the low number of living or dead donors [36].

It should be noted that haemodialysis does not completely replace the functions of the kidneys, but it does provide a better quality of life. In turn, kidney transplantation allows the patient to improve his quality of life and get rid of haemodialysis “machines” [37].

Given the above, we see the importance of the study to survey the number of transplant recipients in the period of 10 years, in view of cost savings, better quality of care and better spending on public health aimed at informing the population regarding the transplant.

Acute renal graft rejection is generally defined as an acute deterioration of graft function associated with histopathological changes. It is important to note that, differently from what was considered in the past, when only variations in serum creatinine above 20% or 30% were valued, currently the persistent elevation above 10% is already sufficient to consider the hypothesis of rejection [38].

If confirmed, every effort should be made to prevent the progression of the condition. Humoral rejection occurs when antibodies attack endothelial antigens, triggering a chain reaction in the complement system and culminating in capillary damage. The main allow antibodies are those that target molecules of the major histocompatibility complex, also called Human Leukocyte Antigens (HLA). Recently, the immunopathological development of staining for the complement C4d fraction, a marker resulting from antibody aggression, has enabled better conditions for the diagnosis of antibody-mediated rejection (RMA). The incidence of RMA varies from 1,8% to 3,2%, but it can result in 27% to 40% of graft loss in one year [39].

Regarding the experience lived in the haemodialysis sector, several patients report the appearance of symptoms and signs of renal graft loss. They want the situation to be reversed, they think there is a chance to improve or even they try to deceive themselves to be able to support reality as it presents itself. However, when the kidney actually

stops, and the doctor announces that haemodialysis must be resumed, the patient receives the news together with the diagnosis of imminent "death".

CONCLUSIONS

In the study, the concern of the disparity of the states of the Federation regarding the number of transplants in regions such as the North and Northeast was seen, thus being the same having to be at the apex regarding financial, human investments and even orientation of the population on donation of organs. In this way, the area of information coverage and, consequently, the number of organ transplants can be improved.

Therefore, this result depends on stimuli from local public sectors, such as the state government, in solving a sequence of small obstacles in the logistics of the donor identification process until the transplants are carried out, which also depends on a harmonious relationship between the teams and a coordination. The only inequality of the Brazilian transplant system resides in geographical disparity. The states where the programs are better structured, with the support of the local government and with equated and aligned teams in organ donation and transplants, offer their citizens a better chance of better health.

Authors' contributions

Oliveira and Rached - designed the study.

All the authors involved in collected the data.

All the authors analyzed the data.

Rached supervised the study.

All the authors involved in manuscript writing.

All the authors involved in critical revisions for important intellectual content.

Interest conflicts

The authors declare that there is no financial, legal, or political conflict of interest involving third parties (governments, companies, and private foundations, etc.).

Financial agreement

There was not financial agreement.

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